The failure of financial macroeconomics and what to do about it

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Abstract

The bargaining power of international banks is currently still very high as compared to what it was at the time of the Bretton Woods conference. As a consequence, systemic financial crises are likely to remain recurrent phenomena with large effects on macroeconomic aggregates. Mainstream macroeconomic models dealing with financial frictions failed to explain at least eight features of the ongoing crisis. We therefore suggest two complementary assumptions: (I) A systemic bankruptcy risk stable equilibrium may be feasible, besides another stable equilibrium related to a stability corridor, (II) inefficient financial markets rarely ensure that the price of an asset is equal to its "fundamental long term value". Both assumptions are compatible with a structural research programme taking into account the Lucas' critique (1976) but may start a creative destruction process of the Lucas' view of business cycles theory.

Keywords: asset prices, liquidity trap, monetary policy, financial stability, business cycles, liquidity trap, dynamic stochastic general equilibrium models.

JEL Codes: E3, E4, E5, E6.

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Introduction

The current worldwide financial and economic crisis encourages revolutionary thinking in the field of macroeconomics and finance, e.g. in places such as the "Institute for New Economic Thinking" launched recently. There is scope for changing the research agenda of macroeconomic business cycles and growth theory. Besides these declarations of intent, where are we today? This paper highlights selected issues.

The first issue concerns the regulation of international finance. Today's capital markets are much less regulated than capital markets in the period from 1945 to 1973. This is identified as one of the reasons for a higher frequency of financial crises. Do conditions exist that may lead to a great reversal of weakly regulated to strongly regulated international financial markets? Our analysis suggests that the bargaining power of international banks is currently too strong so that we will not observe a great reversal in the near future. As a consequence, weakly regulated international capital markets are likely to persist in the next decades. This implies a high probability of financial crises leading to worldwide recessions that can be very costly in terms of welfare. For this reason, macroeconomics theory has to deal with weakly regulated international capital markets, allowing for systematically erroneous valuation of assets (the efficient asset market hypothesis is not valid).

The best theoretical models available before the crisis dealing with imperfect capital markets were "financial accelerator" dynamic general stochastic equilibrium models (Kiyotaki and Moore (1997), Bernanke, Gertler and Gilchrist (1999), Bernanke and Gertler (1999, 2001), Iacoviello (2005)). These models took bankruptcy costs and credit rationing for non-financial firms and, some of them, for banking firms into account. They assumed that debt is backed by the future valuation of collateral. However, they maintained the assumption that collateral is valued according to its fundamental value. In other words, they assume imperfect capital markets along with an efficient financial market hypothesis. The second issue of our paper is then to analyse these models with respect to their capacity to deal with the ongoing financial crisis. We found eight characteristics of the current crisis that could not be explained by the financial accelerator model

The third question asks which assumptions have to be changed if one really wants to do a revolution in mainstream macroeconomics. We identified two major complementary assumptions to remove: (I) Only the locally stable equilibrium without systemic bankruptcy risk matters; then the confidence or liquidity crisis second equilibrium with systemic bankruptcy risk is completely neglected, (II) under the efficient financial market hypothesis the price of an asset is always equal to its fundamental value; then valuation errors are not possible. These two assumptions are *complementary* in the sense that a higher volatility of asset prices leads to a higher volatility of leverage and of investment, which increases the probability to shift to the second systemic risk equilibrium.

In the current macroeconomic modelling, the efficient market hypothesis is related to auxiliary assumptions: (II-b) The no-Ponzi-game condition states that the growth rate of public and private debt has always to be below the real interest rate, (II-c) the *linearization* around the equilibrium of the *unique* stable path leads to a *unique* long term equilibrium, reducing the study of macroeconomics dynamics to qualitatively similar responses of macroeconomic variables to shocks; structural instability is excluded by assumption.

Relaxing these assumptions is compatible with a structural research programme that takes into account the Lucas' critique (1976), but may start a creative destruction process of the Lucas' view of business cycles theory. It is briefly sketched that the ongoing macroeconomics research may be a first step in this direction.

The rest of the paper is organised as follows: In a first section we discuss the problem of financial regulation. The second section analyses the shortcomings of the dynamic stochastic equilibrium model. In the third section we give an outline how to change the underlying assumptions of a research programme that is able to deal with financial crises. A last section concludes.

1. "It" can happen again tomorrow

1.1. A "great reversal" in the regulation of international finance?

In order to get an idea of what is to be expected to change in the real economy in the two decades following the crisis we distinguish two regimes of financial regulation: a weakly regulated financial system and a strongly regulated financial system. These regimes exhibit a number of stylized facts.

Weakly regulated International Finance (regime A): Governments do not impose restrictions on international capital movements. Then, international inter-bank capital flows, and offshore finance may lead to widespread opacity:

- A1. International banks trading international assets have balance sheets which contain items with a value that is not only highly uncertain, but far from its fundamental value. The risk of those assets is not correctly priced. The share of these assets is large.
- A2. International banks may use offshore finance to hide profits (tax evasion) or to hide losses (soft budget constraint).
- A3. An increase in off-balance sheet activities exposes banks to default risks that bear the danger of not being assessed correctly.
- A4. Banks have incentives to take huge risks due to the bail out by governments for banks which are too large and too interconnected. Then, banks remain highly-leveraged in a weakly-regulated financial system.

A1, A2, A3 and A4 lead to a larger probability of expectation driven loss-of-confidence systemic crises, in particular among banks, since banks are more aware of the risk of other banks than depositors. An under-estimated feature of the current crisis is the *persistence* of the lack of trust between banks. There is a naive belief that this trust will be quickly restored at the same time than GDP growth reappears, which would signal the exit of the crisis for the real economy. But this lack of trust is related to a persistent unreliability of the valuation of several items in banks balance sheet, which is not perfectly correlated with GDP growth. We would expect a major crisis once every three normal business cycles of 8 years.

- Remark 1: universal banks doing retail banking and financial market operations are likely to increase the risk of transmission of bubbles on asset prices to the real economy, through a credit channel. Capital gains and capital losses on the equity market would be linked to simultaneous increases (or respectively) decreases of retail credit.
- Remark 2: In this context, government owned banks that are allowed to do international finance are likely to speculate in the same way as privately owned banks, because it is too easy to make profits and losses in the same manner as their privately owned competitors.

The benefit of this regime is a potential better allocation of capital at the international level, along with the drawback of a higher probability of systemic risk at the world level.

Strongly regulated international finance (regime B): Governments impose restrictions on international capital movements. This includes the control of international capital flows of large international banks, the control of issuing securities, and the control of the amount of credit by large retail banks in order to limit bubbles at the national level, when this amount of credit is "too high" or "too low" for small and medium size firms or for households (strong macro-prudential policy). This means that the involvement of government in the decisions for the allocation of capital is large.

The drawback of the strong regulation regime B may be a misallocation of capital at the international level, along with the benefit of a lower probability of the contagion of crisis and of systemic risk at the world level.

The shift from regime A to regime B is a "great reversal" as described by Rajan and Zingales (2003), similar to the one which followed Bretton Woods from 1945-1973 with respect to the period 1870-1940.

1.2. A weak bargaining power of international banking in 1945.

The main task after the Second World War was the rebuilding of the destroyed economies. In this context, at a conference organized in Bretton Woods in 1944, future institutional arrangements for the world economy and financial regulation were fixed. Some conditions favouring regime B after 1945, thus leading to a "great reversal" are:

- Immediate post-war economy, with a strong government stake in the allocation of capital.
- Future reconstruction plans with a strong government stake in the allocation of capital (Marshall Plan Aid), along with a competition with the Soviet Union economic system.
- Capitalism in immediate search of stable arrangements with wage-earners, with a weak influence of the owners of capital.
- International banking in shambles in several countries due to war and destruction.
- Political consensus to keep a regime of fixed exchange rates.

