Speculation and regulation in commodity markets: The Keynesian approach in theory and practice

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Speculation and Regulation in Commodity Markets:

The Keynesian Approach in Theory and Practice

edited by *Maria Cristina Marcuzzo*

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Introduction

The eleven papers presented here are the outcome of the research activity undertaken by the participants in the project—*The return to Keynes. Speculation and stabilization policies: money and commodities*—financed by the Italian Ministry of Education in 2010,[1] whose aim was:

> to carry out philologically accurate analysis of Keynes's views regarding regulation of the raw material and money markets—to assess how relevant they are today in the light of the proposals to regulate the financial markets and the international economic order consequent upon the crisis that has broken out over the last few months, in a climate of opinion where the 'back to Keynes' spirit is gaining ground. More specifically, we intend to examine, not separately, as so often happens, but in close connection, two issues which preoccupied Keynes throughout the whole of his theoretical and practical activity: monetary reform and the stabilization of commodity prices. From the methodological point of view we will not confine our attention to Keynes's published writings, but also take into account the unpublished material, at the level not only of theoretical reflection but also of Keynes's concrete experience as a speculator, mainly on the futures markets for raw materials and money.

In accordance with the guidelines described above the research of the last two years[2] focussed on four main areas of investigation: Keynes's ideas on speculation, case studies of Keynes speculative activity in selected commodity markets, measures of commodity price volatility and proposals for stabilizing commodity prices in the context of a wider macroeconomic framework.

In her paper Marcuzzo analyses Keynes's 'extremely wide practical acquaintance' with organized market as a way to understand his *practice* as speculator and his evolving *views* on speculation which eventually led him to argue against 'unfettered competition' and in favour of regulation of commodity markets.

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[1] In fact, although launched in 2010, the formal denomination of the programme was PRIN (Programmi di ricerca scientifica di rilevante interesse nazionale) 2008.

[2] The preliminary findings and early versions of the papers collected here were presented in five Workshops held at Bocconi University (October, 2010, October 2011, January 2012), University of Rome, La Sapienza (April and September 2012) and in various conferences and seminars: at the European Society for the History of Economic Thought Conferences (ESHET 2011, 2012), Storia dell'Economia Politica Conferences (STOREP 2011, 2012), History of the Economic Thought Society Conference (HETSA 2011), World Economic History Conference (WEHC 2012); seminars at Paris I Sorbonne and London City University. We are indebted to our discussants and commentators for helpful suggestions and criticism.

He relied heavily on information relative to each individual market and commodity, weighing up the quality and reliability of that information through calculation of the relevant data, the advice of experts, and his own assessment of market conditions and of other participants' opinions. The grasp of 'business psychology' became an increasing important element both in his investment strategy and in his views on speculation

His own investment philosophy seems to have changed in the early 1930s, following heavy losses in the commodity market, the 1929 crash and possibly progress in his new theoretical developments which culminated in the *General Theory*. The role of informed opinion about the relevant data gave way to evaluation of market sentiment, conventions and herd behaviour. In the end the ability of the speculator rested, for Keynes, on individual judgment, as opposed to the average market view. In the case of the commodity markets, which played an important role in sustaining or depressing the level of effective demand worldwide, Keynes became increasingly worried about the effect of adverse or excessively optimistic market opinions and ever more apprehensive of the dire consequences of trusting them to ensure the smooth working of the economic system.

In 1923, Keynes published the first formulation of the theory of futures contracts, often labelled 'normal backwardation theory', which he later incorporated in his *Treatise on Money*. This theory hinges upon the idea that speculators provide a protection against price fluctuations and, on average, earn a *risk premium* determined by the working of the market. In their paper, Cristiano and Naldi assess to what extent Keynes, or any other speculator, could ever have used this theory as the guiding principle of his investment strategy and how such an analysis may illuminate speculative behaviour. They focus their attention on the case of the cotton market, reaching the conclusion that:

> During the period considered in this paper, the cotton market went through two main periods, one of relative scarcity until 1925 and one of abundance afterwards, with a peak of excessive supply in 1926-27. Throughout these two periods, Keynes very rarely abandoned his strategy of staying long. However, it is only from 1921 to the spring of 1923, when the *Manchester Guardian* article appeared, that Keynes's behaviour can be taken as a good representation of the idea of routine speculation as risk-bearing as well. When the scheme of sales and repurchases was abandoned after 1923, it seems that Keynes made some attempts at using the information he had, adapting his strategy to a changing outlook.

From 1921 to 1930 Keynes was also active in the London tin market and drew up seven *Memoranda on Stocks of Staple Commodities* which included a section on tin.

Cavalli and Cristiano argue that both Keynes's analysis and his market behaviour bear witness to a highly specific context for speculation, characterized by limited sources of supply and a small number of agents, imperfect information and information asymmetries, frequent attempts at manipulating prices (including one in which Keynes took part), and no clear separation between the cash and the futures markets. At least until the tin cartel was formed in 1931, the tin branch of the London Metal Exchange had looked very attractive to well-informed and well-connected speculators. However, making money with tin proved to be a difficult endeavour, even for a speculator placed in a privileged position.

They conclude by stating that Keynes

> certainly was a competent and relatively well-informed speculator, and could also avail himself of good connections in the industry and the London Metal Exchange. Nonetheless, his decisions about when to step in or out of the market were frequently ill-timed, and he was continually exposed to heavy losses even when his outlook proved on the whole correct.

Foresti and Sanfilippo reconstruct Keynes's investments in the wheat futures markets in the decade 1925-35, on four different market places (Chicago, Winnipeg, Liverpool and Buenos Aires). They find that Keynes adopted a completely different strategy when operating on the North-American markets from the line he followed trading on the Liverpool market. In the former case he tried to anticipate reversal in the price trend, aiming at 'beating the market'. In the latter, he followed a roll-over strategy (renewal of long positions), which is a behaviour more consistent with his own theoretical representation of the speculator as a 'risk-bearer'. This attitude confirms that, in his investment activity, Keynes paid great attention not only to the general economic conditions of the wheat futures trade—i.e. the volumes of production, the stock levels and, obviously, the spot and futures prices—but also to the institutional characteristics and the specific conditions of each market place in which he operated.

Naldi discusses a methodological question that originated in an exchange between Sraffa and Keynes in December 1931 as to whether the commodity rates of interest must be calculated by dividing the monetary cost of borrowing a commodity by the *spot* price or by the *forward* price of the commodity in question. Keynes maintained that the concept of commodity-rate of interest was to be expressed in terms of *forward* quantities. On the other hand, since an implicit observation that commodity-rates are to be expressed in terms of *spot* quantities can be attributed to Sraffa, there appears to be a marked difference in the approaches taken by the two authors. Naldi argues that Keynes's definition, based on the analogy between commodity-rates of interest and

currency-rates of interest, even though formally correct, generates a concept void of operative content because in a monetary economy commodities, unlike currencies, cannot be directly borrowed. On the contrary Sraffa's implicit suggestion seems more apt to be applied to a monetary economy.

The following set of papers deals with commodity price volatility and considers what the most suitable theoretical framework should be to analyse it.

Cristiano and Paesani look at the theory of storage initially proposed by Kaldor and further developed, between the 1940s and the 1960s to explain the relationship between spot and futures commodity prices in alternative to the Keynes-Hicks theory of normal backwardation. They reconstruct how it came about that Kaldor's and Keynes's paths parted on the theory of forward markets when the former meant his theory to be a generalisation of Keynes's own. Their main conclusion is that the separation took place when H. Working grafted the notion of convenience yield onto a non-Keynesian theoretical corpus based on carrying costs and efficient markets rather than on risk perception and heterogeneous expectations as the main determinants of commodity prices.

The theory of storage provides the theoretical reference for the analysis of the relationship between commodity price volatility and market fundamentals by Cifarelli and Paesani, who compare the 1920s with the present decade, focusing on cotton and tin. They show that the series have widely differing properties which reflect the more rapid diffusion of information in the markets today. Furthermore, they argue that, based on full sample correlations, the theory of storage captures the dynamics of data with the exception of historical tin. Rolling correlations, however, qualify this result and show that dynamic correlation for historical tin largely corroborates the theory of storage while recent inroads made by financial agents in the commodity markets seem to have affected the cotton market, giving prominence to financial risk factors.

Growing volatility incommodity prices has been both a symptom and a factor of instability over the past years. The problem, however, is not new. In the interwar period it had already attracted the attention of Keynes, who ascribed it to the lack of storage for surplus stocks. According to Keynes, markets for raw materials and foodstuffs are inherently unstable: a change in demand can hardly be met in the short term by an adequate change in supply, since new production takes time and storage of old production is expensive. Compared with other forms of wealth, particularly financial assets, commodities are unattractive for private agents since they do not give rise to a positive yield but entail high carrying costs. In order to supplement inadequate private storage and set a buffer between production and supply and between consumption and

demand, Keynes proposed that public storage of commodities in buffer stocks should be arranged under the management of an international organization. Between 1942 and 1944, his plans for a Commodity Control, as it was to be called, were widely discussed and repeatedly redrafted, but, like the Clearing Union proposal, they were eventually set aside. Fantacci analyses the peculiar institutional design of Keynes's post-war commodity schemes and explains how they were conceived and revised, why they were not implemented, and what suggestions can be drawn today from a plan that was conceived as 'a middle course' between competition under *laissez-faire* conditions and planned controls.

Rosselli reconstructs Kahn's plea for the creation of buffer stocks managed, for each commodity in question by—in his own words—an 'authority, endowed with suitable financial backing, which can buy the commodity when, in some sense or other, it is cheap—or appears to be so—, can hold it in stock, and can then sell from its stock when the price appears to be relatively high'. Kahn's approach to the establishment of a Buffer Stock as the means to stabilize commodity prices is entirely original, differing both from Keynes's proposal and from the prevailing views of the times, which obliged the Buffer Stock managers to intervene whenever the price of the commodity hit certain given limits. Kahn's analysis and experience of the working of commodity markets persuaded him that the Buffer Stock managers can be successful only if they are endowed with much greater freedom of action than Keynes had envisaged and do not have to buckle under any pre-defined rule. Their unpredictable behaviour must increase the uncertainty under which traders and speculators act, influence market expectations and exploit bearish or bullish sentiments in order to stabilize prices. In other words, the managers of the Buffer stocks must become speculators among other speculators, not for their own profit, but in the general interest.

The last two papers take a wider angle, viewing commodity markets and speculation in commodity within the context of the issues confronting the working of an orderly international monetary system.

Amato and Fantacci draw a comparison between two alternative visions of the international financial system, embodying two alternative principles: the first aiming at producing international *liquidity* on the basis of a reserve currency and the second aiming at providing a pure means and measure for the multilateral *clearing* of current accounts in the form of a currency unit. In fact, the principle eventually embodied in the Bretton Woods system, and persisting even after its demise, tends to identify money with a reserve asset, making possible, and even necessary, the accumulation of global imbalances, despite original intentions to reabsorb them. On the contrary, the principle

which inspired the alternative (Keynes's plan) was intended to deprive money of the character of a reserve asset, thus making it the yardstick for international exchanges, rather than an object of regulation among others. The paper argues that the latter is unquestionably the most appropriate way to manage global imbalances.

The emergence and persistence of large trade imbalances, as well as the volatility of financial flows among countries, have been attributed, at least in part, to the inadequacy of the current international monetary system after the breakdown of Bretton Woods. From a different perspective, the current Euro zone crisis is also the result of a flawed institutional setting. These problems—Valdecantos Halporn and Zezza argue in their paper—are calling for reforms which would temper or obviate the recessionary bias which is the outcome of current systems, as Keynes predicted in the discussion preceding the Bretton Woods agreements. They introduce a set of models based on the stock-flow-consistent approach and discuss how to use these models to explore potential reforms of the international monetary system.

It is fair to say that while our research work has fulfilled some of the objectives we set out to accomplish, more needs to be done to complete the task; however, we feel confident that our starting hypotheses have been confirmed. These were originally stated as follows:

i) there are strong links between fluctuations in prices of primary commodities and agricultural products on the one hand, and financial crisis and structural trade imbalances on the other;
ii) in the absence of buffer stocks for commodities, and with insurance against price volatility based only on market mechanisms the system is doomed to instability;
iii) any policies aiming at stabilizing commodity prices and currencies must go hand in hand with reform of the international monetary system.

As a result, we remain all the more convinced in our ultimate aim of taking the original proposals put forward by Keynes as a basis for reforms designed to cope with the current crisis.

Rome, 31 October 2012 *Maria Cristina Marcuzzo*

PART I

Keynes as speculation theorist and practical speculator

From speculation to regulation: Keynes and primary commodity markets

Maria Cristina Marcuzzo[*]

1. Premise

Keynes was a speculator in commodity markets from 1921 to 1939 (from 1926 through his company, Tilton), when foreign trading was suspended because of the war; from then on he regarded these markets from the point of view of a regulator, putting forward a Buffer Stocks scheme to curb the volatility of commodity prices; this would represent part of his more general proposals to stabilize the international monetary system and foster general growth and prosperity. Clearly his *practice* as speculator had a bearing on his *views* on speculation and the remedies to counter its ill effects.

In a letter to Hawtrey about a month before the publication of the *General Theory*, Keynes wrote, 'I know a great deal' about 'commodity markets and their habits', since 'I have been in constant touch for many years past with dealers in a great variety of commodities and have constantly been engaged in sizing up the significant factors from a practical point of view' (CWK XIII: 627-8).

In this paper I will trace the evolution of his ideas on the matter, which developed from his intimate knowledge of primary commodity markets and his practice as an active player on them. I also present some preliminary findings on his speculative activity, examining two examples of his trading behaviour in the tin and wheat markets, in 1924-25 and from the mid-1920s to the mid-1930s respectively, which are of interest as representative examples of his dealings in the commodity markets.

Here two important points emerge which are worth underlining: 1) in the 1920s and 1930s organized commodity markets were sophisticated trading places in which a variety of derivatives were traded, which could attract shrewd, highly leveraged speculators who could exert a great impact on prices. 2) Keynes was one of them,

* (University of Rome, La Sapienza). Earlier versions of this paper were presented at the HETSA Conference, Melbourne (July 2011), University of Paris, Paris (February 2012), Hyderabad (March 2012), Gide Association, Nice (June 2012). I wish to thank Carlo Cristiano for help and assistance, Eleonora Sanfilippo and Paolo Paesani for comments to a previous draft. Any errors and omissions are mine alone.

heavily speculating in options (mainly metals) and in futures (mainly crops). While further investigation is needed to fully assess his success with commodities, we can provisionally agree with Moggridge's conclusion that his performance was mixed, varying according to the year and the type of commodity (CWK XII: 15-19). 3) The same mixed results were attained in his dealing in shares for King's College, according to a recent study (Chambers and Dimson 2012), showing that his performance was not as 'stellar' as has often been claimed. Be that as it may, after 27 years of activity as a speculator in commodity markets Keynes turned into a regulator, championing the creation of an international agency which would regulate these markets through a system of buffer stocks financed by the Clearing Union.

It is a straightforward conclusion that his 'extremely wide practical acquaintance with commodity markets and their habits' (Keynes to Hawtrey, 6 January 1936, in CWK XIII: 627-8) left a mark on his views on the perils of 'unfettered competition' and the importance of regulation.

2. Trading in the futures market

The commodities Keynes most traded in the futures market were: cotton, copper, tin, lead, spelter, sugar, jute, rubber, wheat, maize, cotton oil, lard and linseed oil. The selection of the commodities might have been influenced by the knowledge he was acquiring as a professional economist. Between 1923 and 1930 he authored a series of *Memoranda* for the London and Cambridge Economic Service (Keynes 1923-30) on some of the commodities he traded in (cotton, copper, tin, lead, spelter, sugar, jute, rubber, wheat) as well as a few others (nitrate, coffee, tea, petroleum, wool) that he does not seem to have traded. The *Memoranda* structure followed a similar pattern for the supply of information: the level of stocks and consumption, the flow of production and the trend of prices; these were always presented with assessment of the quality and reliability of the data. So it would be fair to say that the main interest of Keynes's analysis lies in the evaluation of the amount of information available for each individual commodity and the degree of uncertainty about the future course of the main factors underlying it.

Collection of the 'relevant information' available was the premise to evaluating the 'weight' of any argument that could be inferred from it, according to the conceptual framework which Keynes used in his *Treatise of Probability* to illustrate any decision making process.

From this viewpoint, i.e., the amount of information and the degree of uncertainty, (which affects the confidence that could be accorded), commodities can be divided into three groups: a) copper, tin and rubber, information being abundant but of variable quality, so that it was difficult to predict the pattern the stocks would show; b) nitrate, lead and spelter, with a low degree of uncertainty and thus possibility of reliable predictions; c) cotton and wheat, for which there was plenty of reliable information, but much uncertainty due to the unpredictability of extra-economic factors (weather, parasites).

There is a further distinction, important in Keynes's opinion, between extracted commodities (metals) which are produced throughout the year and those (textile and food crops) that are harvested in a particular season. The distinction matters for the level of financial facilities required in the passage from production to consumption, namely credit: low in the case of extracted commodities and high in the case of crops. When credit plays an important role in the production process, recourse to the futures markets for the purpose of hedging was even more important and in certain cases even mandatory for the borrower, since lending by banks was often conditional upon it.

Before analysing Keynes's views and practice, it helps to recall the behaviour and the financial instruments which were typical of the futures markets in Keynes's own times, although in many respects they prevail even today.

In organized markets it is not easy to draw a line between hedgers and speculators, but it would be fair to distinguish the class of market players who do not wish to possess (nor use) the commodity they buy forward, nor produce (or own) the commodity they sell forward. It is a class of players, the speculators, who—unlike hedgers—deal in future contracts only, i.e., they do not buy and accept delivery of commodities, nor do they sell or deliver commodities.[1] Instead of settlement by delivery, futures contracts are offset by contracts which are the reverse of the previous commitments. Speculators who have sold (bought) a future contract of a given maturity, before expiration must buy (sell) the same amount of the same future. If they have sold, they are 'short' of a given contract, if they have bought, they are 'long' of a given contract. Hedgers of stocks of cash commodities and speculators who expect a

[1] This definitions correspond roughly to the distinction between commercial or a non-commercial trader according to the US Commodity Futures and Trading Commission. A commercial trader is one who is 'commercially engaged in business activities hedged by use of the futures or option markets. This would include production, merchandising, or processing of a cash commodity, asset/liability risk management by depository institution, security portfolio risk management, etc.' (CFTC Form 40). All other large traders who do not meet these criteria are classified as non-commercials. Commercials are normally referred to as hedgers, while non-commercials have no underlying cash business and are hence treated as purely speculative traders (see Sigl-Grüb and Schiereck 2010: 47).

decline in the price of the underlying commodity sell futures in that commodity (they become 'short'), while hedgers against forward sales of cash commodities or speculators who expect a rise in the price of the underlying commodity buy futures in that commodity (they become 'long') (see Stewart 1949).

Profit in the futures market is made whenever there is a positive difference between the buying and the selling price of any futures contract. If prices *fall,* the 'short' who has sold the future at higher price can buy it ('covering' his/her position) at a lower price, making a profit. The 'long' who has bought the future at higher price and sells it ('liquidating' his/her position) at a lower prices, bears a loss. Conversely, if prices *rise*, the 'short' suffers a loss and the 'long' makes a profit. So speculators who expect future prices to rise, are on average 'long' and those who expect prices to fall are 'short'.

Besides futures contracts, options were also typically traded in commodity markets. An option in futures is a contract to buy or sell a future contract at a future time. There are two types of options: a) call options, giving the right to buy the underlying futures at a specified price within a specified time; (b) put options, giving the right to sell the underlying future at a stipulated price at a specified time. If a trader expected an *increase* in the market price of a given future, he/she would buy a call option, which entitles the purchaser to buy the future at a specified price. If the price actually rises above the stipulated price during the specified period, the trader makes a profit exercising the option, i.e., buying the future at the lower stipulated price and selling the future at the higher price. Conversely, if a trader expects a *fall* in the price of the future, he/she would buy a put option, which entitles to sell the future at a given price. If the price actually falls, he/she can make a profit by buying the future in the market and exercising the option, i.e., selling the future at the higher stipulated price. If prices do not match expectations the option is not exercised and the loss is only the premium, i.e., the price paid for the option.

While the buyer of the option has the *right* to buy or sell the underlying future at the stipulated price and time, the seller of the option has the *obligation* to sell or to buy the underlying future at the stipulated price and time. Sellers of put and call options have typically a corresponding position ('long' in the case of a call option and 'short' in the case of a put option) in underlying futures and they trade in the expectation that the option expire worthless so that they can pocket the price of the option (the so called 'premium') as profit.

To buy (sell) options is less expensive than buying (selling) futures since only the price of the option is lost when the option is not exercised.

Finally we need to mention the types of options in which Keynes traded, especially in tin and copper, but also in lead and linseed oil: the 'buyer's option to double' (BOD), the 'seller's option to double' (SOD) and the 'double'.

For a given sum over the future price the buyer of a BOD had the right to buy, and the seller the obligation to sell, double the amount specified, giving notice a few days before the expiration of the option.[2] For a sum below the future price, the seller SOD has the right to sell, while the buyer has the obligation to buy, double the amount. The BOD is the combination of an ordinary purchase of a future and a call option, while SOD is an ordinary sale of a future with the purchase of a put option attached. The double[3] is a combination of a put and a call, giving the right to exercise only one of the two at the expiration date.[4]

Assuming that the price of a futures contract at the time of maturity fully converges[5] to the future spot price of the commodity, because of the arbitrage opportunity that would otherwise arise, the relevant variables in the speculator's decision-making process are the price of the future contract of a given maturity (*FP*), the spot price (*SP*) of the commodity, the expected spot price (*ESP*), and the expected future price (*EFP*) until maturity.

Prices of futures reflect *opinions* as to future demand and supply of the commodity, as well as differences between different markets for the same commodity and between different points in time; in turn demand and supply of options reflect opinions as to the prices of futures. In both cases *opinions about the opinions* of market participants at any point in time matter a great deal.[6]

How did Keynes describe expectations formation? How did *he* form his own expectations? How is the behaviour of the speculator best explained? How can

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[2] How these options worked was explained to Keynes in 1921 by Ruper Trouton, who at the time was with his broker's firm, Buckmaster & Moore (JMK papers: SE/2/1/126-7).

[3] 'A combination of a put and a call is termed a "straddle" on the American exchanges' (Smith 1922: 46).

[4] The cover necessary to carry a position with a broker varied according to the instrument and the underlying. For instance in July 1922, Buckmaster & Moore gave Keynes the following quotes: 'We expect the following proportions to cover to be maintained intact at all times on open positions at their current valuation: in exchange 20%, in Commodities 30%, on Call options Payment in full. We are content that not only cash balances standing to your credit and securities deposited with us (reckoned at their current market value), but also book profits on your open position, should count towards the proportions of cover required' (JMK Papers SE/2/2/25).

[5] 'In a perfect market with costless delivery at one location and one date, arbitrage should force the futures price at expiration to equal the cash price. Otherwise a violation of the law of one price would exist. In reality, delivery on commodity futures contracts is not costless and is complicated by the existence of grade, location, and timing delivery options' (Bose 2009: 20).

[6] As it has been nicely put: 'the speculator is more interested in what average market opinion thinks average market opinion is going to think about demand to consume three months hence, than in demand to consume itself' (Eastham 1939: 108-9).

Keynes's behaviour best be analysed? These are the questions I will attempt to address in the following sections.

3. Keynes on speculation

There is no systematic treatment of speculation in Keynes's work[7] and the question of his views on the matter is best dealt with by examining, in roughly chronological order, the observations on the subject which can be found scattered here and there in his writings.

We can start from the manuscript notes for the preparation of his *Lectures on the Stock Exchange* (1910),[8] to which Anna Carabelli (2002) has drawn attention, providing interesting and useful comments. Here Keynes is careful to distinguish between gambling and speculation, applying the former term to situations in which risk is not calculable or not normally distributed, such as the game of roulette, and the latter to situations in which the risk is calculable and normally distributed, such as life insurance. The dividing criterion is in the amount of knowledge possessed by the actor in both cases: 'the possession of superior knowledge [is] the vital distinction between the speculator and the gambler' (Keynes 1910: 98).

Superior knowledge confers the speculator with an advantage over the market. To Keynes this is a matter relevant *not* to measuring comparative success in gambling and in speculation, which may be dependent on other factors, but to evaluating the nature of the action in the two cases. Unlike speculation, gambling is not reasonable because is a behaviour which has no basis in knowledge, notwithstanding the fact that a gambler may at times be a winner and a speculator a loser.

The next question is whether this 'superior knowledge' allows the speculator to predict the future course of events. There are passages in the *Lectures* which seem to confirm it:

- 'speculation [is a] reasoned attempt to gauge the future from present known data' (Keynes 1910: 95);
- 'the speculator [is] a person who endeavours to make a profit by means of a power of forecasting the future superior to the ordinary' (Keynes 1910: 95);

[7] In the literature Dardi and Gallegati (1992) have argued that Keynes's approach to speculation can be traced back to Marshall. On the other hand Carabelli and Lanteri (2011) argue that there are varieties of 'beauty contest' behaviour, namely acting on the basis of forecasting average opinion, and insist on the peculiarity of Keynes's approach in which the beauty contest in a noncooperative game.

[8] MSS, UA/6/3, Notebook, 8 Lectures on Company Finance and Stock Exchange, Lent Term 1910.

– ‘speculation consists in the use of superior skill in forecasting changes of value to take advantage of them by buying and selling’ (Keynes 1910: 100).

This approach is akin to what we would call today the ‘forecasting theory’, whereby there is no clear trend of price movements in futures markets and profits are determined by the ability of speculators to forecast prices accurately (Lee and Zhang 2009).

The next phase in Keynes’s thinking—as he became more closely acquainted with the working of markets—is the analysis of speculation in futures (currencies and commodities) presented in his ‘The Forward Market in Foreign Exchanges’ (1922), incorporated in the *Tract of Monetary Reform* (1924) and in his 1923 article ‘Some Aspects of Commodity Markets’ (CWK XII: 255-65). The point of speculator as risk-bearer is reiterated in the *Treatise on Money*, where he gave a more refined version of his theory.

Not only is the speculator not a ‘gambler’, but his ability, through superior knowledge, to forecast the future is downplayed. He is not ‘a prophet’ (CWK XII: 260), but rather a risk bearer: ‘The most important function of the speculator in the great organized “future market” [is that of] a risk bearer...’ (CWK XII: 260).

Profits are the remuneration for risk-bearing, not for forecasting skill.

Here we find the theory of normal backwardation/contango, associated with Keynes’s name, according to which to earn positive profit either the speculators are net long (backwardation) or the hedgers are net long (contango). In the former case futures prices normally rise in the duration of each contract, while in the latter the prices of the futures will tend to fall over their life. The theory predicts that future prices have an upward (backwardation) or falling (contango) trend.

In the case of backwardation, if futures prices are downward-biased estimates of expected prices, then they should be seen to rise as the contracts approach maturity. The excess of the expected spot price over the future price decreases as the futures contract approaches maturity because the risk of unanticipated price changes decreases with time, and so does the risk premium hedgers are willing to pay to speculators. Assuming spot prices to remain constant, then futures prices must rise. The price increase, which is brought about by hedgers being long in the underlying commodity and short in the futures commodity, provides the inducement to the speculators to be long in commodity futures.

In the case of contango, if future prices are upward-biased estimates of the expected price, then they should be seen to fall as the contracts approach maturity.

Assuming that the expected price (*EP*) at the date of stipulation of a futures contract is equal, on average, to the spot price at the date of maturity of the future contract (*FSP*), i.e.,

[1] $$EP = FSP$$

Keynes defines, 'the remuneration of risk-bearing is measured by the average excess of the spot price three or six months hence [*FSP*] over the forward price today [*FP*] for three or six months delivery' (CWK XII: 263). In other words,

[2] $$r = FSP–FP$$

When supply and demand are balanced and there are no redundant stocks nor shortage of supply, *FP* is below *SP*, i.e., the situation is that of backwardation. Otherwise, when there are redundant stocks or abundance of supply, *FP* is above *SP*, i.e., the situation is that of a contango. Note the difference between the *futures basis*, which compares futures prices to contemporaneous spot prices, and the *risk premium,* which is the difference between futures prices and *expected* future spot prices. In order for commodities to be stored, futures prices have to exceed spot prices to compensate inventory holders for the cost of storage. Only when stocks fall below the expected level can the spot price exceed the futures price.

So if there is a contango, the risk premium must be higher than in the normal backwardation: 'the additional element of uncertainty introduced by the existence of stocks and the additional supply of risk bearing which they require mean that [the producer] must pay more than usual' (CWK V: 129). So we have

[3] $$r = (FSP–SP) + (SP–FP)$$

4. Keynes's investments in tin and wheat

In which ways did Keynes use his knowledge of the relevant data to speculate on commodities? I examine Keynes's investment in two commodities, tin and wheat, in two different time intervals, 1924-6 for tin, 1937-8 for wheat. Keynes traded heavily in these two commodities in the two periods under consideration, and these are therefore representative examples of his trading behaviour.

4.1 Tin

Cash, futures, and ordinary and double options in tin had been traded in the London Metal Exchange (LME) since 1877, and from 1928 on tin futures could also be traded at

the National Metal Exchange in New York (Reitler 1931).

Keynes dealings in tin began in September 1921 and continued until 1929, with only modest trading in the 1930s; tin was the largest commodity (measured by the value of transactions) in his portfolio. His dealings were speculative, with heavy trading in options during 1924-1925, as we shall see below.

The main problem that Keynes faced throughout the 1920s was the lack of any reliable set of data as to the world 'liquid' stocks, i.e., available for immediate consumption. In fact in the 1920s in the tin market the amount of information at the traders' disposal was variable in quality, mainly due to the long distance at which the production sites lay.

The largest tin producing area was in Southeast Asia, mainly in the Federated Malay States, under British control, and the Dutch East Indies. Other important supplies came from Bolivia, while minor sources were China, Siam, Nigeria, Congo, Australia, India and Cornwall. (Eastham 1939: 17-8). With the advent of the Industrial Revolution, the United Kingdom had been importing large tonnages from abroad, but after the First World War the lead was taken by the United States.

Since production was concentrated so far away, it was very difficult to know what the price would be at the time of the ships' arrival some months later. With the invention of the telegraph, intercontinental lines of communication were established between the countries of the world and merchants were able to anticipate the time of arrival of a cargo of metal. They were able to sell it forward for delivery on a fixed date, thus protecting themselves against a fall in price during the voyage.[9]

In the 1920s the market trend was dominated by the parallel but uneven growth of both production and consumption. Price movements were considerable and widely attributed to the extreme rigidity of both supply and demand, a characteristic of the tin market that Keynes frequently noted (e.g. in CWK XII: 377 and 421).

After the post-war slump, consumption grew faster than production and a period of rising prices culminated in the boom of 1925 and 1926, when consumption exceeded production. Then, for six months, prices remained in the neighbourhood of the peak reached in October 1926, while a sharper fall began in 1928.

When tin consumption began to move upward after 1921, the presence of large stocks in the hands of a pool formed in Malaya and the Dutch East Indies (the

[9] 'In 1869 the opening of the Suez Canal reduced the delivery time of tin from Malaya to match the three months delivery time for copper from Chile. This gave rise to LME's unique system of daily trading dates for up to three months forward which still exists to this day' (see http://e-bursa.ro/burse-de-marfuri-2/burse-marfuri-europa/london-metal-exchange-lme/)

Bandoeng Agreement)[10] retarded the adaptation of production to increased consumption. Then, in 1925, when the effect of the Bandoeng scheme was over and prices were reaching an unprecedented level, new investments were made and new techniques adopted. As a result, and although the consumption trend remained on the whole positive, the situation was finally reversed when production overtook consumption in 1928 and new restriction schemes began to be adopted (Eastham 1936); the fall in price lasted until the end of 1930.

A relatively small error in the estimates of liquid stocks, which were normally very low (below on month consumption) could generate erroneous forecasts of the persistence in time of a surplus of stocks. With regard both to the matter of assessing inventories, and the more general issue of trying to catch the drift of the market in the long run, Keynes could rely on a wide range of sources of information, including journal articles, informal letters circulated by Keynes's broker, Buckmaster & Moore, and miscellaneous data derived from private correspondence with other authorities in the field. Between 1923 and 1926 Keynes adopted the figures of 'visible' supply reported by A. Strauss & Co. As from 1925, however, he began to doubt this source of information, as it included no accurate analysis of the 'visible' supply that was 'afloat' (and therefore not immediately available for consumption), and because it lacked an estimate of the large accumulations in Southeast Asia—or, at least, of their trend variation. Accordingly, from 1927 onwards, in the *Memoranda* Keynes made reference to the London Metal Exchange definition and figures of visible supply, though not without adding a host of further qualifications of his own.

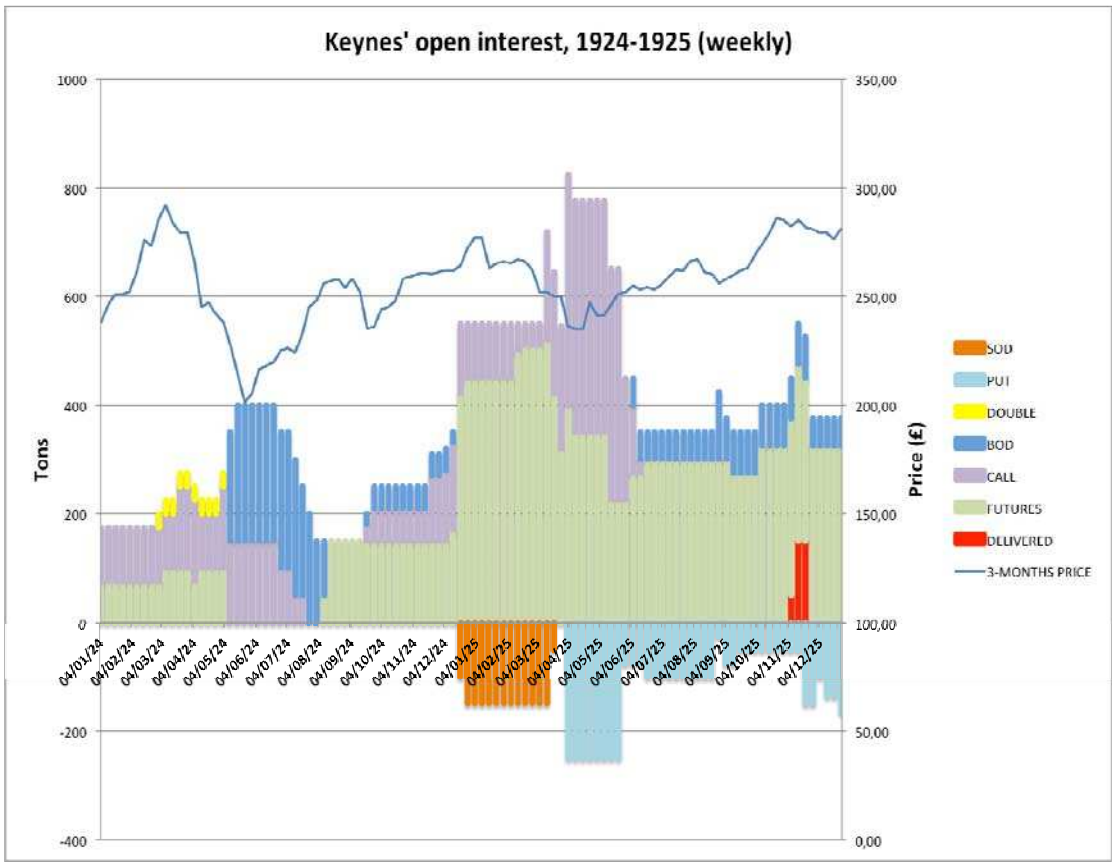
One episode that prompted Keynes's efforts in refining his assessment of stocks was the emergence of a backwardation in the tin market after a long period of contango, due to surplus stock, which had lasted until the Autumn of 1925. At that time Keynes began to share the general opinion of a tin 'famine' in the very long run and singled out tin as the commodity for which an increase in production was the least probable in the near future (CWK XII: 359-60). In the end new elements came to be known which progressively brought to an end the period of strong bullish expectations and by 1928 the trend in prices fully reverted.

Now let us look more closely at his trading behaviour in 1924-1925. Figure 1 shows the weekly account of Keynes's open interest according to his ledgers, recording date and price at which each position was opened and closed, the quantity purchased or sold and the type of contract. For each future contract the price is given per ton, while for

[10] This was a scheme 'designed to take over 19.000 tons of surplus tin off the market in order to raise the price to £240 per ton' (Eastham 1936: 18).

options we have the purchase price and the strike price. The price of the typical three months future has been derived from the Times on line Archives as recorded for each Friday.

Figure 1



Source: Cavalli and Cristiano (2012).

Keynes's tin position began to rise with a series of purchases (call options, BOD and futures) in March 1924. In May 1925 he took a share in a private pool which had been formed to prevent price from falling; from the correspondence we know that Oswald Falk, Rupert Trouton and Jack Budd (son of Cecil) were part of it and, from the ledgers we can infer that Keynes's participations lasted until October 1925, while it is likely that the pool was dissolved at the end of that year.

The cycle of investment initiated in March 1924 resulted in heavy losses, which were only partially offset by the rise in prices that began in August 1924. Although the loss on the position opened in March was over £3000 early in the summer, Keynes kept his long position practically unchanged until November 1924. This move earned him a

substantial recovery before the end of the year, when he decided to increase his position to an unprecedented level. However, the higher risk associated with this enlarged position, along with the price volatility experienced so far, suggested to Keynes (and, probably, to his broker as well) a more prudent strategy of combining purchase of future with SOD contracts. Possibly also as a consequence of his concern about the true level of inventories, when adding a series of purchases throughout December 1924, he hedged each new long position with a corresponding short position of half the quantity purchased. In order to hedge the amount of futures purchased Keynes bought options and sold SOD (traded at discount price) which that he eventually exercised in March. His expectations of an upward trend in prices was frustrated by the short-term events, but the SODs proved decisive in putting a limit to his losses. In fact in March 1925 tin future price turned out to be not only lower than in December, but lower that the discount price at which SODs were traded.

Cavalli and Cristiano, who have studied Keynes's investment in tin over the whole period 1921-30, have found that

> Keynes made appreciable profits between May and December 1925, in a context of steadily surging prices, possibly influenced by the pool itself. Then some minor losses came during a momentary fall in prices in the first half of 1925. Finally, in the ensuing period the boom the market had been expecting eventually took place, with prices reaching their peak between September and October 1926. Meanwhile, favoured by the period of backwardation, Keynes began to take delivery on some of his futures and to stock tin in the LME warehouses, thus moving part of his operations onto the spot market. By means of this technique, Keynes was able to extend the time horizon of his speculations beyond the three months of a standard future contract, with substantial returns in most of the cases. By the end of this crucial period, Keynes aggregate profit had topped £17,000, thanks mainly to the gains made during the 1926 boom, but, as soon as prices fell off their peak, Keynes started losing money. (2012: 67-8)[11]

We can conclude by saying that his speculation in tin showed a combination of strategies, based on a guess about inventories and 'inside' information, where hedging his position in future both in the cash and the options market played a huge part.

4.2 Wheat

An important characteristic of the wheat market was the huge amount of information at the traders' disposal. All the statistics and data related to the volumes of production by country, the net imports, the carry-overs, the shipments throughout the

[11] It must be remembered the double nature of the LME which was both a hedging market and a delivery market.

world, the different qualities of wheat, even the weather and soil conditions in different areas, as well as reports containing prospects, analyses, and forecasts, were regularly published by many institutions. Thus, as far as information is concerned, this market was near to being a 'perfect' one in the sense that everyone involved in trading—farmers, merchants, owners of grain elevators, speculators, and even consumers—could have access to the information they needed to make their decisions.

The most important source of information used by Keynes was George Broomhall's Corn Trade News, a specialized journal providing statistics, reports, and forecasts not only on production, shipment, and prices of wheat, but also on futures trading. The second important source of information, particularly for the North American markets, lay in official reports published by leading American and Canadian institutions, while the third source consisted in information and suggestions from an American correspondent of Keynes, the banker Walter Case.

This was a market that saw great price volatility. Prices, which had risen between 1921 and 1924, declined slowly in the second half of the 1920s, sharply in the 1930s in connection with the Great Depression (Table 1; see Foresti and Sanfilippo 2012).

Table 1: Averages annual prices of imported wheat in United Kingdom, 1922-38 (in shillings per quarter of 480 lb.)

Crop Year	Manitoba No. 3	Arg. Rosafè	Australian
1922-23	43.1	44.5	47.8
1923-24	43.5	44.1	46.8
1924-25	61.2	60.10	61.2
1925-26	55.3	54.7	57.9
1926-27	53.11	52.5	55.0
1927-28	50.8	49.6	52.4
1928-29	45.6	42.3	45.11
1929-30	45.2	40.3	43.6
1930-31	25.4	23.5	26.4
1931-32	24.10	23.8	26.3
1932-33	25.2	23.2	25.9
1933-34	24.6	19.5	23.10
1934-35	28.5	22.4	26.4
1935-36	30.5	28.9	30.2
1936-37	43.6	39.4	43.4
1937-38	41.10	38.2	37.7
1938-39	23.11	22.11	24.4

Source: De Hevesy (1940: 828).

According to Keynes, there were two fundamental reasons for the difficulty in matching demand and supply on wheat markets and, hence, in keeping prices stable: 1) the systematic excess of supply over demand, and 2) the wide fluctuations in supply. As he saw it, the former derived from the subsidies and tariffs implemented by governments to support domestic wheat prices and counteract the fall in the purchasing power of producers and farmers, and from the stimulus to increase production resulting from occasional years of high prices. The section of wheat of the *Memoranda* five times out of seven opens with the following comment:

> Wheat is a baffling commodity to the compiler of comparative stock statistics, because it is a seasonal crop, coming from many different sources, and harvested at different times of the year. As in the case of other commodities, the statistics regularly available month by month are those of 'visible' supplies in 'second hands'; but, owing to the large amounts held on farms and elsewhere 'out of sight' and to the seasonal irregularity of supply, these figures are moderately useful in the case of wheat. (CWK XII, *passim*)

In the third, fourth and fifth *Memoranda* the 'particularly unsatisfactory' is substituted for 'moderately usual' as to signal increasing uncertainty on the level of stocks.

The great volatility of prices made wheat a perfect market for dealing in futures, for both hedgers and speculators.

The main markets in which Keynes operated in the decade 1925-35 were Liverpool, Chicago and Winnipeg. These markets presented different characteristics, not only in terms of geographical location. Chicago and Winnipeg were close to large wheat-producing and exporting areas. Hence, futures contracts on these markets, although specified in terms of generic contract wheat, were related to the specific qualities of the wheat produced in North America (in particular, Hard Winter and Spring wheat in Chicago, and Manitoba wheat in Winnipeg). Moreover, both these markets were endowed with a well-developed storage system (Santos 2006). As a consequence, carry-over costs had a major role in determining the difference between spot and futures prices on these markets. On the other hand, Liverpool was the chief port of arrival for wheat imported from all over the world and bound not only for British markets but also for Continental ones. This market was not equipped with capacious storage facilities, but relied on arrivals from various producers all year round (Working 1942). The difference between spot and futures prices was then influenced more by the succession of arrivals, and, hence, by the conditions of production, than by the carrying costs of stocks. Continuity in arrivals was guaranteed by the succession of harvests from the southern to the northern hemispheres along the year, starting from Australia in October

to conclude in the UK the following September. Each market dealt in futures of various maturities, broadly corresponding to the timing of harvest and delivery to the market of tenderable wheat.

Keynes's ledgers record trading in wheat futures from 30 December 1924 to 3 August 1926 and from 17 October 1929 to 9 December 1935, with a gap of three years which is not easy to interpret.

> His activity was characterized in the first cycle of investments (1925-6) by a series of short sales, both on the Winnipeg and Chicago markets, which brought to him some profits. During this period the wheat market was quite stable and his was able to anticipate a slight decrease in prices, looking at the increasing accumulation of stocks that started in November 1924 and lasted for the first semester of 1925. (See CWK XII: 401)

As far as the second period is concerned (1929-35) Keynes's investment strategy appeared more complex and sophisticated. He traded at the same time on four markets (including Buenos Aires), adopting a different strategy according to the specific conditions of each market-place (see Foresti and Sanfilippo 2012).

Indeed, it appears that Keynes carried out three different types of trading alternatively: (1) long commodity futures, aimed at earning the normal risk premium; (2) time-varying long commodity futures, so as to have larger exposures when the premium is large relative to the risk, and smaller exposures when the premium is small relative to risk. (This strategy might also involve closing a position on one specific market and/or commodity if the risk premium was too low compared to other investments); (3) outright speculation on future prices or price differentials, when the market is deemed to be making a mistake. (This strategy would suggest assuming a short position rather than a long one, or hedging a long with a short position on a different market; i.e., making a straddle).

A straddle is the combination of two opposite positions on two different markets (and possibly two different dates) with a view to closing the positions simultaneously, speculating on the price differential. One reason for a speculator to engage in a straddle may be the lower volatility in price differentials between two markets as compared with the volatility of prices on either market.

Only from 1935 onwards (at least until 1937, as shown in Fantacci, Marcuzzo and Sanfilippo 2010), we can observe a systematic prevalence of long positions, i.e., purchasing a certain quantity of wheat for a certain maturity and, as the maturity approaches, putting it forward to a later date.

We may conclude this overview by saying that speculating in metals—besides tin he traded heavily in copper, lead, and soft pig irons, as well as rubber—Keynes was dealing with simple and double options, which were exercised most of the time. They were a less expensive means than futures to make forecast about prices in the future and spot markets. It must be remembered that Keynes carried half of his portfolio on borrowed money, the margin requirements in his dealings in futures being at the lowest 20 per cent, and at the highest 30.[12] These forecasts were greatly dependent on information about stocks, both 'visible' and 'invisible', and the prevailing production arrangements (cartels, quotas and restriction agreements), which he sometimes worked out himself. In both aspects Keynes kept informed through his broker, Buckmaster & Moore, relying on the advice of friends associated with B&M, such as Rupert Trouton and Oswald Falk who had been his assistants at the Treasury during the First War World, and people in the tin trade.

As for his speculation in crops—besides wheat he traded heavily in corn and cotton—where options were not available in Keynes's time, he had a combination of trading strategies, basing his decisions on the massive amount of information he collected on production and market conditions.

5. A change of view

In the *General Theory*, Chapter 12, the analysis of speculation marks a departure from Keynes's previous views, as the following quotations show: 'the term speculation [is appropriated] for the activity of forecasting the psychology of the market' and it is distinguished from enterprise which is defined as the 'activity of forecasting the prospective yield of assets over their whole life'. And Keynes adds: 'As the organization of investment market improves, the risk of the predominance of speculation […] does increase' (CWK VII: 158).

Thus 'speculation' is no longer an attempt to gauge the 'prospective yield', on the basis of the fundamentals but a bet on a 'favourable change in the conventional basis of valuation' (CWK VII: 159). The conventional basis is of course average market opinion as described in the 'beauty contest' example, so gambling—as in the casino—rather than informed opinion is likely to account for 'the success attained by Wall Street'.

In his speech to the Annual Meeting of the National Mutual, on February 20, 1938, Keynes made another comment in the same vein: 'Speculative markets […] are

[12] On margin requirements before the 1929 crash, see Rappoport and White 1994.

governed by doubt rather than conviction, by fear more than forecast, by memories of last time and not by foreknowledge of next time'(CWK XII: 238).

This explains why speculation does not promote price stability in those markets. Unlike the efficient market theory, according to which by buying low and selling high, speculators push up the low prices and push down the high prices, Keynes points out its possible destabilizing nature. The destabilizing effects of speculation can be described as a sudden and large increase in open interest positions, unrelated to new information about fundamentals coming to the market: futures prices go up if the increase is in demand (an increase in long positions) and down if the increase is in supply (an increase in short positions). So accumulated net long positions in futures, constituting as they do a bet that prices will rise, actually make spot prices rise. Conversely, accumulated net short positions would make spot prices fall.

In 1938 Keynes pointed out that for four commodities (rubber, cotton, wheat and lead) 'which are representative of raw materials marketed in competitive conditions, the average *annual* price range over the decade before 1938 was 67 per cent. An orderly programme of output, either of raw materials themselves or of their manufactured products is not possible in such conditions' (CWK XXI: 459).

The need to regulate commodity markets become imperative, to Keynes's way of thinking, on the outbreak of war, but this may also have reflected his changed view on the nature of speculation, which grew out of his experience as a speculator.[13]

Although Keynes had been advocating government storage of foodstuffs and raw materials since 1926, it was only in 1938 with his article on 'The Policy of Government Storage of Foodstuffs and Raw Materials' that he began to elaborate various buffer-stock schemes, as a means to stabilize prices. By the end of 1941 Keynes was fully engaged in work on a scheme for international buffer stocks, the so-called Commodity Control, drafting nine different versions between January 1942 and February 1943 (Hirai 2008).

The Fifth draft contains the buffer-stock plan that Keynes hoped to get through; it proposed the establishment of international organizations (named Commod Controls), which would deal in individual commodities and would be made up by representatives of the major producing and consuming countries and managed by independent specialists. The task of each Commod Control was to fix the initial basic price at a level reflecting the existing conditions and thereafter to make the price adjust as stocks exceeded or were short of the target rate by selling or buying at a price within 10% below or above the basic price. The finance necessary for the operations would come

[13] The discussion of Keynes's Buffer Stocks scheme draws on Fantacci et al. (2012).

either from the profit deriving from the difference between selling and buying prices, or be supplied on the basis of arrangements between Central Banks or of overdrafts provided by the International Clearing Union (CWK XXV: 190).

The underlying principle of the plan was that: 'to combine the long-period advantages of free competition with the short period advantages of ensuring that the necessary changes in the scale and distribution of output should take place *steadily* and *slowly* in response to the steady and slow evolution of the underlying trends' (CWK XXVII: 126).

Why was the market mechanism unable to do this? Keynes's answer was that:

> The competitive system is in its ideal form the perfect mechanism for ensuring the quickest, but at the same time the most ruthless, adjustment of supply or demand to any change in conditions, however transitory […]. If demand fluctuates, a divergence immediately ensues between *the general interest* in the holding of stocks and the course of action which is most advantageous for *each competitive producer* acting independently. (CWK XXVII: 131, emphasis added)

The reason why speculators may be unable to make the adjusting mechanism work *steadily* and *slowly*, generating a stable price environment, is that since there is no incentive to buy surplus stocks in a falling market, 'it is safer and more profitable to await a further decline' and long-term holding of stocks by speculators 'can only be called into action on a sufficient scale by a drastic fall in prices which will curtail current output substantially and appears to be a long way below any probable normal cost of future production' (ibid.: 132-3).[14]

Since it takes time to increase supply, speculators may act as amplifying factors in pushing up prices and stimulating 'uneconomic and excessive output'.

6. Concluding remarks

In this paper I have endeavoured to analyse Keynes's 'extremely wide practical acquaintance' with organized market as a way to understand his *practice* as speculator and his evolving *views* on speculation which eventually led him to argue against 'unfettered competition' and in favour of regulation in these markets.

He relied heavily on information relative to each individual market and commodity, weighing up the quality and reliability of that information through calculation of the relevant data, the advice of experts, and his own assessment of market conditions and of

[14] This passage is reproduced verbatim from the 1938 article (see CWK XXI: 457).

other participants' opinions. The grasp of 'business psychology' became an increasing important element both in his investment strategy and in his views on speculation.

In the *General Theory* he made it clear that in his opinion 'the energies and skill of the professional investor and speculator are mainly occupied […] not with making superior long-term forecasts of the probable yield of an investment over its whole life, but with foreseeing changes in the conventional basis of valuation a short time ahead of the general public' (CWK VII: 154).

On the inside cover of a booklet in which Kahn kept a record of his Stock Exchange transactions was penned the following motto suggested to him by Keynes in 1934: 'The principles of successful stock speculation are based on the supposition that people will continue in the future to make the mistakes they have made in the past' (RFK papers 15/1).

His own investment philosophy seems to have changed in the early 1930s, following heavy losses in the commodity market, the 1929 crash and possibly progress in his new theoretical developments which culminated in the *General Theory*. The role of informed opinion about the relevant data gave way to evaluation of market sentiment, conventions and herd behaviour. In the end the ability of the speculator rested, for Keynes, on individual judgment, as opposed to the average market view: 'My central principle of investment'—he explained in 1944 to a banker who was critical of his suggestions about how to manage Eton's finances—'is to go contrary to general opinion, on the ground that, if everyone is agreed about its merits, the investment is inevitably too dear and therefore unattractive' (CWK XII: 111).

In the case of commodity markets, which had an important role in sustaining or depressing the level of effective demand worldwide, Keynes became increasingly worried about the effect of adverse or excessively optimistic markets opinions and ever more apprehensive of the dire consequences of trusting them to ensure the smooth working of the economic system. With the primary commodity bubble close to bursting,[15] it is high time for this, among so many other insights of Keynes which have proved relevant in the present crisis, to be taken seriously and acted upon.

[15] Standard & Poor's (S&P), in a 22-page report issued on June 1, 2011, entitled *The Potential Risk of China's Large and Growing Presence in Commodities Markets*, warns that record high commodity prices may represent an unsustainable bubble, subject to sudden correction, especially if the Chinese economy is hit by a significant deceleration or downturn.

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Keynes's activity on the cotton market and the theory of the 'normal backwardation': 1921-1929

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1. Introduction

In 1923, Keynes published the first formulation of the theory of futures contracts, often labelled 'normal backwardation theory' (Keynes 1923), that he later incorporated in his *Treatise on Money* (CWK VI, chapter 29). This theory hinges upon the idea that speculators provide a protection against price fluctuations and, on average, earn a *risk premium* determined by the working of the market. In this paper, we try to assess to what extent Keynes, or any other speculator, could ever have used this theory as the guiding principle of his investment strategy and how such an analysis may illuminate speculative behaviour. In order to do so, we focus our attention on the case of the cotton market, and this mainly for two reasons. First, Keynes himself in his 1923 article (and the same point also emerges in more descriptive analyses he published in the same decade) suggested that cotton is one of the markets where it is more plausible that a speculator could simply behave as a risk bearer. Second, cotton is one of the markets in which Keynes was more active during the 1920s, when his own theory was elaborated, and one of the few in which he had already been investing even before the 1923 article was published.[1]

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[1] Keynes's involvement in the debate on the rationalization of the Lancashire cotton industry during the late 1920s (Marchionatti 1995; Belussi and Caldari 2011) could be a further reason for choosing this commodity as a case study. However, as no direct relation can easily be found between this episode in Keynes's public life and his investments in commodity markets, we did not place much emphasis on this point. More direct evidence of Keynes's outlook on cotton prices can in fact be found in the data considered in Sections 4 and 5.

After a preliminary survey of the cotton market in the 1920s (Section 2), we consider the hypothesis of an investing strategy based on the theory of the 'normal backwardation' in more abstract terms (Section 3). In Sections 4 and 5 we compare the same hypothesis with the trend of prices that Keynes could observe from 1921 onwards and, finally, with Keynes's behaviour on the cotton market over the period 1921-1929. Section 6 concludes the paper.

The different approaches we have employed converge on the same result. Our general conclusion, in fact, is that even if a speculator has a strong belief in the validity of the 'normal backwardation theory', he/she must pay constant attention to the prospects of spot price variations and cannot take for granted that futures prices quoted in the market will incorporate correct forecasts of future spot prices. Indeed, records of spot and futures prices over the period 1921-1939 show that a speculator who relied exclusively on market valuations as expressed by futures prices would have had only a 50 per cent chance of earning a positive risk premium. Not surprisingly, available data on Keynes's purchases and sales suggest that only for a short period at the onset of his activities on the cotton market he might have relied upon the prospect of earning a positive profit in the form of risk premium as indicated by his theory (even though, also in this case, his behaviour reveals a special caution). Afterwards he seems to have relied much more heavily on information on the fundamental tendencies of the market which he did his best to collect.

2. The cotton market in the 1920s and 1930s

The development of organized cotton markets as existing in the 1920s and 1930s started in late XVIII century, when British cotton trade begun to grow quickly in volume, importance, and technical organization and when cultivation of cotton was first attempted in North America, to lead the USA soon to become the most important producer in the world. A crucial evolution in cotton markets, however, took place from mid XIX century when a regular steam service (first trip accomplished in 1840) was established between England and the USA and when a transatlantic cable was successfully laid (1866). The steam service reduced the time necessary to cross the Atlantic from about seven weeks to nine days, thus increasing the speed at which crop reports from the USA could reach Liverpool, and allowing samples of raw cotton to be delivered to Liverpool merchants long before the bales sent from America in ordinary cargo ships. This improvement in transportation caused the development of a market for cotton *to arrive* which gradually replaced auctions of cotton *on the spot* or on

consignment. A formal regulation of contracts of cotton *to arrive* was issued by the Liverpool Cotton Brokers' Association in 1869, but by that time, thanks to the transatlantic cable, which allowed for virtually instantaneous communication between England and America and crucially contributed to establishing an extremely close connection between the price of cotton in different and distant markets, another kind of contract—contracts *for shipment* or for *future delivery*—had acquired such an importance and had evolved in such a manner that in 1871 the same Association made a clear distinction between contracts for specific cotton shipments and general contracts in terms of cotton of standard quality for shipment to be made in named months (Rees 1972: 89-91).[2]

The latter distinction was essential to the development of *hedging* operations (i.e., protection of farmers, merchants and consumers from price fluctuations) as a different activity from that aimed at actual cotton delivery.[3] *Hedging* consists of a set of practices which allow both a subject who owns or will own a quantity of cotton of a specific quality and means to sell it at a precise date (or when opportunity arises) and a subject who wishes to purchase cotton (not necessarily in the same quantity, of the same quality and at the same future date as the other subject may allow) to take protection against fluctuations in the price of cotton even if they cannot directly agree an exchange of commodities because none of them is in the position of providing a suitable counterpart to the other. The subjects who allow to bridge the gaps between these two parties may be called *speculators*, and the instrument they use is the contract for future delivery of cotton of standard quality, which we have just seen to have emerged as a result of improvements in transport and communication technologies.

In order to obtain such a protection, the subject who owns cotton may sign a sale contract for future delivery, while the subject who wishes to purchase cotton at a certain future date may sign a purchase contract for future delivery, both at specified prices. If they cannot directly match these contracts, speculators find two opportunities to offer their own services. For instance, if a cotton merchant (the same would apply to a cotton producer) has acquired 100 bales of cotton of x quality, the futures market allows him/her to hedge against this purchase by selling for future delivery 100 bales of cotton of *standard* quality at a named date (i.e., signing a futures contract), where reference to *standard* quality makes easier to place such a contract in the market—but, as a rule, the

[2] Cotton futures exchange were established in New York in 1870, in New Orleans in 1880, in Liverpool and Le Havre in 1882. The first cotton futures exchange, however, seems to have been the Alexandria Cotton Exchange, active from 1861 to 1961 (Baffes and Kaltsas 2004: 154-64).

[3] Of course, the same applies to any commodity for which similar market arrangements exist.

subject who buys the contract is not interested in actual delivery. If, on or before delivery date (*maturity*) specified in the futures contract, the merchant finds a buyer for the 100 bales of cotton of *x* quality, then the futures contract may be closed out by buying back the same contract—i.e., paying or pocketing the difference between the current futures price for cotton of *standard* quality and the price specified in the futures contract (in fact a *Cotton Market Clearing House*—later *Liverpool Cotton Bank*—was established in Liverpool in 1876 exactly for this purpose). If the latter price is higher than the former (i.e., if, assuming that approaching maturity spot and futures prices tend to converge, spot prices have gone down), the merchant makes a profit on closing the futures contract; but such a profit is approximately offset by the loss in the sale of the 100 bales of cotton of *x* quality, which must be sold at a price lower than expected (i.e., lower than the one agreed in the futures contract); the opposite would be the case if prices had gone up. The merchant will make no profits nor losses due to price fluctuations, and for the conduction of his/her activity may rely on ordinary commercial profits as calculated with regard to the price accepted in the futures sale contract. Exactly the same would apply (*mutatis mutandis*) to the case of a spinner who wishes to purchase a certain amount of cotton at a future date.

Crucial to these developments—to facilitate the operation of the whole system—was the distinction between two markets: one dealing with transactions in specific types of cotton in view of its actual delivery, the other dealing with transactions in a general type of cotton which may lead to actual delivery, but where the parties involved are more often interested in closing the contract before actual consignment. Obviously, the existence of a common system of grading cotton by quality, which, in general, is essential to the good functioning of a market, is also a premise to the use of the latter type of contracts, because it allows to establish a known relationship between *x* quality and *standard* quality.

The same separation and development of two such markets also allowed, on the one hand, *bull* speculation (speculation based on the expectation of an increase in prices) to free itself from the need to accept actual delivery of the produce, and, on the other hand, *bear* speculation (speculation based on the expectation of decrease in prices) to emerge, given that, otherwise, it would have been restricted to those who actually owned a stock of cotton and to the magnitude of that stock (Rees 1972: 92).

Obviously, in principle, what facilitates speculation also makes hedging easier, because an active speculative market may make it easier for the hedger finding a subject interested in the purchase or sale of the necessary contracts. Indeed, Hubbard suggests that, when a thorough examination of all the outstanding contracts of firms active in the

New York Cotton Exchange could be accomplished, only 15 per cent of market operations could be described as purely speculative (e.g., futures purchases guided by an expectation of future price rises which could be fostered by events such as a report on a drought in an important cotton growing area), while the remaining 85 per cent could be described as strictly *trade business*, i.e., *hedging* (Hubbard 1928: 318-22).[4] This happened in 1914, just after the outbreak of WWI, when, in a particularly severe market crisis, brokers were willing to disclose any aspect and motive of their positions and allowed them to be scrutinized in the greatest detail, and also in 1918, just after the Armistice, when a similar investigation was undertaken. Indeed, a keen observer (and actor) of the cotton market such as Hubbard strongly maintained that the two poles around which every component of the cotton trade rotates are producers and consumers (i.e., farmers and spinners). A significant part of the activity of those engaged in futures markets must simply answer the two symmetrical needs of producers and spinners. Nevertheless, purely speculative behaviour, even if covering only a limited portion of total exchanges, may exert an extremely strong influence on short term price movements, if not on longer period trends too (see for instance Hubbard 1928: 392-4).

3. Keynes's theory of speculation on commodity markets

Strictly speaking, it may be argued that Keynes did not present his approach to speculation as a discussion of *futures markets* but of *forward markets*. That is to say of markets where actual delivery of the commodities dealt with, rather than closing out of contracts, was expected to take place at maturity. However, given that forward markets are conceptually close to futures markets, we may take for granted that his analysis may be extended to futures trading as described above. But Keynes's papers also show that he was fully aware of speculation on futures markets and it would be inconceivable that he did not mean to apply his analysis also to those markets—or primarily to those markets. Indeed, behind this peculiarity of his writings there may be a terminological ambiguity: in those years the terms *forward* and *futures* were often used as synonymous.

Following Keynes's approach, the activities of speculators may be distinguished in two main categories. On the one hand, speculators may expect to earn a profit by forecasting price movements better and before than other subjects active in the market.

[4] Garside, on the contrary, argued that, in general, tracing a neat distinction between hedging and speculative transactions would be impossible, and that for this reason computing the percentages of trading of hedging and of speculative character would also be impossible (Garside 1935: 340-1).

In this sense, speculators act as *prophets*. On the other hand, speculators are seen as *bearing a risk*: they do not act upon the expectation of obtaining a profit because they believe they can forecast future price variations better than other operators in the market; what they expect to gain is a risk premium that (if cotton is the commodity we refer to) farmers, spinners or merchants are prepared to pay to protect their ordinary monetary incomes from price oscillations. This we may take to have been what Keynes saw as the *proper* field of activity of the speculators, who provide such a protection—i.e., *hedging*—by selling contracts for future purchase on the futures market to producers or stock owners and contracts for future delivery on the same futures market to spinners or people who want to acquire a stock. Agents belonging to the latter groups are prepared to pay a premium in the form of difference between the spot price they, individually, expect will be established at the time of maturity of the futures contract (expected future spot price: $FSP_{expected}$) and the price agreed for in that very contract (futures price: FP).[5] The mechanics of the hedging operation is such that, as we have already seen, if on maturity the contract will be closed out at a price equal to the then current spot price, irrespective of actual price movements, these agents will face no profits nor losses, except for those profits (or losses) they may have already reckoned accepting FP as their selling price.

From the point of view of the speculators who offer such futures contracts, on the other hand, the risk premium is given by the difference between the spot price they, individually, expect will be established at the time of maturity of the futures contract ($FSP_{expected}$) and the price agreed for in that very contract (FP). But if a speculator has sold a farmer a futures purchase contract and, on maturity, the contract is closed at a price equal to the current spot price (FSP), the speculator will be able to obtain a reward higher than the risk premium originally envisaged if current spot prices turn out to be higher than initially predicted, or lower than that very risk premium if current spot prices turn out to be lower than initially predicted. In this sense, a speculator, even if pursuing a reward as a risk bearer, is also bound to act as a prophet.

This difference between the monetary outcomes of the hedging operation for the farmer and the speculator may be explained considering the third class of subjects active in the market: the buyers of the commodity (in our case, the cotton spinners, or agents who wish to acquire a stock of the commodity). Spinners wish to protect their industrial monetary incomes from price fluctuations and do so by signing futures contracts for purchase of cotton—i.e. contracts approximately symmetrical to those signed by

[5] As already mentioned, it may be assumed that, approaching maturity, spot and futures prices tend to converge.

farmers. If, at maturity, a contract will be closed out at a price equal to the then current spot price, the spinner will reckon no extra profits nor losses. The speculator, on the contrary, will obtain a reward higher than the risk premium he/she had originally envisaged if current spot prices turn out to be lower than initially predicted, or lower than that very premium if current spot prices turn out to be higher than initially predicted. Speculators as a class (i.e. considering the average results of their dealings with both farmers and spinners), in any case, will close their positions with no extra loss nor extra profits beyond the risk premium.

If farmers and spinners could directly exchange the futures contracts which would grant both of them the desired insurance against price movements, speculators would have no *risk bearing function* to exert. As a matter of fact, however, according to Keynes, farmers and spinners do not exactly seek for the same (symmetrical) kind of contracts: 'generally speaking the producer needs to look much further ahead than the spinner, and whilst the latter may provide a good deal of assistance as regards the near future he is not so much help for more distant months' (Keynes 1923: 261).[6] This discrepancy justifies the presence of speculators as a group mediating between needs which are not perfectly symmetrical—where the gap to be bridged requires them to buy forward larger quantities than they sell forward, i.e., it requires speculators as a class to be going long.[7]

Following Keynes, we may assume that 'market opinion of the future course of prices, as expressed in current quotations, is as likely to err in one direction as in the other', and we may conclude that 'the remuneration of risk-bearing is measured by the average excess of the spot price three or six months hence over the forward price today for three or six months delivery' (Keynes 1923: 263), which may be expressed in the following terms:

assuming	$FSP_{expected} = FSP$
the risk premium	$r = FSP_{expected} - FP$
becomes:	$r = FSP - FP$

[6] This point probably explains why, answering a comment on his article, Keynes wrote: 'As regards the general tendency towards a "backwardation" in the price of contracts for distant months, I was comparing distant months with near months, *not* distant months with spot' (Keynes 1923: 266). This remark may alert us to the fact that representing backwardation (which in the 1923 article, unlike in the *Treatise on Money*, is only mentioned and not discussed in depth) as difference between *SP* and *FP* may be a simplification of a more complex picture which involves at least three groups of actors (farmers, spinners, speculators) and at least three prices (spot price and futures prices for near and distant months).

[7] As Kaldor puts it, 'hedging will be predominantly on the selling side' (Kaldor, 1980 [1939]: 27, see also 27 fn. 2).

In this sense, a speculator engaging in sales or purchases of futures contracts may rely upon market valuations and expect to earn a profit equal to the risk premium as defined by the market. But as we shall see later in this section, the same approach also allows to justify a behaviour of the same speculator relying less heavily upon market valuations.

The results expounded above are essentially based upon Keynes's views on speculation as may be recognized in his 1923 article, but in his *Treatise on Money* Keynes also developed an analysis which takes into account forces—essentially determined by the existence of redundant stocks of commodities—which may cause current and future spot prices to be above or below futures prices by an amount different from the magnitude of the risk premium.

In particular, Keynes considered that the difference between *SP* and *FP* may be either positive or negative: if it is positive ($SP - FP = b > 0$), the case is called *backwardation*; if it is negative ($SP - FP = -c < 0$), the case is called *contango*. Within the case of *backwardation*, in turn, Keynes distinguished a case of 'normal backwardation', where the difference between *FP* and *SP* is given by *r*.

'Backwardation' emerges when there are no redundant stocks of commodities (hence no particular pressure tends to depress the current spot price) and, on the contrary, supply turns out to be in shortage. In such a situation, if the current shortage of supply is regarded as 'capable of being remedied in six months but not at once, then the spot price can rise above the forward price to an extent which is only limited by the unwillingness of the buyer to pay the higher spot price rather than postpone the date of his purchase' (CWK VI: 128). In this sense, backwardation, if based upon an upward pressure on spot price, has no limit.

But Keynes also noted that

> it is not necessary that there should be an abnormal shortage of supply in order that a backwardation should be established. If supply and demand are balanced, the spot price must exceed the forward price by the amount the producer is ready to sacrifice in order to 'hedge' himself, i.e. to avoid the risk of price fluctuations during his production period. Thus, in normal conditions, the spot price exceeds the forward price, i.e. there is a backwardation (CWK VI: 128).[8]

In this case, backwardation may be indicated as 'normal backwardation' (CWK VI: 129), and the spot price may be treated as 'normal supply price' (CWK VI: 128), which

[8] As to the downward pressure on futures prices due to a desire to *hedge*, backwardation finds a limit in average total costs of production in the long period and in average variable costs of production in the short period.

may be said to include 'remuneration for the risk of price fluctuations during the period of production, whilst the forward price excludes this' (CWK VI: 128):

$$SP - r = FP$$
$$SP - FP = b^* = r$$

This discussion may be taken to reflect the content of Keynes's 1923 article and amounts to saying that the magnitude of normal backwardation (b^*) is set by the risk premium: given that

$$b = SP - FP = (FSP - FP) - (FSP - SP)^9$$

if in *normal* conditions prices may be taken to be stable $(FSP - SP = 0)$
then $FSP - FP = r$ implies that the value of b^* depends on the value of r.

