Austrian economics and economic verifiability

Introduction:

The position of Austrian economics on empirical verifiability has long been controversial. The thought that economic truths are known a priori and that data are of secondary importance has long been held to be at odds with established scientific method. The a priori nature of economic truth may not be implied by other premises of Austrian thought; this thought is suggested by the attempts of Carl Menger to learn the calculus late in life, a pursuit that would be unlikely to interest him if he saw some fundamental conflict in the use of mathematics in economics. Von Mises uses an empirical reason to deny the usefulness of mathematics---the 'facts' of economics are ephemeral and the sciences should not be aped since economics has no constants.[i]. To these claims, the neo-classicals responded in what may be considered a two pronged argument.

First, they raised the methodological point that whether or not economic facts are sufficiently stable for policy purposes is an empirical claim, and it is not one whose outcome can be decided a priori. Since the claim is an empirical one, it needs to be settled by data. Secondly, the neo-classicals argued that many economic outcomes are the result of two opposing forces---say income effects versus substitution effects----and even the most trite economic arguments ---such as the effect of wages on labor supply---remain indeterminate without some assumption on the orders of magnitude of the opposing forces. Rather than make such assumptions a priori, we are obligated to examine them by looking at the data.

This paper revisits and expands the issue by arguing that the need for 'believing' in some economic positions nonetheless arises from *within* the neoclassical position for three reasons. First and foremost, it is *not* essential to argue that all economic data are ephemeral for the Austrian opposition to be valid. One only needs to show that a sufficient number of economic 'facts' are unstable. This will adequate to cast doubt on decision-making based on 'facts' to those who believe that the economic system is interdependent. Even for those facts which may be known accurately, since the collection of data takes time, we cannot be confident about obtaining accurate data about such phenomenon when policy needs to be enacted. Furthermore, if we overcame this initial delay, since the process of assimilating, storing and computing with economic data take more time, the phenomenon we are addressing will often change its essential form as we seek to execute economic policy. For a substantial portion of the economy, we must decide on the 'reality' being addressed without having direct data. It is an act of faith to state that such errors are small and tend to cancel out. *We simply do not know* if they do cancel out, and there is no reason to believe that errors that are small may not lead to accumulation of small deviations that have significant macro impact[ii].

Consequently, many economic propositions are simply unknowable. This important claim is illustrated with the 'Law of one Price', which is a basic claim of all economists, and yet is repeatedly rejected in empirical tests. We have to come to terms with the raw fact that the world is neither so simple, nor so calm, as to generate the

desired data. It follows that many empirical propositions, particularly those involving policy, must have an a priori base.

Secondly, those facts which appear to be stable lack fine detail---they are aggregate characterizations, such as the gravity equation for trade. Since the neoclassical economists,or necons, believe that their theories are based upon individual behavior, they cannot lawfully prescribe stable laws, as opposed to empirical regularities, when discussing aggregates. All such aggregate behavior has to be derived from individual behavior to be meaningful---indeed this was the slogan of the Lucas-Prescott school of Macroeconomics for over a decade. Such derivations fail, except for the simplest cases, and the 'aggregation problem' is widely accepted as being unsolvable.

Thirdly, those facts that are stable, such as the gravity equation for trade, are predicted by virtually every theory of international trade. As a result, the effort of 'economic science' to separate theories by their (stable) empirical predictions fails. We have to choose between different theories on grounds that are 'beyond' the facts---or, so to speak, metaphysical.

Even the simple economic modes requires arbitrage to provide us mutually beneficial trade; when such arbitrage is quick it leads to the Law of One Price(LoP)., Since LoP fails in a multitude of cases, we have to say that at least one of its underlying assumptions fails. But LoP is based on

1 greed
2 homogeneity of goods
3 speed to equilibrium---

The literature to date has focused upon point 2, the homogeneity of goods. In an earlier paper, I claimed that the failure of LoP is of more significance than is generally believed. Now I want to generalize and deepen the argument. If LoP does not hold, then it is probable that equilibrium is not reached, and if equilibrium is not reached, how do we relate our models to data?

I make no pretence of having done original research with data. I only want to report my surprise upon reading the research of others. Towards this end, I am again following my earlier 'ugly' style of exposition[iii]. I will quote extensively from others in the text---hopefully making my obligations apparent thus---and make direct remarks largely in the Introduction and Conclusion. Large parts of sections 2,5,6 and the Appendix to section 3 are quotes and I have dropped quotation marks only to preserve readability.

Section 2 introduces the reader to the staggering size and complexity of the available data and then makes a point of fundamental importance to those who wish to decide economic policy issues by informing themselves. Readily available data is often unusable,---because it is sometimes unreliable but more often because it is an aggregate or index whose make is not transparent--- while the more accurate data is confidential and inaccessible. The problem is systemic. There is a dilemma here with respect to data.

We want data to be both accurate and accessible.---two requirements that seem at odds with each other.

Section 3 provides evidence for the claim that the LoP is confirmed only for a very limited class of commodities, even after disaggregating to the maximal extent we appear capable of. [This largely reworks sections of my earlier piece.] Section 3 then tries to understand why economists believe in LoP, paying attention to the processes and institutions implicit in our arguments. It finds the implicit conditions necessary for the LoP to be verified are stringent and can be fulfilled only for a narrow range of commodities; furthermore, this range can be expected to get narrower with time.

The potential extent of the problem can be gauged in the Appendix to **Section 3** by looking at one area where the LoP should be rapidly validated----financial markets. This does not appear to be so. The evidence for such anomalies is briefly covered and then we note the disturbing fact that some of the problems are the result of the very institutions that perform arbitrage and are supposed to make the LoP true.

Section 4 elaborates upon the requirements for the interpretation of data as equilibrium values. We not only need to claim that prices move rapidly to equilibrium, but also that the path is rapidly damped. We are confident about arbitrage because we believe in the force of profit maximization and in the impact of competition. But even if we believe that while competition will move us towards an equilibrium, nothing tells us how fast we will be so moved. An equilibrium reached in a decade is of minor interest while an adjustment that is quick but very volatile also makes it impossible to use observed values as equilibrium values. Several papers suggest slowness to equilibrium while Chaos and catastrophe theory provide so many examples of non-monotonic convergence that one is at a loss to pick a 'favorite' example. And we also have to ask if the sectors that are not based on profit maximization, will hasten or hinder such adjustments?

Section 5 asks whether LoP may not fail precisely because of maximization. Unless we assume that there are many sellers at every location, McChesney et al have shown that LoP will be violated. As a result, spatial considerations suggest that most real world data will reflect a variety of monopolistic and strategic elements. Expand this idea to multiple product supermarkets and to one-stop shoppers. We may see that the failure of LoP has little of significance for the functioning of markets.

Section 6 begins by quoting Rothbard and Mises on Quantitative Economics and then seeks to provide some intellectual perspective. While the Austrian school has long been arguing only that some significant part of it may be so. about the evanescent nature of economic parameters and functional forms, it is noteworthy how the research of two of the most prominent neoclassical economists, Franklin Fisher and Zvi Griliches, has forced them to be skeptical of FAM and, by implication, of the fundamental premises of modern empirical economics---that data are reliable instruments for judging between theories or for guiding policy. Once again, one does not need to argue that all data are useless---only that it is not unreasonable to let our priors override the 'facts'.

Section 7 extends the program of questioning FAM to Macroeconomics and then concludes. Macro theory is based on the idea that aggregates can be usefully reasoned upon and the applications of Macro to policy implicitly requires the data to be equilibrium values. The second assumption is one that has simply not been questioned or tested to my knowledge. Macroeconomics deals with many sectors and it needs something like uniform convergence across sectors for its empirical claims to be acceptable—what if one sector only reaches half its equilibrium in the data period?