Already in the interwar period a number of other developments were observed that supported a "great reversal" in the relative bargaining power of international banking and finance in the world economy.

- International capital flows decreased and were under government supervision.
- International trade decreased widely.
- Government stakes in the banking sector in the allocation of capital remained large in a number of countries (e.g. France, Japan, and Germany).
- A large stake of the private banking sector was confined to the national retail banking activity, while facing effective direct credit control in France up to 1983, facing the competition of nationalized financial institutions for deposits (Japan post office), facing regulatory walls against cross state banking in the U.S. and against universal banking with the Banking Act and the Glass Steagall Act (1933), that separated the activities of retail banking and the securities industry.

As a consequence of the Bretton Woods agreement, relatively few financial crises occurred in the period 1945-1973, as recorded for example by Reinhart and Rogoff (2009). Strong regulation and weak bargaining power of the financial sector, may serve, therefore, as a key explanation of the low frequency of world financial crises over the last one hundred years. A world financial crisis may last a decade. The gap between 1929 and 2007 suggested that the frequency was one world crisis every eight decades. However, three decades are related to be Bretton Woods period (1945-1973). Any computation of a probability of occurrence of world financial crisis has to deal with the relative bargaining power of international finance with respect to governments and to wage earners, in particular in its ability to limit the control of international capital flows and maintain a large degree of opacity on those international capital flows.

1.3. A strong bargaining power of international banking in 2012.

Today, the pre-conditions of the Bretton Woods era, which were already limiting the bargaining power of international banking before the agreement was made, are obviously not met. The current economic and geo-political context is totally different from the immediate post World War II context of Bretton Woods in 1945. The balance of power between international finance, government and wage earners will remain in favour of international finance, helped by the usual international coordination problems between governments and jurisdictions.

For this reason, the G20 is currently unable to foster influential reforms limiting effectively the power of international finance. Government control of international capital flows and the aim to decrease their opacity (fighting against offshore finance) and the control of credit aggregate (which is the true objective of the euphemized “macro-prudential regulation”) are words which are not likely to be backed by political decisions. As such, the Dodd Frank Act, the Basel III agreements are much less radical than the Banking Act in 1933 in the United States. What is more, much of the upcoming proposed policies related to macro-prudential regulation are to be implemented for the next boom whereas the crisis is not yet finished. In particular, several proposals intend to control credit aggregates and bubbles on asset prices in order to limit over-lending.

Hence, international banking and finance will be in a position to maintain a non negligible probability of another worldwide financial and economic crisis in the next twenty years. So “it is likely to happen again”, with a much higher frequency than having to wait seventy years for the third worldwide financial and economic crisis, along with a large output and welfare loss due to another depression of the world economy.

What is more, governments may need the support of bubbles in emerging markets (China and India) or on commodities, so that the financial market activities of private international banks restore the profits and the solvability of banks, much faster than by retail credit activities. As a consequence, these bubbles would allow governments to sell shares in private banks that they bought during the liquidity crisis in order to support the banks. This income coming back may limit partially their budget deficit and may decrease their probability of default. This may happen within three years time, a duration which may match electoral cycles. As a consequence, the support of governments for bubbles driven by international banking may exist, as a short term exit of sovereign default risk. The underlying idea is as follows: the harm of bursting bubbles can be repaired by upcoming bubbles.

As well, the opportunities of opacity to support soft budget constraints in a period of crisis are most useful. Imagine a bank in Ireland declaring bankruptcy at the same time when the risk premium on the sovereign debt is high because of IMF negotiations. The ability to delay by a few months the news of the losses of the private banks by hiding them in offshore financial centres allows to avoid a liquidity crisis of the government.

Another benefit of opacity during crisis management is to smooth the social acceptance of buying assets with negative returns with probability one. The trouble with financial crises is that they reveal that some assets exhibit negative returns with probability one, that nobody wants to buy. Opacity allows spreading those losses in larger portfolios to be sold to investors, for example, after an electronic trip to offshore financial centres. In other words, an opaque securitization of losses allows to smooth conflicts during the management of crisis, using the benefits of a veil of ignorance.

Note however, that the default on their sovereign debt of several very large countries of the G7 would leave the door open to unintended consequences. In particular, the default of a large country in the Euro area may imply first the *de facto* nationalization of several large European banks, as governments would rescue them and get the majority of shares, and second, the immediate control of capital flows for the defaulting country, if it gets out of the Euro area. Its devaluated new currency would immediately lead to an increase of the burden of borrowing repayments in Euro (as an "original sin"), a systemic risk on national banks along with a temporary sudden stop on credit, a temporary large drop of GDP and social unrest. However, it is likely that this self-defeating disastrous scenario for capitalism would be avoided at all costs.

Because a great reversal in the regulation of international finance is not likely to happen, one business cycle every three decades is likely to be driven by a worldwide financial crisis. As a consequence, the dominant theories of business cycles need to be revised since they are not capable to dealing with worldwide financial crises. The overall costs of business cycles predicted by these models have also to be revised: the costs of depressions are much larger than the ones of recessions. The key assumptions of these models have to be changed.

2. The failure of the financial accelerator dynamic stochastic general equilibrium models.

2.1. The hypothesis of the financial accelerator DSGE.

The dynamic stochastic general equilibrium (abbreviated DSGE) methodology attempts to explain aggregate business cycles, describing GDP, consumption, investment, prices, wages, employment, and interest rates, and mostly the effects of monetary policy (and to a little extent, the effect of fiscal policy), on the basis of macroeconomic models derived from intertemporal utility maximization (see Carré (2011) for a critical survey).

New Keynesian DSGE models assume that prices are set by monopolistically competitive firms, and cannot be instantaneously and costlessly adjusted. Money plays a role in the short run. Central Banks' behaviour follows for example a Taylor rule (Smets and Wouters (2003)). The DGSE methodology includes extensions with the "financial accelerator" effect, which take into account financial constraints. In this setting, there is heterogeneity of households. Some are lenders, some are borrowers. Four key assumptions are currently made that lead to models with similar results (Kiyotaki and Moore (1997), Bernanke, Gertler and Gilchrist (1999), Bernanke and Gertler (1999, 2001), Iacoviello (2005), Del Negro, Eggertson, Ferrero, Kiyotaki (2010), Gertler and Kiyotaki (2010)).

1. In the first key assumption – credit rationing with a collateral constraint – debt B is limited by the value of a collateral K owned by borrowers. The value of the collateral is given by its expected price q of the next period and a cyclical maximal loan-to-value ratio m, *strictly below one*, that may depend on several characteristics Z.

(1) $$(1+\mathrm{r_t})\cdot \mathrm{B_t} < \mathrm{m}(\mathrm{Z_t})\cdot \mathrm{E_t}(q_{t+1})\cdot K_t$$

The characteristics *Z* are a number of factors that are – up to now – not fully specified. For example, these variables may be related to the inter-bank liquidity market, to the liquidity provided by central banks, to imperfect competition in the banking sector, to the heterogeneity of borrowers' proportion of liquid collateral in their balance sheet, to the heterogeneity of the expectations of lenders…

The key issues for the expected price of the collateral are the time horizon and its valuation at the long term fundamental value. If the expected price is not equal to the long-term fundamental value, the expectation of the asset price next year may differ a lot from the average value of the collateral for the next ten years. However, most of the literature assumes that the valuation of assets follows its long term fundamental value.

The ratio of current debt to the current value of the collateral is limited by the ratio of the growth factor of capital gains to the interest rate factor. This gap between the return on assets and the return on lending is a negative function of the dividends on assets owned by lenders according to the arbitrage equation for lenders presented later on (equation 5).

