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Distinguishing Beliefs and Preferences in Equilibrium Prices: Discussion

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DISCUSSION

BETH ALLEN*: The paper by Alan Kraus and Gordon Sick addresses a question which is of interest both to specialists in the theory of financial markets and to persons working in microeconomic theory. The ability to separate effects which are due to changes in agents' preferences from those which result from changes in traders' beliefs about probability distributions is important, especially if you believe, as I do, that preferences should be viewed as a fixed (albeit unobservable) primitive characteristic in the description of an economic agent, while probability beliefs tend to be subjective and to change, especially as one acquires information.

However, I do have some reservations about what the Kraus-Sick results tell us about markets under uncertainty. My remarks will focus on the themes of restrictions on parametric forms, the possibilities for recoverability of preferences from demands, and the invertibility of equilibrium price functions. I shall begin

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by discussing some literature in economic theory. Then I will return to the Kraus-Sick paper and re-examine it in light of these recent results on related issues.

Theorems addressing the issue known informally as “the Sonnenschein conjecture” have shown that restrictions on the functional form of the aggregate excess demand function are difficult to justify theoretically. One form of the Debreu-Mantel-Mas-Colell-McFadden-Richter-Sonnenschein theorem (see [3]) states that, if there are N commodities, any continuous function satisfying Walras’ Law can be generated, at least on a trimmed price simplex (i.e., normalize prices to sum to one and bound them away from zero), by the maximizing behavior of N agents having monotonic and strictly convex preferences. In other words, practically anything can be an aggregate excess demand function. Moreover, almost anything can be the equilibrium price set for an economy [7].

The recoverability literature asks the question, “Suppose I can observe the entire demand function of a single consumer. Can I, in principle, use this information to obtain the preferences of this agent, or are there demands which are consistent with more than one distinct set of possible preferences?” Mas-Colell has derived conditions, in an ordinal context in the absence of uncertainty, which imply that the preference preorder can be recovered. For the cardinal case, additional qualifications are necessary, although some open questions remain. (See [4], and also unpublished work of Dybvig, McLennon, Polemarchakis, and Seldon.)

Finally, by invertibility, I mean the problem of whether observation of market prices and knowledge of the equilibrium relation permit one to infer all relevant information possessed by traders. We wish to recover information from knowing the prices which make aggregate excess demand equal zero. One approach is to ask when prices form a sufficient statistic for the information initially possessed by traders. The sufficient statistic property tends to hold if some form of monotonicity condition is imposed and if (for models with production) information does not initially appear on both sides of the market (for example, see [5] and the references cited there and recent unpublished work by Margaret Bray). Particular utility functions or classes of probability distributions (for instance, any one-parameter family of distributions, such as the normal distribution, possesses the monotone likelihood ratio property) can suffice to give the requisite monotonicity. The second strategy which microeconomic theorists have utilized in the analysis of rational expectations equilibrium is to study when equilibrium prices are revealing. If there are only finitely many payoff-relevant states of the world or signals, equilibrium prices can be inverted to reveal the state or signal, except in very rare exceptional cases. Radner [9] has demonstrated that the exceptions to the existence of revealing strict rational expectations equilibria are insignificant in a very strong formal sense. If the finiteness restriction is removed, then the relative dimensions of the price space and the space of unknown parameters appear to be crucial. If there are strictly fewer parameters than prices (in the dimensional sense), then revealing strict rational expectations equilibria tend to exist [1, 2]. However, if there are strictly more parameters, markets can be “efficient” only under very special assumptions [6].

Kraus and Sick use very severe restrictions on agents’ preferences and proba-

bility beliefs, although such conditions appear necessary for their derivations and are common in the finance literature. The authors stress that they exploit this special setting for tractability. While I can sympathize with the reasons for choosing this method, I find it very difficult, in light of the results that functional form restrictions on aggregate demand cannot be justified by theory, to accept their assumptions in the absence of empirical verification.

However, the possibilities for full theoretical generalization appear poor. Distinguishing two parameters by observing two prices (or three parameters with three prices) is mathematically impossible in the absence of restrictions to prevent the equilibrium price relationship from either "doubling back" or "becoming flat." The latter is a somewhat less serious phenomenon, since the Inverse Function Theorem tells us that if the derivatives of prices with respect to parameters are of full rank (if the matrix of partial derivatives has non-zero determinant), then invertibility holds locally. Thus, for most values of most price functions, distinguishing the source of small changes would be possible. However, price functions which are "humped" are harder to exclude. Global invertibility can be destroyed whenever the equilibrium relationship is not monotonic. Intuitively, this assertion should come as no surprise when one recalls the sorts of assumptions which appear in the recoverability and invertibility literature.

Thus, to clarify precisely when prices enable us to distinguish preferences and beliefs, I see a need for two lines of further research. First, the restrictions on functional forms of utilities and probability distributions which are necessary and sufficient for the Kraus-Sick results to hold should be derived. This is a theoretical problem. Then these conditions must be tested. This is an empirical issue. Distinguishing preferences and beliefs is an important problem, and I think that the Kraus-Sick results dramatically point out the need for empirical studies of appropriate function forms to use in the modeling of demand in financial markets.

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