We need data which are collected while parameters are stable and after equilibrium is reached. This involves more than one assumption, so let us call the joint assumptions the Fundamental Assumption of Measurement or FAM. Once the implications of these assumptions,--- that measured values are taken to be the equilibrium values generated by stable systems--- are explicitly spelled out, some obvious questions arise about the acceptability of FAM:

1 What if parameters change in the time it takes us to reach equilibrium?
2 What if data is collected in time periods too short for equilibrium to be reached?
3 What if the categories being used for data change before data collection is complete or before equilibrium is reached?

The literature seems to be unwilling to take the question seriously, despite the wealth of evidence suggesting the failure of the LoP and hence the equilibrium assumption. It not only ignores the arguments of the Austrians, but also the claims of some eminent established economists, such as Joseph Schumpeter, that the essence of economic life consists of 'creative destruction', or the frequent violation of the assumption that the parameters of economic life are stable. Here is the view of a deep if neglected neoclassical economist.

> Real economies are subject to a succession of exogenous shocks. The discovery of new products, new processes, new sources of raw materials, new demands, and new ways of organizing production are, as emphasized by J. Schumpeter (1911), the driving forces of economic development and growth. It is unreasonable to suppose that such Schumpeterian shocks are all foreseen and can be incorporated as part of equilibrium. Rather, equilibrium analysis, if it is useful at all, is so because the economy rapidly adjusts to such shocks, approaching a new equilibrium long before the next shock occurs[iv].

Section 2 Data and empirical regularities

The first point to be made is that data has to be generated and collected. Since data is valuable, it is subject to the usual pressures of self-interest. Oscar Morgenstern reports how a minister from an LDC once told him that the data necessary to get foreign aid would be created, if necessary. In 1994 I tried to confirm the extent of flood damages in the US Midwest in 1993. After several unresponsive phone calls, I was finally told by one honest employee that when a flood occurs, "our Congressmen urge us to make up estimates on the spot so we can apply to Washington for funds. It's competitive, so we have to get in before neighboring states have all the money allocated to them!"[this is a paraphrase] Much of the older critiques of data were based upon skepticism of the self-interest that was leading the data to be made public. What is new about the data talked about today is that it is impersonally and systematically generated ---it is a regular job for someone. They have nothing to gain from the data being collected, so there will be no venal biases[v]---but let us look in more detail on some of these datasets. I quote from three sources on 1 export trade data 2price index data and 3 scanner data.

Export trade

Trade data are collected through customs forms, one for each export shipment. There were about **22 million export shipments** originating in the U.S. in 2005. If we base theories upon the actions of individuals, this reminds us that we have information on some 22 million individual decisions. This may seem a number safe from small-sample problems. However, there are 229 countries and 8,867 product codes with active trade, so a shipment can have more than 2 million possible classifications. Most of the traded categories had only 1 shipment during the year, a clear sign that the data are sparse. There are too few shipments, partly because some products are indivisible, and partly because of the constraints of transportation technology[vi].

Surprisingly perhaps, even such extensive data show several regularities.(1) Most product-level trade flows across countries are zero; (2) the incidence of non-zero trade flows follows a gravity equation; (3) only a small fraction of firms export; (4) exporters are larger than non-exporters; (5) most firms export a single product to a single country;(6) most exports are done by multi-product, multi-destination exporters. 1 These facts have proven to be very robust across datasets from different years in several countries. We argue that the sparse nature of trade data is crucial to understand these stylized facts. Data are sparse if the number of observations,that is, total shipments is too low relative to the number of possible classifications_country and product code pairs. Sparse data have some distinctive features owning to the low number of observations: most categories have very few or no observations, and the distribution of the number of observations per category is unimodal at a low count.

Price Indexes

The most frequently encountered sources of disaggregated data are perhaps those collected by the Government to compute Consumer and Producer Price Indexes., the CPI and PPI[vii]. The Producer Price Index program collects monthly price data on about 128,000 individual items from about 32,000 establishments. The FY2007 budget for the Program is about $32 million. The CPI collects data on about 80,000 individual items

(budget unknown). The larger number for the PPI is presumably due to the addition of many intermediate goods in the PPI. How detailed are these individual data? It is worth examining the selection of individual goods in more depth.The CPI is a product of many samples. The Census of Population is Used to select the urban areas from which data on prices were collected And to choose the housing units within each area. A Point-of-Purchase Survey identifies the outlets where households purchase various types of goods and services. The Consumer Expenditure Survey provides detailed information on respondents' spending habits, and enables BLS to construct the CPI market basket of goods and services and to assign each item in the market basket a weight, or importance, based on total family expenditures.

The final stage in the sampling process is the selection of the specific detailed item to be priced in each sampled outlet. This is done in the field, using a method called 'disaggregation'. For example, BLS economic assistants may be directed to price "fresh whole milk." Through the 'disaggregation' process, the economic assistant selects the specific kind of fresh whole milk that will be priced in the outlet over time. This process begins by assigning each kind of whole milk is assigned a probability of selection, or weight, based on the amount the store sells. If, for example, vitamin D, homogenized milk in half-gallon containers makes up 70 percent of the sales of whole milk and the same milk in quart containers accounts for 10 percent of all milk sales, then the half-gallon container will be seven times as likely to be chosen as the quart container. After probabilities are assigned, one type, brand, and size container of milk is chosen by an objective selection process based on the theory of random sampling. The particular kind of milk that is selected by 'disaggregation' will continue to be priced each month in the same outlet. Therefore, nationwide, we would expect to have a relatively representative sample of milk in our index.

Once again, it is somewhat surprising to see that several regularities can be found in such data. First, prices remain constant for extended periods of time in many sectors of the economy. Second, prices appear to change less frequently in the euro area than in the United States. The median consumer price lasts about 4-9 months in the U.S. economy, depending on whether price changes related to sales and item substitutions are included or excluded. The median consumer price lasts about 11 months in the euro area. Third, when prices change, on average they change by large amounts relative to inflation. This suggests that idiosyncratic shocks are a much more important cause of variation in prices than aggregate shocks. At the same time, many price changes are small. Fourth, new cross-country evidence con rms that the frequency of price changes depends positively on the average rate of inflation. Fifth, there is indeed little evidence of synchronization of price changes[viii].

Scanner Data

Keeping in mind how often we find ourselves in front of a cashier, we can appreciate (and be terrified by) the enormous amounts of data that can be collected by someone who has access to our purchases---and someone does. The two leading providers of scanner data are A.C. Nielsen (Nielsen) and Information Resources Incorporated (IRI). Both firms provide a variety of retail information in a number of

channels of distribution (supermarkets, drug stores, mass-merchandisers, and convenience stores) for various geographic regions throughout the U.S. The bases of these data sold by Nielsen and IRI are a sample of stores from which the data companies acquire all point-of-sale (POS) scanner data. The scanner data provides data on total revenue and total units sold by UPC code[ix]. In addition, IRI and Nielsen collect a number of measures of price and of various measures of promotion for each retail outlet they sample, *e.g.*, a specific chain and store location, and a measure of distribution penetration.