(2) $$\frac{\mathrm{B_t}}{q_t K_t} < \mathrm{m}(\mathrm{Z_t})\cdot \frac{1+\frac{\mathrm{E_t}(q_{t+1})-q_t}{q_t}}{1+r_t} \approx \mathrm{m}(\mathrm{Z_t})\cdot\left(1+\frac{\mathrm{E_t}(q_{t+1})-q_t}{q_t}-r_t\right)$$

2. An alternative assumption states that the interest rate on credit includes a default premium that depends on the probability of default, which increases with the debt/asset ratio. The probability of default matters because there are deadweight costs in case of bankruptcy.

(3) $$r_t = r_0 + g\left(\frac{B_t}{\frac{\mathrm{E_t}(q_{t+1})}{q_t}\cdot q_t K_t}\right)$$

The higher the current leverage, the larger is the risk premium. The higher the expected growth of asset prices, the lower is the risk premium.

3. Once these two equations are used, wealth accumulation, also labelled "flow of funds" accounting equality, creates a specific dynamical relation for the financial structure (debt/assets). Typically, the models assume that new shares issues are too expensive, so that internal savings (net of consumed dividends) and new debt finances some financially constrained firms or households:

(4) $$q_t(K_t - K_{t-1}) = B_t - B_{t-1} + \mathrm{F}(\mathrm{K}_t) - (1+r_{t-1})B_{t-1}$$

In overlapping generation models, researchers often assume that capital fully depreciates during each period, so that the flow of funds equation relates the stock of capital to savings (Matsuyama (2007)).

4. A final key relation is an arbitrage condition for lenders, who may own some assets and have to decide whether to lend at a given return or to invest in their own firm, with marginal return G'(K) along with capital gains or capital losses on asset prices (for example, in Kiyotaki and Moore (1997) and Miller and Stiglitz (2010)).

(5) $$r_t = \frac{\mathrm{E_t}(q_{t+1}) - q_t}{q_t} + \frac{\mathrm{G'}(\mathrm{K}_{t,lenders})}{q_t}$$

When the expected capital gains or losses are exactly equal to zero, the arbitrage equation leads to the perpetual rent equation fort the "steady state" price of the asset:

(6) $$q_t = \frac{\mathrm{G'}(\mathrm{K}_{t,lenders})}{r_t}$$

But the dynamical equation is diverging from this steady state price, as soon as the capital gains are not equal to zero at a given date:

(7) $$\mathrm{E_t}(q_{t+1}) = (1 + r_t)q_t + \mathrm{G'}(\mathrm{K}_{t,lenders})$$

This is an unstable dynamical equation for asset prices leading to bubbles, as soon as the price is not exactly equal to its long term value (the net present value of all future marginal returns discounted by the opportunity cost which is the return on lending). This equation is the one which is at the origin of the infinite number of unstable paths, except only one which is stable for linearized systems. This is the equation that needs to be tamed by assuming that only the stable path is chosen by the economic agents. In this case, the *efficient market hypothesis* is valid: the asset price does not differ from its fundamental value at any period of time for which lasts the simulation of the model.

The DSGE models with financial accelerator assumed *imperfect* capital markets, with either the assumption of credit rationing or of bankruptcy costs (also labelled agency costs), but they assumed the *efficient market hypothesis* for the valuation of asset prices, which valued the collateral in the financial constraints.

The financial accelerator results were consistent with a policy advice that is only recently challenged in central banks. Following the Internet Stock Market Bubble (2001), the sometimes called "Jackson Hole conference" consensus was that central banks should not try to stop asset price bubbles before they burst. They have to be accommodated ex post; the repo interest rate should be decreased after the bubble burst. Taylor rules with asset prices have a negligible effect in DSGE including the financial accelerator. Researchers of the Bank of International Settlements, such a Borio and Lowe (2000), however, consistently presented opposite views. What is more, these DSGE models augmented by the financial accelerator present a list of failures when applied to the current crisis.

2.2. The failures of the financial accelerator DSGE.

We will now analyse these failures to describe the current crisis, following DSGE modellers evaluating the usefulness of their model by judging how well model generated data match the data for an actual economy, following Friedman's (1953) criterion for assessing models: what matters is the accuracy of their predictions. A typical approach is to compare actual and model generated relative variances of macroeconomic variables, their simple correlations and auto-correlations (Stadler (1994)):

1. The *welfare cost* of the crisis, related to the large GDP fall in the U.S., was much larger in the current crisis than expected from the model. In a DSGE, the size of the initial shock is exogenous. Assume that an initial large shock occurred; then the

problem is that the subsequent recovery should have been much faster according to the model. A large shock on output should be followed in the next period by a (less) large rise of GDP, and then by a smoothed convergence of output returning back to its trend. For example, there should have been a 30% to 50% recovery of output in the first year following the trough of the crisis. The current crisis led to a *more persistent* loss of output than expected from the model.

2. In the U.S. case, after four years following the crisis, it turned out that *the persistence of the negative shock on employment is much larger than the persistence on output*. This decoupling casts doubt on a linear relationship between output and employment assumed in some of these models. Then, "*unemployment*" is not an exact substitute of "*output gap*" and hysteresis matters even in the U.S. where the commonly held view is that the labour market is flexible.

3. Because the shock was initially related to a negative shock on housing prices, the persistence of the recession implies that the *effect of a fall of asset prices on the subsequent level of output* was understated. This means that *the long run covariance between housing price and output has been underestimated or that a break on their covariance has been missed.*

4. *The variation of the asset prices with respect to the variation of output* is much larger than predicted by the model. As well, *the variation (or the volatility) of asset prices with respect to the consumer price index* is understated. Even though output fell widely during the depression, the variation of asset prices fell even more. In technical terms, the slope of the unique stable path relating the variation of asset prices as a function of the variation of output is too small. This means that *the ratio of both variances* does not match observed data.

5. Because of point (3), the proportion of the variance of the asset price which is not brought by the variance of output and the variance of the consumer price index is relatively small. This means that the coefficient of determination of a regression with the asset prices predicted by the model as a function of output and of the consumer price index is large. Technically, this comes from the linearization of the relations between these variables around a locally unique saddle point. Only points on the unique stable path are then regarded as relevant. As a consequence, the models predict that there will be only negligible changes of welfare when the Taylor rule takes into account asset prices in addition to the output gap and to the consumer price index. *Hence, central banks should not take into account asset prices when deciding their money market rate* (see Gilchrist and Leahy (2002) for a survey). This view is now revised, with a concern for macro-prudential policies since the predicted asset prices do not fit observed asset prices.

6. The central bank is relatively efficient for accommodating the negative shock according to the model with a Taylor rule which does not take into account assets prices, even in simulations including a liquidity trap. During the crisis, monetary policy turned out to be less efficient than expected. *The ability of a monetary policy, in particular of a quantitative easing policy, to escape the crisis has been overstated.* In Del Negro et al. (2010), the duration of quantitative easing policy, where central banks buy assets, was supposed to last less than 10 quarters following the start of the crisis in 2007. Their "Great Escape" title should have been replaced by the over-optimistic "Big Easy" (Escape) title. In January 2012, Alan Blinder argued that the

circumstances (low inflation and low nominal interest rate, persistent excess capacity and fiscal policy paralysed by large debts), that have forced central banks to operate through unconventional policy will be a recurring feature of the economic landscape.

7. *The ability of the fiscal policy to accommodate the crisis is understated* due to an emphasis of the Ricardian effect, even with a zero lower bound in interest rate.

8. The variation of the asset prices with respect to the variation of output was more rapid during the crisis than during the boom. This *asymmetry of the volatility of asset prices for a negative shock with respect to a positive shock* is not taken into account in the linearised DSGE.

