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2016

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Abstract: Despite being a mainstay of modern economic theory, the concept of arbitrage is sorely misused. In this paper we overview such instances, and offer an alternative definition. Most applications of arbitrage use it as a general equilibrating tendency irrespective of whether the outcome is certain. Alternatively, it can be used in a rather "loose" manner to apply to inter-temporal scenarios or situations involving multiple (though similar) goods. Our aim is twofold: first to provide a consistent definition of arbitrage and second, to integrate the activity of arbitrage in the world of uncertainty and entrepreneurship that characterizes the Austrian school of economics.

Keywords: price theory, entrepreneurship, arbitrage, equilibrium

JEL classifications: D5, D8, D9, G

Arbitrage vs. Speculation

Arbitrage is commonly defined as "the simultaneous purchase and sale of the same, or essentially similar, security in two different markets for advantageously different prices" (Sharpe and Alexander 1990). It is important to highlight that the act of arbitrage is only that of trading the asset and the concept says nothing of the costs to obtain the knowledge of the existence of the mispricing: the knowledge of the relevant prices is assumed. It is also assumed that all relevant costs, e.g., transportation, storage, etc., are included in the arbitrageur's calculus.

The appeal of arbitrage as a practical matter is apparent: arbitrage allows an individual to obtain scarce means at no cost and with complete certainty. It is also clear that, given their pecuniary attractiveness, all arbitrage opportunities will be quickly acted on until they disappear. "Out of the market" buyers and sellers will be matched until the asset holdings of the marginal buyer and seller cannot be arbitraged further.

While this action implies that one side of the arbitrage will earn profits, it also implies that the other side of the transaction will experience an (at least) implicit loss. By not acting upon a possible arbitrage opportunity he is giving away some useful and scarce economic goods to the arbitrageur for the difference between the price traded and the best one available.

The difference between arbitrage and speculation is that of *certainty*. Both actions are aimed at obtaining a profit but the former secures a current profit with no possibility of loss (i.e., it is certain) while the latter expects to get a profit in the future but can incur a loss (i.e., it is uncertain). It is for this reason that we can predict that any arbitrage opportunity will disappear as soon as it is discovered while we cannot make the same statement about speculative situations.

Despite the certainty of arbitrage, some economists maintain that all exchanges are speculative (e.g., Mises 1949: 113; Huerta de Soto 2010a: 69). These disparate views can be reconciled in two ways.

The first is by acknowledging that arbitrageurs face the risk of losing one of the prices (i.e., incur operational risk) on the sell-side of the transaction. Since every action takes place in time, even if an individual has found a pair of prices that can be arbitraged, he may find one or both have "disappeared" during the process of the trade. (It is in this very context that Mises claims all market exchanges to be speculative.) The trader cannot be certain as to whether the prices will still be available in the very near future (even seconds), so when he embarks in the act of trading he is speculating that the prices will still be valid.[1] On the one hand, this operational risk will not stop the arbitrageur from trying since the arbitrageur does perceive the opportunity to exist, regardless of its actuality or expected duration. On the other hand, if the prices are no longer available at the moment of trade it must be that the arbitrage opportunity has been exploited (even if only accidentally) thus validating the statement that arbitrage situations will disappear once discovered.[2]

Second, we may reconcile the two disparate viewpoints by revisiting the theory of price formation. Since no individuals can know all the prices in an economy, it is possible that by chance an individual will find both a buyer and a seller whose prices

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[1] At the limit, one type of high-frequency trade is arbitrage, and it is in this sense that the activity is widely seen as equilibrating (Narang 2013). Alternatively, some forms of high frequency trading not reliant on arbitrage-type trades are thought to create mispricings that in turn require an arbitrageable correction (Jarrow and Protter 2012). Of course, it is questionable whether these mispricings can adequately be attributed to arbitrage-type trades. As Friedman (1953) famously argued, "to say that arbitrage is destabilizing is equivalent to saying that arbitrageurs lose money on average." Vuillemey (2015) overviews the dubious claim that high-frequency trading represents arbitrage trades given the delayed nature of settlements.

