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NOISE TRADERS

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ABSTRACT

Noise traders are agents whose theoretical existence has been hypothesized as a way of solving certain fundamental problems in Financial Economics. We briefly review the literature on noise traders. The is an entry for The New Palgrave: A Dictionary of Economics, 2nd Edition (Palgrave Macmillan: New York), edited by Steven N. Durlauf and Lawrence E. Blume, forthcoming in 2008.

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"Noise traders" are economic agents who trade in security markets for non-information-based reasons. The existence of noise traders was theoretically posited as a solution to the "no trade" or "no speculation" results of Grossman and Stiglitz (1980) and Milgrom and Stokey (1982). These authors showed that it is impossible under most circumstances for an agent with superior information to profit from that information by trading. The intuition for the "no trade" result is as follows. A buyer of an asset is prepared to pay a seller a price p only if the buyer believes that conditional on the seller agreeing to sell the asset, the value of the asset exceeds p. But, then the seller, knowing this, is at least as well off keeping the asset. So, no one trades.

But, we do observe trade in the world. Moreover, no trade is difficult to reconcile with the notion of asset market efficiency, in which prices allegedly contain all available information. If some agents produce costly private information and then trade on their private information, security prices will reflect some or all of the information and hence become more informationally efficient. To explain how informed traders can cover the costs of information production when they trade in securities markets, someone in the market must lose money trading against them. "Noise traders" or "liquidity traders" are the names given to the traders who lose money, on average, when they trade. Their trade then provides the subsidy to cover the cost of information production by the informed traders

The idea that there are traders who systematically lose money trading securities leads to obvious questions. Do noise traders really exist? Who exactly are noise traders in reality? How do noise traders survive and persist when they are losing money trading?

Rational Expectations and Efficient Security Markets

In security markets, prices are alleged to reflect "all available information." But, how does this come about? What is the information, and how is it aggregated into the price? The concept of a Rational Expectations Equilibrium (REE) gave formal content to the notion of "market efficiency," which has been a central concept in financial economics for thirty years. The idea is that if agents understand the economy, and understand how markets work, then they know that current prices reflect the information which is known to some agents, but maybe not to others. The uninformed agents understand the link between current prices and the information of the informed agents, and so can infer something about the information in prices. When the prices that prevail in equilibrium coincide with what the uninformed agents can learn from the prices, and with the actions taken by the informed agents, who trade on their information knowing that the uninformed agents will infer (some or all) of the information, then the equilibrium is said to be a Rational Expectations Equilibrium. The idea that prices can convey information, in the sense of REE, is due to Lucas (1972).[1] Also, see Green (1973) and Radner (1979).

But, when all the information of the informed agents is revealed, in a fully revealing REE, there is a problem if information acquisition is costly. Grossman (1976) considers a model of the stock market in which there are two types of traders "informed" and "uninformed." Informed traders take positions in the market based on their information. Uninformed traders have no information, but know that prices will reflect the information of the informed traders. Grossman shows that the equilibrium prices aggregate and reveal the information perfectly, "but in doing this the price system eliminates the private incentive for collecting the information" (p. 574). Grossman is quite clear in identifying the paradox, but he also proposes a solution:

[1] Grossman (1981) provides a brief intellectual history of REE. Also, see Allen and Jordan (1998).

> When a price system is a perfect aggregator of information it removes private incentives to collect information. If information is costly, there must be ***noise*** in the price system so that traders can earn a return on information gathering. If there is no ***noise*** and information collection is costly, then a perfect competitive market will break down because no equilibrium exists where one collects information. (p. 574) [Emphasis added.]

Beja (1976) also argues that REE and costly endogenous information acquisition are not compatible when agents are strategic and that consequently asset prices cannot be efficient.

So, "noise" is required if agents are to acquire and trade on their costly information. But, what is this "noise"? The example of "noise" that Grossman (1976) points to is "an uncertain total stock of the risky asset" (p. 574). Grossman (1977) describes "noise" simply as "many other factors" (p. 431). The device of adding a random noise term to the aggregate supply of the asset is used in Grossman and Stiglitz (1980). They show that when information production is costly and there is noise in the asset supply, then some traders will acquire information and trade, but rational expectations prices will not be fully revealing.