2.3. The financial accelerator DSGE model and the persistence of large negative shocks.

The Real Business Cycles approach, followed by the DSGE modelling emphasized that their impulse propagation approach was able to replicate macroeconomic time series, in particular their persistence properties, while using impulses related to productivity shocks or demand shocks which are persistent, according to an auto-regressive process (sometimes, the random term is the log of an random term):

$$\log(\varepsilon_t) = \rho \cdot \log(\varepsilon_{t-1}) + u_t \quad \text{with } \sigma^2(u) \text{ given.}$$

In order to describe the current crisis, it is possible to increase the size of the initial shock (that is increasing the variance of the shock *u*), and also to increase the autocorrelation parameter denoted ρ.

But the trouble with this approach is that it implies an *unexplained, non structural and ad hoc* break on the parameterization of the impulses with respect to previous studies describing the post-war business cycles before 2007, in particular in the United States. This is an inconsistency leading to a disguised defeat of the *structural* ambition of the DSGE research program.

With respect to the propagation equations of DSGE models, other unexplained, non structural and ad hoc breaks with respect to pre-2007 studies have been introduced in order to increase the persistence of negative shocks in the simulations. They are related to the technology introducing more lags and longer time to build and/or to the utility function with a larger habit persistence parameter. These changes of parameters may fit the ongoing crisis but not the previous post war business cycles.

In the impulse and propagation theories of the business cycle, one can set the cursor between a pure « random impulse » model of a cycle (for example, an auto-regressive model of output) and a pure deterministic causal chains endogenous cycle. Causal factors omitted in the propagation mechanism are then reverted in the « variations of the random impulse », leading to an omitted variables bias. For example, these ad hoc breaks in the persistence are added in the financial accelerator DSGE models of the crisis at the same time than introducing additional financial features in the model. But it is not clear whether the increase of persistence in the simulation is really due to the modeling of the banking sector or on, say, the ad hoc increase of the habit persistence parameter in the representative household utility function.

By contrast, it may be that causal chains are missing in those models which may explain the break leading to an increase on the persistence of the shock for the ongoing crisis. Those causal factors may be related to unreliable asset pricing, to the inefficient design of incentive compatibility contracts leading to the distribution of *ex post* losses which were not *ex ante* taken into account, to the government deficits following bailing out the banks, to the persistent loss of trust between private banks on the inter-bank money market leading to persistent quantitative easing by the central banks and so on. Those factors are omitted and fall into the increase of the auto-correlation coefficient of the random impulse or the "habit persistence" parameter.

In fact, the problem is not new: the business cycle models without the financial accelerator found a loss of utility for the representative agent which is very small for post-war business cycles in the United States:

"*It indicates that economic instability at the level we have experience since the Second World War is a minor problem, even relative to historically experiences inflation and certainly relative to the cost of modestly reduced rates of economic growth.*" Lucas (1987, p.30)

A key determinant of the cost of the business cycles is the unconstrained Euler equation for households, the growth of consumption is determined only as an increasing function of the rate of interest on savings and decreasing with the aversion to consumption volatility,

$$g(C) = \frac{r_t - \rho}{\sigma}.$$

This equation is rarely challenged in macroeconomic textbooks. However, it does not match the data (Caroll (1997). It leads to too small costs of cycles for the representative agent. The social cost of consumption volatility is far too small (Lucas (1987), and Gollier (2001, p.224).

This equation assumes very specific *resource constraints,* which are not valid with credit rationing, or lack of demand on a market during a liquidity crisis. A structural research programme allows other possibilities for defining resource constraints for households. Using the unconstrained Euler equation for describing households behaviour may lead to low values when measuring the welfare costs of recessions.

However, even when the Lagrange multipliers related to the financial constraints are taken into account so that the Euler equation changes in the financial accelerator models, the social cost does not increase a lot. So the financial accelerator model may lead to a "business cycle redux", as analysed by Cordoba and Ripoll (2004):

"Theoretical studies have shown that under unorthodox assumptions on preference and production technologies, collateral constraints can act as a powerful amplification and propagation mechanism of exogenous shocks. We investigate whether or not this result holds under more standard assumptions. We find that collateral constraints generate a typically small output amplification. Large amplification is a "knife-edge" type of result."

The clear-cut distinction between growth and business cycles theories which does exist in macroeconomic textbooks faces then an empirical problem with recessions and world financial crises. The possibility to disentangle the growth component from the cyclical component in macroeconomic time series changes with respect to more regular periods. Large

crises last long and affect the growth trend, not only the cyclical component: USA 1929-1946, Japan 1990's-2010. This led us again to the question on the modelling on the break on the persistence of negative shocks.

The DGSE models with the financial accelerator model take into account bankruptcy costs. However, liquidity problems and systemic stability of the financial systems (systemic bankruptcy due to the loss of confidence of banks and/or investors) was set outside of the model. A *second persistent ("stable") equilibrium* was set aside of those models, which considered only a unique equilibrium. This existence of a second persistent equilibrium is another asymmetric property of the economy during crisis, with respect to the boom period.

3. Changing two key complementary assumptions

3.1. The structural research programme compatible with the Lucas Critique

Although the financial accelerator DGSE models assumed imperfect capital markets, they were not able to describe the mechanism of the 2007-2010 crisis. We argue that, besides the imperfect capital markets assumption of the previous section, five additional assumptions, alternative to the usual settings, are required, to make progress in explaining macroeconomics exhibiting financial crises. Because the "Lucas critique" is the usual argument against changes in fundamental hypotheses used in macroeconomic modelling, we will detail for each of these hypothesis whether they contradict the structural modelling research programme which intends to take into account the Lucas critique.

The defence of the mainstream dynamic stochastic general equilibrium remains based on recurrent references to the Lucas critique (1976): "*Given that the structure of an econometric model consists of optimal decision rules of economic agents, and that optimal decision rules vary systematically with changes in the structure of series relevant to the decision maker, it follows that any change in policy will systematically alter the structure of econometric models*".

Because the parameters of large scale macro-econometric models at the time were not structural, i.e. not policy-invariant, they would necessarily change whenever economic policy (the rules of the game) changed. Economic agents do and should take changes in economic policy into account when deciding on their actions. Policy conclusions based on these models would therefore be potentially misleading. In other words, the expectations, the behaviour of individual agents and the behaviour of the government were not correctly specified in the macro-econometric models of the seventies.

The "structural research programme" followed the Lucas critique. It suggests that if we want to predict the effect of a policy experiment, we should model the "deep parameters" (related to preferences, technology, and resource constraints) that govern *individual* behaviour as well as government policy behaviour. Only changes in economic fundamentals can have long run effects on the time path of the economy. We can then predict what individuals will do, *taking into account* the change in policy.

We propose two complementary assumptions to improve financial macroeconomic models that are not inconsistent with the "structural research programme" that followed the Lucas critique.

3.2. Hypothesis I: a stable equilibrium with a "liquidity uncertainty trap" is possible.

3.2.1. Irving Fisher's capsizing regime versus stability corridor regime.

We argue first that the financial accelerator is a misreading summary of Irving Fisher's ideas. Ben Bernanke is one of the most qualified economist scholars due to his long-term interest for the crisis of the thirties and his revival of Irving Fisher's debt deflation ideas during the last thirty years. However, Ben Bernanke proposed the misleading statement that central banks should intervene after the burst of an asset price bubble (Bernanke and Gertler (2000)), without ex ante control of such a bubble.

"We explore the implications of asset price volatility for the management of monetary policy. We show that it is desirable for central banks to focus on underlying inflationary pressures. Asset prices become relevant only to the extent they may signal potential inflationary or deflationary forces. Rules that directly target asset prices appear to have undesirable side effects. We base our conclusions on (i) simulation of different policy rules in a small scale macro model and (ii) a comparative analysis of recent U.S. and Japanese monetary policy"

(Bernanke Gertler, NBER WP, 2000, (abstract, p. 2)).

