Differences of Opinion

Hal R. Varian*
University of California, Berkeley

November, 1990

Abstract

This is an entry on differences of opinion for the *New Palgrave Dictionary of Money and Finance,* edited by John Eatwell, Murray Milgate, and Peter Newman.

Conventional mathematical models of financial markets such as the CAPM or the state-contingent claims model typically assume that probability beliefs are the same for all individuals. This is presumably done on grounds of analytic tractability rather than realism. Just as it takes differences of opinion to make horse races, it is likely that a substantial portion of trade in actual financial markets is be due to different probability beliefs.

1 Information and opinion

Different probability beliefs may be due to differences in information or differences in opinion. By differences in information, I mean differences in beliefs that arise because of different observations of data. By differences in opinion, I mean differences in beliefs that are not data-based. If one person tells another person something that is perceived as information, the second person will adjust this views to incorporate the additional information. If one person tells another person something that is perceived as "just an opinion," then no adjustment in views will take place.

*Email for comments: `hal@sims.berkeley.edu`.

Although there has been much progress in examining differences in information in financial markets, less attention has been paid to models of differences of opinion. However, models of financial markets that do not allow for differences of opinion generally imply that there is hardly any trade in equilibrium. The result that there is essentially no trade if there are no differences of opinion is often called a "nonspeculation theorem."

In general, people trade because they have different probability beliefs, different tastes, or different information. Suppose that initially everyone has the same information, and that they make trades on basis of their probabilities and their tastes. Now suppose that some agents acquire some new information that changes their probability beliefs, but that each agent who acquires information changes his probability beliefs in the same way. That is, everyone *interprets* the information in the same way.

Then even if only *some* of the agents actually acquire the information, *none* of the agents would be willing to trade. For anyone that would be willing to buy an asset from me must have information that indicates the asset has become more valuable. But then I would be foolish to accept the offer to trade! I wouldn't want to trade with anyone who would be willing to trade with me. This is sometimes called the "fundamental theorem of Marxian economics;" the reference is to the famous statement by Groucho Marx: "I wouldn't want to be a member of any club that would have me as a member."

Nonspeculation theorems have been established by Rubinstein [1975], Milgrom and Stokey [1982], Tirole [1982], and others. They are discussed in more detail in Varian [1989].

In a world where a nonspeculation theorem holds, there would be an initial round of trade based on differences in endowments, probability beliefs, and preferences. After this initial round, new information would change asset prices, but would not involve any trade. This seems contrary to observation: there is substantial trade in risky assets, most of which is apparently due to differences in interpretation of information. This is what I call "differences of opinion."

2 Analysis of differences of opinion

If we acknowledge that differences in probability beliefs are important in determining asset prices and patterns of trade, what does equi-

librium theory tell us about how these differences might affect asset prices?

Let us suppose that the demand by agent i for some asset depends on its price and on i's opinion about the value of the asset, which we denote by v_i. If the asset is in fixed supply, the equilibrium price must satisfy

$$\sum_{i=1}^{n} D(p, v_i) = S.$$

Suppose that the dispersion in opinions increases; what happens to the equilibrium price?

We know that if demand is a concave function of the variable v_i, then the sum of the demand functions decreases if we take a mean-preserving spread in the distribution of v_i. In order to keep aggregate demand equal to supply, the equilibrium price must decrease. Hence, increases in dispersion of opinion will decrease or increase the asset price depending on whether demand is a concave or convex function of the opinion variable. This turns out to be a general principal which is valid in a number of different models; see Varian [1989] for details.

This observation about the curvature of demand is useful in at least two ways. First, if we are attempting to estimate models where differences of opinion are important, we must allow for nonlinear demand functions; in particular, we must allow for arbitrary curvature of demand functions. Second, if our demand model is based on optimization, we can, in principal, simply differentiate the first-order conditions twice with respect to v_i in order to determine the curvature of the demand function. Since the slope of a demand function depends on the second derivatives of the utility function, the curvatures of a demand function will depend on the third derivative of the utility function. In an expected utility framework, this boils down to statements about how risk aversion *changes* as wealth changes. See Varian [1985] and Varian [1989] for details.

3 Other theoretical work

Armed with this insight about the curvature of demand functions, we can understand several of the theoretical results in the literature. In most models of financial markets, demand depends on some measure of the difference of expected value and price. In this case we can write $D(v_i - p)$, so that the curvature of the demand function with respect

to price is the same as the curvature of the demand function with respect to the expected value.

Since demand is a linear function of price in many CAPM models, this immediately implies that differences in the dispersion of opinion do not affect equilibrium asset prices in such models, a result observed by Lintner [1969], Williams [1977] and others. If there are short-sales restrictions in a CAPM content, demand is, roughly speaking, a convex function of price, due to the trunctation of demand at zero. In this framework, an increase in the dispersion of opinion raises asset prices, as observed by Miller [1977] and others.

4 Empirical studies

There have been several empirical studies which examine how opinion differences influence asset prices. According to Cragg and Malkiel [1982], who undertook one of the earlier investigations of this sort: "We found that the best single risk measure available for each company was the extent to which different forecasters were not in agreement about that company's future growth ... [These results] suggest that the variance of analysts' forecasts may represent the most effective risk proxy available." (p. 4)

There have been many subsequent studies using similar data which tend to support Cragg and Malkiel's observation. Many of these studies use the survey data provided by Lynch, Jones & Ryan, a financial analysis firm that provides surveys of market expectations data. See their annual publication, *The Annotated Bibliography of Earnings Expectations Research* for abstracts of recent work in this area.

References

John Cragg and Burton Malkiel. *Expectations and the Structure of Share Prices*. University of Chicago Press, Chicago, 1982.

John Lintner. The aggregation of investors' diverse judgements and preferences in purely competitive markets. *Journal of Financial and Quantitative Analysis*, 4:347–400, 1969.

Paul Milgrom and Nancy Stokey. Information, trade and common knowledge. *Journal of Economic Theory*, 26:17–27, 1982.

Edward M. Miller. Risk, uncertainty, and divergence of opinion. *Journal of Finance*, 32:1151–1168, 1977.

Mark Rubinstein. Security market efficiency in an arrow-debreu economy. *American Economic Review*, 65:812–824, 1975.

Jean Tirole. On the possibility of speculation under rational expectations. *Econometrica*, 51:1163–1182, 1982.

Hal R. Varian. Divergence of opinion in complete markets. *Journal of Finance*, 40:309–317, 1985.

Hal R. Varian. Differences of opinion in financial markets. In Courtenay C. Stone, editor, *Financial Risk: Theory, Evidence and Implications*. Kluwer Academic Publishers, Boston, 1989.

Joseph T. Williams. Capital asset prices with heterogeneous beliefs. *Journal of Financial Economics*, 5:219–239, 1977.