The data collected by IRI and Nielsen represent a sample of the retail outlets operating in the U.S., and both firms use different proprietary methods to project total sales. IRI and Nielsen cover some areas, and some distribution channels, better than others. Both IRI and Nielsen have very good coverage from supermarkets. There is significantly less coverage in the mass-merchandiser and convenience store channels. For products that have substantial sales outside the supermarket channel, the IRI and Nielsen data can present questions as to the representativeness of the data. However, to our knowledge, the data from IRI and Nielsen are the best available to study demand for these products. Although the "raw" data contains each individual POS transaction, the data Nielsen and IRI sell to their clients typically consists of *aggregates* of total sales in dollars and units by brand and UPC code. To our knowledge, IRI and Nielsen rarely sell (aggregated) price and quantity information from individual stores. Instead, they typically aggregate the quantity and revenue data up to either the level of the chain within a specific geographic area, *e.g.*, Giant Foods in the Washington, DC metropolitan area, or, more often, aggregate over all chains and stores within a geographic area for a given channel, e.g., revenue and quantity within the Washington, DC metropolitan area for all supermarkets.

IRI and Nielsen also collect data on shelf prices; however, there are potential measurement problems with this data. It is worth noting these, because the detail is of a nature we encounter in our everyday grocery shopping, and hence will carry some conviction if we claim that similar effects are possible even for cases not within our daily purview. The most important problems likely result from discounts (e.g., coupons or club) received by some consumers but not observed (or only imperfectly observed) in the data. For example, if a consumer purchased Coke at $3.99 and used a $.50 coupon, the price would be recorded as $3.99. There is a similar problem for "club" or "loyalty card" purchases, which entitle a customer with a card to a substantial discount on promoted items. In some cases, the price is recorded as the most commonly occurring price (typically the price with a club card), in other times average revenue is recorded. An additional issue in both the IRI and Nielsen data results from the time interval over which data is collected. While both collect and report data weekly, different retailers change their prices on different days of the week, e.g. promotions at some retailers run Sunday to Saturday, while others run on a Thursday to Wednesday schedule. Thus, it is quite possible that the shelf price reported by IRI or Nielsen in a given week will only correspond to the actual shelf price for a portion of the reported week. Market researchers and economists too have found that, holding price constant, promotional activities by retailers can have large incremental effects on sales. Economic theory does not give

explicit guidance as to how this activity should be empirically modeled. Note that if we are to model such effects, our data must be very specific---it must say exactly which product, when, what type of display and what discount.

Section3: The 'Law' of one Price

The Law of one Price [hereafter LoP] is one of the most basic laws of economics and yet it is a law observed in the breach. That a given commodity can have only one price, except for the briefest of disequilbrium transitions, seems to be almost an axiom. Why has the law been accepted? Can the law be confirmed by data? If not, why is the law still accepted? Verifying the Law of one Price involves getting accurate data on many thousands of individual prices as well as the many forces that have affected them such as location, quality etc. Of the Austrian economists, it is F A von Hayek who worried most about our inability to collect many particular facts. Hayek first used this insight to provide the most pungent critique of centralised economic planning in the 1930's; later he used these ideas to build a sophisticated case for differentiating between the physical and the social sciences. In the physical sciences the number of elementary facts that needed to be known before acquiring a satisfactory explanation of phenomenon were few, while in the social sciences they were many. The primary facts of the social sciences were so many that they not only defied analytical manipulation by the human mind, they were so many that we simply could not hope to gather all of them.[x] "The chief difficulty [in the social sciences] becomes one of in fact ascertaining all the data determining a particular manifestaion of the phenomenon in question, a difficulty which is often insurmountable in practice and sometimes even an absolute one."

As a result, Hayek went on to say, the social sciences should not aim at making particular predictions, since, even if the theory was correct, the particular facts required for prediction could never be ascertained anyway ; rather, the social sciences should only attempt to indicate general patterns that could be relied upon to develop.[xi] Hayek was always skeptical of the trend of scientism to claim to 'know' and it is in the same skeptical spirit that this essay is written.[xii]

The examples of empirical studies below are chosen from amongst many others and deal with increasing levels of fineness in the data, from motor cars, with their many attributes combined in one physical product, to consumer goods, which still have many attributes, to identical products. Note how, in each case, there is definite evidence that economic forces do work, thus distance does increase price variation, and common currencies do diminish them, but the point is that economic forces are neither strong enough nor persistent enough to produce the LoP as an empirical phenomenon. First, motor cars in Europe

> This paper uses micro-level price data from the European car market to examine why there are deviations from the law of one price. The absolute law of one price is strongly rejected, but there is convergence to its relative version. *Matthias Lutz* REVIEW OF INTERNATIONAL ECONOMICS]

Next, closely related consumer goods in the US.

> We use new disaggregated data on consumer prices to determine why there is variability in prices of similar goods across U.S. cities. …Surprisingly, we find that variability is larger for traded-goods. We attribute this finding to greater price stickiness for non-traded goods. [Haskel, J. and H. Wolf. "The Law Of One

Price - A Case Study," Scandinavian Journal of Economics, 2001, v103(4,Dec), 545-558.]

Thirdly, narrowly defined commodities in futures markets

> The law of one price (LOP) is tested for narrowly defined commodities traded in futures markets in different countries during the period 1973-80. Although the LOP holds as an average tendency for most of the commodities, there are instances of large riskless arbitrage returns (before transactions costs). Deviations from the LOP tend to be commodity specific rather than due to a common external factor and they tend to be smaller the longer the maturity of the futures contract.[Protopapadakis, Aris; Stoll, Hans R. Spot and Futures Prices and the Law of One Price,Journal of Finance,38,5,Dec., 1983, 1431-1455]

Finally, identical goods sold by multinational retailers;

> We use retail transaction prices for a multinational retailer to examine the extent and permanence of violations of the law of one price (LOOP). For identical products, we find typical deviations of twenty to fifty percent, though there is muted evidence for convergence over time. [Thaler, Shiller, Ville Aalto-Setala (2003) ,"Explaining Price Dispersion for Homogeneous Grocery Products", Journal of Agricultural & Food Industrial Organization: Vol. 1: No. 1,Article 9. http://www.bepress.com/jafio/vol1/iss1/art9]

No wonder that Williamson and Milner summarized the evidence by writing that " The hypothesis that arbitrage quickly equates goods prices internationally has probably been rejected more decisively by empirical evidence than any other hypothesis in the history of economics".[xiii]

As ordinarily stated the law relies on a simple thought experiment, which will be referred to hereafter as the 'snapshot'. "Imagine two prices being demanded in one market for exactly the same good,--- who but a fool would pay the higher price? Therefore if both sellers are to be able to sell they must charge exactly the same price. Hence, the law of one price. " However this formulation is so simple as to invite obfuscation. What exactly does it mean for the prices we will *observe* in a market? Does it mean that all prices are identical at all times? But this is verifiably false--- indeed if this were true, the market would become redundant as it would no longer be the mechanism that produces efficiency by disseminating information and equalizing prices. As described above, the law of one price is the name of a process and not a result.

So the proposition must be that "When equilibrium is reached, ie the quantity demanded equals the quantity supplied at a stated price, then all transactions must be at the stated price". Something like the above is believed, at least by implication, by the many economists who have attempted to provide empirical verification of the law. For such a definition of the law to retain practical content, we must slip in an implicit assumption--- that equilibrium is rapidly attained. We need to be observing the data at time periods longer than the time to convergence, a requirement that seems to demand different observation

periods for each group of commodities. Unfortunately, most of the careful empirical work that has been done suggests rates of convergence that are not particularly fast.

Going back to the 'snapshot'. Suppose I know of a difference of a dollar a bag for basmati rice between two stores. The cheaper bags cost $5 each and 10,000 of them are available. To profit by arbitrage, I would need to have $50,000 to pay for the cheaper bags and then I would have to be able to sell the 10,000 bags to realize my full profit. If I sold only 5000 of the rice bags at the higher price, not only would I make less direct profits but I would also be saddled with inventory and depreciation. Let us take the easier option and just assume that the bags will be sold at $6 if they can be bought.