A central claim for this error is a common misunderstanding of the ideas of Irving Fisher (1933), that financial crises are only related to a financial accelerator amplifying technological and productivity shocks leading to over-investment, such as the new car industry in the 1920's, the internet industry in the 1990's and so on. For Haberler (1941)

"*But clearly, over-investment rather than over-indebtedness is the primary cause of the breakdown… We may thus conclude that the "debt-factor" plays an independent role as intensifier of the depression, but can hardly be regarded as an independent cause of the breakdown.*" (Chapter 4, 1941 edition, p.115-116).

However, Irving Fisher refers regularly in his 1933 paper to a boat metaphor:

"To take another simile, such a disaster is somewhat like the "capsizing" of a ship which, under ordinary conditions, is always near stable equilibrium, but which, after being tipped beyond a certain angle, has no longer this tendency to return to equilibrium, but, instead, a tendency to depart from it. But if the over-indebtedness is not sufficiently great to make liquidation thus defeat itself, it is then more analogous to stable equilibrium; the more the boat rocks, the more it will tend to right himself."

For small wave shocks on its large side, the boat oscillates around its equilibrium, inside a "stability corridor". By analogy, this describes, regular economic cycles, not a large crisis. But, for large waves on its large side, the boat passes below a threshold angle, and falls into the water. This corresponds to a low level equilibrium related to "economic instability".

Hence, the story of Irving Fisher is not only a story of amplified oscillation *around a single equilibrium* (in a corridor of stability), it is also a story of bifurcation towards a second low stable equilibrium ("persistent instability"), with an overall risk of macroeconomic bankruptcy, along with a breakdown of the financial system and low production level with self-finance autarky. This second "*liquidity uncertainty trap*" equilibrium may also be related to a bank run low equilibrium as dealt with by Diamond and Dybvig (1983) or Bryant (1981) in the field of microeconomics of banking. The economy may only be able to pass the downward threshold (the threshold angle for the boat) leading to the second bad equilibrium due to the over-lending amplification of over-investment. Else, over-investment theories alone may lead only to minor shocks and the economy remains only in the stability corridor. As a

consequence, because without the financial accelerator, the shift to the low equilibrium ("instability") is unlikely to occur, *over-lending is then a cause of the breakdown*.

A dynamical model representing a possible relationship between the asset price at the current date *q(t)* and the asset price at the next date *q(t+1)* is shown in figure 1. Starting from the equilibrium E1, if a *small negative shock* on the asset price *q(t)* occurs, such that *q(t)* is equal to B, the economy exhibits small fluctuations around the stable equilibrium E1. These fluctuations occur in a *corridor of stability*.

But if a *large negative shock* occurs, such that the asset price q(t) is below the value of a second unstable equilibrium E2, then the asset price dynamics follows a different decreasing and diverging path towards a third equilibrium, which is also stable, the equilibrium where the asset price is equal to zero and no one buys the asset (liquidity crisis). Because this third equilibrium is stable, the model is able to *explain* the *persistence of large negative shocks.*

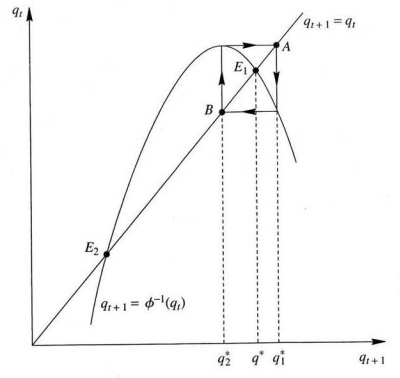

Figure 1. Small cycle in a stability corridor and large shock crisis.

Until recently, modern mainstream macro-economics dealing with the financial accelerator very rarely considered this second "stable" equilibrium related to instability to be important. Minsky's (1982) question "*Can it happen again?*" referring to the 1929 crisis was answered as "never". The argument was based on an under-valuation of the probability of a world financial crisis: the probability was assumed to be close to zero. It was also based on an under-valuation of the *ex post* cost of a world financial crisis. For example, the evaluation of the cost of the financial crisis in the 1990s in developed countries such as Sweden were 2 to 5 times smaller than the cost incurred by emerging economies such as Argentina. This was also backed by Lucas (1987) small valuation of business cycles loss of welfare for a representative agent with a constant intertemporal elasticity of substitution.

Since the start of the crisis, central bankers changed their views and considered the possibility of macro-prudential regulation policies. The problem highlighted is not that bankruptcy costs were missing in the financial accelerator. What is missing is the possibility of systemic bankruptcy due to expectations of a high probability of default due to a lack of confidence.

The Lucas critique does not exclude that there are multiple equilibria in the economy. Driskill (2005) even states that "*multiple equilibria are a ubiquitous feature of dynamic rational expectations models*". Driskill (2005) reviews many papers which assume four criteria leading to a coordination of beliefs selecting a unique equilibrium. Real business cycle models in the spirit of the structural research programme assume that without exogenous shocks the economy would remain on its unique long-run equilibrium path. Even with exogenous shocks, prices are assumed to change infinitely rapidly so as to clear all markets instantaneously. By contrast, the structural modelling research programme emphasizes only the neat modelling of

expectations. It is inconsistent to claim that the possibility of a liquidity crisis equilibrium, which is *ontologically driven by expectations* as in Bryant's (1983) model, contradicts the "structural research programme" following the Lucas critique.

3.2.2. Qualitative differences between the "liquidity uncertainty trap" and the "stability corridor" for policy makers.

The issue at stake is not only to have a particular modelling of the persistence of large negative shocks. A DSGE model far from its unique equilibrium but with shocks with large persistence, such as Bianchi and Mendoza (2010) may provide the same predictions than a model with two stable regimes and a probability of transition from one regime to the other. What is more, the model with multiple equilibria may be more unstable to fit and may have larger prediction errors, in particular because of the non linear modelling of the probability of transition. These issues are faced by the behavioural multiple regime macroeconomic model built by De Grauwe (2010).

But "*to predict is not to explain*". Shmueli (2010) describes the usual distinction between prediction and explanation in applied statistics as follows. The "*prediction*" objective targets to *minimize the "root mean square error"* of the difference between the observed outcome variable and the predicted outcome from the association (not necessarily causal) with other variables, often with a focus on *out of sample* predictions. The "*explanation*" objective targets to *minimize the bias of the coefficients* between an explained outcome variable and explanatory variables, in order to test causal hypothesis about theoretical constructs, often with a focus on the *in sample* explanation of past events. Because the targets differ, there is not a perfect overlap: a good model for "forecasting" may not be a good model for "explanation". Note that this issue is distinct from parsimony. A parsimonious model may be better to predict or may be better to explain depending on omitted variable bias, on over-fitting or on near-multicolinearity issues (Chatelain and Ralf (2012)).

However, multiple equilibria models differ from single equilibrium models because they are related to explanations based on *qualitative discontinuity*. This is a distinct argument that Shmueli to state that "*to predict is not to explain*", which has been put forward by Thom's (1993) catastrophe theory. We highlight this *qualitative discontinuity* from the point of view of policy makers. Policy makers may face distinct policy objectives in these regimes, along with a *credibility dilemma* for inflation targeting versus financial stability objectives, which reverses policy priorities:

In the stability corridor regime, targeting inflation at 2% and output growth at 2% are efficient policies, and the economy faces mild distributional issues. For inflation targeting, *the credibility of limited money creation and of the independence from government* is regarded to be efficient.

In the liquidity trap regime, policy makers intend to avoid deflation and the zero bound on nominal interest rate. They may have to act as "spenders of last resort". Although the liquidity trap and the liquidity uncertainty trap occur simultaneously most of the time, there may be some cases of liquidity uncertainty trap without deflation.