After this discussion, Keynes considered the case in which redundant liquid stocks do exist. In such a case the forward (or *futures*) price may be above the spot price: a situation which is called *contango*, where $(SP - FP) = -c < 0$.[10]

Nevertheless, Keynes added, $SP < FP$ does not imply that no risk premium will be paid to the speculator who assists the producer in bearing price risks. Implicitly assuming that the risk premium cannot be lower than b^* (i.e., it cannot be lower than in *normal conditions*) he concluded that

> the quoted forward price, although above the present spot price, must fall below the anticipated future spot price by at least the amount of the normal backwardation; and the present spot price, since it is lower than the quoted forward price, must be much lower than the anticipated future spot price (CWK VI: 129):

$$FSP_{expected} - FP = r \geq b^* > 0$$
$$FP < FSP_{expected}$$
$$SP < FP$$

[9] This equation may also be written as $b = SP - FP = r - (FSP - SP)$. In such a form it has been interpreted (Fantacci, Marcuzzo, and Sanfilippo 2010: 8) as underlying Keynes's statement that 'the fact that there is a "backwardation" in the price of a commodity, or in other words that the forward price is below the spot price, is, therefore, not necessarily an indication that the market takes a "bearish" view of the price prospects' (Keynes 1923: 262), where a *bearish view* would imply that $(FSP - SP)$ is expected to be negative. But it might also be argued that that statement, seen within its context, does not appear to rely upon considerations concerning the role that r might play as complement of $(FSP - SP)$ in the definition of b.

[10] According to Keynes the magnitude of 'c' will be equal to the carrying costs (CWK VI: 129). Indeed, 'c' cannot exceed carrying costs, otherwise it would pay to buy spot and sell forward; an opportunity which would be immediately eliminated by arbitrage operations. However, it may be argued that, if the amount of commodity currently offered on sale is not large enough, 'c' may be smaller than carrying costs (Rees 1972: 439-40).

$$SP < FP < FSP_{expected}$$

(or, less formally, $SP << FSP_{expected}$)

In general, however, in contango, in order to cover the risk premium it will be necessary to pay 'more than usual' (i.e., the risk premium will be higher than b^*), because of 'the additional element of uncertainty introduced by the existence of stocks and the additional supply of risk bearing which they require' (CWK VI: 129), which further increases the difference between $FSP_{expected}$ and SP.

Following the proof of the dependence of the value of b^* from the value of r that may be recognized as implicit in Keynes's discussion of the magnitude of normal backwardation, and following the lines developed in Fantacci, Marcuzzo and Sanfilippo (2010), the analysis considered above may be reformulated by defining the risk premium in terms of a comparison between variations of spot prices ($FSP - SP$) and differences between spot and futures prices ($SP - FP$).

Assuming that

$$r = FSP_{expected} - FP$$

may be written as:

$$r = FSP - FP$$

we obtain $$r = (FSP - SP) + (SP - FP)$$

In a situation in which backwardation does persist in time,[11] if the risk premium must be positive, spot prices cannot increase more than the risk premium (they may rise less than the risk premium, be constant or decrease), because

$$r = (FSP - SP) + (SP - FP)$$

implies

$$b = r - (FSP - SP)$$

Similarly, in a situation in which contango does persist in time, if the risk premium must be positive, spot prices must increase more than the risk premium, because

$$r = (FSP - SP) + (SP - FP)$$

implies

$$-c = r - (FSP - SP)$$

[11] Obviously, b and $-c$ may persist but change their magnitude through time, which would add to the complexity of the results we may reach.

To put it in other words, persistence of contango is consistent with positive risk premium only if the relevant rate of price variation is higher than in the case of persistence of *abnormal* backwardation (assuming $b = c$).

But to extract information about the profits of individual speculators from the relationships concerning the potential range of price variations consistent with earning positive profits (risk premium) over contracts signed in cases of contango or of *abnormal* backwardation, we have to see what the above relationships imply in terms of specific contracts. In the case of contracts signed in *abnormal* backwardation those relationships imply that actual profits will depend on the initial value of b and on actual price variations:

$$r = (FSP - SP) + b$$

which means that a speculator who has bought forward can earn a positive profit for any value of

$(FSP - SP) > 0$ and also for $-b < (FSP - SP) < 0$ (if the speculator has sold forward, $r > 0$ for any $(FSP - SP) < b$).

On the other hand, actual profits on contracts signed in contango, will depend on the initial value of c and on actual price variations:

$$r = (FSP - SP) - c$$

which means that a speculator who has bought forward can earn a positive profit only for $(FSP - SP) > c$ (if the speculator has sold forward, $r > 0$ for any $(FSP - SP) < 0$ and also for $0 < (FSP - SP) < c$).

These results may be developed with regard to the analysis of a speculator's behaviour. In a given situation of contango or of backwardation, a speculator may opt for an active participation in the market: rather than relying upon the conviction that market valuation allows for a positive risk premium, he/she may decide whether a given futures contract may offer an adequate risk premium according to his/her forecast of the future course of spot prices. Indeed, the fact that, as we shall see in the next section, records of spot and futures prices show that a speculator who relied exclusively on market valuations as expressed by futures prices would have had, in the years 1921-1939, only a 50 per cent chance of earning a positive risk premium may be seen as evidence of the wisdom of maintaining an active attention to market prospects.[12] In this sense, speculators must do their best to understand if the situation is going to evolve towards higher or lower spot prices and the degree of such variations. However, as

[12] This view had been taken also by Garside, who stressed that even though no figures on aggregate speculative profits could be compiled, it could be argued that 'speculative traders in the aggregate over a period of years about break even' (Garside 1935: 343).

noted above, if a speculator has bought forward, the ranges of price variations consistent with positive profits seem to be more stringent in the case of contango than in the case of backwardation, because such range (given $b = c$) is larger in backwardation than in contango (the opposite if the speculator has sold forward).

But if on a market a particular *FP* is established, this means that it equilibrates demand and supply of futures contracts—that is to say, producers and consumers who hedge in opposite directions, speculators who pursue profits as risk bearers and speculators who intend to go long (bulls) or short (bears) because their expectations are different from those reflected by the value of *FP*. Predicting the behaviour of a particular speculator without knowing anything about his/her personal views and characteristics would then be impossible. But if we know the behaviour of a particular speculator in a specific context, an attempt to infer an outline of those personal characteristics may be ventured.

If a speculator—as seems to be the case for Keynes's investment in the cotton market (see end of Section 4 below)—is observed to buy forward more substantially in contango than in backwardation, this may be interpreted as due (but other explanations could be conceived) to an assessment of predictions over the future course of spot prices, within the relevant time horizon (11 months in the case of cotton futures contracts), as more reliable in contango than in backwardation. If a speculator—again: as seems to be the case for Keynes's investment in the cotton market—consistently avoids going short both in contango and in backwardation, it may be supposed that he/she considers expectations of price reductions as less reliable, within the relevant time horizon, than expectations of price increase.

But we must also add that similar considerations apply to potential variations of futures prices, which we have ignored because we have implicitly assumed that futures contracts were closed out only at maturity. Broadly speaking, these variations might be ignored by a speculator who is confident of his/her predictions on future spot prices and determined to close his/her contracts only at maturity. But can a speculator really presume that such variations will not reflect or influence movements of spot prices at maturity? If the answer is negative, as it may necessarily be, speculators should consider the possibility of closing out their positions before maturity, when this must be done at prices not necessarily equal to current spot price, which is something which was and is commonly done. This implies that to the definition of r considered above ($r = FSP_{expected} - FP$) we must add consideration of the possibility of calculating a rate of profit as $FP_1 - FP_0$ (where 0 is the time when the futures contract is signed and 1 is the time—before maturity—when it is closed out). Therefore, we may presume that observing Keynes's

behaviour as a speculator we may see that he closed his positions before maturity or at maturity according to how he assessed the prospects of futures and spot price movements.

4. Keynes's activities in the cotton market (1921-1939)

Among Keynes's investments in commodity markets, American cotton occupied a significant position. Keynes dealt continuously in American cotton and sometimes in Egyptian cotton on the Liverpool market throughout the 1920s and more sporadically in American cotton in New York and Liverpool during the 1930s. For their relative dimension and their continuity in time and, in the following sections we focus on Keynes's dealings in American cotton on the Liverpool market during the 1920s, which may be taken as the best sample upon which to test our hypothesis that the theory of the normal backwardation may have influenced Keynes's investment strategy.

The present reconstruction is based on the records of Keynes's dealings in commodities preserved in the Keynes Papers[13] (KP). The available data are provided by the ledgers in which Keynes reported his transactions (KP/SE/11/2), by his correspondence with the broker Buckmaster & Moore (KP/SE/2/1-6) and, from April 1926 onwards, by the weekly statements of the Tilton Co., Ltd (KP/TC). The ledgers are the main source. For each transaction, these documents report the dates and prices at which each position was opened and closed, the quantity purchased or sold, and the type of contract.

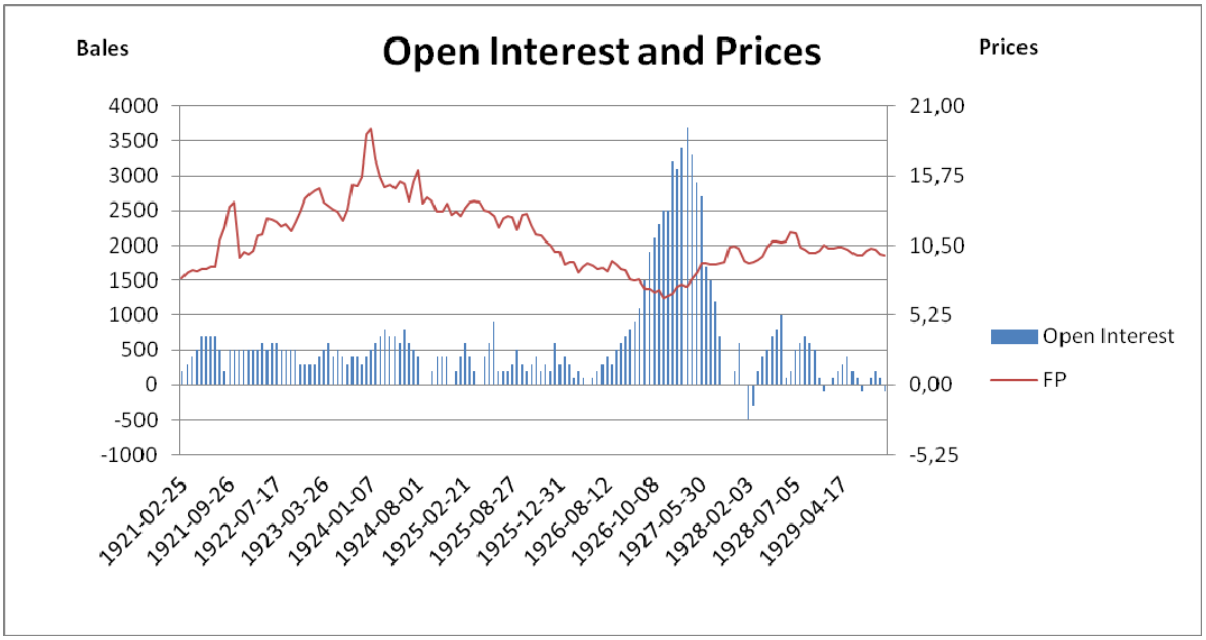
The financial instruments used by Keynes in his operations on the Liverpool cotton market were ordinary futures contracts of purchase or sale, which could be signed for delivery on one of the coming eleven months but not for later dates. These contracts were constantly regulated through weekly settlements of the debits and credits on both open and closed-out contracts, so that heavy liabilities would not build up (Smith 1922: 51-2, 57-8; Rees 1972: 95-6). In principle, in addition to these contracts, Keynes could also make use of *options* (also called *privileges*). *Put options* implied the right to claim a sale and *call options* implied the right to claim a purchase of a given quantity of cotton, within a given period, at a price previously agreed and based upon an official closing price of the day before the option was exerted. *Double options* (also called *straddle*) implied the privilege to either buy or sell or do neither (Rees 1972: 442-3). Use of these instruments, however, was regarded as a sign of 'highly speculative transactions of a gambling nature' (Smith 1922: 47). Indeed it was officially accepted in

[13] The Keynes Papers are kept at King's College, Cambridge.

Liverpool but prohibited in the New York Cotton Exchange (Smith 1922: 45-7; Hubbard 1928: 232), and Keynes's broker clearly refused to assist him in embarking in such operations (KP SE/2/1/143). As it results from the ledgers, unlike in his dealings in metals, investing in cotton Keynes only used ordinary futures contracts. Keynes's correspondence with his broker (Buckmaster & Moore) and the ledgers regularly updated by Keynes's himself on his activity on the cotton market give us a fairly complete picture of his operations.

Figure 1 shows Keynes's open interest in the Liverpool market for American cotton and the trend of prices along the period 1921-1929. The *FP* considered is the price of cotton for delivery in six months. As it is clear from the figure, Keynes was almost uninterruptedly long in the cotton market. In the period 1921-1929 he opened 129 positions, only 7 of which were short.

Figure 1



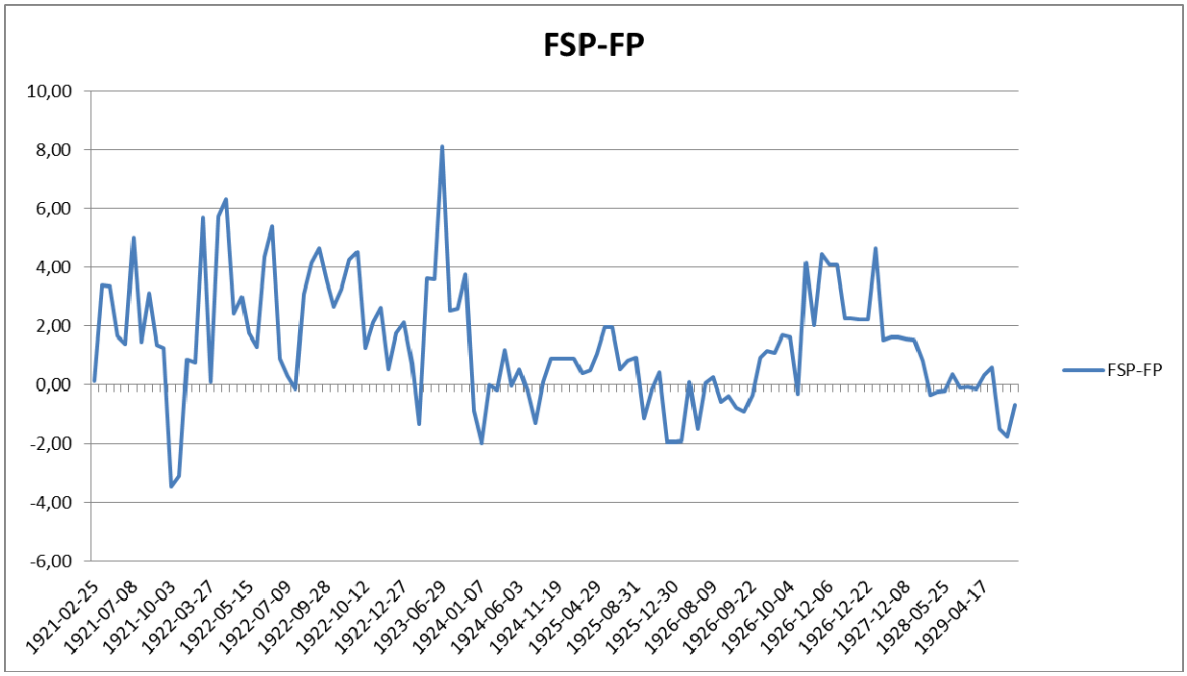
Sources: Keynes's ledgers (KP/SE/11/2); *The Times* online Archive.

With these investments, Keynes cumulated a net positive difference of £13,488 along the period, with a peak of £15,833 in December 1927 and a minimum of –£1,288 at the beginning of his dealings in 1921. From 1922 onwards, Keynes's cotton account always remained positive. For the period from February 1921 to April 1926 we have calculated a cumulative positive difference of around £6,300. A document of the Tilton Company reports a cumulative profit on Cotton of £4,970 for the period from April

1926 to November 1929 (KP TC/3/5), but the Tilton account included several dealings in Egyptian cotton that are not included in our calculation.

The fact that Keynes made profits staying almost systematically long on cotton is not inconsistent with the hypothesis of speculation as risk-bearing. Moreover, an analysis of the relation between *FP* and *FSP* carried out on the 122 long positions opened by Keynes shows that, in the majority of cases, *FSP* turned out to be higher than *FP*. This is shown in Figure 2 below, where *FP* is the price actually paid by Keynes while *FSP* is the spot price that Keynes would have obtained taking each position to maturity. The figure describes a hypothetical situation in which Keynes would have acted on the basis of a strict application of his theory, routinely closing each position at maturity instead of choosing the moment when to close it. As *FSP* was higher than *FP* in most of the cases, this would have resulted in a positive difference.

Figure 2

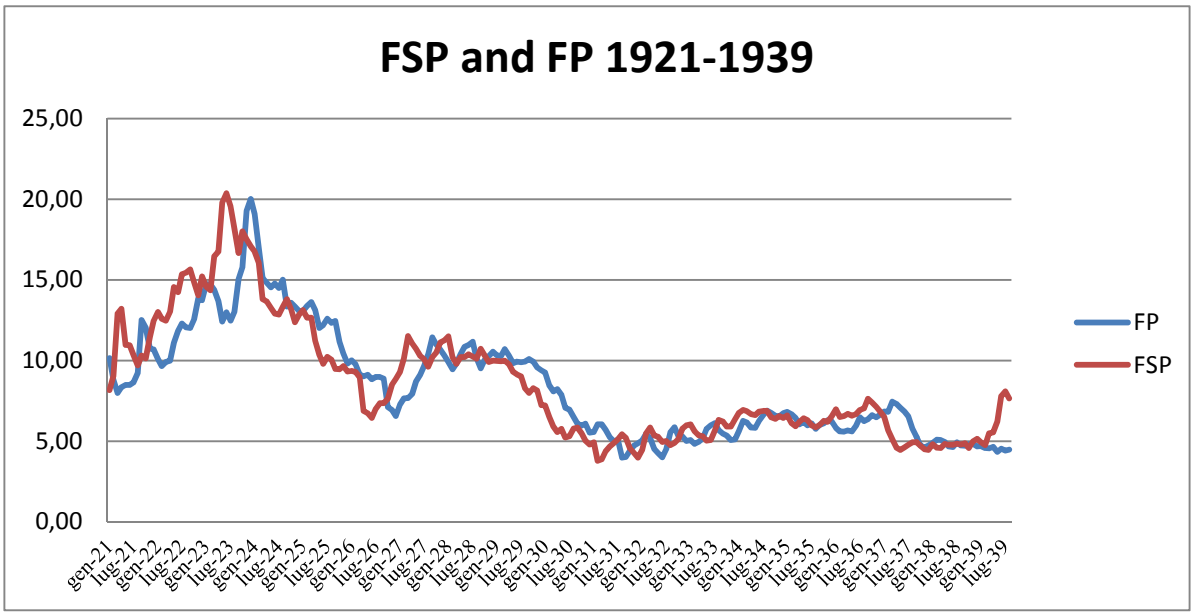


Sources: Keynes's ledgers (KP/SE/11/2); *The Times* online Archive.

However, once the same test is made on contracts taken independently of Keynes's choices, the relation between *FSP* and *FP* becomes less clearly defined. In order to test this difference we have calculated the monthly average of *FP* for each month from 1921 to 1939. Then, we have compared this average prices with the corresponding level of *FSP*: for example, the monthly average price of cotton for delivery six months hence

(*FP*) in January 1921 has been confronted with the average spot price in July 1921 (*FSP*), the monthly average price of cotton for delivery six months hence in February 1921 with the average spot price in August 1921, and so on. The results are shown in Figure 3 below, where the blue line represents the trend of the price of cotton for delivery in six months and the red line represents the corresponding level of spot prices (monthly averages). On the whole, at least after 1923, no clear downward bias of *FP* relative to *FSP* emerges.

Figure 3



Source: *The Times* online Archive.

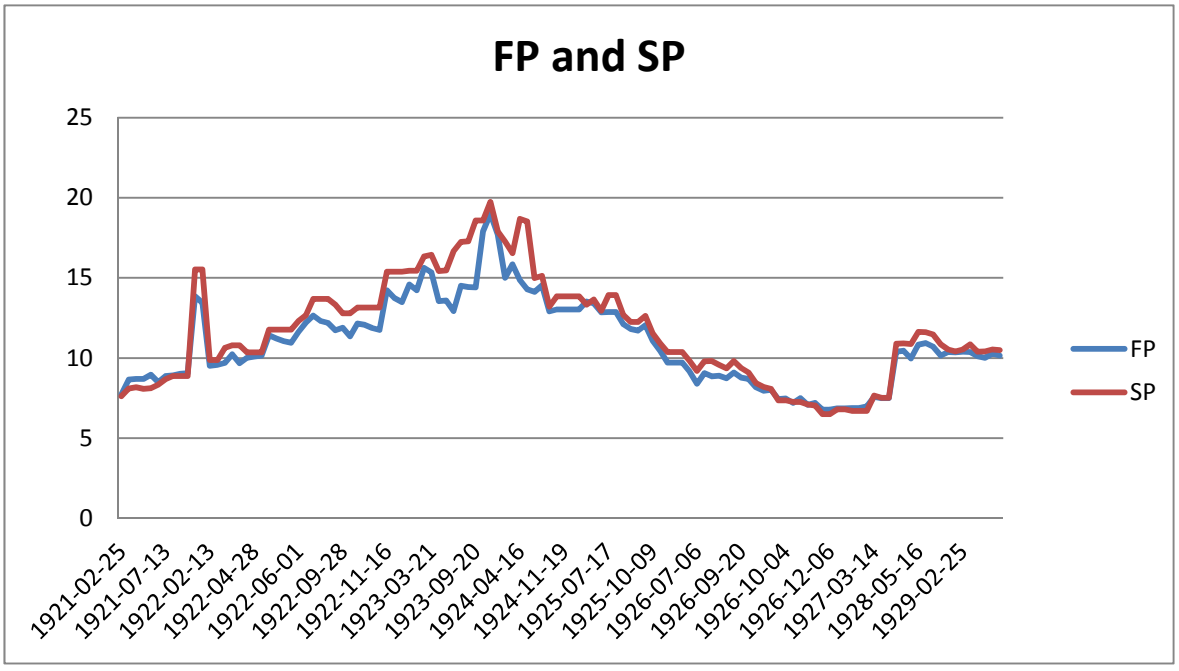
This can be compared with Keynes's 1923 article. On this occasion Keynes estimated that 'in the largest and most organised market the cost of a hedge-sale works out at less than 10 per cent per annum (e.g., 5 per cent for a sale six months forward) and often rises to 20 per cent per annum […] and even much higher figures' (Keynes 1923: 263). It is plausible that Keynes had cotton in his mind when he wrote this sentence (indeed, few lines later he wrote 'if we take the example of cotton […]'), and the above chart shows that, throughout the period 1921-1923, cotton futures prices frequently corresponded to an underestimation of the corresponding level of spot prices at the time of delivery. More in detail, taking the prices of the six months future contract from January 1921 to December 1922 and the corresponding levels of *FSP*, the average

difference is 1.87 points (1 point = £2) on an average price of 10.64, this corresponding to a positive difference of 17.5 per cent.

However, once the same analysis is extended until 1929 or 1939, the results are different, because after 1923 there is a less marked tendency of *FSP* to turn out higher than *FP*. Taking the values of *FP* in the period from January 1921 to February 1929 (and thus excluding from observation the values of *FSP* after the Wall Street crash of October 1929), the average difference is 0.49 points, corresponding to +4.3 per cent on average *FP* price. Finally, extending the analysis to the *FP* quotations in February 1939 (*FSP* until August 1939, immediately before the outbreak of WWII), the average value of *FSP* – *FP* falls to 0.09 (1.05 per cent on an average *FP* of 8.50 points). Interestingly enough, over this longer period, the number of cases in which the value of *FSP* – *FP* is positive is the same number, 109, of the cases in which the same difference is negative.

Another aspect that we have tried to consider is the relation between Keynes's dealings and the level of backwardation (contango) observable in the market. Figure 4 below shows the level of *SP* and *FP* on each day in which Keynes opened a new position.

Figure 4



Sources: Keynes's ledgers (KP/SE/11/2); *The Times* online Archive.

It can be noticed that Keynes's positions were most frequently opened in a period of backwardation (*SP>FP*), the only exceptions being two short periods, the first at the beginning of 1921 and the second in the last three months of 1926.[14] On the other hand, it can also be noticed that Keynes usually remained long in both cases, and that 15.5 per cent of Keynes positions (20 positions on a number of 129) were opened during a contango. Considering that contango is quite rare, this is quite a high percentage.

5. Keynes's investments more in detail

In order to obtain a more detailed analysis of Keynes's dealings, we have subdivided his 129 operations into 38 cycles of investments, one for each specific contract (contracts being classified according to their expiry date). For instance, the first cycle consisted of one future on July cotton bought on 25 February 1921 and the second included two futures on October 1921 bought in July and September 1921. A large part of Keynes's cycles, especially in the earlier period, consisted of small positions of a few hundreds bales (100 bales being the minimum). As time went on, however, Keynes happened to cumulate larger positions on the same contract: the two largest cycles included cumulative long positions, of 2,600 bales each, for delivery on July 1925 and July 1927 respectively.

A closer analysis of these cycles shows that while staying almost uninterruptedly long, Keynes changed his investing technique along the way. More specifically, the period 1921-1929 can be divided in two sub-periods, one in which Keynes's investments followed a well-defined pattern, and a second one, in which Keynes's technique became less definite and more complex. From a strictly chronological point of view, the dividing line between the two phases corresponds to the publication of the 1923 article and of the first issue of the London and Cambridge Economic Service *Special Memoranda on Stocks of Staple Commodities* (Keynes 1923-30, CWK XII, henceforth: *Memoranda*). In what follows, the possibility that there may be a nexus of cause and effect between the two events—the change in Keynes's market behaviour and his debut as an expert in matter of commodities in general and cotton in particular—has been taken into account. Another aspect we take into account is that 1923 also corresponds to the peak of prices during the period we have considered: after December 1923 prices on the whole declined until 1927 and never recovered to their maximum level (ca. 20 points).

[14] Early in 1921, the contango was a consequence of the crop of 1920 being much larger than expected (Hubbard: 1928: 58). In 1926, contango set in as a result of a bumper crop (CWK XII: 403-13).

5.1 Period 1: 1921-1923

For more than two years, between February 1921 and August 1923, an exception being made for two short positions, Keynes's most frequent technique consisted in buying a contract of relatively long duration that he then sold and repurchased (the two operations being made every time on the same day) at intervals along the period until quite close to maturity. Keynes used this method with nine of the first eleven contracts he dealt with (the last one was the future on August 1923 bought in September 1922).

For example, in May 1921 Keynes bought 100 bales for delivery in March 1922. Afterwards, the same quantity on the same date was sold and repurchased three times—on 16 August 1921, 3 October 1921, and 13 February 1922—and then closed 14 days later. After a small gain in August and a considerable positive difference of £966 in October, Keynes incurred in a heavy loss (–£866) on 13 February, that he partially recovered two weeks hence with a gain of £136. The cumulative difference on this cycle of investments was +£300.

The cycle on cotton for delivery in January 1923 is another example of this investing technique, but for a small variation on the same theme. Keynes opened this position with a contract of the maximum duration (11 months) on 100 bales in February 1922, and then he renewed the same position in March, May, and July. The small variation is that, in September, the quantity was taken at 200 bales before the position was finally closed in October. The outcome was a positive difference of £1,004 on an initial investment of £1,940 that had been taken to £4,752 in September, after a series of alternate results: –£4 in March, +£274 in May, +£252 in July, –£86 in September, +£464 in October (this time on a doubled amount).

Another example shows that the results could be much more alternate than that, but that, on average, Keynes's technique was working quite well. In June and July 1921 Keynes opened a cumulative position on 400 bales for delivery in May 1922. This position was closed and re-opened for the first time on 16 August 1921, at a positive difference of £116. On 3 October, Keynes sold this contract at a positive difference of £3,504, repurchased the same amount on May 1922 and kept it until 13 February, when he once again sold and repurchased the same amount on May 1922. This time, however, he sold at a loss of £3,096. In the end, when the position was definitively closed in April, after another sale and repurchase on 27 March, Keynes obtained a cumulative positive difference of £952 on an initial investment of £7,132. Keynes did the same with the futures on July and October 1922, and with the contracts on, March, July 1923 and

August 1923. The differences earned on these contracts were very satisfactory.[15] Afterwards, however, profits (and prices) began to fall, while the sale and repurchase technique was abandoned in favour of other ways of staying prevalently, but not systematically, long.

5.2 Period 2: 1923-1929

In this second phase Keynes's behaviour became less uniform and more elaborate, even though the strategy of being prevalently long was abandoned only in 1928, when the open interest was sometimes short. The Table A1 in the Appendix is a year-by-year reconstruction of Keynes's investments in cotton from 1923 to 1929. As the period considered in the Table corresponds to the publication of six *Memoranda*, a concise reference to these documents has been included for each year in which a report was issued, together with a short account of the actual trend of prices (all prices indicated are for delivery six months hence). In the remaining part of this section, a tentative analysis of the correlation between Keynes's information and behaviour is provided. This analysis may be read as a comment to the Table A1 in the Appendix.

One thing that can be noticed is that Keynes's open interest frequently included relatively large positions on July (old crop) and October (new crop), and that the positions on July were usually larger than those on October. This may depend on the fact that investments on old crop (July) could be based on known factors (the size of the last harvest plus the carryover from the previous one) while speculation on new crop (October) could only be based on a more uncertain outlook. Moreover, positions on July were always long, even in periods of falling prices, while those on October were sometimes short.

In general, it doesn't seem that Keynes was employing any routine strategy in this period, and that, as it is quite obvious, he made use of the information he had. For instance, it was perhaps not by chance that Keynes closed his large short position on October 1925 as early as January 1925 (see Appendix). This in fact is the month when information about the new crop (concerning, for instance, acreage) begins to circulate. Not unlikely, Keynes opened this position at the end of 1924 in the expectation of a fall in

[15] Keynes started with an initial investment of £4,040 on the October 1923 contract—200 bales bought for the first time on 28 April 1923 as a roll-over of the position on May cotton—and obtained a positive cumulative difference of £1,042 at the end of September after two sales and re-purchases in May and July. A gain of £1,004 on an initial investment of £1,940 was the cumulative result of the cycle on cotton for delivery in January 1923, a position that Keynes opened on 27 February 1922 and renovated four times in March, May, September, and on 13 October, before closing it on 23 October. The positive differences on the positions on March, July, and August 1923 were £1,202, £282, and £301 respectively.

prices in 1925, but new information suggested him that this would not have happened. Another possibility is that the trend of prices he could observe was different from the one he expected. Whatever the case, the decision to close so early the short position on 2,000 bales, on the whole, proved sound. The price of cotton for delivery in October 1925 never fell significantly below the level at which Keynes had sold it. In general, the above chronology shows that Keynes made relevant exceptions to the July + October rule. Only a minor position on July 1926 and no positions at all on July 1928 were opened, and in 1928 Keynes's behaviour changed completely, as he dealt with only one contract (January 1929) with frequent switches from long to short positions. Finally, it may also be observed that, unlike in period 1, Keynes's profits are not evenly distributed along time: a large part of the profits made in this period came from two big positions on July and October 1927 and a smaller one on January 1928 that were all closed in 1927.

Some conjecture could also be made on the rationale for Keynes's investments along this second period. In the first *Memorandum*, issued in April 1923, Keynes had come to the conclusion that 'unless the "up-country" stocks have been much under-estimated', stocks would have fallen below the 'working minimum' before the next crop:

> It would seem, therefore (1) that the price of present-crop cotton must rise to a sufficient premium over new-crop prices to induce spinners to reduce their stocks below what they ordinarily consider convenient, and (2) that the price of American cotton must rise to a level which is to some extent deterrent, that is to say, which will cause a diversion or postponement of demand. (CWK XII: 274-5)

For a while after this *Memorandum* was issued, Keynes went on making profits purchasing new crop cotton with contracts of relatively short duration,[16] before the new crop came on the market and Keynes decided to stay long on it cumulating futures on 500 bales of cotton for delivery in July 1924. However, during the successful cycle on July 1924, Keynes began to lose money staying long on small amounts (100 bales each) of cotton. He lost money on a contract on December bought in October 1923 and on a contract on May purchased in February 1924. When the second *Memorandum* appeared, in June 1924, prices were still going downwards. Nonetheless, Keynes still described a situation of scarcity and wrote that 'some curtailment of consumption is inevitable' (CWK XII: 321) before the next crop. Keynes's based this view on his own estimate of the minimum current crop that would have avoided a state of famine—that he fixed at

[16] A couple of futures on cotton for delivery in October 1923, bought in March and April 1923 and closed in August and September, and another contract on January 1924 , which was bought at the end of June 1923 and closed in September.

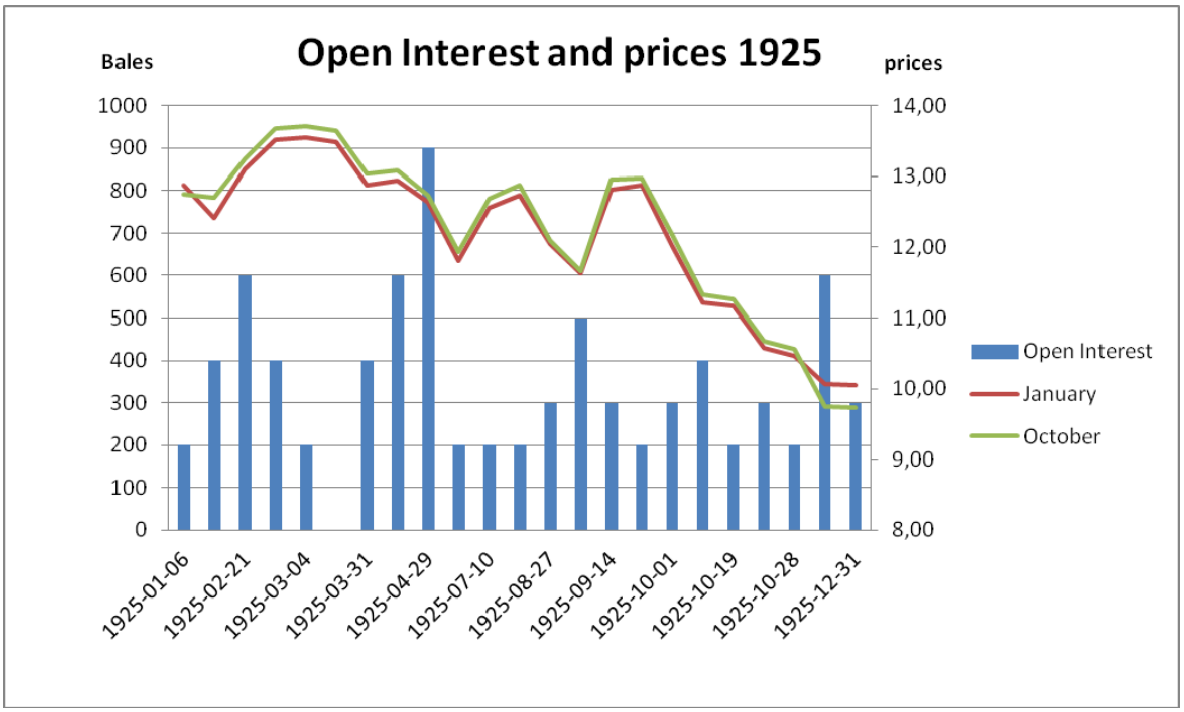
11,500,000 bales—and on the 'first official estimate of conditions (as on May 25)', that indicated 'a crop of less than 11,000,000 bales' (CWK XII: 321-4). We don't know what Keynes came to know about the new crop after 25 May 1924. What can be observed is that he kept until maturity three contracts on October 1924 that were opened between February and June of the same year losing money on them, that he lost £732 on a replica on a larger scale of the previous year investment on July cotton (2600 bales on July 1925), and that this happened while prices continued to fall. On the other hand, this time, the investment on July cotton was not followed by another long position on October. Rather than that, Keynes went heavily short on new crop (October 1925). In turn, the loss on July 1925 and the way Keynes rapidly closed the short position on October 1925 seem to suggest that, late in 1924, Keynes was overestimating the fall of prices of the new crop and, at the same time, that he was underestimating the fall of prices of the old crop.

After that, Keynes opened only a minimum position (100 bales) on July 1926, and bought 400 bales October 1926. On the basis of what Keynes wrote in the third and fourth *Memoranda*, the insignificant position on July does not come unexpected. Being issued in July 1925, the third *Memorandum* came in a crucial period of the year for cotton. Here Keynes noticed that, even though the rate of consumption in the six months before 31 January 1925 had been higher than in the previous two periods, 'if the rate of consumption is maintained during the current half-year, there will be left on 31 July next, roughly 3 1/2 million bales. The necessary minimum world carryover may be put at 2 million bales. There is, therefore, no reason why consumption should not be maintained and even increased somewhat, provided that the world is content to risk a minimum carryover' (CWK XII: 366-9). A similar trend is confirmed in the fourth *Memorandum* of February 1926. Keynes reported of a 'fairly comfortable carryover of rather more than 3 millions bales', estimating at 19 million bales the 'available supply of cotton for the current season' (CWK XII: 411-12). Keynes only took notice of an element of uncertainty that was emerging, pertaining the supply of high grade-cotton, because it was becoming clear as the season proceeded that 'the current crop include[ed] an unusually large proportion of low-grade cotton untenderable against the future contract' (CWK XII: 412). In addition to this, Keynes noticed that 'a large carry-forward would be advisable in view of the present being a bumper crop and of the probability that if the existing low prices continue, the expenditure on labour and fertilisers will be curtailed, even if the acreage is maintained' (CWK XII: 412). On the whole, and apart from minor uncertainties, the situation had turned from one of scarcity to one of relative plenty.

While this view is perfectly consistent with Keynes's decision of not cumulating too large a combination of long positions on July and October, the same predictions cannot explain why Keynes did not decide to stay short, as he had tried to do with the October 1925 contract. It is possible that the 400 bales on October 1926 were a bet (that Keynes lost) on the few elements of uncertainty in a context in which a state of plenty over the next future was the most probable outlook. But it could also be observed that Keynes seemed to have some kind of bias against staying short. He did it only sometimes, usually with bad or scarce results, and his more usual alternative to staying long was to go out of the market.

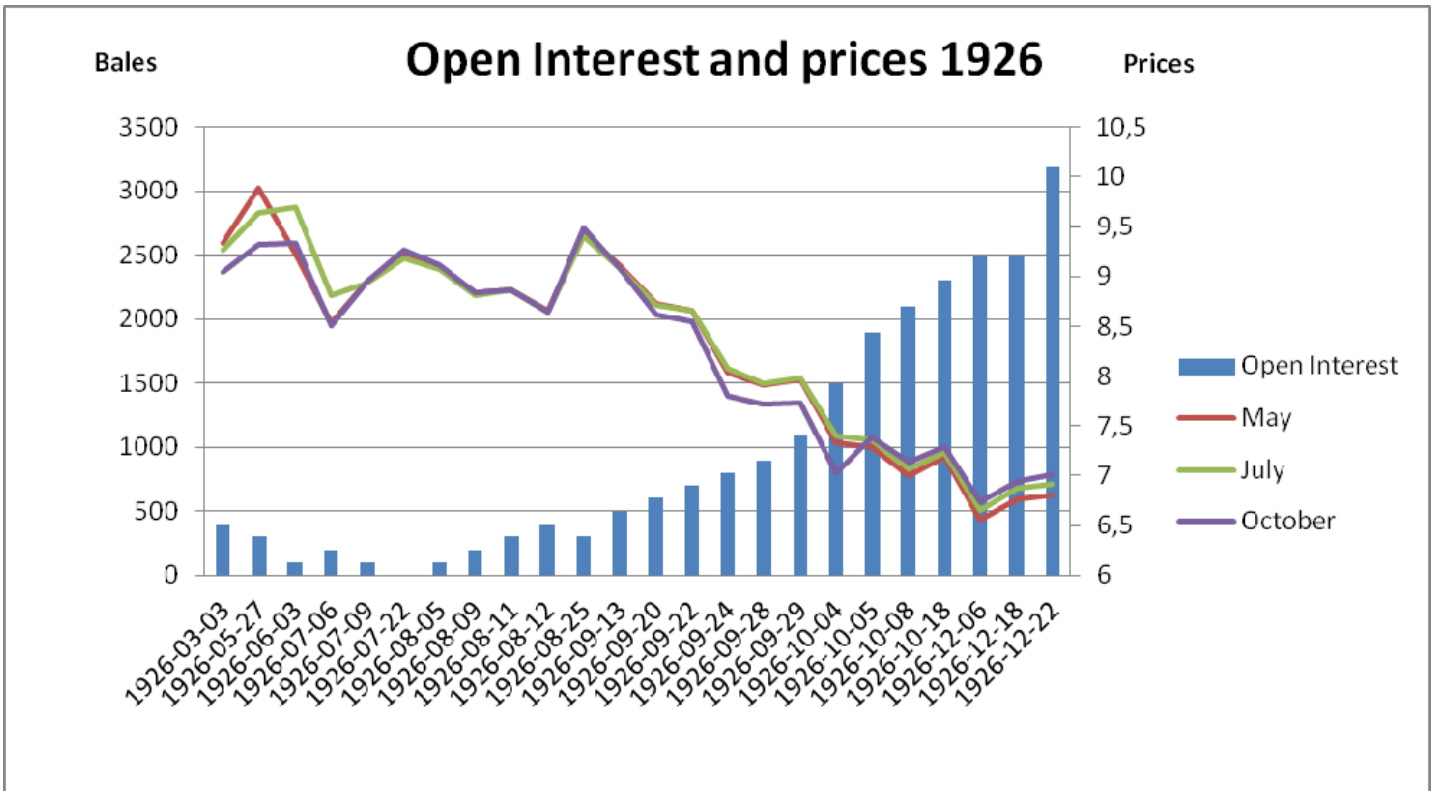
Figures 5 and 6 below show the trend of prices and the evolution of Keynes's position in 1925 and 1926. Keynes kept staying long while observing a downward trend of prices in presence of a large supply and of a 'bumper crop'. With the minor exception of a small profit made on 100 bales on July 1926, Keynes went on losing money with long positions opened between 1925 and 1926 on cotton for delivery in January and October 1926 and on January, March and May 1927. Then Keynes progressively reduced his position, and even exited the market in the summer of 1926, before cumulating his largest position afterwards, which, again, happened in a period of falling prices.

Figure 5



Sources: Keynes's ledgers (KP/SE/11/2); *The Times* online Archive.

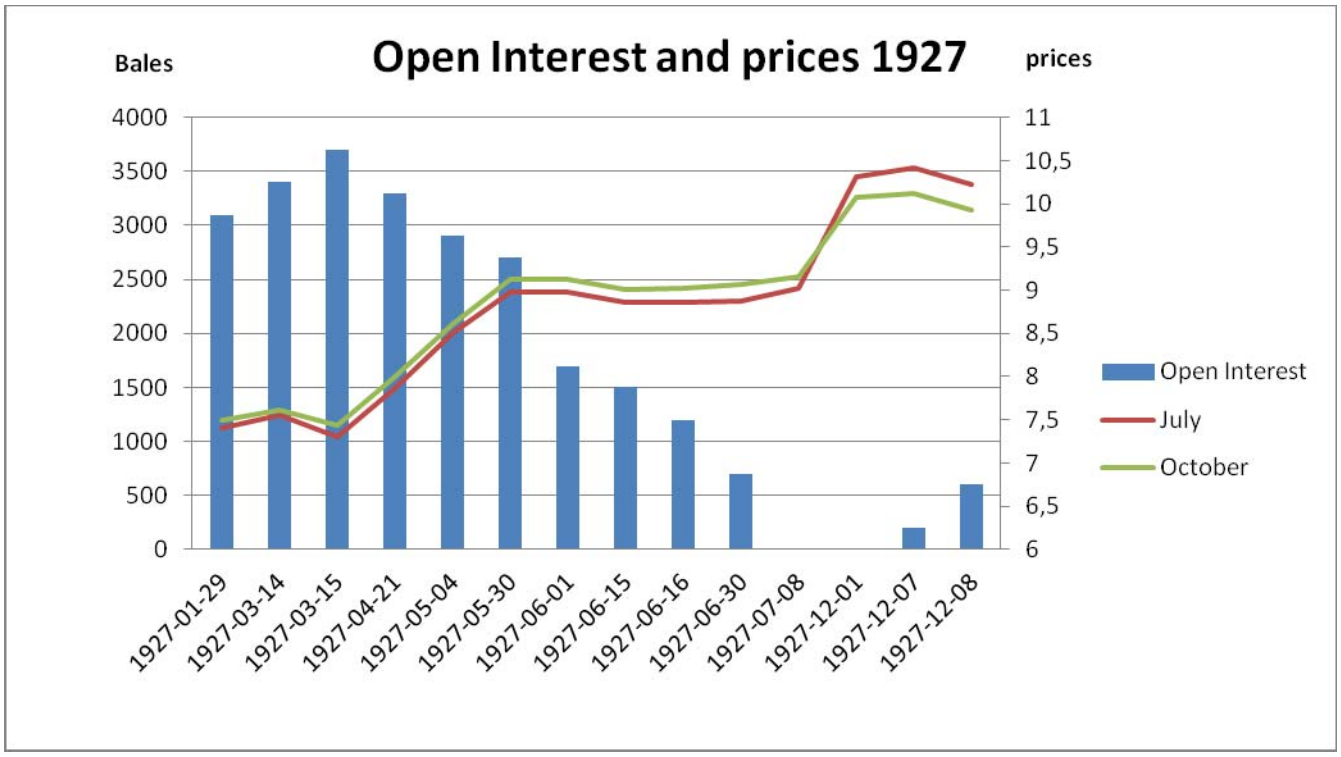
Figure 6



Sources: Keynes's ledgers (KP/SE/11/2); *The Times* online Archive.

Figure 6 suggests that Keynes had probably predicted the rebound of prices that happened in 1927. In fact, the two big positions on July and October cotton that gained Keynes a large part of his total profits on cotton during the 1920s were cumulated while prices were still falling, but when Keynes liquidated these positions the prices of July and October futures had risen from a minimum below 7 points to a maximum of around 10.5 points. After exploiting this great opportunity, Keynes again brought his open interest down to zero in July 1927.

Figure 7



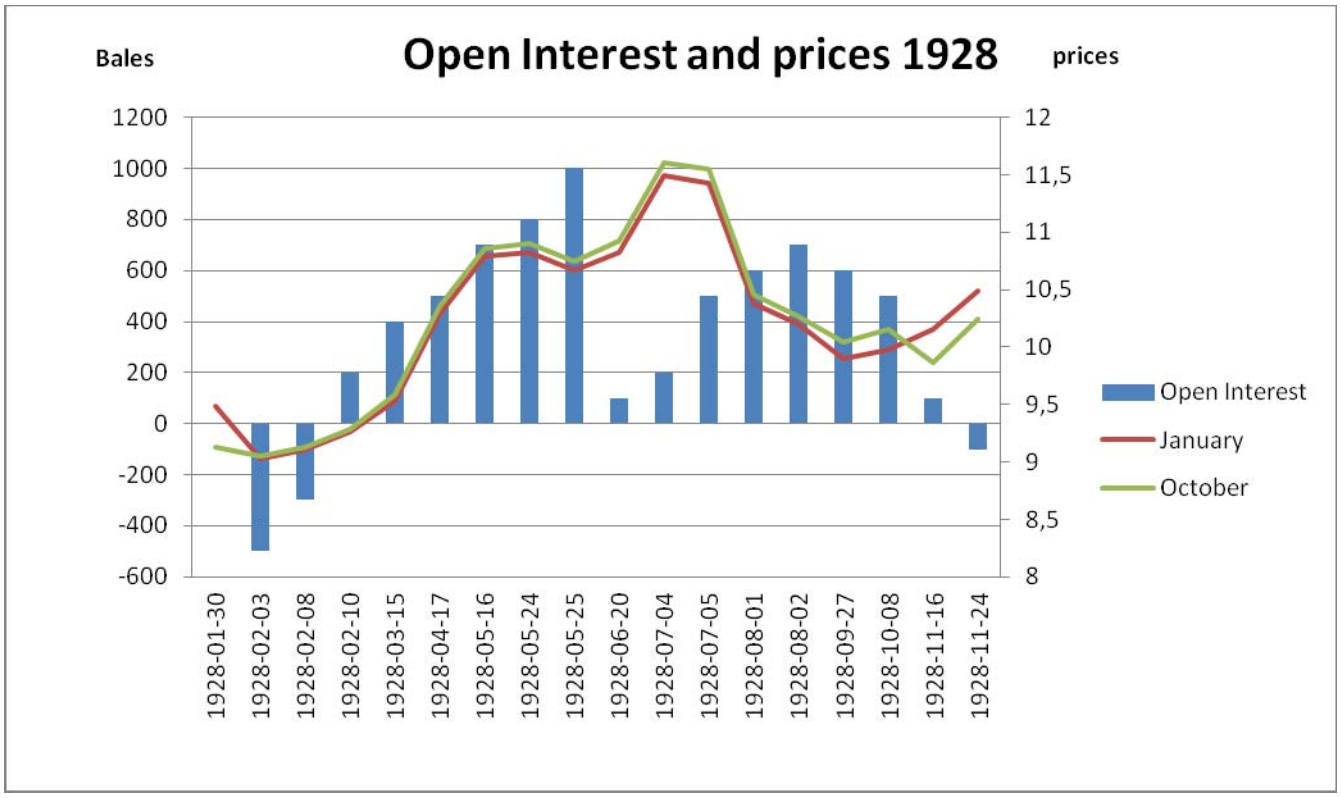
Sources: Keynes's ledgers (KP/SE/11/2); *The Times* online Archive.

Meanwhile, in the *Memorandum* of March 1927, that was prepared when the open interest was at its peak before rapidly falling to zero in July, Keynes had confirmed that the available supply for 1924-25 had been of 19 million bales. Assuming a 'comfortable carryover of 3 million bales', still there were 16 million bales left for current consumption. In addition to this, Keynes could now avail himself of the data about consumption during the same period, which had been as low as 13,75 million bales. This resulted in a carryover of 5,5 million bales, that was to be added to the 'record crop' of 17,7 million bales, with an available supply that reached 23 million bales (CWK XII: 455-60). Even worse, while the low level of prices had lead to an increase in US consumption, the coal stoppage had reduced consumption in UK. Thus, with a price of cotton below the cost of production for many producers,

> a campaign is on foot throughout the Southern States to secure a reduction of acreage in the coming season. A figure of 25 per cent is aimed at, but a reduction of 10 per cent will probably prove to be nearer the mark. Even so supplies should be ample through 1927-8 as well as 1926-7. (Ibid.)

The period that followed this *Memorandum* was therefore quite uncertain, as it was not clear whether the suggested plans would have been implemented, or to what extent they would have been successful. In this phase, the only cycle that deserves some attention is the curious one on January 1929, which resulted in a loss of £1,638, mainly due to the short positions it included. As it is clear from figure 8 below, when Keynes cumulated a net short position early in 1928, prices began to rise. Later adaptations did not give good results.

Figure 8



Sources: Keynes's ledgers (KP/SE/11/2); *The Times* online Archive.

6. Conclusions

Daily price determination in cotton markets is a very complex process (see Çaliskan 2009), and such complexity was not inferior at the time when Keynes was active as a speculator (see Garside 1935: 345-65). If, broadly speaking, data relating to world demand and supply may exert a dominant influence on price trends over a time horizon

of some months—and Keynes's approach to selecting the information he published (and presumably deemed most relevant) in the *Special Memoranda on Stocks of Staple Commodities* for the London and Cambridge Economic Service suggests that he was persuaded of the importance of this influence—more strictly speculative influences may certainly be crucial in shorter time horizons. More specifically, being cotton an annual crop, the period when the crop actually reaches the market and the fact that its use in industry would spread over the whole year are important elements which may be seen as introducing a somewhat regular trend component in price movements, but also complicating a more straightforward and general comparison between annual supply and demand. Furthermore, the importance of accumulated stocks and their influence in the determination of actual annual supply must be considered—and the *Memoranda* show that Keynes gave importance to all these elements. But also rumours, estimates, forecasts and facts relating to the amount of land (acreage) annually devoted to cotton cultivation, to weather conditions from winter, when land is prepared for the cultivation, till the end of the picking season (cotton fruits over an extended period, and in the USA the picking season approximately starts in August and ends in January) had (and still have today) an important influence on prices in both spot and futures markets. Similarly important were data relating to the presence of pests, and in particular of the boll weevil.[17] Reports relating to these elements were crucial to assess the size of each year's crop, but they were also subject to much approximation and to provide indications which could be corrected or reversed by further information.[18] And somewhat similar arguments may be applied to estimates of world demand for cotton and to its evolution through time.

The links we had attempted to establish at the end of Section 2 between the theory of speculative markets as elaborated and published by Keynes during the 1920s and his activity on the cotton market are not disproved by the analysis of the data we have been able to collect. But what may be stated with sufficient certainty is, so to speak, much less pretentious. During the period considered in this paper, the cotton market went through two main periods, one of relative scarcity, until 1925, and, afterwards, one of abundance, with a peak of excessive supply in 1926-27. Throughout these two periods, Keynes very rarely abandoned his strategy of staying long. However, it is only from 1921 to the spring of 1923, when the *Manchester Guardian* article appeared, that

[17] Since its first appearance in the USA in 1892, the boll weevil had caused damages to the cotton crop as high as 34 per cent (Hubbard 1928: 40-1, 124; Garside 1935: 23-6).

[18] For instance, estimates of acreage may involve considerable approximation; a wet autumn and early or late frost at the end of the picking season may cause large crop estimates corrections (Hubbard 1928: 19-37; Garside 1935: 13-28).

Keynes's behaviour can be taken as a good representation of the idea of routine speculation as risk-bearing as well. When, after 1923, the scheme of sale and repurchase was abandoned, it seems that Keynes made some attempts at using the information he had, adapting his strategy to a changing outlook.

Immediately after 1923, Keynes observed the change from a state of scarcity to one of increasing plenty, and the earlier *Memoranda* suggest that this change was perceived with some delay; nonetheless, it seems that Keynes tried to adapt to the new situation, reducing his long positions and even making some attempt at staying short. After 1925, however, during a period of falling prices quite consistent with the outlook given in the *Memoranda*, Keynes did not go short. Rather than that, at intervals, he entered and exited the market staying prevalently long, as he was waiting for the rebound of prices that eventually happened in 1927. What can be very tentatively concluded is that Keynes followed a sort of asymmetric strategy, consisting in staying systematically long when the expectation was for a rise in prices but not necessarily short in the opposite situation.

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The Times online Archive, available at: <http://www.thetimes.co.uk/tto/archive/>.

Appendix

Table A1: Analysis of Keynes's investments in phase 2, 1923-29

Year	Keynes's outlook (as from *Memoranda*) and trend of prices	Keynes's investments
1923	April, *Memo* No. 1: scarcity Prices rising to the peak of 20 points in December	March and April: two purchases (100 bales each) for delivery in October. These positions will be closed in August and September at a positive difference of £ 362. In June Keynes buys 200 bales for delivery in January 1925 (this will result in a considerable gain of £1176). In Autumn, a new long position for 300 bales on July 1924 is opened (it will be increased to 500 bales during 1924) On 20 September, a long position on 100 bales for delivery in August 1924 is opened (it will be taken to delivery).
1924	June: *Memo* No. 2: scarcity Prices falling from the peak of 20 points to 13 points at the end of the year	The long position on July is increased to 500 bales. Another long position, 400 bales on October, is cumulated between February and June. The long position on July closed between April and July at a positive difference of £482. On 1 August the contract on 100 bales for delivery in this month purchased on 20 Sept. 1923 is closed. The difference is +£622. The long position on October is closed very closed to delivery at a loss (–£358) In October Keynes opens a long position on 200 bales for delivery in December. The position will be closed in December at a loss (–756). A new and larger cycle on July 1925 is opened during the Autumn: 2100 bales (that will grow to 2600 in April 1925). In November Keynes opens a 2000 bales short position on October 1925 (that will be closed early in 1925). A new small position on 100 bales for delivery in May 1925 is opened in December.
1925	July, *Memo* No. 3: scarcity is less than expected The decline of prices continues: below 10 p.ts at the end of the year	January and a December: very small gain closing the short position on 1000 bales for delivery in October this year. August: a long position on 300 bales for delivery in October is opened (it will closed in September at a positive difference of £664). Between March and July the big long position (2600 bales) on July is closed at a cumulative loss of –£732). In October Keynes purchases 300 bales for delivery in January 1926. The position is closed on 31 December at a negative difference of –£696. At the end of December Keynes bought 400 bales for delivery in October 1926).

1926	February, *Memo* 4: plenty. Prices barely above 6 p.ts at the end of the year after constant decline	A minor position (100 bales) on July opened in March Open interest reduced to zero in July New long position on 300 bales, delivery January (1927), opened between July and October (and new losses: –£618). September: purchase of 100 bales for delivery in March (this will be closed at a loss in January 1927). 400 bales for delivery in May 1927 purchased in August and September (this will be closed in 1927 at a loss). June and July: Keynes closed at a negative difference of £404 the October cotton bought in December. Between August and September Keynes buys 2000 bales for delivery in July 1927 (to which 600 bales will be added before the end of March: this cumulative position of 2600 bales will result in a profit of £7156, the largest ever). New large position on October 1927 (600 bales, it will gain Keynes another relevant profit of £2300). In December Keynes buys 200 bales on December 1927 (and again this will result in a good profit of £1884).
1927	March, *Memo* No. 5: plenty and regulation. Gradual recovery of prices: above 10 p.ts in December	Keynes brings the open interest on July to 2600 bales (from 2000) and then realises the relevant profits on this position and the other two on October and December opened in 1926. The cumulative gross profits from these three contracts amounts to £11340. The open interest is zero in July. No new position is opened until December.
1928	No *Memorandum* for this year. Fluctuations of prices between a min. just above 9 p.ts and a max. just below 12 p.ts	January and February: sales of 600 and 500 bales on January 1929. As a result Keynes is net short for a while. All these short positions are closed before the end of April at a loss of –£1138. In May Keynes opens two long positions, again on January 1929, closing them in June and thus obtaining a small gain. In June, a new short position on January 1929 is opened. It will be closed in July and August with new losses of –£442. In August, another small long position on January 1929 (100 bales) is opened, and a new small loss comes (–£42) when this position is closed (very soon, on 27 September).
1929	*Memo* No. 6. Price quite stable at around 10 p.ts	–£485 cumulative losses on minor long positions on July and October 1929. Minor losses from two small long positions on March and January 1930.

Sources: Keynes's ledgers, London and Cambridge Economic Service *Special Memoranda on Stocks of Staple Commodities*: *The Times* online Archive.

Keynes's speculation in the London tin market: 1921-1930

Nicolò Cavalli and Carlo Cristiano[*]

1. Introduction

The present research considers the tin branch of the London Metal Exchange (LME) in the years before the formation of the Tin Producers' Association in 1929 and the first Tin agreement in 1931 (Fox 1974; Hillman 2010). The market is viewed from the particular standpoint of an economist-speculator, our analysis being largely based on the *Collected Writings* and the Papers of John Maynard Keynes (henceforth CWK and KP), who dealt with tin both as a speculator on the LME and, from 1923 to 1930, as editor of the London and Cambridge Economic Service *Special Memoranda on Stocks of Staple Commodities* (henceforth *Memoranda*, CWK XII, 267-506 and 512-647).

Section 2 presents an overview of the tin market during the 1920s which is largely based on the *Memoranda* and related material in the KP, while references to more recent literature are given in order to fill the gaps, or for comparison with Keynes's 'on the spot' view. In addition to the *Memoranda*, Keynes wrote at least three other notes on tin: the first, dated 1 December 1926, is a private typescript focusing on tin shares, with relevant information about Keynes's expectations as to the production and consumption of tin; the second, a manuscript note based on the same scheme as the *Memoranda*, was sent to Oswald Falk on 7 July 1928; finally, a third *Memorandum*, on 'The production and consumption of Tin', was drawn up in September 1928. Unlike the other two, this document was published and is now included in the CWK (XII, 506-512). Originally, it appeared in *Recueil Mensel de l'Institute International du Commerce* on 20 October 1928.

The analysis of Keynes's investments presented in section 3 is based on the ledgers in which Keynes recorded his transactions (KP/SE/11/2), on the correspondence with the broker Buckmaster & Moore (KP/SE/2/1-6) and, for the period after its foundation in April 1926 onwards, on the weekly statements of the Tilton Co., Ltd (KP/TC). The

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ledgers are the main source. For each transaction, these documents show the date on and prices at which each position was opened and closed, the quantity purchased or sold, and the type of contract. For future contracts, the ledgers record the price per ton. For options, Keynes recorded the purchase price and the strike price.

Another resource we employed is *The Times* online Archive, from which a series of tin prices from 1921 to 1930 was derived. The series of prices we employed consists of the tin quotations at the LME on each Friday during the period as they were published in *The Times* newspaper on the following Saturday. Under the heading 'Home Commercial Markets' the newspaper reported the cash price and the prices of a range of five different contracts for future delivery: prices for delivery before the end of the current month, for delivery before the end of the first, second and third month hence, and finally the price of 'three months' tin, i.e. for delivery 90 days thence. The 'three months' future was the standard contract, and the fact that it arrived at maturity on a specific day, and not a whole month, reflected the nature of the LME, which remained first and foremost a delivery-terminal market (Gibson-Jarvie 1976). The list of prices also reflects the limited time horizon (three months) within which the speculator was bounded.

2. The tin industry during the 1920s

A large part of the world's tin is mined in a few areas located far from the centres of consumption. During the 1920s, the Federated Malay States and the Netherlands East Indies controlled approximately one half of the world production of tin concentrates (cassiterite); Bolivia could claim one quarter of the whole production, while China, Siam and Nigeria were minor but still relevant sources. The mining industry in Cornwall, the leader until the end of the eighteenth century, was now reduced to a very low quota of the world market, while the capital that used to be invested in the Cornish mines was flowing in new directions. In part, it financed the smelting industry in the United Kingdom, where a significant quota of the Asian tin and almost all the Bolivian tin was refined; in part, these and other resources raised in the London market came to finance both the mining and the smelting sectors of the Malayan tin industry, thus favouring a process of vertical integration in these areas. However, the process of vertical integration proved slower in the tin industry than in the other non-ferrous metal industries, and was never extended from the production of tin metal to its consumption. Another peculiarity of the tin industry was that the methods and costs of tin mining could vary significantly from one place to another, depending on the nature of the

deposits and on the available techniques and financial resources, thus creating significant differential rents in the most efficient sites (CWK XII: 377-8; Hillman 1984: 404). Finally, another key feature of the tin industry during the 1920s was the emergence of the United States as the most important of the consuming countries, with a quota that grew by over 50 per cent over the period under scrutiny.[1]

The 'problem with tin', as described by Hillman (2010, chap. 4), was that determination of the proper level of investments *vis-à-vis* the marked fluctuations of prices proved overwhelmingly difficult after the First World War. Thus, for instance, nobody knew whether the peak of prices over £350 in 1926, after a minimum below £200 only a few years before, could be taken to be a momentary boom, the long run price, or even an underestimation of what the price was to be a few years thence. What was clear, on the other hand, was that tin represented an extreme case of the boom-bust cycle that is typical of commodities in general, while the organization of the industry lagged behind that of other sectors in the process of 'rationalization' that characterized the period following upon the First World War.

Commodity prices volatility also attracted Keynes's attention, not only as a speculator but also as an economist. Keynes first described the cycle of commodities—in which the time lag between a fall (rise) in prices and the moment when producers reduce (increase) their investments leads to violent oscillations of prices—in an article for the *Manchester Guardian* Reconstruction supplement of March 1923, and put forth the first proposal for governmental control of raw materials in 1926, thus preparing the ground for the analysis of commodity price volatility in chapter 29 of the *Treatise on Money* (CWK VI) and for the more refined schemes of commodity control from 1938 onwards (Fantacci et al. 2012). In this respect, tin was very interesting as a case study. Hillman (2010: 90) describes Keynes as the author of 'some of the most careful assessments of the market', highlighting the 1928 note on 'The production and consumption of tin' as 'particularly revealing'.

In this note, Keynes reconstructed the trend of the tin industry as from 1920: at an early stage,

> [t]he slump of 1920-21 caused enormous accumulations of the metal and a crisis in the producing countries, calling for the intervention of the Straits and Dutch Indies Governments in the market. From 1922, however, to the middle of 1927 the consumption of tin regularly exceeded production and the redundant stocks were

[1] For more detailed analysis of the tin industry during the 1920s see Furness (1926; a copy of which is extant in KP LCE/3/60-73), Eastham (1936), Myers (1937), Fox (1974: chap. 1) and Hillman (2010: chaps. 2-4).

> steadily absorbed. By the end of 1926 supplies had, indeed, reached a dangerously low level, and the price of the metal was correspondingly high. (CWK XII: 507)

As Hillman (2010: 57-9) has shown, as from 1923 the latter opinion tended to prevail. However, the spell of rising prices subsequent to 1922 had stimulated new investments in the Federated Malay States, and it was not clear whether the new investments were filling a gap or creating surplus capacity. When Keynes wrote his note of September 1928, symptoms of a situation of overproduction were emerging. On the other hand, in Keynes's writings, a doubt still remained in the *Memorandum* of August 1929, while the existence of surplus capacity was clearly admitted only in the last report of September 1930.

The intervention of the Malay and Netherlands Indies governments mentioned by Keynes began in December 1920 and was based on the Bandoeng Agreement, a scheme for the purchase and accumulation of tin during the period of depressed prices that followed upon the end of the war. According to Hillman (2010: 56), on its formation in 1921 the pool held 19,700 ton of tin, amounting to 34 per cent of the world stocks. The *Memorandum* of April 1923 reported that 16,200 tons were still in this pool on the 1 of January 1923, being a part of a total world stock of 40,000 tons at the same date, concluding that, on the whole, 'present stocks do not show much surplus over the working minimum of (say) 20,000 tons' (CWK XII: 289). On supply, Keynes wrote that '[t]he production of Tin in recent years has ranged approximately from 110,000 tons to 125,000 tons per annum' (CWK XII: 288), giving no indication about the trends in consumption and prices, but other commentators were less cautious. In January 1923, *The Mining Journal* was placing strong emphasis on the recent fall in the costs of production, arguing that, notwithstanding an average price of £159 10s. 6d. in 1922, against £165 6s. 6d. in 1921, 'supplies were […] heavy'. The same article accounted for this situation with the increasing consumption in the United States, and a further increase in American demand expected to occur in 1923. *The Mining Journal* anticipated prices at around £220 or £230, and therefore high enough 'to bring out these [of the Eastern Pool] stocks'.[2] Eighteen months later, in June 1924, Keynes's second *Memorandum* would confirm this outlook:

> world's output in tin in the past six years has been very steady […] and does not at present show much response to higher prices. The falling-off in European consumption since 1913 has been balanced by increased consumption in the United States, which now takes about 60 per cent of world output. (CWK XII: 337-8)

[2] Press cutting in KP LCE/3/9.

The liquidation of the Asian pool was one of the factors taken into consideration in adapting production to increased consumption, and Hillman has argued that '[s]ince the size of the [Bandoeng] pool was public, as was its release policy, the tin market could easily see the extent to which rising consumption was outstripping available production' (2010: 57). However, evidence in the KP suggests that not all the adjustments of the release policy that were made along the way were promptly communicated to the market. The scheme for the liquidation of the Bandoeng pool was published in the same month, April 1923, as the first *Memorandum*, when the fall in prices had come to a halt and all signs suggested an outlook remaining positive for the near future. In the second *Memorandum* of June 1924, Keynes reported that sales had come to a momentary halt in April 1924, because the price was below the minimum fixed in the plan. Nonetheless, Keynes wrote that '[t]he whole quantity will have been released from the agreement by November 1924' (CWK XII: 335). Again, in the July 1925 *Memorandum* Keynes affirmed that '[t]he whole quantity […] had been released from the agreement by November 1924, and had been actually sold by the end of the following month' (CWK XII: 375) . However, in October 1925, Buckmaster & Moore informed Keynes that a residuum of 3985 tons still remained at the end of 1924, and that this amount had 'probably' been 'shipped in the first eight months of 1925' (KP LCE/3/40). Meanwhile, in June 1924, Keynes's own outlook had remained prudently concealed behind a quotation from the *Engineering and Mining Journal*, in which no clear position was taken as to the probable famine of tin (CWK XII: 337). In the ensuing issue of July 1925, Keynes gave no indication of what the trend of prices would have been over the next future (CWK XII: 373-8).

Quite possibly, Keynes's reluctance in publishing his own forecasts reflected the ups and downs of his performance as a speculator, as that will be shown in Section 3, as well as some lack of transparency in the Bandoeng pool liquidation scheme. Along with these circumstances, however, other and more permanent reasons suggested that any attempt at forming a reasonable expectation as to the price of tin over the near future would have been very difficult. One of these reasons—which Keynes understood quite early—was that tin mining and the consumption of smelted tin were particularly inelastic, and even perfectly rigid within a large range of prices, while the demand for tin stocks tended to fall very rapidly as soon as stocks grew over a very low working minimum. Along the way, Keynes discovered a second and connected reason for this feature, namely the fact that the information on the level of existing stocks of tin was fundamentally unreliable. Taken together, these factors led to a situation in which price oscillations were at the same time extremely wide and very difficult to predict.