So even if I am greedy and knowing I still need the $50,000 to effect the arbitrage. If I do not have it at hand, I would either need to save up the capital or borrow it. But saving up takes time, and the arbitrage opportunity may well disappear while I am engaging in thrift. Alternatively, I can try to borrow the money, but from whom? Why will someone lend me money without knowing what my proposed business plan is? And if I tell them about the arbitrage, why should they loan me money instead of engaging in the arbitrage themselves? Buying and selling to live off the difference in prices is not so simple it seems.

So the law can be expected to work only in specialized markets with standardised goods and large traders---such as the wholesalers of the rice market in an LDC.[xiv] In other words, the law is true for those commodities for which accepted standard amounts can be defined, and which have prosperous traders who are habituated in transacting large sums of both money and quantities of goods. This needs homogeneous commodities in high demand--- a condition true only true for the traditionally designated Staples or the precious metals.

The following conditions are needed for the LoP to be plausible:

A Multiple sellers at one spot to ensure competition at each location

B Standardised, bulk sale commodities with specialized traders, for which ready credit is available[xv]

C Rapid attainment of equilibrium

Is it likely that conditions A & B & C above will be fulfilled in the modern world? Everyday experience suggests not.

First, even if all commodities were goods, the sheer volume of goods makes the collection, compilation, storage and transmission of data so costly that we will never get individual data, only indexes and aggregates. What can be tested with the data we gather is some index of goods that we think to be 'similar'—,say 'cheese', which contains both French and US cheese.. But the price index for 'cheese' can rise either because tastes cause more French cheese to be consumed, or because French cheese prices have risen,. In either case ,LoP appears violated..[xvi]

Secondly, the trend of modern consumerism is towards more personalized products, which not only increases the number of goods to be considered but also makes price discrimination more likely. By separating the explicit and measurable component of a commodity from the implicit and reputational components, Barzel has provided an extensive and persuasive argument to support this point.

Thirdly, all modern economies are moving away from mass produced manufactured goods and towards services. Since services contribute about 70 percent of GDP in economies as disparate as Bangladesh and the United States, it is the applicability of the law to services that should dictate the empirical importance of the law. But services are notoriously known to be both personalised and subject to price discrimination, making both conditions A & B unlikely. The literature on this point is large and uncontested, so I will only provide some representative quotes. In differentiating the service economy T.P. Hill wrote in 1987 that "because economic theory is dominated by the goods paradigm, price discrimination tends to be treated as a special case", whereas for services such price discrimination is more like the norm. This is illustrated with examples from health, education, transport, hotels and restaurants---no wonder that "anyone who has worked or set up house in more than one country knows that as far as services are concerned, standardization is a joke".[xvii]

Fourthly, fluctuating transport costs, caused partly by unpredictable shifts of oil prices as well as by technological developments, when combined with the crudity of our statistical tools, make it impossible for us to discriminate between hypotheses of instantaneous and lagged price equilibrium. In 1994 J M Roberts produced the interesting result that, once we allow for small errors, the data does not allow us to distinguish between models of complete price flexibility vs incomplete ones.

It may be thought that transactions costs and the absence of specialized traders are responsible for the failure of LoP in so many markets for goods and services. In financial markets, on the other hand, relative to the volume of transactions and the wealth to be reaped, the transactions costs are small and there are also many specialized traders to effect arbitrage. Nonetheless, there are several surprising failures of LoP; what is even more suggestive is that examination of the failures of LoP in finance has led some scholars to conclude that it is the arbitraging institutions themselves that may be responsible for the persistence of the price differentials giving rise to a failure of LoP. I provide suitable quotes in the Appendix.

Will increasing information processing capacities bring an end to persistent price differentials? This far from obvious. Looking at price behavior of suppliers on the Internet, it appears to be in the interest of sellers to acquire one degree of information beyond that acquired by consumers---hence there will always be some room for the sellers to manipulate consumers and violate the LoP in the process[xviii]. Even if the law of one price is true, we have no way of verifying it except for a small class of goods. The "theory-data gap"--- between the specifications which allow the theory to apply and the conditions under which the relevant data can be collected in the real world---is much too large, and shows no signs of becoming smaller.

Appendix Sec 3 Financial anomalies
"Anomalies: The Law of One Price in Financial Markets "Author(s): Owen A. Lamont and Richard H. Thaler Source: The Journal of Economic Perspectives, Vol. 17, No. 4 (Autumn, 2003), pp. 191-202

Traditionally, economists thought that the Law could be applied almost exactly in financial markets because of the workings of arbitrage. Arbitrage, defined as the simultaneous buying and selling of the same security for two different prices, is perhaps the most crucial concept of modern finance. The absence of arbitrage opportunities is the basis of almost all modern financial theory, including option pricing and corporate capital structure. In capital markets, the Law says that identical securities (that is, securities with identical state-specific payoffs) must have identical prices; otherwise, smart investors could make unlimited profits by buying the cheap one and selling the expensive one. It does not require that all investors be rational or sophisticated, only that enough investors (dollar weighted) are able to recognize arbitrage opportunities. According to the standard assumptions, the Law should hold in financial markets because if some investors mistakenly think that odd-numbered shares of some stock are better than even-numbered shares, rational arbitrageurs will prevent these investors from driving up the price of odd-numbered shares (unlike the aspirin market discussed above). Moreover, unlike international trade where it may take some time to move gold physically from London to Zurich, one would expect the Law to hold not only in the long run, but almost instantaneously, since one can quickly buy and sell securities. 1 p192

The late 1980s saw a proliferation of a special type of closed-end fund called country funds, which trade on U.S. exchanges, but hold equities in a specific foreign country (Klibanoff, Lamont and Wizman, 1998). These country funds often had much larger deviations between price and value than those observed in the domestic funds, and the deviations were much too large to be consistent with any rational story. An extreme example is the Taiwan Fund trading on the New York Stock Exchange. During early 1987 (shortly after its start), it had a 205 percent premium, meaning that the price was more than three times the asset value (the premium stayed above 100 percent for ten weeks and above 50 percent for 30 weeks). This mispricing can persist due to legal barriers preventing U.S. inves? tors from freely buying Taiwanese stocks. Still, the question remains why U.S. investors were willing to pay a dollar to buy less than 33 cents worth of assets. P193-4

A third situation from international equity markets is Siamese Twins. Siamese Twins, as discussed in Rosenthal and Young (1990) and Froot and Dabora (1999), are firms that for historical reasons have two types of shares with fixed claims on the cash flows and assets of the firm. An example is Royal Dutch/Shell, which has both Royal Dutch shares (traded in Amsterdam) and Shell (traded in London). There is only one firm, the Royal Dutch/Shell Group, but based on the 1907 merger agreement, all cash flows are split so that Royal Dutch shares receive 60 percent and Shell shares receive 40 percent. Given this setup, the ratio ofthe market value ofthe Royal Dutch to the market value of Shell should be 1.5. However, this ratio has varied considerably from its theoretical value, from 30 percent too low in 1981 to more than 15 percent too high in 1996. After trading at a

premium of greater than 10 percent for most the decade of the 1990s, Royal Dutch shares are now trading at roughly par with the Shell shares

"Limits of Arbitrage: The State of the Theory"

Denis Gromb¤INSEAD and CEPR ,Dimitri Vayanosy LSE, CEPR and NBER, March 8, 2010

Limits of arbitrage are commonly viewed as one of two building blocks needed to explain anomalies. The other building block are demand shocks experienced by investors other than arbitrageurs. Anomalies are commonly interpreted as arising because demand shocks push prices away from fundamental values and arbitrageurs are unable to correct the discrepancies. Such non-fundamental shocks to demand are often attributed to investor irrationality. In this sense, research on the limits of arbitrage is part of the behavioral finance agenda to explain anomalies based on investors psychological biases.