In the liquidity uncertainty trap (or "capsizing" regime), policy makers have to restore financial stability, trust and liquidity on the interbank market and/or the deposits market and/or the sovereign debt market. They may have to act as "lenders of last resort". They may use persistent "unconventional" quantitative easing policy as well as "conventional" budgetary policy. In order to restore confidence and financial stability, *a strong credibility for unlimited money creation for refinancing banks, for example, for the next three years, is required*. The same may apply as well for buying government bonds in order to sustain

government budget in the context of the risk of bailing out the banking system by the government. This credibility goes along with *no independence of the central bank* from the government. What is more, in this regime, policy makers have to handle huge distributional conflicts related to the distribution of unplanned losses. How to share the losses between groups (borrowers versus lenders, investors versus wage earners, banks or government, the rich or the poor, the current or the next generations, foreign countries or IMF, and so on) is the main source of uncertainty.

In the liquidity uncertainty trap regime, bank runs and banking crises are followed by government bailing out banks, or insuring deposits, with a risk of a public debt crisis, which may be sometimes followed by a rise of inflation to decrease public debt. As taxes are needed as well to bail out the banks, savers and pensioners and/or wage earners pay, along with a transfer from an old generation (facing the crisis) to a young generation which may not face a crisis next period (Amable, Chatelain, De Bandt (2002)). A banking crisis may also last a long time, with continued "Zombie" lending to bankrupt banks and firms as in Japan (Caballero, Hoshi, Kashyap (2006)). All these events lead to large swings in income distribution due to transfers between lenders, borrowers, bankers, governments, savers, and wage earners.

3.2.3. Radical uncertainty versus misleading incentive compatibility constraint.

There have been some arguments that radical uncertainty was missing in the modelling of business cycles. Radical uncertainty refers to a first time or unique event for which a probability distribution cannot be computed. However, financial crises are no longer first time events. The uncertainty is mostly related to the distribution of losses. When a depositor runs to a bank, he hopes to arrive earlier than another one, in order to shift the distribution of the losses of the banks to latecomers. It is not impossible to set a subjective probability distribution for who is going to pay for the losses. As long as the negotiation process for sharing the losses does not end, this additional uncertainty surrounds the crises. Large uncertainty is not necessarily radical uncertainty.

More important than the omission of radical uncertainty is the omission of default and fraud. In the theoretical modelling of financial constraints and financial structure, default is only taken into account *ex ante* with incentive compatibility constraints such than the return when an economic agent cheats is equal to the return when this economic agent does not cheat. This limits the size of credit, so that internal funding is proportionally sufficiently large. In this case, diverting funds of the company amounts to divert a sufficiently large proportion of the agents own funds, so that the agent does not benefit from diverting funds.
However, this modelling has the drawback that *agents never fraud* in the model. It first suggests that the ex ante rational regulation of international capital markets is always able to eradicate fraud *completely*. Second, there is no ex post default due to fraud, and the ex ante design of the financial contract already planned the distribution of losses, so that the distributional uncertainty mentioned above is ruled out.

An alternative model is the tax evasion model by Allingham and Sandmo (1972). Agents still fraud and face a probability of being discovered and paying a fine. Note that, in this case, the probability of being discovered for international financial fraud is very low due to the competition for opacity between jurisdictions, except from very large fraud following extreme events.

3.3. Hypothesis II: reject the efficient market hypothesis that the price of an asset always reflects its fundamental value.

3.3.1. "Inefficient" asset pricing is compatible with the Lucas Critique.

The problem of the financial accelerator DGSE was that the expected price of collateral is assumed to be always equal to its fundamental value (no over-valuation or under-valuation). In real economies, the under-valuation is fostered by fire sales, and a liquidity crisis leads to too few exchanges on the financial markets, which explains the asymmetry between under-valuation brisk fall during a crisis and longer periods building up the over-valuation of assets during booms. With weakly regulated international banks, opacity implies that asset prices are never equal to their fundamental value or that the fundamental value cannot even be correctly defined.

A key consequence is that one exit option from a banking crisis is to start a new bubble elsewhere. Describing this phenomenon is currently forbidden in the mainstream macroeconomic modelling. It seems that international capital surfed from the Asian Bubble to the Internet Bubble to the Housing Bubble to the next bubble: Chinese bank lending, China's or India's stock market, commodities markets. But, who knows, e.g. in the case of China, whether asset prices are correctly valued, and whether Chinese statistics are reliable?

It seems that rejecting the assumption that the price is equal to its fundamental value is difficult for many macroeconomists, whereas in the field of microeconomics of banking, economists such as Schleifer and Vishny (2010) do not have difficulties to reject it when describing unstable banking. The assumption itself is only a narrow interpretation of the efficient market hypothesis as it is seen by financial economists. Malkiel (2003) uses as a "definition of efficient financial markets that such markets do not allow investors to earn above-average returns without accepting above-average risks", p.60. Then markets can be efficient, even if many market participants are irrational and stock prices show larger volatility than can be explained by fundamentals. On the other hand, behavioural finance added some insight in the explanation of excess volatility of asset prices. "Evidence from behavioural finance helps us to understand, for example, that the recent worldwide stock market boom, and then crash after 2000, had its origins in human foibles and arbitrary feedback relations and must have generated a real and substantial misallocation of resources." (Shiller 2003, p.102)

Rejecting the narrow interpretation of the efficient financial market hypothesis is not incompatible with the structural research programme. If two groups of agents face different information on the expected value of an asset on the same date: some are correctly informed, some are not.[1] The research programme would require a neat modelling of different resource constraints (information), preferences and technology for rational investors. It could even be rational for naïve investors to follow the herd when the cost of acquiring the true information is too large. Then, there may be the possibility that the price of an asset differs systematically from the fundamental value of this asset.

The issue of inefficient asset pricing is also related to the issue of multiple equilibria with rational expectations. According to Driskill (2005 p.176), multiple equilibria are endemic because of the conjunction of the rational expectations assumption with an infinite time

[1] Scheinkman and Xiong (2003) derive speculative bubbles in an equilibrium model where small differences in the beliefs of agents lead to trade. These bubbles are accompanied by large trading volume and high price volatility.

horizon: "*In an infinite-horizon model, this means that there is always one more price to be determined – the next-period price – than there are equilibrium conditions. That is, for any arbitrary number of periods n, there are n equations – the equilibrium conditions that demand equals supply – but n+1 endogenous variables – the n prices plus the (n+1)th expected price"*. Then, infinite horizon auxiliary assumptions are quite often used as an equilibrium selection device coordinating beliefs, which is presented in the next subsection.

3.3.2. Reject the No Ponzi Game and the Transversality Conditions.

The transversality condition on the growth of accumulated capital (in endogenous growth) or the growth of population (in exogenous growth) states that these growth rates have to be lower than real interest rate used as a discount rate in the infinite horizon optimization models:

$$g_K < r$$

By analogy to a finite horizon terminal condition, it states that the discounted value of capital in the infinite horizon is zero. The transversality condition is the choice of a terminal condition for infinite horizon optimization problems which is necessary only when lifetime utility is finite at the optimum (Kamihigashi (2004)). This property clear states that the transversality condition does not *imply* that discounted utility has always to be bounded. On the contrary, Halkin (1974) famous simple counter-example demonstrates that *in general*, there are no necessary transversality conditions for infinite horizon optimal control problems, when one does not assume that the objective function converges. The first model of this type was proposed by Ramsey (1928) with an objective function without discounting and it did not assume those transversality conditions, and it is still not considered as flawed.

The No-Ponzi Game condition (henceforth the NPG condition) on public and/or private debt (which also stands for a transversality condition for debt) eliminates the possibility of Ponzi chain letter by stating that the growth of public or private debt has to be lower than the real interest rate charged on this debt in the infinite horizon.

$$g(B) < r_t .$$

Firstly, three remarks regarding macroeconomic theory can be made:

(1) This assumption is used to rule out *the existence* of bubbles *prior to the infinite horizon* in macro-economic models. This is consistent with the efficient financial market hypothesis eliminating the possibility of bubbles.