On the inelasticity of demand and supply, in July 1925, Keynes quoted from a report circulated by 'A firm of stockbrokers' (most likely Buckmaster & Moore):

> The cost of tin in the Straits is very low. The average company whose shares are quoted in the London Stock Exchange producing in the East has an all-in cost of less than £50 per ton of black tin (60 per cent pure). The lowest producer of all is at £23 a ton. Even with tin at a price as low as £200 a ton these companies make very large profits and naturally turn out as much as their dredge capacity. There is, therefore, no need for fear that an increase in price will be followed by an increase in production. There are only a few negligible producers, such as the Cornish mines, whose production is much influenced by the price of the metal. Between 40 and 50 per cent of the tin consumed in this country, and a somewhat smaller percentage of that consumed in America, is in the tin plate trade, whose prosperity is in no way dependent on the price of tin. The demand for tin for other uses, such as in white metal bearings, is practically independent of the price. The future course of the price of tin will, therefore, be determined almost exclusively by the progress of consumption, and especially by the absorption in the United States. (CWK XII: 377-8)

In the same *Memorandum*, Keynes observed that 'violent price fluctuations ensue whenever the difference between the [production and consumption] has to be absorbed into or out of stocks' (CWK XII: 377; see also 421) but offered no further clarification on this point. Quite plausibly, this was connected with the position of the smelters in the chain from mining to consumption. In fact, while the smelters usually financed the miners, sometimes through vertical integration but mainly through advances on the price of tin ore, no such relationship existed between the smelters and the consumers[3]. In addition to this, when tin in excess (be it in the form of tin ore or smelted tin) remained in the hands of the smelters, this surplus could not be easily disposed of through a fall in prices, because the demand for smelted tin was extremely inelastic. In this situation, smelters could find themselves in the position of having to finance large stocks of tin for a long time, and probably for this reason they had an interest in keeping their inventories at a very low level.

In chapter 29 of the *Treatise on Money* Keynes offered an explanation of price volatility based on the supposedly high carrying costs of involuntarily held surplus stocks, which looks very much like a generalisation of the above hypothesis as to the possible reason why the tin smelters used to keep their inventories at a very low level. In particular, by identifying liquid capital with redundant stocks it is possible to account for the behaviour of agents, e.g. the tin smelters, whose choices are predominantly driven by the need to avoid/get rid of any accumulation of surplus stocks—even though,

[3] See Eastham (1936: 15-6) and Fox (1974: 13).

obviously, there is no reason to suppose that Keynes's generalization was exclusively based on the tin smelters. And the same could be said of Keynes's definition of carrying costs, in which he included—along with interest charges, warehouse and insurance charges, and allowances for deterioration—the '[r]emuneration against the risk of changes in the money value of the commodity during the time through which it has to be carried by means of borrowed money' (CWK VI: 121). Arguing on the basis of these definitions, Keynes explanation of commodity price volatility was that when involuntary stocks of any commodity accumulate, producers begin to sell at a very low price in order to get rid of inventories, and the more inelastic demand is and the higher the carrying costs (including the remuneration against risk), the lower the price will fall (CWK VI: 121-7; 129-30).

In turn, this relates to the speculator's point of view. Any variation in the level of stocks in the hands of smelters was a key indicator of the level of consumer demand, but, as Keynes showed, information on this indicator was by no means readily accessible. Keynes understood this difficulty during his editorship of the *Memoranda*. The earlier issues were based on data pertaining to the 'visible supply' of tin, but in the 1926 report Keynes began to question these figures as 'extremely misleading' (CWK XII: 417) because, as he explained again in 1927 (CWK XII: 468), the 'visible supply' did not correspond to the stocks of tin actually available for consumption, for it included the tin 'in transit', or 'afloat'. Moreover, Keynes introduced a distinction between stocks of tin concentrates withheld by the miners and the smelters' stocks, with the further complication that some smelters were located far away from the consuming countries while others were not.

In the 1927 *Memorandum*, Keynes published his own estimate of the stocks that had been readily available in the United Kingdom, United States, and Holland from January 1923 to February 1927, coming to conclusion that inventories were rarely above the quantity needed for one month's consumption. The February 1927 level represented an absolute minimum during the period: 3,962 tons against a 'visible supply' of 14,221 tons and an average consumption of 10-11,000 tons per month. On the whole, this revealed a situation in which any small change in the levels of production and consumption could result in marked price fluctuations, and in which there was no widely accepted estimate of the level of stocks ready available for consumption.

Keynes's ongoing research on tin stocks influenced his outlook. As early as July 1925, he had noticed that 'in some cases, e.g. tin and rubber, the volume of stocks is now approaching the irreducible minimum', and tin in particular was singled out as a very special case: '[i]t is not suggested that in all these cases production cannot be

increased if a substantial incentive is offered, except, perhaps, the production of tin' (CWK XII: 359-60). Consistently with this analysis, the long-term outlook on tin was for a rise in prices. A few months later, on 29 October 1925, Keynes received a report (KP LCE/3/34) for private circulation by Buckmaster & Moore which amounted to a substantial confirmation of his outlook in the July *Memorandum*. Then, in the fourth *Memorandum* of February 1926, Keynes quoted almost *verbatim* from a Buckmaster & Moore report of 1 February to describe a situation in which everything depended on the trend in consumption :

> It hardly seems possible that enough tin can be found in 1926 to satisfy a consumption on as high a scale as in 1925. On the other hand, there will probably be more than enough tin to satisfy a consumption on the scale of the previous years. If consumption in 1926 shows signs of maintaining the 1925 level, the price may rise sensationally; but if it falls off to the level of 1924, the price may fall sensationally. (CWK XII: 421)

Ten months later, Keynes's private note of 1 December 1926 followed the same line of argument, focused on the trend of consumption in Europe and the United States. Keynes noted that the level of activity in Germany during 1926 had been unexpectedly low, while Britain's weak demand had been mainly the result of the coal strike. Now that the coal strike was over and Germany was recovering, with no significant reduction in US demand in view, Keynes concluded that no fall in prices could be expected in 1927. Most significantly, at this date Keynes still believed in the 'longer period prospects of the exhaustion of Tin supplies over the next five years' (KP LCE/3/115). Meanwhile, the tin market began to show a marked backwardation.[4] In itself unusual, this was indirect confirmation of the dramatically low level of inventories, and a further obstacle in the way of adapting supply to increasing demand. As Keynes explained, the premium of the spot price over the future price 'afforded a considerable incentive during the year to economize stocks of ore in the hands of smelters and stocks of tin in the hands of consumers, with the result that the real excess of current consumption over current production has probably been somewhat greater than has appeared' (CWK XII: 474). These remarks are followed by a gap in the papers until June 1928, when Keynes's long-term outlook on the tin fundamentals had begun to change. Then, in 'The production and consumption of Tin' of September 1928, Keynes observed that even with consumption at a very satisfactory level, output was running too fast: 'Since April, 1928, production has been definitely ahead of consumption in spite of the very satisfactory level of the latter' (CWK XII: 507-8). In August 1929 (sixth *Memorandum*)

[4] A 'backwardation' corresponds to an excess of the spot price over the forward price, the opposite situation being a 'contango'.

Keynes registered an increasing level of liquid stocks (12,046 tons), which after the very low levels of 1927 and 1928 (3,962 and 2,876 respectively) looked much like a step back to normality, but was in fact the beginning of the long depression that lead to the cartelization of the tin industry after 1929. Only in September 1930, when restriction schemes were already under way, was the existence of surplus capacity taken for granted in Keynes's seventh *Memorandum*.

The last two *Memoranda* also made reference to the existence of a private pool for the manipulation of prices that had been in operation in 1928 and 1929. This is revealing, for it offers a further reason—barely mentioned in Keynes's analysis but very clear in the papers related to his investments—why tin represented a very special case among staple commodities. In itself, the very low level of tin stocks, usually below one-month consumption and sometimes as low as ten-day consumption, made the tin market rather susceptible of manipulations, because any small amount of privately owned stocks could suffice to exert an influence on prices. In addition, the very low level of daily tin turnover in the LME was a further element in favour of manipulation. This aspect, almost completely overlooked in Keynes's writings, has been noted in the literature (Gibson-Jarvie 1976; Hillman 2010) and finds further original confirmation in the KP. However, before the 'bull pool' mentioned in the *Memoranda*, there had been at least one other bull pool, in which Keynes himself took a share in May 1925.

The information we have about this episode is far from complete but of some interest. We know that Keynes entered the pool when it was formed on 14 May 1925, that his maximum quota of 266 tons was 1/11 of the total amount (KP SE/2/5/95), and that the participants aimed at exerting an influence on the market, preventing any fall in prices while waiting for the boom to come. But we do not know if it was a success, nor is it clear how long it lasted. The pool is mentioned in Keynes's correspondence up to August 1925. Then there is a gap in the correspondence, while in the later correspondence that exists for the period from February 1926 onwards no reference to the existence of a pool can be found. Only a few members of the pool are mentioned in the KP, but we know that, along with Keynes's friends and associates like Oswald Falk and Rupert Trouton, one who certainly took part in the operations was Jack Budd, the son of Cecil Budd.

Cecil Budd has been described as 'the British government main interlocutor on nonferrous metals' (Ball 2004: 459). After a career in Vivian Younger & Bond, Budd became chairman of the LME in 1902, and then the Minister of Munitions during the war. He was the first managing director of the British Metal Corporation (BMC), when it was formed in November 1918, with the aim of putting the supply of tin from within

the empire directly under British control, while at the same time reducing the German influence (Harrison 1959; Ball 2004). In 1929 Cecil Budd retired, leaving the BMC to a triumvirate of three managing directors. His son Jack was one of them.

Fragments of the correspondence between Keynes and his associates show how the pool operated day by day. For instance, on 15 May 1925 someone from the Buckmaster & Moore office in London informed Keynes that '[t]o-day Falk was away and Trouton and I had to arrange a plan of campaign with Jack Budd'. The plan went thus: 'We decided that he [Jack Budd] should buy up to 200 tons or in an emergency up to 300, the former with the object of putting up the price £1, the latter in order to avoid a crash' (KP SE/2/5/87). Keynes's correspondence with Falk gives us the general outline of the pool strategy as it was decided in June. On 28 May Keynes wrote:

> […] it may be important to have plenty of ammunition on Tuesday. I suggest that the present members of the Pool be asked to agree to an increase of 500 tons in the Pool maximum, pending additional resources obtained from elsewhere. […] On the other hand, there is, in my opinion, something to be said for stopping where we are and buying no more for the present, but taking tin steadily off the market we now have enough to be almost *sure* of producing an impression *in time*. If we buy more, we diminish our strength to *hold* tin in a falling market. We must not get into our heads that it is in any way [unreadable word, perhaps 'important'] for tin to be at any given level of height *quickly*. (KP SE/2/5/97-8)

The question was settled on June 2, when Keynes received a letter from the broker:

> I had a note from Falk this morning, in which he says that he and Trouton agree that our best plan is to hold the tin we have got and wait for America and the bears to buy. Then, if we are right about fundamentals, we shall win in the end. We must make sure that we can see tin down a long way, and avoid if possible selling to encourage the bears. (KP SE/2/5/113)

Other details could be gleaned from the KP, but nothing that can tell us if and when the members of the pool did 'win in the end'. The trend of prices showed as from May 1925 suggests that they probably did. Prices of tin, cash and three months, were £243 and £246 respectively when the bull pool was formed: they had risen above £280 by the end of the year and never fell back to the May 1925 level until 1928. On the other hand, the cost of seeing 'tin down a long way' remains unknown, and the peak in prices was reached only 17 months after the formation of the pool, in October 1926. But what is probably more interesting in analysing Keynes's overall investments in tin during the 1920s is that, notwithstanding his personal skills as an economist and his sound information as a market analyst, and despite his good connections in London and his share in the pool, Keynes did not make very much out of his investments. As we will

see in the remaining part of the paper, Keynes took a series of ill-timed decisions. This resulted in heavy losses that eventually wiped out the bulk of the profits he had realized during the market upswing. Not even a well-informed and well-connected investor like Keynes could succeed in coming to terms with the extreme volatility of the tin market, and even the huge profit that he made during the 1926 boom was swallowed by the losses that came after 1927.

3. Keynes's dealings

Keynes's dealings in tin began in September 1921 and went on almost uninterruptedly until 1930. The ledgers reveal that tin took the largest share in Keynes's commodities portfolio during the 1920s, representing 48 per cent of the whole value of Keynes's purchases—the second largest commodity being cotton, which accounted for 12 per cent only.

The correspondence with the broker reveals an earlier phase of 'learning-by-doing', Keynes simply getting an idea of how the market worked, and then a few years of bullish expectations in tune with the market sentiment. Then, after four years of considerable exposure to market volatility, with cyclical depletion of the profits made during the upswings, Keynes developed two different strategies: first of all, we see a clear pattern emerging as from the end of 1924 onwards, when Keynes started hedging his long positions by means of put options (and 'seller's options to double', as explained below). Later on, in May 1925 he joined the pool, and so was able to exploit (rather than being exposed to) information asymmetries, at the same time reducing the risk of exposure to downswings while betting on a boom. It is not easy to assess the impact of the pool on Keynes's performance and behaviour. We can observe, however, that Keynes made appreciable profits between May and December 1925, in a context of steadily surging prices, possibly influenced by the pool itself. Then some minor losses came during a momentary fall in prices in the first half of 1925. Finally, in the ensuing period the boom the market had been expecting eventually took place, with prices reaching their peak between September and October 1926. Meanwhile, favoured by the period of backwardation, Keynes began to take delivery on some of his futures and to stock tin in the LME warehouses, thus moving part of his operations onto the spot market. By means of this technique, Keynes was able to extend the time horizon of his speculations beyond the three months of a standard future contract, with substantial returns in most of the cases. By the end of this crucial period, Keynes aggregate profit had topped £17,000, thanks mainly to the gains made during the 1926 boom, but, as

soon as prices fell off their peak, Keynes started losing money. Showing some indecision, he first reacted by changing the composition of his long bet into options rather than futures, but the downswing proved to be persistent. Consequently, albeit with a certain delay, Keynes stepped off the market while continuing to incur in considerable losses.[5]

A relevant aspect of the market is the ample use that could be made of options, in the form of call, put, and double options, buyer's option to double (BOD), and seller's option to double (SOD). This cannot be gleaned from *The Times* archive, probably because options were dealt in only over the counter, but is apparent in the KP. Classically, a future contract entailed the obligation to buy or sell a specified quantity at a fixed price on a specific date, a call (put) option permitted its holder to purchase (sell) a specific amount of tin at a predetermined price (the strike price, or 'basis', as reported in the KP) on or before the expiration date of the contract, and a double option was a combination of a put and a call. All these conventional options were connected with the 'three months' price, which was their strike price, while the BOD and SOD strike prices respectively stood at a premium and a discount on the three months prices. A handwritten letter in the KP explains what a BOD was:

> In exchange for a sum at present about £3 over the forward price for tin the buyer purchases tin much like the ordinary forward purchase but has the additional right to double the amount he takes or not, as he pleases, having to notify 3 days before the end of the 3 months what his intention is.[6]

The explanation of a SOD option is summed up in another letter that Keynes received from the broker:

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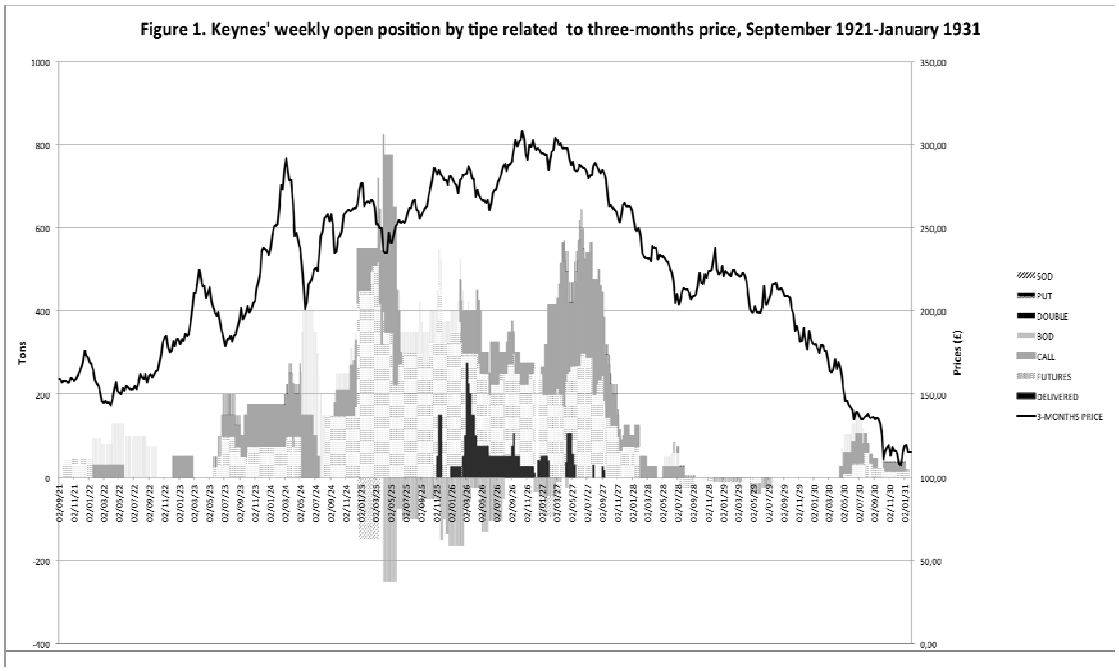
[5] Unless explicitly stated, all estimates of Keynes's profits and losses given in this paper were derived from the data available in Keynes's ledgers. In a simple accountancy scheme, Keynes's ledgers recorded the purchases on the left-hand side and the sales on the right-hand side, with the corresponding date and prices. Crosschecking with other archival material confirmed that this source is satisfactorily reliable and complete. In particular, all the transactions documented in the correspondence with Buckmaster & Moore are recorded in the ledgers (while there are transactions in the ledgers of which no trace has remained in the correspondence). Moreover, the data available in the ledgers are perfectly consistent with Keynes's position as it can be reconstructed through the weekly statements of account the Tilton Company. Our estimates of Keynes's profits are also compatible with, though not perfectly corresponding to, the estimates reported in the Tilton papers. However, as Tilton Co. was created only in April 1926, such comparison could not be made for the previous period. As neither brokerage fees nor interest costs are recorded in the ledgers, all the figures that appear in this paper indicate gross profits (losses). From the correspondence with the broker we learn that brokerage fees amounted to 0,1 per cent on each transaction and that the required margin on each position was quite low, varying from 20 per cent of the negligible positions at the very beginning of Keynes's dealings in tin and other non-ferrous metals to a more prudent 30 per cent throughout the period.

[6] Handwritten letter, undated and unsigned (KP SE/2/1/126-7).

> If you buy an SOD you get the tin cheap but you give the seller the right to put an equivalent amount on you if the price falls. That is to say you get your tin cheaper if you are prepared to run the risk of having double the amount if the market goes against you […] if you sell an SOD […] you sell the tin for a low price with the option of selling double the amount if the price goes in your favour.[7]

In figure 1, Keynes's dealings are shown in detail, drawing upon the data available in the ledgers. The figure presents a week-by-week account of Keynes's open interest, divided by type of contract and by long (positive y-axis) or short (negative y-axis) positions, offering an overview of the complete history of Keynes's speculation in tin over the period 1921-1930 which will serve as basis and reference point in the remainder of the paper.



Keynes's first purchase was a three months future on 45 tons of December tin which he continued for a further three months on December 2, seventeen days before delivery, gaining a difference of £371 5s. On 19 January1922, Keynes decided to sell his March tin in advance, at a small loss, and bought a BOD on a higher quantity—65 tons. With prices rising from £156 in September 1921 to £166 in January 1922, Keynes may well have thought that a further rise was to be expected in the first part of 1922, and an upswing eventually occurred, but only in third quarter of the year, when cash tin rose above £170 and Keynes had already exited the market. The loss on the first BOD

[7] Dated 11 December 1924 (KP SE/2/4/195-6).

amounted to £1,551.5s. Possibly for this reason, a third and less risky way of betting on a price rise was inaugurated on 7 April, when Keynes bought a call option on which he earned a difference of £48. Keynes also attempted a bolder strategy: on the same day his first BOD was closed at a heavy loss, he bought another BOD, this time on 50 tons. The new BOD was exercised on its last day, gaining a gross profit of £278. Keynes then rolled over the same position, this time with a gross profit of £550. Thus, on 7 October 1922, when Keynes exited from the market, his tin account registered a small gain of about £265.

At that time, prices—both cash and three months—were around £164, while the trend had on the whole been positive since March, when tin had bottomed at £142. This was just the beginning of the long period of unstably rising prices that would top £300 in October 1926. Apparently, it was very difficult to guess when it was the time to step in and when it was better to keep out of the market. The loss on the first BOD had shown Keynes that sound mid-term expectations could easily be frustrated by short-term volatility. But there was also the opposite problem. For instance, from October 1922 to March 1923 tin prices rose steadily and fast from around £164 to £225 (three months), and Keynes took advantage of this favourable situation, making a profit of £1,253 simply by buying a call option on 50 tons on 4 December 1922, closing it on February 28 and doing nothing else before May. On the other hand, following a less conservative strategy, he could have gained much more.

Meanwhile, the trial and error process was continuing. In May 1923, one month after editing the first *Memorandum*, Keynes tried a new strategy, buying a future on 25 tons and a double option on the same amount. He repeated this operation in June, probably trying to create a combination of contracts that could work as a BOD in the case of a rise in prices, while limiting the losses in the opposite situation. In the end, the small losses that came from these dealings (£58) were offset by a gain of £300 on an ordinary call option on 50 tons bought on 21 June. Keynes rolled over and increased his position in October, with an additional purchase of 25-tons futures. Closing these contracts in December, Keynes realized a gross profit of £2,506, and decide to roll over the same position three months hence, realising another good difference (£2,635). At the beginning of 1924 Keynes was making money with tin, and as from March 1924 his long position began to grow to an unprecedented level. While Keynes as an analyst was still cautious in his assessments of market prospects, his speculation reveals that his expectations were undoubtedly bullish.

This behaviour seems consistent with the scenario that Keynes was observing. Consumption was still growing faster than production, and even if the liquidation of the

Bandoeng pool probably hindered the surge in prices it also represented a built-in mechanism that decreased the probability of too rapid a fall: had prices dropped below a certain threshold,[8] the monthly supply would accordingly have fallen by 880 tons. Therefore, Keynes kept staying long, and only at the end of 1924 did he begin to hedge his growing long positions systematically. This may have been due to the fact that the liquidation scheme of the Bandoeng pool was expected to be over by January 1925: the exhaustion of the pool created the conditions for a faster growth of prices, at the same time depriving speculators of the reassuring mechanism described above; another possibility is that Keynes began to hedge his long position in December 1924 because his open interest was growing much higher than ever before, thus entailing a heavier burden for him.

The first of three major cycles of investments started on 20 March 1924 with a purchase of five call options, four BODs, and two futures, continued in May with the purchase of three more BODs, and was not a success. Early in August, Keynes had incurred an aggregate loss of approximately £2,700. In the second cycle, Keynes rolled over to November the BODs bought in May for delivery in August, made another purchase in September, and did nothing in October. Thus, at the beginning of November, Keynes's open interest included two futures on the same month and two BODs plus two call options on December: these positions resulted in a gain of over £2,000. Then, during the third cycle (December 1924-March 1925) Keynes's open interest almost doubled, a considerable risk compensated for with a combination of futures and SODs, the latter type of contracts being, in the words of the broker, 'a hedge against your straight tin': during December, Keynes sold 150 tons SOD for delivery in March as a hedge against corresponding purchases of 300 tons futures on March. Early in March the price fell below £250, so the use of SODs as a hedge proved to be a happy idea. Keynes's loss was around £1,800, but would have exceeded £5,000 without hedging.

Bullish expectations, apparently based on sound mid-term considerations about the state of demand and supply, were producing alternate results. On the whole, by March 1925 Keynes had lost all the profits made since September 1923 and the cumulative account of his speculations on 29 May 1925 was negative at around minus 300£. The end of this earlier phase coincided with the change in the tin section of the *Memoranda*, when Keynes became increasingly sceptical about the quality of the available information on stocks, and this entailed new doubts and uncertainty. Therefore, with

[8] In the early 1923, Keynes's sources indicated that the threshold was probably around £230 (KP LCE/3/9).

negative profits up to date and an obvious dilemma between risk and profitability, it does not come as unexpected that Keynes joined a pool in May 1925. In a narrow market such as tin, a relatively wide pool could provide insurance against volatility by managing it through market operations drawing upon good quality information from insiders. As it happened, Keynes's tin account had turned from a loss before the pool to a cumulative profit of about £5,000 by the end of December 1925, on top of a rising pattern of prices that was followed by a momentary decline in early 1926. We can rule out the possibility that Keynes's pool could have determined the positive trend that lasted until December 1925, but it could certainly have reduced volatility along the trend. Compared with the 19,000 tons of the Bandoeng pool, its size—almost 3,000 tons[9]—was relatively small, but not negligible in a context in which the stocks available for consumption sometimes dipped below 3,000 tons. Accordingly, from May to December 1925, the operations outside the pool,[10] which we can trace in the ledgers, provided Keynes with an outstanding positive difference of more than £8,500, the outcome of a strategy predominantly based on a long exposure of about 400 tons split between futures (from 225 to 325 tons) and options (call and BOD), hedged by a relatively small amount of put options.

Despite the pool, however, hedging by means of options grew in the third quarter of 1925, when Keynes bought put options for about £1,700, probably also as a consequence of the state of growing uncertainty that would emerge in the *Memorandum* of February 1926. Keynes attributed quite a substantial value to his hedging policy—which eventually would prove pointless, as Keynes had to drop these options incurring the corresponding losses. In any case, this was the cycle when Keynes's strategy paid off better than ever: his long positions afforded him a positive difference of more than £8,000, of which more than £3,000 came from the liquidation of 200 tons spot: for example, on 26 November 1925 Keynes bought 150 of tons due on 5 March 1926 at a price of £281, accepted delivery and then sold the whole amount on the spot market, in tranches of 10 or 25 tons at prices of even £320 when the backwardation was at its peak. He concluded the liquidation of this amount a year later, in November 1926. This successful strategy was carried through in the first part of 1927, when world production was shrinking despite the boom in prices, depleting stocks and allowing for further

[9] Keynes's quota amounted to 266 tons, corresponding to one eleventh of the pool.

[10] The ledgers provide an account of Keynes's personal movements, which in a very few cases were 'from the pool', while we scarcely have any evidence of the pool operations, except for some documents that cover the period until 30 July 1925 (See KP SE/2/5).

appreciation coupled with backwardation.[11] By carrying substantial amounts of stocks in the LME warehouses and selling them spot when the price was high enough, Keynes made good profits, even if discounted for the fees required by the London Metal Exchange for use of its facilities, which seem to have been fairly modest.[12]

Before the boom at the end of 1926, however, the first part of 1926 had provided another example of tin market unpredictability. Keynes ended August losing about £2,300 on a substantial bull position opened before and during a temporary fall in prices. As there was no timely inversion in the price trend, and in order to limit the losses, Keynes later decided to buy some put options—just in time to witness a dramatic upswing leading to the original price level and to further losses for Keynes. Then, the long expected boom came underway. At this time, in the last part of 1926, Keynes's open interest was composed of nine different futures due on October and December, for a total amount of 200 tons, and two calls, due on November and December, for a total amount of 50 tons. Keynes also stopped hedging until 1927. On the first tranche of futures, with delivery in October, he ended up completely offsetting the losses of the first cycle, gaining around £6,000. Prices, in fact, reached their peak (£310 as an average level) in the third quarter of 1926. By the end of this period, Keynes's cumulative profit topped £17,000—the highest value that he was able to reach over the whole decade. A document in the Tilton papers dated 15 December 1925 (KP TC/4/1/84), confirms that a large part of this cumulative profit, £10,528, came from positions that were opened in a period of eight months subsequent to the creation of the Company.

As shown in Section 2, the crucial issue at this point was to guess whether the peak of prices was just a momentary boom or part of a longer trend leading to the exhaustion of the world supply of tin, as predicted in many quarters during the 1920s. In this connection, Keynes opened a smaller cycle in December 1926 on March 1927, when he rolled over his long position, this time hedging it by means of a put option on 10 tons and a SOD on 50 tons. It seems that Keynes feared that the downswing in prices would further continue, as eventually proved to be the case in January 1927, before prices started raising again in March: the put options purchased in March were not taken up and Keynes made a profit on his long positions of about £900. 1927 was also the year in

[11] 'Throughout 1926 and 1927, the average premium paid for spot over forward was around £6/16/-, rising on occasion to as much as £17' (Hillman 2010: 58; see also CWK XII: 473 and 602). Our data substantially confirm the average level of backwardation, while the maximum level we could find is higher at over £22 on 15 October 1926.

[12] The amounts reported in the correspondence with the broker during the pool were negligible. As a matter of example, two pool warrants on 50 tons each reported rents of £7 and £16, the latter probably corresponding to a longer (but not specified) period of storage than the former (KP/SE/2/5).

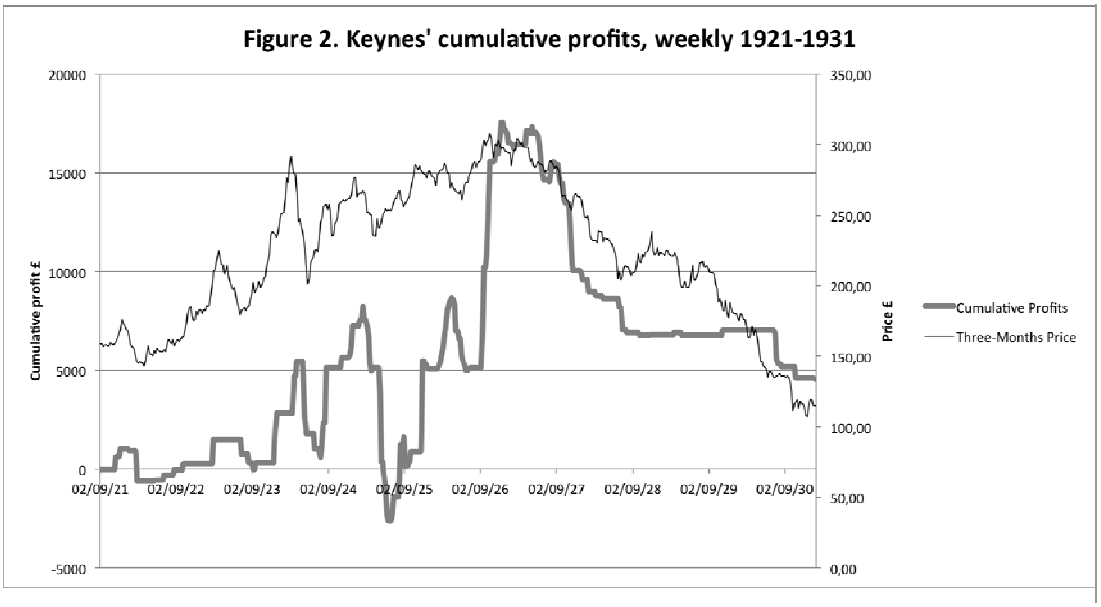
which Keynes published the first *Memorandum* with assessment of ready available stocks, having raised serious doubts about the visible stocks data in 1926. Probably as a consequence of a more uncertain long run outlook and of his doubts about stocks data, Keynes became a little more cautious, shifting towards call options although raising his aggregate long position at the same time. Eventually, no further significant surge took place and, from April 1927, the price trend inverted, now showing a fairly steady decline punctuated by momentary increases instead of the positive trend interrupted by momentary falls that had prevailed so far. Along this trend, tin fell from about £298 on 1 April 1927 to £198 in May 1929, the only appreciable interruption coming in the period July-November 1928.

Meanwhile, in May-June 1927 Keynes's open interest was again quite considerable, reaching 350 tons long, of which 125 futures. These positions resulted in some losses. Then, in August and September 1927, Keynes greatly reduced his long position as prices fell sharply. In doing so, his losses exceeded £5,000. In November, while experiencing the fall in his cumulative profits, Keynes continued the liquidation of his open interest up to April 1928, when was left with no open positions at all. However, it was not last long before Keynes came back on the market, buying a call option, two BODs and a double option with delivery date between July and August 1928. However, he ended up losing about £1000, choosing to sell off his options well before their date of expiration, most likely fearing a further fall in prices. What Keynes could not know was that the downward trend of 1928 would be letting up for a spell, right from July to November, when prices rose by £20, most likely consequent upon the intervention of a bull pool, as was to emerge only at the end of 1928.[13]

In September 1928 Keynes wrote: 'The present weakness of the market may become more accentuated, but it is essentially a passing phase due to new dredger production having matured a little faster than is wise' (CWK XII: 512, quoted in Hillman 2010: 90), and this offered a clue to Keynes's behaviour on the market. From July 1928, Keynes had gone short but he had to close the bulk of his positions early because of the temporary surge in prices due to the distortive intervention of the above-mentioned pool. However, Keynes did not reconsider his short bet until much later in the year. Then, Keynes exited from the market for about a year, while prices were continuing to drop steadily. On stepping in again, from April 1930, he acquired a bull position for about 185 tons, probably considering at the on-going cartelization, but again closed these contracts at a loss of about £1,800. This was the last episode in Keynes's

[13] Howeson's pool (see Hillman 2010: 91). Keynes's only reference to the bull pool is that of August 1929 (CWK XII: 537).

speculation in the tin market as studied in the present analysis. At this point, Keynes's gross nominal profit on the whole period covered in this paper came to £4,613. This is indirectly confirmed in the papers of Tilton Company: of the £10,528 registered after the first 8 months, in December 1926, only £919 were left in February 1929.



4. Conclusions

Keynes's analysis and direct experience of the tin market are on the whole indicative of a highly specific, and in some ways extreme speculation context. The tin branch of the LME during the 1920s was far from showing the characteristics that textbooks on organized markets usually prescribe. Rather, it was a very imperfect market, with limited sources of supply, a relatively low number of buyers and sellers, imperfect information, and even attempts at manipulating prices. Moreover, the usually very low level of stocks and limited access to relevant information about inventories, together with the high volatility of prices and limited time horizon provided for with the standard 'three months' futures contract and connected options, concurred in making speculation in tin a potentially very profitable but in practice very complex and risky endeavour. Keynes's dealings represent an interesting case-study in this respect. He certainly was a competent and relatively well-informed speculator, and could also avail himself of good connections in the industry and the LME. Nonetheless, his decisions

about when to step in or out of the market were frequently ill-timed, and he was continually exposed to heavy losses even when his outlook proved on the whole correct. Without the hedging techniques afforded by the wide range of available options (and, possibly, without entering a pool), Keynes would probably have kept his open interest at a lower level. Otherwise, he might have incurred heavy losses. More specifically, Keynes's behaviour reveals a pattern, which seems to emerge after 1924, when he began to cover his long positions with more or less marked (and costly) forms of hedging. This continual modification of the mix of contracts employed, in the attempt to apply long/mid-term expectations to short period volatility, is consistent with Keynes's analysis. In particular, we noticed that the increasing use of hedging ran parallel to a growing concern about the scanty available information on inventories. However, it is worth noting that neither the more refined investment techniques elaborated during the period nor Keynes's in-depth analysis of market fundamentals sufficed to constitute superior performance. In the end, about 60 per cent of his highest cumulative profits over the whole period (£10,500 on £17,000) came between May 1925 and December 1926—that is, when Keynes's pool was active and during a generalized boom in prices. Subsequently much of this profit dwindled away.

Another plausible conclusion to this paper is that, compared to his dealings as a speculator, Keynes's analysis of the tin market might have been more fruitful. It is in fact possible, and even probable, that Keynes's experience with tin offered much of the evidence upon which the analysis of commodity prices volatility in chapter 29 of the *Treatise on Money* was based. As we saw in section 2 above, the very low level of working stocks, the particularly marked rigidity of supply and demand, and the high carrying costs (including the remuneration against price risk), made of tin a sort of extreme case of the relation between redundant stocks ('liquid capital') and price variations. On this point, however, and just because tin was an extreme case, it would be well worth also evaluating what Keynes could learn from his speculation in other commodities, like cotton and wheat among crops, lead and copper amongst non-ferrous metals, all of which had a section in the *Memoranda* and a significant part in Keynes's portfolio.

On the other hand, and just because tin was such a limiting case of Keynes's theory, it may well be worth noting what this theory has to say about the tin industry before regulation set in during the 1930s. In this respect, chapter 29 of the *Treatise on Money* and Keynes's own specific analysis of the tin industry in the lesser known textual evidence, such as the sections on tin in the *Memoranda* and related papers in the KP, seem to suggest that a more detailed analysis of the smelting branch of the tin industry

could be of some help. While most of the analysis and historical reconstruction from Furness (1926) to Hillman (2010) has put a great deal of emphasis, on one hand, on tin mining and, on the other hand, on the consumption of tin, the intermediate process of smelting might have not received all the attention it would deserve. In fact, in the perspective that can be derived from Keynes, the smelters' decisions on inventories could generate wide price variations over the short period, thus determining a situation of great uncertainty as to the use that could be made of prices as an appropriate indicator of the relative scarcity of tin in the long run.

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An analysis of Keynes's investments in the wheat futures markets: 1925-1935

Tiziana Foresti and Eleonora Sanfilippo[*]

1. Introduction

Between 1914 and the late 1930s Keynes carried out increasingly intense investment activity on the foreign exchange, securities and commodity markets, operating on his own behalf and on that of many institutions (Moggridge 1983). It was during those times, on the basis of his first-hand knowledge of speculative behaviour, that Keynes worked out a theory of speculation, which we find dispersedly in his published writings (Keynes 1923, 1930). This theory, known as the theory of 'normal backwardation', was elaborated by Keynes with particular reference to the functioning of commodity futures markets.[1]

Keynes's theoretical interest in commodity markets arose from the need to account for the great price fluctuations which occurred in the years immediately after World War I. Following in the tracks of Emery (1896), Keynes[2] saw organized markets as having emerged to meet the demand for hedging transactions against risk of price changes. In particular, Keynes grounded his speculation theory on producers' and speculators' different attitudes towards risk. In his own words: 'What the producer requires of speculator is not so much someone who knows better than he does the future prospects of cotton, as someone who will take off his shoulders at reasonable probability of profit such part of the risk as he cannot afford to bear himself' (Keynes

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[1] The literature on the theory of 'normal backwardation' is quite extensive. For a full reconstruction of the evolution of this theory in Keynes's writings see Fantacci, Marcuzzo and Sanfilippo (2010). For a detailed analysis of Keynes's different views on speculation and the theoretical debate on the subject see Marcuzzo (2012), and Cristiano and Paesani (2012) both in this volume.

[2] Keynes's first encounter with Emery's *Speculation on the Produce and Stock Exchanges of the United States* (1896) dated back to the Autumn of 1905, during his economic apprenticeship with Marshall (Raffaelli 2000: 128).

1923: 262). In Keynes's view, under the hypothesis that producers and speculators shared common expectations, 'for the sake of certainty the producer, not unnaturally, is prepared to accept a somewhat lower price in advance than what, on the balance of probability, he thinks the price is likely to be when the time comes' (Keynes 1923: 261).

Backwardation is an excess of the current spot price over the forward price, which represents remuneration for the speculator's risk-bearing (Keynes 1923: 263).[3]

In the *Treatise on Money* (CWK VI: 128), Keynes distinguished between a backwardation due to an abnormal shortage of supply, and a 'normal backwardation',[4] which instead occurs when supply and demand are balanced (i.e. under 'normal conditions').[5] When current market conditions are not normal, as in the case of redundant stocks, 'the forward price [rises] above the spot price […] This contango must be equal to the cost of the warehouse, depreciation and interest charges of carrying the stocks' (CWK VI: 129). In this framework, speculation emerges as a long-run activity, based on continual renewal of long positions,[6] finalized to earn profits by averaging out results over different years.

The link between this theoretical representation of speculative behaviour and Keynes's own practice as an investor in commodity markets is a deep and complex one, and mutual influences certainly exist between them. This paper aims to provide a contribution to investigation into this relation, focusing on Keynes's transactions on the wheat futures markets.[7]

The fact that Keynes traded on four different market places (Chicago, Winnipeg, Liverpool and Buenos Aires) makes analysis of his investments in this commodity particularly interesting and affords us full appreciation of the variety of his investment strategy and its evolution through time.[8]

This research develops upon Fantacci et al. (2010), our main reference study, along three broad lines. First, we consider the entirety of Keynes's operations, between 1925

[3] Keynes underlines that: 'The fact that there is a "backwardation" in the price of a commodity […] is not necessarily an indication that the market takes a "bearish" view of the price prospects' (Keynes 1923: 262).

[4] According to Blau (1944: 23) 'a state of affairs corresponding to the Keynesian theory of the "normal backwardation" is not more than one of many possible constellations in the futures market, and there is no reason to assume that it is the most probable one'.

[5] Hicks (1939: 138) interpreted Keynes's normal conditions as those in which 'demand and supply conditions are expected to remain unchanged'.

[6] This behaviour describes a roll-over strategy (see section 4 below).

[7] For analysis of Keynes's trading on the tin and cotton markets, see respectively Cavalli and Cristiano (2012), and Cristiano and Naldi (2012) both in this volume.

[8] It is worth noting that during the 1930s wheat acquired a growing weight in Keynes's portfolio, reaching by June 1937 the quota of 34 per cent of the total of his commodity investments (Fantacci et al. 2010: 5 fn. 7).

and 1935, whereas Fantacci et al. (2010) concentrated on May-September 1937. Second, we reconstruct Keynes's trading activity on the wheat futures markets, building on a larger number of sources. These include unpublished archival material like Keynes's ledgers and papers relating to the Tilton Company,[9] and the correspondence with his broker Buckmaster & Moore and with Walter Case, an American banker. Third, we employ data on spot and future prices for a better understanding of Keynes's investment strategy. These data are mainly drawn from George Bromhall's *Corn Trade News*,[10] one of Keynes's main sources of information. In fact, explicit references by Keynes to this bulletin appear not only in the *Special Memoranda on Stocks of Staple Commodities* (Keynes 1923-30) but also in the 1937 correspondence with Kahn (Kahn Papers, RFK/13/57/223-24) attesting to the fact that Keynes took the *Corn Trade News* as a reliable source on the wheat market over time.

The interval of time considered in this analysis is mainly the decade 1925-35, although we also provide some insights into Keynes's dealings beyond 1935, and more precisely up to August 1936. The main source from which we have drawn the relevant information about dates, quantities, maturities, prices, markets and the kind of operations (forward sales or purchases) performed by Keynes are his ledgers (Keynes Papers,[11] KP hereafter, SE/11/2/31, 37, 55, 59 and 60), which exactly cover the period 1925-35. The papers relating to the Tilton Company (KP, TC/1-4) represent a subsidiary source (which proved particularly useful to check the operations recorded in the ledgers) and offer data on open positions and book and realized profits and losses. In fact, although the opening and closing of the same position are recorded on the same line in the ledgers, the handwriting or material mistakes made by Keynes occasionally give rise to some doubts or difficulties in interpretation: in these cases the weekly statements of the Tilton Company have been fundamental to correct certain ambiguous or erroneous dates, prices, or month of delivery. This was the case especially for the operations conducted by Keynes from July 1931 to November 1932 (KP, SE/11/2/55), exact reconstruction of which would have been hard without cross-checking the information contained in the ledgers with that contained in the Tilton Company accounts for the same period (KP, TC/4/2/88-156). Furthermore, the Tilton Company

[9] This is the company created by Keynes in 1926, for the management of part of his own wealth, through which he specifically operated in the commodity futures markets (CWK XII: 9).

[10] The *Corn Trade News,* a daily review of the grain trade, was founded in 1888 by George Broomhall (1857-1938), a grain broker based in Liverpool. Starting as a small local sheet, in few years it became one of the leading world sources of information on the grain market. It provided tables with prices (spot and future) on the different markets, volume of productions, shipments, and a reliable and highly considered grain trade weekly review on market prospects written by Broomhall himself (*Corn Trade News*, Jubilee Issue, 1938: 5-7).

[11] The Keynes Papers are kept at King's College, Modern Archives, Cambridge, UK.

statements represent the sole source of information on the operations carried out in 1936 to offset the positions Keynes opened in the second half of 1935 (KP, TC/4/3/101-133).

The structure of the paper is as follows. Section 2 provides an overview of the functioning and characteristics of the wheat futures markets at the time of Keynes's investments. Section 3 presents a description of the international wheat market and Keynes's view of this market as drawn from his *Special Memoranda on Stocks of Staple Commodities* (CWK XII: 267-647). Section 4 contains a detailed reconstruction of Keynes's operations and provides a representation of his investment cycles in the decade considered. Finally, Section 5 suggests an interpretation of Keynes's behaviour in the wheat futures markets which helps better to qualify his view of the functioning of the commodity futures markets.

2. Wheat futures trading: an overview

Wheat had represented one of the main agricultural products exchanged in the world market since the beginning of the 20th century. At that time, world wheat production was divided into two areas, 1) northern hemisphere production: North America (the US and Canada), eastern Europe (surplus area), western Europe (deficit area), and India;[12] and 2) southern hemisphere production: Argentina and Australia.[13]

The development of transport and communication systems played a crucial role in favouring the growth of the dealings in this commodity. A seasonal supply (depending on unpredictable factors such as weather conditions, infestations and rusts) had to cope with demand which was, by contrast, continuous and uniform throughout the year. The huge fluctuations in world wheat prices afforded greater scope for the development of an organized market.

Broadly speaking, at least five conditions must be fulfilled by any product before it can be the object of dealings in an organized market: (i) durability, (ii) measurability, (iii) the possibility of grading (all these three conditions amounts to saying that the commodity 'must be fungible'); (iv) high frequency of exchanges and finally (v) being subject to price fluctuations (Smith 1922: 4-5). The fact that supply cannot rapidly be

[12] India was basically an import country, which exported wheat only when the world wheat price was rising.

[13] In general, a cereal year dates from 1 August to 31 July in the Northern hemisphere, and practically coincides with the calendar year in the Southern hemisphere. The crops of the southern hemisphere were harvested in December and January, while the crops of the northern hemisphere were harvested basically from May to September, with the exception of the Indian crop, which was harvested in March and April. In North America, in particular, the harvesting period was in July and August (Timoshenko 1928: 26).

adapted to demand makes room for the professional dealers and recourse to futures contracts as producers' hedging instruments. As we know, commodity futures are, in fact, contracts to sell a given commodity at a future date for the price agreed when the contract is stipulated. Of the various agricultural products, wheat in particular met these requirements.

By the interwar period, the US and the Canadian governments—two of the four big export countries—had adopted a grading system, which standardized the different qualities and types of wheat exchanged on the market. This made it possible for the North-American producers to sell abroad on the basis of grades rather than samples (Boyle 1929: 17) and favoured the use of futures contracts as the major instruments for world wheat trading. The object of the dealings was not a specific lot of wheat but, rather, a given quantity of wheat of a defined (and generally recognized) quality, with the proviso that any difference in the quality actually delivered allowed for variations in the pre-fixed price. The seller was given the option to decide the actual day and grade of delivery, and was free to tender the wheat on any day between the first and the last day of the month of maturity of the futures contract. The futures contracts seldom gave rise to actual delivery of the commodity and usually offsetting was achieved by buying/selling an opposite contract before the date of maturity[14] (Fantacci et al. 2010).

In the mid-1920s—when Keynes began to invest in wheat futures—Chicago, Winnipeg and Liverpool were the three main trading places in terms of exchanges volume and importance.[15] During the 1930s Buenos Aires also became a favourite trading place for wheat futures in accordance with the growing quota acquired by Argentina in the world production and its growing role among export countries.[16]

Chicago and Winnipeg were close to large wheat-producing and -exporting areas. Hence, futures contracts on these markets, although specified in terms of generic contract wheat, were related to the specific qualities of the wheat produced in North America.

The completion of the Illinois-Michigan Canal (1848), the growth of the Lake Michigan commerce that followed, the establishment of the Chicago Board Trade

[14] This characteristic distinguishes the futures from the forward contracts.

[15] Different measurement systems for quantities traded are adopted in the different markets: bushels (lots of 5000, 10,000, 15,000, 20,000 or 50,000) in the North-American markets, loads (1,2,5 or 10) in the Liverpool market and tons in Buenos Aires. The forward prices are expressed in the currency in which the contract is actually denominated, respectively dollars (cents) for Winnipeg and Chicago futures; sterling for Liverpool futures and pesos for Buenos Aires.

[16] In the period 1927-36 grain export represented more than 50 per cent of all Argentine exports. In contrast to the United States, Canada and Australia, where wheat often had to travel a thousand and more miles before it reached its port of exportation, wheat production in Argentina was almost entirely confined to an area within no more than 150 miles from the principal seaports (De Hevesy 1940: 333).

(1848), and a confluence of innovations, including grain elevators, railroads and grain exchanges had been boosting trading by means of forward contract as far back as 1863 (Santos 2013). In May 1865, the Chicago Board Trade turned traded forward contracts into futures contracts (Hieronymus 1977). By the late-nineteenth century, the Chicago Board Trade had become the US's premier organized grain and provision futures exchange, bringing the Chicago market, during the 1920s, to a leading position in the world market (Chandler 1977: 212).

The standard maturities of the wheat futures contracts exchanged on Chicago were: May, July, September, December (KP, SE/11/2/31-59). Six classes of wheat were quoted: Hard Red Spring, Durum, Hard Red Winter, Soft Red Winter, Common White, White Club, five being further sub-divided into two or three other classes. Each of these sub-divisions in turn could embrace two or more grades, e.g. No. 1 or 2 or 3 Dark Hard Winter. Thus on futures contracts in Chicago the seller had a choice of seven (actually fourteen) grades (Smith 1922: 23).

Winnipeg was the other major trading place in the North American market. The region of Manitoba produced a special quality of wheat (which took the same name) that became famous all over the world for its high quality (Boyle 1929: 13). Unlike Chicago, during 1920s Winnipeg had no Board but three Wheat Pools of farmers of Alberta, Manitoba and Saskatchwan, which operated in concert through a jointly owned Central Selling Agency. Pooling was a system in which 'farmers voluntarily signed an agreement to deliver all their wheat to the pool for five years and would receive, in return, an initial payment per bushel and the remainder in interim and final payments based on the actual return for that grade' (Friesen 1984: 334). Until 1929 the pools handled over 50 per cent of all Canadian grain; subsequently overestimation of the final market price of wheat led the pools to the bankruptcy (1931) and placed the Central Selling Agency under federal control. The Canadian Wheat Board was established only in 1935 as an alternative to the open market.[17]

The Canada Grain Act (1912) defined four grades for Manitoba Spring Wheat: No 1 Hard, and Nos 1, 2 and 3 Northern; three each for Alberta Red and White Winter Wheat, and two for Alberta Mixed Winter Wheat (Smith 1922: 22). The standard maturities for the Winnipeg future contracts were: May, July, October, December (KP, SE/11/2/31-59).

In the 1930s Liverpool represented the leading world market for the wheat trade. Wheat was an important crop in the arable areas of the Eastern Counties, where it was not grown alone, but as a part of a rotation which included root crops, rotation grasses

[17] It became compulsory to use this government agency in 1943 (Ankli 1982). See also Levine (1987).

and other grain crops like barley and oats (De Hevesy 1940: 636). This shortage of home production together with, as from the repeal of the Corn Laws (1846), a free trade policy made Great Britain the major import country for wheat. Nevertheless, in response to the drop in wheat price due to the Great Depression—as well as for military reasons—at the beginning of the 1930s the Government decided to increase wheat production. Thus, in 1932, the British Wheat Act provided for a duty of 2s per quarter on non-Empire wheat and direct subsidy to British wheat-growers.[18]

The standard maturities for the Liverpool wheat futures contracts were: March, May, July, October and December (KP, SE/11/2/31-59; TC/4/3/115). The maturity of March was linked to the harvesting time of the Indian crop.

The development of futures markets went with an increasingly widespread attitude of suspicion towards the 'evils of speculation'. From the very outset, the press had questioned the legality—as well as the morality—of futures contracts. In June 1887, for instance, the *New York Tribune* concluded that 'holding speculation in food products hostile to public welfare and the gambler in grain an enemy of the American producer' (quoted in Stevens 1887: 37). Similarly, that year the Londoner *St James Gazette*, asked: 'At what point does legitimate trading suddenly become transformed into mad speculation, involving the public in the greatest inconvenience and entailing loss or ruin upon thousands of innocent people?' (Ibid.: 38). The main point under discussion lay in the destabilizing effects of speculation on prices, which in the case of wheat, because of its paramount importance in the livelihood, made the debate particularly heated. Not surprisingly, the first American legislation on futures (Hatch and Washburn Bills 1892) aimed at the 'short seller' because the 'illimitable' quantities of 'fictitious' products that could actually be offered on the market 'must reduce the price' (quoted in Emery 1896: 71). American Congress made repeated attempts to find some appropriate means of regulation of future trading (Lower 1978).

Legislation and regulation of the wheat futures markets developed along different lines in Great Britain, the US and Canada (Santos 2006). A professional trader operating on the three main market places had to be well aware of their institutional characteristics.

[18] This duty was abolished as from 1 January, 1939. On the impact of Britain's trade policy change in 1932 on its economic growth see Kitson and Solomou (1990).

3. The international wheat market in the 1920s and 1930s

Immediately before World War I, the combined wheat exports of the USA, Canada, Argentina and Australia amounted to 50 per cent of the world's wheat trade. This percentage would reach a peak of almost 90 per cent in the early to mid-1920s as a consequence of the disruption and destruction of agricultural production, especially in Europe due to the World War I and the Russian Revolution (De Hevesy 1940). As shown in Table 1, Canada was always the largest exporter followed by the USA between 1922 and 1927 and by Argentina and Australia in the late 1920s and 1930s.

Table 1: Principal exporters per cent share of world wheat trade, five-year annual averages

	1909-10 to 1913-14	1922-23 to 1926-27	1927-28 to 1931-32	1932-33 to 1936-37
United States	16.0	23.2	17.7	9.0
Canada	13.9	36.9	34.6	37.4
Argentina	12.3	17.05	20.4	24.1
Australia	8.0	11.03	13.7	19.1
TOTAL	50.2	88.9	86.4	89.6

Source: De Hevesy (1940: Appendix 10).

The combined share of the four largest exporters would decline slightly, after the mid-1920s, due largely to the rise in protectionism as countries tried to defend home agricultural markets and producers. In those years, many European importing countries tried to cover their national consumption with increasing substitution of home-grown for foreign wheat. The introduction of these protective measures had severe consequences. Wheat producers in the exporting countries encountered difficulties in adjusting production quickly. The degree of specialization of these wheat growing areas made it impossible to convert wheat acreage to alternative agricultural production. Moreover, Argentina and Australia did not have such extensive grain storage capacity as the United States and Canada. The former countries were then forced to export wheat irrespective of market conditions. The latter countries, experiencing severe balance of payments problems, were driven to sell immediately, contributing to the downward

spiral in wheat prices that characterized the months before the New York stock market collapse of October 1929.

Stocks were never a significant share of world trade levels. In the years from 1890 to 1913 wheat stocks had covered 17.6 per cent of world production, while from 1922 to 1928 wheat stocks accounted for only 14.7 per cent of world production.

Table 2: World wheat stocks, Big Four exporting nations and World, 1922-39 (million bushels)

	22-26	27	28	29	30	31	32	33	34	35	36	37	38	39
USA	120	111	115	232	294	329	391	382	274	148	142	83	155	275
CAN	37	56	91	127	127	139	136	218	203	214	127	37	24	105
ARG	63	69	95	130	65	80	65	75	118	85	65	51	65	180
AUS	29	35	36	41	49	60	50	55	85	57	43	41	50	70
BIG4	249	271	337	530	535	608	642	730	680	504	377	212	294	630
WRD	622	669	726	993	934	1023	1022	1125	1186	942	784	567	630	1194

Source: De Hevesy (1940: Appendix 25).

As table 2 shows, from 1927 through the years of the Great Depression there was a glut of wheat. By 1929, wheat stocks were, in fact, 37 per cent above the average of the years from 1922 to 1926. The reverse in this trend was due to the drought which brought the Canadian and American crops short in 1934-1935. Another surfeit, due to a bumper crop, occurred in 1939.

The accumulation of surplus stocks (1929-35) went with a striking fall in wheat prices (1930-35), as shown in table 3.[19]

[19] On the impact of overproduction on wheat carryovers in the years 1930-35, see Malenbaum (1953).

Table 3: Averages annual prices of imported wheat in United Kingdom, 1922-38 (in shillings per quarter of 480 lb.)

Crop Year	Manitoba No. 3	Arg. Rosafè	Australian
1922-23	43.1	44.5	47.8
1923-24	43.5	44.1	46.8
1924-25	61.2	60.10	61.2
1925-26	55.3	54.7	57.9
1926-27	53.11	52.5	55.0
1927-28	50.8	49.6	52.4
1928-29	45.6	42.3	45.11
1929-30	45.2	40.3	43.6
1930-31	25.4	23.5	26.4
1931-32	24.10	23.8	26.3
1932-33	25.2	23.2	25.9
1933-34	24.6	19.5	23.10
1934-35	28.5	22.4	26.4
1935-36	30.5	28.9	30.2
1936-37	43.6	39.4	43.4
1937-38	41.10	38.2	37.7
1938-39	23.11	22.11	24.4

Source: De Hevesy (1940: 828).

With regard to the situation of the stocks, in his 1923 article on 'Some Aspects of Commodity Markets', Keynes (1923: 263-264) emphasized that: 'The present position as regards stocks of many stable commodities is abnormal and interesting in a high degree. It has certainly been a feature of the recent trade depression […] that the production of staple raw materials has fallen off much more than the consumption'. The need to analyse the influence of the volume of stocks on price changes in detail drove Keynes to draw up seven *Special Memoranda on Stocks of Staple Commodities* between 1923 and 1930 (CWK XII: 267-647).[20] In his view, this statistical enquiry was 'of the utmost interest both to the businessman and to the economist […]. [It] may […] throw

[20] Keynes authored the *Memoranda* on behalf of the London and Cambridge Economic Service, which was a joint venture between the London School of Economics and Cambridge University established in 1923. It aimed to support business by providing the existing statistics in a usable form and developing new indicators. Longer *Special Memoranda* were produced on particular subjects. The LCES was directed by an Executive Committee consisting of William Beveridge and Arthur Bowley from LSE and John Maynard Keynes and Hubert Henderson from Cambridge. The *Memoranda* were published in April 1923, June 1924, July 1925, February 1926, March 1927, August 1929, September 1930.

much light on the hidden mechanism lying behind cyclical movements' (CWK XII: 268).

In his first *Memorandum* (1923), comparing different sets of data on wheat stocks and current supplies of the Big Four plus India and UK, Keynes observed how:

> The general effect of these figures is to show that the aggregate supply of wheat to importing countries has been fairly steady in the last three years and that the stocks now on hand are fully as adequate as they have been at any time since the War. […] Wheat is, however, relatively cheap compared with other commodities, perhaps too cheap; and it remains to be seen whether the present level of relative prices is high enough to continue to call forth adequate supplies from the countries of export. (CWK XII: 313-314)[21]

This state of affairs continued until 1926, as documented by Keynes in the second, third and fourth *Memoranda*. In all cases, Keynes provided limited information on stocks, referring readers to the *Corn Trade News* and to the *Wheat Studies* and venturing no conjecture on possible price developments.[22] The 1927 *Memorandum* reported growing stocks in the USA and an otherwise balanced situation in Canada, Australia and Argentina (CWK XII: 505). In 1929, the gradual increase in stocks and traded volumes, which had been recorded between 1923 and 1928, in connection with low prices, was 'dramatically reversed as a result of poor harvest reports from all four of the leading export countries […] In two months the price of Canadian wheat has risen by more than 70 per cent. Sharp, if less spectacular, increases have also occurred in American, Australian and Argentine prices' (CWK XII: 570). Three months later, the situation was to change once again under the negative impact of the Great Depression. In 1930 Keynes concluded that 'the price of many commodities today (e.g. sugar, rubber […] even wheat) bears little or no relation to total costs of production, and may rather be said to represent the current conditions on which the existing and prospective surplus can be held' (CWK XII: 577).

Even though Keynes's analysis is grounded on a careful account of the world stock levels, he appears to be well aware that these data are not sufficient to fill out a complete picture of the wheat market conditions. In fact, from 1925 on, Keynes, reminded readers that, especially in the case of wheat, comparative stock statistics—

[21] His sources were the International Institute of Agriculture, founded in Rome in 1905 under the patronage of the King of Italy and taken over by FAO after WWII, George Broomhall's *Corn Trade News* (see footnote 10 above), the US Department of Agriculture.

[22] *Wheat Studies* was an accurate monthly review of grain trade published by the Food Research Institute of the Stanford University.

representing the visible supplies—were 'particularly unsatisfactory' because the large amounts held on farms and elsewhere kept 'out of sight'(CWK XII: 401, 445 and 504).

4. Keynes's trading activity in the wheat futures markets

The first operation in the wheat futures for which we have evidence was on 30 December 1924.[23] Keynes went on trading in this commodity—although discontinuously—up to 1939, when the commodity markets closed on the outbreak of war.

We have divided the decade considered here into two sub-periods, one from the date of the first operation recorded in the ledgers to 3 August 1926, the other from 17 October 1929 to 9 December 1935.

In the interval between these two sub-periods, no investments in wheat futures are recorded in the ledgers, even though the years 1927-1928 saw Keynes active in futures contracts in other cereals.[24] We have yet to arrive at a clear explanation of this gap in wheat trading but we may infer that it should have some causal relations with both his negative financial situation at the time[25] and his dealings on the other grain products, but also with the depressed conditions characterizing the wheat market in those years. Indeed, as we have already seen, in the second half of 1920s the wheat market came up against the severe consequences of the introduction of protectionist measures.

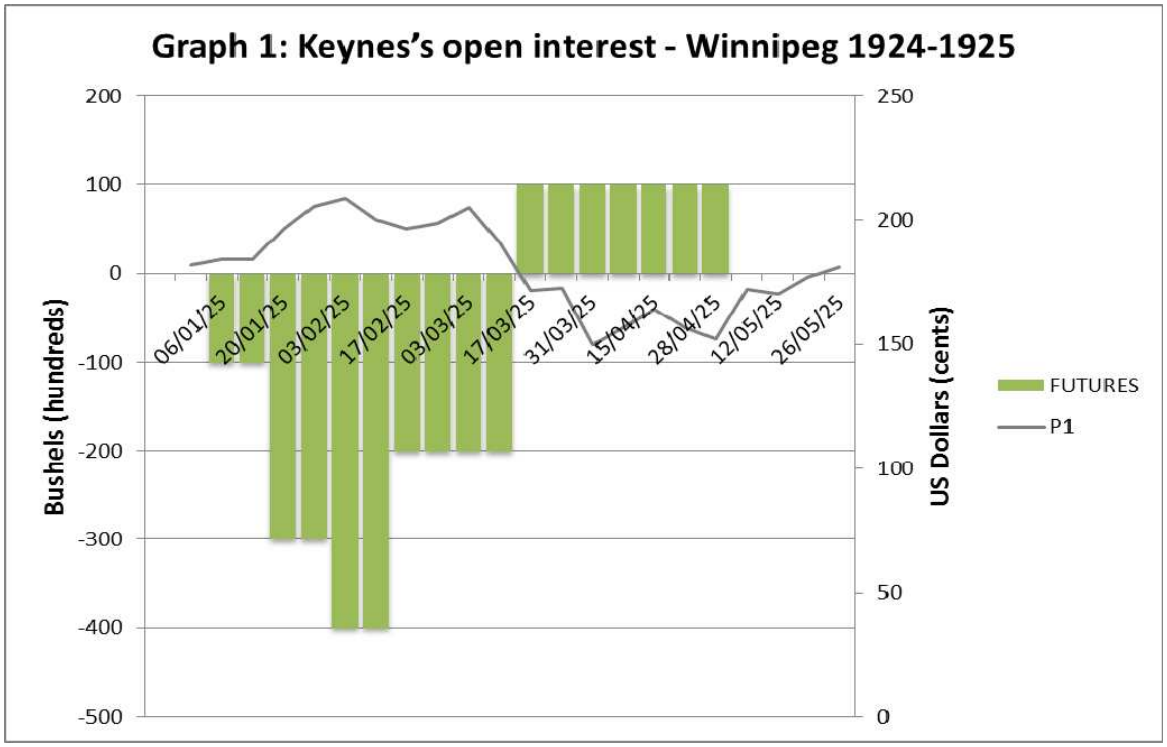
From 1924 to 1926 Keynes traded on the Winnipeg and Chicago futures markets. In the first seven operations recorded in the ledgers, from 30 December 1924 to 29 January 1925, Keynes went short both on Winnipeg and Chicago markets (selling forward contracts basically for May deliveries and in one case for July delivery), revealing his bearish expectations on both places (see Graphs 1 and 2). Given that from December 1924 to the end of January 1925 future prices were increasing on both markets (although more sharply in Chicago than in Winnipeg), we may conjecture that his

[23] Before this date investments in the wheat futures market are not recorded in the ledgers, but Keynes had already been active since 1920 in futures markets on other commodities, like cotton, tin, copper, spelter, lead, sugar, rubber and in futures on currencies (KP, SE/11/2/4-30). At the end of 1924 he entered upon the grain markets: that same year he was appointed First Bursar of the King's College and his involvement in speculative activity increased.

[24] Keynes operated in corn futures (on the Chicago market) and maize futures (on the Buenos Aires and London markets). For example, in 1928 Keynes bore losses for £2755 on the Chicago corn market in the first part of the year and realized profits for £2104 on the Buenos Aires maize market in the second part of the year (KP, TC/4/2/27). In the latter case Keynes adopted an investment strategy based on the renewal of long positions.

[25] In 1928-29 Keynes bore a severe financial setback, from which he fully recovered only after 1932. The two other important financial setbacks in Keynes's career as an investor occurred in 1920-21 and 1937-38 (Skidelsky 1992: 638).

strategy aimed at anticipating reversal in the trend prices.[26] Then, from 10 February to 16 March 1925, just when prices were falling on both places, confirming his expectations, Keynes progressively closed his positions, making a huge profit. In this case Keynes traded contracts of six-month maturity but he decided to offset these positions as soon as he had a chance of earning profits. On 17 March 1925, when the future price was low, Keynes opened a long position on the Winnipeg market for a contract of a longer maturity (October), expecting a future increase in prices, and he closed this position on 5 May, as soon as his expectation proved correct, again reaping some profits.



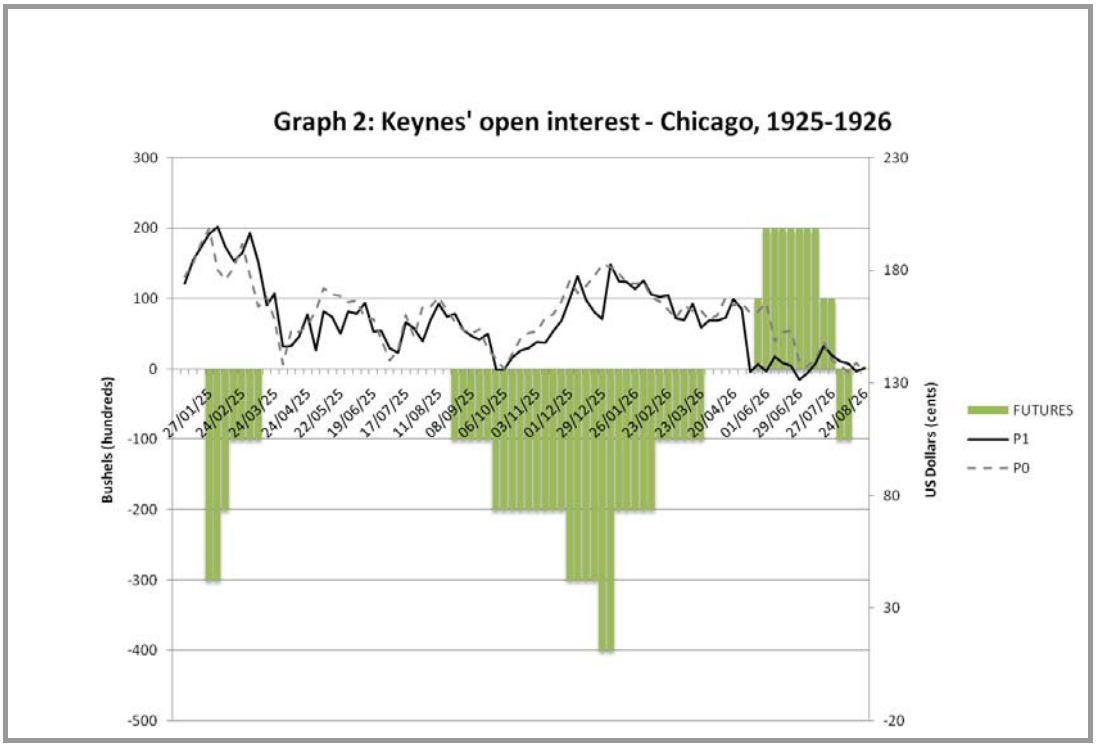
Source: Keynes's ledgers. Futures prices are drawn from the *Corn Trade News* (weekly edition), published on Wednesday.

Note: The price refers to 1 bushel of wheat (= 60 pounds or 1016 kg). P1 denotes the futures price of the contract for the first available standard maturity on the Winnipeg market.

From 24 August 1925 to 24 March 1926 Keynes started a second cycle of investment on the Chicago market, again assuming short positions (see Graph 2). He made four 'short sales' from the end of August 1925 to the end of December 1925 for

[26] Skidelsky (1992: 640) points out that in the 1920s the 'philosophy' which characterized Keynes's investment behaviour in general was that of acting against the opinion of the majority of people and, by these means, trying to anticipate the reversal in the future course of prices.