[2] Note that enacting an unrelated trade may correct an arbitrageable mispricing. By way of example, consider that U.S. dollars may be cheaper than Australian dollars in the United States than they are in Australia. A European who starts demanding more U.S. dollars to shift a trade from Australia to the United States, and who in turn reduces his demand for Australian dollars, will re-equilibrate the Australian dollar-U.S. dollar exchange rate, though not through any arbitrage activity.

can be arbitraged. We cannot expect, however, this to be the situation in all cases. It is more likely that individuals will *purposely* try to find arbitrageable prices, i.e. that they will have to embark in the entrepreneurial action of seeking out arbitrage opportunities. Since this amounts to speculation given that the agent cannot be sure as to whether he will find such situations, the success of the outcome will be uncertain. This realization creates a necessity to distinguish between two different activities, (1) that of arbitraging two or more *known* prices and (2) that of *discovering* arbitrageable prices. The former is an action with a certain success predicated on the successful discovery of misaligned prices, while the latter is shrouded in uncertainty.

One conclusion from this reconciliation is that only in a world where all information pertaining to price formation was fully known would there be no arbitrage opportunities. Since all prices would be known to all in such a world, there would be no asset for which an individual could offer less than the marginal bid or pay more than the marginal offer. As a practical matter, information is dispersed throughout the economy and created continuously through the entrepreneurial process of price discovery and formation (Huerta de Soto 2010a). Arbitrage opportunities may still appear, though if discovered they will be exploited by alert individuals. Just as entrepreneurs embark in different enterprises to satisfy the needs of consumers and will be later followed by others if they prove successful, some entrepreneurs will try to profit by finding arbitrage opportunities with competition among them playing the same role as in any other market. The continuous and unpredictable creation of information and the uncertainty that naturally follows is the source of arbitrage opportunities.

It is not only arbitrageurs who will act in a way that reduces the amount and magnitude of arbitrageable opportunities, but regular market participants (those agents who enact trades not motivated by arbitrage) will also use their entrepreneurial faculties

in order to find the best available. In both cases, arbitrageurs and regular market participants thus pursue their role in the same manner. By exercising their entrepreneurial foresight they are able to secure risky profits due to market "mispricings".[3]

Since the concept of arbitrage is important for financial analysis, we propose to rectify our misgivings of the current definition with an alternative: "*An arbitrage is when one or more assets are bought or sold simultaneously, resulting in a monetary profit at the trade's completion, even if the magnitude of such profit is unknown in advance.*" Important in this definition is that it is constrained exclusively to monetary profits after a trade is settled with no reference to psychic profits.[4]

Our more narrow definition serves a three-fold purpose. First, it places the activity back into its proper domain and excludes many similar or analogous exchanges (e.g., convergence trades) from its implications. Second, our modified definition includes all types of transactions not only those referring to a single asset as stated in the law of one price, which becomes only one, although probably the most relevant, case of arbitrage. Third, it provides a more comprehensive view of the price formation process, and gives a heightened emphasis on entrepreneurial foresight to align prices, both intra-temporally in the case of traditional arbitrage opportunities and inter-temporally in the case of purely speculative endeavors.

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[3] Mises (1949: 338) refers to these mispricings as "false prices" which exist at any given time because they don`t reflect the information that some other agents are, at the same time, willing to offer less than the bid prices or above the offer. Uncertainty is the reason these situations may exist, and the market process the reason why they won`t last.

[4] More to the point, once the trade is settled this implies that its monetary profit is certain. The extent of this profit is still unknown and *non-monetary* losses due to, e.g., declines in purchasing power could still occur.

Arbitrage in Modern Financial Economics

The main literature of arbitrage in financial economics can be divided between: (1) pricing theories such as the capital asset pricing model (CAPM) and arbitrage pricing theory (APT), and (2) studies about convergence trades or limited arbitrage, such as Shleifer and Vishny (1997) and Kondor (2006).

Pricing Theories

Although standard economic theory has a well-grounded definition of arbitrage, the absence of uncertainty in its asset pricing creates some inconsistent statements related to arbitrage. For example, Varian (1987: 59) expresses the no arbitrage condition in equilibrium as:

$$\textit{If } Rx \geq 0 \textit{ then we must have } px \geq 0,$$

where Rx is the portfolio's pattern of returns and px the cost of the same portfolio. If a portfolio has a positive return it must also have a positive price. Varian's no arbitrage condition matches the arbitrage definition proposed here to the extent that any combination of arbitrageable assets can be considered as forming a portfolio. The problem with this concept of arbitrage appears, as it does in other applied models, when the model cannot capture uncertainty.