(2) It implies bounded utility. Note that it is not a necessary assumption of infinite horizon optimisation. An infinite objective function is a possible solution, as in the Ramsey (1928) model. If one maximizes discounted utility over time, why should one refuse infinite utility?

(3) It is a key assumption to obtain Ricardian equivalence (e.g. the inefficiency of budgetary policy financed by debt and followed by taxes later on) (Barro (1974)). It is related to an infinite horizon government solvency condition which is necessarily fulfilled in the real world. However, this may be different from short run solvency. Imagine that we apply a similar reasoning than in the financial accelerator: public debt is solvent based on expected taxes net of public expenditures:

$$(1+r_t)\cdot B_t < \tau_{t+1}\cdot Y_t\left(1+g_{t+1}(Y)\right) - G_t\left(1+g_{t+1}(Y)\right)$$

If the expected growth of output is large and if the interest rate on public bonds is low, this solvency constraint is likely to be respected. This is what bond holders may think about in the short run. They would like taxes to increases and public expenditures to fall, but would enjoy more growth of output which increases the tax base.

Imagine that this is the case for *all* future periods. Then, for all dates the public debt is "short term" solvent. Imagine that at the same time, the growth rate of output is equal to the growth rate of public debt, but is larger than the real interest rate on public debt. Then, the "infinite horizon" (no Ponzi game) solvency constraint is not fulfilled, whereas the short run solvency constraint is always fulfilled. In this case, the infinite horizon solvency constraint is meaningless. Utility is unbounded though. In this context, we do not know whether Ricardian equivalence holds or not.

Secondly, those conditions are not frequently observed in real economies, whereas the economies described in mainstream macroeconomic theory always assume them in thousands of pages of textbooks and journal articles. For example, Azizi *et al.* (2012) found that the no Ponzi game condition and the transversality condition where only valid for 24% of the observations of OECD data during the last forty years. Twenty years ago, a similar result was acknowledged by Blanchard and Weil (1992): *The average realized real rate of return on government debt for major OECD countries over the last 30 years has been smaller than the growth rate. Does this imply that governments can play a Ponzi debt game, rolling over their debt without ever increasing taxes?"*

Thirdly, although it is not the spirit of their use in macroeconomic theory, are those conditions *normative*, that is "good economic" policy should satisfy no Ponzi game and transversality conditions?

For maximizing government solvency, this is not the case more than half of the times. Using OECD data since 1970, Azizi *et al.* (2012) found that, in the cases of public debt retrenchment (a decrease of the debt/GDP ratio improving government solvency, 45% of overall cases), only 42% of those cases occurred with the growth rate of debt and of GDP lower than the 10 years government bonds yields. By contrast, 58% of debt retrenchment annual events occurred with the 10 years government bonds yield below the growth rate of output.

For maximizing economic growth, not a single "growth miracle" would have ever been achieved with policy makers targeting the transversality condition! Indeed, in all the cases of growth miracles, the growth of output consistently exceeded the real rate of interest for several decades (for example, Japan 1960-1990, China 1990-2010). Then, endogenous growth models where the growth rate of output exceeds the real interest may be relevant (Amable, Chatelain, Ralf (2010)). On the other hand, very low real interest rates cannot be a cut-off for selecting high productivity projects. This means that other criteria than interest rate (such as growth driven industrial policy by MITI in Japan) were used in order to allocate capital to high productivity investment. Countries failing to use alternative criteria than interest rates to select high productivity may have faced stagnation with low interest rates.

For minimizing bubbles, subsequent financial crises, the volatility of output and employment, the argument is that "too" low interest rate with respect to economic growth and the growth of debt would lead to "over-priced" assets, excess leverage and bursting bubbles. However, this was likely to be the case during the years of "low interest rate financial repression" around the world in the 1950's and 1960's. But, there was an adverse effect, much more capital control,

so that the frequency of financial and banking crises was very small. On the other hand, a counter example may be found with the 1987 stock market krach and the savings and loans debacle in the United States where the growth of output was on average below the real rate of interest during several years before the krach.

If the non efficient financial market hypothesis is consistent with the research programme following the Lucas critique, then one can take final steps by rejecting the no Ponzi game and the transversality conditions.

3.3.3. Reject the unique stable path dynamics auxiliary assumption.

Intertemporal optimization with rational expectations leads nearly always to a short-term equilibrium that is a saddle point, i.e. it exists only one path of lower dimension which is stable; all the others are unstable. The assumption that all agents are able at any time to carry out their desired actions means that all points which are not on the stable manifold are regarded as irrelevant. All unstable paths are therefore ruled out by assumption. But this "rational expectation" hypothesis is an additional assumption with respect to the Lucas critique.

Furthermore, the *linearization* around the equilibrium of the *unique* stable path leading to *unique* long term equilibrium reduces the study of macroeconomics dynamics to damped exponential responses of macroeconomic variables to *small* shocks. As a consequence, the volatility of asset prices on the saddle-path is much lower than on the others, for the same optimizing model. As well, the predicted covariance of asset prices with output on the unique stable path differs a lot with respect to what is on the unstable paths.

Several points can be made here:
First, rejecting the *unique* equilibrium goes along with accepting the "expectation driven" liquidity crisis alternative equilibrium. Multiple equilibria driven by expectations are consistent with the research programme.

Second, the *linearization* considers only small shocks, which do not correspond to recessions. It leads to a repetitive representation of macroeconomics dynamics as damped responses of macroeconomic to small shocks. Along with the multiple equilibria hypothesis, *large* shocks are likely to shift the regime of the economy, and the dynamics would differ dramatically.

Third, "*the unique stable path*" goes along with the no Ponzi game condition which rules out that the economy follows temporary bubble paths for asset prices *prior* the infinite horizon. That means that *all* agents know when asset prices are on a bubble path, and that they decide ex ante *never to be* on the unstable path.

Fourth, these models are structurally unstable, since a small disturbance that moves the economy away from the converging path changes the behaviour of the system (Vercelli (1991), Ralf (2000)). This is not desired as it contradicts the paradigm of market clearing at any time and, therefore, all points outside the converging path are considered as economically irrelevant (Burmeister et al. (1973)). In practice, the macroeconomics theorist choose a number of "jump" variables at least equal to the dimension of the unstable manifold, which jump to the stable manifold immediately after any shocks and force convergence to the unique long-run equilibrium. The initial condition does not determine the path chosen by the representative agent: it is instead the infinite horizon terminal value. More precisely, in the financial accelerator DSGE, the arbitrage equation for lenders (equation 4), which is the

origin of the instability, is valid on unstable paths where assets tend to an infinite value. Lenders are not "irrational", they are doing rational arbitrage between two expected returns taking into the expected price of assets next period. However, they are not "infinite horizon" rational on those unstable paths. Their valuations of assets do not converge smoothly to the perpetual rent long run equilibrium value. They may not even compute the expected average rate of return on assets over the next ten years, but just for the next year.

Fifth, ruling out over-valuation and under-valuation by the market rules out the rational next period/short term "*market timing*" behaviour, which takes advantage of these mis-valuations and which in turn amplifies the fluctuations of assets prices. It has been taught for nearly fifty years that mutual funds managers can make money, buying assets more sensitive to the market index when the stock market is expected to be bull (assets with beta over unity) and selling them when the market is expected to be bear. "*Sudden stops*" for emerging market crises is a "business cycle timing" variation on the "market timing" behaviour: when an economy is expected to face a recession, investors decide to sell assets of this country. It is the same scheme which is described by Schleifer and Vishny (2010) on rational *unstable banking*. A number of naïve investors do not know that the asset is not correctly priced. A boom with over-priced assets is expected to be followed by a crisis, with under-priced assets, with knowledgeable investors (banks) taking advantage of this price differences. Then, it is easy to compute the conditions for more informed rational banks to speculate.