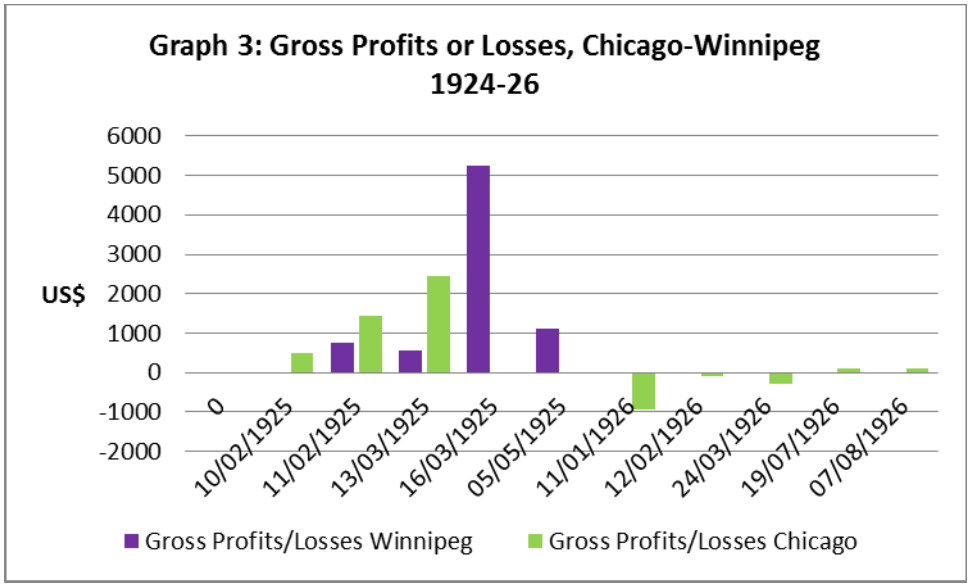
contracts of May delivery and then closed these positions in the following three months. During this second investment cycle futures prices on the Chicago market fluctuated above and below the prices fixed in the contracts sold forward by Keynes. Consequently, Keynes bore some losses in the first three operations he made, making profits only with the fourth. Then, from 5 May to 17 July 1926, he went long again by buying 2 contracts, but in one case he sold at the same price at which he had purchased and in the other he gained only a very small profit. In the last operation of this phase Keynes went short again by selling forward 10,000 bushels for December delivery on 19 July 1926. He closed the position on 3 August, making some profits. Looking at the spread between spot and future prices (see Graph 2), we observe that along these investment cycles, in the presence of backwardation, Keynes decided to go short in the period August 1925-March 1926 and long in the period May-July 1926. In both cases, his open interest was greater when the positive differential between spot and future prices came higher. We also remark that in the only phase of contango of the whole period, between January and March 1925, he went short.



Sources: Keynes's ledgers. Futures prices are drawn from the *Corn Trade News* (weekly edition), published on Wednesday. Spot Prices are drawn from the *Wheat Studies* of the Food Research Institute (1934).

Note: The price refers to 1 bushel of wheat (= 60 pounds or 1016 kg). P0 denotes the spot price. P1 denotes the futures price of the contract for the first available standard maturity on the Chicago market.

In relation to these investment cycles in wheat futures, Keynes recorded in the ledgers realized profits for £ 2290 in 1925 and realized losses for £ 163 in 1926, with a greater loss at the beginning of the year (following his unfortunate second investment cycle), partially offset by a gain at the end of the year (see Graph 3).



Note: Our calculation on the basis of data contained in Keynes's ledgers.

It must be remembered that at that time the gold standard system guaranteed a fixed parity between dollar and sterling, so the exchange risk for an investor like Keynes, who—as we have seen—in 1924-26 traded only in contracts denominated in dollars, was not so great.[27]

Then, as recalled above, there came a break in Keynes's investment activity and we find no more records on wheat futures in the ledgers until October 1929.[28]

On 17 October, a few days before the Big Crash on the NYSE, Keynes recorded a forward purchase of 200 tons of wheat for February delivery on the Buenos Aires futures market and he closed the position a few days later, on 30 October. The reason for this single operation on a market that Keynes had never used before for futures wheat trading, following upon a suspension of almost three years in his trading in this commodity, is by no means clear. The only thing that we can infer from his behaviour is

[27] The risk was not completely eliminated because some slight oscillations around the parity (the exchange rate that Keynes recorded for the wheat futures contracts he traded in May-August 1926 in the Chicago market was 1£= 4,86$, KP, TC/4/1/10-41) were usual and could easily affect an investment activity like future trading based on the gain (or losses) deriving from the differentials between the opening and closing prices of a given contract.

[28] This break is confirmed by the statements and accounts of the Tilton Company (KP, TC/4/2/2 and TC/4/2/57).

that he had bullish expectations on this market but it is hard to reconstruct the elements on which he founded this opinion. We may conjecture that Keynes's choice to invest in Buenos Aires wheat futures could have depended on his expectations of approaching financial difficulties for the North-American markets or on some privileged information he had acquired. Nevertheless, the increase in future prices in Buenos Aires failed to come about and Keynes judged it imprudent to wait beyond the end of the same month. So he rapidly closed the position he had opened less than two weeks before, losing some money in the process.

After this operation there is another break in the records of the ledgers from the end of October 1929 to July 1931. This break seems much more explicable with the turmoil on the financial markets brought about by the Great Depression, which extended throughout 1930. In fact, as Keynes himself warned in his last *Memorandum* (1930):

> At the close of the crop year 1929-30 international wheat prices reached their lowest post-war level […] The decline in the volume of trade between 1928-9 and 1929-30, over 300 million bushels, was the largest change recorded in the twentieth century […] There is nothing in the immediate outlook to lift prices to even a moderately high post-war level. (CWK XII: 644 and 647)

His deeply pessimistic view also appears in a letter he wrote to Walter Case[29] on 16 December 1930: '[…] I cannot perceive the least reason in the world for expecting an early recovery. Nothing whatever is happening to make such a thing likely'. As far as commodities are concerned, he wrote: 'I am somewhat sceptical as to a material recovery being brought about merely by restriction of supply. It will be very difficult to maintain any material recovery unless it be through an increase in the side of demand' (KP, BM/2/175).

One consequence of this difficult economic and financial situation was the decision of the British government to devaluate sterling, abandoning the gold standard and the fixed parity with the dollar on 21 September 1931. The fluctuations in the rate of exchange heightened the level of uncertainty in transactions for British investors and made trading in the international futures markets more challenging. Nevertheless, Keynes does not appear to have been discouraged by this additional difficulty: his long-lasting training in foreign exchanges markets helped him cope with it.

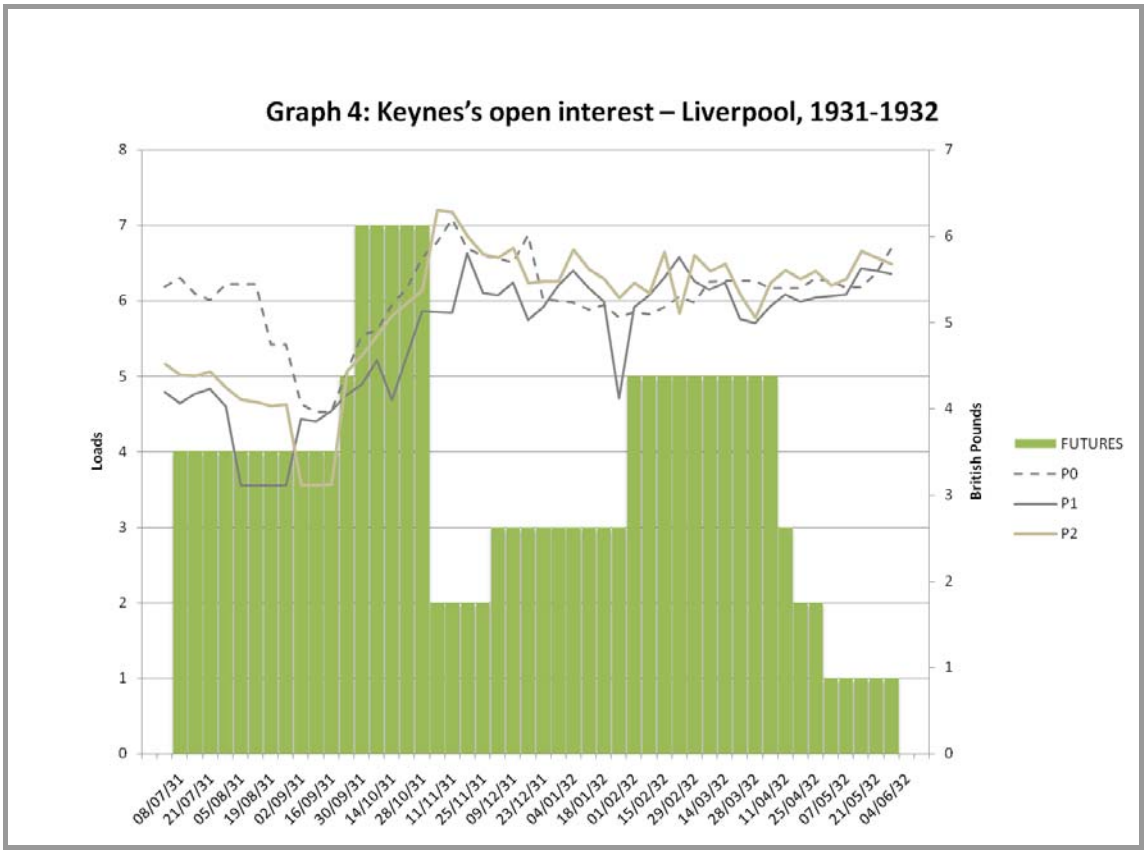
In fact, a few months before Great Britain's abandonment of the gold standard, Keynes returned to wheat futures opening a long position on the Liverpool market on 3

[29] Walter Case (1885-1937) was a banker, director of an American investment firm based in New York, the Case, Pomeroy & Co. In the period 1930-37 Keynes exchanged letters and cables with him containing information about wheat and commodities in general.

July 1931. The reason behind this decision can be inferred from a letter that Keynes wrote to Case dated 29 July:

> […] I am more inclined to think than I was that it is just worth while having at the back of one's head that a purchase in terms of sterling of commodities having a world price may be in conceivable circumstances a hedge against anything that might happen to sterling. This also applies to the question of buying wheat in Liverpool. On further consideration I think that I overstated the objections to Liverpool as a market. (KP, BM/2/121)

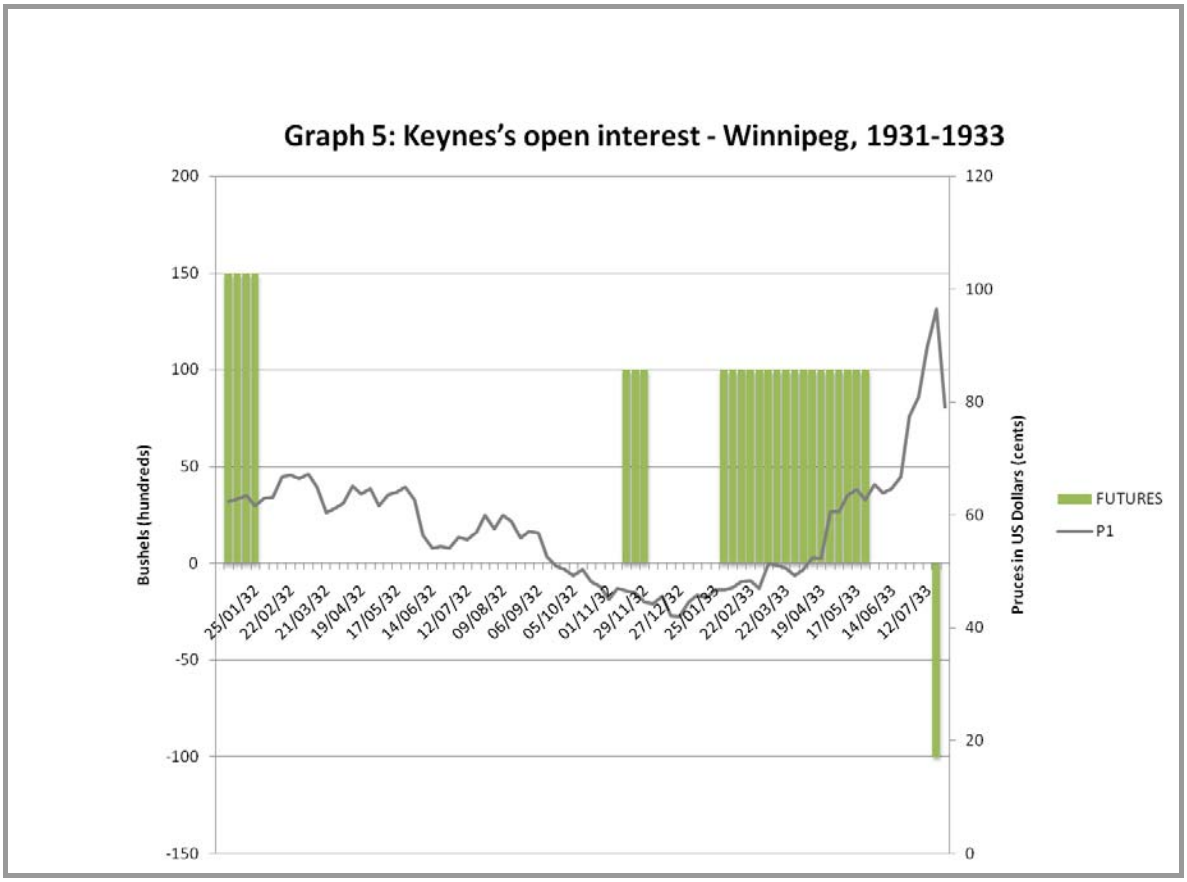
As shown in graph 4, Keynes kept long positions over the whole period spanning from July 1931 to June 1932, in situations of both backwardation and contango.



Source: Keynes's ledgers. Spot and futures prices are drawn from the *Corn Trade News* (weekly edition), published on Wednesday.

Note: P0 denotes the spot price. P1 denotes the futures price of the contract for the first available standard maturity on the Liverpool market. P2 denotes the futures price of the contract for the second available standard maturity on the Liverpool market.

On 2 December 1931 he also opened a long position on the Winnipeg market (see Graph 5) with a forward purchase of 15,000 bushels of wheat for May delivery at a price of 65 ¾ cents.



Source: Keynes's ledgers. Futures prices are drawn from the *Corn Trade News* (weekly edition), published on Wednesday.

Note: The price refers to 1 bushel of wheat (= 60 pounds or 1016 kg). P1 denotes the futures price of the contract for the first available standard maturity on the Winnipeg market.

On the same date Keynes registered in the ledger the opening of another long position in the Liverpool market with a forward purchase of 1 load of wheat to be delivered on May at a price of 6 pounds, which means that Keynes was betting on an increase in prices in both markets in the following six months. Although Keynes opened two positions on two markets on the same day, the combination of these operations did not take the form of a straddle.[30]

[30] A straddle is the combination of two opposite positions on two different markets (and possibly two different dates) with a view to closing the positions simultaneously, speculating on the price differential.

On 28 January 1932 (i.e. far before the delivery date) he closed his position on Winnipeg at a price of 61½ cents, lower than the purchase price of two months before. Probably at the time he imagined that the future price on Winnipeg would fall even further in the following months and his strategy aimed to limit the losses.

That same day (28 January) he still had bullish expectations on the Liverpool market and he opened another long position by buying forward 2 loads of Liverpool wheat for May delivery at a price of 5/2 ⅜ pounds. In April 1932, near the delivery date, he closed all his opened positions for May Liverpool wheat with alternate fortunes, because in one case (for the contract bought in September 1931) he sold at a price higher than the original purchase price, while in the other cases he sold at a lower price.[31] From the different timing of the offsetting of these long positions on the two markets we may conjecture that, in February-March 1932, Keynes was still confident of having a chance of profit on Liverpool or that he was following a different investment strategy in the two markets.

On 29 February 1932, Keynes closed the long position he had opened on 25 September 1931 for 1 load of wheat for March delivery on the Liverpool market for a price higher than the buying price, gaining some profit and, at the same time, he opened another long position for 1 load for a longer maturity (July). He closed this latter position on 2 June 1932, when, approaching the month of delivery, his expectation of an increase in price proved correct. These operations made it clear that on the Liverpool market Keynes followed a roll-over strategy of long positions.

On 9 November 1932, he returned to the Winnipeg market, trying the same strategy he had adopted on the same market one year before (in December 1931). He went long, buying forward 10,000 bushels for December delivery at a price of 47 ½ cents. This time he appeared more cautious in two respects: he bought a future contract of a lower quantity and a shorter maturity (two months rather than six months). It is to be noted that from December 1931 to November 1932 the future price on Winnipeg decreased from 65 ¾ to 47 ½ cents—a circumstance that could have justified Keynes's bullish expectation. The sensible reasoning at the bottom of Keynes's investment choice seems to have been that since the price had fallen sharply in the previous year it should necessarily rise back in the near future. In any case, as graph 5 shows, the future price on the Winnipeg market remained low for a while and Keynes decided to close his position on 30 November 1932 at a price of 44 ½, losing some money.

[31] More precisely, he sold forward the wheat bought on December 1932 at a price only slightly lower that the buying price, but he sold at two prices substantially lower than the buying price the 2 loads that he had bought forward on 28 January 1932.

In spite of the evidence against it, Keynes remained convinced of the rationale of his investment choice (i.e. that the future price on the Winnipeg market was abnormally low) and shortly after, on 31 January 1933, when the future prices rebounded to 47 cents (that is, the same level reached in November 1932), he again bulled the market. In fact, he opened a long position of 10,000 bushels, this time for July delivery. On this occasion, Keynes hit the mark: the future price started to climb back and he closed his position on 30 May 1933 at a price of 68 cents, making a huge profit.

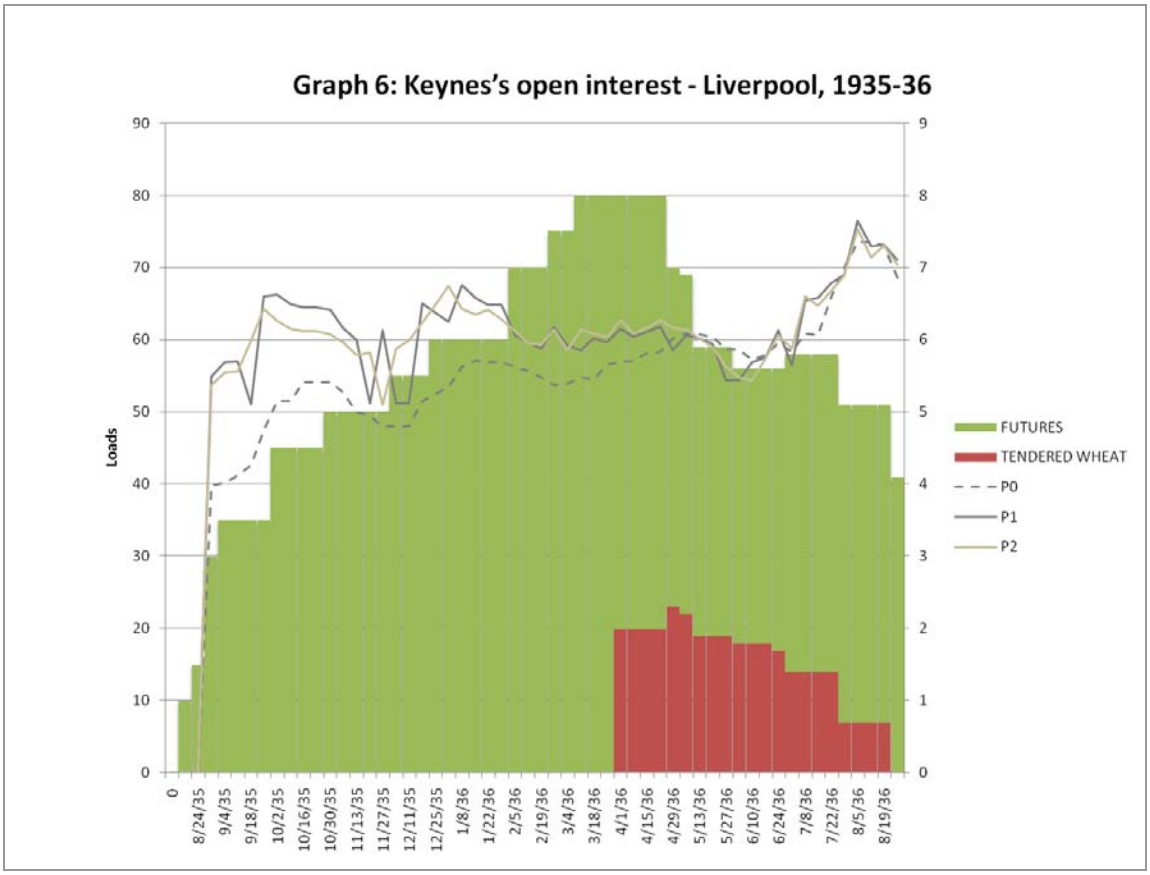
In July 1933 the future price for contracts of July delivery (practically the spot price) on the Winnipeg market shot up.[32] On 15 July 1933 Keynes made a short sale of 10,000 bushels for July delivery at the exceptionally high price of 98 cents and closed his position a few days later, on 24 July 1933, at 82 cents. In the Winnipeg market—as we have seen—Keynes acted as an investor trying to anticipate inversion in the price trend.

After this period of intense investment in the Liverpool and Winnipeg markets, Keynes abandoned the wheat market for two years, until July 1935. In these years he traded heavily in cotton, spelter, corn and maize and, in the first part of 1935, also in cotton oil (KP, TC/4/3/99).

After this break, on 8 July 1935 Keynes returned to wheat futures, buying forward a large quantity of wheat (50,000 bushels) on the Chicago market for September delivery, gambling on a future increase in prices. Only ten days later he closed his position at 85 cents (that is, 5 cents higher that the buying price), making a huge profit. The choice of this timing and market and the motivations behind his bullish expectations may well have been closely connected with the institutional changes brought about in the Winnipeg wheat futures market on 5 July 1935, i.e. the establishment of the Canadian Wheat Board, which made Chicago the only market place entirely devoted to private trading in North-America.

A different technique was adopted by Keynes one month later on the Liverpool market. From August to December of that year Keynes opened a series of long positions through contracts of 5 loads at a time (Graph 6). This behaviour testifies to Keynes's increased financial capacity from the mid-1930s onwards. It must in fact be remembered that a cover of about 25 per cent was to be deposited to the broker for each given contract.

[32] Thanks to the fact that delivery in the wheat market was possible until the last day of the month of the maturity, future contracts could even be exchanged during delivery month.



Sources: Keynes's ledgers and Tilton Company statements. Spot and futures prices are drawn from the *Corn Trade News* (weekly edition), published on Wednesday.

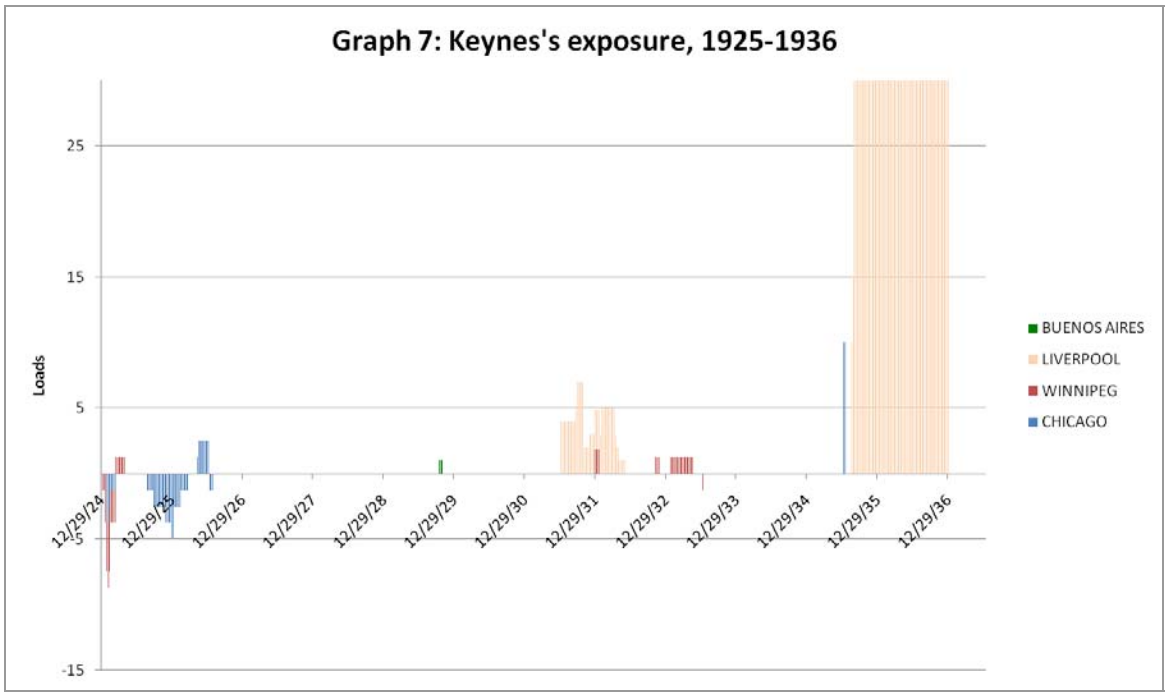
Note: P0 denotes the spot price. P1 denotes the futures price of the contract for the first available standard maturity on the Liverpool market. P2 denotes the futures price of the contract for the second available standard maturity on the Liverpool market.

As a result of his investment policy, Keynes ended the year having bought forward 55 loads of Liverpool wheat for March delivery and 5 loads for May delivery (KP, TC/4/3/100). Looking at the differential between spot and future prices on the Liverpool market, it is worth noting that there was almost always a contango situation. Unfortunately, the records in the ledgers stopped here and we cannot trace the exact dates on which he closed any given contract. In any case, analysing the weekly statements of the Tilton Company for the period December 1935-August 1936, we have reconstructed Keynes's investment path. In the period January-March 1936 Keynes went on buying forward huge quantities, reaching an exposure of 80 loads of Liverpool wheat for different maturities (KP, TC/4/3/101-111).

At the end of March 1936,[33] he took delivery of March wheat (which is a very rare event for a professional speculator).[34] He immediately sold a part of it on the spot market and progressively the rest of the amount, as shown in Graph 6. Thus, from the end of March to the end of August, he bore very high storage costs.[35] The episode referred to by Moggridge (CWK XII: 61), when Keynes wanted to measure the cubic capacity of the King's College Chapel to store wheat, relates to this period of his investment activity. After March 1936, Keynes went on buying forward for longer maturities, applying again a clear roll-over strategy (KP, TC/4/3/115-133).

5. Analysis of Keynes's investment behaviour

Graph 7 offers an overview of Keynes's exposure (in terms of quantity) on the four markets in which he operated in the decade 1925-35.



Source: Keynes's ledgers and Tilton Company weekly statements.

Note: We have converted bushels into UK loads (1 load = 8000 bushels). The scale adopted goes up to 30 loads.

[33] On 24 March 1936 (KP, TC/4/3/113) Keynes also opened a long position on the London wheat future market. In particular, he traded futures contracts on Manitoba wheat.
[34] Keynes took delivery also in the tin market in one case (see Cavalli and Cristiano 2012, in this volume).
[35] In a letter dated 26 April 1936, the secretary of the Tilton Company informed Keynes about the high level of storage costs on wheat, which amounted to about £250 at the end of March (KP, TC/1/58).

Keynes entered into the wheat futures markets by trading in the North-American markets, Winnipeg and Chicago, which were, as we have seen, more developed than the European ones during the 1920s. In the years 1924-26 his investment strategy was characterized by a substantial predominance of short positions on both markets (as a consequence of his bearish expectations on future prices), and does not seem to have been as sophisticated as one might have imagined considering the stage of development of these markets at that time.[36] More specifically, in the first cycle of investments (from December 1924 to May 1925) the duration of the cycle was quite short (2-3 months) and the quantity traded relatively small (maximum 40,000 bushels/5 loads). The strategy followed was to anticipate the market trend, betting on a decrease in prices when they were rising.

From August 1925 to August 1926 Keynes operated exclusively on the Chicago market. He took on pre-eminently short positions in the presence of a slight backwardation. At the beginning of May 1926, when he opened his only long position on this market, we observe a significant positive spread between the spot price and the future price (in the first three weeks it was +22 ⅛ c, + 25 ⅝ c, + 25c, see Graph 2, section 4). He closed this position on 17 July, when the spread between spot and futures prices had dropped drastically (+3 c). Only two days later, however, on 19 July he opened a short position which he closed two weeks later, when the spread turned negative (–½ c). In this second cycle of his investments Keynes adopted the same behaviour as in the previous one, the quantity traded remained small, and the only change to be seen was extension of the length of the investment cycle up to 6 months. The turning points in his positions on both investment cycles occurred in the same period of the year: March and August 1925 on the Winnipeg market and March and July/August 1926 on the Chicago market (see also Graphs 1 and 2, section 4). It is, in fact, to be remembered that in March some reliable information on the future crops of the same year began to be available and from July to August wheat was tendered in the US and Canada. Even though (from January to March 1925) he had simultaneously open positions on Winnipeg and Chicago for a while, Graph 7 shows that Keynes did not adopt any form of straddle between the two markets.

[36] Stewart (1949: 3-4) made an interesting analysis, based on some case-studies for the period January 1924-December 1932, of the different investment strategies on the Chicago wheat futures market implemented by speculators. In particular he distinguishes three different categories of speculators: '*Scalpers* are traders who for the most part trade for themselves in the pit, buying and selling on small fluctuations in prices and ordinarily closing the day with even, or nearly even positions. *Spreaders* are traders who assume opposing long and short positions of the same amount in different markets or different futures in the attempt to obtain a profit from changes in the relative prices in the different markets or futures. *Other speculators* are all remaining traders, who buy and sell speculatively in the market—large or small, long-term or short-term, professional or amateurs'.

On the whole, we can conclude that in the 1920s Keynes aimed at 'beating the market', seeking to derive profits from his skill in forecasting the market trend.

In the 1930s Keynes's investment activity became more complex and diversified, reflecting both his increased ability as speculator and the further developments in the wheat futures markets.

Keynes's strategy in the Winnipeg market in 1931-33 followed the same pattern as in the 1920s. The duration of the investment cycle was very short and the quantity traded quite small (maximum 15,000 bushels/approximately 2 loads). Here, in contrast with the situation in the 1920s, we see a prevalence of long positions, but his strategy was always aimed at anticipating reversal in the price trend.

In July 1935 on the Chicago market we observe (see Graph 7) once again a long position of a quantity of 50,000 bushels (approximately 6 loads) lasting only 11 days (from 8 to 19 July 1935), which brought him a huge profit.

Following a different line, in the Liverpool market Keynes adopted a roll-over strategy both in the years 1931-32 and in 1935-36. The duration of the investment cycles was about one year. The striking difference between the two investment cycles in the Liverpool market lies in the quantities traded, amounting to a maximum of 7 loads in 1931-32 and 80 loads in 1935-36. One reason for this increase in his exposure between 1931 and 1935 lies in the restoration of his financial wealth after the setback he suffered during the Great Depression.

A glance at the differential between spot and futures prices (see Graphs 4 and 6, section 4) suffices to appreciate the fact that Keynes followed a roll-over strategy of long positions both in situations of backwardation (as was the case for most of the period 1931-32) and in situations of contango (January-February 1932 and August-December 1935). One possible explanation of the peculiarity of this behaviour on the Liverpool market lies in the extension of the time horizon of his investment decisions, which made him a long-term speculator.

6. Conclusions

Keynes was, as we have seen, a well-informed trader and his choice of a specific investment pattern—led, as is obvious, by the profit motive—was grounded on both quantitative and qualitative factors. More specifically, he paid attention to the stock levels, conditions of production in general, and prices (spot and future), but also to the institutional environment in which he operated. All these elements concurred to shape his strategy, which was differentiated according to both the general conditions of the

wheat market at a given time and the specific conditions of each market place in which he traded.

In fact, what emerges from analysis of Keynes's operations on the wheat futures markets in the decade considered is a substantial difference in his speculative behaviour when he traded respectively on the North-American markets and on the Liverpool market.

On Winnipeg and Chicago he went basically short in the 1920s and long in the 1930s, but he never followed a roll-over strategy of long positions. We may imagine that he deemed the conditions prevailing in both markets not be such that his theory of 'normal backwardation' held and, as a consequence, were not suitable for adoption of a long-term type investment activity based on renewal of long positions.

On the Liverpool market—where Keynes entered only at the beginning of the 1930s—he exclusively adopted a roll-over strategy, in the presence of both backwardation (in 1931-32) and contango (in 1935). From this circumstance we may infer that he considered Liverpool a market in which the strategy implied in his theory of speculation was worth following. The reasons why the Liverpool market appeared to be less volatile than the North-American markets probably has to do with the specific characteristics of the wheat spot market in Great Britain and, in particular, with the fact that this country was able to rely on regular provisions, over the whole calendar year, coming from the producing countries of the Commonwealth (India and Australia) as well as the other exporting countries.[37]

As far as the relation between Keynes's theory and practice in the commodity markets is concerned, analysis of his trading in wheat futures confirms the fundamental tenet that backwardation is not a permanent feature of the commodity futures markets and, accordingly, the theory of 'normal backwardation' represented only a special case. In fact, in his *practice* of speculation, recourse to the strategy which is more consistent with his view of the speculator as a 'risk-bearer' is confined only to some specific situations. In fact, Keynes seemed to have been well aware of the 'special circumstances' which render each commodity, and even—as we have seen—each market-place 'a special case' (Keynes 1923: 264).

[37] This circumstance also explains why the Liverpool price was considered the 'barometer of the wheat world prices' (*Corn Trade News*, Jubilee Issue, 1938: 5).

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PART II

A methodological problem

Keynes and Sraffa on the concept of *commodity rate of interest*

Nerio Naldi[*]

1. Introduction

In *General Theory*'s Chapter 17 ('The Essential Properties of Interest and Money'), after arguments already developed in previous chapters, Keynes proposed to provide a further and presumably deeper explanation of how investments could settle at a level too low to allow for full employment. As a first step towards this end he stated that 'an analogue of the rate of interest on money' may exist 'for every kind of capital asset' (CWK VII: 222) and referred to Sraffa's 1932 review of Hayek's *Prices and Production* as the locus where the relationship between that magnitude (named by Keynes *own-rate of interest* or *commodity-rate of interest*) and the money rate of interest 'was first pointed out' (CWK VII: 223, n. 1).

Economists interested in the concept of commodity rate of interest have generally taken for granted that Keynes had simply adopted the definition originally put forward by Sraffa. But two letters sent by Keynes to Sraffa in December 1931 give us a hint to explore the differences between their approaches to the subject. Considering these letters, an ambiguity in Sraffa's definition becomes visible: it does not make clear if, in the context of a monetary economy, the commodity rate of interest, once approached through the route chosen by Sraffa, must be calculated by dividing the monetary cost of borrowing a commodity by the *spot* price or by the *forward* price of the commodity in question—and, in this sense, the very fact that Sraffa really meant to provide a definition of that concept cannot be taken for granted. But such a definition may acquire precision if, in the light of Keynes's extant comments, an implicit statement that commodity rates should be expressed in terms of *spot* quantities is attributed to Sraffa. Keynes, on the contrary, both in the 1931 discussion with Sraffa and in the *General Theory*, clearly maintained that the concept of commodity rate of interest had to be expressed in terms of *forward* quantities. But when it emerges that the definition of that concept was an object of dispute between Keynes and Sraffa, it becomes important to

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understand the grounds of their respective choices. In the case of Keynes, an answer to this question may be found in an understanding of commodity rates of interest as an extension of the ordinary definition of rate of interest on money, or, which amounts to the same thing, in a mechanical transposition of a relationship conceived with regard to a non-monetary economy into the context of a monetary economy.[1] In the case of Sraffa, on the other hand, in order to explain both the peculiarities of his text and his determination not to accept the definition proposed by Keynes, we will put forward some conjectures based upon the idea that he shared Keynes's view that *commodity rates* should be conceived as rates of interest paid on commodity loans, but that he believed that such a concept should be differently specified when applied to a non-monetary economy and to a monetary economy.

2. Sraffa's approach to commodity rates of interest

Sraffa, in his 1932 review of Hayek's *Prices and Production*, was not pursuing the aim of presenting a particular theory, as that of criticizing Hayek's analysis of the relationships between money, prices and levels of production. In particular, he came to discuss the concept of commodity rate of interest in order to criticize the way Hayek had distinguished between monetary and non-monetary economies and his proposal of fixing the money-rate of interest, in an economy where demand shifts from consumption to capital goods, at the level of *the natural rate* as could be identified in a non-monetary economy. According to Sraffa, Hayek had distinguished between monetary and non-monetary economies as if, in a monetary economy, capital demand and supply being expressed in terms of money, the action of banks could cause the *actual*, or money, rate of interest to diverge from the equilibrium, or *natural*, level, while in a non-monetary economy a similar divergence could not take place (Sraffa 1932: 49).[2] Sraffa was convinced that such a distinction was wrong, because in a non-monetary economy more than one *natural rate* would exist and, out of equilibrium, those rates would diverge from one another:

> An essential confusion, is the belief that the divergence of rates is characteristic of a money economy […] If money did not exist, and loans were made in terms of all sorts

[1] The latter statements should not sound contradictory: in a monetary economy, money is the only commodity whose rate of interest may be directly determined by the same formula which in a non-monetary economy would apply to any commodity.

[2] In Hayek's words: 'In a money economy, the actual or money rate of interest ("Geldzins") may differ from the equilibrium or natural rate, because the demand for and the supply of capital do not meet in their natural form but in the form of money, the quantity of which available for capital purposes may be arbitrarily changed by the banks' (Hayek 1931: 20-21).

> of commodities, there would be a single rate which satisfies the conditions of equilibrium, but there might be at any one moment as many 'natural' rates of interest as there are commodities, though they would not be 'equilibrium' rates. […] if loans were made in wheat and farmers […] 'arbitrarily changed' the quantity of wheat produced, the actual rate of interest on loans in terms of wheat would diverge from the rate on other commodities and there would be no single equilibrium rate. (Sraffa 1932: 49)

The latter point was only asserted, and the reader might expect that Sraffa, in order to develop his critique, would further pursue the description and analysis of *natural rates* (or *commodity rates*) within a non-monetary economy. But what he actually did was considering the way the existence and variations of such rates of interest may be recognized *in a monetary economy*:

> In order to realise [how in non-monetary economies commodity rates may diverge from one another and from their equilibrium level] we need not to stretch our imagination and think of an organised loan market amongst savages bartering deer for beavers. Loans are currently made in the present world in terms of every commodity for which there is a forward market. (Sraffa 1932: 49-50)

Indeed, following Sraffa's text we may gather that, in a non-monetary economy, natural rates of interest, or commodity rates of interest, could be defined considering that a loan made in terms of a given commodity j (Q_j^S) would imply the agreement to return a given quantity of the same commodity (Q_j^F) at the end of the borrowing period, so that for each commodity the level of its own rate of interest (i_j) would be:

[1] $$i_j \equiv \frac{Q_j^F - Q_j^S}{Q_j^S}$$

But Sraffa's argumentative strategy, as already noted, did not rely on such a formalization and indicated how commodity-loans may be recognized in nowadays economic activity, even though no loan as those underlying equation [1] is directly contracted:

> When a cotton spinner borrows a sum of money for three months and uses the proceeds to purchase spot, a quantity of raw cotton which he simultaneously sells three months forward, he is actually 'borrowing cotton' for that period. (Sraffa 1932: 50)[3]

[3] The reason why cotton spinners should follow this line of conduct may not be as obvious as Sraffa seems to imply: their ordinary activity leads them to buy cotton to use and transform it, not to keep it for a period and sell it afterwards. An explanation for their selling cotton forward may be based on the observation that cotton spinners, assuming that prices of raw and wrought cotton move in the same direction, in order to hedge against future variations in the price of wrought cotton may sell forward the same amount of raw cotton bought spot. If prices go down, the profits obtained on the forward contracts may compensate for the loss on the price of wrought cotton, which has to be sold at a price lower than expected. If prices go up, the extra profits obtained selling wrought cotton will be cancelled out by the

Having identified such a *loan*, Sraffa indicated how the rate of interest paid on that operation, which he implicitly identifies as *natural* or *commodity* rate of interest, may be calculated in terms of cotton:

> The rate of interest which [the cotton spinner] pays, per hundred bales of cotton, is the number of bales that can be purchased with the following sum of money: the interest on the money required to buy spot 100 bales, plus the excess (or minus the deficiency) of the spot over the forward prices of the 100 bales. (Sraffa 1932: 50)

He then argued that divergences between supply and demand for a commodity cause divergences between spot and forward prices and divergences between the *natural* rate of interest on that commodity, the *natural* rates on other commodities and the *equilibrium* rate of interest. In equilibrium, on the other hand, spot and forward prices will coincide and *natural* (or *commodity*) rates will all have the same value (equal to the money-rate of interest). On this basis, following Sraffa's argument, we may take for granted that also in a non-monetary economy, in equilibrium, the relevant rates will be all at the same level (although, we may add, given that no unique standard would exist, it could not be said that they would be equal to a specific commodity rate). Similarly, also in a non-monetary economy, a disequilibrium in which production of some commodities is led to increase and that of other commodities is led to diminish would cause divergences among commodity rates.[4]

We may probe deeper into the meaning of Sraffa's description of the relation between spot and forward prices, money-rate of interest and commodity rate of interest by noting, first of all, that, as Sraffa is considering a monetary economy, the case he

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loss on the forward contracts. This explanation is closely mirrored in a passage from Marshall's *Industry and Trade*: 'A British miller [...] [h]aving ordered the purchase of a certain quantity of what he needs […] "hedges", by selling at once in a central market an equal quantity of standard wheat for delivery at about the time at which he expects that the wheat, which he has just bought, will be in his elevator ready to be made quickly into flour. If wheat falls in the interval, his flour has to compete with that made from cheaper wheat; but, what he loses through that fall, is returned to him almost exactly by his gain on the "future" which he has sold. Conversely, if wheat rises in the interval, he has to pay on the sale of his "future" about as much as he gains from the corresponding upward movement of his flour. By buying a future he does *not* speculate; he throws on the shoulders of the general market the risks and the chances of the gain that would otherwise have come to him through general movements external to his own business' (Marshall 1970 [1923]: 259-60; see also Hubbard 1928: 405; Garside 1935: 320-2, 329, 383-4; Rees 1972: 101). I wish to thank Luca Fantacci and Cristina Marcuzzo, who pointed out to me this explanation and Marshall's passage. We may wonder why Sraffa did not illustrate the point by also referring to the more obvious case of a cotton merchant buying cotton spot and selling it forward (see Garside 1935: 380-2).

[4] To mark this second part of his reasoning Sraffa uses the following words: 'It is only one step to pass from this to the case of a non-money economy, and to see that when equilibrium is disturbed, and during the time of the transition, the "natural" rates of interest on loans in terms of the commodities the output of which is increasing must be higher, to various extents, than the "natural" rates on the commodities the output of which is falling; and that there may be as many "natural" rates as there are commodities' (Sraffa 1932: 50).

examines does not coincide with the operation of borrowing 100 bales of cotton as may be conceived with regard to a non-monetary economy. In a monetary economy only money is directly borrowed and subsequently returned augmented by an interest—cotton is not. In this context, as indicated by Sraffa, in order to borrow 100 bales of cotton we must first of all borrow the quantity of money we need to buy them spot ($100_{bales} P_c^S$); the cost of this operation being $100_{bales} P_c^S i_m$. Then we must consider the difference between the price we pay to buy the 100 bales spot and the price at which we sell them forward (with delivery at the date corresponding to the end of the borrowing period): $100_{bales}(P_c^S - P_c^F)$. If the spot price is higher than the forward price, this is an additional cost of the operation; if the spot price is lower than the forward price, this is an earning which reduces the total cost. The crucial magnitude in Sraffa's definition is then the *total monetary cost* of the operation:

[2] $$[\,P_c^S i_m + (P_c^S - P_c^F)\,]100_{bales}$$

No other cost might be of any interest to an agent whom, in a monetary economy, whishes to *borrow cotton*. Sraffa, however, possibly in order to establish a link between the *commodity loan* he had outlined with regard to a monetary economy and the case of a non-monetary economy, argued that that cost may be turned into a rate of interest by expressing it in terms of bales of cotton. As a matter of fact, however, as noted by Potestio (1989: 261),[5] he did not explicitly state if, to that effect, we should divide the *total monetary cost* of the operation by P_c^S or by P_c^F. The results would be approximately equal, but not exactly equal:[6]

[3] $$\frac{i_m P_c^S 100_{bales} + (P_c^S - P_c^F)100_{bales}}{P_c^S} = (i_m + 1 - \frac{P_c^F}{P_c^S})100_{bales} = \alpha_{bales}$$

[4] $$\frac{i_m P_c^S 100_{bales} + (P_c^S - P_c^F)100_{bales}}{P_c^F} = (i_m \frac{P_c^S}{P_c^F} + \frac{P_c^S}{P_c^F} - 1)100_{bales} = \beta_{bales}$$

While Sraffa's argument has generally been understood as pointing to the latter magnitude (see, for instance, Barens and Caspari 1997; Bonifati 1991; Eatwell 1987; Kregel 1982; Kurz 1995, 2010; Naldi 2001; Panico 1988; Ranchetti 2001), only Deleplace (1986, 1988), Majewski (1988) and Oka (2010) seem to have opted for the former view.[7] But Keynes's letters to Sraffa on the content of his article give the impression that Sraffa did not favour the solution provided by equation [4].

[5] Potestio quotes an unpublished manuscript by Ian Steedman entitled *Own Interest Rates and Concepts of Equilibrium* where the same point had already been raised.

[6] The difference between the two increases with the difference between spot and forward prices, but it tends to zero when the length of the time interval considered for the payment of interest approaches to zero (Fisher 1965 [1896]: 360-1; Oka 2010: 2 n.1).

[7] In both cases, however, no reason was given for choosing one of the two options.

3. Keynes's letters to Sraffa

The extant correspondence between Keynes and Sraffa has been reviewed by Ranchetti (2005) and the most interesting point which emerged with regard to Sraffa's 1932 article relates precisely to the definition of the interest rate on loans of bales of cotton.

Keynes, reading the final typescript of Sraffa's article (SP D3/9/192/1-22),[8] seems to have believed that Sraffa did not express himself with sufficient clarity:

> I have pencilled some small verbal changes, either for the sake of the English or for the sake of clearness. The only material point is the rewording which I suggest on page 16. But here I think I must be giving the meaning which you intend. (Letter from Keynes to Sraffa, 18.12.1931, SP D3/11/65/56; quoted in Ranchetti 2005: 130)

Accordingly, he suggested to substitute Sraffa's formulation with an alternative sentence which read as follows:

> The rate of interest which he pays, per hundred bales of cotton, is the number of forward bales that can be purchased with the interest on the money required to buy spot 100 bales, plus the excess over 100 (or minus the deficiency) of the number of forward bales which can be purchased for the same price as 100 spot bales (SP D3/9/192/16; quoted in Ranchetti 2005: 131).

Keynes's suggestion, however, was not accepted by Sraffa and the formulation at page 16 of his typescript was reproduced with no important differences also in the published article.

If it is clear that Sraffa was not convinced by Keynes's proposal, the letter just considered does not illuminate the source of their disagreement. But a second letter, written by Keynes while sending to the printer the typescript of the article, touched exactly on that point:

> As regards the forward bales, I am sending the first of your alternatives to the printer, but will you in proof again consider my alternative, since I am not yet persuaded that it is wrong? It is a characteristic of interest to be payable in arrear, and not in advance. If it is payable in advance we call it discount. Thus it seems to me to be of the essence of the case that the amount of interest be calculated in <u>forward</u> bales; that is to say we have to find how many forward bales can be obtained by parting with a given number of spot bales. (Letter from Keynes to Sraffa, 21.12.1931, emphasis in the original, SP D3/11/65/52; quoted in Ranchetti 2005: 131-2)[9]

[8] SP refers to Piero Sraffa Papers (Wren Library, Trinity College, Cambridge).

[9] Sraffa's *second alternative*, which can still be seen in Sraffa's own copy of the typescript, was not significantly different from the first (SP D3/9/191/16; D3/9/192a).

These are the remarks which suggest that Sraffa did not share Keynes's view that the result had to be expressed in terms of *forward* bales and, by implication, they lead us to think that Sraffa believed that the relevant magnitude had to be expressed by a number of bales contracted for *spot* delivery. Indeed, this emerges from what Keynes presented as the criterion apt to be applied to solve the controversy: does the *borrowing cost*, in the case at hand, emerge as payable in advance (in which case it would generate a *discount*) or in arrear (in which case it would generate an *interest*)?[10]

Once the question is put in these terms, Keynes's view seems to be unassailable: the *cost of borrowing* 100 bales of cotton, understood as the amount of money indicated by Sraffa, actually emerges only at the end of the period; how could it be treated as if it could *buy* a number of bales of cotton spot (i.e., at the beginning of the period)? If Sraffa had a different opinion, Keynes's letters do not seem to provide any hint as to its grounds. The question, however, may be further considered.

4. The grounds for Sraffa's approach: some hypotheses

First of all, we may stress that the fact that Sraffa believed that the cotton-rate of interest could be expressed in terms of bales contracted for *spot* delivery is not as obvious at it may appear from Keynes's second letter. The text published by Sraffa, just like the typescript he had submitted to Keynes and all the preparatory notes known to us (SP D3/9), does not state that the cotton-rate of interest should be defined in terms of *spot* bales. This possibility emerges from Keynes's comments, and it may be recognized in the text of Sraffa's article only if we assume that when Sraffa mentioned *the number of bales that can be purchased* with the amount of money corresponding to the cost of borrowing cotton he *implicitly* referred to spot bales. To study the question it may then be appropriate to consider two different directions of enquiry. First, we may consider which reasons might have led Sraffa to refrain, in his 1932 article, from providing a full specification of a formula apt to calculate the value of the natural, or commodity, rate of interest. Second, we may consider which reasons might have led Sraffa, in private discussions to favour a definition of that rate in terms of spot bales.

Let us start from the question of the absence, in Sraffa's 1932 article, of the full specification of a formula apt to calculate the value of commodity rates of interest in a monetary economy. To explore this direction of research, we must start from some

[10] This remark rules out the possibility that the price referred to by Sraffa could have been the spot price currently quoted at the time of delivery referred to in the relevant forward contract, which, in Keynes's opinion, would give rise to a payment *in arrear* just like the forward price.

premises. First of all, we may take as a fact that Sraffa's wording, when he referred to the number of bales that can be purchased with the amount of money corresponding to the cost of borrowing cotton, was genuinely ambiguous and that he was aware of that ambiguity (indeed, had he not already been aware of it, the remarks contained in Keynes's two letters could not have failed to alert him). Granting this, we may stress that Sraffa did not discuss commodity rates of interest in order to develop a theory of those magnitudes, but only to show the inconsistency of Hayek's approach and of his prescriptions for monetary management. Given this aim, it may be argued that establishing a relationship between divergences between spot and forward prices, demand and supply for commodities, and commodity rates of interest was sufficient to serve Sraffa's purpose. Indeed, within the compass of his analysis, it would have been irrelevant whether the monetary cost of borrowing cotton was divided by the spot or forward price of cotton: in both cases the relationships between commodity rate, money rate and spot and forward prices would have been going in the same directions and the same would have applied to the effects of differences between spot and forward prices. Furthermore, this conclusion is also consistent with the possibility that Sraffa preferred contrasting Hayek's views on rates of interest in a non-monetary economy by studying commodity-loans in a monetary economy because he was convinced that discussions of non-observable cases should be dealt with with special caution, if not avoided at all.[11] In this sense, an additional reason to refrain from presenting a complete formula designed to calculate the value of commodity rates of interest in a monetary economy could have been that he was determined to avoid any risk of mechanical applications of such a formula to the case of a non-monetary economy.

This explanation addresses Sraffa's approach exactly as it emerges from the text of his article. The same explanation, however, cannot account for Keynes's remarks as far as they may be interpreted as implying that Sraffa, in private discussions, had maintained that an alternative definition of the concept of commodity rate of interest was to be preferred to the one proposed by Keynes, and, in particular, that the monetary economy analogue of the concept of commodity rate of interest as defined in a non-monetary economy should be arrived at by expressing the cost of borrowing a commodity in terms of spot quantities of that very commodity.

[11] In the opening pages of his article Sraffa had accepted the idea of 'a comparison between the conditions of a specified non-monetary economy and those of various monetary systems' (Sraffa 1932: 43), but within the discussion of commodity rates he almost ridiculed the perspective of a direct examination of such a case: 'we need not to stretch our imagination and think of an organised loan market amongst savages bartering deer for beavers' (Sraffa 1932: 49).

As already noted, if, in a monetary economy, we wish to *borrow cotton*, we must start by borrowing money. The cost of the whole operation is a monetary cost, and in order to express that cost as a rate it may be obvious to divide it by the amount of money initially borrowed. If we borrow money in order to borrow (or, more precisely, *buy and later sell*) 100 bales of cotton, the monetary rate of interest paid on that operation may be calculated by dividing its monetary cost by $100_{bales} P_c^S$, as in equation [5]. In this sense, dividing by P_c^S would be incomplete; dividing by P_c^F or by $100_{bales} P_c^F$ would be meaningless.

[5] $$i_c = \frac{i_m P_c^S 100_{bales} + (P_c^S - P_c^F)100_{bales}}{100_{bales} P_c^S}$$

Such a rate may be understood as a *commodity rate* because it pertains to the operation of *borrowing* a commodity. Sraffa's reference to that rate as *a number of bales* and, consequently, to the division of the cost of borrowing cotton by the price of cotton (which we may now take to have been P_c^S) rather than by the amount of money initially borrowed ($100_{bales} P_c^S$) may be understood as a way to emphasize the analogy between that rate as may be calculated within a monetary economy and the rate which would apply on a commodity-loan in the case of a non-monetary economy. Use of analogy instead of full analytical exposition is a shortcut that Sraffa could take because he was not developing a theory; he was just manoeuvring on Hayek's ground in order to criticize him. His statement, however, could also be justified by the fact that, when the quantity of cotton initially borrowed (or, more precisely, *bought*) is 100 bales, or could be reduced to 100 bales,[12] the rate envisaged as *a number of bales* numerically corresponds to the value of the cotton-rate of interest as defined in equation [5]. Dividing the monetary cost of borrowing cotton by P_c^S would then reflect two aspects of Sraffa's argument. On the one hand, it would reflect Sraffa's view that in a monetary economy the *commodity* rate of interest is a *monetary* rate of interest. On the other hand, it would reflect Sraffa's strategy of developing an argument concerning a non-monetary economy by considering data and facts as may be observed in a monetary economy—i.e., it would reflect his way to bridge the gap between an observable case and a non-observable case.

This seems to offer a sound explanation for Sraffa's supposed preference for dividing the monetary cost of borrowing cotton by P_c^S, as seems to be implicit in Keynes's letters. Keynes would then be wrong in stating that Sraffa was depicting a

[12] Sraffa's wording was as follows: 'the rate of interest which he pays, *per hundred bales of cotton*, is the number of bales that can be purchased with the following sum of money […]' (Sraffa 1932: 50, our emphasis).

reward paid *in advance* rather than *in arrear*—i.e., *a discount*, rather than *an interest*. The real point separating their approaches seems to be that the operation that, following Keynes's letters, can be recognized as envisaged by Sraffa may be described as borrowing cotton, but it only implies buying cotton today and selling that very quantity of cotton at the end of the period, while it is money which is initially borrowed and later returned augmented by an interest. Keynes, on the contrary, conceived an operation implying, at the end of the period, the calculation of the quantity of cotton which should be sold in order to repay the amount of money initially borrowed and the corresponding monetary interest—that is to say, it implied the equivalent of returning an augmented amount of cotton (not of money!) at the end of the borrowing period. This may not be immediately evident if Keynes's view is formalized on the basis of Sraffa's approach to the concept of commodity rate of interest (as in equation [4]). But the point was crystal clear to Keynes, who stated that 'we have to find how many forward bales can be obtained by parting with a given number of spot bales' (letter from Keynes to Sraffa, 21.12.1931). This is the way he was to follow in the *General Theory* and we may see how it relates to equations [1] and [4]:

[6] $$\frac{Q_c^F - Q_c^S}{Q_c^S} = \frac{\frac{(1+i_m)100_{bales}P_c^S}{P_c^F} - 100_{bales}}{100_{bales}} = \frac{\frac{i_m P_c^S 100_{bales} + (P_c^S - P_c^F)100_{bales}}{P_c^F}}{100_{bales}} = \frac{i_m P_c^S 100_{bales} + (P_c^S - P_c^F)100_{bales}}{100_{bales} P_c^F}$$

If Keynes, having in mind equation [1], wanted to calculate Q^F, he may have seen that to that effect the monetary cost of borrowing cotton was to be divided by P^F.[13] This presupposition probably led him to overlook the fact that Sraffa's wording was not directed at identifying a number of bales of cotton as such but a percentage, and, consequently to overlook the possibility that Sraffa's approach was radically different from his own.

To put it in other words, Keynes proposed to replicate within a monetary economy what may be conceived as the structure of commodity-loans in a non-monetary economy. Such an operation, as shown by equation [6], may be successfully accomplished using data observable in a monetary economy. But the scheme—even though formally correct—would be totally unconnected to the logic of observable economic behaviour in a monetary economy, where, in ordinary circumstances, no one calculates that sort of returns. It is for this reason—we may presume—that Keynes's view might have been judged by Sraffa as *wrong* (letter from Keynes to Sraffa,

[13] As a matter of fact, dividing the monetary cost of borrowing cotton by P^F we obtain $Q^F - Q^S$, not Q^F.

21.12.1931). Sraffa's approach, on the other hand, would follow the logic of the assessment of costs and profitability as universally applied in monetary economies, where agents are interested in monetary costs and returns and pay no attention to *commodity-costs* and *commodity-returns*.

5. Keynes's definition of commodity rate of interest in Chapter 17 of the *General Theory*

To complete our discussion we may now consider how the concept of commodity rate of interest was defined by Keynes in Chapter 17 of his *General Theory* within an argument aimed at showing that the rate of interest on money may pose particular obstacles to the attainment of a volume of investment sufficient to allow for full employment. To this effect Keynes developed a comparison between properties of money and of capital assets in general. Such a comparison was based on the idea that as 'the money-rate of interest […] is nothing more than the percentage excess of a sum of money contracted for forward delivery […] over what we may call the 'spot' or cash price of the sum thus contracted for forward delivery […] for every kind of capital asset there must be an analogue of the rate of interest on money', so that, for every commodity we would have 'a rate of interest in terms of itself,—a wheat-rate of interest, a copper-rate of interest, a house-rate of interest, even a steel-plant-rate of interest' (CWK VII: 222-3).[14] In this sense, the money rate of interest (equation [7]) and the wheat-rate of interest (equation [8]) may be expressed by the same kind of relation:

[7] $$i_m \equiv \frac{Q_m^F - Q_m^S}{Q_m^S}$$

[8] $$i_w \equiv \frac{Q_w^F - Q_w^S}{Q_w^S}$$

Obviously, however, while equation [7] describes a phenomenon which may be directly observed in a monetary economy, given that in such an economy commodities are not directly borrowed, the same cannot apply to equation [8]. In the latter case, Q^F cannot be directly observed; to calculate it we must go through a roundabout route based on knowledge of spot and forward prices and money-rate of interest.

Such a route is illustrated by Keynes with a numerical example where 100£ is the price of 100 quarters of wheat for spot delivery ($Q_w^S P_w^S$); 107£ (to be paid a year hence)

[14] The rate of interest that an asset may command, measured in terms of itself, is called by Keynes *own-rate of interest*. Accordingly, *money rate of interest* and *commodity rate of interest* are other names for *own-rate of interest* when the latter refers, respectively, to money or to a commodity such as wheat.

is the price of 100 quarters of wheat for forward (a year hence) delivery ($Q_w^F P_w^F$); and 5% is the money-rate of interest (i_m).

Given these data, if today we possess 100£, we can alternatively turn them into 100 quarters of wheat spot, or in 105£ for forward delivery (a year hence) which can be used to buy 98.13 quarters of wheat for forward delivery ($^{105}\!/_{1.07} = 98.13$). This means that 100 quarters of wheat spot are equivalent to 98.13 quarters for forward delivery. This example may be translated in a formula (where *q* stands for *quarters of wheat*) for the wheat-rate of interest, which turns out to be –1.87%:

$$[9] \qquad i_w = \frac{Q_w^F - Q_w^S}{Q_w^S} = \frac{\frac{105£}{107£}100q - 100q}{100q} = \frac{98.13q - 100q}{100q} = -0{,}0187$$

This formula reflects Keynes's words[15] and corresponds to the following equation:

$$[10] \qquad i_w = \frac{Q_w^F - Q_w^S}{Q_w^S} = \frac{\frac{(1+i_m)100qP_w^S}{100qP_w^F}100q - 100q}{100q} = \frac{\frac{i_m P_w^S 100q + (P_w^S - P_w^F)100q}{P_w^F}}{100q}$$

Equation [10] is perfectly equivalent to equations [4] and [6] and implies that Keynes assumed as starting point the definition of what a commodity rate of interest would be in a non-monetary economy and *adapted* it to the case of a monetary economy *without modifying its analytical structure*.[16] In particular, it reflects the point of view Keynes had expressed discussing with Sraffa in December 1931: as Keynes aimed at calculating Q^F (or $Q^F - Q^S$), the monetary cost of borrowing a commodity had to be divided by P^F.

Concluding his illustration of the definition of commodity rates of interest, Keynes appended the already mentioned footnote recalling Sraffa's 1932 review of Hayek's book: 'This relationship was first pointed out by Mr Sraffa, *Economic Journal*, March 1932, p. 50' (CWK VII: 223, n. 1). Knowing that in December 1931 Keynes had

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[15] '£100 spot will buy £105 for forward delivery, and £105 for forward delivery will buy $^{105}\!/_{107}$ 100 […] quarters for forward delivery. Alternatively £100 spot will buy 100 quarters for spot delivery' (CWK VII: 223). As a matter of fact, however, Keynes's numerical conclusion is somewhat at variance with the data and the algorithm of equation [9]: 'Thus 100 quarters of wheat for spot delivery will buy 98 quarters of wheat for forward delivery. It follows that the wheat-rate of interest is *minus* 2 per cent per annum' (ibid.; emphasis in the original). We may conjecture that this result, if not the product of a simple numerical approximation, reflected Keynes's implicit adoption of Fisher's formula $j = i + a + ai$ (where $j = i_m$, $i = i_w$ and $a = \frac{P_w^F - P_w^S}{P_w^S}$) mutilated of the term ai (Fisher 1965 [1896]: 9; Fisher 1907: 359; Fisher 1930: 39).

[16] Equation [10] corresponds to the definition applied by Fisher (1965 [1896]; 1907; 1930) and by modern intertemporal equilibrium theorists (see Barens and Caspari 1997: 283-8).

disagreed with Sraffa precisely on the analytical structure of the definition of commodity rates of interest, this statement is somewhat surprising. We may only accept it if we consider that the relationship between money rate of interest, spot and forward prices, and commodity rate of interest shows the same signs in both Sraffa's and Keynes's approaches, or that Sraffa, at least with regard to the argument developed in the *General Theory*, had come to accept Keynes's point of view. In both cases, given the ambiguity of Sraffa's own presentation, no real incompatibility with his 1932 article would emerge.[17]

Having defined the concept of commodity rate of interest, Keynes went on arguing that there is no reason why we should expect that at any moment in time those rates will be the same for every commodity: 'the relation between "spot" and "future" contracts, as quoted in the market, is notoriously different for different commodities' (CWK VII: 223). This, indeed, is the same result reached by Sraffa in his 1932 article.

Then, parenthetically, Keynes referred to the fact that a similar variety of rates may be easily observed in markets for currencies (CWK VII: 224). The latter point is interesting because an antecedent to Keynes's attention to commodity rates may be recognized in his April 1922 article 'The Forward Market in Foreign Exchanges' (reprinted the following year as part of Chapter 3 of his *Tract on Monetary Reform*).[18] In that paper a concept of own-rate of interest was not explicitly defined and discussed, but Keynes's later formula may be understood to be implicit in his 1922 analysis of the relations between spot and forward exchange rates and the levels of national and foreign short term interest rates, which he described as 'a mathematical calculation of interest rates' (Keynes 1922: 105).[19]

Indeed, Keynes's definition of commodity rate of interest corresponds to the identification of a state of indifference between investing 1£ in money or in wheat (equation [11]), or between investing 1£ in the UK or in the USA (equation [12]):

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[17] Sraffa's extant manuscript notes on Keynes's *General Theory* do not comment on the footnote mentioned above. But in a paragraph of those notes the concept of commodity rate of interest, as employed by Keynes in Chapter 17 of his book, is described as *defined in the normal way* (SP I 100/10). Other references to commodity rates in the same manuscript do not help to clear the point.

[18] On this relationship see Kregel (1982: 452-5).

[19] In his April 1922 article, Keynes used data on spot and forward exchanges in Milan he had been provided by Sraffa (CWK IV: 108; letter from Keynes to Sraffa, 14.2.1923, SP Add.ms.a.427/7). The latter circumstance is consistent with testimonies that, on the occasion of their first meeting (most probably in August 1921), Keynes was particularly impressed by Sraffa's considerations on the forward markets for currencies (Ingrao and Ranchetti 1996: 520; Ranchetti 2005: 119, 136 n. 1; Naldi 2001: 26, 37 n. 16). A similar reconstruction is contained in one of the obituaries which appeared after Sraffa's death: 'on a visit to England in 1921 he met Keynes and took his fancy with a discussion of hedging on the forward exchanges' (*The Times*, 6 September 1983).

[11] $$i_w = i_m \frac{P_w^S}{P_w^F} - 1 + \frac{P_w^S}{P_w^F} \quad \text{implies} \quad \frac{1£}{P_w^S}(1+i_w)P_w^F = 1£(1+i_m)$$

[12] $$i_\$ = i_£ \frac{e^S}{e^F} - 1 + \frac{e^S}{e^F} \quad \text{implies} \quad \frac{1£}{e^S}(1+i_\$)e^F = 1£(1+i_£) \quad \text{where } e = \frac{x£}{1\$}$$

But the analogy between Keynes's commodity rates of interest and currency rates of interest conceals a difference which reflects the importance of the fact that, in a monetary economy, commodities cannot be directly borrowed, while currencies can. As we have already noted, commodity rates can only be *constructed* through observation of money-rate of interest and spot and forward prices of the commodities in question. Accordingly, as it appears from equation [11], when we apply Keynes's formula we automatically obtain the *equilibrium value* for the commodity rate we are considering (i.e., the value which marks the indifference between investing in money or in the commodity in question).[20] However, given that in a monetary economy commodity rates, as conceived in equation [8], do not have an autonomous existence,[21] their values, as we may construct them, cannot be compared with any actual rate and cannot guide an agent's behaviour in any way. In this sense, we may say that a mechanical transposition of commodity rates of interest from a non-monetary to a monetary context, as in the case of Keynes's definition, even though formally correct, generates a concept void of operative content. On the contrary, in the case of currencies, just like in equation [7], own-rates can be directly observed and have an operative content: the comparison between observable values and calculated equilibrium values may guide an agent in international arbitrage operations. Similarly, an operative content may be recognized also in Sraffa's approach to the definition of *an analogue* of a non-monetary economy commodity rates of interest as may apply in a monetary economy. This is not surprising, if we think that Sraffa's definition is directly rooted in economic behaviour as may be actually pursued in a monetary economy. Of course, as we have seen in note 3 above, this rate measures spinners' cost of hedging against variations in the price of their manufactured product. But, in principle, it might also allow them to compare their industrial profits (calculated on the capital directly invested in buying raw cotton) with the alternative of acting as merchants whose ordinary business is buying and selling raw cotton and may gain the cotton rate of interest as defined by Sraffa. Cotton merchants,

[20] See Barens and Caspari (1997: 293).

[21] We may consider that the same point was stressed by Lerner (1952) stating that Keynes's commodity rate of interest is the money rate of interest measured in terms of a particular commodity, so that his wheat-rate of interest, for instance, should more properly be called *wheat rate of money interest*: the rate of interest on money-loans measured in terms of wheat.

in turn, might use the same rate in order to compare the returns from their activities with the alternative of lending money.

6. Conclusions

A peculiar aspect of the way Sraffa approached the definition of the concept of commodity rate of interest in his 1932 article is that he pointed out that to obtain a *natural rate of interest* (or *commodity rate of interest*) the monetary cost of borrowing a commodity should be divided by the price of that commodity, but he did not specify whether it should be the spot or the forward price. At first sight this may appear to be a deficiency in Sraffa's article. But considering the context and the aim he was pursuing we may conclude that a more precise definition was not necessary. On the other hand, we have seen that two letters sent by Keynes to Sraffa suggest that in private discussions Sraffa had maintained that the definition of the concept of commodity rate of interest, or, more precisely, of the analogue of such a concept as could be identified with regard to a monetary economy, should be arrived at by dividing the monetary cost of borrowing cotton by the spot price of cotton rather than by its forward price. If this was the case, we may presume that Sraffa opposed the alternative view because—being based upon a mechanical transposition of a relationship conceived with regard to a non-monetary economy—it was completely unconnected to the logic of economic behaviour in a monetary economy. On the contrary, Sraffa's approach would have been unequivocally rooted in a monetary economy.[22]

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[22] It may be worth stressing that Sraffa's approach was developed as part of his critique of Hayek's 1931 book and that Sraffa did not further refer to the concept of commodity rate in his later writings, except in his manuscript notes on Chapter 17 of the *General Theory*.