The main representative of standard pricing models is the Arbitrage Pricing Theory developed by Ross (1976).[5] As in the CAPM pioneered by Sharpe (1964), the objective is to find a causal relationship between risk and return for different assets and portfolios. Specifically, the expected return of an asset within the CAPM framework

[5] A very readable summary of this literature can be found in Roll and Ross (1995).

hinges on (1) the rate of return of some risk-free asset, (2) the rate of return of the general market portfolio, and (3) the degree of correlation between the asset in question's return and that of the general market index, as measured by beta.

What the CAPM states is that if two or more different assets have the same risk relative to the "market" (i.e., beta) they will have the same expected return. There are no arbitrage opportunities available as the relevant prices will adjust until expected risk-adjusted returns equalize. Stated differently, in equilibrium there are no strict arbitrages to exploit, at least not according to any traditional use of the term, as the CAPM deals with distinct assets whose prices differ only due to their risk profiles. By purchasing and selling different assets simultaneously an equilibrium is reached but the investor is taking on risk according to the profiles of the assets traded (or, at least, the risk as defined by beta with respect to the general market return).

Instead of using the "market" as benchmark, the APT takes various systematic factors, including (as in Roll and Ross 1995), (1) unanticipated inflation, (2) changes in the expected level of industrial production, (3) unanticipated shifts in risk premiums, or (4) unanticipated movements in the shape of the term structure of interest rates. The return of an asset is determined by its sensitivity to any number of factors, defined by factor specific betas.

As in the CAPM, in a well-diversified portfolio the idiosyncratic factors affecting return cancel out so "returns on large portfolios are influenced mainly by the systematic factors alone" (Roll and Ross 1995: 122). While seemingly similar to the CAPM with only the addition of further factors affecting return, the APT also makes the claim that if two different portfolios have the same sensitivity to each factor they can be arbitraged. Indeed, it will be the very act of arbitrage which keeps asset prices in

equilibrium according to APT, while in CAPM equilibrium obtains through a trial and error process which standardizes risk-adjusted returns.

Since the concept of beta is integral to both analyses, it is instructive to point out two details before questioning whether they are useful tools to signal arbitrage opportunities (at least according to APT).

First, betas are not *exhaustive*. The return on any asset at every point of time cannot be explained completely by the combination of betas and the change of systematic factors; the idiosyncratic and other unidentified factors also play a role. Even in the context of a well diversified portfolio neither the CAPM nor the APT can affirm that the different idiosyncratic factors must necessarily cancel out. In other words, the determining factors of an asset's return, as well as its associated betas, can never be completely defined. This insight is one key in understanding why empirical tests of the CAPM point to its inability to explain actual returns fully, and also why theorists have constructed ever more complex pricing models to include more factors to correct these misgivings. Fama and French (1992, 1995) argue that the CAPM is misspecified as a result of stocks with high (low) book-to-market values earning a high (low) return because the former have different risk factors than that offered by the general market. Although they do not identify such a factor, they argue that a different "general market" return – that of the high book-to-value stocks – will proxy for such a factor, which they coin the "distress factor".[6] The continued poor performance of the CAPM to accurately predict risk-adjusted security returns provides at least *prima facie* evidence that the

[6] In a similar vein APT follows this logic by extending the potential factors to any number, depending on the specific model's specifications. What these attempts, and others like them, overlook is that relevant factors can never be fully elaborated and thus a sizable error variable will remain a feature of all pricing models dependent on them.

relevant factors are yet to be fully elaborated on, or that they cannot be fully enumerated, or most commonly, that such betas are subject to change.