This article departs from the conventional view in two related respects. First, it argues that research on the limits of arbitrage is relevant not only for behavioral explanations of anomalies but also for the broader study of asset pricing. Indeed, psychological biases are not the only source of non-fundamental demand shocks: such shocks can also arise because of institutional frictions relating to contracting and agency, as the examples in the next section show. Research on the limits of arbitrage characterizes how non-fundamental demand shocks, whether behavioral or not, impact prices. According to the conventional view, non-fundamental demand shocks concern investors other than arbitrageurs, and therefore can be understood independently of the limits of arbitrage. Our second departure is to argue that many non-fundamental demand shocks can be understood jointly with limits of arbitrage within a setting that emphasizes financial institutions and agency. Indeed, arbitrage is often performed by specialized institutions such as hedge funds and investment banks, and the trading strategies of these institutions are constrained by agency frictions. At the same time, financial institutions and agency frictions are the source of many non-fundamental demand shocks. In this sense, financial institutions do not necessarily correct anomalies, but can also cause important for the smooth functioning of financial markets. In standard models, however, there is no scope for such intervention because the equilibrium is Pareto optimal. Research on the limits of arbitrage has the potential to deliver a more useful framework for designing and assessing public policy. Indeed, this research takes a two-tiered view of financial markets: a core of sophisticated arbitrageurs trade against mispricings, and in doing so provide liquidity to a periphery of less sophisticated investors. Under this view, the financial health of arbitrageurs is crucial for the smooth functioning of markets and the provision of liquidity. Understanding how financial health is affected by arbitrageurs' trading decisions, and whether these decisions are socially optimal, can guide public policy.

Section 4

The fact that economic life is complex is of course a hallmark of the Austrian school; but what does this complexity produce when it is mathematically modeled? The cobweb model can give rise to situations of neutral equilibria where there is constant movement since agents realize they are not at equilibrium, but these movements may neither speed us towards the true equilibrium or lead us along a monotonically damped price path. Franklin Fisher states this forcefully:

> There are two fairly common mistakes that must be avoided in considering such matters. First, one must not confuse the fact that the economy will move away from positions that are not equilibria with the much deeper and unproven proposition that the economy always converges to equilibrium (let alone the proposition that it spends most of its time near equilibrium). In more specific terms, the fact that agents will seize on profitable arbitrage opportunities means that any situation in which such opportunities appear is subject to change. It does not follow that profitable arbitrage opportunities disappear or that new opportunities do not continually arise in the process of absorbing old ones. (pp. 75-76)

When studied experimentally, we have results that provide both stable price movements and cobwebs---so there is no assurance from experimental economics. What is even more disconcerting is the claim that the chaotic outcomes which emerge in such models can even give rise to higher profits and utilty when compared with steady state outcomes! Such behavior is said to be exhibited in some labor markets, in fisheries and in some agricultural markets. A different form of chaos arises when we consider products where we form our tastes or decisions based on the choices of others---this can happen in financial markets, where many believe in 'following Soros'---a phenomenon surely visible in fashions for clothes.[xix]

> Grandovetter and Soong argue that bandwagon effects can arise from three reasons: a) a simple desire to seek status by being "in with the crowd," b) certain enjoyments requiring others to be around, as in a crowd at a football game, and c) greater availability of services for widely consumed products such as major brand software, related to the path dependence and lock-in arguments of Arthur (1989, 1994). Snob effects can arise when the crowd becomes perceived as excessive and one wishes to go against it or to escape from it.
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> They argue that both effects can inhere in a single commodity for a single person. Thus, someone might be inclined to buy a push-button telephone when 20% of their friends do so, but may perversely desire an old rotary phone when 90% of their friends have push-button ones. They describe the former for the ith customer as the lower threshold, $X^i_l(P_x)$, and the latter as the upper threshold, $X^i_u 9P_x)$. As the price, P_x, rises the lower threshold rises and the upper falls. (Rosser, p. 81).

> The relationship between price and quantity can becomes multivalued and even chaotic in such cases.

If a series of local equilibria exist, then it is quite possible that the system jumps from one equilibrium to another due to small changes in exogenous variables. This is turn means that we cannot tell whether our prices are converging to a specific equilibria, or if they keep moving in order to chase a moving equilibria. Nothing very sophisticated is needed, just non-monotonicity of demand or cost curves. Joan Robinson famously made the point:

"Cases of multiple equilibrium may arise when the demand curve changes its slope, being highly elastic for a stretch, then perhaps becoming relatively inelastic, then elastic again. This may happen, for instance, in a market composed of several subgroups of consumers each with a different level of incomes. There will be several critical points at which a decline in price suddenly brings the commodity within the reach of a whole fresh group of consumers so that the demand curve rapidly becomes more elastic. The marginal revenue curve corresponding to such a demand curve may fall and rise and fall again, and there will be several points of monopoly equilibrium. The net monopoly revenue at each point would be different, but it is unlikely that any monopolist would have sufficient knowledge of the situation to enable him to choose the greatest one from among them. If the monopolist had reached one equilibrium point there would be no influence luring him towards another at which his gains might be greater." Rosser, pp. 92-93).

So the profit motive may not move prices rapidly or monotonically---in fact in some sectors it may not move it at all. The non profit sector is large---

> Approximately 1.4 million nonprofit organizations are registered with the IRS. The figure includes a diverse group of organizations, both in size and mission, which range from hospitals and human service organizations to advocacy groups and chambers of commerce. When compared to other sectors of the economy, the nonprofit sector accounts for 5.2 percent of gross domestic product (GDP) and 8.3 percent of wages and salaries paid in the United States.[xx]

And if we count the Government as another organization not motivated by profit, since its current share is estimated at 43%, we reach the seemingly strange conclusion that *almost half of the GDP in the USA is generated outside the private sector*---and this in the country leading the charge for Free markets? But my point is a much more limited one---if prices are supposed to move quickly because of the force and vitality of the profit motive, what reliance can we have upon arbitrage in an economy where almost 50% of output is not moved by profit?[xxi]

A direct study of the speed and monotonicity of convergence is desirable --- especially since several earlier studies [Levy, Bergejk, Caballero] showed rather slow rates of convergence. More recent studies, with the disaggregated BLS data, show a separation between sectors which have 'flexible' and 'sticky' prices. However, a simulated study of the impact of monetary expansion in such a disaggregated model gave the unexpected result that the impact of monetary expansion was to *reduce* the prices in those sectors with flexible prices!

Somehow, one would think that all the wealth of detailed data would allow one to follow the dispersion, transmission and adjustment of the prices of individual goods.

This does not appear to be the case. In particular, one wants to get direct estimates of the speed with which prices of individual goods adjust to shocks. Unfortunately, the wealth of detail does little to help the ordinary inquirer. [I was told that "You should realize that these data are not stored in a straightforward way and it will take you a significant amount of time (8-10 weeks?) to learn about our databases, the programs needed to access them, and how to access the specific data you want." The staff were being very helpful and I did not want to ask why the data were 'not stored in a straightforward way.']

The PPI does not publish the actual prices it collects from survey participants. It publishes price indexes which measure the changes in revenue received by companies for the sale of their products. These indexes are calculated on both a product and industry basis. In other words, even at this level, the available data is aggregated. Furthermore, for several reasons, the pursuit of individual goods is not feasible even by insiders in the BLS at this level. First, the data are almost certainly insufficient for looking at specific items such as eggs. The average sample size for a given item, such as eggs, in a given area, such as Cleveland-Akron, is 10 price quotes. Because the CPI reflects consumer shopping patterns, the price data contain considerable heterogeneity. Isolating a single homogeneous item thus leads to extremely small sample sizes. For example, in the relatively homogeneous category of eggs, the most common unique item contained an monthly average of 62 price quotes for all 87 areas[xxii].