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PART III

The theory of storage

Kaldor and the relationship between 'normal backwardation' and the theory of storage

Carlo Cristiano and Paolo Paesani[*]

1. Introduction

Standard explanations of the relationship between commodity prices at different delivery dates (e.g., Clark et al. 2001) are based on the theory of storage. The theory posits that stocks of commodities have a productive value, a *convenience yield*, deriving from the possibility of meeting unexpected demand while avoiding the cost of frequent revisions in production and of manufacturing disruptions and varying inversely with the level of stocks (Geman 2005). At the same time, holding stocks entails financial and storage costs (*carrying costs*). These costs, net of convenience yield, determine the difference between futures prices at different delivery dates through arbitrage operations.

The theory of storage was developed between the 1940s and the 1960s, mainly by the US economist Holbrook Working, in alternative to the Keynes-Hicks theory of 'normal backwardation' (Telser 1958; Cootner 1960). The main difference between the two theories may be summarized as follows. Whereas the theory of normal backwardation posits that futures prices tend to systematically underestimate future expected prices (proxied by spot prices), as producers hedge against the risk of price declines by selling forward at a discount, the theory of storage assumes no such bias. As inventories decline (increase), their convenience yield increases (falls) and spot prices tend to rise above (fall below) futures prices net of carrying costs. Having introduced the notion of convenience yield, Nicholas Kaldor (1939) is generally considered the initiator of the theory of storage (e.g., Fama and French 1987; Ng and Pirrong 1994; Geman and Ohana 2009; Jarrow 2009; Benavides Perales 2010) and as such separated from Keynes and assimilated to Working on the theory of forward markets.

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This separation is puzzling for two main reasons and deserves to be investigated as such. First, Kaldor introduced the notion of convenience yield in his attempt to formulate a generalised theory of forward markets, capable of contemplating normal backwardation as a special case. Second, in elaborating his theory, Kaldor brought together two typically Keynesian elements: the risk premium paid by producers to hedge against the risk of price declines, and net carrying costs (storage costs net of convenience yield) which are the negative of 'Mr Keynes' "own rate of interest" in Ch. 17 of the *General Theory*' (Kaldor 1939: 3 fn. 4).

In exploring these issues, the paper reconstructs the link between the debate on the theory of forward markets, that took place in Britain in the 1930s and 1940s, and the theory of storage, as developed by H. Working. This link is particularly relevant for its connections with the continuing debate on the relative role of fundamentals versus speculation in determining commodity prices. As we show below**,** at least two competing theories of the relationship between spot prices and futures prices existed in the 1940s, one giving prominence to speculation and heterogeneous expectations, one to fundamentals and homogeneous expectations.

Interestingly, we find that that Kaldor's own theory was capable of encompassing both these theories as special cases and that Kaldor's separation from Keynes on the theory of forward markets occurred when Working grafted the notion of convenience yield onto a non-Keynesian theoretical framework, based on the observation of the US wheat market. This was meant to describe a competitive market dominated by professional dealers offering storage facilities and sharing the same (correct) price expectations rather than a market dominated by speculators and hedgers trading on the basis of heterogeneous expectations and trying to get rid of redundant stocks, which is what Kaldor had in mind. In this sense Kaldor should not be regarded as the initiator of the theory of storage but rather of a theory of voluntary stock holding and speculation much closer in spirit and substance to Keynes than to Working. This conclusion is particularly important in view of the fact that Working's theory is one of the first applications of the efficient market hypothesis. To the best of our knowledge, Kaldor's role in the development of the theory of commodity pricing has never been investigated in a systematic way, nor have its implications for the evolution of the theory of forward markets.

Based on these considerations, the rest of the paper is organized as follows. Section 2 discusses the Keynes-Hicks theory of normal backwardation, focusing on the role of stocks, and briefly mentions Keynes's theory of the own rate of interest. Section 3 investigates the genesis of the concept of convenience yield and Kaldor's initial

formulation of a 'generalised theory of the forward market'. Section 4 reconstructs how Kaldor came to reformulate his theory in the context of a Symposium that took place in 1940 and whose results were published in *The Review of Economic Studies*. Section 5 explores the theory of storage and its linkages with Kaldor. Section 6 concludes the paper.

2. The Keynes-Hicks theory of normal backwardation

Keynes's early analysis of commodity markets focused on price volatility and its bearings on short term credit and the market for hedging. In an article published in 1923[1] Keynes brought to attention the huge value of the annual flow of commodities extracted or harvested from the soil compared to the amount of fixed and floating capital in the hands of producers (1923: 255). This placed a heavy burden on the market for short term loans, and created a situation in which producers were de facto compelled to hedge their risks if they wanted to have access to bank loans, for bankers were not willing to take upon themselves the risks connected with price volatility.

The hedging technique described by Keynes in 1923 is one in which the price risk is eliminated by means of forward sales at discount price. As Keynes put it, 'The producer […] is prepared to accept a somewhat lower price in advance than what, on the balance of probability, he thinks the price is likely to be when the time comes' (1923: 261), the difference between the two prices being the risk premium. Insofar as producers hedged their production by selling it forward to merchants or other producers located at a lower stage of the process of production, the whole business could be carried out without speculators. But Keynes noticed that the time horizon of producers and that of the merchants did not usually match. This gave scope to speculators, acting as *risk-bearers*, to enter the market and earn a part of the risk premium as defined above.

Compared with a more traditional idea of speculation, based on the assumption that speculators entertain different and more accurate expectations on prices, Keynes's 1923 article introduced an element of innovation. Now, hedgers and speculators could even have the same price expectation, while the profit of the speculator would result from investments in futures contracts, each purchased at the downward biased future price tendered by the hedgers. In *Value and Capital*, Hicks would generalize the same argument as follows:

[1] 'Some Aspects of Commodity Markets' (Keynes 1923).

> If we are to allow for uncertainty of expectations […] we must not take the most probable price as the representative expected price, but the most probable price ± an allowance for the uncertainty of the expectation, that is to say, an allowance for risk[; while] the percentage by which the representative expected price falls short of or exceeds the most probable price, is not determined solely by the *opinion* of the planner about the degree of uncertainty. It is also influenced by his *willingness* to bear risks. (Hicks 1946: 126-7)

When applied to speculation and hedging, this entails that

> it is of the essence of speculation, as opposed to hedging, that the speculator puts himself into a more risky position as a result of his forward trading […]. He will therefore only be willing to go on buying futures so long as the futures price remains definitely below the spot price he expects; […] and it will not be worth his while to undertake the risk if the prospective return is too small. (Hicks 1946: 138)

Keynes returned to the problem of hedging by means of forward sales in the context of a wider analysis of the causes of fluctuations of investments in Chapters 27, 28, and 29 of the *Treatise on Money*, where the expression 'normal backwardation' was employed for the first time. In volume I of the *Treatise* Keynes gave a general definition of fixed, working, and liquid capital—'We shall call goods in use fixed capital, goods in process working capital, and goods in stock as liquid capital' (CWK V: 116)—referring the reader to vol. 2, Chapter 28 for a 'more detailed definition' of working and liquid capital:

> I define working capital as being the aggregate of goods […] in course of production, manufacture, transport and retailing, including such minimum stocks, whether of raw materials or of finished products, as are required to avoid risks of interruption of process or to tide over seasonal irregularities […]. It does *not* include surplus stocks, which constitute liquid capital. (CWK VI: 103-4)

Keynes thus distinguished between that part of stocks that is *deliberately* held—and therefore included in working capital, because it is supposed to be useful in certain circumstances—and that part which is a 'surplus' over this amount and therefore *involuntarily* held. The point that Keynes was making is that '[i]f, as the result of a previous miscalculation, such stocks come into existence, the price of the goods continues to fall until either consumption increases or production falls off sufficiently to absorb them' (CWK VI: 130). The reduction of price below the normal level that producers would be willing to accept in order to get rid of their surplus stocks, depends on the costs of carrying these stocks. These costs include—along with insurance and warehouses charges, allowances for deterioration, and interest charges—the cost of

hedging (risk premium), that Keynes considered particularly relevant.[2] Because of these costs, holders of liquid capital tend to get rid of it as rapidly as possible with the effect of depressing prices. As carrying costs are much higher than usually admitted—Keynes argued—price fluctuations are also much wider than they would otherwise be.

Restating the same argument in terms of the forward markets, Keynes discussed the case of producers who hedge themselves by selling forward, making a distinction between two cases: one in which 'there are not redundant liquid stocks', and one in which 'there exist redundant liquid stocks' (CWK VI: 128-9). In the former case there will be backwardation, which will only be limited 'by the unwillingness of the buyer to pay the higher spot price rather than postpone the date of his purchase' (CWK VI: 128)—and in the special case of a market in equilibrium, the one that Hicks would consider in *Value and Capital* (1946: 138), the backwardation will be at its 'normal' level. In the latter case,

> The existence of surplus stocks must cause the forward price to rise above the spot price […] ; and this contango must be equal to the cost of the warehouse, depreciation and interest charges of carrying the stocks. But the existence of a contango does not mean that the producer can hedge himself without paying the usual insurance against price changes. On the contrary, the additional element of uncertainty introduced by the existence of stocks and the additional supply of risk bearing which they require mean that he must pay more than usual. In other words, the quoted forward price, though above the present spot price, must fall below the anticipated future spot price by at least the amount of the normal backwardation; and the present spot price, since it is lower than the quoted forward price, must be much lower than the anticipated future spot price. (CWK VI: 129)

Indicating current price by *CP*, forward price by *FP*, expected price by *EP*, warehouse, depreciation and interest costs by *c* and the risk premium by *r*, when liquid capital exists, prices stand in the following relation

$$CP < FP < EP$$
$$CP + c = FP = EP - r$$

This explanation of the spread between current and future prices already included, along with the risk premium, the cost of carrying stocks. The importance of this latter element was downplayed, if not altogether overlooked, in Hicks's *Value and Capital.*[3]

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[2] On this point, Keynes took issue with Hawtrey's theory of liquid stocks, based on the idea that the amount of stocks held by producers is inversely proportional to the level of the rate of interest. See Hawtrey's *Currency and Credit* and *Trade and Credit* and CWK VI: 117-23.

[3] For Hicks 'Stocks may indeed be left in the shops unsold; but they are unsold because people prefer to take the chance of being able to sell them at a future date rather than cut prices in order to sell them

By contrast, Kaldor would consider carrying costs an essential component of his theory of forward markets, a theory based on the development of the Keynes's ideas in the *Treatise* and in Chapter 17 of the *General Theory*. In that chapter, discussing the concept of own rate of own interest (the return of an asset in terms of itself) Keynes isolated three attributes which different types of assets possess in different degrees:

> i) Some assets produce a yield or output q, measured in terms of themselves, by assisting some processes of production or supplying services to a consumer.
>
> ii) Most assets, except money, suffer some wastage or involve some cost through the mere passage of time (apart from any change in their relative value), irrespective of their being used to produce a yield; i.e. they involve a carrying cost c measured in terms of themselves. […].
>
> iii) Finally, the power of disposal over an asset during a period may offer a potential convenience or security, […] there is, so to speak, nothing to show for this at the end of the period in the shape of output; yet it is something for which people are ready to pay something. […] We shall call it liquidity premium l. (CWK VII: 225-226)

Based on these concepts, Keynes argued that the own rate of interest of any commodity is $q - c + l$. As shown in Section 3 below, Kaldor's convenience yield corresponds to the element q in Keynes's formulation, while the 'net carrying costs' in Kaldor's theory speculation and forward markets derives from the Keynesian definition of the own rate of interest of any commodity.

3. Kaldor on speculation, risk and convenience yield

Kaldor re-elaborated the Keynesian concepts of fixed, working and liquid capital, normal backwardation and own rate of own-interest in the first part of his 1939 essay on *Speculation and Economic Stability* (Kaldor 1939). In the context of this re-elaboration, he formulated a generalized version of Keynes's theory of the forward market which consists of three main elements: 1) the notion of speculative stocks, 2) the introduction of the concepts of convenience yield and net carrying costs, 3) the establishment of the idea that hedgers can be both forward sellers and forward buyers.

Kaldor defined speculative stocks of assets as 'the difference between the amount actually held and the amount that would be held, if other things being the same, the

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now' (1946: 131). While this is not inconsistent with Keynes's argument, Hicks did not enter into the practical problems connected with the variations of prices that might become necessary in order 'to sell them [the stocks] now'. Moreover, Hicks did not follow Keynes on the definition of carrying costs, and held fast to the notion that the level of stocks of intermediate products is 'determined through the rate of interest' (1946: 118).

price of that thing were expected to remain unchanged' (Kaldor 1939: 1) and discussed the two conditions for an asset to be the object of speculation: 1) perfect or semi-perfect marketability, and 2) low carrying costs. Perfect marketability requires that the asset be an article of general demand, fully standardised or capable of full standardisation. Low carrying costs require that the asset be durable and valuable in proportion to bulk. Carrying cost *proper* consists of wastage and storage cost.

> But *net* carrying cost also depends on a third factor: the yield of goods. In normal circumstances, stocks of all goods possess a yield, measured in terms of themselves, and this yield which is a compensation to the holder of stocks, must be deducted from carrying costs proper in calculating net carrying costs. The latter can, therefore, be negative or positive. (Kaldor 1939: 3)

While Kaldor recognized that his definition of net carrying cost is 'the negative of Mr Keynes' "own rate of own-interest" in ch. 17 of the *General Theory*—except that no allowance is made here for the factor termed "liquidity premium"[4]' (Kaldor 1939: 3 fn. 4)—the relationship between the notion of speculative stocks and Keynes's taxonomy of capital assets in the *Treatise* is more complex. Kaldor distinguished between goods which are used in production and goods which are used up in production. Fixed capital, in the sense of the *Treatise*, belongs to the first category and cannot be used for speculative purposes as it lacks standardization. Working and liquid capital, instead, belong to the second category and, being standardized, can be used for speculation. Like working capital, speculative stocks are held voluntarily and 'have a yield , *qua* stocks, by enabling the producer to lay hands on them the moment they are wanted and thus saving the cost and trouble of ordering frequent deliveries, or of waiting for deliveries' (Kaldor 1939: 4). Unlike working capital, however,

> the amount of stocks which can thus be 'useful' is, in given circumstances strictly limited; their marginal yield falls sharply with an increase in stocks above 'requirements' and may raise very sharply with a reduction of stocks below 'requirements' […] Hence as we defined 'speculative stocks' as the *excess* of stocks over normal requirements […] we may say that with working-capital-goods carrying costs are likely to be positive when speculative stocks are positive, and negative when they are negative. (Kaldor 1939: 4)

Having related his own notions of speculative stocks and convenience yield to Keynesian categories, Kaldor went on to discuss the relationship among current, future

[4] A possible explanation for this omission may be that Kaldor developed his theory of speculation focusing on perfectly marketable (i.e. very liquid) goods. The relationship between liquidity and risk premia, however, is a complex one. On this see Kaldor (1939: 4 fn. 5) and Kaldor (1960).

and expected price, under the assumption of a *single expectation for the market as a whole*. Kaldor recognized that

> The expectations of different individuals composing the market are normally different of course. But it is permissible to speak of a single expectation for the market as a whole, since *cet. par.* there is always a definite amount of any good that would be held, at any particular expectation, if all individuals' expectations were the same. (Kaldor 1939: 1 fn. 1)[5]

> If expectations were quite certain, speculative activity would so adjust the current price that the difference between expected price and current price would be equal to the sum of interest and carrying costs […] minus the yield […] If expectations are uncertain, the difference […] must cover, in addition, a certain risk premium. (Kaldor 1939: 5)

In algebraic terms, this reads as follows:

$$EP - CP = i + c + r = i + c' - q + r$$

Where, EP is the expected price, CP is the current price, r is the risk premium (related to price fluctuations and increasing with the dispersion of expectations around the mean and the size of commitments), i is the interest cost, c net carrying cost, c' carrying cost proper (wastage and storage) and q the convenience yield.[6] The presence of risk creates the incentive for market participants to develop facilities, in the form of forward contracts, to transfer risk from risk-adverse to risk neutral (or less adverse) agents in return for the payment of a premium. As to this, Kaldor distinguished among three different cases.

> If speculative stocks are zero, i.e. $EP = CP$, then $-c = i + r$, i.e. the negative of carrying cost must be equal to the sum of interest cost and risk premium, and since i and r are always positive, the carrying cost must be negative, i.e. the yield must exceed the sum of storage cost and primary depreciation by the required amount. In this case $FP = CP - r$, the forward price must fall short of the current price by an amount which Mr. Keynes calls normal backwardation'. (Kaldor 1939: 6)

In algebraic terms,

$$FP - CP = i + c' - q, \text{ hence } FP = EP - r$$

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[5] It should be noted that differences in individual risk premia make transactions possible even if all individual price expectations are equal. It should also be noted that, while Kaldor made explicit assumptions about expectations this was not the case with Keynes.

[6] In Keynes's formulation i was included in c.

> The proposition that the forward price must fall short of the expected price by the amount of the marginal risk premium, […] is probably true in the majority of markets; in the case of certain industrial raw materials, however, where the outside buyers are contractors with given orders for the period ahead, the 'hedgers' may be predominantly forward buyers, and the 'speculators' spot buyers and forward sellers. Now the 'carrying costs' for these speculators may be higher than the carrying costs for the market generally. This is because the yield of stocks of raw materials (which in our definition is included in net carrying costs) consists of convenience, […] and this convenience is largely lost if the stock held is already sold forward. (Kaldor 1939: 6)[7]

$$FP - CP = i + c', \text{ hence } FP = EP - r + q$$

As in the first case, $EP = CP$ (normal conditions, balanced markets), speculative stocks are zero and what stocks are traded have a positive convenience yield. In this case, however, contrary to the previous one, the yield accrues to forward buyers (hedgers) rather than speculators. This implies: 1) that the forward price will be higher than the expected prices (reflecting the hedgers' eagerness to buy) and 2) that contango will be observed. Contango will also be observed when speculative stocks are positive, their yield is zero ($q = 0$), the current price falls below the forward price by an amount equivalent to (positive) carrying costs, and the forward price falls below the expected price irrespective of whether hedgers are forward buyers or forward sellers.

$$FP - CP = i + c', \text{ and } FP = EP - r$$

At this stage, Kaldor's theory of the forward market is already a generalisation of Keynes's own, built on a less selective definition of stocks and a more complex vision of hedging practices. As to the similarities, both theories focus on hedgers and speculators, trading risks on financial markets, rather than on dealers, earning revenues for providing storage facilities, and both theories relate speculation to the business cycle, through its impacts on price and output.

4. The Symposium

Kaldor's 1939 essay became the object of intense debate and of a Symposium on the *Review of Economic Studies*. J.C.R. Dow's contribution to the Symposium deserves particular attention (Dow 1940) for the arguments used to criticize Kaldor's theory and, in particular, the idea that for some industrial raw materials, *where the outside buyers*

[7] Kaldor specifically related the possibility of transferring q to stocks of raw materials, which assist production and whose usefulness comes from being readily available, rather than to of financial assets, where the yield always stays with stock holders.

are contractors with given orders for some period ahead, stock-holders (speculators selling forward) loose the convenience yield to hedgers (forward buyers) and forward prices exceed expected prices.

Dow acknowledged that forward sales would transfer the yield of stocks from stock-holders to hedgers, but claimed that futures rather than forward contracts, a difference ignored by Kaldor (Dow 1940: 186-7), were the standard instruments to hedge stocks. Selling futures rather than forward, stock holders retained control of their stocks and of the convenience yield, while 'there is *always* the possibility that the forward price will be above the expected price; and *always*, with the normal sort of risk, the futures price will be below both' (Dow 1940: 187). By ignoring the difference between futures and forward contracts, Kaldor had therefore treated as general a very specific case.

Dow's second line of criticism was based on the notion of *negative* risk, the risk that prices rise rather than fall (positive risk). Negative risks affect two categories of agents: 1) manufacturers using the commodity as input, and 2) speculators sell futures contracts without owning the stocks. Symmetrically, positive risks, affect producers and buyers of futures contracts. Assuming identical price expectations (as Kaldor had done) and different degrees of risk aversion, Dow showed that when positive and negative risks were equivalent futures prices would fluctuate between $EP - r$ and $EP + r$, whereas in case positive risks prevailed (the normal case for Dow) futures prices would be lower than expected prices (as in the case of normal backwardation). Only in very specific circumstances, much more specific than what Kaldor had envisaged, would negative risks prevail.

Kaldor's curt response to Dow[8] and to 'some further discussions on the subject with Mr. R. G. Hawtrey' (Kaldor 1940: 196) gave him a chance to refine his theory of the forward market.

> The main defect in my previous account was the insufficient allowance made for the *difference in expectations* of different individuals. […] I still believe that for certain problems in the theory of speculation, this concept of the 'representative expectation' is perfectly legitimate. […] From the point of view of the theory of the forward market, however, it is not legitimate; for the determination of the forward price, and in particular, the relation of the forward price to the expected price will not be the same in the case where everybody's expectations are equal as in the case where the 'representative expectation' is an average of different individual expectation […] In

[8] On this see Kaldor (1940: 197 fn. 4, 198 fn. 2, 199 fn. 2).

> both cases individuals participating in the forward market can be divided into two groups: 'speculators' and 'hedgers'.[9] (Kaldor 1940: 196)

When all individuals have the same expectations 'forward transactions can only arise between hedgers and speculators owing to differences in the "marginal risk premium"' (Kaldor 1940: 197). 'Insofar as hedgers are both sellers and buyers of futures, their opposite risks mutually cancel each other out, hence the futures price in transactions between hedgers and hedgers can vary anywhere between' (Kaldor 1940: 198) $EP - r$ (the lowest price hedgers accept when selling forward) and $EP + r$ (the highest price hedgers accept to pay when buying forward). As to which of the two cases is likely to prevail, Kaldor stated

> In my earlier paper I have said that in the majority of markets, the hedgers will be forward sellers; and only in the case of certain raw materials […] can it be the other way round. I should now like to modify this statement. The hedgers are likely to be predominantly buyers, rather than sellers. (Kaldor 1940: 197)[10]

If hedging influences the position of the futures price FP relative to EP, a second factor hitherto not discussed by Kaldor—arbitrage—determines the level of FP relative to current prices CP. Arbitrageurs buy spot and sell futures simultaneously, holding stocks until the date of delivery. They run no risks of the sort hedgers and speculators trade among themselves and their presence limits the extent to which futures prices may rise above current prices when stocks are relatively abundant. 'While there is no limit, apart from expectations to the extent to which the futures price may *fall short* of the current price, it cannot *exceed* the current price by more than the sum of interest plus carrying costs'.[11] If the arbitrageur, by holding stocks, obtains the advantages, as well as the disadvantages, which other holders of stock obtain from their holding, his 'carrying cost' will consist of the cost of storage and wastage *minus the yield*, so that

$$FP - CP = i + c' - q$$

but since, in all cases

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[9] Kaldor defined *hedgers* as 'those who have certain commitments, independent of any transactions in the forward market, either because they hold stocks of the commodity, or are committed to produce the commodity, or are committed to produce, in the future, something else for which the commodity is required as a raw material... *Speculators*, on the other hand, have no commitments apart from those entered into in connection with forward transactions' (Kaldor 1940: 196).

[10] Kaldor provided two main motivations for this change of mind: (1) 'technical uncertainties connected with production are much greater in the stages of production prior to the stage where the futures market is situated than in subsequent stages' (Kaldor 1940: 197), (2) producers, especially producers of agricultural crops, may compensate price fluctuations with output fluctuations, moreover, if output risk prevails the 'risks borne by producers are enlarged, and not reduced, by hedging' (Kaldor 1940: 197).

[11] If FP exceeded $CP + i + c'$, riskless profits could be earned by buying spot, selling forwards and holding stocks to maturity.

$$EP - CP = i + c' - q + r$$

$$FP = EP - r$$

In this case, which applies to securities in particular, the futures price falls short of the expected price by an amount equivalent to the marginal risk premium irrespective of whether hedgers are predominantly buyers or sellers. But 'where the yield consists simply of "convenience," the arbitrageurs would enjoy no such convenience, on stock bought solely for arbitrage purposes' (Kaldor 1940: 199). This implies the possibility that the futures price rises above the expected price. Expressing this possibility in algebraic terms

$$FP - CP = i + c'$$

$$EP - CP = i + c' - q + r$$

$$FP = EP - r + q$$

In this re-stating the two cases, Kaldor moved forward with respect to his 1939 formulation.

> I still maintain, therefore, that in the case *everybody's expectation are assumed to be the same*, the conclusions stated in my earlier paper were correct. […] In markets were hedgers are predominantly sellers, or even when they are predominantly buyers but the yield is a money return which automatically accrues to all holders, the futures price must fall short of the expected price by the marginal risk premium. In markets where hedgers are predominantly buyers *and* the yield of stocks consists of convenience, the future price can exceed the expected price. […] In the latter case, […] FP will be either $EP + r$, or $EP - r + q$, whichever is less. (Kaldor 1940: 200)

In the more realistic case of heterogeneous expectations, multiple types of transactions are possible 'not only between hedgers and hedgers, and hedgers and speculators, and hedgers and arbitrageurs, …, but also between speculators and speculators; and transactions of the latter type may swamp all others' (Kaldor 1940: 200). In this case, which we may surmise Kaldor had come to consider as the most relevant one, FP will fluctuate between $EP - r$ (the average demand price of *bull* speculators, the counterpart of *bear* speculators and hedger sellers) and $EP + r$ (the average supply price of *bear* speculators, the counterpart of *bull* speculators and of hedger buyers).

$$EP - r \leq FP \leq EP + r$$

With speculation and heterogeneous expectations being given a prominent position and the introduction of arbitrageurs , Kaldor's final formulation of the theory of forward

markets significantly downplays the role of the convenience yield. On the specific issue of normal backwardation Kaldor concluded

> The doctrine first propounded in Mr. Keynes' *Treatise on Money*, and taken over by Professor Hicks […] has only a limited application. It is not valid if there is a marked divergence in individual expectations; and even if unanimity of expectations is assumed it will only necessarily hold if markets where hedging is predominantly on the selling side or where the yield of stocks enters automatically in arbitrage costs. (Kaldor 1940: 201)

Hawtrey (1940) acknowledges Kaldor's effort in modifying his theory of the 'expected price' but retains his perplexities about the assumption of uniform price expectations. Hawtrey objects to this hypothesis on the basis of a series of arguments which may be summarized as follows:

> Not only are there sure to be some people who have formed no expectations at all in regard to the economic quantity concerned, but those who have will have formed very incomplete expectations. […] The most complete expectations will take the form of estimates of the respective probabilities of a series of results. But different people's estimates will not relate to the same series of results. Nor will they relate to the same future dates […] In the particular case of dealers in a forward market, the trader who hedges does so for the express purpose of being relieved from estimating future price movements. […] And the expectations formed by the professional dealers and the speculators themselves do not take the form of an estimate of what the price will be at some future dates. The speculative buyer merely anticipates a rise and the speculative seller a fall. (Hawtrey 1940: 203)

Hawtrey's contribution concludes the 1940 Symposium with what appears as a further generalization of Kaldor's own theory, based on the identification of two limiting cases, reflecting very different degrees of uncertainty regarding commodity prices, in the context of the same theory. 'When the future movement of prices becomes very uncertain, there are wide differences of opinion among dealers, and both bulls and bears hope for big gains. … When there is very little difference of opinion among dealers as to price movements, there may practically be no speculation' (Hawtrey 1940: 204). In the first case, speculators dominate the market, prices fluctuate a lot and price margins may be regarded as risk premiums. In the second case, transactions involve hedger buyers (manufacturers) trading with hedger sellers.[12] Dealers, who carry the

[12] As to hedger sellers, Hawtrey writes: 'the hedging sellers are almost entirely the *holders* rather than the producers (of stocks)' (Hawtrey 1940: 204) and justifies this significant departure from Keynes's main focus on producers as hedgers on the basis of a series of arguments presented on page 204 of his essay. Kaldor had reached analogous conclusions focusing on agricultural producers.

stocks and sell them forward, relieve manufacturers of the cost of holding the stocks and receive their compensation through the premium of the forward price over the spot price. It is only when the 'shortage of spot supplies becomes severe enough to outweigh the entire carrying cost that a "backwardation" or excess of the spot price over the forward price appears. The scarcity must be temporary.' (Hawtrey 1940: 205).

Hawtrey's two cases are particularly interesting as they indicate the two directions along which the theory of forward markets evolved in the 1940s and 50s. On one side, Working's works on the wheat markets (see Section 5 below), focusing on: 1) storage cost and convenience yield as the main determinants of the difference between commodity prices at different delivery dates, 2) efficient markets dominated by dealers offering storage facilities, sharing the same (correct) expectations about prices and market fundamentals. On the other side, the British literature putting emphasis on: 1) speculation and volatility as the main determinants of commodity prices, 2) relatively efficient markets populated by distinct categories of traders (hedgers vs. speculators), operating on the basis of heterogeneous expectations.

An application of the British approach to the theory of commodity prices can be found in an article by Gerda Blau that was published, once again in the *Review of Economic Studies*, four years after the Symposium (Blau 1944). From a theoretical point of view, this article did not add new ideas to the debate. To a large extent, Blau's paper built on the Kaldorian framework as it has been described above. Only, it downplayed the importance of convenience yield and placed more emphasis on expectations, as well as on the relative weight of hedgers, speculators, arbitrageurs, in determining futures prices.

The downplaying of convenience yield was the result of focusing on futures instead of forward markets. Provided that, in futures markets, standardized commodities are dealt with, and that the difficulty of obtaining new supplies of these standardized commodities at arm's length is supposed to be very low in these markets, the convenience of holding stocks turns out to be very low. On the other hand, the great emphasis on the role of expectations, and especially on the possible existence of different expectations among the agents operating in the same market, somehow reinforced Kaldor's conclusion that the Keynesian theory represented a special case.

More specifically, situations in which the opposing forces of bull and bear speculation dominate, thus placing FP somewhere between $EP - r$ and $EP + r$, were very plausible. At the same time, however, Blau came to the conclusion that commodity markets could not easily become the sort of 'casino' markets described in chapter 12 of Keynes's *General Theory*. Rather than that, Blau came back to some of the seminal

ideas of Keynes's 1923 article, where speculation could not act effectively in limiting price instability but could nonetheless reduce the producers' risks connected with it (Blau 1944: 23-6).

As Keynes also had argued, price instability is a necessary condition for speculation, so there is a (plausibly quite high) minimum level of volatility that has to be accepted if speculation has to exist. On the other hand, the 'danger' that speculation could augment market instability instead of reducing it

> […] is likely to be more severe in an organised market of railway shares than in an organised market for an agricultural crop because the railway shares' value for the community as a whole is likely to depend on expectations over a period of 10-20 years or more while the agricultural crop's value […] is likely to depend on expectations over the crop year and hardly more than one year after. (Blau 1940: 25)

Blau was here probably referring to the Keynesian idea of radical uncertainty over longer periods (CWK VII: 147-64; Keynes 1937). Especially in the case of crops, the life of a commodity traded in futures exchange is much shorter, and this increases the probability that the individuals operating in the markets will rely on their knowledge of fundamentals instead of falling into the beauty contest situation described by Keynes in the *General Theory*. This conjecture finds supports in Blau's subsequent observation when she writes: '[…] despite all limitations, hedging can, on the whole, be regarded as an effective insurance against major price fluctuations, and because of the lowered risk the hedger can do a larger amount of transactions with the same amount of capital' (1944: 26). Once again developing an idea that was put forth by Keynes in 1923, Blau observed that 'A further reason for the lowering of costs' is that 'the hedge is generally accepted […] as a collateral by crediting banks', and went further to say that 'the security derived from hedging may diminish the cautious trader's natural disinclination to carry stocks which has been characterised by Keynes as one of the faults of the competitive system' (Blau 1944: 26; see also Keynes 1938).

It is not at all clear whether Keynes or Kaldor would have endorsed Blau's opinions about the relative efficiency of commodity markets,[13] and it is not our object to answer this question. On the other hand, these conclusions are interesting enough, from the

[13] Keynes became convinced that commodity markets were characterized by endemic excess volatility, due to the reluctance of traders to hold stocks, and proposed to correct what he saw as a market failure by means of government-sponsored buffer stocks (Keynes 1938). Blau was aware of Keynes's opinion when she wrote: 'the security derived from hedging may diminish the cautious trader's natural disinclination to carry stocks which has been characterised by Keynes as one of the faults of the competitive system' (Blau 1944: 26). Kaldor came to the endorse Keynes's vision in the 1970s (on this, see Spraos 1989).

standpoint of the present reconstruction, because they base a reappraisal of the economic function of commodity markets on a view of their functioning that, as it will be shown presently, is very different to the one that Working was developing in the same years.

5. The theory of the price of storage

As the debate on commodities and futures markets was going on in Britain, parallel research on this issue was being conducted in the USA, notably by Holbrook Working. Based on his knowledge of the US wheat market, Working (1948, 1949a) formulated the theory of the price of storage to explain the difference between spot and futures prices. This theory consists of three elements: 1) the idea that all prices, spot prices included, react to market expectations in approximately the same way, irrespective of the time of delivery, 2) that their difference depends on carrying costs net of convenience yield, and 3) that net carrying costs can be positive or negative.

The origin of this theory can be traced back to Working (1942) where the author, building on previous research (Working 1934, Hoos and Working 1940), refuted the prevailing idea (that Working attributed to Hawtrey 1938, among others) that 'spot prices are not generally supposed to reflect anticipations of the future in the same degree as futures prices' and concluded that 'the difference between prices of successive wheat futures at any given time seems to reflect the existing market appraisal of the prospective marginal cost of carrying wheat from one delivery month to the next' (Working 1942: 47).

In the context of this analysis, Working observed cases of negative carrying costs in connection with low stock levels that were in blatant contradiction with the cost of carrying theory, and related this to the need of maintaining a minimum amount of stocks to ensure regular production (Working 1942: 42-3). This argument was akin to that put forth by Kaldor to introduce the notion of convenience yield but a post-script to the 1942 article, the Appendix note on pp. 51-52, bore witness to the fact that Working had written that paper before coming into contact with Kaldor (1939) and the Symposium. In this note Working subscribed to Hawtrey's criticism of Kaldor's treatment of market expectations and downplayed the importance of risk as a factor determining futures prices. The note made no mention of the notion of convenience yield.

Building on these results, Working (1948: 2) compared four different theories to explain the case of negative carrying costs, which he defined *inverse carrying charges*,[14] in the market for wheat, listing them as follows:

(1) 'Cash and futures prices, though related, are not equivalents aside from the time element, at least in the United States wheat market.'
(2) 'The future, as against the present, is discounted.'
(3) Expectations regarding future demand and supply conditions tend to have more effect on prices of deferred futures than on cash prices or on near futures.
(4) An inverse carrying charge is a true negative price of storage, arising from the fact that stocks may have a high marginal 'convenience yield'.

Working refuted the first explanation on the basis of technical considerations and of his knowledge of hedging practices on the US wheat market. In particular, he found that futures were commonly sold (bought) in connection with a purchase (sale) on the cash market only when the discount (premium) of the spot price on (over) the futures prices was expected to fall (increase). Working saw this form of discretionary hedging as arbitrage 'in fact as well in form because its occurrence depends on a judgement regarding the relation between two prices' (Working 1948: 5). As shown below, this was the first step of a general redefinition and generalization of the concept of hedging that continued at least until Working (1962).

As to the second explanation, traced back to Vance (1946) and Keynes (CWK VI), based on futures prices being downward biased, Working concluded that this could not 'explain more than a very small inverse carrying charge' (Working 1948: 13). Working refuted the third explanation, *that expectations should affect prices for different forward dates differently*, on the basis of the same arguments, as he had used in 1942 and recognized that 'heavy surplus stocks may force spot and futures prices into a pattern of relationship determined by the costs of carrying stocks' (Working 1948: 13). Generalizing this argument, Working introduced a theory in which inter-temporal price relations depend *exclusively* on the price of storage (carrying costs). Finally, he explained the possibility of inverse carrying charges by explicitly referring to Kaldor and to his notion of convenience yield (Working 1948: 20-1).[15]

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[14] As Working states 'In the technical language of American futures markets, *carrying charge* refers to a difference at a given time between prices of a commodity for two different dates of delivery. […] In British usage, 'contango' and 'backwardation' refer to positive and inverse carrying charges respectively' (Working 1948: 1).

[15] When stocks are low, and their convenience yield positive and very high, net carrying costs (storage cost minus convenience yield) will be negative (backwardation).

Indicating by P_1 a spot or forward price, by P_2 a forward price for a date later than that to which P_1 applies and by P_s carrying charges (price of storage), Working summarizes his framework with the following formula

$$P_1 + P_s - P_2 = 0$$

As Working put it, the previous equation

> gives no information by itself regarding the economic influences which determine any one of the variables included, but it affords a basis for explaining any one of them in terms of known explanations of the other two […] Treatment of the carrying charge as a price of storage involves providing a direct explanation of P_s instead of relying on explanations in terms of differences between the explanations of P_1 and P_2. Direct explanation … is simpler and more reliable than indirect explanation and it opens the possibility of explaining either P_1 or P_2 in terms of the other and of P_s These advantages prove substantial in practice. (Working 1948: 22-3)

Working saw P_s as a function of outstanding stocks and as the main independent factor determining the difference between spot and futures prices.

Working (1949a) clarified the relationship between P_s, P_1 and P_2 in the context of an analysis of hedging by professional dealers supplying storage services. Based on practical examples, Working showed how futures prices at different delivery dates could guide a dealer in his decisions by providing 'a basis for anticipating his return for storage which is far superior to any estimate which could be made in the absence of a good hedge in a futures market or of an outright forward sale […] and a means through hedging, of *assuring* receipt of that return' (Working 1949a: 1257-8).[16]

Working (1953) noted three relevant facts about hedging in commodity futures markets:

> First, […] hedging of the sort here considered is not properly comparable with insurance. It is a sort of arbitrage. […] Secondly, hedging does not eliminate risks arising from price variability. Risk is less than on stocks held unhedged but it still exists. […] Thirdly, hedging is not necessarily done for the sake of reducing risk. (Working 1953: 325)

[16] In particular, Working discussed the problem of a dealer, holding stocks at the end of November and deciding whether to sell in December or to hold on until May, and showed how this decision depended on whether the difference between futures prices for delivery in May and December was sufficient to cover carrying costs, under the assumption that spot prices at the end of April stood in the same relationship to future prices in May as spot prices in November stand to future prices in December.

Based on these observations, Working defined hedging as 'the purchase or sale of futures in conjunction with another commitment, usually in the expectation of a favourable change in the relation between spot and futures prices' (Working 1953: 326).

In his 1962 synthesis of the 'New Concepts Concerning Futures Markets and Prices' developed over the previous thirty years, Working clarified that he saw hedging as a 'multipurpose' activity done to seek profit from stock holding and speculation, to avoid loss, and to reduce risk, and 'defined as the use of futures contracts as a temporary substitute for a merchandising contract' (Working 1962: 432). In the same context, he noted that 'futures prices tend to be highly reliable estimates of what should be expected on the basis of *contemporarily available information* concerning present and probable future demand and supply' (Working 1962: 432). This definition is relevant as it connects Working's investigation of commodity futures markets with a parallel strand of his research activity concerning the time-series properties of financial prices. As part of this investigation, Working came to the conclusion that prices forming on *perfectly functioning markets* move as random walks and that price changes are completely unpredictable (Working 1949b), findings that would be at the core of the 'efficient market hypothesis'.[17]

6. Conclusions

The main conclusions of our paper may be summarized as follows. In 1939, Kaldor proposed a generalization of the Keynes-Hicks theory of normal backwardation relating differences between spot and futures prices to the type of hedgers prevailing in the market. In particular, where hedger sellers prevailed Kaldor thought futures prices would fall below spot prices, taken as proxy of future expected price (normal backwardation). Where hedger buyers prevailed, however, futures prices would tend to rise above spot prices. This generalization was based on three main assumptions: 1) homogeneous expectations, 2) risk averse hedgers, 3) speculators insuring hedgers in return for a premium. In response to several lines of criticism to his 1939 contribution, Kaldor reconsidered his views, introducing the possibility of heterogeneous expectations. This led him, and other British authors, to admit the possibility of speculators trading among themselves rather than with hedgers and to downplay the role of fundamentals in determining commodity emphasizing that of speculation and the role of a third category of operators, arbitrageurs.

[17] For a recognition of the role of Working in the development of the efficient market hypothesis see Samuelson (1982).

Meanwhile, in the US, Working developed a model of wheat prices at different delivery dates based on the assumption of homogeneous expectations and of trading taking place among professional dealers, offering storage facilities in competition against each other, producers and consumers. Working observed that spot and futures prices moved in step and that, normally, spot prices fell below futures prices due to storage cost (contango). The fact that sometimes this was not the case confronted Working with a puzzle which he named reverse carrying charge. Working's discovery of the notion of convenience yield allowed him to solve this puzzle, without abandoning his preferred theoretical framework and the idea that fundamentals rather than speculation are the main determinants of wheat price.

Kaldor's separation from Keynes on the theory of forward markets therefore occurred when Working introduced the concept of convenience yield onto a non Keynesian theoretical framework. This model, one of the first applications of the efficient market hypothesis, differed from Kaldor's final formulation in not assigning any specific role to professional speculators in the price formation process. Moreover, whereas Kaldor and other British economists working on the theory of forward markets formulated a complex taxonomy of different cases, classified on the basis of the identity of market participants, on the prevalence of one type of trader over the other (e.g. hedgers versus speculators), on the type of hedging technique and on the type of commodity, Working's theory was based on a specific market structure (dealers selling, manufacturers buying), on a specific hedging technique (discretionary hedging) and on a specific commodity (wheat).

Explaining how Working's theory of storage**,** including the notion of convenience yield, came to prevail on Kaldor's more general approach is not the object of this paper. However, our reconstruction seems to indicate two possible (and possibly concomitant) explanations. First, the theory of the price of storage is based on observable and measurable factors rather than on expectations and individual risk premiums. Second, the theory of the price of storage is consistent with the efficient markets hypothesis.

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A new test of the theory of storage comparing historical and contemporary data

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1. Introduction

In this paper, we adopt an historical perspective to analyse commodity price volatility and its relationship with market fundamentals. In particular, we work on a balanced sample, comparing the 1920s (1921-1929) with the present decade (2000-2011) and focusing on two staple commodities, cotton and tin.[1]

The main reasons to expect a change over time in the relations of interest are related to the growing financialization of commodity markets observed in recent years (UNCTAD 2009; Tang and Xiong 2010) and to the absence, in the 1920s, of a fully developed theory of fair pricing and market efficiency orientating trading strategies. At the same time, the two periods are comparable in terms of available trading instruments, if not of rapidity in the transmission of relevant information, and in terms of a trading environment free of State intervention.[2]

Our analysis is grounded in the theory of storage. This theory illuminates the benefit of holding stocks of physical commodities. Inventories have a productive value, a convenience yield, deriving from the possibility of meeting unexpected demand, while avoiding the cost of frequent revisions in the production schedule and of manufacturing disruptions (Geman 2005). At the same time, holding stocks involves carrying costs, that is physical storage costs and financial (opportunity) costs. According to the theory of storage, the difference between future and spot prices mirrors carrying costs net of

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[1] The paper is part of a wider research project investigating, among other issues, J.M. Keynes's trading activity on commodity markets, his views on the causes and consequences of volatility, his proposals about possible remedies. The fact that Keynes was particularly active on the cotton and tin markets and that most of his trading activity took place in the 1920s motivates the choice of our sample.

[2] We chose not to extend the sample to the 1930s because of the massive State intervention which occurred then in response to the collapse of prices.

convenience yield. The latter, in turn, depends on available stocks which also affect volatility.

This work makes two main contributions to the empirical literature on commodity prices. The first consists in constructing a new database on the spot and future prices of cotton and tin for the 1920s, drawing on the historical archives of *The Times*. The second contribution consists in testing: 1) whether the diffusion of information across commodity markets is significantly different between the two periods, 2) whether the relationship between volatility and net storage costs is consistent with the predictions of the theory of storage and with Samuelson's (1965) maturity effect.

We present an innovative test of this theory—as set out in Pindyck (2001)—based on the interrelation between net storage costs and spot price returns conditional volatility. Our approach follows Ng and Pirrong (1994) in so far as we analyse interactions between net storage costs and the conditional variability of commodity prices but introduces a more restrictive sign assumption. Moreover, the structure of our model is more closely related to the dynamic properties of the time series. As to this, whereas Ng and Pirrong (1994) regress the rate of change of spot and futures prices on lagged net storage costs in order to avoid multicollinearity problems in the second stage GARCH analysis, we use bivariate VECM and standard Constant-Conditional Correlation (CCC) GARCH models (Bollerslev 1990) to obtain unbiased parameterizations of respectively the short-run return dynamics and the corresponding volatilities. The a priori requirement that the correlation between the time series be constant is not unduly restrictive in our context since the fair pricing ensures that futures and spot prices co-move over time. An accurate analysis of the correlation between net storage costs and spot returns conditional variances is set out over the full sample and, in order to accommodate periods of stress, using rolling correlations. A priori causality is not imposed on the analysis, since both variables are simultaneously affected by the outstanding stock of commodities.

The main findings of the paper may be summarized as follows. As expected, the diffusion of information is slower and less complete in the 1920s than in present times. This results from the observed behaviour of returns and from the structure of the estimated VECM and GARCH parameterizations. Using full sample correlations, the theory of storage seems to capture the dynamics of data with the exception of historical tin. Rolling correlations, however, qualify this result in two ways. First, dynamic correlation for historical tin corroborate the theory of storage but for one notable exception in 1925. Second, the recent inroads of financial agents in commodity markets

seem to have affected the cotton market, reducing the impact of fundamentals on pricing.

The rest of the paper is organized as follows. Section 2 contains an essential review of the relevant literature. Section 3 describes the empirical methodology. Section 4 reports the preliminary empirical analysis of the data. Section 5 analyses their conditional first and second moments. The full sample and rolling correlations between net storage costs and spot returns conditional variances are set out in Section 6, and Section 7 concludes.

2. Literature review

Holbrook Working was the first to propose the theory of storage (Working 1948; 1949a) building on the notion of convenience yield introduced by Kaldor (1939). The convenience yield can be defined as the stream of implicit benefits, in terms of planning security and stock-out avoidance, accruing to consumers or producers from holding a stock of a given commodity. On this see Cristiano and Paesani (2012). The theory of storage was developed, from the 1940s to the 1960s (Brennan 1958; Telser 1958; Cootner 1960), in alternative to the Keynes-Hicks theory of 'normal backwardation' and has become standard reference ever since.[3] According to the theory of storage, the difference between future and spot prices mirrors carrying costs (storage costs plus interest rate) net of convenience yield. *Ceteris paribus*, when inventories are abundant the convenience yield is small and futures prices tend to exceed spot prices for a given interest rate. In the opposite case, when stocks are scarce the convenience yield is high and spot prices tend to exceed futures prices.[4] An additional effect, discussed by Ng and Pirrong (1994: 209), relates stocks availability to price variability. *Ceteris paribus*, as buffers provided by stocks decline, the elasticity of supply decreases and prices become more volatile for a given demand shock. Combining the two effects a negative relation between volatility and net storage costs obtains. This relationship is central to our paper and is going to be accurately explored in the following sections.

Geman (2005: 25) identifies three main strands in the literature on commodity price volatility and market fundamentals. The first strand models the convenience yield as a

[3] See Williams (1986), Bresnahan and Spiller (1986), Williams and Wright (1989), Brennan (1991), Deaton and Laroque (1992) among others. On the concept of 'normal backwardation' see Keynes (1923, 1930), Hicks (1939), Blau (1944), Hirshleifer (1989).

[4] On this see Fama and French (1988: 1077 Fig. 1) and the literature cited therein.

random exogenous quantity (e.g. Gibson and Schwartz 1990). A second approach directly analyses the role of inventory in explaining commodity spot price volatility (Geman and Nguyen 2005). Finally, Routledge et al. (2000) propose an equilibrium model in which the convenience yield appears as an inventory-dependent endogenous variable.

A statistical study performed by Fama and French (1987) shows that the variance of prices decreases with inventory levels. Williams and Wright (1991) analyse a quarterly model with a yearly production of the commodity and identify that price volatility regularly increases after harvest time until the next one. Milonas and Thomadakis (1997), modelling convenience yields as call options, find empirical support for the hypothesis that convenience yields are related negatively to stocks and positively to spot price volatility. For analogous findings see Heaney (2002). As shown below our assessment of the theory of storage and our results are consistent with this approach.

3. The dynamics of the theory of storage

3.1 Theoretical considerations

Indicating by $F_{t,T}$ the futures price contracted at time t for delivery at time $t+T$ and by S_t the spot price, fair pricing and the theory of storage imply that the two prices are related in the following way (Clark et al. 2001)

[1] $$F_{t,T} = S_t e^{(k_{t,T}+r_{t,T}-c_{t,T})\tau}$$

Where $k_{t,T}$ represents storage costs as a proportion of the price of the commodity, $r_{t,T}$ is the riskless rate of interest, $c_{t,T}$ is the proportional convenience yield and *(Tt)/365* is equal to the difference between the delivery date (or time to maturity) T and the current date t. In logarithmic terms, the above relationship can be used to define net storage costs z_t

[2] $$z_t = f_t - s_t - r_{t,T}\tau = (k_{t,T} - c_{t,T})\tau$$

where $f_t = log\ F_{t,T}$ and $s_t = log\ S_t$. This relationship posits that markets are sufficiently liquid and that prices convey all relevant information. The theory of storage and the associated tests would be affected by failure of these hypotheses.

We model the dynamic relationship between volatility and net storage costs extending Pindyck (2001), who distinguishes between spot markets for commodities and markets for storage. Our theoretical model consists of the following three equations:

[3] $$S_t = S_{t-1} + \frac{1}{\alpha}(N_t - N_{t-1}) + \varepsilon_t$$

[4] $$c_t = \phi_1 \sigma_t^2 - \phi_2 N_t + \gamma_t$$

[5] $$z_t = k_t - c_t$$

Equation [3] establishes a direct relationship between the spot price S_t in first difference and the change in outstanding stocks ΔN_t, taken as a proxy of net demand. The random vector ε_t captures unexpected shifts in demand and supply. Equation (4) reflects the direct relationship between (spot) price volatility σ_t^2 and the (unobservable) marginal convenience yield c_t and the inverse relationship between c_t and the level of outstanding stocks N_t. The random vector γ_t captures unexpected changes in the demand and supply of storage. Equation [5] defines net storage costs z_t as the difference between gross storage costs k_t and convenience yield. Gross storage costs are assumed to be a fixed proportion of the price of the commodity. All the parameters in Equations [3] to [5] are assumed to have a positive sign.

Solving the model [3] to [5] we obtain the equation, which clarifies the dynamics between volatility and net storage costs under the assumption that the theory of storage holds

[6] $$\Delta z_t = \Delta k_t + \alpha \phi_2 \Delta S_t - \phi_1 \Delta \sigma_t^2 + \omega_t$$

Where ω is a linear combination of the stochastic components of the model

$$\omega_t = -\alpha \phi_2 \varepsilon_t - \Delta \gamma_t.$$

3.2 Statistical methodology

The statistical methodology we employ to investigate the linkages between volatility and commodity price dynamics consists of three steps. First, after preliminary analysis of the time series properties of the data, we estimate a bivariate Vector Error Correction model (see Equations [7] and [8]) to filter away any serial correlation of the spot and futures returns, controlling also for the common stochastic trend driving prices in the long-run. Inter-temporal arbitrage should bring about cointegration between spot and futures prices.

[7] $$\Delta s_t = a_0 + \sum_{j=1}^{n} a_j \Delta s_{t-j} + \sum_{k=1}^{m} g_k \Delta f_{t-k} + \pi_1 \left(f_{t-1} - b_0 - b_1 s_{t-1} \right) + u_{\Delta s,t}$$

[8] $$\Delta s_t = a_0 + \sum_{j=1}^{n} a_j \Delta s_{t-j} + \sum_{k=1}^{m} g_k \Delta f_{t-k} + \pi_1 \left(f_{t-1} - b_0 - b_1 s_{t-1} \right) + u_{\Delta s,t}$$

The residuals of the VECM equations, $u_{\Delta s,t}$ and $u_{\Delta f,t}$, are used in a second step to obtain measures of volatility using the bivariate CCC-GARCH model set forth below (see Equations [9] to [12])

[9] $$u_t = \begin{bmatrix} u_{\Delta s,t} \\ u_{\Delta f,t} \end{bmatrix}; \quad \left(u_t \middle| \Omega_{t-1}\right) \sim N(0, H_t); \;\; H_t = \Delta_t R \Delta_t$$

[10] $$R = \begin{bmatrix} 1 & \rho_{\Delta s,\Delta f} \\ \rho_{\Delta s,\Delta f} & 1 \end{bmatrix}; \qquad \Delta_t = \begin{bmatrix} h_{\Delta s,t} & 0 \\ 0 & h_{\Delta f,t} \end{bmatrix}$$

[11] $$R = \begin{bmatrix} 1 & \rho_{\Delta s,\Delta f} \\ \rho_{\Delta s,\Delta f} & 1 \end{bmatrix}; \qquad \Delta_t = \begin{bmatrix} h_{\Delta s,t} & 0 \\ 0 & h_{\Delta f,t} \end{bmatrix}$$

[12] $$h^2_{\Delta f,t} = \omega_f + \alpha_f u^2_{\Delta f,t-1} + \beta_f h^2_{\Delta f,t-1}$$

Finally, we calculate full sample and rolling correlations between the conditional volatilities and net storage costs as defined in Equation [2] above. Equation [6] cannot be estimated directly since, given the definition of z_t, ΔS_t would not be orthogonal to the residual ω_t[5] This being the case, a correlation analysis between z_t and $h^2_{\Delta s,t}$ is the correct approach to investigate the implications and the explicatory potential of the theory of storage where, following Pindyck (2001) and Equation [6] we expect to find a negative sign. Two types of correlation are investigated, static (Equation [13]) and dynamic.

[13] $$\rho = 1 - \frac{6 \sum_{t=1}^{n} d_t^2}{n^3 - n}$$

where d_t , according to Spearman, is the difference between the ranks of the t^{th} pair of the set of n pairs of elements. The Spearman correlation coefficient is non parametric and provides consistent results when the pair of variables are related by any monotonic function. The exact sampling distribution can be obtained without requiring preliminary knowledge of their joint probability distributions. Static correlations are computed over the full sample ($t = 1, 2, \ldots, n$) and the effects of relevant events that impact on the relations of interest may cancel out. The likely presence of volatility clustering in the series (and of its impact on their co-movement) suggests complementing the static analysis by m-period rolling correlations where m is equal to 52 weeks.[6] These are calculated according to Equation [1]

[5] The choice of instruments for assets priced in efficient markets is somewhat arbitrary, which hinders the implementation of a standard instrumental variable procedure. Indeed, spot price first differences show little serial correlation, and the traditional use of own lagged values as instruments becomes inappropriate.

[6] Each time t rolling correlation is centered at mid-sample, i.e. is computed over a window that runs from t–(m/2) to t+(m/2)–1.

[14] $$\rho(m)_t = 1 - \frac{6\sum_{i=-m/2}^{\frac{m}{2}-1} d_{t+i}^2}{m^3-m}$$

The corresponding standard errors, used for inference purposes, are approximated by

$$se(\rho(m)_t) = \sqrt{\frac{1-\rho(m)_t^2}{m}}$$

4. Preliminary statistical analysis

To test the dynamic relationship between volatility and market fundamentals we employ weekly data on spot, one month and three month futures prices for cotton and tin, observed over two distinct periods: 7 January 1921-31 December 1929; 2 January 2000-15 September 2011 (See Appendix 1).

The historical cotton and futures prices and the interest rate, used to compute net storage costs, come from the online archives of *The Times* (Sections: home commercial markets, money markets). Cotton prices refer to the Liverpool American Future Contract (100 bales, 48,000 pounds) and are quoted in British pounds.[7] Tin prices are quoted in pounds per tonne. The interest rate is the Three month Discount Bank Bill rate.

The contemporary cotton spot and futures prices come from the US Department of Agriculture and the Intercontinental Exchange (NYSE: ICE) respectively and are quoted in US cents per pound. The contemporary tin prices come from the London Metal Exchange (LME) and are quoted in US dollars per metric tonne. Eurodollar (Three-month Eurodollar Deposit Rate, London) and Three month Treasury Bill rates are used to compute the net storage costs for, respectively, tin and cotton. Prices are provided by Datastream and interest rates by Fred Database.

According to the ADF unit root tests, the logarithms of the spot and futures prices turn out to be *I(1)* in levels and *I(0)* in first differences, a stylized finding of financial time series (tests available from the authors upon request). As expected z_t time series are always stationary.

Returns are measured as weekly first differences of log prices. If markets are efficient, prices should behave as martingales and the corresponding first differences

[7] Hubbard (1923: 288-95) provides full details on this type of contract and on the functioning of the Liverpool exchange for American Futures Contracts on Cotton.

should be serially uncorrelated, i.e. have fair game properties. From an economic point of view, these properties imply that any serial correlation due to noise trading should be wholly eliminated by compensatory trading by informed arbitrageurs/speculators. Comparing the four sets of returns the following characteristics emerge (see Tables 1 and 2).

Table 1: Analysis of returns. Cotton

1921-1929				2000-2011			
	Δs_t	Δf_t^1	Δf_t^3		Δs_t	Δf_t^1	Δf_t^3
Mean	–0.0002	–0.0002	–0.0002	Mean	0.0013	0.0013	0.0012
Std dev	0.0386	0.0389	0.0378	Std.dev.	0.0450	0.0475	0.0421
Skew	0.0102	–0.0874	–0.1569	Skew	0.1614	–0.2922	–0.3313
Kurt	4.666	4.521	5.070	Kurt	3.987	7.282	7.221
JB	54.1	45.7	85.5	JB	27.4	474.7	464.0
Auto (1)	**0.133**	**0.102**	**0.086**	Auto (1)	0.031	0.049	0.011
Auto (3)	**0.012**	0.008	0.017	Auto (3)	0.017	–0.003	–0.006
$Auto^2$ (1)	**0.260**	**0.253**	**0.189**	$Auto^2$ (1)	0.045	**0.109**	**0.212**
$Auto^2$ (3)	**0.229**	**0.202**	**0.114**	$Auto^2$ (3)	**0.083**	**0.013**	**0.089**

Notes: Skew: Skewness; Kurt: Kurtosis; JB: Jarque-Bera normality test; Auto (n): Ljung-Box test statistic for n-th order serial correlation; $Auto^2$ (n): Ljung-Box tests statistic for n-th order serial correlation of the squared time series; bold print indicates statistically significant test at the 5 per cent level.

First, in both time periods standard deviations are comparable and futures standard deviations decrease with maturity, which corroborates Samuelson's hypothesis (Samuelson 1965). Second, the JB tests statistics show that deviations from normality, due to both skewness and excess kurtosis, are larger for contemporary than for historical data. Third, heteroskedasticity looms large in all cases. We detect, however, a significant difference in the serial correlation of the returns. The historical data are inconsistent with the martingale hypothesis, which casts some doubts on the efficient dissemination of information on commodity prices in the 1920s as risk-free arbitrage opportunities seem to persist over time.

Table 2: Analysis of returns. Tin

1921-1929				2000-2011			
	Δs_t	Δf_t^1	Δf_t^3		Δs_t	Δf_t^1	Δf_t^3
Mean	–0.0004	–0.0005	–0.0004	Mean	0.0023	0.0022	0.0022
Std dev	0.0244	0.0236	0.0224	Std dev	0.0418	0.0417	0.0409
Skew	–0.6250	–0.4712	–0.4803	Skew	–0.7270	–0.7203	–0.7409
Kurt	5.469	4.576	4.774	Kurt	6.696	6.820	6.867
JB	149.3	65.8	79.4	JB	401.0	423.7	435.9
Auto (1)	**0.107**	**0.191**	**0.174**	Auto (1)	–0.074	–0.071	–0.060
Auto (3)	**0.015**	**0.046**	**0.039**	Auto (3)	0.048	0.038	0.050
Auto^2 (1)	**0.120**	**0.279**	**0.154**	Auto^2 (1)	**0.164**	**0.160**	**0.135**
Auto^2 (3)	**0.105**	**0.115**	**0.081**	Auto^2 (3)	**0.246**	**0.246**	**0.252**

Notes: Skew: Skewness; Kurt: Kurtosis; JB: Jarque-Bera normality test; Auto (n): Ljung-Box test statistic for n-th order serial correlation; Auto^2 (n): Ljung-Box tests statistic for n-th order serial correlation of the squared time series; bold print indicates statistically significant test at the 5 per cent level.

5. Analysis of the short run conditional mean and conditional variance dynamics

Since the information matrix of our system is block diagonal (see Equations [7] to [12] above) with respect to the conditional mean and conditional variance parameters, it is possible to adopt a two-step estimation approach with no reduction in efficiency (Pagan and Schwert 1990).

Table 3: Characteristics of the Vector Error Correction Models

Cotton				
1921-1929			2000-2011	
	Δs_t, Δf_t^1	Δs_t, Δf_t^3	Δs_t, Δf_t^1	Δs_t, Δf_t^3
VAR order	3	3	1	1
Cointegration characteristics	Restricted constant	No cointegration	Restricted Constant	Restricted Constant
Tin				
1921–1929			2000–2011	
	Δs_t, Δf_t^1	Δs_t, Δf_t^3	Δs_t, Δf_t^1	Δs_t, Δf_t^3
VAR order	3	1	2	2
Cointegration Characteristics	Restricted constant	Restricted Constant	Linear deterministic trend	Linear deterministic trend

The preliminary estimation of the VECM equations is performed using the FIML Johansen procedure. We cannot report, for evident lack of space, the estimates of the bivariate Vector Error Correction Models that have been used to parameterize the short run dynamics of the spot and futures price rates of change. The corresponding Johansen cointegration tests are set out in Appendix 2. The cointegration characteristics and the autoregressive order of the VECMs are summarized in Table 3. The order of the systems computed with historical data is consistently higher than the order of those obtained with contemporary data, corroborating the hypothesis, mentioned above, of a speedier diffusion of information in recent times along with more efficient arbitrage.

The conditional variability of the VECM residuals is then parameterized with the help of the bivariate CCC-GARCH model, as specified above. Tables 4 and 5 provide some relevant results.

Table 4: GARCH analysis. Cotton

1921-1929								
	ω	α	β	$\rho_{\Delta s,\Delta f}$	$E(v_t)=0$	$E(v^2_t)=1$	*JB*	*LLF*
Δs_t, Δf^1_t								
$h^2_{\Delta s,t}$	0.0002 (21.09)	0.362 (31.54)	0.575 (124.54)	0.957 (880.13)	–0.139	0.983	19.548 [0.00]	2364.2
$h^2_{\Delta f1,t}$	0.0002 (21.22)	0.303 (38.78)	0.604 (139.50)		–0.142	0.982	13.821 [0.00]	
Δs_t, Δf^3_t								
$h^2_{\Delta s,t}$	0.0004 (28.88)	0.258 (15.79)	0.495 (43.61)	0.929 (403.48)	–0.061	0.998	37.469 [0.00]	2259.9
$h^2_{\Delta f3,t}$	0.0002 (21.75)	0.214 (17.51)	0.617 (68.61)		–0.067	0.998	37.789 [0.00]	
2000-2011								
	ω	α	β	$\rho_{\Delta s,\Delta f}$	$E(v_t)=0$	$E(v^2_t)=1$	*JB*	*LLF*
Δs_t, Δf^1_t								
$h^2_{\Delta s,t}$	0.0003 (13.96)	0.105 (8.34)	0.755 (65.93)	0.038 (0.94)	0.036	1.000	20.016 [0.00]	2059.1
$h^2_{\Delta f1,t}$	0.0001 (9.19)	0.102 (12.65)	0.838 (109.49)		0.024	1.001	17.902 [0.00]	
Δs_t, Δf^3_t								
$h^2_{\Delta s,t}$	0.0001 (9.50)	0.090 (18.82)	0.844 (112.26)	0.028 (0.75)	0.035	1.000	8.609 [0.01]	2154.9
$h^2_{\Delta f3,t}$	0.0002 (11.22)	0.154 (11.66)	0.753 (64.77)		0.035	1.000	13.900 [0.00]	

Notes: *t*-ratios in parentheses and probability values in square brackets.

Table 5: GARCH analysis. Tin

1921-1929								
	ω	α	β	$\rho_{\Delta s,\Delta f}$	$E(\nu_t)=0$	$E(\nu^2_t)=1$	*JB*	*LLF*
Δs_t, Δf_t^1								
$h^2_{\Delta s,t}$	0.0002 (33.43)	0.120 (9.19)	0.401 (27.26)	0.943 (576.04)	0.002	1.002	39.901 [0.00]	2733.6
$h^2_{\Delta f1,t}$	0.0002 (31.93)	0.114 (9.29)	0.505 (40.75)		0.001	1.002	9.068 [0.01]	
Δs_t, Δf_t^3								
$h^2_{\Delta s,t}$	0.0003 (30.37)	0.156 (7.27)	0.263 (12.88)	0.903 (357.46)	0.003	1.002	93.762 [0.00]	2612.9
$h^2_{\Delta f3,t}$	0.0002 (33.12)	0.131 (8.98)	0.526 (40.29)		–0.0004	1.002	24.795 [0.00]	
2000-2011								
	ω	α	β	$\rho_{\Delta s,\Delta f}$	$E(\nu_t)=0$	$E(\nu^2_t)=1$	*JB*	*LLF*
Δs_t, Δf_t^1								
$h^2_{\Delta s,t}$	0.0002 (78.94)	0.056 (24.67)	0.808 (423.97)	0.990 (5565.4)	-0.003	1.001	338.407 [0.00]	3460.5
$h^2_{\Delta f1,t}$	0.0002 (71.18)	0.062 (21.42)	0.780 (307.09)		-0.002	1.001	379.677 [0.00]	
Δs_t, Δf_t^3								
$h^2_{\Delta s,t}$	0.0001 (3.33)	0.060 (3.84)	0.835 (24.04)	0.984 (335.42)	-0.004	1.002	323.919 [0.00]	3333.4
$h^2_{\Delta f3,t}$	0.0001 (3.07)	0.060 (3.67)	0.830 (19.94)		0.000	1.002	359.326 [0.00]	

Notes: *t*-ratios in parentheses and probability values in square brackets.

The usual misspecification tests suggest that the standardized residuals ν_t are well behaved and that the heteroskedasticity of the original return time series is captured by the model ($E(\nu_t)=0$, $E(\nu^2_t)=1$ and the corresponding Jarque-Bera (JB) statistics are systematically smaller).[8] Of great interest is the difference in persistence between the historical and contemporary estimates, with β (which measures volatility persistence)

[8] The conditional normality of the standardized residuals, however, is rejected by the Jarque-Bera test statistics, and the *t*-ratios reported in the tables are based on the quasi-maximum likelihood estimation procedure of Bollerslev and Wooldridge (1992).

significantly lower in the former case. Conversely coefficient α (which gauges the impact of innovations) is much larger with historical than with contemporary data.

These findings reflect the difference in the dissemination of information which, as already documented above, was less rapid and pervasive in the 1920s than in the present day. This implies that new information had a much larger impact on pricing and on volatility, the latter being, in turn, less affected by its own lagged value.

It is noteworthy, finally, that the GARCH structure of the contemporary cotton and tin returns shares the stylised characteristics of financial assets: a large persistence coefficient, a small coefficient of the innovations, their sum being close to one.

The theory of storage as developed by Working, is based, among other things, on the assumption of market information efficiency (Working 1949b).

As a consequence, the inefficiencies detected in the 1920s might impair the quality of our results. In other words, we expect to find a stronger corroboration of our a priori with contemporary rather than with historical data.

6. Correlation analysis

Correlation analysis provides some interesting results on the co-movement between conditional return volatility and net storage costs and allows to test the dynamics implied by Equation [6] above. If, in a given time period, inventories are significantly above their average value, we posit that: 1) net storage costs z_t exceed their average value (irrespective of the sign of their average) and 2) volatility $h^2_{\Delta s,t}$ is likely to be smaller than its average value. The covariance and the correlation are thus expected to be negative. This holds true also in the opposite case.[9]

Based on this argument, we interpret observed positive correlations as deviations from market fundamentals due to additional financial considerations, possibly related to risk factors and/or to inefficiencies in the pricing of information.[10] This corresponds to

[9] If inventories are significantly below their average value: 1) storage costs net of convenience yield will be lower than their average and 2) volatility will be above its average value.

[10] The empirical approach by Ng and Pirrong (1994), disregarding sign considerations, would interpret incorrectly this finding as a validation of the theory of storage. As is well known, (expected) returns are positively related with risk. Increases in volatility can thus be associated with positive basis changes which, in turn, induce a positive correlation between net storage costs and spot return volatility. Moreover, a stylised aspect of recent commodity price behaviour is the leading role of futures price movements which reflect changes in market outlook.

cases where increases in volatility are associated with falls in the convenience yield, i.e. to cases where the coefficient ϕ_1 of Equation [4] is negative, violating our *a priori*.[11]

Table 6 shows full sample Spearman and Pearson correlation between the conditional variances of the spot rates of return $h^2_{\Delta s,t}$ and net storage costs at time t.[12]

Table 6: Full sample correlation coefficients

Cotton			
	Maturity	Spearman	Pearson
1921-1929			
$h^2_{\Delta s,t}$	1	–0.1506 (–3.28)	–0.0390 (–0.84)
$h^2_{\Delta s,t}$	3	–0.1291 (–2.81)	0.0224 (0.48)
2000-2011			
$h^2_{\Delta s,t}$	1	0.0948 (2.35)	0.0107 (0.26)
$h^2_{\Delta s,t}$	3	–0.0782 (–1.93)	–0.4002 (–10.77)
Tin			
	Maturity	Spearman	Pearson
1921-1929			
$h^2_{\Delta s,t}$	1	0.0379 (0.82)	–0.0078 (–0.17)
$h^2_{\Delta s,t}$	3	0.0704 (1.52)	0.0774 (1.67)
2000-2011			
$h^2_{\Delta s,t}$	1	–0.2373 (–6.02)	–0.0681 (–1.68)
$h^2_{\Delta s,t}$	3	–0.4130 (–11.18)	–0.3309 (–8.64)

Note: *t*-ratios in parentheses.