If there is uncertainty about the supply of the asset in the market, or about the level of demand, or about the risk aversion of other traders, then uninformed traders cannot be sure that prices reflect the information of the informed traders. The basic idea is that the uninformed traders confuse the private information with uncertainty about the other unknown variables. It is this additional uncertainty, or noise, which makes it possible for the informed traders to trade without perfectly revealing their information, and hence profit from its production.

The device of adding a noise term to aggregate supply does result in REE that are only partially revealing. Unfortunately, there were two problems with this approach as a general matter. First, the partially revealing REE models require somewhat special assumptions. Second, it was not clear what the proposed noise shock to aggregate supply really corresponds to in reality.[2] On the first point, Green's (1977) nonexistence example uses a noise term on the traders' endowments, and suggests that this will not be a suitable basis for a general approach. The general equilibrium literature did develop a number of generalizations, including for example the difference between the dimensions of the signals and the dimension of the prices. E.g., see Jordan (1983) and Ausubel (1990). Others have provided slightly different models that have partially revealing equilibria, but still there seems to be no general approach. See, e.g., Allen (1981); and see Allen and Jordan (1998) for a discussion.

Noise Traders

REE models assume that traders maximize expected utility with *rational* beliefs, where rational beliefs are defined to be consistent with the model itself. There may be "noise," but this was not viewed as emanating from incorrect beliefs.[3] In general, the notion of "noise" in the REE literature was somewhat vague and corresponded to a random error term added to the aggregate excess demand function. Understanding the role of "noise" appeared to require leaving the REE world and explicitly detailing the origin of "noise." This was done by Kyle (1985).

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[2] There are other problems as well. Hellwig (1980) pointed out that REE requires traders to act rationally with respect to information, yet they ignore the effect of their transactions on the price. This was deemed the "Schizophrenia problem." Hellwig (1980), "…Grossman's agents are slightly schizophrenic" (p. 478).

[3] There is the issue of how traders come to understand the model, that is, how they learn. On that question see, e.g., Blume, Bray, and Easley (1982) and Blume and Easley (2004).

Kyle (1985) posited the existence of "uninformed noise traders who trade randomly" (p. 1315).[4] Kyle identifies certain people as trading in a way which makes noise in the sense that their trade is not based on information. That is, he explicitly posits the existence of a class of agents – people -- who trade in a certain way so as to fulfill the role of "noise." By explicitly introducing noise traders, Kyle focused attention on the details of the trading process. This became the foundation for the study of market microstructure.[5] Around the same time as Kyle, Glosten and Milgrom (1985) also introduced a similar class of agents: "…we assume that there are informed investors and purely 'liquidity' traders" (p. 76). Earlier Treynor (1971, under the pseudonym W. Bagehot) talked about "liquidity-motivated" traders.

In REE models agents do not act strategically, the process of learning from prices occurs in equilibrium (as opposed to happening in real time), and the details of trading are treated in reduced form (agents submit demand functions to an auctioneer). Kyle and Glosten and Milgrom changed this by specifying the trading process in a way that was not possible in REE models. In both papers there is a competitive marketmaker who receives orders from traders, at least one of which is superior information. The marketmaker must infer the information of the informed trader from the order flow. The marketmaker knows that some traders are privately informed, and that others are not trading based on any superior information (the noise traders). Inference about information occurs as the marketmaker learns by watching the order flow. Gradually, the marketmaker changes his price to reflect the information.

Still, the noise traders in this new type of model were not well-motivated. In fact, their motives are not explained. They earn a lower than average return than the informed agents, who earn an above average return. If the uninformed noise traders could at least buy the market portfolio, then they could earn the average return on the market. But, in fact they are not allowed to buy the market portfolio. That is their root problem; see Dow and Gorton (1995).

Diamond and Verrecchia (1981) suggest adding a noise term to agents' risk exposures (their endowments). Risk-averse agents will then have an insurance motive for trading. De Marzo and Duffie (1999) propose a model where different traders have different discount rates. Shocks to their discount rates provide an incentive to trade that other traders cannot distinguish from speculative trading intended to profit from information about the liquidation value of the asset. These papers solve the theoretical problem of finding a logically consistent model that can be used as a basis for economic analysis, including welfare statements, of markets with imperfect information revelation. Papers that have applied these models in various settings include Biais and Mariotti (2005) (for the De Marzo and Duffie model) and Dow and Rahi (2000, 2003) (for the Diamond Verrecchia approach).