Second, because of the heterogeneity, it would be burdensome for BLS staff to select specific homogeneous items for such a study, which would end up being quite expensive and probably subject to high variance because errors, either in data collection or in BLS selection, could affect the results.

Third, many prices change slowly with prices changing on average only once every eight to 11 months. Because BLS samples are rotated either every two years or every four years, only a very small number of price changes in any specific item will be observed before that item is replaced.

Fourth, most price changes for durable goods only occur when models change. If one wishes to observe price changes in homogenous goods, durable goods of a given model will frequently show no price changes at all.

To follow the dispersion, transmission and adjustment of the prices of individual goods in a world with micro-data is beyond the range of ordinary persons and probably requires a bureaucracy in itself[xxiii].

Section 5

In some ways the most damaging evidence against the use of data to confirm or refute theories comes from the fact that profit maximization may require a failure of the (verifiable) law of one price. When used to analyse price differences in separated markets, the law has been challenged by Mcchesney et al. They correctly point out that every separated supplier is a local monopoly. Once we work out the logic of local monopolies, it is no longer true that the law holds. In other words, there is the implicit institutional requirement that there be at least two, and preferably several, suppliers at every point in space. Once we add this institutional requirement, the arguments of Mcchesney et al, being based on the effects of local monopoly, fail[xxiv]. In an earlier piece I had commented that this was "not so much a logical defect of the traditional law as a reminder that the traditional snapshot implicitly assumes that there is full competition at every location". Since this implicit assumption significantly fails, as I discuss below, we must accept the failure of LoP as a consequence of profit maximization. Most observable prices will represent both strategy and locale and the use of equilibrium theories upon such data remains an act of faith.

The plethora of data obtained from POS transaction records should satisfy the quantitative economist by their volume. But the sheer volume alone does not solve questions of aggregation, or functional form, or endogeneity of explanatory variables. More interestingly, none of our usual procedures recognise how the institutions at work have adapted to their particular circumstances. Economists at the FTC, who have to argue for or against mergers of firms, urge caution in moving from the retail level POS data to inferences about wholesale market elasticities[xxv].

Furthermore competition between wholesalers often takes place through more complicated contracts than the competition between producers of most final goods. The "prices" manufacturers charge retailers are often complex, and may include fixed fees of various types, quantity discounts, minimum or maximum purchase commitments, etc. In practice, payments between manufacturers and retailers are often broken into two components --- "list" prices and trade promotions, and there can be much bargaining on the details. Most of the attractiveness of economic theory arises from a consideration of cases involving firms that produce single products and accept market prices as given--- scanner data does not follow this convenient format. The relationship between data and theory becomes considerably more complicated for multi-product retailers that compete with one another. We discuss three complications here that relate to institutions that are prevalent in the retailing environment.

One complication is the "one-stop shopping" nature of retail outlets, which generates demand-side complementarities among products on the shelf that are unrelated to consumers underlying preferences for the products. For example, a lower price for milk might draw customers into the store where they then decide to purchase detergent while they are there. This makes milk and detergent complements in demand from the perspective of the grocery store, even though consumer preferences for these products are probably unrelated.

A second complication is the extensive use in retailing of frequent, but temporary discounts on alternative sets of products over time.

A third complication that arises in the retailing environment is that retailers have scarce shelf space and can sometimes use this to their advantage to discipline the pricing behavior of suppliers. ..If retailers can credibly threaten to remove a product from their shelves when faced with a price increase, the elasticity of demand for a product at the manufacturer level can exceed the elasticity at the retail level.

To take a simple example. If there is retail space for only two products and there are four wholesalers for commodities that are practically substitutes, then the retailer can threaten to remove the product of a wholesaler who tries to raise his price by even a little. So the wholesaler can face what is effectively an infinitely elastic demand curve for his product, regardless of what is true at the level of the actual consumer.

The difficulty posed for FAM by such facts lies in the realization that, even though the law of one price is being flouted by measured data, competition is actually fierce and the market is doing what it should. We all operate under multiple constraints. What justifies the usual mathematical modeling is the implicit presumption that the effects of the constraints which are implicit but ignored by the model will not reverse the results of analysis done on the explicit constraints. When we move to the level of the micro-data that are available, such a presumption is challenged.

Section 6

The presentation of the Austrian opposition to mathematical economics and econometrics that I found clearest is that due to Murray Rothbard, so I will quote him, as well as his quotes from Mises, below. Rothbard is so clear that no comment is needed. At the end I will relate the relevance of the new micro-data to the views of Rothbard and Mises.[xxvi]

[Rothbard] Praxeology is the distinctive methodology of the Austrian school. ..Praxeology rests on the fundamental axiom that individual human beings act, that is, on the primordial fact that individuals engage in conscious actions toward chosen goals. ..The praxeological method spins out by verbal deduction the logical implications of that primordial fact. .. This structure is built on the fundamental axiom of action, and has a few subsidiary axioms, such as that individuals vary and that human beings regard leisure as a valuable good. ..Furthermore, since praxeology begins with a true axiom, A, all the propositions that can be deduced from this axiom must also be true. For if A implies B, and A is true, then B must also be true.

Mises's radically fundamental opposition to econometrics now becomes clear. Econometrics not only attempts to ape the natural sciences by using complex heterogeneous historical facts as if they were repeatable homogeneous laboratory facts; it also squeezes the qualitative complexity of each event into a quantitative number and then compounds the fallacy by acting as if these quantitative relations remain constant in human history. In striking contrast to the physical sciences, which rest on the empirical discovery of quantitative constants, econometrics, as Mises repeatedly emphasized, has failed to discover a single constant in human history. And given the ever-changing conditions of human will, knowledge, and values and the differences among men, it is inconceivable that econometrics can ever do so.

[Mises] There are, in the field of economics, no constant relations, and consequently no measurement is possible….The econometrician is unable to disprove this fact, which cuts the ground from under his reasoning. He cannot help admitting that there are no "behavior constants." Nonetheless, he wants to introduce some numbers, arbitrarily chosen on the basis of historical fact, as "unknown *behavior constants*." The sole excuse he advances is that his hypotheses are "saying only that these unknown numbers remain reasonably constant through a period of years." [34] Now whether such a period of supposed constancy of a definite number is still lasting or whether a change in the number has already occurred can only be established later on. In retrospect it may be possible, although in rare cases only, to declare that over a (probably rather short) period an approximately stable ratio which the econometrician chooses to call a "reasonably" constant ratio prevailed between the numerical values of two factors. But this is something fundamentally different from the constants of physics. It is the assertion of a historical fact, not of a constant that can be resorted to in attempts to predict future events. [35] The highly praised equations are, insofar as they apply to the future, merely equations in which all quantities are unknown. [36]

In the mathematical treatment of physics the distinction between constants and variables makes sense; it is essential in every instance of technological computation. In economics there are no constant relations between various magnitudes. Consequently all ascertainable data are variables, or what amounts to the same thing, *historical* data. The mathematical economists reiterate that the plight of mathematical economics consists in the fact that there are a great number of variables. The truth is that there are only variables and no constants. It is pointless to talk of variables where there are no invariables. [37] pp14-15

How does the micro-data reported in Section 2 relate to the views described above. First, let it be said that the data does show regularities. This was so both for the Export data and the CPI/PPI data and the regularities were noted above. But it is important to point out that these regularities do not permit, or even encourage, theorizing in the sense that Mises and Rothbard understood that activity. There are empirical regularities ,yes, but that may be all that they are. We had no prior expectation that they would be there and we have no reason to believe that they will continue. But are these empirical regularities such as to suggest a new theory? "The new micro data confirm that there is a great deal of heterogeneity in price setting, in terms of the frequency and the size of price changes, but also in terms of how frequent "sales" are and what form sales take….The micro data underlying the consumer price index in the United States are so rich that questions of the form "what do the micro data say?" have no simple answers. The question "how frequently do prices change?" has no simple answer, because in micro data there is a distribution of the frequency of price changes."[xxvii] The Austrians can rightly claim that the heterogeneity insisted upon by them has been largely verified.