[11] This claim is based on the stylized observation that low stocks entail high volatility, low storage costs and high convenience yield.

[12] We repeated the analysis replacing z_t with its one-period lagged values (estimates available upon request). No significant differences appear with respect to results discussed in the main text.

We include both one and three months spreads in the analysis in order to assess whether, as expected, the convenience yield rises with maturity (see Milonas and Henker 2001, among many others), focusing on results obtained with the Spearman procedure for the reasons mentioned in Section 3. The findings seem to corroborate the maturity effect.

In the case of cotton, the theory of storage is borne over both periods, with the exclusion of the contemporary one month contract. In the case of tin, the theory of storage does not seem to apply for historical data whilst contemporary data strongly support it. This might be partly explained by the observed improvement in the contemporary transmission of information.

In order to investigate the effects on the relations of interest of the large price gyrations (see Figures A1 to A4 of Appendix 1) and of the observed volatility clustering (see Tables 1 and 2), we perform the dynamic Spearman rolling correlation analysis as detailed by Equation [14] above, using three months futures contracts. The results, based on a 52 weeks window (m = 52), are reported in Figures 1 to 4 below.

Historical data exhibit an irregular pattern.[13] In the case of cotton (Figure 1), the theory of storage is strongly rejected only in 1926 and again in the early months of 1928. In both cases this appears to be connected with falling prices (see Figure A1), high volatility and excess stock accumulation (see Table A1). In the case of tin (Figure 2), in line with full sample results and with our conjecture about the likely blurring impact of market disfunctions, most rolling correlations are statistically not significant.

Contemporary cotton data (Figure 3) are less informative. The theory of storage is rejected for long bouts of time, especially in 2001, 2003 and from the second quarter of 2007 to 2010, mostly in connection with periods of price declines as in the case of historical data.[14] The theory of storage fares better for tin, especially from 2003 to 2005 and from the second half of 2007 to 2010. This reflects the highly efficient structure of the London Metal Exchange.

[13] For evident lack of space we have chosen to comment only four of the sixteen possible correlations as reported in Table 6 above.

[14] The significant and positive correlations of these periods might be explained by the financial risk consideration mentioned above.

Figure 1: Dynamic correlations for cotton, 1921-1929

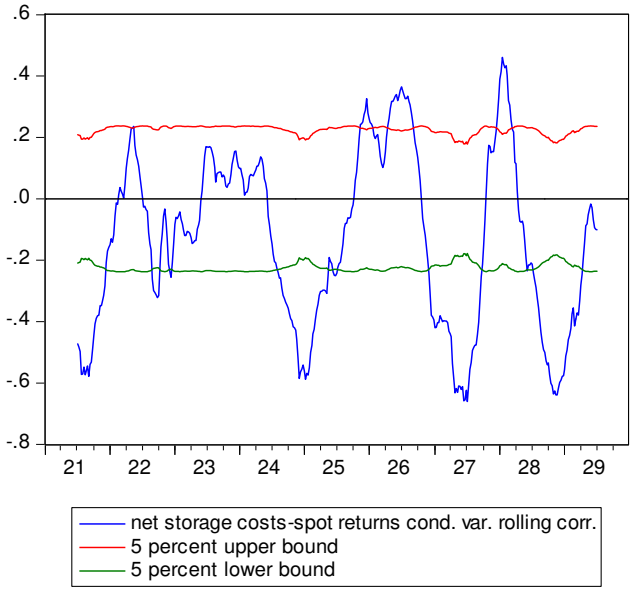


Figure 2: Dynamic correlations for tin, 1921-1929

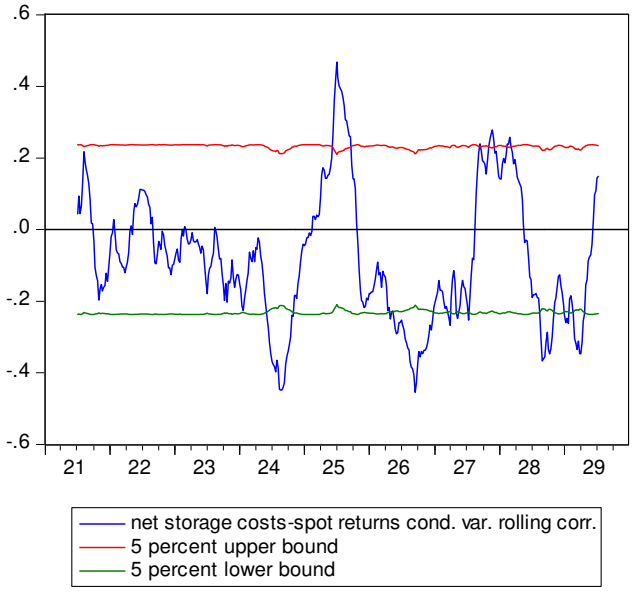


Figure 3: Dynamic correlations for cotton, 2000-2011

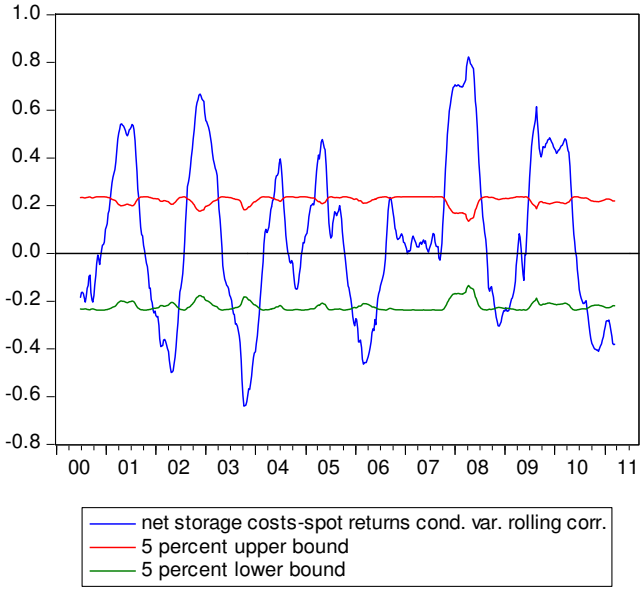
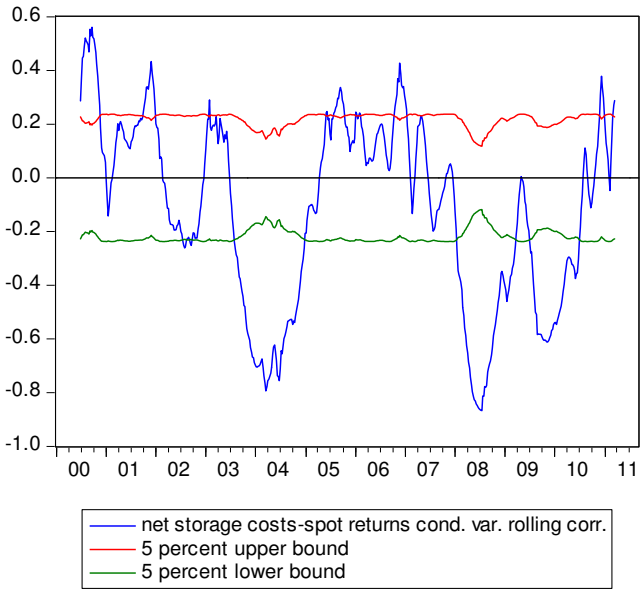


Figure 4: Dynamic correlations for tin, 2000-2011



7. Conclusions

In this paper we investigate the relationship between commodity price volatility and market fundamentals, proxied by the interest rate adjusted basis, comparing the 1920s with the present decade focusing on cotton and tin. In this context we develop an innovative test of the theory of storage grounded on recent strands of the literature. Our first result is to find that the series have widely different properties which reflect the speedier diffusion of information in the markets today. This emerges both from the analysis of the dynamics of returns and from the structure of the GARCH parameterization of their conditional volatilities. Our second finding is to show that, based on full sample correlations, the theory of storage seems to capture the dynamics of data with the exception of historical tin. Rolling correlations, however, qualify this result and suggest that recent inroads of financial agents in commodity markets might have affected the cotton market, giving prominence to financial risk factors.

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Appendix 1[+]

The *Special Memoranda on Stocks of Staple Commodities*, written by J.M. Keynes for the London and Cambridge Economic Service, provide essential information on the fundamental dynamics of commodity markets in the 1920s (Keynes 1923-30). Total stocks of American cotton declined as a result of falling crops and increasing consumption between 1921 and 1923. This contributed to rising prices and was followed by three years of very abundant crops which pushed prices down in spite of increasing consumption. Finally, the curtailment of crops and of stocks contributed to the partial recovery of prices between 1927 and 1929 (see Figure A1 and Table A1). In the case of tin, the upward trend in prices, observed between 1922 and 1926, was accompanied by consumption increasing at a more rapid pace than production and by diminishing stocks. The surge in production between 1927 and 1929 contributed to observed inversion in the price trend (see Figure A2 and Table A1). According to data reported in Table A2 both world production and consumption of cotton have been moving in step over the sample period, increasing from an average of 93.7 and 94.9 (million of 480 lb bales) respectively, between 2000 and 2003, to an average of 114.8 and 115.5, between 2004 and 2010. The sharp fall in stocks registered in 2009 and 2010, the result of falling production in 2008-2009 and of steady consumption, possibly coupled with a bout of speculative activity, accompanied the observed surge in prices at the end of the sample period (see Figure A3 and Table A2). Coming to tin, world production has ebbed and flowed over the sample period. Meanwhile, consumption has been systematically higher than production, with the sharpest imbalances observed between 2006 and 2008, and again at the end of the sample period. This, together with global financial factors, might contribute to explain the two peaks in prices observed over the sample period (see Figure A4 and Table A2).

[+] We would like to thank Carlo Cristiano, Nicolò Cavalli and Leonardo Maria Giuffrida for their help in collecting the data.

Figure A1: Cotton prices, 1921-1929

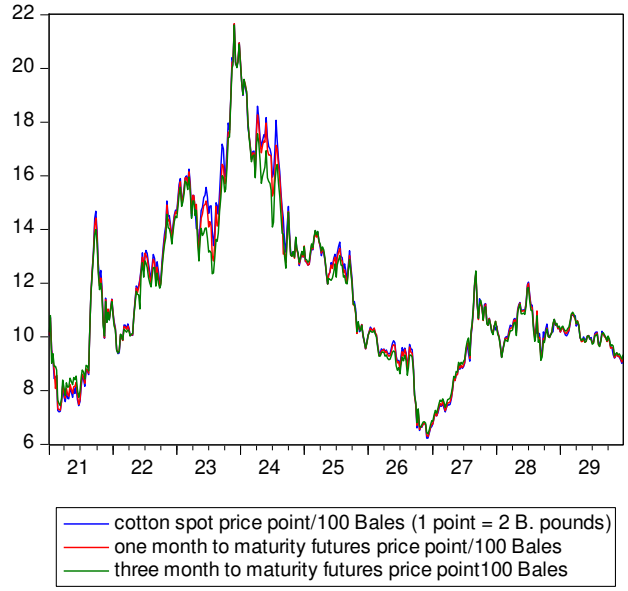


Figure A2: Tin prices, 1921-1929

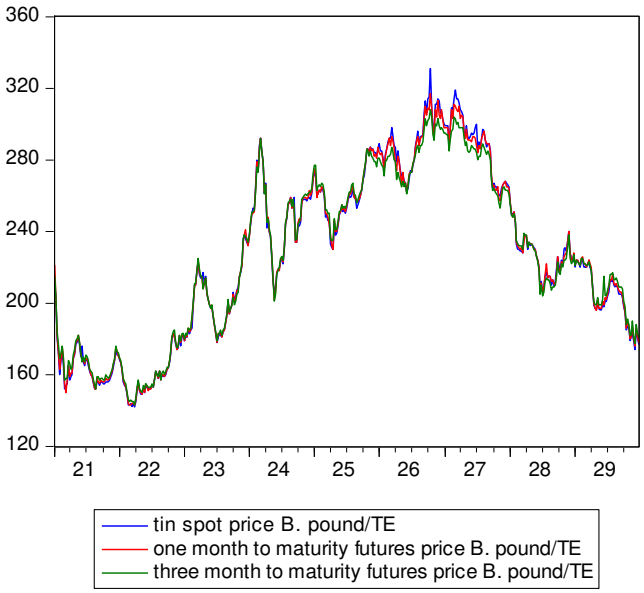


Figure A3: Cotton prices, 2000-2011

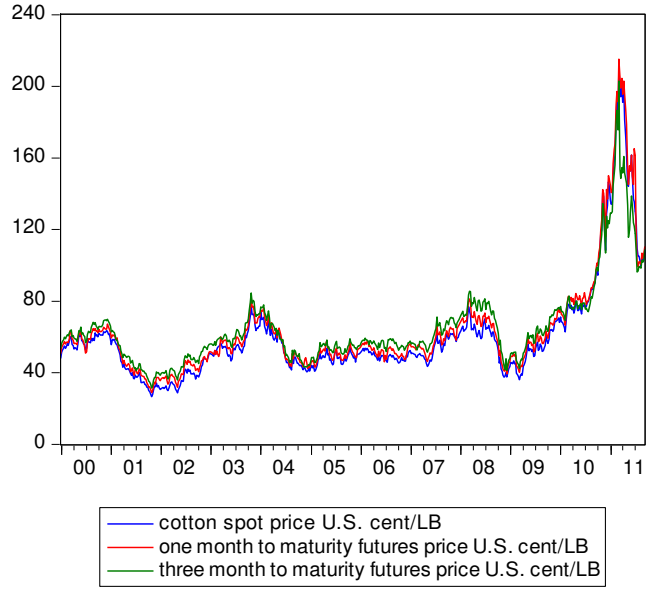


Figure A4: Tin prices, 2000-2011

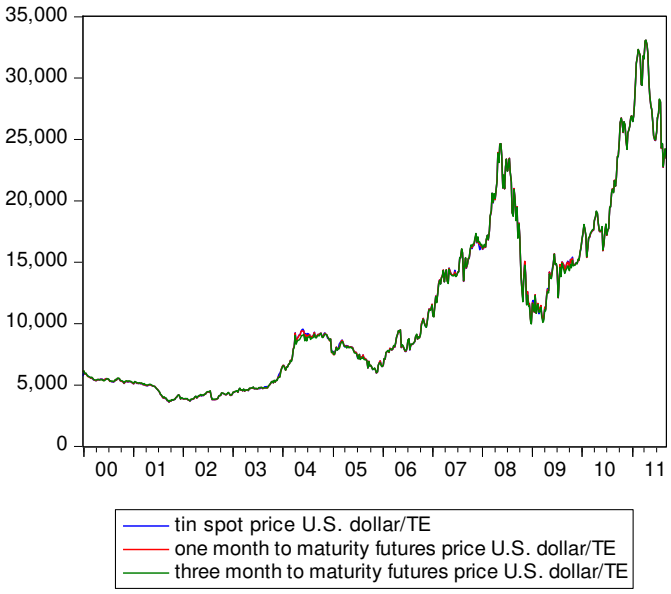


Table A1: Flows and stocks, 1921-1929

	Cotton[1],[2]			Tin[3],[4]		
	Production	Consumption	Stocks at end of season (1 Aug)	Production	Consumption	Stocks at end of year
1921	8,442	12,556	7,066	–	–	43,500
1922	9,738	12,666	3,081	130,000	132,000	45,400
1923	10,128	10,955	2,554	127,500	139,000	36,000
1924	13,639	13,256	3,141	140,000	144,500	32,000
1925	16,122	13,730	5,666	144,500	154,500	22,000
1926	17,977	15,780	7,637	143,000	146,500	18,500
1927	12,956	15,407	5,020	157,500	155,000	21,000
1928	14,478	15,076	4,417	175,000	167,500	29,000
1929	14,749	13,023	6,613	188,000	181,000	36,000

Notes: (1) American cotton 1,000 bales; (2) Source (Keynes 1923-30: 585); (3) Tons of 2,240 lb; (4) Source (Keynes 1923-30: 604).

Table A2: Flows and stocks, 2000-2011

	Cotton[1],[2]			Tin		
	Production	Consumption	Stocks at end of season (1 Aug)	Production[3]	Consumption[4]	Stocks at end of year
2000	89.1	90.8	49.4	277	–	–
2001	98.7	93.7	54.5	281	277.9	–
2002	91.0	97.6	47.6	241	275.8	–
2003	96.7	97.2	48.1	257	296.6	–
2004	121.6	107.9	60.6	287	318.2	–
2005	116.4	115.0	61.9	297	332.1	–
2006	121.8	122.8	62.3	296	355.8	–
2007	119.7	121.1	60.7	307	360.5	–
2008	107.1	107.3	60.5	273	338.4	–
2009	101.5	118.4	44.0	279	307.2	–
2010	115.5	116.1	43.4	261	–	–

Notes: (1) Source: http://www.fas.usda.gov/cotton/circular/2010/December/cotton_full12-10.pdf; (2) Millions of 480 lb bales, Total world; (3) Sources: United States Geological Survey Mineral Resource Program, British Geological survey, Millions of metric tons, Total world; (4) Source: www.itri.co.uk

Appendix 2

Table A3: Johansen cointegration tests: trace test statistics

Cotton					
	Hypothesized No. of Cointegration Relationships	Trace Statistic	5 per cent Critical Value	N. of lags in VAR	Deterministic Trend Assumption
1921-1929					
s_t, f_t^1	None at most 1	48.6949* 3.1434	20.2618 9.1645	3	Restricted constant
s_t, f_t^3	None at most 1	18.1090 3.2364	20.2618 9.1645	3	Restricted constant
2000-2011					
s_t, f_t^1	None at most 1	90.2499* 1.6098	20.2618 9.1645	1	Restricted constant
s_t, f_t^3	None at most 1	37.4795* 1.6191	20.2618 9.1645	1	Restricted constant
Tin					
	Hypothesized No. of Cointegration Relationships	Trace Statistic	5 per cent Critical Value	N. of lags in VAR	Deterministic Trend Assumption
1921-1929					
s_t, f_t^1	None at most 1	82.0492* 1.8175	20.2618 9.1645	3	Restricted constant
s_t, f_t^3	None at most 1	82.8599* 0.9883	20.2618 9.1645	1	Restricted constant
2000-2011					
s_t, f_t^1	None at most 1	182.2550* 0.04675	15.4947 3.8415	2	Linear deterministic trend
s_t, f_t^3	None at most 1	50.7235* 0.0573	15.4947 3.8415	2	Linear deterministic trend

Note: * denotes rejection of the null hypothesis at the 5 per cent level.

PART IV

From commodity markets regulation to the reform of the international monetary system

Keynes's commodity and currency plans for the post-war world

Luca Fantacci[*]

'The fluctuations in the prices of the principal raw materials which are produced and marketed in conditions of unrestricted competition are quite staggering', observed John Maynard Keynes at the eve of the Second World War. In fact, he calculated that, over the previous ten years, price fluctuations of four significant commodities, measured by the excess of the year's high over the year's low, had been 42 per cent for cotton, 61 per cent for lead, 70 per cent for wheat and 96 per cent for rubber, with an average price range for the four commodities of 67 per cent (Keynes 1938: 458-9). Over the twelve months up to May 2011, price variations measured by the same criterion for the same four commodities have been 173 per cent, 59 per cent, 125 per cent and 89 per cent respectively—with an average of 112 per cent, almost double than at Keynes's time.[1]

Indeed, in the wake of the current financial and economic crisis, commodity markets have undergone unprecedented oscillations (Figure 1). Such sharp fluctuations of prices represent a major element of uncertainty and distress for producers and consumers alike, particularly when they affect foodstuffs or raw materials on which the nutrition or livelihood of entire populations depend.

The problem, however, is not new. Markets for primary commodities are structurally exposed to dramatic imbalances: the alternation of abundance and shortage, with the price volatility which it entails, appears to be, over the centuries, a persistent feature of commodities as opposed to manufactures (Jacks et al. 2009: 13).

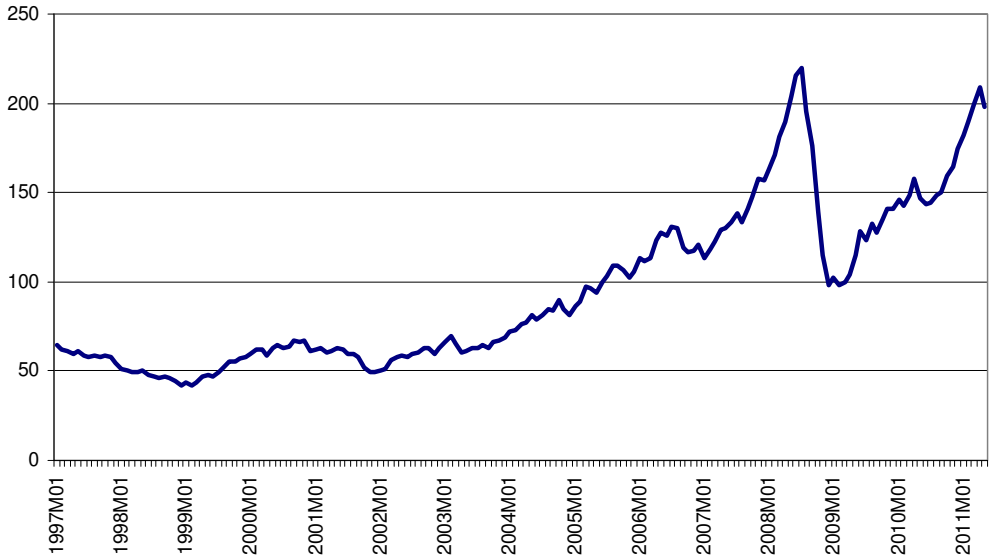
Throughout history, the evil consequences of agricultural cycles have been fought primarily by centralized redistribution. Already in ancient Greek and Roman cities, the supply and distribution of grain was entrusted to a public official, known as *praefectus annonae* from the time of Augustus till the end of the Empire. The office survived, under various names, through the Middle Ages and up to the early modern era. This vital function was performed by the management of public granaries that functioned as

[*] (Bocconi University, Milan).

[1] Calculations based on the monthly time series of the IMF Primary Commodity Prices (available online at: http://www.imf.org/external/np/res/commod/index.asp; accessed 19/07/2011).

buffer stocks, collecting grain in years of plenty to redistribute it in years of famine.

Figure 1: Index of primary commodity prices



Source: IMF, Index of market prices for fuel and non-fuel commodities (2005 = 100) (available online at: http://www.imf.org/external/np/res/commod/index.asp; accessed 19/07/2011).

The practice was abandoned only in the eighteenth and nineteenth centuries, with the gradual emergence and diffusion of the doctrine of free trade. Competitive commodity markets have undoubtedly produced benefits by reducing rents, promoting innovation, and enhancing productivity. On the other hand, however, they have failed to avoid the continuous alternation between over- and under-production.

Ideally in competitive markets the price mechanism should operate to adjust consumption and output in a manner to absorb temporary misalignments, by encouraging buyers and discouraging sellers when the price falls and the other way round when the price rises. At the same time the price mechanism should balance productive capacity to long-run demand and ensure production at the least possible cost, by throwing inefficient producers out of the market. That the actual functioning of price mechanism is different from the ideal model is obvious to any observer of the large fluctuations which affect the prices of primary commodities even over short periods of time, particularly in periods of economic uncertainty and financial instability.

It is quite obvious, then, that the issue should rise to the fore in the turbulent interwar period. What is perhaps less known is that, throughout those years, Keynes

devoted great attention to this problem, producing a series of contributions that have not yet received the attention they deserve. In fact, Keynes regarded commodity price oscillations as a factor of imbalance that played a major role in amplifying the trade cycle and aggravating the depression. And even with respect to this peculiar factor, he came to believe that neither unfettered competition nor centralized planning were capable of providing an adequate cure. He therefore suggested to resort, as an ideal middle way, to the institution of buffer stocks, i.e. stocks of foodstuffs and raw materials stored and managed by an international organization. During World War II, he proposed, on behalf of the Treasury, the establishment of an International Commodity Control along similar lines. Yet the proposal was not strongly endorsed even by the British government and soon disappeared from the agenda of post-war trade negotiations.

The purpose of this paper is to review the neglected contributions of Keynes concerning the functioning of commodity markets and the need to establish international buffer stocks. I start by tracing the writings that Keynes devoted to these issues over two decades (section 1). In the light of these texts, I try then to reconstruct Keynes's thought concerning the causes and consequences of commodity price fluctuations (2) and the possible solution represented by buffer stocks (3).[2] Finally, I shall analyse the discussions that followed Keynes's proposal, concentrating on three aspects: the relationship between buffer stocks and restrictions (4); the relevance of buffer stocks as an instrument to contrast the trade cycle (5); the finance of buffer stocks and the relationship between the Commodity Control and the Clearing Union (6).

1. Keynes's writings on buffer stocks

The stabilization of commodity prices is not commonly regarded as an important theme within Keynes's broader concern for macroeconomic stability. Yet, for two full decades, between 1923 and 1943, Keynes repeatedly addressed this issue, analysing the wide fluctuations of prices and stocks of staple goods, condemning the ensuing problems for both producers and consumers, investigating the causes of those fluctuations and the ineffectiveness of speculation in reducing them, and suggesting possible remedies, particularly in the form of buffer-stock schemes. The continuity of his interest for the matter and the originality of his contributions have been

[2] A previous draft of the first part of this paper appeared in Fantacci and Rosselli (2009).

appropriately emphasized by Sabbatini (1989) and by Dimand and Dimand (1990).[3] However, those authors overlook several relevant writings, both published and unpublished, which span over two decades and may help appreciate more fully the peculiarity of Keynes's explanation for commodity price fluctuations and the rationale for his buffer-stock proposals.[4] Here we shall attempt to provide a general review of all the various writings, both academic and political, that Keynes dedicated to this issue, together with the peculiar instances that occasioned them, in order to be able, in the next two sections, to analyse their content and the policy indications that they suggest.

As an economist, Keynes was particularly concerned with the stability of the economic system as a whole. However, his interest for the functioning of commodity markets began as a practitioner rather than as a theoretician (Fantacci, Marcuzzo and Sanfilippo 2010). Already in 1920, he started to invest in various commodities, ranging from metals to cotton to wheat. His first written contribution on the subject came only a few years later, in March 1923, with an article in *The Manchester Guardian Commercial*, *European Reconstruction Series*, entitled 'Some Aspects of Commodity Markets' (Keynes 1923a). At the same time, Keynes started to edit a series of *Special Memoranda on Stocks of Staple Commodities* for the London and Cambridge Economic Service. He produced altogether seven issues between April 1923 and September 1930, where he collected and commented periodical data on the volume of surplus stocks throughout the world, with a view to provide information 'of the utmost importance both to businessmen and to economists' (Keynes 1923b: 267).

From his practical acquaintance with commodity markets, both as an investor and as the editor of these enquiries, Keynes must have drawn quite early the impression that competitive markets did not provide adequate incentives for the private storage of raw materials that could have contributed to even out fluctuations in their production. In fact, only three years passed before he published a further article, this time discussing the scope for government intervention on commodity markets. It was written in reaction to a declaration by Herbert Hoover, then US Secretary of Commerce, who criticized all forms of output or price control. Keynes's contribution appeared in *The Nation and Athenaeum* in June 1926 with the title 'The Control of Raw Materials by Governments'

[3] Brief accounts of Keynes's interest for commodity policy, mainly focused on the schemes he developed during World War II, are provided also by Tonveronachi (1981) and by Kaldor (1983) in their reviews of vol. XXVII of the *Collected Writings*.

[4] We have already suggested (Fantacci, Marcuzzo, Rosselli and Sanfilippo 2012) the strong coherence between those proposals and the theoretical framework developed by Keynes, particularly in the *Treatise on Money* and in the *General Theory*.

(Keynes 1926), and aimed at underlining the peculiar merits of buffer-stock schemes, with respect to other commodity policies, in supplementing the lack of private storage.

Keynes stressed the chronic insufficiency of commodity stocks also in crucial passages of his major theoretical writings. Chapter 29 of the *Treatise on Money* indicates the obstacles to the accumulation of stocks of raw materials as a factor that aggravates the trade cycle. In a special section, he also discusses the role of forward markets, arguing that their existence does not help to reduce the fluctuations of commodity prices on spot markets. Chapter 17 of *The General Theory* discusses the advantages of money with respect to commodities as a means of storing wealth, and the depressing consequences on investments and employment.[5] These two texts provide a thorough analysis of the problem of the insufficient incentives to the private holding of stocks, but they do not mention buffer stocks as a possible solution.

It was in 1938 that Keynes turned to advocate 'The Policy of Government Storage of Foodstuffs and Raw Materials' in an article published under this title in the September issue of *The Economic Journal*. The occasion was provided by the Essential Commodities Reserve Bill being approved by the House of Commons in May with the purpose of building up strategic reserves in the prospect of war. Keynes argued that a similar policy would be equally desirable to 'tackle the problems of peace' (Keynes 1938: 463), and developed a detailed scheme to promote private storage of raw materials in public warehouses. Due to Keynes's health problems, the paper was read by Gerald Shove at the August meeting of Section F of the British Association for the Advancement of Science, and received positive comments both by participants and in several newspaper articles, 'nearly all expressing cautious agreement' (letter from Keynes to Shove, 23 August 1938, in JMK 30/PS/6/249-50).[6] Most prominently, Keynes's proposal was presented and discussed in the cover article of *The Economist* on August 20, 1938, significantly entitled 'The New Joseph', as it credited Keynes for having raised an issue that 'since the days of Joseph […] has hardly received the attention it deserves'. Keynes also sent copies to a number of authorities, hoping that his proposal might be put into practice, yet to no avail.[7]

The design and negotiation of post-war economic arrangements offered Keynes a further occasion. Already in the early drafts of the proposal for a Clearing Union, he

[5] Keynes's views in this respect will be more widely discussed in the next section.

[6] References beginning with JMK are to the documents preserved in the papers of John Maynard Keynes, Modern Archive, King's College, Cambridge UK.

[7] In particular, he sent copies of the paper to Oliver Stanley, President of the Board of Trade, to Sir Thomas Inskip, Minister for the Co-ordination of Defence, and to Henry Wallace, US Secretary of Agriculture, and author of a similar scheme for wheat, 'the ever-normal granary' (CWK XXI: 470-6).

envisaged a role for international buffer stocks (Keynes 1941: 39-40). Harrod encouraged him to work on a parallel scheme, entirely devoted to commodities (Harrod 1951: 531). Between January 1942 and February 1943, Keynes produced a plan for the international regulation of primary products, elaborating nine successive versions in the attempt to take account of major criticisms and to win broader support for the proposal.[8] The last draft was eventually endorsed by the British government, but it was even less successful than the Clearing Union within Anglo-American post-war planning. In fact, the buffer-stock plan not only was not adopted, but it was never put forward as a formal British proposal (Skidelsky 2000: 239). Perhaps even the commitment of Whitehall was not all so strong, if it is true, as Meade reports, that, when the buffer-stock plan was taken in front of the Cabinet, 'Churchill, who was preoccupied with aspects of the war itself, took little notice and was heard to ask afterwards "What's all this about Butter Scotch?"' (Williamson 1983: 132). However, let us proceed in order and, before describing Keynes's proposed solution to commodity price fluctuations and how it failed to be adopted, let us consider his explanation of their causes and effects.

2. Causes and consequences of commodity price fluctuations

Already in his first article, Keynes observed that commodity markets had been affected by wide price fluctuations, especially in the recent past, and advanced an explanation along the following lines: the post-war boom had raised prices, stimulating supply and retarding demand; however, this had failed to re-establish a parity between the two, since supply had continued to rise, overshooting demand; the resulting accumulation of abnormal stocks had then caused prices to decline; yet, in the absence of a timely adjustment of supply, prices had continued to fall even below costs of production; eventually, then, production was drastically reduced and, for certain commodities, almost suspended, greatly undershooting consumption; as a consequence, prices had started to rise abruptly and showed no evidence of slowing down, since production only gradually adjusted to increased demand (Keynes 1923a: 264). Keynes thus anticipated, with regard to the specific case of post-war commodity markets, the analysis that was later generalized and developed into a formal model, in particular by Kaldor, and that came to be known as the 'cobweb cycle'.[9]

[8] Title, date, archival and bibliographical reference for each draft are provided in Fantacci, Marcuzzo, Rosselli and Sanfilippo 2012, table 1. For a detailed and comprehensive analysis of the main differences between them, see Hirai 2008.

[9] The cobweb model was developed by Kaldor (1934), with explicit reference to Schultz (1930) and Ricci (1930), as an explanation for the fluctuation of agricultural prices under the assumption of adaptive

However, it was only in his 1926 article that Keynes not only described the cycle but also provided some hints as to its possible fundamental causes. In particular, he underlined two peculiar features of commodity markets, the concurrence of which is required to produce wide fluctuations of prices: 'an inability of the market to carry surplus stocks and an inability of the producers, acting separately, to restrict production quickly' (Keynes 1926: 549). In other terms, in Keynes's view, the chain of events described above crucially depends on the concomitance of two conditions, which typically characterize commodities: (i) the slow adjustment of production to variations in demand, *and* (ii) the impossibility to smoothen changes in supply by recurring to surplus stocks, i.e. by accumulating stocks when demand falls in order to draw from them when demand rises.

The first condition, the inability of producers to rapidly accommodate variations in demand, may follow from the high capital intensity or from the long duration of the productive process, as in the case of seasonal crops. Such a delay in the adjustment of production may have dramatic effects in terms of price fluctuations: e.g. an initial miscalculation on the part of producers resulting in overproduction (Q_0) will cause prices to fall, and, until the scale of production cannot be corrected, prices will continue to fall. When eventually output is curtailed, prices will have fallen to such a level that the quantity produced (Q_1) may well be insufficient to satisfy demand at that price level. Therefore, underproduction takes the place of overproduction without even passing from an intermediate position of balance between supply and demand. As a consequence, prices will rise to a level (P_2) which is excessive as the former price (P_1) was insufficient. 'In the long run this violent oscillation in price and in supply will be as injurious to the consumer as to the producer. Obviously the world will be better off on the whole if it can be prevented' (Keynes 1926: 548-9).[10]

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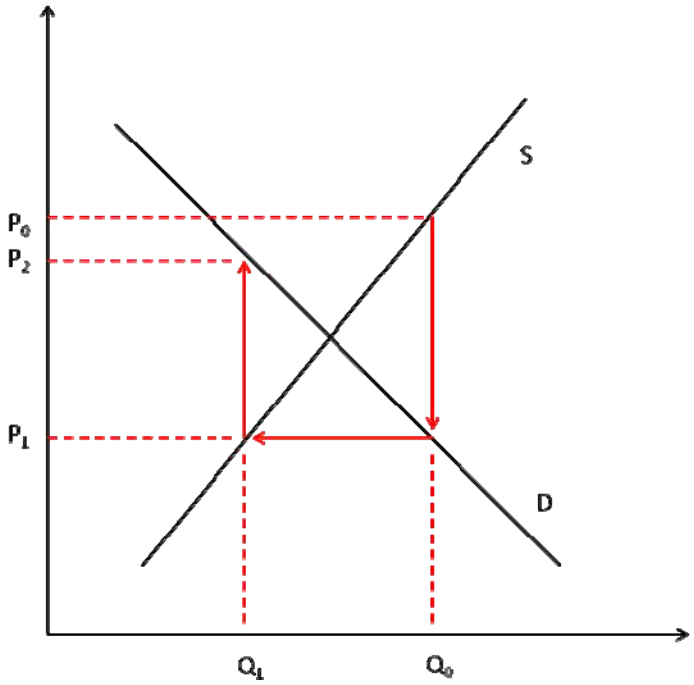
expectations of producers. Similar fluctuations had been described earlier in stock-breading, with the analysis of what is known as the 'pork cycle' by Hanau (1928).

[10] For the distinction between production adjustments in the short period and in the long period, Keynes is obviously indebted to Marshall, as observed by Skidelsky (2000: 234); the reference is, in particular, to the *Principles of Economics* (Marshall 1920: book V, chapter V, §§ 27-36).

Figure 2: The 'cobweb cycle'



It is worth noting that the problem is not a low elasticity, but rather a slow reactivity in the adjustment of supply to price variations: for most commodities, consumption is continuous, production is discrete. The decisive factor is the length of the production process, which retards adjustment of supply to changes in demand: the consequence is not simply that a long time is required, after a shock, for equilibrium between supply and demand to be re-established, but that prices may fluctuate widely without ever assuring equilibrium.[11]

The second crucial assumption for the existence of the cobweb effect is the lack of available stocks of commodities. If conspicuous stocks of commodities were held, they could serve as a buffer, expanding and diminishing to accommodate decreases and increases of demand, well before any possible variation in the scale of production. On the other hand, since for most commodities available stocks are very limited in proportion to the annual output, adjustments of supply depend entirely on variations of production, and hence are discontinuous, whereas prices react immediately to bring demand at a level with available supply.

[11] As also Kaldor (1934: 134) observes, the cobweb model only applies to cases 'where adjustments are completely discontinuous on the side of supply and instantaneous on the side of demand'. It is the discontinuity of changes in production that produce the cobweb effect, whereas the relative elasticity (or viscosity) of supply and demand determines whether the cycle converges (or diverges).

Due to the fact that stocks are normally fixed at quite low levels, any slight variation in either direction may be taken as an index to impending price instability: any increase (or decrease) in the volume of stocks for a specific commodity suggests an excess of production over consumption for that commodity (or vice versa), and hence a downward (or upward) pressure on its price. It is not surprising, then, that in those same years Keynes started compiling data on 'Stocks of Staple Commodities'. In the introduction to the first issue, Keynes indicated their fluctuations not merely as a symptom but as a factor of price volatility: 'movements in the volumes of stocks have an immense influence on the course of price changes' (Keynes 1923b: 267).

Now, given the wide fluctuations of commodity prices, one could think that they would provide sufficient scope for the speculative holding of stocks, in the expectation of price rises, and that in turn such speculation would contribute to smoothen price fluctuations. Why then is the market unable to carry adequate surplus stocks of commodities? In order to address this question, we must turn together with Keynes to the role of speculation on commodity markets, distinguishing operations on spot and on forward markets.

Speculation on spot markets involves the actual purchase and sale of a commodity, in view of profiting from price variations. The speculative holding of stocks is counter-cyclic if speculators buy on the downward slope of the cycle, anticipating a price rise, and sell on the upward slope, anticipating a price decline. As long as this occurs, Keynes admits that speculation may indeed have a stabilizing effect on commodity prices. However, in 1923, he observed that this was not in fact happening for various contingent reasons: political uncertainties deterred speculators from buying on declining prices, their financial position was weakened by the current slump, and they were perhaps induced by previous slumps to expect prices to decline below production costs before they started to rise again. For all these reasons, even if they knew that prices were below their equilibrium level, speculators waited to buy until 'famine' arose (1923a: 265; 1923b: 270).

In general, in order for speculators to be induced to purchase, not only must they have an expectation of an increase in prices, but the expected increase must be large enough to compensate them for the costs of carrying the commodities (deterioration, warehouse and insurance charges) and for the opportunity costs of not investing in other assets (Keynes 1926: 549). Moreover, one must consider the risk of further unexpected price declines, since the length of time for which the holding will be necessary and the

price at which the commodity will eventually be sold are both highly uncertain (Keynes 1930a: 121-4; Keynes 1938: 457).[12]

In the *Treatise*, Keynes considered also whether the existence of forward markets could serve to stabilize commodity prices on spot markets. His argument distinguishes two situations, with and without redundant stocks, but the answer is negative in both cases. Forward prices reflect expectations: indeed, Keynes suggested that they could be considered, on average, to be equal to expected spot prices, minus a risk premium reflecting the willingness of the seller to renounce part of the expected return on the sale in exchange for certainty. Therefore, forward prices would anticipate a convergence towards equilibrium, increasing in reaction to excess demand and decreasing in reaction to excess supply. However, Keynes argued that forward prices do not set either floors or ceilings to the fluctuations of spot prices. If there are no liquid stocks, suggesting a shortage of supply, forward prices will indeed rise, but spot prices may rise indefinitely above them as long as buyers are unwilling or unable to postpone their purchases. On the contrary, if there are liquid stocks, reflecting an excess supply, forward prices may indeed decline, but spot prices will have to fall below them, otherwise those carrying stocks would have an incentive to sell them spot and buy them back forward, rather than incurring in carrying costs (Keynes 1930: 128-9). Hence, spot prices will not be prevented from fluctuating widely even by the existence of forward markets.

The consequences of commodity price fluctuations are the aspect which is least discussed by Keynes in his writings on the subject. However, this was not because he regarded them as unimportant, but because he considered them self-evident. As he wrote in the introduction to the first extant draft of his proposal: 'The whole world is now conscious of the grave consequences of this defect in the international competitive system' (Keynes 1942: 113). In any case, several important implications may be drawn together from Keynes's scattered remarks, and grouped under two headings: the problems affecting specific (however broad) types of countries or agents, and those affecting the economic system as a whole.

The first order of problems bore the severest implications for producers and producing countries. As already observed, periodic slumps might cause prices of primary goods to fall below production costs, and hence 'below what could provide a reasonable standard of life' (Keynes 1943: 169). On the other hand, a sudden and

[12] 'Uncertainty', whatever the source, may reduce the incentive to hold stocks of commodities only insofar as there is an alternative form of holding wealth—namely money—which is assumed to be unaffected by such 'uncertainty'. This is why, as we shall discuss later, Keynes's analysis of commodity markets is closely related to his theory of liquidity preference, and in particular to the observations of Chapter 17 of the *General Theory*.

violent price change in the opposite direction would penalize buyers of staples, although these were normally in a better position to pass on a cost increase, by raising the prices of manufactures. Both buyers and sellers could, of course, hedge against unanticipated price fluctuations by entering into futures contracts and thus fixing their prices in advance. However, this would still imply a cost, in the form of a risk premium paid to speculators. Therefore, the cost of price fluctuations, or of hedging against them, could be burdensome, particularly for those countries that based great part of their economies on the production of specific commodities.

A second evil follows from price fluctuations as such, regardless of their direction, affecting not alternately different groups but indifferently the entire economy: short-term volatility of commodity prices, according to Keynes, is a major factor in aggravating the trade cycle. As Keynes argues in the *Treatise*, price fluctuations have a vicious circle effect on the holding of stocks: if price fluctuations are amplified by the exiguity of liquid stocks (which fail to compensate for lengthy adjustments of output), the holding of stocks is discouraged by price volatility (which increases the ensuing risks) (Keynes 1930a: 121-4). In turn, the lack of accumulation of liquid stocks implies that there is no support to demand (and prices) during the downturn, and that there is no immediate supply of working capital during the upturn (and hence that there is a strong upward pressure on prices) (Keynes 1930a: 116). Recovery is thus retarded and the trade cycle is amplified.

The argument is developed further in Chapter 17 of the *General Theory*, where the high carrying costs of commodities compared to money are shown to 'play an essential part' in the possibility of equilibrium with underemployment. The production of new capital assets, including stocks of commodities, is not profitable, and hence is interrupted, whenever their marginal efficiency falls short of the money rate of interest; and the latter is kept high by the fact that money, as an asset, entails higher liquidity and lower carrying-costs than commodities: 'what matters is the *difference* between the liquidity-premium and the carrying-costs; and in the case of most commodities, other than such assets as gold and silver and bank-notes, the carrying-costs are at least as high as the liquidity-premium' (Keynes 1936: 237). In other terms, demand and employment may be depressed by the fact that money is preferred to commodities, as a store of value, since the former yields a positive return (thanks to its liquidity) while the latter yield a negative return (due to their carrying-costs). The practical implications of this had been clear to Keynes already since his first interest for the functioning of commodity markets, when he observed that the combination of these two circumstances result in a conspicuous demand for credit by producers and traders, for the purpose of

carrying large stocks for a long time until they reach their final consumer. Therefore, a sharp rise in commodity prices increases the demand for credit, and thus raises its price, contributing to create the conditions for a crisis, by depressing together consumption and investments (Keynes 1923a: 256-9).

For all these reasons, Keynes was brought quite soon to believe that competitive markets were not capable of maintaining the stability of commodity prices which was required to assure a reliable provision of foodstuffs to consumers and to allow the planning of production, both by the producers and by the users of raw materials. Therefore, since he was convinced that this failure was caused by inadequate private motives towards the accumulation of commodities, he started to look for a possibility of supporting the storage of primary goods by means of public intervention and international coordination. And, from the beginning, he explicitly advocated this policy both as a means to reconcile the interests of consumers and producers and as a measure to prevent or at least dampen the trade cycle.

3. Keynes's buffer-stock proposals

The first time Keynes mentioned the need to contrast commodity price fluctuations by enhancing co-ordinated storage facilities was in his introduction to the *Memorandum on Stocks of Staple Commodities* published in June 1924: 'It seems as if relative prices could be kept a good deal steadier if the organisation for carrying stocks at a moderate cost were on a larger scale' (Keynes 1924: 315).

In 1926, Keynes made a further and more explicit endorsement of buffer stocks in his article for *The Nation and Athenaeum*, 'The Control of Raw Materials by Governments'. Replying to the indiscriminate condemnation of government controls recently made by Hoover, Keynes urged to distinguish policies aimed at defending monopolistic profits from those aimed at avoiding the evil effects of wide price fluctuations for both producers and consumers. Whereas the purpose of output restrictions was 'to make abnormal profits', the purpose of buffer stocks would be 'to avoid abnormal losses'. Keynes ascribed such losses to the 'inability of the market to carry surplus stocks' (Keynes 1926: 549) and hence advocated government intervention to 'supplement the deficient carrying power of the market' (ibid.: 550).[13]

[13] The same criticism against restriction schemes is repeated in the introduction to the *Memorandum on Stocks of Staple Commodities* of September 1930. Such schemes eventually proved ineffective in preventing a fall in prices, in the face of the general decline in demand associated to the world depression following the stock market crash (Keynes 1930b).

In 1938, Keynes could cite not only the negative examples of restriction policies (such as private monopolies, cartels, quotas, price agreements aimed at protecting the interests of producers of specific commodities), but also the recent adoption of policies that he considered more favourably: the accumulation of stocks by governments to use in time of war, or to protect producers or—what was even more desirable for Keynes—to smoothen fluctuations of demand and supply. As significant examples of the latter, Keynes mentioned Wallace's ever-normal granary and the Bank of Sweden program for the purchase of stocks of commodities as a part of their reserves (Keynes 1938: 462-3).

Keynes's proposal was to provide for government storage of private stocks. The latter would remain in the ownership of depositors, but would be stored at special conditions: they would be exempt from warehouse charges, or subject only to a nominal charge, and they would benefit from an advance by the government up to 90 per cent of the market price of the commodity delivered into storage, free of interest or at an interest equal to the rate on Treasury bills. The advantages would be to secure a supply of raw materials, not only to face the war but also to contrast the trade cycle, at a low cost for the government, and to facilitate the course of private trade, rather than interfering with it. The scheme could be regarded as a form of foreign investment, with the advantage of being situated at home. The acquisition of the commodities might cause an outflow of gold. However, this need not imply a reduction of reserves. Indeed, Keynes was inclined 'to regard the policy of holding liquid stocks of raw materials as a natural evolution of the policy of holding liquid stocks of gold outside the banking system' (Keynes 1938: 469).[14]

This last aspect of the proposal was rather an object of concern for Keynes's critics, since it might seriously undermine the prestige of gold and possibly lead to another gold scare. However, the main preoccupation seemed to be that the management of buffer stocks might be deviated from its noble purpose to the defence of more special interests, particularly those of producers, aimed at maintaining artificially high prices by the accumulation of stocks.[15] The same concern was shared by the article in *The Economist* (see section 1 above), which however expressed a substantial appreciation for Keynes's diagnosis of the problem. *The Economist* acknowledged that the competitive system

[14] Keynes's proposal is close, yet not identical, to the commodity reserve currency advocated, in those same years, in particular by Benjamin Graham (1937). In 1943-44, Keynes explicitly confirmed his sympathy for this type of proposal, yet questioned its political viability and certain aspects of its implementation in a debate with Benjamin Graham, Frank Graham and Friedrich Hayek in *The Economic Journal* (CWK XXVI: 30-40; see also Fantacci, Marcuzzo, Rosselli and Sanfilippo 2012).

[15] These observations, together with other minor criticisms related to more specific aspects of Keynes's proposal, were made at the seminar where the paper was read, and were reported to Keynes by Harrod in a letter dated 20 August 1938 (in Besomi 2003: 833-4).

puts a discount on the holding of commodities, and hence that stocks are chronically insufficient, except when markets are controlled by monopolies, which however contrast with the general interest. It also acknowledged that a greater volume of stocks would be important, both in war and in peace, especially for a country of consumers of staples such as Britain. However, the article expressed apprehension for the fact that 'some bureaucrat sitting in Whitehall or in the Thames House, should be equipped with the finance and the authority to become the world's supreme jobber' and that, instead of bringing demand and supply closer together, buffer stocks 'having originated as an attempt temporarily to increase demand, [may] remain as a permanent addition to supply'.

These criticisms may be better reviewed in the light of Keynes's later proposals for a buffer-stock scheme. In fact, in his 1938 paper, Keynes had only proposed that the government provide storage facilities for the accumulation of private stocks, and not that it should act as a jobber, buying and selling massive amounts of commodities in the name of the public (with the risk of acting, in fact, in the interest of powerful lobbies). It was only in the proposals of an International Commodity Control elaborated during the war that Keynes envisaged the actual purchase of commodities by a centralized authority and entered into the details of how the buffer-stock scheme should be managed.

Discussions about buffer stocks were resumed in British government circles during World War II, in relation with the problem of export surpluses. The blockade and the disruption of trade channels caused producing countries to experience difficulties in selling their entire production. In order to prop up the blockade and to support Dominions and Allies who suffered the greatest surpluses, Britain started purchasing and accumulating stocks of commodities, in view of using them for post-war relief.

An official sub-committee was set up for this purpose, with a budget of £200 million: on 9 November 1940 Sir Frederick Leith-Ross was appointed chairman and Keynes became Treasury representative (CWK XXVII: 3).

With respect to commodities, the war had the same effect as a severe trade cycle. The remedy adopted by Britain was anti-cyclical, since it consisted essentially in absorbing excess supply during the conflict in view of satisfying the excess demand that was to be expected after the end of the hostilities.

From his very first contributions to the debate, Keynes insisted that it was not just a matter of providing contingent relief in times of war. Commenting on the British attempt to involve the United States in a concerted approach to the problem of surpluses, he wrote to S. D. Waley at the Foreign Office on 25 November 1940:

> If we really want to get U.S.A. in, we ought to make it seem more interesting and of real significance to the world as a whole. As it is, we are simply appearing as suppliants pleading with them once more to give us financial assistance and to pull chestnuts out of the fire. On my view of the matter that is not at all a correct view of the situation. If this is anything at all it is a world scheme of the greatest possible post-war significance. (CWK XXVII: 5)[16]

One of Keynes's primary concerns, throughout the first stages of the debate on export surpluses, was to overcome the logic of subsidization to producers—'we must cease to be their milch cow', he wrote to his Treasury colleagues on 26 February 1941 (CWK XXVII: 15)—or at least to distinguish between subsidies, aimed at supporting producers, and price policies, aimed at damping short-term price fluctuations: 'The question how far subsidies should be disentangled from price policy is another issue. I should like to see them disentangled […] I am rather frightened by the atmosphere of comprehensive and open-hearted philanthropy which seems to prevail' (CWK XXVII: 17).

Another peculiarity of Keynes's approach to the problem of export surpluses was that he immediately associated it with the problem of US current account surpluses. In a letter dated 1 April 1941, he drew the attention of Leith-Ross on 'the outstanding economic problem of the post-war world—how the U.S.A. is to redress her unbalanced creditor position' (CWK XXVII: 19). The idea was that producers were having trouble selling their commodities, because the US were not spending or lending enough money to finance the purchase of those commodities. In other terms, if producers were accumulating surplus stocks of commodities, the US were accumulating surplus balances of money, by running systematic trade surpluses. As we shall see, Keynes's buffer stock scheme and the Clearing Union can be seen as an attempt to address the two issues jointly, as two specular aspects of the same problem.

During his stay in Washington for the negotiation of American loans to Britain, Keynes met Dean Acheson at the State Department to discuss the problem of export surpluses. Keynes sketched out three different approaches to the problem: to lend money to producing countries; to buy their commodities regardless of any actual need for them; to build a partnership between producers and consumers. The first two lines of conduct were regarded by Keynes as a form of temporary relief, whereas the third would have aimed at a permanent solution of the problem. The first two approaches were those adopted by the US and the UK respectively; the third was the one that Keynes recommended. To this end, he envisaged the establishment of buffer stocks,

[16] Keynes had made the same point in a letter to Leith-Ross on 23 November 1940 (CWK XXVII: 6).

along the lines of the 'ever-normal granary' proposed by Vice President Wallace when he was Secretary for Agriculture. As L. P. Thompson reports in his minutes of the meeting: 'Mr Keynes had in mind particularly (i) the problem of post-war relief and reconstruction in Europe and (ii) a permanent scheme of the 'ever-normal granary' type. […] Mr Keynes believed that there might be found in this surplus scheme the beginnings of a comprehensive scheme for equalising the prices of the main commodities throughout the world' (CWK XXVII: 22). Keynes insisted on this point in a letter that he wrote to Acheson on 4 June 1941 as a reminder of the 'main upshot' of the conversation:

> The international discussions relating to particular commodities […] might naturally lead on to a more ambitious plan for stabilising within reasonable limits the prices of leading internationally traded raw materials and even for some kind of international holding cartel which would apply the idea of the ever normal granary to the international field. (CWK XXVII: 24)

The schemes that were elaborated during the war, however, differed in two important respects from Keynes's proposal of 1938. First, they were intended from the outset as international facilities, not only offered to all the producing countries, but also managed collectively by an international body comprising producers and consumers.[17] Second, such organization was supposed not merely to store the commodities on behalf of participating countries, but to purchase them on its own account.

The accumulation of stocks of commodities along these lines appeared as a possible solution to the problem of surpluses. At the same time, it presented the further benefit of preparing to meet the excess demand that was to be expected after the war was over. In more general terms, quite apart from the contingent situations created by the war, buffer stocks came to be seen as a convenient way to smoothen the cycles that typically characterize the production of foodstuffs and raw materials even in times of peace, by absorbing excess output in periods of abundance in view of releasing the reserves to supplement inadequate supply in times of scarcity.

The function of buffer stocks, together with the meaning of their name, is explained quite clearly in a letter of 29 November 1941 from Sydney Caine, Financial Advisor to the Secretary of State for the Colonies, to Leith-Ross:

> comparatively small changes in production or consumption are needed to turn an 'unmanageable' surplus into a shortage or vice versa. This in turn emphasises the

[17] Whether the management should be restricted to the US and to the UK or entrusted to a truly international organization was a matter of discussion. In any case, it was never conceived as a unilateral initiative on the part of the British government.

> importance of stocks and their proper management *in acting as a buffer or cushion* to absorb the shocks of changes in either consumption or production […] the centre of interest is shifting more and more to this question of the proper management of stocks. (T 247/9: 2; emphasis added)[18]

This letter also testifies to the growing interest for buffer stock schemes as a way of managing commodity markets. Keynes was, of course, a major advocate, since he saw them as 'a middle course between unfettered competition under *laissez-faire* conditions and planned controls which try to freeze commerce into a fixed mould (CWK XXVII: 111). Accordingly, he spent all his efforts to win support for the idea within the British government, in view of proposing it within Anglo-American talks as a fundamental pillar of post-war planning. As he wrote to Caine on 3 December 1941: 'We ought to aim in my opinion at moving Americans to favour commodities schemes which are worked primarily, as you suggest, by control of stocks leaving normal market organisation as free as possible apart from that' (T 247/9: 4).

Competitive commodity markets had the benefit of allowing for free negotiations and of favouring low-cost producers and hence providing incentives for continuous increases in productivity, but were liable of producing wide price fluctuations in prices to the detriment of producers and consumers alike. As Caine wrote to Keynes on 22 January 1942: 'the real objection to the competitive system is that it is inherently opposed to security and stability. Equally, however, it has the great virtue that it is opposed to stability in the sense of stagnation'[19] (T 247/9: 11-12). Restriction schemes, on the other hand, had the advantage of stabilizing prices, but also the drawback of imposing high prices and discouraging innovation. Buffer stocks seemed capable of combining the virtues of stability and change, by avoiding price fluctuations in the short term, beyond predetermined limits, even while permitting corrections in the long term, in order to accommodate major shifts in technology and taste.

It was with this intention that, in those same days, Keynes followed Harrod's recommendation to dig up his proposal of 1938 and wrote the first draft of a plan for the establishment of an International Commodity Control, with the task of managing buffer stocks.

The Commodity Control was to define a basic price for each commodity. In the earlier drafts, Keynes suggested that the basic prices should be set according to the cost of production, ascertained by ordinary accounting methods. He later accepted the

[18] All archival references beginning with T refer to documents held at the National Archives, Kew, Richmond (UK).

[19] This sentence was included almost literally by Keynes in the fifth draft of the plan (Keynes 1942: 131).

suggestion of Sidney Caine of the Colonial Office to avoid establishing a general criterion ex ante for all commodities, but rather to aim at allowing the basic price to converge towards the marginal cost by a process of trial and error.[20] In the first extant draft, dated 14 April 1942 and circulated as an official Treasury memorandum, it was specified that the basic price could be adjusted up to ±5 per cent over the year. The adjustment would occur according to prescribed rules, but with ample margins of discretion for the managers of the scheme, who would have to reduce the basic price if stocks were increasing beyond a stipulated figure or at more than a stipulated rate, but would remain free to determine the degree of the correction and to deliberate changes at any time, in exceptional circumstances, even by more than 5 per cent (Keynes 1942: 117-8). The control would buy whenever the price fell 10 per cent below or sell whenever it rose 10 per cent above that price. Within these limits, free and competitive markets would handle the trade (Ibid.: 116).[21]

Both ranges were criticized by some for being too narrow and by others for being too wide. Keynes suggested that the percentages were to be intended as an indication and not as a bind for the managers of the scheme, who should be entitled to larger changes if required (CWK XXVII: 110). It was minimum prices, rather than maximum prices, that attracted most criticisms: they were regarded as a possible cause of overproduction, which would have made it necessary to complement buffer-stock schemes with output restrictions. The objection, already raised by *The Economist* against Keynes's 1938 proposal, was again voiced with respect to his 1942 scheme by J. W. F. Rowe of the Ministry of Economic Warfare.[22] Keynes replied that if, after falling 10 per cent below the basic price, the price of a commodity was still so high as to unduly encourage output of high-cost producers, this was a sign that a reduction of the basic price was needed: 'Under my plan the price would be reduced until it no longer had this stimulating effect. I should say that that, and not restriction, is the right remedy' (ibid.: 109). An excess supply was to be cured by a price reduction, rather than by an output restriction. This confirms Keynes's conviction that commodity policies should not hamper the play of market forces in the long run, but only avoid meaningless price fluctuations in the short run. The general purpose of his proposal was to favour stabilization in lieu of restriction (see also Keynes 1942: 113-4).

[20] See letter from Caine to Keynes, 22 January 1942 (Public Record Office, T 247/9/A5).

[21] These principles of management remained unaltered throughout the various versions. The precise quantitative limits varied, yet they were always indicated by Keynes explicitly just for the sake of illustration.

[22] Rowe had collaborated with Keynes at editing the *Special Memoranda on Stocks of Staple Commodities* for the London and Cambridge Economic Service, from 1925 to 1930.

The Bank of England criticized Keynes's buffer-stock proposals for being too *laissez-faire*, since they left room for private trading, and favoured instead 'a solution by way of international agreements on price and quantity'. Keynes's reply was resolute:

> International agreements, by which prices were absolutely fixed and quotas rigidly determined for every producer and perhaps for every consumer also, so as to freeze or stereotype world trade into a mould—what mould, calculated on what principles, I have no idea—seem to me terrifying, not least from our own special point of view. I suspect that this bias towards rigidly controlled state trading on Russian lines influences the general critical approach. The same bias seems to appear in [the Bank's] Deputy Governor's letter. In reply to [this] I can only plead guilty of aiming at a plan which does take a middle course between unfettered competition under *laissez-faire* conditions and planned controls which try to freeze commerce into a fixed mould. (CWK XXVII: 111)

It is not my intention here to describe in detail the provisions of the plan, nor to give account of how it was modified through its successive drafts. I shall concentrate, instead, on the aspects of the proposal that were at the same time more distinctive and more controversial, and that therefore have an important part both in the discussions that accompanied the redrafting and in the eventual demise of the plan. As anticipated, I shall focus on three points: the relationship between buffer stocks and restrictions; the relevance of buffer stocks as an instrument to contrast the trade cycle; the finance of buffer stocks and the relationship between the Commodity Control and the Clearing Union.[23]

4. Buffer stocks and restriction schemes

That Keynes's plan did not provide sufficient scope for the regulation of production was the main criticism that it had to face throughout the entire period of its elaboration. Already a month after the circulation of the first draft, Rowe advocated a combination of buffer stocks and regulation: 'it appears to be more practicable to attack the problem of price instability by a combination of output regulation and the holding of buffer stocks'.[24] Rowe suggested that stabilization should concern not only prices of products, but also incomes of producers and proposed a system of quotas as a means to that end (T 247/9: 47). More generally, Rowe raised the issue of income distribution among producers facing a different structure of costs and yields as a further objective of

[23] A previous draft of the last part of this paper was included in Deambrogio and Fantacci (2011).
[24] Letter to Keynes of 20 February 1942 (T 247/9: 44).

commodity policy, apart from the need to balance the interests of producers against those of consumers.

However, the strongest supporter of restriction was Sir Donald Fergusson at the Ministry of Agriculture. Keynes described Fergusson's ideas as 'barmy',[25] he suggested that they would imply a 'Russian' (scilicet Soviet) form of planning and he accused them of being impracticable: 'The complete international planning of every agricultural crop, and indeed the output of every other primary product throughout the world, is all very well. But it is hard to think of anything less likely to be acceptable'.[26] Keynes was not overstating for the sake of irony. Fergusson was indeed in favour of Soviet-style centralized planning on a global scale, as the following passage shows:

> in my view it is not only desirable, but a matter of urgent practical necessity, to prepare schemes for the regulation of production and export quotas to come into operation immediately after the war. There has got to be an expansion of the production of most foodstuffs and, in my view, it is of vital importance that this expansion should be properly planned. Each country must know what its agricultural policy and production programme for a period of years is to be and this, in turn, must mean regulation of production and quotas. (T 247/10: 56)

Fergusson was not equally fair in representing Keynes's position. Whether he did it intentionally or not, he failed to appreciate the true nature of Keynes's plan, for instance when he questioned its viability on the ground 'that hardly any country will be willing to delegate to an international economic body control over their food supplies or agricultural policies' (T 247/10: 57). The object of the Commodity Control (despite what the somewhat unfortunate name might suggest) was not to interfere with national commodity policies, but to provide a reliable international framework for them to be conceived and implemented. Keynes conceded that international restriction may sometimes be inevitable. Yet he did not think of it as the rule, but rather as the exception (T 247/9: 57).[27]

Not only: the establishment of buffer stocks, and the greater ease afforded by them to international trade, might even make restrictions unnecessary, by removing the

[25] The expression is used in an undated letter to Sir Wilfred Eady that Moggridge dates January 1943 (CWK XXVII: 166). It is quite probable, however, that the letter was written at least six months earlier, since already on 30 June 1942 Fergusson wrote to Keynes: 'I do not suppose that there is any possibility of reconciling what you describe as my "barmy" views with your thesis' (T 247/9: 148).

[26] Letter from J. M. Keynes to D. Fergusson, 14 January 1943 (T 247/10: 69-70).

[27] Following this idea, in the last draft of the proposal Keynes included a section on 'The quota regulation of exports', where he conceded that 'for an obstinate disequilibrium between supply and demand at a price level reasonably tolerable to producers […] we might have to fall back on the organised restriction of production' (CWK XXVII: 186-7).

causes that had traditionally induced countries to adopt them. As Harrod observed, in the decade before the war, 'there was great uncertainty about the future of prices; great increases could not be ruled out; the Treasury plan is designed to remove such anxieties. For all these reasons some of the extravagancies of protection may fall away of their own without the necessity of our imposing "regulation"' (T 247/9: 101). The advantages of the buffer stock plan in terms of price stabilization could even be used deliberately as a counterpart to induce producers to renounce restrictions. Producers have an interest in keeping prices high, but they also have an interest in keeping prices stable. The ability of the buffer stock scheme to secure the latter could be offered as a counterpart for a concession on the former: 'Its offer of stability may be regarded as a reasonable quid pro quo to producers for resting content with a lower price than they would otherwise have aimed at' (T 247/10: 16, emphasis in the original).[28]

In fact, if only the question is considered without prejudice, there is no need to oppose restrictions to buffer stocks as if they were incompatible alternatives. As Harrod observed, they serve two different purposes. 'The buffer-stock plan and restriction schemes are directed to different problems, namely oscillation and chronic over-production' (T 247/9: 115). 'The former is directed against oscillation of prices and producer incomes due to seasonal, climatic and cyclical causes; the latter are directed against a persistent tendency to over-production in the face of inadequate demand' (T 247/9: 110).

5. Buffer stocks as a way of contrasting cyclical crises

This leads us to the second point, which was, not by chance, the object of particular concern on the part of Harrod: the importance of buffer stocks as an instrument to contrast the trade cycle. It was Harrod, in fact, who urged Keynes to mention this explicitly in his proposal, as he had done in the article of 1938. In a 'Note on Sir Donald Fergusson's Note' dated 19 July 1942, Keynes goes so far as to state that the main goal of the buffer stock scheme is to dampen the trade cycle: 'It is devised primarily as a major instrument for dealing with the trade cycle in the decade after the "transitional" period' (T 247/10: 15).

Yet, according to Harrod, buffer stocks were not merely one way, but *the best way* to smoothen the trade cycle:

[28] Of course, producers could reach the same goal of stabilizing sales prices by stipulating contracts on commodity futures markets, where 'for the sake of certainty, the producer, not unnaturally, is prepared to accept a somewhat lower price in advance than what, on the balance of probability, he thinks the price is likely to be when the time comes' (Keynes 1923a: 261).

> I come more and more in my own mind to lay stress on this as the supreme mode of curing the trade cycle. The amounts involved in public works are so disappointingly small and the period of gestation from the trade cycle point of view so troublesomely long. The buffer stock on the other hand could create hundreds of millions of pounds of investment almost overnight, smoothly, automatically, without fuss or flurry, consultation or debate, exactly as the circumstances require. (T 247/9: 7)

What does Harrod mean, when he says that the buffer stock creates investment? Surplus stocks of commodities do not yield a substantial revenue. In fact, they have a negative yield, measured by the carrying costs.[29] And this is precisely the reason why private individuals have no incentive to hoard commodities, but prefer to keep their wealth in other, more profitable forms. Yet, even if it is an international organization that takes up the task of accumulating commodities, it is difficult to view it as an investment. Indeed, hoarded commodities are neither consumed nor invested, but represent a net subtraction to output. So at what condition can Harrod describe them as investments? At the condition that they are purchased with new money, possibly created by the Clearing Union.

6. Money and commodities: Commod Control and the Clearing Union

Harrod not only insists on the need to contrast the trade cycle, but he sees in the joint operation of buffer stocks and the Clearing Union an unrivalled means to that purpose. As he writes on 2 June 1942:

> It is a further beauty of the scheme that by centralizing the finance of the various commodity controls (and, if possible, linking it to that of the Clearing Union) it secures that purchases during the depression release what is for the time being 'new' money, not money withdrawn from incomes elsewhere. This infusion of new money is precisely what is needed , to combat depression, and I do not believe that any other practical way has ever been suggested of securing an infusion of like magnitude. (T 247/9: 100)

According to Harrod, the Clearing Union would favour the operation of a buffer stock scheme not only by providing funding, but also by encouraging free trade, and hence by discouraging protectionist measures and output restrictions: in the pre-war decade 'foreign payments were becoming progressively more difficult, and nations were bound as a precautionary measure to secure that as many of the bare essentials as

[29] As argued by Keynes in Chapter17 of the *General Theory* (Keynes 1936: 237).

possible were produced at home; we hope that the Clearing Union, or whatever arrangement serves in its stead, will produce easement here' (T 247/9: 101).

Harrod regards the Commodity Control and the Clearing Union as complementary institutions, together with the third pillar of the post-war economic order envisaged by Keynes, namely the International Investment Board:

> The remedies at their disposal are interactive and mutually dependent. For example the nature, intensity and timing of the currency adjustments which the Union may require of an excess debit country must depend on the plans, if any, of the Investment Board in regard to that country. The plans of the Investment Board will depend on its diagnosis of the current phase of the Trade Cycle. They will also depend on the amount of purchasing power likely to be released (or absorbed) by the Commodity Control, and conversely. It is clearly important that the measures devised by each of the three institutions should be part of a common concerted policy. (T 247/9: 31)

Together with the Clearing Union and the Investment Board, the Commod Control would have been an instrument of monetary policy. The buffer stocks would have acted as a sort of official reserve: any increase would have implied a monetary expansion and any decrease a contraction.