But is it really plausible to believe that there is a significant demand for individual stocks or bonds based on an insurance motive? Stock indexes, exposure to the yield curve, or foreign currency could experience demand variations due to insurance motives, but there are close substitutes for individual stocks and bonds from a risk point of view. Also, if investors do start off with different discount factors, one would expect them to trade these differences away.

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[4] In private correspondence, Kyle said that he did not originate the term "noise trading," but attributes it to Sanford Grossman.

[5] Garman (1976) appears to have been the first to use the term "market microstructure." See Easley and O'Hara (2003) for a survey of the microstructure literature.

In other words, plausibly the demand curve for an individual asset should be almost perfectly elastic. The price at which it becomes elastic, (given the prices of all other assets) should be almost identical for all agents. Hence we revert to the situation where the asset has a unique fundamental value that all agents will agree on if they have the same information about the asset's cash flows. So, the issue of who noise traders actually are remains an open question.

Who are the Noise Traders?

The details of the identity of noise traders or liquidity traders were initially left vague. For example, Glosten and Milgrom (1985) write of exogenous events motivating their trade, like "job promotions or unemployment, deaths or disabilities…" (p. 77). These shocks were not well identified. Notably, noise traders were modeled as equally likely to be buying or selling securities, which while making models technically tractable, is counterintuitive. Exogenous reasons for needing money, and hence having to sell securities seems more natural than exogenous reasons for having to buy securities.

The details of the identity of noise traders are important, because if noise traders are simply irrational there is clearly an incentive for "smart money" to take advantage of them, and eventually eliminate them from the market. The "market selection hypothesis" is the idea that irrational traders will eventually be driven out of the market. Noise traders should not survive, and so cannot play the role envisioned for them. In fact, there is a long history of arguing that rational traders will eliminate irrational traders from the market, by taking their money when they trade at incorrect prices. This process is what causes prices to be driven to (or close to) fundamental values. E.g., see Friedman (1953).

Noise traders can only survive if there are some frictions or barriers preventing them from being eliminated by the smart money. That is, there must be some limits to arbitrage. One possibility is that the smart money has a limited horizon over which trade can occur. With a limited horizon, the noise traders could cause losses to the smart money by moving prices further away from fundamentals. This is the idea in DeLong, Shleifer, Summers, and Waldman (1990), Dow and Gorton 1994), and Shleifer and Vishny (1997). These papers argue that there are "limits to arbitrage," providing an explanation for the persistence of noise trade.

Still, the question remains: Who are the noise traders? One view sees noise traders as individuals who are simply less than rational; they are subject to behavioral biases and fads. For example, Shiller (1984) argued that some investors rely on "popular models" which are wrong and also they can be subject to fads. Along the same lines, Shleifer and Summers (1990) wrote: "Some investors are not fully rational and their demand for assets is affected by their beliefs or sentiments that are not fully justified by fundamental news" (p. 19). A large literature argues that individual investor trading is subject to a myriad of psychological biases, and that such individuals may use various heuristics, "popular models," as the basis for their investment decisions. This literature is surveyed in Barberis and Thaler (2003).

A second rationale for noise trading focuses not on individual investors, but on professional traders and money managers ("funds") hired by principals/investors. Funds do not invest and trade their own money; they work for others. This creates a potential conflict of interest or agency problem. This notion is developed by Dow and Gorton (1997). They argue that churning by funds, which occurs when they do not become informed and want to pretend that they have, is "noise," in a setting where all market participants are rational. Among the other agents in the market are hedgers. Noise trading, being a manifestation of agency problems, reduces the

profitability of traders to the employers of the traders and money managers. But, it benefits hedgers who earn more when they hedge. Consequently, they hedge more, which in turn can support more informed fund trading. Dow and Gorton (1997) show that a "small" amount of hedging demand can result in a "large" noise. Irrationality is not needed to explain significant amounts of noise.

Summary

Noise traders play an essential role in modern finance theory, but their identities, motivations, and ability to persist remain topics of research.

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