Second, a beta itself is a *simplification* of very complex phenomena (perhaps it is even better described as a metaphor of finance, as in Phillips (2010). Beta describes in a *single number* the causal relationship in a very simple way (typically linear) between the change in a systematic factor and the return on a particular asset. As a practical matter the process is much more complex. Consider the following example: assume there is a change in inflation expectations. How will this affect the price of given stock, *ceteris paribus*? First, the very term "inflation expectations" does not refer to a simple or even unique phenomenon. Inflation expectations differ depending on the specific asset, or its location in the productive structure of the economy (e.g., due to "Cantillon effects" of changes to the money supply, as in Bagus and Howden (2012: 272-73)). On an epistemic level the expectation about inflation will either be skewed by the individual's specific knowledge of the inflationary process or by his location with respect to the source of the inflationary shock (Howden 2010). There is also the issue of the inflation expectation being unique to the individual due to the assets that he considers relevant in his inflation-estimating calculus. Given these difficulties we can only know, and in an imprecise way, *historical* reactions to similar situations as we cannot completely isolate the impact of one factor, even one as seemingly simple as inflation expectations. It is also clear that even in the unlikely case that the same change of expectations were to take place in the future its impact does not have to be the same as a result of either a change in the sensitivity of the asset to the factor in question, or because the factor itself is a less (or more) important determinant of the final return (i.e., its weighting has changed).

These criticisms are not especially new. As early as Roll (1977) the applicability of the very concept of the "general market return" which beta will express sensitivity to, was demonstrated to be an unobservable variable. Still, a beta may be a useful device mindful of several caveats. It is not *predictive*, nor can it foretell the future behavior of prices. This simple insight is instrumental for the task at hand because it implies that, at least according to our definition of arbitrage and its more traditional variants, betas cannot be arbitraged (as in Ross (1976) and Roll and Ross (1995)).

At this juncture we can see the difference between the "soft" statement by the CAPM, in which there is room for speculation as asset prices will adjust to their specific risk as perceived by market participants, and the "hard" version of the APT, in which different portfolios with the same betas will be arbitraged as their respective future returns are already *implied* by them. If betas cannot be arbitraged it follows that neither can portfolios based on them.

Limited Arbitrage or Convergence Trades

Convergence trades are situations where two or more assets are known or thought to converge at some point in the future, notwithstanding the fact that the prices may diverge in the present. Assume that two assets with very similar cash flows currently trade at different prices for exogenous reasons. Arbitrageurs should enter both markets simultaneously to take advantage of the pricing differential. They are exposed to potential losses as there is no reason why prices *should* converge immediately or even within the time deemed profitable by the cost of capital. As arbitrageurs are capital constrained any further divergence of prices, be they exogenous, e.g., Shleifer and

Vishny (1997), or endogenous, e.g., Kondor (2009), may lead to an even wider divergence as arbitrageurs unwind their positions to cover capital losses.[7]

Although these trades are commonly viewed as cases ripe for arbitrage the literature acknowledges the risk element apparent in them (Shleifer and Vishny 1997). Kondor (2009:1) readily admits that when he uses the term "arbitrageur" in these cases he does so somewhat "loosely". Under our own definition these could only be considered as arbitrage trades if the action of the trade resulted in a profit at the moment the trade is enacted, and at every point until the convergence was complete.

First let us look at the example of limited arbitrage proposed by Shleifer and Vishny (1997): the arbitrageur buys in London and sells in Frankfurt the same Bund future at different prices.[8] Why should we not consider this arbitrage? Should not the two equivalent assets trade at the same price *always*? One reason they are not equivalent assets is because neither of them can necessarily be delivered on the other market. (If this was possible we can easily see that the arbitrageur would not need capital, he would buy in London and sell in Frankfurt and settle the transaction by delivering the London contract to his counterparty in Frankfurt, thus profiting the difference.) On the contrary, if he cannot deliver his London contract to cover his short we must say that he has two different assets even though they represent the same type of claim to equivalent cash flows. Since he will need capital in order to face the margin requirements in both exchanges the prices of the two otherwise identical assets can diverge owing to liquidity conditions on their specific market. The risk that a mispricing becomes even more pronounced and causes short-term losses jeopardizing the liquidity of the arbitrageur is

[7] Alternatively, if these divergences are caused by uninformed "noise traders" informed arbitrageurs may be bid out of the market as divergences grow too wide or persist for longer than their liquidity allows for (De Long *et al.* 1990).
[8] A similar example in the context of the equity market can be found on Froot and Dabora (1999).