The use of the Clearing Union to finance buffer stocks met the fierce opposition of the Bank of England. In a letter from Catterns, at the Bank, to Hopkins, at the Treasury, dated 2 April 1942, the argument reads as follows:

> We feel strongly that a scheme of this sort should not be closely associated with any international clearing scheme. It would be difficult enough in any event for an international currency organisation to gain in its initial years enough confidence to persuade the principal countries to entrust it with the bulk of their reserves; but it would have little or no chance of doing so if there were any risk of its assets being locked up in commodities. (T 247/9: 75-6)

The Bank fails to acknowledge that a clearing scheme does not involve the accumulation of 'reserves' by surplus countries, but merely of credits with the clearing centre. Within a clearing scheme, the 'assets' of creditor countries correspond to the 'liabilities' of the debtors. Now, it might seem vexing to oblige a country with a positive trade balance to keep that balance in the form of a credit with the clearing centre. However, this way of reasoning is gravely misleading, since those credits only arise thanks to the existence of the clearing centre: just as the latter affords debtor countries the facility of spending money that they have not previously earned, symmetrically it allows creditor countries to sell goods or services that they would not have otherwise been able to sell. In other words, the 'reserves' kept with the clearing centre only exist

thanks to the clearing centre itself. That said, if part of those assets are backed by commodities, it should be all the better for the safety of the creditors. Understandably, Keynes suggests Hopkins to reply along the following lines:

> I find the objection […] concerning the relationship of the proposals to the Clearing Union very perplexing. If some part of the liabilities of the Clearing Union were covered by assets in the shape of stocks of commodities, instead of by mere book debts from potentially insolvent countries, I should have supposed that this would improve the security of those with credit balances. I do not follow why a creditor of the Clearing Union should feel more comfortable if his balance is covered by an unsecured liability of Brazil than if it is covered by bags of coffee. (T 247/9: 78)

Further objections to funding buffer stocks by issuing money come from Crick of the Ministry of Food. Crick proposes to assign financing of the buffer stocks to governments rather than monetary authorities, so as to avoid 'unnecessary and possibly undesirable extension of functions' of the latter (T 247/9: 85). Why does Keynes propose that the funding come from monetary authorities? Perhaps because he wants to associate the accumulation of commodity stocks with monetary expansion. This, indeed, is what Keynes argues in the brief notes on Crick's comments that he sends to Hopkins on 12 May 1942:

> one considerable advantage of the proposed scheme would be lost, namely, that those governments which are financially weaker would suffer no reduction of their foreign purchasing power when demand falls off. The fact that international purchasing power is stabilised is an important aspect of the present proposal, which would be lost if the scheme is divorced from the Clearing Union. (T 247/9: 86)

The Treasury plan does not envisage the financing of buffer stocks by governments, but it does admit the possibility of making recourse to loans on international markets. Here the criticisms come from Waley, at the Treasury. In a letter to Keynes dated 11 January 1943, Waley raises two objections to the possibility of funding the buffer stocks by issuing bonds.

First, the service of the loan would have to rely on one or both of the following sources: (i) profits from the management of the buffer stocks, which may not be substantial, or even positive, especially during years of depression and hence of strong commodity accumulation by the Control; (ii) revenues from export duties of the participating countries, which in turn are only usable to service an international commodity loan if they are exacted in a freely convertible currency. Now, both of these sources may eventually prove to be lacking.

Second, the loan may not have adequate guarantees for several reasons: either the Commodity Control does not initially have an established record of credit repayment and cannot be called to respond of its liabilities in front of any obvious international court; or the US could be unwilling to offer guarantee for the loan; or the UK could be incapable of offering adequate guarantee, since it will quite probably be a debtor and not a creditor country in the immediate post-war period.

For all these reasons, Waley is ultimately in favour of financing the buffer stocks through the issue of new money by the Clearing Union, despite certain drawbacks:

> On the whole I am inclined to prefer the original idea that finance should be found by the Clearing Union despite the fact that a Central banking Institution ought not in principle to tie itself up in long term finance, and the more general danger that the Clearing Union idea may come to grief if it is regarded as an international philanthropist with a bottomless pocket. (T 247/10: 52-3)

However, the supposed drawbacks indicated by Waley may be somewhat misleading. By financing the buffer stocks, the Clearing Union would indeed be providing long-term loans (or, rather, loans of indefinite length). And, yet, these long-term loans would not be like that type of bank credit, which is usually intended to finance fixed capital investments with little guarantees and uncertain outcome. On the contrary, they would be more akin to mortgages, i.e. long-term credits with a strong guarantee, where the main risk is connected with a possible depreciation of the asset that serves as pledge. In this respect, despite the different maturity, mortgages are more similar to short-term commercial credit than to long-term investment loans. Mortgages are traditionally regarded as the most secure form of assets for a bank, and have been occasionally used also by central banks as a form of backing for the issue of banknotes. The loans of the Clearing Union to the Commodity Control would ultimately be guaranteed by the commodities purchased and stored in the buffer stocks.

Far from being precarious, this guarantee could be regarded as safe as the gold reserves used by the soundest central banks to back their currencies. Indeed, it would be even safer, since gold reserves are traditionally fractional, whereas the commodities stored within the buffer stocks would cover the full value of the money issued to finance their purchase (minus the possible depreciation on the market, up to the limit of the oscillation allowed for by the Commodity Control, and hence not more than 10 per cent). Moreover, commodities represent a far more diversified investment compared to gold reserves.

As far as the second point raised by Waley is concerned, one could ask: is it more ‘philanthropical’ to purchase the commodities that a people has produced with the sweat

of the forehead or to purchase the bonds that a government has issued with a stroke of the pen? Is the issue of money more liable of being inflationary, i.e. 'bottomless', in the former case or in the latter?

In his rejoinder to Sir Waley's perplexities concerning the financing of buffer stocks, Keynes confirms that even he considers preferable that it should come from the Clearing Union. However, he also insists that it should not be difficult to find willing lenders if the Commodity Control were to make recourse to loans from international markets. In fact, there seems to be scope for a substantial demand for bonds backed by commodities and remunerated at a variable rate, dependent on the price of the underlying basket of commodities.

> For many years past there has been talk of setting up some sort of tabular standard based on the price of a composite commodity, in terms of which long-period loans might be negotiated, so that in each year interest and capital would be paid in terms of money at rates fluctuating in accordance with changes in the money value of the tabular standard adopted. It has been generally agreed that there was something to be said for a loan of that kind, in certain contexts at any rate, and that it might be attractive to some investors as offering an insurance against a depreciation in the value of money. It seems to me that, if the Buffer Stock Control was raising a loan, here was an ideal opportunity for experimenting along these lines. For, unlike most borrowers, the security against their loan […] would go up and down in the same proportion as their liability when there were changes in the value of money. (T 247/10: 53-4)

The last remark reflects Keynes's concern to avoid the 'competitive struggle for liquidity' that arises, as he described in 1932, when the value of liabilities is fixed in terms of money, whereas the value of assets fluctuates on the market, and hence the expectation of decreasing prices is sufficient to effect sales and hence actual falls in prices in a deflationary spiral (Keynes 1932: 39).

For all these reasons, the Clearing Union is seen as the natural source of funding for the buffer stocks. However, this does not warrant to infer that the establishment of the Clearing Union is a necessary condition for the establishment of the Commodity Control, and hence that the failure of the former automatically entailed the renunciation to the latter. In fact, Keynes also envisaged that buffer stocks may be financed from some other source of purchasing power, in the case that the Clearing Union should not be established: 'Purchases are to be financed through the Clearing Union, or, if that does not come into existence, by central banks working in co-operation' (T 247/10: 17).

Once again, a more concrete and detailed proposal comes from Harrod, who suggests that, even if the Clearing Union is not established, the financing of the buffer

stocks could be entrusted to a mutual credit scheme functioning along the same principles:

> Hopkins raises the important question whether the whole scheme depends on the Clearing Union. Broadly I think it does. But supposing we are driven to some arrangement for mutual credit (and we must at least have that if there is to be any Anglo-American co-operation at all), then I think the finance of the buffer stock could be modelled accordingly. […] My suggestion would mean applying the same principle mutatis mutandis that you have if there is a Clearing Union, namely the use of the de facto surpluses on the balance of payments. (T 247/9: 132-3)

Despite the many oppositions, the ninth and final version of the plan was endorsed by the Committee on Reconstruction Problems, and printed on 6 February 1943.[30] One month later, its proposals were submitted to the War Cabinet by the Chairman of the Committee, William Allen Jowitt, 'with a recommendation for their acceptance as a basis for discussion with the United States of America and other members of the United Nations'.[31] In the meantime, a United Nations Conference on Food and Agriculture had been summoned for the following May at Hot Springs, Virginia. On 8 April, the Cabinet asked that the buffer-stock plan be considered by a Committee concerned with commercial policy, and on 30 April, on behalf of the Committee, the Chancellor Kingsley Wood recommended to the government 'that our delegation to the Food Conference […] should be given discretion to hand a copy of the plan […] to the State Department'.[32] Lionel Robbins, who was a member of the British delegation to the conference, reports in his diaries how they decided not to lay out the plan, but simply to present its main principles, since they wanted to promote a general buffer-stock authority covering all commodities, and not a separate governing body for agricultural products, which would have been quite certainly dominated by the interests of the producers (Howson and Moggridge 1990: 13 and 42). Eventually, the conference set the basis for a purely consultative body, FAO, and one of the main tasks with which it was entrusted was to study the place that buffer stocks ought to have in international commodity arrangements (United Nations 1943).

[30] 'The International Regulation of Primary Products', Public Record Office, CAB 66/34/34/47: 6-23. All references beginning with CAB refer to documents held at the National Archives, Kew, Richmond, UK.
[31] 'Memorandum by the Minister without portfolio', Public Record Office, CAB 66/34/34/47: 4.
[32] 'Memorandum by the Chancellor of the Exchequer', Public Record Office, CAB 66/36/35: 3.

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Richard Kahn and the stabilization of commodity prices

Annalisa Rosselli[*]

1. Introduction

Although Richard Kahn played an important role in spreading the Keynesian ideas which permeate his works—Keynes referred to him as 'his favourite pupil'—nowadays he is an author little studied and nearly forgotten, perhaps because his fame was overshadowed by the towering figures and strong personalities of his Cambridge colleagues Joan Robinson and Nicholas Kaldor. Thus, it is not surprising that an important part of his activity in the 1950s—both as a researcher and as a policy advisor—is practically unknown. His interest in the stabilization of the prices of primary commodities has been investigated only once (Palma 1994) and the archive material related to it has been only partially, and sometimes inaccurately, examined. Yet, this is interesting material which sheds light both on Keynes's influence upon Kahn and on Kahn's originality. The Keynesian influence is apparent in Kahn's choice of an International Buffer Stock as the instrument for avoiding 'excessive' price fluctuations, following a proposal put forward by Keynes himself in the pre-war period (Keynes 1938). Kahn's originality is expressed in the way he proposes that the International Buffer Stock should be managed, which differs both from Keynes's approach and from the views prevailing in those years about the working of buffer stocks.

It is the aim of this paper to fill this gap in our knowledge of Kahn's activity and post-war approach to economic policy in the spirit of Keynes, with his emphasis on correcting market failures without destroying market mechanisms.

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2. The unfinished book

The fluctuations in the prices of primary products, their causes and consequences and how best to curb them, are the subject of a book which kept Kahn busy for nearly nine years, but which he never published. In his book Kahn advocates the creation of buffer stocks managed, for each commodity in question, by an 'authority, endowed with suitable financial backing, which can buy the commodity when, in some sense or other, it is cheap—or appears to be so—, can hold it in stock, and can then sell from its stock when the price appears to be relatively high' (RFK 2/12/2/1).[1]

The book was never completed. Related notes and correspondence, half-finished and completed chapters make up five bulky files which are preserved among Kahn's papers. However, it is not easy to reconstruct the story of the book's composition. There remain large gaps that the available documentation does not enable us to fill. In particular, the causes which deterred Kahn from publication are not clear, so that we do not know whether Kahn was dissatisfied with the final result or publication was prevented by other contingent reasons.

There is evidence that Kahn began working on the book in 1952, on the invitation of the FAO, the Food and Agricultural Organization of the United Nations. The FAO's interest in the subject is not surprising. Ever since the Hot Springs conference convened in 1943 to promote its establishment, the FAO had always been concerned with the problem of stabilizing the prices of primary products[2] whose fluctuations deeply affected the income of producers in less developed countries and impaired food provision. However, being more the creation of the 'minds of experts and scientists' than the result of governmental action (Marchisio and Di Blase 1991: 4), the FAO was devoid of political power. Two of its most ambitious projects in the post-war years—the establishment of a World Food Board which would have de facto managed the world agricultural economy and an International Commodity Clearing House—had failed because of opposition from the United States, which feared having to bear most of the cost, and from the United Kingdom, which had no interest in price stability and did not want to lose the opportunity of importing raw materials at very low prices. In the early 1950s the FAO had relinquished any project of international governance of food provision and had confined its function to that of advising governments and providing non-binding recommendations. The FAO began to follow closely those few agreements which were being implemented on a commodity-by-commodity basis. There was rising

[1] References beginning with RFK are to the documents preserved in Richard Kahn's papers, Modern Archive, King's College, Cambridge UK.
[2] See United Nations 1943, Resolution XXV.

concern that the aim of these agreements was more the allocation of the surplus production and the defence of the interests of producers than the stabilization of prices and the prevention of shortages of agricultural commodities. For this reason the FAO economics department, together with one of its most competent and active officers, Gerda Blau,[3] chief of the Commodities Branch, decided to direct its research towards bringing price stabilization and production efficiency back to the forefront.

Blau went to visit Kahn in Cambridge in January 1952 and persuaded him to write a report on the issue. They agreed that the results of his work would appear as 'a printed monograph, published under your [Kahn's] name'.[4] The deadline was Spring 1952, but Kahn asked for (and obtained) a postponement to July 1952, the first of many more to come. Intense academic activity and, above all, the usual perfectionism which always made him feel dissatisfied with what he had written delayed Kahn's work. Gerda Blau gave Kahn all the support she could: she provided him with the help of a research assistant who sent him relevant material and two lists of bibliographical references;[5] she accepted the fastidious financial and travel arrangements proposed by Kahn; and, above all, she never ceased to encourage him. However, it was only in the Summer of 1953 that the first four chapters of the 11 listed in the provisional table of contents were sent to Rome.[6] In this early version, following the indications of Gerda Blau, Kahn criticizes the interpretation of buffer-stock schemes as a means to increase the income of producers, to the detriment of efficiency in the allocation of resources. Although concerned with the disastrous effects of the low price of primary products on the income of developing countries, Kahn was very careful in keeping the main goal of buffer stocks—to reduce price fluctuations in the interest of consumers and producers alike—distinct from the more ambitious 'ancillary objectives' of the fight against poverty, or the building up of stocks to relieve famine, which required other means.

The four chapters were welcomed enthusiastically by Gerda Blau. She wrote, in a very optimistic mood:

> this paper, with some adjustment in presentation, may well turn out one of the best things that happened to FAO in a long time. […] What I particularly like about it, is the fact that for once it will certainly not be a study which merely appeals to FAO's

[3] Gerda Blau entered FAO in 1947 and worked for it until her retirement. She took her Ph.D. at the London School of Economics and began her career by publishing an important article on futures trading in the *Review of Economic Studies* in 1944. She was a good friend of many Cambridge economists, including Joan Robinson, Nicholas Kaldor, Ruth Cohen, who were frequently her guests in Rome while working as consultants for FAO.

[4] Letter from Gerda Blau to Richard Kahn, 27 February 1952, FAO Archives, File 0_53_1_A_1.

[5] Letters of 4 February and 28 March 1952 in RFK 2/13.

[6] The titles of the 4 chapters are: 3) Ancillary objectives; 4) The technique of Buffer Stocks; 5) Buffer Stocks and the balance of payments 6) The problem of separate markets (RFK 2/12/3).

> standard clientele of Ministries of Agriculture and producers' organizations who have been repeating their half-baked and ineffective exhortations re[garding] buffer stocks for so many years, but that instead its arguments will surely penetrate to, and rouse, some of the hard core of the much more hard-boiled and influential people in Treasuries and Boards of Trade.[7]

The same enthusiasm was shared by another economist who had just joined the FAO staff—H. Tyszynsky, an expert in commodities.[8] He prepared a summary of Kahn's paper[9] and confirmed that it was a 'most valuable contribution to our study of international commodity policy'.

However, one year passed before two new chapters were sent to FAO headquarters. Added to the revised and rearranged old material, they make up what Kahn named—on the cover of the file—'the long version', in 5 chapters and an Appendix (RFK 2/12/2/1-163). This time they got a rather chilly reception in Rome, perhaps also as a result of the changed international political climate which is well expressed by the final report of the Commission on Foreign trade appointed by the US government (the so-called Randall Commission). In 1954, the report had concluded that all international commodity agreements had to be opposed in principle, since they were against the freedom of individual initiative, and in practice, since they were often a means to receive aid from the United States.[10] Gerda Blau confessed to having many doubts about the practical workability of buffer stocks as described in Kahn's paper. Moreover, she disagreed with the choice made by Kahn of presenting his scheme as opposed mainly to *laissez-faire* policies. She found that the approach to fight was not liberalism but nationalism and protectionism, however disguised. The real support for *laissez-faire* policies was indeed inexistent at the time. The surpluses of commodities which were being generated were not the result of slack demand but of 'very powerful national policies' which gave incentives to producers out of touch with the world trade situation. As long as these national policies were adhered to, 'what can a buffer stock do about their effect?'[11] The scheme had other points she could not agree with, in particular the discretion left to the managers of the Buffer Stock (see below), but she still hoped to publish the book under the auspices of FAO as a contribution to the debate. She asked for a summary of the main arguments, in order to sound out the reactions of her superiors, whom she expected to share her doubts.

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[7] Letter from Gerda Blau to Richard Kahn, 25 July 1953, FAO Archive.
[8] He published two articles on international commodity agreements in *Economica* in 1949 and 1950.
[9] Letter from Tyszynski to Gerda Blau, 14th October 1953, FAO Archive.
[10] However, in spite of its recommendations of lowering US tariffs, the report was the result of a compromise with the protectionist wing of the Congress.
[11] Letter from Gerda Blau to Richard Kahn, 6 July 1954, FAO Archive.

More favourable comments came from Tyszynsky, perhaps less concerned than Gerda Blau with the political implications of the proposal. He grasped the novelty of the scheme suggested. In his opinion the strongest argument in favour of buffer stocks, provided by Kahn and largely overlooked in previous discussions of the subject, was that this scheme not only stabilized prices, better than the market forces of speculation could ever do, but simultaneously allowed for a more efficient organization of productive resources as a result of a greater feeling of stability of the producers.[12]

We do not know whether Kahn ever prepared the summary Gerda Blau had asked for. There is a gap in our reconstruction, since the relevant files in the FAO archives for the years 1954-59 appear to be missing.[13] We know that the project was resumed in 1956, when Kahn came back to Cambridge after spending one year in Geneva where he had been working for the United Nations, although by then the chances of publishing the results with the support of FAO were almost nil. In fact, Gerda Blau wrote to Kahn to send her any new material in an envelope marked 'personal', 'the buffer stock study having become a slightly delicate subject here—but I managed, hopefully, to save some printing money for it'.[14] With or without FAO support, Kahn continued his research and, in the Easter and Michaelmas terms of 1956, he devoted his course on Economics of Government Intervention to the buffer stocks.

Joan Robinson played an active part at this stage of the work, well beyond her usual role of preferred interlocutor for Kahn. The notes for one of his lectures are in her handwriting (RFK2/14/91-95) and she assembled cuttings from the 'long version' to provide the 'short version' of the book (RFK 2/12/1/4-101) which, however, was submitted in Kahn's name.[15] Although even this third version, by Kahn's admission, still needed 'a certain amount of patching up' (RFK2/13/57), it is the only one which resembles a complete book and was probably sent to Rome in the Summer 1957.

The revisions were never made, though, and we do not know the reason, whether opposition inside FAO which made the publication unlikely or lack of time on Kahn's part, or both. The changed political climate of the Cold War, so different from the enthusiasm for international cooperation of the last years of the war, is acknowledged by Robinson-Kahn in the Introduction, where it is admitted that the buffer-stock concept

[12] Letters from Tyszynski to Gerda Blau, FAO Archive, 30 September and 30 October 1954 FAO Archive.

[13] The files with the correspondence of Gerda Blau in the years 1954-59 have not been preserved in the FAO archives and after 1953 no mention of Kahn's work can be found in the minutes of the meetings of the Branch Directors of the FAO Economics Department.

[14] Letter from Gerda Blau to Richard Kahn, 5 November 1956 (RFK2/13/56).

[15] Contrary to what is said in Palma (1994: 117), the 'short version' was written *after* the 'long' one. This new version of the book is in five chapters: Introduction, The case for buffer stocks, Some objections, Ancillary objectives, The technique of buffer stocks.

'flourished in the idealist climate of opinion of those times' (RFK2/12/1/4). We know that after this last attempt Kahn, perhaps discouraged, diverted his efforts to individual commodity schemes, to which he applied the ideas he had developed. In 1959 he worked for the International Sugar Council and wrote them a report arguing that a buffer-stock scheme was superior to export quotas and particularly appropriate for sugar, whose price broadly fluctuated over the year. Around the same time, he finished a 'pretty lengthy' report on the International Tin Agreement (see section 4 below).

Gerda Blau was kept informed and appreciated Kahn's new policy proposals. In the meanwhile international relations between the two blocks showed signs of improvement and in the climate of *détente* prevailing also within FAO at the end of 1959, she felt free to invite Kahn to go back to their old project. She wrote in December:

> Have you decided anything about publishing? I know we have relinquished our rights but if you'd still like to consider it, we probably would be interested again in publishing. There is renewed interest and it seems that the 'Camp David'[16] spirit would make it possible for the Americans no longer to look upon an FAO publication on buffer stocks as part of the Cold War against them. (RFK 13/13/25-6)

This time Kahn's reply to Gerda Blau—on December 23rd, 1959—left no hope: '[…] I am afraid that the idea that I had of getting something on buffer stocks really ready for publication about now has had to be abandoned' (RFK 13/13/28).

The manuscript was finally abandoned and Kahn's research on buffer stocks remains today one of the less known parts of his activity.[17]

3. Kahn's case for buffer stocks: the analysis of price volatility

Kahn's case for buffer stocks can be organized around three questions:

a. Why do prices fluctuate so much?
b. Why speculation does not succeed in stabilizing prices? In particular, which is the role of future markets?
c. Which are the consequences for consumers and producers?

We will analyse them in turn.

[16] In September 1959 Dwight Eisenhower and Nikita Khrushchev met at Camp David marking a new phase in the relationship between the USA and the USSR.

[17] Palma 1994 is the only study of the manuscript, although largely incomplete. No mention of the research on buffer stocks is found in Pasinetti (1987). However, in the interview that Kahn gave to Cristina Marcuzzo in 1987 (Marcuzzo 1988: 47), Kahn said that he was intrigued by the subject and mentions his activity for FAO.

a. The starting point for Kahn, as for Keynes, is a failure of the market for primary products to reach a stable equilibrium. Kahn investigates the reasons for this market failure in terms of traditional partial equilibrium analysis, to which he adds a strong Keynesian flavour. Partial equilibrium analysis focuses on the elasticities of demand and supply. If the elasticities are low, chance changes in demand or supply have a strong impact on the price of the commodity, since large variations in price are necessary to eliminate even small gaps between demand and supply. Demand for primary commodities is inelastic, since they usually make only a small fraction of the total cost of the final goods, in whose production they enter as inputs. Great changes in the price of the primary commodity have a small effect on the final price that consumers pay and, therefore, on their demand.[18] Likewise, producers are highly specialized and highly competitive. They cannot move their resources to other productions and this makes the supply very inelastic. Therefore, they are obliged to take any price they can fetch. Changes in demand and price fail to stimulate or reduce output in a significant manner.

So far it is standard partial equilibrium analysis, which can explain short-term fluctuations of prices. When expectations are brought into the picture, it can be understood why these fluctuations do not iron themselves out over time and Kahn's analysis comes closer to that of Keynes. Expectations of producers, who face the uncertainty of the future, are exceedingly affected by the current situation. When prices are high, there is a tendency to be too optimistic and to overinvest . When they are low, financial pressure and lack of incentives induce producers to neglect maintenance, so that when the demand recovers, the re-establishment of an adequate productive capacity is slow and costly. The outcome is a permanent mismatch between supply and demand: it is the 'cob-web' effect that Keynes had already described in his 1938 article (Keynes 1938).

b. Private speculation could help, since speculators perform the useful task of carrying the commodities from times of abundance, when they are bought at low prices, to times of scarcity, when they can be sold at higher prices. Kahn compares their function to that of transport facilities. However, as Keynes had already remarked, high storage costs, together with risk and borrowing costs which increase as the stocks are being piled up, prevent profit-seeking speculators from providing their service—a public good—in the amount which is necessary to stabilize prices, above all when it is most needed in times of depression.

[18] This reference to demand rigidity was not present in Keynes.

The stabilizing action of professional speculation is hampered by three obstacles: finance; need for diversification; short-sightedness.

> Finance is a serious limitation on any speculative market. Indeed the normal situation at a time when the price of a commodity has fallen heavily is how to avoid bankruptcy for some of those who are involved in the crash rather than how to take advantage of an excellent opportunity of making money. The professionals at those times are usually harassed rather than ebullient. (RFK2/12/2/29)

The funds of the professional speculators are borrowed and limited, which increases the natural reluctance at putting all the eggs into one basket. 'As an expert speculator takes up a bigger and bigger position in a commodity because of its apparent cheapness, he becomes more and more cautious in placing reliance on his bullish expectations' (RFK2/12/2/30).

While a public agency can take a long-term view and buy when the price begins to fall, professional speculators knows that the price can decrease even further, under the pressure of large stocks which are being liquidated because 'held in unsteady hands'. Before the speculators decide to step into action, the drop in prices can be dramatic. The existence of futures markets does not help in times of falling prices, since they enhance 'bearish' sentiments.

c. Against the consequences of price instability—periodic disasters for producers, serious shortages for consumers—Kahn is convinced that the creation of buffer-stocks is beneficiary. Unlike restriction schemes and quotas, which benefit producers at the expense of consumers, 'the essence of the buffer-stock scheme is that it benefits producers and consumers alike, and increases efficiency all round' (RFK2/12/1/26). It benefits producers, because, in terms of utility, gains and losses of equal amount do not compensate each other, and producers are better-off if they are saved from catastrophic losses even if they have to give up wind-fall profits when prices are rising. It benefits consumers, and efficiency in general, because average costs are lower when prices are stable and productive capacity is adequate to long-term demand, since high-cost producers, who can survive only if prices are exceptionally high, must leave the market.

Kahn's arguments are clearly presented in a solid theoretical framework, but they are not entirely new. We find more or less the same arguments in some of the publications that Kahn read to prepare for his book (Porter 1950: 95-97; Staley 1937: 92-99). What is new and highly controversial, is his idea of how the buffer-stock administrators should manage it. In Kahn's view, they should be endowed with large discretionary powers and not have to follow any pre-determinate rule. All plans for

buffer stocks required fixing floor and ceiling prices. On the contrary, discretion, which was to be used in exceptional cases in Keynes's plan, becomes the rule for the behaviour of the managers of the buffer-stock in Kahn's proposal.

3. The technique of buffer-stock operation in principle

In fact, Kahn's scheme differs from other buffer-stock schemes[19] in two major respects:

a) it must 'aim at solvency in the ordinary commercial sense' (RFK2/12/1/66);
b) it is run by an authority who fixes a buying and selling price, but who is free to intervene in the market at any price in the range between them and who is also free to modify the 'ceiling' and 'floor' prices without obeying to any automatic rule.

Other schemes, in Kahn's opinion, implicitly assume that the buffer-stock authority, that Kahn refers to simply as 'Buffer Stock', can rely on unlimited resources, which is extremely unlikely. Yet, it is only in this case that the trade-off between the two objectives of the Buffer Stock—the aim of price stability and that of its own survival in the long-run—can be easily reconciled. Kahn is well aware that the Buffer Stock operates in a market where there are not only individual agents who buy the commodity for their own use, but also other speculators who gain from temporary deviations of the price from its long-term trend. When the price gets close to the 'floor', speculators who are convinced that the Buffer Stock will defend the 'floor', will be only happy to accumulate stocks of the commodity, relying on the hope of future increases in price and on the expectations that the Buffer Stock will prevent them from incurring into any loss. By doing so and buying the commodity, they will help to stop the fall of its price. In this case, the Buffer Stock performs its task of price stabilization very effectively, but it contributes to the profits of the speculators without any gain for itself to cover its own costs.

If traders are convinced instead that the 'floor' will be lowered, they will unload all their stocks to the Buffer Stock which can go on buying only if its funds are unlimited. If they are not and eventually the 'floor' is lowered to avoid heavy losses, the Buffer Stock will have saved itself at the cost of price instability since 'there is little security in a floor which drops under your feet whenever you try to set foot on it' (RFK2/12/1/69). How then to reconcile limited resources and price stability?

[19] See the authors quoted above and also Harrod (1948) and St Clare Grondona (1958).

Kahn suggests the introduction of dealing prices which, if they must be fixed, are set wide apart, just to indicate to the market what are possible extremes of price fluctuations. Their determination is neither a political matter of bargaining between producers and consumers, nor does it follow an automatic rule, but it depends on the judgment of the experts who are selected to manage the buffer stock.

When the price moves in a range between the dealing prices, the authority must not be passive, but must operate by trying to reconcile moderate opportunities for gain, which require risk-taking and some price instability, with its main objective of reducing price fluctuations in the general interest. Kahn proposes the policy of 'coming in late as a buyer and selling in good time' (RFK2/12/1/72). If the authority waits to buy, it may hope for a spontaneous re-adjustment of the market, and save its resources for when they are most necessary as the price threatens to fall dramatically. If it sells as soon as the price begins to rise, it can make a small profit besides slowing down the rise of the price.[20]

There is no doubt on which side Kahn stands between discretion and automatic rules binding the Buffer Stock. In contrast with the positions held by Harrod (1948) (who maintains that dealing prices must be subject to a variation limit of 3 per cent) or Porter (1946) (who maintains that dealing prices should be the average of market prices) or St Clare Grondona (1958) (who advocates automatic rules for price adjustments), Kahn wants to give to the buffer-stock authority the discretion to deal as it thinks best. This is the only way to avoid situations where the market is unanimously convinced of the direction and amount of the price changes. 'It is bad enough if the market can guess which way the cat is going to jump if it jumps at all, it is fatal if they not only know this for certain but also how far it is going to jump and when' (RFK2/12/1/87).

If the Buffer Stock wants to survive in a speculative market, and does not have unlimited resources, it must keep the market guessing. Changes in the dealing prices must be infrequent, unexpected, as unpredictable as possible.

It may seem paradoxical that stability is promoted by an arbitrary behaviour. But the objective of the authority is to ensure that those who believe there will be a change in dealing prices will hold this belief with great uncertainty, and this uncertainty will be increased by the interventions of the Buffer Stock. The behaviour of the agents can be affected not just by influencing the content of expectations, but the confidence with which the expectations are held.[21]

[20] On the role of the Buffer Stock as speculator in the public interest see Fantacci et al. (2012).

[21] Keynes's influence on this point could not be clearer. Keynes distinguishes between a probability statement and the 'weight of the argument', i.e., the evidence on which the probability statement is based. See Roncaglia (2009: 496-7).

There are many similarities between Kahn's views on the working of the commodities market expressed in his unfinished book on Buffer Stocks and the description of financial markets in his article on Liquidity preference written—and published—in the same years (Kahn 1954). In both cases we have two kinds of economic agents who operate in the market. In the financial markets there are speculators who hope for capital gains and who make their predictions about the future behaviour of bond prices on the basis of accurate calculations. But there are also 'orphans and widows' who 'do not have a clue' as to what may happen, and, for lack of a better alternative, prefer to think that the present situation will persist and do not change the composition of their portfolio.

Similarly, in the commodities markets, there are professional speculators who are experienced traders and gather all the available information on the state of stocks, supply and demand. On this basis they form their predictions. Yet, there is also 'the manufacturer, the consumer, the grower […] who […] "lives from hand to mouth"' (RFK2/12/2/29).They make 'an important contribution to the average, and it is on the whole a contribution which is highly colored by the expectation that prices will go on moving as they have been' (Ibid.).

In both markets if a 'best guess' could be held with absolute certainty, it would lead to a yes/no behaviour. In the financial markets if speculators think the rate of interest will fall, they invest all their funds in securities; if they think that it will rise, they sell securities for money. Similarly, in the commodities market, if speculators could be certain that the Buffer Stock will defend the floor, they would buy all the stocks of the commodity in question (and this would certainly happen if the Buffer Stock were endowed with unlimited resources); if they could be certain that the floor would be lowered, they would sell all their stocks. In the former case speculators would be allied with the Buffer Stock, in the latter they would compel the Buffer Stock to abandon its defence of the price, even if it did not intend to. How can the Buffer Stock use speculation to its own advantage, when its resources are limited? It must influence expectations, and in this task it is helped by the fact that 'the future is uncertain and that speculators are hesitant' (RFK2/12/2/34) . As Kahn notes on his article on Liquidity preference, the division is not just between agents[22]; it is also inside their minds and no 'best guess' can be held with absolute certainty. 'Innate skill may be great but it still has the laws of chance to contend against' (RFK2/12/2/30). The Buffer Stock can be successful in curbing price fluctuations only if it convinces the market that it can be successful. The skill Buffer Stock managers require is not just the knowledge of the

[22] This point is clearly made in Dardi 1994.

market, like any other speculator, but the ability to influence opinions and expectations. And it is from this perspective that Kahn assessed the only actual experience of international buffer stocks in the 1950s: the 'Tin agreement'.

4. Dealing with real Buffer Stocks: the International Sugar Agreement and the International Tin Agreement

After failing to have his book accepted, Kahn preferred the lower-key approach of making 'special studies of particular aspects from time to time',[23] in the belief that his arguments in favour of international intervention on the commodity markets would appear more convincing if supported by practical illustrations rather than theoretical arguments. Although even these attempts were not particularly successful and Kahn failed to convince his political interlocutors, his faith in the potential of buffer stocks as a means to dampen fluctuations of primary products did not waver, as testified by two memoranda which he prepared in 1959. Both memoranda remained unpublished. One was written for a meeting of the International Sugar Council in September 1959, the other was a report on the working of the International Tin Agreement. The former is interesting because it testifies that Kahn was still convinced in 1959 of the feasibility of a buffer-stock scheme; the latter is much longer and more articulated; it is the application to an actual case of the principles explained in the book which never appeared.

The International Sugar Agreement was based on 'restricted quotas'. The aim of the agreement was to constrain the price within a range between a 'floor' and 'ceiling' price per pound of sugar of a given quality. The countries which had signed the agreement were obliged to restrict their production up to a maximum of 20 per cent whenever the price overtook the floor. In September 1959 the International Sugar Council—which managed the agreement—proposed to supplement the quota restriction with a multilateral options scheme, i.e., obligation to buy (or sell) sugar for a given amount whenever the price reached the boundaries of the fixed range. Kahn was invited to participate in a meeting where the proposal was discussed, and he criticized it. In his written comment he argued that fluctuations in the price of sugar were mainly seasonal and reflected fluctuations in the existing stocks which were subject to abrupt variations, depending on the expectations and fears of the speculators who often take a 'wrongful and disharmonious view' (RFK 2/19/850). Under these circumstances, Kahn deemed that the options scheme was neither useful nor appealing enough to the countries

[23] Letter of Richard Kahn to Gerda Blau , 23 December 1959, RFK/13/13/28.

involved to be accepted. He suggested an alternative approach, but also concluded his report with an Appendix 'designed to draw attention to the superior , but not necessarily conflicting, merits of a buffer-stock scheme'(RFK2/19/839). In the Appendix—which is less than one page long—Kahn reiterated his belief in the effectiveness of a Buffer Stock, funded with the proceeds of the sales of sugar at the highest price, to keep the price in a range even narrower than the one envisaged by the agreement.

Kahn's ideas, along the same lines, are more clearly expressed in what he himself called his 'Tin report'.[24] The International Tin Agreement (hence ITA) had come into force in July 1956, after nine years of study and negotiations. It was ratified by countries which represented 90 per cent of the world production of tin and 45 per cent of its consumption (the United States, although a big importer, for 'emotional reasons', says Kahn, preferred a behaviour of 'benevolent neutrality' (par. 5)).

Agreement implied the establishment of a Buffer Stock which was the focus of Kahn's attention, and probably also of the FAO which commissioned the report, whose interest for us lies in the careful reconstruction of the operations of the tin Buffer Stock and the reasons that Kahn provides for its successes and failures. The concluding assessment was that the Buffer Stock had 'not been unsuccessful in weathering a difficult period' (par. 41), but that many problems could have been avoided if the ITA had been conceived and managed in a less cautious way. Indeed, the whole report is a comparison between the Buffer Stock as it actually existed and the 'ideal' buffer stock that Kahn advocated and hoped to see established for several other commodities. The differences between the two were of three kinds:

a) *the objective of the Buffer Stock*. The actual buffer stock was conceived by the ITA as 'ancillary to a restriction scheme', since the ITA worked primarily through export control. When the Buffer Stock held more than 10,000 tons of tin (approx. 7 per cent of the yearly consumption), the Council of the participating governments interpreted this as a signal of a persistent discrepancy between supply and demand and fixed a 'total maximum permissible amount' for exports. Quotas of the restricted production were allocated among the producers. Given that the determination of this permissible amount was subject to time-lags and errors, the aim of the Buffer Stock was to level out the ensuing fluctuations of prices,[25] and not to keep the output reasonably stable. On the contrary, the Buffer Stock advocated by Kahn had the aim of completely obviating the need for restrictions, 'by carrying the whole onus of the difference

[24] RFK2/19. References are to the numbered paragraphs of the report.
[25] 'The function of the Buffer Stock, considered realistically, is to round off the rough edges which are created by the operation of restriction scheme' par. 49

between unrestricted production and consumption and of fluctuations in privately held stocks' (par. 52). It was debatable which commodities were best suited for a buffer stock of this kind.[26] Since a growth in demand for tin was easily foreseeable in the near future, it was worthwhile preserving the productive capacity which would be destroyed if the price of tin were allowed to fall to a very low level. However, in the case of tin, the discrepancy between supply and demand was estimated by Kahn as probably too large to be absorbed by a Buffer Stock and he considered some restriction scheme unavoidable. Therefore, while the 'ideal' Buffer Stock aimed to stabilize output or its rate of growth, the real Buffer Stock had the less ambitious aim of restricting the range of price variations, while production was adjusting to demand.

b) *the size of the Buffer Stock and the funds at its disposal*. The maximum size for the holdings of the ITA Buffer Stock was approximately 15 per cent of the yearly production. Kahn thought that it should have been at least three times as large. The funds, collected by the producers before the ITA entered into force, with no contribution from the consumers, were also too small. A larger Buffer Stock would have mitigated the need for restrictions as large as those enforced (they reached 43 per cent of the yearly production), besides proving itself a profitable business when the price rose again. From the point of view of the producers, the larger the Buffer Stock the more stable the level of production, although at the cost of slackening the subsequent rise of the price. But Kahn thought that this was a cost worth paying.

c) *the discretionary powers of the manager of the Buffer Stock*. This is the most original and innovative part of the whole report. Under the ITA, the discretionary powers of the manager were limited. There was a floor and a ceiling price, and the manager was obliged to buy tin at the floor price, as long as he had funds available, and to sell tin at the ceiling price, as long as his supplies lasted. The interval between the floor and the ceiling price was divided into three parts: in the upper third the manager could sell tin, in order to prevent steep variations in price; in the lower third he could buy tin, for the same reason; in the middle third he could do nothing unless explicitly authorized by the Council.

Kahn noted that these provisions, conceived to keep the price within a narrow range, had the opposite result of increasing the size of its fluctuations. The aim of the ITA was 'to achieve a reasonable degree of stability of prices' but, in Kahn's view, not enough emphasis had been put on the term 'reasonable'. The buffer-stock manager interpreted his mandate as the obligation, not the possibility, to buy and sell as soon as he was

[26] Kahn thought that coffee, cocoa and cotton were particularly well suited, while the case for tin was more problematic.

allowed to do so; these were also the expectations of the market. These expectations, held with strong conviction, were damaging for the operation of the Buffer Stock, since they enhanced the destabilizing effects of speculation.

On the other hand Kahn thought that the Manager should have 'complete discretion to operate, if and when he wished to do so, in either direction anywhere between the floor and the ceiling prices' and that 'speculators, traders and users should be in a state of doubt as to the Manager's policy and actions' (par. 71). The Manager should try to use the forces of speculation to help him stabilize the market. When the price hits the floor, speculators should be reasonably expected to begin to buy the commodity, in view of a subsequent price increase—especially if they know that supply has been restricted and a demand surplus can be reasonably foreseen. If they do not begin to buy and their bearish sentiment persists , it is for two reasons. One reason is that they think that the prospective gain will not be high enough, if the Manager begins to sell tin as soon as the price enters into the higher third of the interval, in order to please the consumers. Therefore the floor and ceiling prices should be set wide apart, the Manager should wait to sell and speculators must be left with the hope of high price increases, at least for a short period. The damage to consumers who have to pay a high price for a few days is more than offset by the shorter duration of the restrictions, since the extra production is absorbed by the piling-up of the stocks.[27] The other reason for the persistence of a bearish attitude is that speculators may expect that the floor could be lowered, because the Buffer Stock runs out of funds. In this case they wait in the hope of purchases at a lower price. Kahn suggests that the Manager should not be obliged to buy tin at the floor price until his funds are exhausted, but he should be free to suspend the support to the floor price and to buy at a lower price, with the positive results of making a good profit when the price increases and of confounding the speculators, while preserving the floor price. Kahn is well aware that

> Complete abolition of this obligation, much though there is to be said for it, would involve so radical a departure from the conventional concept of a buffer-stock scheme as not to be worth consideration here—not at any rate in connection with a buffer-stock scheme which is merely ancillary to scheme for control of exports, itself designed taken by itself to keep the price between specified floor and ceiling prices'. (par. 79)

Kahn's 'ideal' Buffer Stock, as it emerges in the Tin report, is endowed with very substantial resources that can be increased by successful market operations. Its Manager

[27] In the actual working of the ITA Buffer Stock, instead, the price range was not large enough. It was made even narrower by the decision of the Council to give to the Manager the power of selling tin when the price was still in the middle third.

should be completely free to operate on the market, in an unpredictable manner; information about the holdings of the Buffer Stock should be kept secret; speculators must know only that the Buffer Stock exists and that it is powerful, so that their bullish or bearish sentiments can be exploited in favour of the aims of the Buffer Stock, not against them.

5. Conclusions

There is no doubt indeed that in this proposal Kahn draws his inspiration from Keynes in many respects. The knowledge he had acquired through Keynes and with Keynes on the actual working of commodity markets is at the basis of his plan. Like Keynes, Kahn never assumes an economic agent with perfect foresight. On the contrary, his traders and speculators in commodities take decisions under uncertainty and act under expectations which can be influenced by public intervention.

Kahn adds to the broad lines of Keynes's plan his usual attention to details, and he is not satisfied until all possible cases are taken into account; his analysis and experience of how speculators act and think persuade him that the managers of the buffer stock must be endowed with greater freedom of action than Keynes had envisaged.

If we want to look for evidence of how strong Keynes's influence over Kahn is, we must seek it in his approach to the problem. When the market fails, it must be corrected, not destroyed. The consequences of the failure, social and economic, cannot be passively accepted. The correction must not entail self-inflicted scarcity and poverty , as export restriction and quotas would do. The market for primary products is inefficient, since there is not enough hoarding in the economy, given that the speculators cannot afford the costs of financing and storage which increase with time and size of their positions. The necessary hoarding must then be provided at a lower cost by a public authority, which can survive only if it becomes a speculator among other speculators, not for its own profit, but in the general interest.

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Back to which Bretton Woods? Liquidity and clearing as alternative principles for reforming international finance

Massimo Amato and Luca Fantacci[*]

1. Currency unit vs reserve asset

The most direct and compelling motive for a 'return to Bretton Woods' comes not from a need of historical erudition, but from the present state of the economy. The current crisis, and the persistence of global imbalances *despite* the shock represented by the crisis, has raised the issue of the reform of the international financial system. Not only a certain number of scholars, but also many journalists, economic advisors and policymakers have advocated 'a new Bretton Woods' to assert the necessity of new rules. Too few, however, remember that the Bretton Woods Conference, besides defining the norms and designing the institutions that were to rule international finance, was also characterized by the deliberate intention of establishing that peculiar norm and institution which is international money.[1]

This fact deserves, for at least four reasons, far more attention than it normally receives:

- money is the first economic norm and institution: without a money providing a common measure, there is no condition for trade or finance; and the way money is designed deeply affects the structure of economic relations and the operation of all other norms and institutions;
- the monetary system that was established in 1944 collapsed in 1971, and has not been replaced;
- the lack of an international money is one of the major factors of current global imbalances;
- the institution of an international money is not something that happens by itself: Bretton Woods was the only instance in history in which it was deliberately accomplished by an international conference, and it required then a great deal of thinking and negotiating.

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[1] Helleiner (2010) provides further explanations of why the calls for 'a new Bretton Woods' have failed to bring about a major reform of the international monetary and financial system.

Among G-20 countries, several have raised in particular the issue of reforming the international monetary system. The most explicit analysis and proposal on this front has come, perhaps, from the governor of the People's Bank of China, Zhou Xiaochuan, in a speech published last March on the official site of the Bank, just before the G-20 summit in April 2009 (Zhou 2009).

The document goes straight to the point:

> The outbreak of the current crisis and its spillover in the world have confronted us with a long-existing but still unanswered question, i.e., what kind of international reserve currency do we need to secure global financial stability and facilitate world economic growth, which was one of the purposes for establishing the IMF? (Zhou 2009: 1)

Before looking into the details of the proposal, it is possible to infer the two main characteristics of the new money advocated by Mr Zhou from the expression he uses to designate it. He speaks of an 'international reserve currency'. The new money is thus characterized by two qualifications that may seem rather obvious, but should not be taken for granted. The new currency, whatever form it may take, is intended by Mr Zhou to be:

a) an *international* currency, and
b) a *reserve* currency.

The first characteristic is strongly emphasized by Mr Zhou. The idea is that *international* economic relations require *international money*, and that a real international money cannot and should not also be a national money. The use of a national money as an international money gives rise to an impasse that Mr Zhou describes, appropriately evoking the Triffin dilemma:

> Issuing countries of reserve currencies are constantly confronted with the dilemma between achieving their domestic monetary policy goals and meeting other countries' demand for reserve currencies. On the one hand, the monetary authorities cannot simply focus on domestic goals without carrying out their international responsibilities; on the other hand, they cannot pursue different domestic and international objectives at the same time. They may either fail to adequately meet the demand of a growing global economy for liquidity as they try to ease inflation pressures at home, or create excess liquidity in the global markets by overly stimulating domestic demand. The Triffin Dilemma, i.e., the issuing countries of reserve currencies cannot maintain the value of the reserve currencies while providing liquidity to the world, still exists. (Zhou 2009: 1)

It is significant that text presents the problem from the point of view of the country that issues the currency used as an international reserve asset. This may well be intended not only as a concession to the balance of payment problems of the US, but

also to suggest that China, as a rising economic power, does not intend to replace the US in the uncomfortable position of having to provide a new international reserve asset with its own currency. It is as if Mr Zhou were saying that China is totally unwilling to enter, in the twenty-first century, in the same mess that has already troubled the economies of UK in the nineteenth and of US in the twentieth century.

On the other hand, the second characteristic seems to be taken for granted by Mr Zhou. In fact, as a solution to global imbalances and as a way out of the Triffin dilemma, he suggests the establishment of an international *reserve* currency:

> The desirable goal of reforming the international monetary system, therefore, is to create an international reserve currency that is disconnected from individual nations and is able to remain stable in the long run, thus removing the inherent deficiencies caused by using credit-based national currencies. (Zhou 2009: 2)

It is at this point that Mr. Zhou recalls the historical precedent of Bretton Woods:

> Back in the 1940s, Keynes had already proposed to introduce an international currency unit named "Bancor", based on the value of 30 representative commodities. Unfortunately, the proposal was not accepted. The collapse of the Bretton Woods system, which was based on the White approach, indicates that the Keynesian approach may have been more farsighted. (Zhou 2009: 2)

This recollection has the merit of reminding us that at Bretton Woods there was not only one plan, but two radically different plans, based on two radically different principles, moreover suggesting that the plan adopted was perhaps the wrong one. This is why 'Back to Bretton Woods' cannot be simply a slogan, calling for a revival: it requires to reopen a discussion in view of a decision. The question is, then: 'Back to which Bretton Woods?'

Mr Zhou seems to have no doubts in proposing a return to Keynes's plan. In principle we subscribe to this point of view, and yet we must be sure to understand what Keynes really proposed.

In Mr Zhou's reconstruction, Bancor seems to be confused with the tabular standard that Keynes had outlined in the *Treatise on Money* in 1930 (Keynes 1930: 351-354). In fact, Bancor is not a basket of commodities, but a pure unit of account. Quite appropriately, Mr Zhou refers to it as a 'currency unit'. However, as we shall argue, a currency unit is not the same thing as a reserve currency, but is in fact incompatible with it. Throughout this paper we will try to show that reserve currency and currency unit are mutually exclusive, both logically and historically. It is important therefore to distinguish between the two, in order to understand which one we need to avoid the

accumulation of global imbalances, allowing both goods to be traded and debts to be paid.

Indeed, to provide a means to allow global trade and to absorb global imbalances was also the explicit goal of the American plan for Bretton Woods and of the agreement that was eventually signed, as expressed in Article 1. Now Mr Zhou suggests that Keynes's plan might have been more appropriate and effective to reach those same goals. Yet he fails to explain why. Our main argument is that Keynes's plan would have been better exactly because the money that it would have established, Bancor, was not a *reserve currency*, but a *currency unit*. Mr Zhou uses two different expressions, yet without asking whether they are in fact compatible.

This is precisely what we will enquire, by going back to Bretton Woods or rather back to the theoretical elaborations and the political discussions that prepared the conference. However we can anticipate here a definition of both kinds of currencies, in order to suggest the relevance of the distinction.

Whether it is national or international, a reserve currency is a *store of value*: this means that, even if it is intended as a means of payment for the settlement of international debts, it is always possible for a country *not* to spend it and to accumulate it indefinitely, thus building up the global imbalances that it would be intended to reabsorb.

Instead, a currency unit is an *instrument for the denomination of debts*. It is therefore impossible by definition to own it or even more to accumulate it. It is intended exclusively to measure the value of actual goods and services and to facilitate their exchange, but it is not itself a commodity. In this sense, it allows imbalances to be created in order to facilitate trade, but it requires and allows those imbalances to be duly reabsorbed. It is not part of the wealth neither of a specific nation nor of the international community as a whole.

This is why we agree with Mr Zhou when he suggests that Keynes's plan might have been 'more farsighted'. In fact, Bancor was not conceived only as an international currency as distinct from a national currency. It was also conceived as a currency unit as opposed to a reserve currency.

In this sense, the story of Bretton Woods, with respect to the goals that it was supposed to achieve, is the story of a failure: it is the story of how, instead of an international currency unit, a national reserve currency was eventually established as international money.

In the next sections we shall enquire how this happened (2), what the implications were for the possibility of global imbalances (3), and what possible remedies this story suggests (4).

2. Keynes vs White

In the diplomatic run-up towards Bretton Woods, the establishment of an international currency unit appeared to be, at least at a certain stage, a common concern of both the parties involved. Both the British and the American proposals had, at least in certain drafts, provisions concerning the adoption of an international unit of account: Bancor in the Clearing Union and Unitas in the Stabilization Fund. It appears somewhat paradoxical that the adoption of an international unit of account should be discarded already in the course of the Anglo-American negotiations that lead to the publication, in April 1944, of the Joint Statement that eventually provided the working draft for the Bretton Woods conference. If both the British and the US representatives agreed on the opportunity of introducing an international unit of account, why did they discard this hypothesis in the course of their bilateral talks, even before submitting it to the other 42 delegations summoned at Bretton Woods?[2]

A possible answer may perhaps be sought for in the different roles assigned to the international unit of account in the two schemes. As Horsefield has pointed out: 'for Keynes this would have been a true medium of exchange […] for White it was no more than a standard of value' (Horsefield 1969a: 64). This is usually understood as a further confirmation of Keynes's alleged inflationary spur, as opposed to the sound principles of orthodox finance supported by White. According to this interpretation, the Keynes plan provided for the creation *ex nihilo* of a new international medium of exchange, whereas the White plan remained soundly anchored to the available quantity of the old international medium of exchange, i.e., gold.

It is true that the introduction of an international unit of account was essential to the Proposal for an International Clearing Union, from the very first version, sketched out by Keynes in 1941, while, on the contrary, it was purely accessory to the White Plan. The first Draft Proposal of the latter (dated April 1942) had no provision at all for an international currency. In fact, it was followed by a commentary which included a very

[2] Some of these delegations at Bretton Woods did advance proposals for the adoption of an international unit of account. They however lacked the force to contrast an omission, which was clearly not due to mere distraction. The sponsors of the Fund did not just lack good reasons to introduce an international unit of account: they apparently had good reasons to refuse it.

sceptical section on 'A new international currency' (White 1942: 78-82). The adoption of an international currency is described by White as:

a) *useless*, if it were to be introduced merely as a *unit of account* to supplement national currencies, since this would not reduce calculations in foreign trade nor exchange rates instability;
b) *impracticable*, if it were to be introduced as a medium of exchange to *substitute* national currencies, since this would imply a renunciation of monetary sovereignty;
c) *worthwhile*, if it were to be introduced as a medium of exchange to *complement* existing national and international currency.

This last point deserves closer consideration, since it appears as a substantial concession towards the essence of the Clearing Union Proposal. As White explicitly states, it would have allowed to reabsorb global imbalances inherited from the war, in the form of a concentration of gold in the US:

> it may be worthwhile giving the Bank note-issuing powers—based on some gold reserve—solely in order to make the world's monetary gold stock do more work, and at the same time help correct the maldistribution of gold. (White 1942: 79)

This was, indeed, the main purpose of the Clearing Union. It was in view of attaining this goal that, according to Keynes, an international currency was needed. And even this was promptly recognized by White:

> if the Bank were to be established and given the authority to issue notes [or, as we shall see, to provide overdraft facilities, in the logic of the Clearing Union], what unit should it be? It would be preferable to adopt a new unit. The adoption of a new international unit of currency of account [sic] would probably meet with little opposition, whereas an attempt to use any one of the existing currencies, such as dollars, sterling or francs for that purpose would be opposed on the grounds that it would seem to give the country possessing that currency some slight advantage in publicity or trade. (White 1942: 81-82)

Showing perhaps little intellectual honesty, White accused the Clearing Union of proposing (b), which was clearly to be refused, whereas it was in fact proposing (c), which he himself recognized as desirable. And, showing little practical consistency, after having praised (c) in 1942, he pursued (a) in the later drafts.[3]

Unitas was introduced as the 'Monetary Unit of the Fund', in a separate section under this title, only in the third draft (dated 11 December). Unitas was to have a fixed

[3] This was done, as we shall suggest, only to be able to easier show the uselessness and to abandon the idea of a new international money altogether, in favour of surreptitiously promoting the dollar as an international currency.

gold equivalent of 137 $^{1}/_{7}$ grams of fine gold, corresponding to a dollar equivalent of $10. The choice of a gold equivalent corresponding to a round dollar equivalent suggests that the second equivalent was considered more important than the first: Unitas was just another way of saying $10. This is perhaps the reason why 'the significance of the Unitas in the Stabilization Fund was a source of some perplexity to the United Kindgdom' (Horsefield 1969a: 41). As Phillips observed, it was merely a unit of measure, except in the clause providing for deposits of gold, where it became 'a warehouse receipt for gold' – a clause which disappeared in the subsequent versions of 26 June and 10 July, being substituted by the provision for gold convertibility of national currencies at par (Ibid.).

What is the reason for introducing a monetary unit which is in fact nothing else than another name for gold? Perhaps it was only smoke in the eyes for the British, while US officials remained fundamentally critical against the introduction of an international currency. They feared the possible inflationary effects of an accumulation of balances, and they believed that there would be strong opposition against the use of government funds to purchase an international currency (different from gold), in view of sterilizing its effects.

At a meeting with US representatives in Washington in February 1944, Keynes proposed modifications to the Fund, in view of making Unitas more similar to Bancor. The objections of US officials revealed their opposition to the adoption of an international money as such: in their view, the British, 'unable to secure the redistribution of real gold, proposed to create a substitute out of thin air' (quoted in Horsefield 1969a: 65).

By this time, US representatives appear to have already abandoned even the idea of an international money. It was the British who insisted on the adoption of Unitas, in view of introducing and preserving the distinction between national and international money. The British feared that entrusting the Fund with members' currencies could threaten the autonomy of national monetary policy. On the contrary, White considered the adoption of an international unit of account, over which the US would have no control, as a surrender of monetary sovereignty (thus implicitly suggesting that American monetary sovereignty would suffer no limitation).[4]

The issue remained unsettled throughout February and March. British officials regarded it as a matter of so fundamental importance that it ought to be deferred to the

[4] See H.D. White, *Some Notes on the Articles of Agreement of the International Monetary Fund*, May 1946, Princeton papers, Box 10, File 27 (Horsefield 1969a: 65).

decision of the Ministers.[5] This, in turn, would have required a comprehensive revision of the problems arising from Clause VII of the Lend-Lease arrangement, and hence an attention that Ministers could not afford, under the war events of Spring 1944 (Horsefield 1969a: 65). The American government pressed for reaching an agreement, until Britain accepted the version without Unitas, which was published on 21 April.

The publication of the Joint Statement in London on the following day was introduced by an *Explanatory Note by United Kingdom Experts*,[6] in which the functioning of the Fund was related to that of the Clearing Union, and it was shown that 'these two arrangements represent alternative technical setups, capable of performing precisely the same functions' (Horsefield 1969b: 129).

Even if this declaration may well have been inspired by political prudence, in the attempt to reach a mediation, it is nonetheless true that the Joint Statement was still consistent with the main objectives of the Clearing Union. The fact that Britain eventually accepted to do without an international unit of account does not mean that they were willing to renounce their main goals: the autonomy of national economic policy, and the possibility of reconciling the goals of domestic economy and the needs of foreign trade. The points on which British delegates insisted at Atlantic City seem to confirm this, being primarily aimed at preserving the right of members to modify their exchange rates as they may consider necessary or advisable in view of domestic balance (Horsefield 1969a: 82-83).

Between the Joint Statement and the Articles of Agreement, another sea change occurred in this very crucial aspect of the international monetary system: from gold as the only standard of value to a gold-dollar standard, in other terms from an international to a national reserve currency.[7]

The change was accomplished in two steps. Both surprisingly quiet, apparently straightforward, without discussion, and without trace in the proceedings of the Conference (United Nations 1948).

The first step was probably made on the train trip towards Bretton Woods, by the members of the US delegation that were responsible for preparing the draft to be submitted at the Conference. The addition of a reference to 'gold-convertible currencies' (i.e., in 1944, only the dollar) to the article defining the 'common

[5] This makes it all the more surprising that it should be settled, between Atlantic City and Bretton Woods, without even being discussed by the delegates, and reinforces the hypothesis, according to which the issue was passed under silence because it was too important to be left open to discussion (Van Dormael 1978: 200-203).

[6] Reprinted in Horsefield (1969b: 128-31).

[7] The problems experienced several decades before with a 'limping bimetallism' could have contributed to dissuade from adopting a double standard.

denominator' for international exchanges was presented as a joint US and UK amendment to the draft, among other amendments proposed by other delegations that had had the opportunity to see the draft beforehand. It is however quite puzzling that, after having agreed on a common plan at their previous meeting, they should have also agreed to change it. It is comprehensible that the plan could be accompanied by amendments proposed by either the US or the UK on specific points of divergence. But a joint amendment to a joint statement sounds like nonsense. It is easy to imagine that the British officials would have never backed it. In fact, they had already explicitly opposed any reference to 'gold-convertible' currencies.

The second step consisted in the outright substitution of 'the U.S. dollar' to 'gold-convertible currencies' (thus excluding any other currency that should gain convertibility thereafter). This second step was taken presumably during the last days of the Conference, at night, by a special committee. Again, without discussion.

As Moggridge reports: 'despite the delay in finishing the Conference, there were still not complete copies of the Articles of Agreement ready when the delegates signed them at the end' (Moggridge 1989: 96). This is confirmed by Keynes himself, in a memorandum on the International Monetary Fund dated 29 December 1944:

> We, all of us, had to sign, of course, before we had had a chance of reading through a clean and consecutive copy of the document. All we had seen of it was the dotted line. Our only excuse was the knowledge that our hosts had made final arrangements to throw us out of the hotel, unhouselled, disappointed, unanealed, within a few hours. (Keynes 1944: 149)

Why this hasty outcome? Why was an existing national currency eventually preferred to a new international unit of account? In order to answer, it is necessary to consider in detail the consequences of the two options for international economic relations. This is the object of the next session.

3. International Clearing Union vs International Monetary Fund

What were the consequences of adopting a national reserve currency rather than an international currency unit? Let us analyse the functioning of the two plans, paying particular attention to the way in which each of them deals with the common declared goal of allowing the imbalances implied by the physiological operation of international trade, but in view of their reabsorption.

Keynes's proposal for the post-war international monetary regime envisaged the establishment of an International Clearing Union. Each country would hold an account

with the Clearing Union. The accounts would be denominated in an international unit of account called Bancor. The equivalence between Bancor and the currency of each country would be set at a certain par. The initial balance of each account would be set to zero Bancor. International trade transactions would be settled by transfers of a corresponding amount of Bancor, from the account of the importing country to the account of the exporting country. Each country would be granted an overdraft facility, i.e. the possibility of spending Bancor that it had not yet earned, thus recording a negative balance with the Clearing Union. A country with a negative balance would be called a deficit country; a country with a positive balance would be called a surplus country. Each country would be granted the possibility of accumulating a (negative or positive) balance up to the level of its quota equal to its relative weight in international trade.

Within the system thus designed, international money would be created every time a deficit country used the overdraft facilities provided by the Clearing Union to pay for its imports towards a surplus country. Money creation would thus take the form of an increase in the positive Bancor balance of the surplus country with the Union. Symmetrically, a *destruction* of international money, and hence a reabsorption of the temporary imbalances, would occur whenever a payment would take place in the opposite direction, from a surplus country to a deficit country, reducing the positive balance of the former and the negative balance of the latter. Every other type of payment, from a deficit country to another deficit country or from a surplus country to another surplus country, would only involve a transfer of negative or positive balances, without affecting the overall volume of money outstanding.

Hence, in any given moment, the total amount of international money would be equal to the aggregate trade imbalances within the Union (i.e., to total deficits = total surpluses). Money creation would thus be closely tied to trade, with the purpose of providing financial breathing room for trade deficits. Within such a system, it is not the availability of money that allows trade, but rather trade that gives rise to the money required.

Until now, we have only considered the mechanisms for the creation of money. It is not surprising, therefore, that they should appear inflationary, as indeed they were accused to be by the critics of the Keynes plan. Of course, if this had been the entire plan, those critics would have been right. But we still have to look at the rest of the picture.

In fact, the Clearing Union was not intended to encourage *systematic* deficits, but only deficits of a *temporary* nature. Accordingly, to avoid the accumulation of

permanent deficits, the Keynes plan included not only limits but also interests to be paid on negative Bancor balances. Such interests were intended to serve as an inducement, for deficit countries, to converge towards a balanced trade.

However, the facilities provided by the Clearing Union were intended to serve the interests of both surplus and deficit countries, since they would have allowed the former to sell just as they would have allowed the latter to buy, goods that could not have been exchanged without the existence of the Union. Hence, not only deficit countries, but also surplus countries were required to collaborate in re-establishing the balance of the system.

Accordingly, to avoid the accumulation of permanent surpluses and the ensuing stagnation of excess money, the Keynes plan included also limits and fees to be paid on positive Bancor balances. Such fees were intended to serve as an inducement for surplus countries, to contribute to the convergence towards a balanced trade, and were designed to perform as a sort of drain for excess money (i.e., imbalances) within the Union.

On the basis of common sense, the fact of imposing on creditor countries the same obligations of debtor countries may appear arbitrary and unjust. However, this common sense is not an innate wisdom responding to a natural justice, but it stems from a peculiar conception of money, which in turn is tied to the historical embodiment of monetary institutions in the form of a reserve asset, i.e., of *liquidity*.

In fact, the obligation of the creditor is perfectly justified in a system where the balance is defined in terms of *clearing* (i.e., accounts equal to zero): since surplus and deficit countries are all out of balance, the burden of correcting the imbalances should be distributed symmetrically between them.

This is precisely the intention that inspires Keynes in designing this peculiar feature of the Clearing Union:

> a country finding itself in a creditor position *against the rest of the world as a whole* should enter into an obligation to dispose of this credit balance and not to allow it meanwhile to exercise a contractionist pressure against the world economy and, by repercussion, against the economy of the creditor country itself. This would give us, and all others, the great assistance of multilateral clearing. (Keynes 1941: 47, emphasis in the original)

The credits do not arise from having spontaneously lent a money, which could have been used for any other purpose, or even not used at all, i.e. a reserve currency; they arise from having carried out a trade transaction that only the existence of the Clearing Union has made possible thanks to the existence of a currency unit. Hence, there is no reason to remunerate those credits.

In fact, the credit required by international trade is not made available by surplus countries, but by the existence of the Clearing Union itself. Keynes himself described the properties of his plan in the following terms: 'The peculiar merit of the Clearing Union as a means of remedying a chronic shortage of international money is that it operates through the velocity, rather than through the volume, of circulation' (Keynes 1943: 31).

The amount of money becomes irrelevant in the sense that the functioning of the Clearing Union and its capacity of supplying an adequate money for international transactions does not depend on the initial endowment of means of payments (e.g. in the form of gold reserves or of reserve assets in general).

Keynes is not unaware of the current relations of power, reflected in the endowments of gold reserves and credits at the end of the war. The US are the owners of over 80 per cent of all global monetary gold: hence they have a legitimate interest that this gold accumulated under the old monetary law is not simply wiped out by the new. For this reason, Keynes envisages the possibility of converting the old money into the new, by depositing in the Clearing Union gold and receiving an equivalent credit balance in Bancor. However, in order to ensure the enforcement of the new rule, he also establishes that such a conversion should be irreversible. In other terms, gold should be convertible into Bancor, but Bancor should not be convertible into gold. The only shift that makes any sense is from the old to the new, and not vice versa.

Hence, without disregarding the status quo, and the given distribution of power, Keynes aims at inaugurating a new monetary order where distribution of power responds to different rules as in the past.

By contrast, the plan approved at Bretton Woods depended from the outset on the collection of a predefined quantity of money in an International Monetary Fund. It did not create an international currency, but merely gave the possibility of swapping the national currencies deposited in the Fund in order to perform international settlements. The basket of gold and currencies collected in the Fund provided thus a sort of reservoir for international reserve assets, in the form of national currencies that could be exchanged one for the other within given limits.

Each country subscribed to a certain quota of the Fund, depositing the corresponding amount in the Fund, 25 per cent in gold and 75 per cent in its own currency. Each country was thus entitled to purchase from the Fund the currency of another country, for the purpose of effecting a payment towards that country. The amount of its own currency in the Fund increased accordingly. Deficit (and surplus)

countries were therefore characterized by the fact of holding more than (or less than) 75 per cent of their own quota in their own currency with the Fund.

However, the conditions for deficit and surplus countries in the Fund, unlike those in the Clearing Union, were strongly asymmetrical: a deficit country was obliged to repurchase its own currency from the Fund and was subject to a cost for the operation, which was structured, therefore, as a 'hidden loan'; instead, a surplus country was not subject to any obligation or to any cost, and hence had no incentive to restore a balanced trade nor to reabsorb previously accumulated imbalances. On the contrary, there is an incentive to maintain surplus balances, in order to earn a rent.

The provisions of the Articles of Agreement to deal with persistent and widening surpluses were contained in the so-called 'scarce currency clause' (article VII). It is often stated that creditor countries were not adequately involved in the adjustment of post-war imbalances because this clause was never fully enforced. In fact, it was perhaps the most important and effective clause of the whole Agreement. The real problem was that the application of this clause implied a suspension of the rest of the Agreement. According to its provisions, if the currency of a country became scarce (because of a persistent trade surplus of that country that induces all other countries to demand its currency) the Fund may borrow or purchase the scarce currency and allow the other members to impose protectionist measures. All these provisions amounted to a perpetuation of international imbalances and to an organization of global trade which contrasted sharply with the purposes of the Agreement and with the instruments originally designed to accomplish them.

Moreover, the scarcity of a currency (namely the US dollar) was not only possible, but probable. Indeed, the total resources of the Fund were set at such a low level, that it had no chance of meeting the requirements of international trade. Hence, from the very beginning, post-war international settlements had to rely on an alternative reserve asset, in the form of the national currency of the greatest surplus country, i.e. the United States.

Perhaps at this point we have all the elements to explain why the reference to gold in the Articles of Agreement was inevitably by-passed by the reference to the dollar: gold reserves were insufficient to manage the imbalances required by the expansion of global trade and post-war reconstruction.

The shortfalls of the articles of agreement of Bretton Woods paved the way to a creation of international reserve assets, which occurred not inside but outside the framework of the Fund, and without any restriction or link to the trade of actual goods, mainly through the development of the euro-dollar market. Unlike the Clearing Union

based on Bancor as a currency unit, the prevailing system based on the dollar as a reserve currency had no built-in mechanism designed to ensure both the circulation and drainage of international money. In other terms, despite their common goals, the latter was not capable of reabsorbing global imbalances, but rather allowed its currency to be indefinitely hoarded as a reserve asset by foreign central banks.

This perspective may help understand post-war disequilibria not as the result of deviations from the rules of the game, but as an inevitable concomitant of its operation. In particular, the intrinsic problems of a reserve currency system, as they have appeared since its inception, may give account of apparent paradoxes, namely why it was possible to pass from a dollar shortage to a dollar glut, i.e. from a lack of international reserve assets to an excess of international reserve assets and hence from a net creditor position to a net debtor position of the US; and why, vice versa, the current crisis has detonated in the form of a sudden shift from a superabundance of international money to a sudden draught of international capital movements.

Moreover, the fact of having seen the limits inherent in a reserve currency may help understand the current political and scientific impasse in the face of growing global imbalances. When international money is conceived and implemented as a quantity of reserve assets, there seems to be always too little or too much of it and never an adequate measure. The reasons for this difficulty are manifold:

1. it is difficult to estimate in advance how much international reserve currency is needed, especially when the need is not clearly defined;
2. it is difficult, once the requirements have been estimated, to adjust the actual amount accordingly, or to define the rules of its creation, so as to accommodate the fluctuations in its requirements;
3. the same quantity may result either insufficient or excessive according to its actual use in circulation.