3.4. Two complementary assumptions: inefficient asset pricing determines the shift from the stability corridor to the "capsizing" regime.

Inefficient asset pricing implies the possibility of larger shifts in asset pricing. On figure 1, the probability of transition from the stability corridor to the capsizing regime depends on the probability to have negative shocks on asset prices that are larger than (E2-q*). The modelling of asset pricing as being efficient and much closer to their fundamental value decreases the probability to shift to the "capsizing" regime. Because inefficient asset pricing increases the probability of transition from the stability corridor to the "capsizing" regime, the assumptions of inefficient asset pricing and multiple equilibria are complementary.

When asset prices were much less volatile with less opacity on their valuation and when the contagion of negative shocks between national and international asset classes were limited, such as during the Bretton Woods period (1945 to 1973), the economy was able to remain in the stability corridor. As such, Lucas business cycle theory was compatible with highly regulated international finance. It corresponds to the U.S. business cycles features when Lucas got his Ph.D.

By contrast, there were again frequent banking and financial crisis in several countries after 1973. To find assets valued at their long term average value, in particular in the balance sheet of international banks, is particularly difficult. This increased uncertainty on the valuation of assets leads to a higher probability to shift to the "capsizing" regime. It was not so relevant for the Bretton Woods period. This behaviour of economies is related to the period where Krugman got his Ph.D.

3.5. The Ongoing Macroeconomics Crisis Literature

It is too early as well as very difficult to have a judgment on the ongoing macroeconomic literature dealing with the current crisis. It is on the making, based on working papers the

content of which change every three month, with few papers already published in academic journals. The aim is to introduce banks' leverage, interbank liquidity, large shocks, fire sales and systemic crises into macroeconomics. Our first and superficial impressions from a limited sample are the following:

(1) Although DSGE bashing becomes very fashionable since the beginning of the crisis, there is a slight inconsistency in these revolutionary declarations and the recent output supposed to renew macroeconomics. Most of the papers keep the DSGE framework. For example, some papers mostly assume a larger size of initial shocks than previously done in order to mimic the larger swing of the crisis in their simulations.

(2) Many papers remain very orthodox with respect to the valuation of assets based on their fundamental value (efficient asset markets hypothesis).

(3) Perhaps, because they are on the making, these models are often not elegant nor parsimonious, packed with a large number of heavy equations as intending to model very much in detail for example the inter-bank market, as well as banks and non financial firms wealth accumulation, along with habit persistence.

(4) By contrast, there is clearly a need to offer an undergraduate level model, to be relevant to explain the crisis. A good starting point may be the Krugman (2002) "fourth generation" crisis paper, which relates asset prices to output with simple equations.

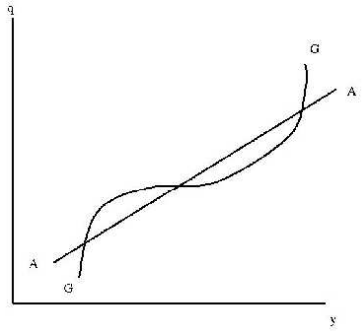

Figure 2. Krugman's fourth generation crisis.

To draw a parallel in the history of science, some of those models look like Middle Ages extensions of the Ptolemaic models of the law of motions of planets. In order to explain the cyclical retrograde movement of Mars in the sky, planets were assumed to move in a small circle called an epicycle, which in turn moves along a larger circle. According to Hald (2003), "*Small systematic discrepancies between observed and predicted values (of Ptolemy's model) were noted. Arab and European astronomers in the Middle Ages thus improved upon Ptolemy's model by adding epicycles to epicycles, eccentrics to eccentrics, eccentrics with moving centers, and so on.*" For Duhem (1906), the objective was to "*save the phenomena*" for a better *prediction*, not for a better *explanation*. Adding epicycles amounts to approximate any cyclical movements due to the convergence of a finite sum of complex Fourier series (Hanson (1960)). By contrast, the Kepler model changed two *complementary* core assumptions for a better *explanation*, later refined by Newton's law of gravity: the earth and the other planets revolved around the sun and the orbit of a planet is an ellipse (with the sun in one focus) instead of a circle. The Kepler model turned to be less complex than Ptolemy's model and with a much better fit. It used fewer parameters and restrictions along with a large

decrease of the maximal error with respect to the Ptolemy's model. Spanos (2007) checked also the white noise nature of its residuals which is not the case of the Ptolemaic model. The two new core assumptions were *complementary* to reduce complexity. Copernicus' model, which changed *only the first one* and kept the assumption of the orbit of a planet as a circle, was as complex as Ptolemy's model along with the same maximum error for the motion of Mars (Hald (2003) p.166). Note that the parallel for changing core assumptions is also related to, at the time, religious and, nowadays, ideological beliefs defended by scholars from powerful institutions.

A research programme for the financial macroeconomics theory of depressions would have to take into account these two *complementary* assumptions: (1) the "capsizing" or "liquidity uncertainty trap" second equilibrium and (2) that the short run pricing of assets may differ from their long run "efficient market hypothesis" value. Both assumptions are compatible with multiple equilibria arising with rational expectations (Driskill (2005)). Unfortunately, it is not granted that model complexity would disappear, at least in the medium run. It took centuries for astronomers and decades for Kepler to find out a less complex model.

"*All models are wrong but some are useful*" (Box (1976): We need criteria to decide what is an "useful model" for choosing among alternative hypothesis equally consistent with the available evidence. According to Friedman (1953, p.10) "*there is general agreement that relevant considerations are suggested by the criteria "simplicity" and "fruitfulness"... A theory is "simpler" the less the initial knowledge needed to make a prediction within a given field of phenomena; it is more "fruitful", the more precise the resulting prediction, the wider the area within which the theory yield prediction, and the more additional lines for further research it suggests"*. We observed that the current assumptions in recent research modelling financial depressions in DSGE models are not "*simpler*". We presented a number of arguments that changing two complementary assumptions in financial macroeconomics is more "*fruitful*": more precise predictions, wider area of prediction and more additional lines for further research.

4. Conclusion

Because the cost of the recession (which increases with the persistence and/or the duration of the crisis) is much larger than expected, the *ex ante* benign neglect of central banks of the building up period of the bubble is now challenged. If the ex-post cost of financial crisis is very large, it is useful to spend sizeable resources against asset price bubbles in advance.

Sixty years after, we share the same personal view as Friedman (1953, p. 41-43): "*Some part of economic theory clearly deserves more confidence than others... The weakest and least satisfactory part of current economic theory seems to me to be in the field of monetary dynamics, which is concerned with the process of adaptation of the economy as a whole to changes in conditions and so with short-period fluctuations in aggregate activity.*" As for now, we do not know yet to which extent the forthcoming macroeconomic theory will take into account a weakly regulated financial sector and the rejection of the efficient capital market hypothesis. However, we are disturbed by the presentiment that we are on the eve of failing once again to arrive there, and that key complementary assumptions in the current way of doing mainstream macroeconomics may not be changed for a long time, although they may provide better prediction and better explanation.

What we suggest is to be less dogmatic in the requirement for certain assumptions in macroeconomic modelling that restrict the outcomes of the economic models too much to

explain the volatility of asset prices, recurrent financial crises and depressions in a world with weakly regulated banks.

Finally, let us broaden the perspective. To focus only on macroeconomic policies is likely to be too narrow in order to understand the world economy with weakly regulated international finance. Fruitful research would have to investigate the interplay between innovative macroeconomic policy, relevant or feasible banking and financial regulatory policy at the microeconomic or financial institutions level, and political economy issues dealing with the competition between international jurisdictions and dealing with the distribution of income and losses among different groups of economics agents.

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