a common element in risky arbitrage models (Grossman and Miller 1988; De Long *et al.* 1990; Campbell and Kyle 1993).[9] Because of the threat of losses from a market-specific loss of liquidity, we can see the importance of our proposed redefinition of arbitrage as it rules out any possibility of future losses. Therefore in this case there is no arbitrage as traditionally stated, or even limited arbitrage in the sense of Shleifer and Vishny (1997), but rather pure speculation.[10]

It is important to highlight here that speculation not only refers to actions in which we cannot be certain as to the future value of an asset. Using leverage to buy a bond assumed to have no default risk is hardly considered limited arbitrage even though it does present the same situation: even if the value at some point in the future is known it will vary in the meantime, e.g., due to collateral requirements and liquidity constraints, thus creating the possibility temporary losses until the maturity of both contracts.

The problem lays in the modifier in the term "limited arbitrage". While it does represent a convergence trade, differing liquidity positions in different exchanges (or wherever the asset in question is traded) give rise to a degree of risk on the otherwise riskless trade. In sum, there can be only speculation or arbitrage, and never the twain shall meet.

Salvaging Arbitrage

[9] These "risky arbitrage" models show that not all "arbitrage"-type opportunities will be exploited owing to liquidity constraints. Alternatively, in Dias de Sousa and Howden (2013), arbitrage trades may not occur because divergent prices for equivalent assets in different markets do not actually represent a misalignment in need of arbitrage. If the assets trade on separate markets, differences in, e.g., discount rates, will create unique present values giving the appearance of a pricing discrepancy when none exists.

[10] This example raises a deeper question as to what assets can the law of one price apply to, specifically what attributes constitute the "same" good. Multiple physically identical goods with the same end (as is the case with financial assets trading in separate markets) cannot be considered candidates for the law of one price (and by extension, arbitrage) since ancillary conditions concerning their tradability (such as liquidity or settlement constraints) can and do differ.

The existence of derivatives and assets with very similar cash flows (e.g. bonds of the same issuer with slightly different maturities) has given rise to a business model centered on "arbitraging" the mispricing.[11] In light of our previous discussion questioning the applicability of the concept of arbitrage to most exchanges, this raises the question of the practical matter of arbitrage profits across different securities, instead of the more traditional form of arbitrage which is confined to a unique asset. While such an application is similar, it is a distinct analysis in need of a different standard to uphold it to. Such a standard is to be found in a modified definition of arbitrage, though one which must also contain several key characteristics: (1) an immediate profit coupled with (2) certainty.

Any transaction that does not meet those two cannot be considered arbitrage. The reason arises from the lack of knowledge, or uncertainty that exists regarding the future. If an exchange results in even a temporary loss we cannot state we are locking in a profit with *certainty* at the time of contract. Since we cannot be sure of the future value there remains the possibility that the trade will not result in a profit at its time of completion. Alternatively, even if the trader is assured that at some future date a profit will be available, he will be uncertain as to whether he will be able to complete the exchange at that date. Perhaps his personal liquidity position will dictate that he needs to end the transaction early, or his own untimely end may dictate that the deal is terminated. In all cases, it is not only the risk apparent in the future value of the asset but also in the trader's future personal experiences that remove the possibility of a successful arbitrage opportunity.

[11] Long-Term Capital Management remains one of the most famous, and ultimately least successful, investment companies making use of this convergence strategy.

Our clarified definition of arbitrage allows for only those transactions that immediately allow for a profit, even if the magnitude is not known in advance. Many convergence type trades have this property of a temporary profit, albeit one that can turn into a loss. This is especially apparent in the pricing of derivative products as well as with well-known theories such as put-call parity (Stoll 1969) and the Black-Scholes option pricing model (Hull 2009: 285-286). For example, purchasing an option with a negative premium locks in a minimum profit, the extent of which will depend on if and to what extent the option is in-the-money. The existence of these trades are important to the extent that they illustrate why the concept of "certainty" is important in arbitrage, as it excludes many transactions that are approximately like arbitrage save for this feature.