On the other hand, the fact of having appreciated the virtues of the clearing mechanism based on an international currency union may help us to imagine a way out of the structural flaws of the present system, and not merely a way of containing its most dramatic effects. This allows us to reconsider more in detail the constructive part of Mr Zhou's proposal, with a better understanding of its actual scope and limits.

4. Bancor vs Special Drawing Rights

The proposal advanced by Mr Zhou is to enhance the use of Special Drawing Rights as an international reserve asset: 'The SDR has the features and potential to act as a

super-sovereign reserve currency. Moreover, an increase in SDR allocation would help the Fund address its resources problem and the difficulties in the voice and representation reform' (Zhou 2009: 2).

To this end, Mr Zhou recommends to: 'Actively promote the use of the SDR in international trade, commodities pricing, investment and corporate book-keeping [and to] create financial assets denominated in the SDR to increase its appeal' (Zhou 2009: 2-3).

The strengthening of the role of the SDR in international economic relations requires, moreover, a redefinition of the governance of its issuing process and of the balance between the countries and currencies supporting it. This is why Mr. Zhou further suggests that: 'The basket of currencies forming the basis for SDR valuation should be expanded to include currencies of all major economies' (Zhou 2009: 3).

The first part of the proposal was already endorsed by the G-20 in April 2009 and was implemented shortly thereafter. With a general SDR allocation taking effect on 28 August and a special allocation on 9 September 2009, the amount of SDRs has increased almost tenfold, from SDR 21.4 billion to SDR 204.1 billion.

The use of SDRs as a reserve asset can certainly serve to substitute part of the conspicuous reserves in dollars held throughout the world and particularly in Asia. It may therefore allow to ease the bilateral tensions between China and the U.S.

However, despite the extraordinary increase, total SDR allocations are still dramatically insufficient to reabsorb the global imbalances accumulated in over sixty years of dollar standard. Despite having increased by a factor of ten, they are still ten times lower than the overall foreign exchange reserves of China alone, and fifteen times lower than the foreign indebtedness of the US.

Moreover, and more seriously, it is far from clear that even an expanded use of SDRs as a reserve asset would avoid the accumulation of *further imbalances*. In fact, unlike the provisions of the Clearing Union, the IMF rules do not impose on countries that accumulate SDRs in excess of their original allocation any kind of charge or constraint; on the contrary, if a member's SDR holdings rise above its allocation, it earns interest on the excess.

In addition, if the volume of SDRs should increase, there would also be an increasing concern to assure their acceptability. To avoid an inflation of SDRs it would be necessary, as the Chinese proposal suggests, to increase their use, not only as a means of payment for the actual trade of goods and services, but also to denominate financial assets. In any case, it would be essential to assure their constant convertibility into *equally appealing* national currencies. In other terms, it would be necessary to

assure the liquidity of both the SDRs and of the currencies that are included in the basket and that represent de facto the ultimate form of international liquidity, as long as SDRs are conceived as a basket of national currencies.

It is for this reason that the Chinese request to include the yuan in the SDR-basket have been challenged by the counter-request to assure full convertibility of the yuan on foreign exchange markets.[8] But this would amount to requiring the yuan to increasingly assume the function of an international currency, which is exactly what the Chinese proposal intends to prevent, with a view to avoiding the substitution of current international imbalances with new international imbalances.

A way out of this dilemma could be to transform the SDR from a reserve asset to a currency unit in the image of Bancor. This would involve the following steps:

- to make SDR the ultimate means of denomination and payment of international debts, i.e., the international money;
- to establish, accordingly, a one-way convertibility, from national currencies into SDRs, but not from SDR to national currencies;
- to introduce symmetric charges on SDR balances above and below original allocations;
- to link new issues of SDRs to international transactions or to purchase of primary goods as real reserve asset by the IMF or by another international organization.

In any case, the primary objective of a sound monetary regime should be to define the rules not only of money creation, but also of its circulation and destruction, in order to ensure that the imbalances are always reabsorbed. In order to achieve this objective, as we have tried to show in this paper, two crucial features are required:

- not only the distinction between international money and national currencies,
- but also the existence of a pure international unit of account, that cannot by definition serve as a reserve asset.

At Bretton Woods, the conjunction of these two features allowed Keynes to design an international financial system in which the interests of each single country are not set at variance with those of other countries and with the well-being of international trade as a whole. This plan was rejected in favour of a system that was supposed to serve the same goals while in fact its operation has led in the diametrically opposite direction. The oft-invoked new Bretton Woods should perhaps not merely re-propose the Keynes

[8] See, for example, Marsh and Seaman (2009).

plan, but it ought to reinterpret its main principles according to the present economic and political situation of the world.

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Reforming the International Monetary System. A stock-flow-consistent approach

Sebastian Valdecantos Halporn and Gennaro Zezza[*]

1. Introduction

The debate on the urgency of reforms in the current International Monetary System (IMS) has revamped immediately before the Great Recession which started in 2007, due to the growing and persisting disequilibria in the current account balances of some major economies, notably the U.S. as a deficit country, and Germany, China and the oil exporters as surplus countries. The debate was further stimulated by an influential intervention by the governor of the People Bank of China (Zhao, 2006) but after an international agreement for an extraordinary allocation of reserves in Special Drawing Rights (SDRs) in 2009, the debate has faded away, while more urgent problems—such as the high and persistent level of unemployment first, and the sovereign debt crisis in Europe later—were brought to the forefront of the agenda. We aim to show that the current international monetary 'non-system', as it has been defined,[1] still plays a relevant role in current macroeconomic problems, and a reform of the IMS is necessary to achieve more balanced growth at the world level.

The current state of global imbalances is depicted in Figure 1, obtained from the latest (April 2012) I.M.F. World Economic Outlook database, which includes predictions up to 2017. Current account balances of key countries have been scaled by U.S. GDP, to make them directly comparable. Since the 1980s, the U.S. have experienced external deficits, which started to increase in magnitude from the mid 1990s. The mirror image of the U.S. deficit is the surplus of oil and gas exporters—Opec and Russia—and of China, while Japan slightly reduced its weight among export-led-growth countries. Germany increased its surplus with the start of the Euro era, from 1999.

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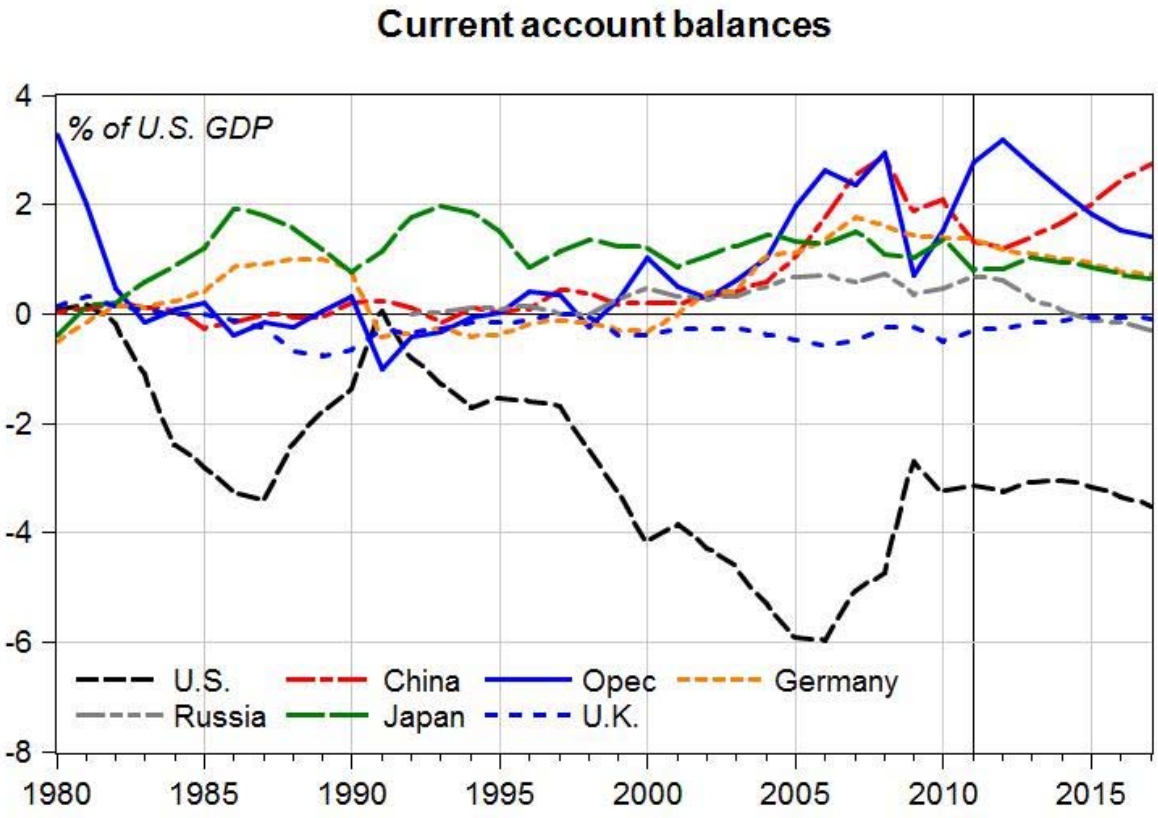
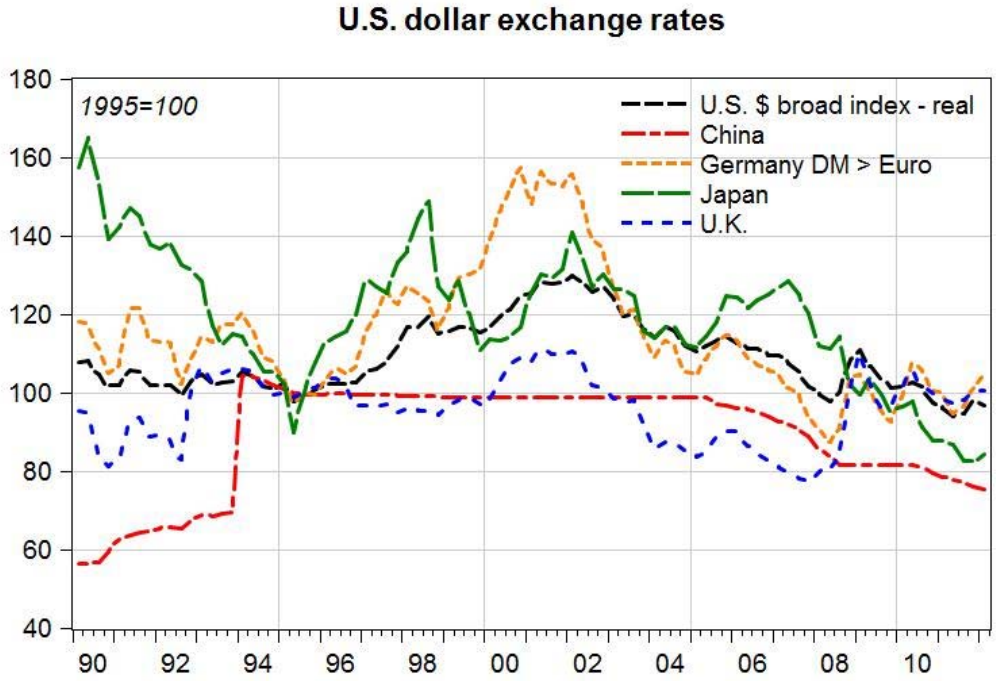
[1] By Triffin (1960), quoted in Piffaretti (2009).

Figure 1



Since the end of the Bretton Woods system in 1971, exchange rates have been floating, although some countries—notably in Europe—chose to enter into a managed floating system first, and adopted a common currency later. In a pure floating regime, we would expect the currencies of deficit countries to depreciate against the currency of surplus countries. However, since the demand for U.S. dollar arises not just from the U.S. current external account, but also from its financial account since foreign investors demand dollar denominated financial assets, the large and growing U.S. deficit has not been followed by a comparable depreciation of the dollar, as the data in Figure 2 show.

Figure 2



On the contrary, the U.S. dollar appreciated in real terms up to 2002, and some countries running a growing surplus against the U.S.—notably China—managed to peg their currency up to 2007.

In order to keep their currency from appreciating, many U.S. trading partners compensated the net demand for their currency stemming from their current account surplus with an equivalent net supply, used to purchase U.S. safe financial assets. The value of U.S. securities held by China in June 2011 had grown to 1.7 billion dollars, with Japan holding a slightly smaller amount at 1.6 bn dollars. Oil exporters hold a much smaller amount—given the size of their trade surplus. In Table 1 we report the holdings of U.S. long-term Treasury securities, which form the largest share of U.S. debt (other than equity) held abroad. The large share held in financial centres may be due—at least in part—to indirect holding of U.S. assets from surplus countries.

It has been suggested that U.S. financial assets are demanded by emerging economies as an insurance against possible capital flights, rather than as a measure to keep their currency undervalued. Whatever the reason, a growth strategy based on the accumulation of foreign debt is fragile and doomed to generate crisis which will be the more severe the higher the level of foreign debt.

Table 1: Foreign holdings of U.S. Long-Term Treasury Securities

by major holders in 2011. Per cent of U.S. GDP

	2011	2006	2000	1994
China	8.63	2.72	0.71	0.24
Japan	5.42	4.00	2.22	1.80
Brazil	1.40	0.25	0.07	0.00
Oil exporters	0.96	0.55	0.32	0.28
Taiwan	0.96	0.46	0.41	0.39
Russia	0.90	0.03	0.03	0.00
United Kingdom	0.78	0.35	0.74	0.64
Switzerland	0.70	0.25	0.18	0.14
Caribbean Fin. Centres	0.64	0.36	0.33	n.a.
Luxembourg	0.58	0.39	0.14	0.02
Belgium	0.56	0.09	0.07	0.13
Int.l organizations	0.42	0.14	0.29	0.14
Germany	0.38	0.28	0.55	0.65

Source: Department of the Treasury; B.E.A.

Notes: 1) values at end Dec 94; Mar 00; Jun 06; Jun 11, scaled by annual U.S. GDP. 2) Oil exporters include: Ecuador, Venezuela, Indonesia, Bahrain, Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia, the United Arab Emirates, Algeria, Gabon, Libya, and Nigeria. 3) Caribbean Financial Centres include: Bahamas.

The country issuing the international currency, the United States at present, will not have an external constraint, as long as her creditors are willing to accept dollar-denominated assets in exchange for exports to the U.S. However, the accumulation of U.S. financial assets in foreign countries will lead to capital losses, should the U.S. dollar devalue. And should foreign investors decide abruptly to stop rolling over their credit towards the U.S., financial turmoil may arise, unless the Federal Reserve is willing to fill any gap between supply and demand for U.S. financial assets. The current system has therefore been described as a 'balance of financial terror'. This is a slightly different way to put the so-called 'Triffin dilemma' (Triffin 1960): Triffin noted that when the international currency is issued by a single country—as it is the case with the U.S. dollar—the international demand for that currency may not be compatible with the domestic targets for monetary policy in the issuing country.

In a different perspective, again, if the world uses a single currency—the U.S. dollar—hoarding of that currency for precautionary reasons (or for whatever other reasons) put a deflationary bias on the system as a whole, as Keynes noted. According to the Fantacci's (2011) interpretation of Keynes, it is the use of the currency as a store

of value—rather than as a mere numerary or medium of exchange—which generates a deflationary bias, which would disappear under different institutional arrangements.

A similar set of problems has emerged, in our view, with the institutional arrangements that led to the adoption of the Euro, governed by an independent Central bank. As sovereign nations renounced to the possibility of devaluing their currency against their trading partners within the Euro zone (EZ from now on), the persistence of trade imbalances led to the accumulation of debts in the periphery, matched by credits in the core countries, notably Germany. When core countries stopped allowing capital to flow towards deficit countries, and required that deficit countries paid out their debt, a 'debt crisis' started.[2]

According to many commentators, all of the current problems were clear to Keynes as he laid down his proposal for the Bretton Woods conference. Keynes's proposal was centred on an International Clearing Union which would issue an international currency—the Bancor—which could not serve as a store of value, and would be created (and destroyed) automatically with current account deficits or surpluses. Equally important was the principle that external imbalances were a problem to be solved by the surplus countries as well as the deficit countries, to avoid the recessionary impact which arises when the adjustment is pursued by deficit countries alone.

As it is well known, the Keynesian plan was abandoned in favour of White's plan, which was amended at the last minute to have a gold-backed U.S. dollar as the only international currency, with a new international reserve asset—labelled Special Drawing Rights—based on a basket of currencies that could be allocated to participating countries. The institutions which were set up to supervise international payments and provide liquidity to deficit countries which were running out of reserves—the World Bank and the IMF—were organized so that a country requiring external liquidity was forced to adopt restrictive policies, and the recessionary trait which Keynes wanted to avoid was instead embedded into the system.

In the following we will briefly review, in Section 2, Keynes's proposal, and briefly examine how the international monetary system evolved, in Section 3, reviewing the relevant literature on the prospects for reform.

In Section 4 we present a formal model for the analysis of alternative organizations of the international monetary system, and in Section 5 we report some simulation results of our model. Section 6 summarizes and concludes.

[2] Space limitations prevent us from addressing the Euro zone problems in more detail. We will devote a different paper to this subject.

2. Main features of Keynes's Bancor proposal

A recent analysis of the debate which led to the Bretton Woods conference has recently been published by Fantacci (2011),[3] from which all the crucial features of a Bancor system, as imagined by Keynes, are clearly laid down. However, to our knowledge this paper is the first attempt to summarize Keynes's proposals in a formal setting which, given our stock-flow-consistent approach, has the merit of forcing us to propose a solution for all practical details.

The main reason for a new currency—the Bancor—and a new international institution—the Clearing Union (CU)—is to avoid the recessionary impact which are implicit in any system where the medium of exchange is provided in insufficient quantities, or—which amounts to the same thing—is hoarded either because it is perceived as a safe store of value or for insurance reasons.

Therefore, the Bancor should be only a unit of account that the CU uses to settle international transactions. It follows that, at least in principle, other existing currencies—including the U.S. dollar—would be used only domestically, and that there will be no need for international reserves.

Any transaction between two countries through the CU—say exports of goods from country A to country B—would generate an increase in the Bancor balance for country A, and a corresponding decrease in the balance for country B. Bancors are thus created—with limitation as we shall see later—without any need for collateral.

Each country would have a fixed—but adjustable—exchange rate between its own currency and the Bancor: there will be a threshold on each country's Bancor balance—say 3 per cent of that country GDP—which implies an automatic readjustment of the parity. If country A is running to large a surplus on its current account, and no other adjustment measures are taken (see below), the CU will have its parity appreciate against the Bancor, and a symmetric measure would be taken for countries running a deficit.

A Bancor-based system would therefore have the usual advantages of a managed exchange rate system, with a reduced volatility with respect to a floating rates regime.

The other important aspect of Keynes's proposal is that both creditor and debtor countries should bear the cost of readjustment, in the present of current account imbalances. This can be achieved by having both creditor and debtor countries pay interest on any Bancor position different from zero—at a rate determined by the CU. Interest would be paid in Bancor, which means that the creditor country will see its

[3] See also Piffaretti (2009).

balance with the CU reduced when interest are paid, while debtor countries will see their balance increase. It follows that—for the amount of interest paid on creditor positions—a country with a surplus would be giving part of its exports 'for free' by an amount given by interest payments.

Interest payments will generate a 'profit' for the CU, which can—and should—be used to sustain less developed countries. Since these countries usually lack technology and/or capital which must be imported, crediting the Bancor position of these countries would provide the necessary purchasing power.

In order to reduce imbalances, and avoid interest payments, surplus countries could also provide directly foreign aid to deficit/less-developed countries. In principle, they could also provide direct investment, or acquire financial assets. However, direct investment in a foreign country will imply a future stream of profits in the opposite direction, while the acquisition of financial assets will imply interest payments, as well as the future repayment of the debt. Allowing a Bancor-based system to coexist with these capital movements may not change significantly the unstable properties of the current dollar-based system: we plan to explore this issue in more detail in future research.

Another issue which is debated is whether the Bancor should be backed by some collateral, such as gold or securities.[4] In this paper we will assume that the Bancor is a pure fiat money, and we plan to explore other alternatives in future research.

3. The debate on IMS reforms

An early advocate of a reform of the International Monetary System (IMS) along Keynes's lines was Davidson (1992-93).[5] In his (2004) contribution, he reminds that, since the world economy is a closed system, Keynesian results of the recessionary effects of a propensity to over-save are relevant, irrespective of the exchange rate being fixed or flexible. He advocates a new system where countries running an external surplus have to share the cost of realignments by either (a) increasing their imports; (b) increasing foreign investment in deficit countries; or (c) increasing foreign aid. A similar position, stressing the need for coordinated solutions, can be found more recently in Kregel (2010).

The more recent debate has seen a growing number of contributions with slightly different approaches.

[4] See, among others, Rossi (2007) for some discussion.
[5] See also Davidson (1999); (2004).

Rossi (2009) stresses the relevance of Keynes's 'banking principle', according to which final payment must take place in the currency of the vendor, rather than leaving the vendor with a claim on deposits in a different country and currency, as it is today. He suggests the creation[6] of a Clearing Union (CU henceforth) which should issue a supranational currency backed by assets (securities). He notes that, under the Clearing Union, each country running a trade deficit will be supplying securities for an equivalent amount to the CU. On the other hand, the CU will be selling securities to surplus countries. No imbalance will occur. This last point, however, is problematic in our view, as it assumes that surplus countries are willing to accept CU securities (or debtor countries' securities). Imbalances will not disappear because of the adoption of a consistent system for clearing international transactions. Rather, by establishing mechanisms for automatic adjustment of trade (or capital movements) imbalances.

Alessandrini and Fratianni (2009a; 2009b) propose to establish a CU starting from an agreement between the U.S. and the ECB. They make it clear that a CU does not imply a unique monetary policy: 'A single monetary policy applied to vastly heterogeneous countries amplifies divergences between countries with different levels of development' (2009a: 20) which is also quite appropriate for the Euro area. The supranational currency they advocate would not replace domestic currencies: rather, establishing a CU should let countries acquire a degree of freedom in running monetary policy on domestic targets.

In our view, the contributions of Bibow (2009) and Costabile (2009) share some common features and provide more detail. In their proposals, the CU would imply a semi-automatic mechanism for exchange rate realignments, whenever a country's balance with the CU exceeds a given limit. Creation of supranational money would be endogenous. The new 'currency' would be overdraft money generated automatically by countries external deficits with the CU, up to a given quota. Interest rates would be applied to both deficit and surplus countries balances with the CU. Proceeds from interest payments would be used by the CU to support developing countries, thus ensuring that the coordinated realignment process advocated by Keynes and Davidson is in place. Finally, in this proposal no country should keep additional reserves, other than as their CU position.

Mateos y Lago et al. (2009) stress the need to reduce the demand for international reserves for insurance purposes (the over saving in Davidson's words) and explore different alternatives. Their results are summarized in a chart reproduced as Figure 3.

[6] From an initial agreement between China and the U.S.

Figure 3. Features of Alternative International Monetary and Reserve Systems

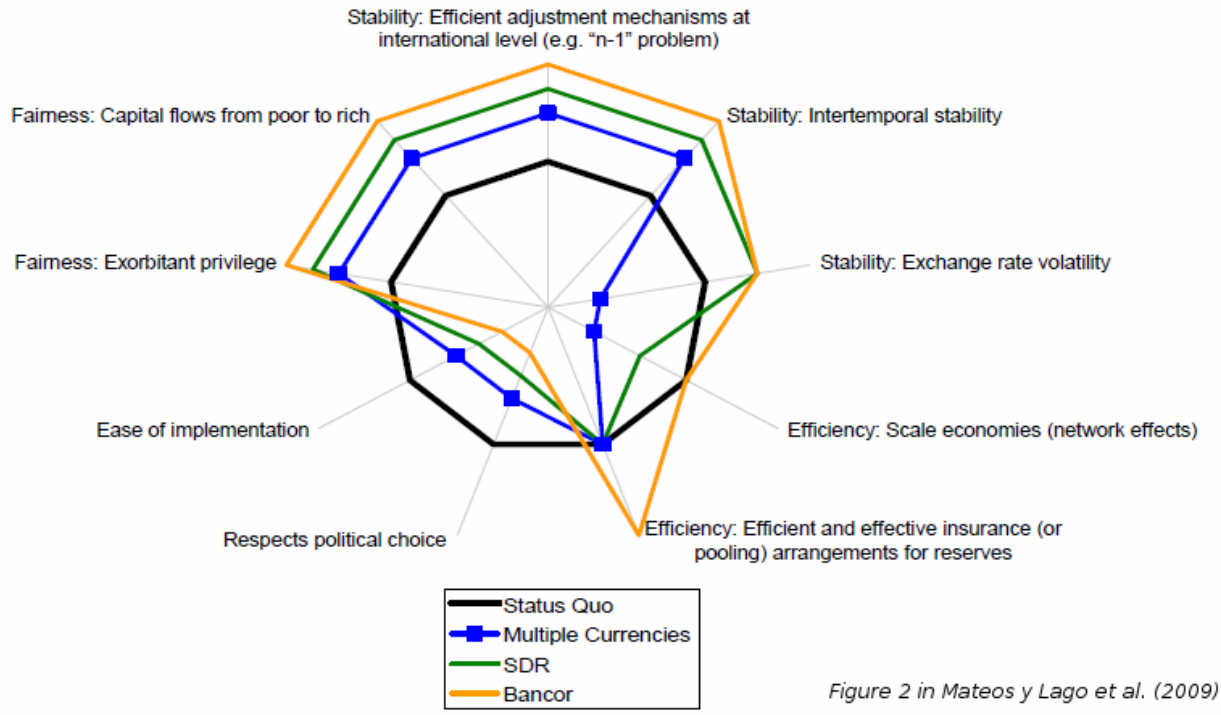


Figure 2 in Mateos y Lago et al. (2009)

The figure shows how alternative settings in the IMS would compare relative to the current situation. Their analysis suggests that a system along the lines of Keynes's Bancor would perform best with respect to:

- eliminating the 'exorbitant privilege' given to a single country issuing a reserve currency;
- eliminating global imbalances which imply that rich country have a current account deficit which implies in turn a transfer of financial capital from developing countries;
- reducing the instability of the adjustment mechanisms in exchange rates;
- improve the inter-temporal stability of currency values, and reduce exchange rate volatility;
- providing better insurance by eliminating the need to accumulate reserves.

However, they admit that the complex coordination problems required by establishing a CU and a Bancor are very relevant.

4. A stock-flow-consistent model with an international monetary institution

Our model is in the tradition of open economy, stock-flow-consistent models pioneered by Godley (1999) and Godley and Lavoie (2003). The main feature of these models is the complete integration of the real sectors of the economy with the financial sector, so that the linkages between money and credit on one side, and investment and growth on the other, are clearly set out. Besides, in these models saving for all sectors accumulate into wealth (or debt for negative saving). This allows an appropriate formalization of future income payments arising from dividends, interest payments etc., and in addition it is assumed that the existing stocks of wealth and debt are relevant for future expenditure and saving decisions. The result is a class of models which describe the evolution of an economy through time, with no necessary distinction between a 'short period' and a 'long period', since the latter is implied by a sequence of (out of equilibrium) short term adjustments.

While many of the features of stock-flow models relate to accounting identities, and should therefore be common to any proper macro model, in our approach based on Godley and Lavoie (2007a), it is assumed, in the Keynesian tradition, that production is demand-led, and that discrepancies between expected values of, say, disposable income, and the realized value will not be cleared instantaneously by some price adjustment, but will result in an unexpected level of one (or more) stock of assets, and this deviation from 'equilibrium' will be taken into account for future decisions, so that the economy is path dependent.

The path-breaking work of Godley (1999) and Godley and Lavoie (2003) showed how to model a watertight system with a complete, although simple, representation of both the current external balances and of the financial balances of two countries, and used the model to show that external imbalances for the country issuing an international currency can persist possibly without limits. They also showed that some results of the Mundell-Fleming textbook model do not hold, and offered insights on how to model alternative institutional or policy settings, such as fixed versus flexible exchange rates, and exogenous versus endogenous interest rates.

Later work include Izurieta (2003), who developed a model of dollarization; chapter 6 of Godley and Lavoie (2007b); Lavoie and Zhao (2010) who move to a three country model of China, Europe and the U.S. where the exchange rate between the U.S. dollar and the euro is floating, while the Chinese Renminbi is pegged to the U.S. dollar; Lavoie and Daigle (2011) who model exchange rate expectations; Mazier and Tiou-Tagba Aliti (2012) who expand Lavoie and Zhao (2010) to include endogenous inflation.

The current model expands on this literature—which shares a common modelling setting—to include an additional region and an international monetary institution, so that our model aims at describing the U.S., which is the only country issuing a reserve currency in our baseline scenario, Europe—or better the Euro zone—who has a floating exchange rate vis a vis the other currencies, China, who pegs its exchange rate to the U.S. dollar, and the 'Rest of the world', who also pegs to the U.S. dollar. The purpose of adding a fourth region[7] is to allow for more flexibility and realism, as well as being able to eventually tackle the 'n-th country problem'.[8]

4.1 The model[9]

As usual in SFC models, the accounting framework can be synthetically described with the help of matrices: a matrix for flows, reported in Table 2 for a representative country, and a flow-of-fund matrix, in Table 3, which implies—together with net capital gains on assets—a balance sheet matrix (not reported for space considerations).

Table 2: A Social Accounting Matrix for a typical region

	Prod.	**Hous.**	**Firms**	**Banks**	**C. B.**	**Gov.**	**RoW**	**C.A.**	**Total**
1. Production		+C				+G	+XN	+I	+GDP
2. Households	+W			+divB +rB					+YH
3. Firms	+P								+YF
4. Banks			+rL			+rB	+rBF		+YB
5. Central Bank				+rA		+rB	+rBF		+YCB
6. Government		+TH	+TP	+TPB	+PCB				+YG
7. Foreign						+rB			+YW
8. Capital account		+SH	+SF	+SB	0	+SG	-CA		+S
Total	+GDP	+YH	+YF	+YB	+YCB	+YG	+YW	+I	

[7] A model aiming at discussing current global imbalances should represent simultaneously the countries we list plus oil exporting countries, who also exhibit external surpluses. This is left for future exercises which take into account the impact of oil prices on economic activity.

[8] Exchange rates for the first n-1 countries imply the n-th exchange rates, and therefore it is not possible for all countries to target given exchange rates, unless they are mutually consistent. We will turn back to this issue when we discuss different model closures.

[9] The model consists of approximately 230 equations and it is not reported here for space consideration, but it is available from the authors on request. A detailed technical description of the model will appear in Mazier, Valdecantos Holporn, and Zezza (forthcoming).

Table 2 is organized following the usual input-output practice of recording payments in the columns, and receipts in the rows. This allow a tight identification[10] of who is paying to whom. For convenience, payments related to production are recorded in a separate row and column (#1), while all other payments are recorded in a transfer sub-matrix (from #2 to #7 in Table 2). Expenditure on real assets is recorded in column #1, while the corresponding row is expanded in Table 3 which details the flow of funds for our model.

Before moving to the analysis of flow of funds, we can briefly describe the main assumptions of the 'real sector' in the model—which are rather conventional in the SFC literature.

We assume that production is demand determined, and therefore we don't have an explicit representation of (the change in the stock of) inventories. This assumption implies that the sum of the payments in row #1 in Table 2 equal the sum of income payments in column #1.

The functional distribution of income is given,[11] and the wage bill, together with interest and dividends paid by bans, determines household income, which is taxed (row #2 and corresponding column in Table 2). Households spend out of disposable income and wealth and the residual saving determines the end-of-period stock of household wealth.

Non-financial firms do not distribute dividends, and have to pay taxes and interest on the existing stock of loans. Retained earnings are available for investment, which is determined by the profit rate, the cost of servicing the debt, an accelerator term and one version of Tobin's q.

We assume that banks distribute all of their profits—obtained from net interest payments—to households, although we keep the possibility of changing these assumptions in different versions by computing net bank profits and net wealth.

The Central bank is assumed to transfer its 'profits' to the government.

The government deficit is obtained as the difference between expenditure on goods and services, which grow at a constant, exogenous rate plus interest payments and tax receipts. Any deficit is financed by issuing new bills.

Imports are determined on a bilateral basis from GDP and the exchange rate, since we assume fixed prices in this preliminary version of the model.

[10] Tighter than what national accounts usually do, since only few countries report flows in a SAM framework, while most other countries report receipts and outlays separately for each sector.

[11] Although the model allows for exploring the impact of exogenous changes in this distribution.

Taken together, all these assumptions are sufficient to determine each sector financial balance—the capital account row in Table 2. Table 3 shows how this can be decomposed into financial assets and liabilities.

Table 3: Flow of Funds for a typical region

	Hous.	**Firms**	**Banks**	**C. B.**	**Gov.**	**RoW**	**IMF**	**Total**
Real assets		+ΔK						+ΔK
Cash	ΔH		ΔHb	–ΔH				0
C.B. advances			–ΔA	+ΔA				0
Bank deposits	+ΔM		–ΔM					0
Bank loans		–ΔL	+ΔL					0
Domestic g. bills			+ΔB	+ΔBcb	–ΔB	+ΔB		0
Foreign g. bills			+ΔBF	+Δ*BFcb*		–ΔBF		0
SDR				+ΔSDR			–ΔSDR	0
Total	+SH	+SF	+SB	+SCB	+SG	-CA	–ΔSDR	+ΔK

Our assumption that banks distribute all of their profits is consistent with our simplifying hypothesis on portfolio management. We assume that household keep their wealth in the form of cash or bank deposits, while banks have a more sophisticated portfolio, demanding both domestic and foreign bills, which are imperfect substitutes, according to their rates of return.

The demand for loans is given by the desired investment which cannot be financed by retained earnings and loans are provided on demand, with no credit rationing.

Banks are required to hold reserves as a share of deposits, and ask for advances from the Central bank whenever the amount of liquidity from deposits—or eventually own capital—is insufficient to provide loans plus satisfying their demand for domestic and foreign bills.

Again, Central banks are willing to provide advances on demand with no restriction on credit.

So far, our model does not depart from other open economy models already developed in the SFC literature. Our novel contribution consists in how we model

Central banks behaviour, and on the introduction of a supranational monetary institution, which we label 'IMF' for convenience.

4.2 Closure of the baseline 'U.S. Dollar Model'

The U.S. dollar model attempts to represent the international monetary system 'as we know it', i.e., a system in which a national currency (the U.S. dollar) is at the same time the international unit of account and medium of exchange. As it was noted by Keynes in the *Treatise*, if both functions are embedded in the same instrument, the latter also becomes a store of value. Therefore, in the current international monetary system the dollar is simultaneously:

1) The currency in which international trade is undertaken.
2) The unit of account for real and financial transactions.
3) The store of value held by the central banks which decide to accumulate reserves (regardless of the various reasons that they may have to do so). It should be noted that in recent years there has been a slight move towards reserve diversification.[12]

Thus, our standard model is one in which the People's Bank of China and the Central Bank of the Rest of the World, whose exchange rates are fixed against the dollar, accumulate reserves under the form of dollars. However, as it is observed in reality, keeping the dollar notes idle yields no interest earning. Hence, the way in which international reserves are actually held is under the form of U.S. Treasury bills.

It is now important to explain in detail how the model is closed, i.e., how stock-flow consistency is derived from the equations that constitute the model. Let us start with the EZ.

We assume that the EZ has a floating exchange rate with the U.S. dollar, which is therefore determined as the value which clears the market for U.S. bills in Europe. The tight accounting of our model ensures that the current account of each country equals its financial account, and therefore if a price variable—such as one exchange rate—implies a balance for the financial account, accounting consistency ensures that the current account is also cleared, since trade volumes, demand for international assets and the exchange rate are simultaneously determined.[13] The external balance of Europe will therefore be in equilibrium, once portfolio and trade adjustments are completed.

Once this has been done, we need to explain how the equilibrium in the balance sheet of the European Central Bank (ECB) is reached. Recall that since the ECB

[12] See Lavoie and Zaho (2010) for a model which addresses this issue.
[13] We have verified this statement through alternative closures of the model where the exchange rate was determined to clear the current account, and model behaviour did not change.

transfers its entire profits to the European government, its net wealth is constant over time. Therefore, we must ensure that the change in ECB's total assets equals the change in total liabilities. This is obtained through equation 174, which states that the ECB buys euro-denominated bonds in such a way that its assets and liabilities are consistent with a constant stock of wealth.

Let us now turn to the cases of China and the Rest of the World. Since their currencies are pegged to the dollar, the exchange rate can no longer ensure that their domestic bond markets are in equilibrium. Therefore, the adjustment in these markets has to be done by quantities, i.e., someone has to step in and purchase (sell) the excess supply (demand) of bonds. We assume that this agent is the central bank of each of these countries. Now, since the exchange rate is fixed, nothing guarantees that the current account is equal to the capital plus the financial account (which is an identity that needs to hold all the time). In order for this identity to hold, reserves need to be accumulated or depleted, depending on the performance of the current account. Reserves are accumulated under the form of U.S. Treasury bills. Although it may seem odd to write reserve accumulation in this way instead of referring to the current account surplus/deficit, given that the model is stock-flow-consistent it can be shown that our equations imply that the change in foreign reserves is equal to the gap between the current account and the capital plus the financial account (this one, excluding the demand for Treasury bills by the central bank which, in fact, is what we are defining as foreign reserves). Note, however, that the way in which our equations are written is not arbitrary—they imply, as it was described in the case of the Eurozone, that the balance sheet of the central banks is in equilibrium.

We can finally turn to the description of the behaviour of the U.S., which in turn will be useful to derive the 'hidden equation' that characterizes every SFC model. As it was already described, under the present system the dollar plays several functions. Thus, it may well be the case that the domestic supply of dollar-denominated bills (which is a result of the budget deficit of the U.S. government) differs from the world's demand for these assets. Thus, there is nothing that ensures that this market is in equilibrium. Hence, this also requires a quantitative adjustment carried out by some of the agents in the model. We will assume that the FED intervenes in the Treasury bills market by absorbing any excess supply or by selling part of its holdings in order to clear this market. We are now left with the task of ensuring that the balance sheet of the FED is in equilibrium, but we will show that this is redundant. Taking a look at the balance sheet of the FED, it is possible to observe that there are now endogenous variables left to be defined, i.e., the whole model has been already specified. Thus, it should now be

the case that the demand for Treasuries by the FED is such that the balance sheet of the FED is in equilibrium. This is the 'hidden equation' of this closure.

4.3 Closure of the SDR model

The SDR model attempts to represent one of the various alternatives that have been put forward during the last years based on a stronger role played by the SDR within the international monetary system. This proposal consists of taking up the idea of the substitution account, originally designed in the late 1970s. Under such a situation, governments and central banks would deposit dollar reserves in the IMF in exchange for claims denominated in SDR. Therefore, in a context where China and the Rest of the World accumulate foreign reserves, they would no longer be doing this under the form of U.S. Treasury bills but under the form of SDRs. Phrased differently, China and the Rest of the World would still be creditor countries but their credits would no longer be against the U.S., but the IMF. The IMF, once it receives the dollars from China and the Rest of the World, could either keep them or exchange them for U.S. Treasury bills. In essence the system would not work very differently to how it works today since in the end the U.S. would be bearing with the costs of an ever-increasing demand for global liquidity (i.e., if China and the Rest of the World keep on accumulating reserves, now under the form of SDRs, the U.S. would still be increasing its liabilities—the only change would be who its creditor would be).

Since the system would be working quite similarly, the closure of this model is rather similar to the one of the dollar model. Let us discuss it in detail.

As regards the Eurozone, the only change that should be noted is that the (non-operative) foreign reserves are constituted in SDRs and not in U.S. Treasury bills. However, since the euro is flexible these reserves are constant. We can assume that the euro, being one of the currencies that compose the SDR (which, as we will explain soon, is a basket-currency), has a positive stock of SDRs which has been allocated exogenously.

The cases of China and the Rest of the World are also similar to the dollar model. Since their exchange rates are fixed, the equilibrium in the bond market is ensured by the domestic central bank's purchases/sales of domestic bonds. However, reserve accumulation is no longer materialized in U.S. Treasury bills, but in SDRs. Thus, we can observe that there will be an endogenous demand for SDRs every period, given by the current account surplus/deficits of China and the Rest of the World. Based on the idea of the substitution account, each issuance of SDR by the IMF is backed up by an equal purchase of U.S. Treasury bills by the IMF. Since the IMF pays no interests on

SDR issuances but earns a positive interest on its holdings of Treasuries, it can make a profit, and therefore will accumulate wealth over time. Since the growing wealth of the IMF has to be kept in some kind of asset, we assume that this asset is also the U.S. Treasury bills.

Regarding the U.S., the situation is exactly the same one that we presented in the dollar model, with the slight difference that the composition of the demand for U.S. Treasury bills has now changed due to the introduction of the substitution account. But in essence, the idea remains the same: the FED ensures the equilibrium in the Treasury bills market and these interventions are such that its balance sheet is always in equilibrium.

The last point that needs to be explained is how the SDR is constituted and how the exchange rates of each of the four national currencies with respect to the SDR are determined. First of all, it should be noted that in this model, the SDR is not playing the role of an international medium of exchange (the dollar is keeping its role in this regard) and not necessarily the role of an international unit of account. The sole change that the idea of the substitution account proposes is to modify the international store of value, but the underlying problems of the international monetary system would still be there. That is why we consider that a further move onwards, a move that takes us closer to Keynes's idea of an international clearing union, should be taken. However, in terms of Fantacci (2011) this would imply the substitution of the principle of clearing for the actual principle of liquidity, which is not an easy decision to make (no matter how beneficial would be in economic terms).

Now that it is clear what the SDR is in our model, we can explain how it is composed. We define the SDR with respect to the dollar as a basket currency composed in equal terms by the dollar and the euro, i.e., the strong currencies. Appropriate equations determine the exchange rates of the euro, the Renminbi and the currency of the Rest of the World with respect to the SDR, respectively. These conversion rates are then applied in all the equations that embody some kind of relationship between the national currencies and the SDR (for instance, central bank's profits equations).

4.4 Closure of the Bancor model

We finally explore the implications of the introduction of an International Clearing Union (CU), roughly along the lines discussed in section 2 above.

Recall that this proposal implies the elimination of the U.S. dollar or any other financial asset as the international money (which, in turn, as Keynes suggested, is the reason why the adjustment mechanisms that are observed in the actual system are

asymmetric, meaning that the burden of the adjustment process is only born by the debtor countries) and its substitution for an international unit of account, the bancor, that would be used as a tool for settling international payments.

The introduction of an international clearing union, as it was suggested by Keynes, requires the compromise and coordination of all member countries. This institutional setting would tend to reduce global imbalances through three different mechanisms:

1. The elimination of the dollar (or any other financial asset) as the international medium of exchange would automatically deprive it from its role of international store of value. Countries would no longer be able to hoard dollars since the latter would no longer circulate internationally. Instead, surplus countries would accumulate bancors in their accounts at the Clearing Union. The impossibility to hoard international reserves, regardless the performance of the current account, would be a first disincentive to run persistent surpluses.

2. Unlike the case of a national clearing union (for instance, the banking system) where deposits are considered interest-bearing assets for the private sector, in the case of the international clearing union both credits and debits would be subject to interest payments. In other words, even though a country could be in a surplus situation, it could be argued that the positive stock of bancors has been lent by the clearing union (in the end, the surplus of the country is not against the clearing union, but against the rest of the world). Thus, both debtor and creditor countries would pay interests on their bancor balances (be them positive or negative). The fact that interest must be paid on these balances would encourage countries to keep them the closest to zero as it is possible. In order to do so, surplus countries could increase imports, undertake FDI projects abroad or send foreign aid to developing countries.

3. If the two aforementioned mechanisms were not sufficient to reduce the size of global imbalances, countries would be allowed to devalue their currencies in such a way that the external adjustment is made through the price mechanism.

To begin with, we introduce the international clearing union as the supranational institution where countries surpluses and deficits are registered under the form of bancor balances. These balances would be positive (negative) if the sum of the past stream of current account balances is positive (negative). Recall that in our standard model countries accumulated foreign reserves under the form of U.S. Treasury bills. Moreover, note that the change in the stock of foreign reserves was written as the difference between the change in all the remaining components of the balance sheet of each national central bank, assuming that the change in the central bank's wealth was always zero (since it transferred all its profits to the government). It is important to remember

this closure of the model because here lays the main modification that we introduce when modelling the international clearing union.

Table 4 presents a simplified version of the balance sheet of the five institutional sectors of one country. As it can be seen, bancors appear as an asset for the central bank. This does not mean that the bancor balance held at the ICU constitutes a actual asset for the country since this is not part of its wealth. But in order to preserve stock-flow consistency, it is necessary to register these bancors as an asset for the central bank. Otherwise, consistency would be lost since a surplus country would have registered a current account surplus that increases the domestic monetary base (liability for the central bank) while no balancing entry would be registered in the assets side, thereby reducing the central bank's net worth. Hence, this is a first complication that we encounter when eliminating the circulation of international money.

Table 4: A simplified balance sheet with Bancor holdings

Households	Firms	Banks	Government	Central Bank
	+K			
+Cash				–Cash
		+Reserves		–Reserves
+Deposits		-Deposits		
	–Loans	+Loans		
		–Advances		+Advances
		+Bonds	–Bonds	

Hence, the basic model is closed as follows:

i. All exchange rates are exogenously fixed to the bancor. Thus, each currency rate is also fixed with respect to the rest.

ii. Since the exchange rate is fixed, the central bank needs to intervene in order to clear the domestic bond market (recall that standard SFC models assume that the exchange rate is the price that clears the bond market).

iii. The stock of bancors of each country is determined by the equilibrium in the balance sheet of the central bank. Note that all the remaining components are already given. Thus, the change in the stock of bancors acts as a residual.

We can now introduce the adjustment mechanisms that stimulate countries to spend at least part of their surpluses instead of hoarding them at the ICU. Once these have been introduced, we expect global imbalances (which are represented by the trajectories of the current accounts) to be narrowed down. Basically, the ICU collects interests paid on existing Bancor balances (since not all the stock of bancors is necessarily depleted through the international trade mechanism described above) and transfers them as foreign aid.

We assume that interests are distributed equally to all the countries whose GDP is below the world average. This criterion is taken in order to replicate the mechanism proposed by Keynes, whereby these flows of foreign aid would help developing countries in their catching up process. Thus, the first step that needs to be taken in the process of distribution of foreign aid is to find out how many countries would be recipients of these flows.

Since these flows of foreign aid must take the form of goods (recall that this proposal for the reform of the international monetary system implies the elimination of international flows of money) the flow of foreign aid must somehow contribute to the development of the recipient country. We can do this by adding the flows of foreign aid to the stock of capital, as if it was an additional source of investment.

Finally, the interest payments paid and the foreign aid received by each country must be computed in such a way that, as Keynes proposed, the country's stock of bancors changes accordingly. For instance, if a country pays interests to the ICU its position must worsen (if the country was a creditor its credit should decrease, and if the country was a debtor its debt should increase). Since the change in the stock of bancors of each country is determined by the equilibrium of the balance sheet of the central bank, it is required that we incorporate the flows of interest payments and foreign aid into the balance sheet of the central bank.

This closure of the model ensures its consistency.

5. Model simulation under alternative closures

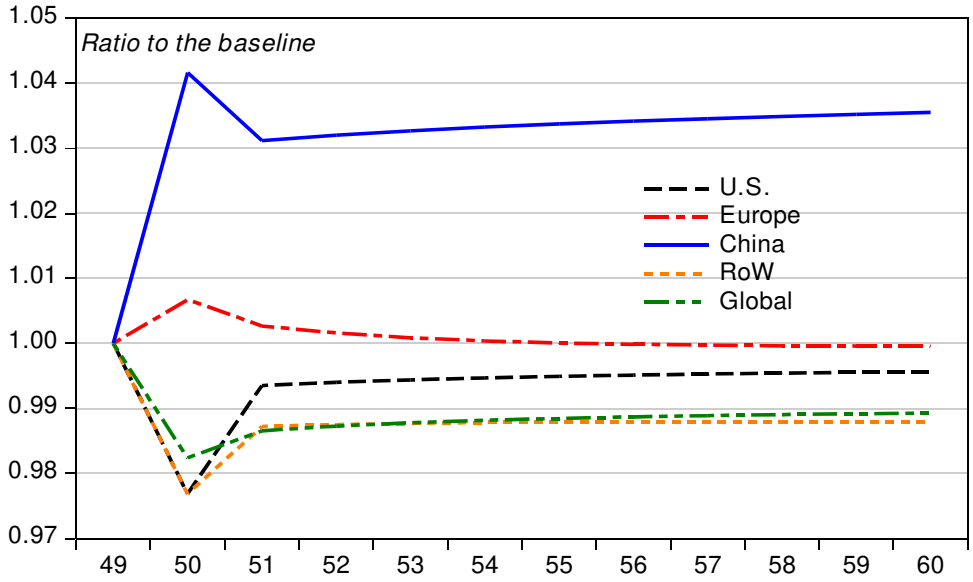
The aim of this section is to find scenarios that, based on the present configuration of the international monetary system, show the Triffin dilemma. In order to do so, we need to examine the impact of a situation in which the world's demand for the international currency (the dollar) increases while, at the same time, the issuer of that currency (the U.S.) pursues a restrictive monetary policy. This is a situation that could possibly happen and in such an event the result that we can foresee *a priori* is one of a global recession. The reason for this outcome would be given by the fact that the tighter credit conditions in the U.S. would discourage investment and economic growth, thereby improving the U.S.' current account. However, such an improvement in the external position of the U.S. is incompatible with a situation in which China pursues an export-led growth strategy, which in turn requires a growing amount of international liquidity. This scenario represents, in turn, one of the key shortcomings of the current *non-system*. As it was pointed out by Keynes for the case of the Gold Standard, the present *non-system* implies an asymmetric adjustment process through which the whole burden falls over the debtor countries. In this case, in order to restore external equilibrium the U.S. should reduce its level of activity.

We start with a stationary version of the 'U.S. dollar model' and assume that at a certain point of time, China decides to devalue the Renminbi by 5% in order to gain competitiveness such that exports are stimulated. Simultaneously, the U.S. responds to this policy by increasing its interest rate by 50 basis points. Therefore, from the perspective of the U.S., although China's goods are now cheaper, the negative income effect that results from the restrictive monetary policy may end up in an overall decrease of imports from China. Figure 4 shows the impact of this shock on the level of activity both at the domestic and global level.

As can be seen from Figure 4, the combination of a 5% devaluation of the Renminbi with a 50 basis points increase in the U.S.' interest rate leads to a global recession. Although China experiences higher growth as a result of the better performance of its exports, the recession in the U.S. ends up outweighing the expansive effect of China. There are various reasons why these two shocks play in a negative direction for U.S. GDP. First of all, the appreciation of the dollar against the Renminbi deteriorates the competitiveness of U.S. exports (the evolution of the current account of the U.S. can be observed in Figure 5). Second, the higher interest rate reduces investment since the burden of firm's debt becomes heavier. Finally, as a result of the lower level of activity, income falls thereby affecting household's consumption.

Figure 4

Effects on GDP of a 5% devaluation of the RMB and a 50 bp. increase in r_US



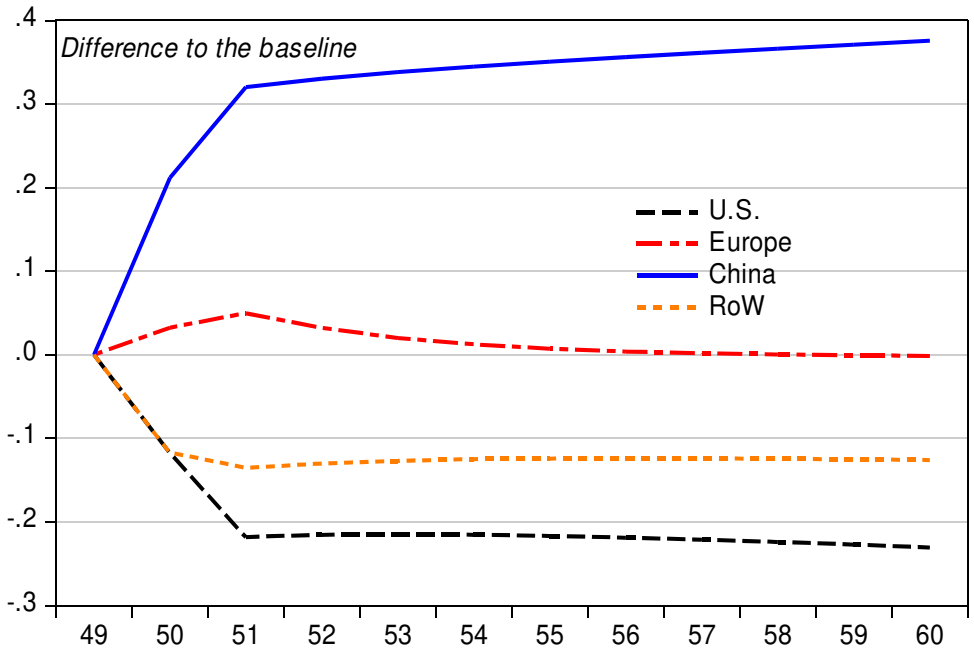
The effect on the Rest of the World is also negative because since it has its currency pegged to the dollar, the devaluation of the Renminbi with respect to the dollar implies an appreciation of the currency of the Rest of the World against the Renminbi. Therefore, the current account of the Rest of the World worsens as well (see Figure 5). The situation in the Eurozone is better since its exchange rate is flexible against the dollar. Hence, following the increase in the interest rate of the U.S. the dollar appreciates slightly against the euro (due to the capital inflows to the U.S. that seek better returns), which improves Europe's competitiveness against the U.S. However, this effect tends to fade away as the recession ends up reducing European exports to its three trading partners. As it can be seen in Figure 5, Europe's current account is always very close to a balanced position since its exchange rate is flexible an no specific shocks have been introduced regarding the structure of its economy.

Let us discuss more in detail the results shown in Figure 5. As regards China, its current account jumps into surplus because its currency has lost value (gained competitiveness) with respect to the currencies of its three trading partners. Regarding the U.S., in the period when the shock takes place the current account goes into deficit because whereas the impact of the devaluation of the Renminbi on U.S. imports is immediate, the impact of the increase in interest rates on investment is lagged (recall how the investment function was written). The 'positive impact' of the recession in the U.S. on its external position can be observed from the second period onwards since the

current account deficit narrows down. A similar situation explains why the current account deficit of the Rest of the World is slightly reduced from the second period onwards, i.e., the negative income effect that results from the current account deficit ends up settling the external position of the Rest of the World in a better situation with respect to the moment in which the shock takes place.

Figure 5

Effects on GDP of a 5% devaluation of the RMB and a 50 bp. increase in r_US



Let us now turn to the growing model with the dollar as the international currency. Note, however, that the configuration of the international monetary system is exactly the same. As a result, the comparison between Figure 6 and Figure 7 with respect to Figure 4 and Figure 5 shows that there is practically no difference between the two models. This, in principle, should be no surprise.

Figure 6

Effects on GDP of a 5% devaluation of the RMB and a 50 bp. increase in r_US

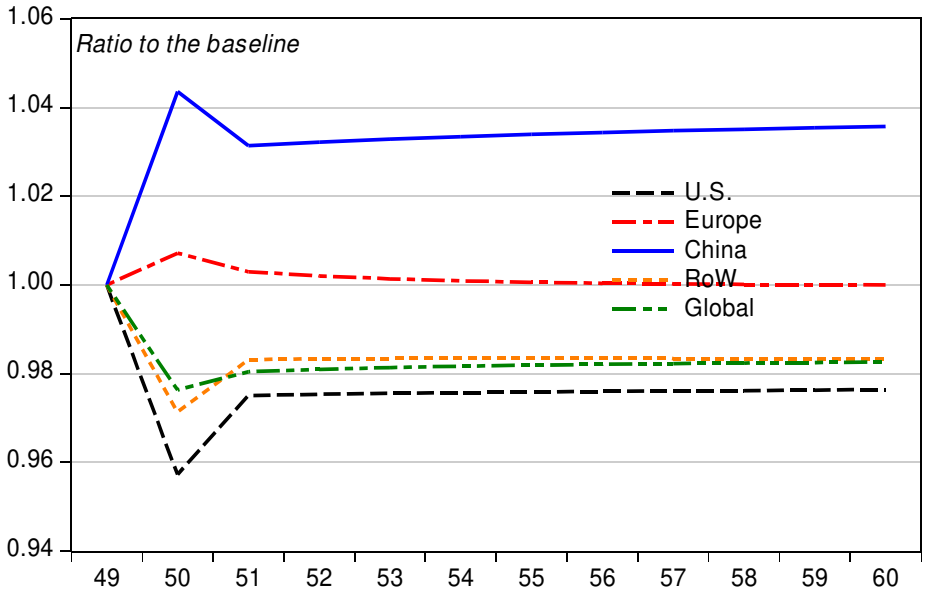
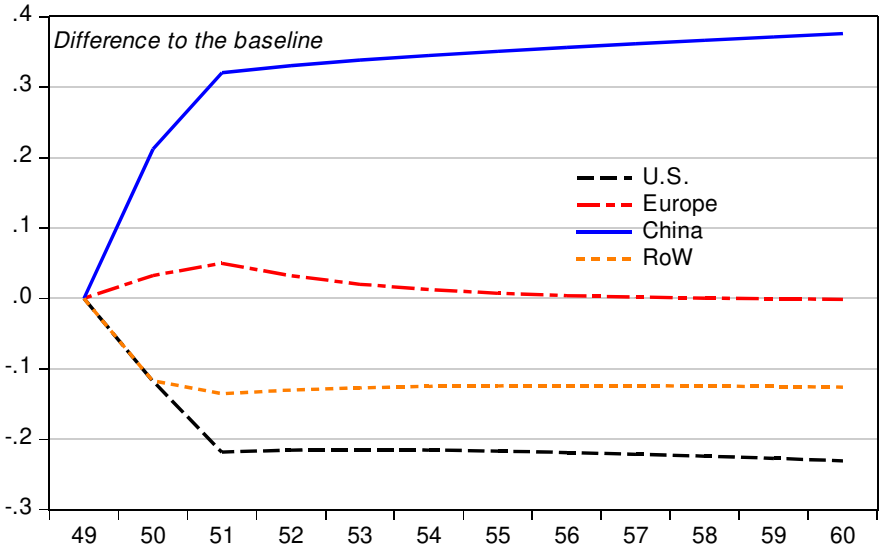


Figure 7

Effects on GDP of a 5% devaluation of the RMB and a 50 bp. increase in r_US



We next present the results of the same shock, but applied to the SDR-based model. Recall that in this case we are substituting the role of the dollar as the international store of value, but we are not changing the essential features of the international monetary system. Thus, we expect to get very similar results to the ones obtained in the previous model, which in our view represents the current state of affairs regarding the working of the international monetary system. And, in fact, that is what can be deduced from Figure 8 and Figure 9, which look very similar to the previous ones. The small differences can be explained by the fact that some flows of interest payments experience slight changes (for instance, in the dollar based model China earns interests on its foreign reserves and in the SDR model reserves yield no interests at all). But, in essence, it is clear that the working of the international monetary system will not change by the simple fact that the dollar is taken away its role as an international reserve currency. What should be done, if there is a real will to reduce global imbalances and the recession-biased adjustment mechanism implicit in the current *non-system*, is to give the SDR a function that is closer to the one that Keynes proposed for the bancor.

Figure 8

Effects on GDP of a 5% devaluation of the RMB and a 50 bp. increase in r_US

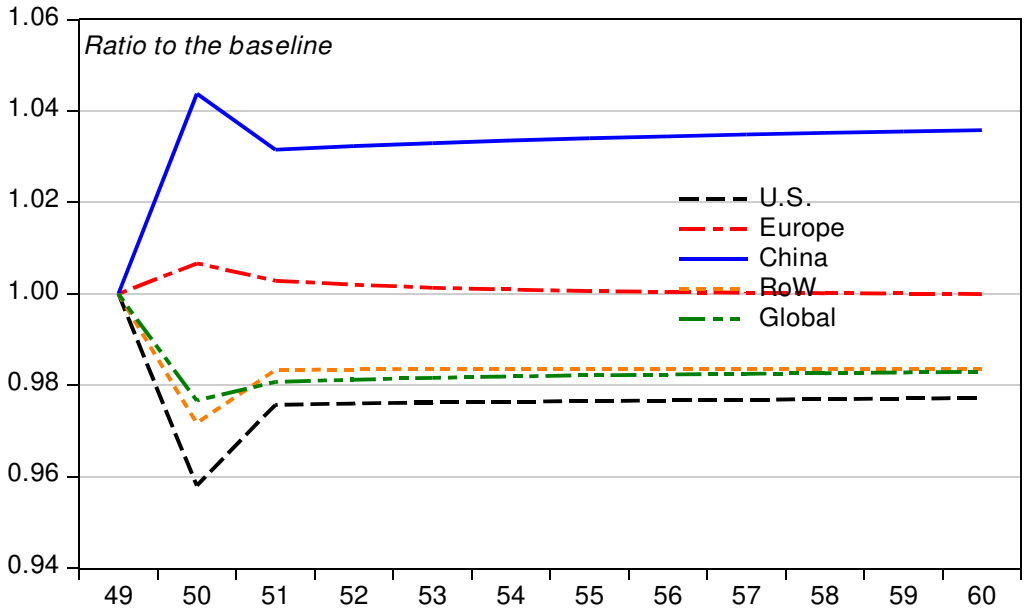
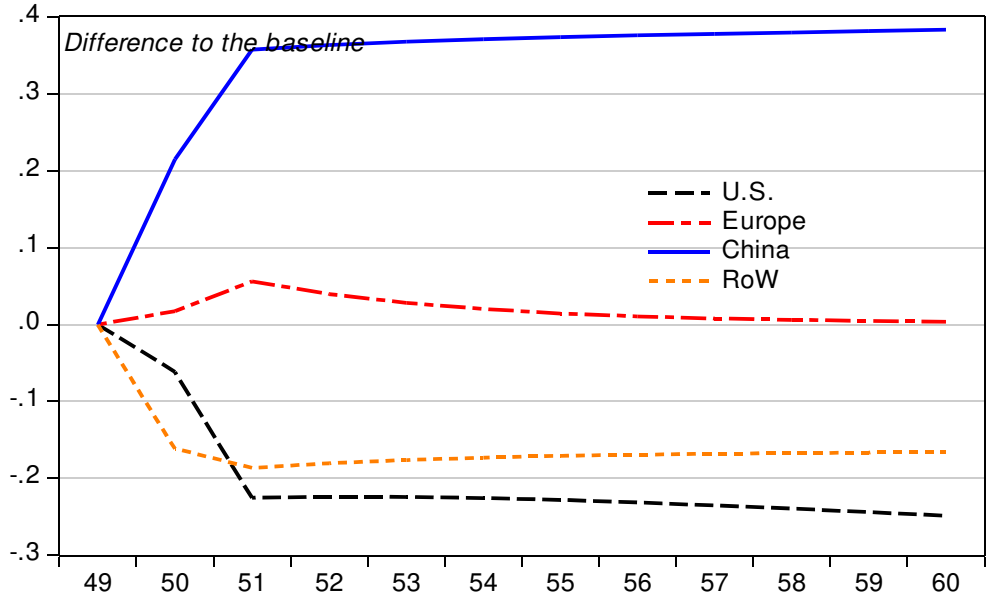


Figure 9

Effects on GDP of a 5% devaluation of the RMB and a 50 bp. increase in r_US



5.2 Model simulation under the Bancor closure

We finally present some preliminary results from simulating the 'Bancor-based' model.

In this setting, we cannot replicate the previous experiments driven by devaluation, since the exchange rate management is now depending on each country's Bancor balance at the CU.

Instead, we compare the outcome of an expansionary fiscal policy in the U.S., which in the current exchange rate regime would imply an increasing current account deficit for the U.S. matched by accumulation of U.S. assets in surplus countries.

In the Bancor-based model, the expansionary policy in the U.S. will have the usual effects of widening current account balances. However, when the U.S. exceeds its predetermined limit on its Bancor balance, the dollar automatically devalues. This boosts net exports in the U.S., and net imports in the other countries, restoring the balances (Figure 10[14]). The global impact on GDP in other countries is therefore

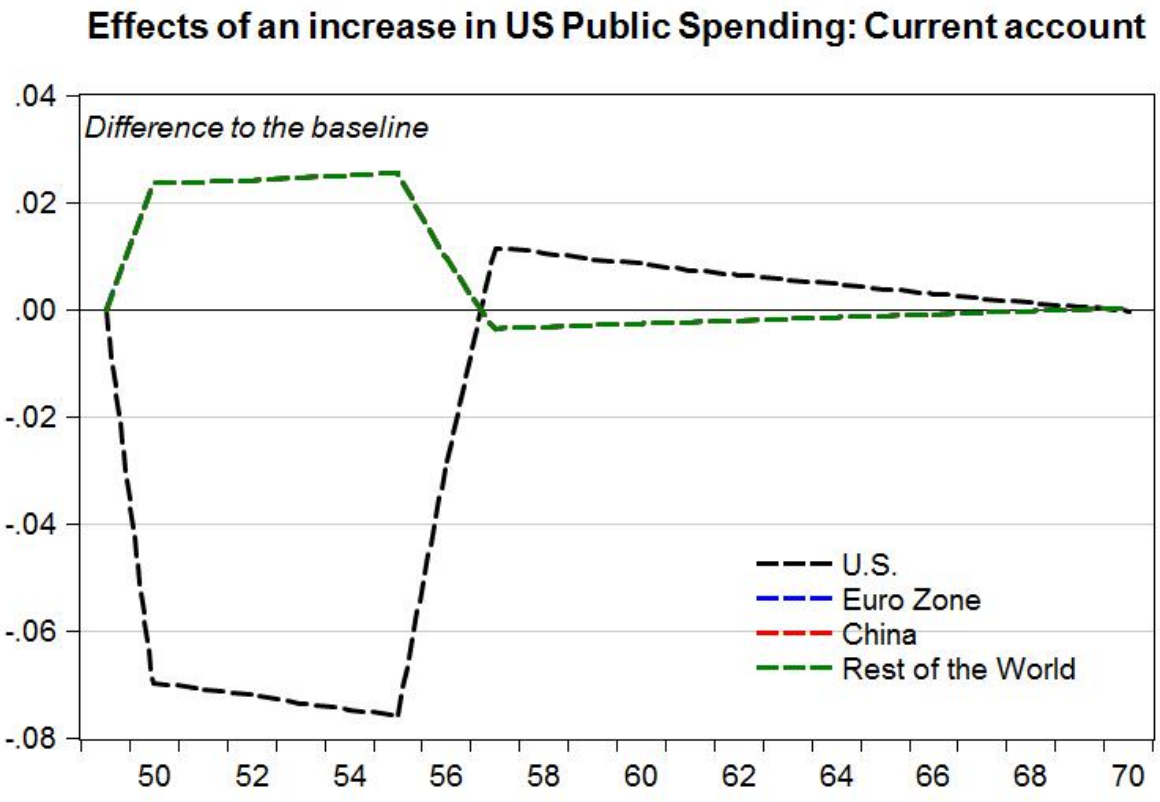
[14] The current account of China, the Euro Zone and the RoW overlap in the chart.

limited, as the increase in net imports after exchange rate realignments compensates for the increase in net exports before the adjustment.

This institutional setting will therefore make it impossible to pursue export-led growth in the medium term, which is one of the potential sources for accumulation of debt and instability.

We tried to introduce into the model an automatic redistribution of CU profits to less developed countries. However, with the current parameter settings which assumes that all countries have similar features in the baseline, aid transfers tend to create oscillatory behaviour. We therefore leave a better specification of international transfers to future research.

Figure 10



6. Conclusions

In this paper we have addressed the links between global imbalances, which have repeatedly been a co-determinant of financial instability and global recessions, and the current state of the International Monetary System. Several authors, usually in the Keynesian tradition, underline that the possibility of hoarding the international currency, be it for speculative, strategic or insurance reasons, is one of the determinants of the features of the current system. They therefore suggest, although with different technical details, possible reforms of the IMS along the lines of the original Keynes's plan for the Bretton Woods Conference. However, this literature does not usually adopt a full, consistent model to evaluate the implications of monetary reforms on both the real and the financial sector of integrated economies pursuing non-coordinate policies.

The aim of this paper has been to provide such a framework, in the tradition of stock-flow-consistent models pioneered by Godley (1999) and Godley and Lavoie (2003). We have set up a model of four blocks: the United States, the Euro zone; China and the 'Rest of the World'. All countries trade with each other in both goods and financial assets, and for each economy we make simple assumptions on the behaviour of households, non-financial firms, banks, the central bank and the government.

We chose to minimize the amount of specific assumptions about each block, in order to be sure that our simulation results would not depend on arbitrary priors (such as, for instance, a lower propensity to import in one block). The only specific assumptions are that China and the RoW peg their currencies to the U.S. dollar, while the euro is allowed to float.

We then close our model assuming—as in the current system—that the U.S. dollar is the only international medium of exchange and store of value, so that a current account surplus in China, say, would be matched by an equivalent increase in U.S. bills held by the Chinese Central bank. With this closure we are able to replicate the 'Triffin dilemma': a restrictive monetary policy in the country issuing the international currency will have global recessionary effects.

We next modify our model to study the potential impact of an increased role for SDRs as reserve currencies, and show that in this case the consequences of a restrictive monetary policy are very similar to the case where the U.S. dollar is the reserve currency. A monetary reform which does not question the necessity for surplus countries to share the cost of readjustment will not have any significant impact.

We finally assume the introduction of an International Clearing Union and the Bancor, used to settle international payments, and confirm through simulation that this

setting would automatically adjust current account imbalances, preventing countries to pursue export-led strategies which necessarily imply financial instability.

We still need to strengthen our results with alternative closures of the model in the Bancor regime, as well as expanding our model to take inflation and price competitiveness into account. This will be the object of future research.

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