The case of export trade data is even more striking. The authors of the study claim that the sparse data make it unlikely that any theory will be found. To make their point that show that a model which chooses an export category at random, like a ball dropping in a bin at random, with the size of the bin determined by the export market size, 'explains' the data. The authors are quite frank about the limitations of their study:
What do we learn when the balls-and-bins model matches a particular fact? Surely we are not suggesting that firms actually ship their goods at random! Our view, instead, is that if a fact cannot falsify the balls-and-bins model, it will fail to identify the right model of the extensive margin. For example, as long as a model correctly predicts the gravity equation, it will also match the pattern of zeros across countries once the sparsity of the data is accounted for. Similarly any model that reproduces the distribution of export sales will be able to match the facts concerning multi-product and multi-destination exporters. The qualification is important: the balls-and-bins model embeds the economic determinants of the data used in the calibration. Other economic forces need not have played any role in shaping the outcomes. P3-4
In other words, some empirical regularities in economics seem to be inexplicable. I am not sure how Rothbard would have responded to this[xxviii].

Conclusion

The basic concepts of econ were formed at a time when agricultural goods provided all the guiding images of economic concepts---after all in poor economies foods take up more than 80% of household expenditure, and the early theorists of economics talked about a fixed supply of agricultural goods meeting the market demand curve and establishing equilibrium. It took a while to get to the modern picture of quantity adjusting to market price---there were arguments over whether it was not price that adjusted to given quantities. Adam Smith uses a model of labor demand based on a wages fund of agricultural goods in some parts of the Wealth of Nations and when David Ricardo wanted to talk about macro issues he still used the picture of the economy as a giant farm. Under these circumstances, there was little ambiguity about either the commodity being traded or the relevant quantity being traded. "So many apples at such a price". Insofar as there was difficulty it was about the motivation of peasants---were they really profit maximisers? As markets have expanded choice and as agents have turned out to be increasingly motivated by profit, we have not let the increased complexity of the world of commodities interfere with our theorizing. The literature is quite aware of most of the empirical problems which arise, witness the continual studies of arbirage, PPP, real exchange rates , LoP etc, but does not appear to face up to the methodological conundrum they pose. Otherwise it is hard to explain the considerable investment in trying to extend PPP and, by extension the LoP, to consumer goods[xxix].

We can begin by asking if the law of one price is still acceptable as an *empirical* phenomenon in this new world, and then expand the question to whether measured economic data can be *assumed* to be equilibrium values[xxx].

The LoP may fail because some individuals are not maximisers, and others are not knowledgable, and yet others lack credit---we just have to hope that the three do not classes do not combine to form a significant whole in the market.

Since LoP is readily appealed to, it allows the following conclusions to be drawn:

First, since the law has been accepted till now, it tells us that economists *have* accepted a priori laws.

Second, that some laws may never be 'testable' as general propositions, and so economists may have to continually accept a priori laws.

Third, that these laws, when we spell out the reasons for their acceptance, require institutions and heterogeniety. Accepting and incorporating institutions and heterogeniety makes life simpler and more true.[xxxi]

Fourth, insofar as data are used , they are almost always aggregated---how many studies of 1inch wood nails are there? Therefore the neoclassical reluctance to consider aggregate laws in their own right may be false modesty[xxxii].

Finally, the failure of the LoP shows us that the stability we require for our subject to be meaningful is obtained by assuming away 'secondary' effects. Akerlof and Yellen have forcefully argued that such effects are made 'secondary' largely by assumption, and this issue needs to be followed up with care.[xxxiii]

The process deciding what is measured and when it is measured typically has little to do with the underlying economic process---"get the price of a dozen brown eggs every Monday" . Nonetheless, *by assumption*, the measured values are taken to be equilibrium values. In order for this procedure to work, We need data which are collected while parameters are stable and after equilibrium is reached. Once the implications of our 'measuring for inference' are explicitly spelled out, some obvious questions arise:

What if parameters change in the time it takes us to reach equilibrium?
What if data is collected in time periods too short for equilibrium to be reached?
What if the categories being used for data change before data collection is complete or before equilibrium is reached? Since all these events are possible, the reality of empirical economics relies upon the aggregate impact of all three being negligible.

John Maynard Keynes sensed the difficulties of attaining such a goal for quantitative economics and made an argument for qualitative reasoning which was quoted appreciatively by Rothbard.

> It is a great fault of symbolic pseudo-mathematical methods of formalizing a system of economic analysis, that they expressly assume strict independence between the factors involved and lose all their cogency and authority if this hypothesis is disallowed: whereas, in ordinary discourse, where we are not blindly manipulating but know all the time what we are doing and what the words mean, we can keep "at the back of our heads" the necessary reserves and qualifications and the adjustments which we have to make later on, in a way in which we cannot keep complicated partial differentials "at the back" of several pages of algebra which assume that they all vanish. Too large a proportion of recent "mathematical" economics are mere concoctions, as imprecise as the initial assumptions they rest on, which allow the author to lose sight of the complexities and interdependencies of the real world in a maze of pretentious and unhelpful symbols. John Maynard Keynes, The General Theory of Employment, Interest, and Money (New York Harcourt, Brace, 1936), pp. 297–98.

This would seem to imply that what we need a language that is amorphous and flexible to understand a moving problem, precise enough for logical reasoning, yet loose enough for the results of reasoning to be applied to the changing world.[xxxiv]
The macroeconomic thinking that Keynes encouraged requires data to be substantiated. But all such macroeconomic studies appear to be based on the assumption that the macroeconomy achieves equilibrium. This is a much stronger assumption because we are not only asking the entire economy to satisfy the FAM, but also that it do so at a speed consistent with the data gathering timeframe. Every sector may reach equilibrium but some may do so at periods well below the data gathering time-frame and others may do

so well above it. One suspects this will make a difference, but since the question has not been studied, we simply do not know.[xxxv]

We need theories of the data , as gathered, and as aggregated; not just assuming that aggregates behave 'like' representative agents; or assuming that we can somehow intuit the behavior of aggregates---as in the Keynesian consumption function. The fundamental issues turn out to be fairly simple to state. **Our theories do not match the actual data generating process**. For example, supermarket products and hence observed prices may result from a bargain between retailer and wholesaler over shelf space, but we simply do not consider this fact in our models. This is not an incidental blemish, but it is a pervasive feature of economic data and the implications can influence all aspects of the economy. It is not claimed that specialists do not have accurate information---the managers of hardware stores can be well informed about each of the 10,000 different items in their store---but is being claimed that the public at large, whose knowledge and perception drives the markets, cannot expect to have accurate and reliable data on which to test their beliefs. In what may be an ' unintended consequence' of the Austrian position we return to an emphasis upon words---upon deriving meaning in context, and on the role of intentions. This is of importance for policy, since real problems cannot be separated into dessicated compartments and then solved.