Note that this definition does not concern the number of assets involved or the maturity matching of cash flows or asset maturities. The only concern is the realization of a profit. Alternatively, one can think of this definition as being any trade for which the net present value is positive at all times. This definition subsumes the more standard definition, and thus we can also use the term "arbitrage" to describe any event where one security is mispriced (e.g. an option offered with a negative premium: the NPV of that trade would always positive although variable so anyone buying it would be arbitraging the price spread).

While this definition of arbitrage may appear too similar to the traditional one to add anything additional of substance to the analysis, we maintain that it provides a clear guideline with which to distinguish arbitrage transactions from more common speculative endeavors. Furthermore, it allows us to make the claim *a priori* that mispricings that can be arbitraged according to our definition will disappear once discovered, while the same cannot be stated about speculative situations. This does not

imply that the concept of the costless arbitrage cannot exist outside of a theoretical construct owing to the uncertainty created by actions occurring over time. Alertness to unexploited profit opportunities (as in Kirzner 1973) necessarily implies an uncertain environment, as prices would already be at their equilibrium levels otherwise. In our proposed definition we can make the certain claim that entrepreneurs will exploit certain trades, while other speculative endeavors will rely on the standard expected cost-benefit calculus. Other prevailing definitions and uses of arbitrage do not make the same distinction, and thus indiscriminately claim that a variety of transactions will be undertaken due to arbitrage when in fact no such clear rationale exists.

In most of the literature on financial asset pricing, "arbitrage" does not refer to a specific activity but is rather a necessary assumption needed to solve a system of equations. While such uses of arbitrage pricing include transactions that cannot be arbitraged in some instances, a more egregious violation in the use of the term is the arbitrage-free condition. This situation arises when all assets are priced appropriately such that no individual´s gain can outpace the market return (in either absolute or, more commonly, risk-adjusted terms). This literature is not concerned with concrete examples of arbitrage, but rather the condition is used to rule out certain solutions to a system of differential equations. The literature that emerged after Schleifer and Vishny (1997) has been motivated by the inability of "no-arbitrage pricing" models to match empirical data.

We redefine arbitrage as "when one or more assets are bought or sold at the same time locking in a monetary profit with certainty at the time of trading, even if it cannot be certain as to the amount of such profit." This allows us to return to the root of the problem of price formation and provides a standard to judge the concrete action of arbitrage. This is in contrast to the theoretical and empirical literature, which faces

difficulties establishing what actually *should* be included as an arbitrage opportunity (i.e., can the trade occur across markets, time, are resource constraints binding, etc.). There are six key advantages to using our modified definition of arbitrage rather than its more standard usage.

1) The importance of arbitrage is that we can derive economic laws from it: we *know* arbitrage opportunities will be exploited once discovered. The reason is that arbitrage means *certain* profits. In distinction, many modern uses of the term try to use economic theory to derive additional cases where arbitrage may exist. These types of applications amount to putting the cart before the horse as they use arbitrage as an equilibrating mechanism when the proper conditions for its use do not exist.

2) Arbitrage and speculation differ from each other only to the extent that we move from a certain realm to an uncertain one. We know what will happen when an arbitraged situation is discovered; on the other hand we cannot state the outcome of speculative situations.

3) Trades outside the proposed definition are speculative (including so called convergence trades) because we do not know their outcomes a priori.

4) Arbitrage can only take place in a dynamic and uncertain environment. This insight rectifies the anecdote popular amongst some economists that two people could never see a ten dollar bill on the street in front of them, as if the profit opportunity actually existed it would already be exploited (as popularized in Malkiel 1973). This very situation does in fact exist, and the associated arbitrage profits result because of the very existence of true uncertainty. The market that functions within this fundamentally uncertain

environment will make such opportunities short-lived, but still allows for their existence.

5) In a dynamic environment, arbitrage is the culmination of previous entrepreneurial actions that alter an existing price array.

6) Those actions aimed at obtaining arbitrage profits will lead to the same effects as any other entrepreneurial act: the creation and transmission of information and social coordination.

Our proposed use of arbitrage sets a specific domain for arbitrageable transactions, and places all others into the category of speculation. This approach finds affinity with Huerta de Soto's (2010a) dynamic concept of the entrepreneurial function, whereby he explicitly includes both ideas of time and uncertainty to the pricing process:

> From a temporal standpoint, entrepreneurship can be practiced in two different ways: synchronically or diachronically. The first is called arbitrage and is entrepreneurship exercised in the present (understood as the temporal present from the actor's point of view) between two distinct places or situations in society. The second is called speculation and consists of the exercise of entrepreneurship between two different points in time. One might think that entrepreneurship, in the case of arbitrage, amounts to discovering and transmitting information which already exists but which is dispersed, while in the case of speculation, "new" information is created and transmitted. Nevertheless, this distinction is purely artificial, because discovering what "already existed," though no one knew it existed, is synonymous with creating.

> Thus, qualitatively and theoretically speaking, there is no difference between arbitrage and speculation. (Huerta de Soto 2010a: 69)

Both acts of arbitrage and speculation are essential for social coordination according to Huerta de Soto. His use of arbitrage does not correspond to what we define as arbitrage but to the act of purposely looking *for* arbitrage opportunities. If we do not assume the entrepreneur knows what prices can be arbitraged *ab initio*, he must first obtain that information, and, as we have already explained this is better considered as an act of entrepreneurship which is speculative in nature and takes place in time. The result of this activity will be the other facets of entrepreneurial actions: the creation and transmission of information leading to social coordination (Huerta de Soto 2010a: 64-67).

Entrepreneurs will embark in those actions in order to obtain profits through both intratemporal and intertemporal trades, but they can never be certain of success, giving further justification to Huerta de Soto's (2010a:69) claim that "there is no difference between arbitrage and speculation." Even though this idea is more in line with our view of arbitrage and speculation and, in our opinion, is one step forward from Kirzner's concept as it also includes the Misesean insights of uncertainty and time, the difference between arbitrage and speculation can still be highlighted further. In a dynamic environment, arbitrage is the culmination of previous entrepreneurial actions. As such, any activity involving arbitrage is akin to an action embedded within another action. In the uncertain world the most we can say is that it is an action that is part of a broader action whose beginning is speculative in nature, i.e., the act of finding the arbitrageable prices. This is not to say that the market is necessarily inefficient to the

extent that the very act of arbitrage must be predicated on an uncertain outcome, but rather a truthful depiction of the reality of the pricing process. This emphasis is apparent in much of Kirzner's theoretical work, whereby disequilibrium prices allow for arbitrage opportunities and it is the entrepreneurial action of *finding* (or being alert to) these prices that can be arbitraged that is a speculative action with uncertain success.[12]

In fact, while some authors, e.g., Fama (1991), view arbitrage opportunities as indicative of inefficient markets, the role of efficient markets is to coordinate the uncertain and disparate valuations of individuals that are the ultimate cause of arbitrage opportunities.

Conclusion

This paper has overviewed the primary definition of arbitrage currently in use in mainstream financial economics literature and some of its applications. Despite being a seemingly simple and straightforward concept, it is used in a quite fluid manner which compromises its usefulness. We have provided an alternative definition to shed light on these prevailing uses and applications.

In particular, by defining arbitrage as only those transactions which result in a positive net present value at all times during the duration of an exchange, we have added rigor to the use of the term. Specifically we have been able to exclude a large

[12] This is a variation on the argument given by Huerta de Soto (2010b) against Grossman and Stiglitz' concept of "informationally efficient markets", the result of which will be an "equilibrium degree of disequilibrium" (1980: 393, see also 1976). As the costs of gathering information are unknown in advance of the search, and the expected benefits are also shrouded in uncertainty until realized, there can be no conscious decision to search for a profit opportunity but leave it unexploited once a certain cost is surpassed. Compare with Rizzo (1979: 9; 1995:12), Hülsmann (1997:48), and Sautet (2000: 45).

body of “quasi-arbitrage” activities, such as those found in Shleifer and Vishny (1997), and thus limit the use of the concept to its proper domain.

One final conclusion of this work is that many prior uses of arbitrage are now exposed for the speculative endeavors they are. The more stringent definition made use of herein may have the drawback of making pricing theory reliant on arbitrageable mispricings more limited (and perhaps more difficult) to apply, but at least it is more honest.

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