Over the years I have been bothering many colleagues with my puzzled queries. I want to thank Charles Engel, Ed Leamer , Hugo Kuyzenkamp , and Phil Garcia for patient replies to my emails

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[i] Menger, Karl, "Austrian Marginalism and Mathematical Economics", in Carl Menger and the Austrian School of Economics, ed J R Hicks and W Weber (Oxford, 1973)

[ii] This is an area that has been explored by George Akerlof and Janet Yellen and by Larry Summers and his co-authors; we have a variety of models each of which shows that small deviations from perfect rationality can have first order consequences.

[iii] Rashid, Salim., "The "law" of one price:Implausible, yet consequential" THE QUARTERLY JOURNAL OF AUSTRIAN ECONOMICS VOL. 10, NO. 1 (SPRING 2007): 79–90

[iv] Franklin Fisher, "Disequilibrium and Stability", p90

[v] Perhaps this also means that there will not be as much care bestowed on the collection of data.

[vi] "A Balls-and-Bins Model of Trade", Roc Armenter and Miklós Koren February 2010

[vii] I am very grateful to Scott Sager, Ken Stewart and Amy Hobby for answering my queries.I have used their replies with only the minimal editing needed for my purposes.

[viii] "On implications of micro price data for macro models" by Bartosz Maćkowiak and Frank Smets , pp7-8

[ix] UPC refers to Universal Product Code or what we call a 'bar-code'. It corresponds to a precise package size/brand of a consumer product. For example, a UPC would refer to a 15 ounce
package of General Mills Cheerios cereal. The 10 ounce box of Cheerios would be a
separate UPC as would the 15 ounce box of Honey Nut Cheerios. Within a single
product category, e.g. ready-to-eat cereal, there are literally thousands of different UPCs.

[x] F. A. Hayek, "The Theory of Complex Phenomena" in idem, *Studies in Philosophy, Politics and Economics* (New York: Simon and Schuster, 1969), pp. 22-42. quote from p 27.
Hayek returns to this theme at two points in his Nobel lecture,
"The Pretence of Knowledge," in idem, *New Studies in Philosophy, Politics, Economics and the History of Ideas* (Chicago, University of Chicago Press, 1978)
I am grateful to Joseph Salerno for guidance regarding Hayek.

[xi] In the language of mathematics, which Hayek would probably disapprove of, it is the topological,and not the metric, structure that is the provenance of the social sciences.

[xii] Section 9 of the essay on Complex Phenomenon is particularly poignant. Note Hayek's approving quote of Warren Weaver in a footnote on p 40, where Weaver questions whether increasing knowledge does not also increase ignorance., This is a theme hinted at by some earlier scholars, but which awaits a fuller development.

[xiii] As quoted by Gary C Hufbauer, erik Wada and Tony Warren in The benefits of Price Convergence: Speculative Calculations, Institute for International Economics, Washington D.C., 2002, 17. This slim monograph contains a clear and valuable discussion of the issues and nothing said by me affects the value of the Hufbauer et al findings.

[xiv] Martin Ravillion doubts the profit calculating capacity of the Arothdars (large rice traders) of the Dhaka rice market in his study of the Bangladesh famine of 1974

[xv] This really covers several conditions, but as they are met by trade in wholesale goods like staple, I think it best to provide a single condition.

[xvi] It would be nice to find a specific example, but I have not found one yet in the literature.

[xvii] Eric jones, "The Price of information" typescript, no date.

[xviii] Search, Obfuscation, and Price Elasticities on the Internet, Glenn Ellison MIT and NBER and Sara Fisher Ellison MIT,June 2004.

[xix] J BarkleyRosser, From Catastrophe to Chaos ,2nd ed Kluwer 2000

[xx] Non-profit Sector in Brief 2007

[xxi] Zvi Griliches repeatedly expressed doubts about the reliability of the statistics describing such sectors.

[xxii] The degree of heterogeneity can be seen in the attached checklist used by an economic assistant when selecting a specific type of egg to be priced

[xxiii] If we want to model the process by which data are actually generated, a further complication lies in the use of price/revenue algorithms by many supermarket chains. If such algorithms include local idiosyncratic patterns and if there are many such idiosyncratic patterns in the sample area, then interpretations of the data become even more complex.

[xxiv] McChesney, Fred S., William F Shugart, David D Haddock, "On the Internal Contradictions of the Law of One Price", Economic Inquiry, Oct 2004, v 42, 4, 706-716.Section 6

[xxv] Demand System Estimation and its Application To Horizontal Merger Analysis†*
Daniel Hosken, Daniel O'Brien, David Scheffman, Michael Vita April, 2002 FTC—Economics, pp2,3-4,21,24.

[xxvi] "Praxeology: The Methodology of Austrian Economics" **by** Murray N. Rothbard From The Logic of Action One: Method, Money, and the Austrian School by Murray N. Rothbard (Cheltenham, UK: Edward Elgar, 1997), pp. 58–77;
http://lewrockwell.com/rothbard/rothbard38.html

[xxvii] Macowiak and Smets, p10

[xxviii] For a penetrating and stimulating discussion of how the appeal to stochastic factors often evades the issue in Economics, see Tryfos, Peter., The Measurement of Economic Relationships (2004, Kluwer)

[xxix] Ghironi, Fabio and Marc J. Melitz, "International Trade and Macroeconomic Dynamics with Heterogeneous Firms." *The Quarterly Journal of Economics* 120.3 (August 2005): p865(51). Charles Engel of Wisconsin provides a very helpful set of Notes for understanding PPP on his website

[xxx] Much of the early econometric work was done on agricultural commodities, eg Henry Schultz, but he seems to see no problem with such an assumption.

[xxxi] Graddy, Kathryn. Testing for Imperfect Competition at the Fulton Fish Market,The Rand Journal of Economics,26,1, Spring, 1995,75-92. "In this article, I report the results of a study of the prices paid by individual buyers at the Fulton fish market in New York City. In principle, this is a highly competitive market in which there should be no predictable price differences across customers who are equally costly to service. The results indicate that different buyers pay different prices for fish of identical quality. For example, Asian buyers pay 7% less for whiting than do white buyers, a result which is inconsistent with the model of perfect competition."

[xxxii] Nails may have the LoP but only because we have used our common sense to aggregate them leaving out screws and nuts. When the aggregates are of richer micros we may have no a priori idea of their behavior---hence the Lucas type of New macro is misplaced precision.

[xxxiii] Once we allow 'small' changes in the specification of models, many variants of standard models can be made to 'fit the data'. Luttmer, Erzo G. J. Asset Pricing in Economies with Frictions, Econometrica,64,6,Nov., 1996,1439-1467. "This paper examines how proportional transaction costs, short-sale constraints, and margin requirements affect inferences based on asset return data about intertemporal marginal rates of substitution (IMRSs). It is shown that small transaction costs can greatly reduce the required variability of IMRSs. This suggests that the low variability of many parametric, aggregate consumption based IMRSs need not be inconsistent with asset return data. Euler inequalities for a transaction cost economy with power utility are tested using aggregate consumption data and returns on stocks and short maturity U.S. Treasury bills. In the majority of cases there is little evidence against power utility specifications with low risk-aversion parameters. The results are obtained with transaction costs on stocks as small as .5% of price, and are in sharp contrast to the strong rejection of the analogous Euler equalities for a frictionless economy".

[xxxiv] Keynes does not seem to realize that the practical effectiveness of using the Macroeconomic thinking he was espousing required speedy price convergence in all sectors of the economy. —what if one sector only reaches half its equilibrium in the data period?

[xxxv] I hope to run some simulations of a simple CGE by the time of the conference---so I may have something to report. Of course, given the magnitude of the problem, such simulations are purely illustrative exercises.