Information in Financial Asset Prices

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Wrap-Up Discussion

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As a theorist I like to think about the theory that underpins any economic discussion. Sometimes the theory is explicit, sometimes implicit. I detected both explicit and implicit theorizing during this conference. Let me elaborate on this theme. The discussion in this conference has fallen into two major areas:

1. Modelling high-frequency financial data by time series methods that incorporate general-equilibrium or arbitrage arguments;
2. Broader monetary policy arguments that consider the impact of financial modelling and high-frequency data on monetary policy.

The first area has explicit models; but in the applications of the models we often moved into the second area, where there were no explicit models. This creates a tension that I will explore below.

Asset-Pricing Models

Asset-pricing models are well developed and the theory, as discussed in the conference, very well understood—see Duffie (1996) or Milne (1995) for overviews. Effectively, one can construct general-equilibrium models of real variables to produce time series of financial prices. The 'equity premium' puzzle is the result of a simple version of this model, with a representative agent, failing to match the data. I think *puzzle*is a misnomer—a better description is 'simple model does not fit the data.' Numerous variations of this basic model have been formulated: more-flexible formulations of preferences; introduction of money through cash in advance or other transaction technologies to support a demand for money and nominal returns; transaction costs on asset trading; and production technologies have all been introduced in attempts to better explain the data.

None of these adaptations has been very successful. One possible explanation is that the representative agent model is simply too restrictive to explain multi-agent asset-trading economies with wealth-enhancing intermediation activities. One of the real challenges now is to construct tractable multi-agent economies that may track the data and financial trades more accurately. Such a model is necessary for any general equilibrium of agents with disparate expectations and a non-trivial role for monetary policy where the monetary authority may have different expectations than do private agents. A similar general framework is required for any discussion of international finance, where different agents trade assets and commodities dynamically across countries. Finally, such a structure is necessary for a non-trivial financial intermediation sector that plays a strong role allocating and advising on financial decisions.

An alternative route to the full general-equilibrium model approach, one favoured by financial asset-pricing and derivative theory, is to abandon the attempt to match (infrequent) macro real variables to high-frequency financial prices and, instead, employ an arbitrage-factor approach to asset pricing. The basic idea is simple: consider a few random factors, possibly associated with some financial instruments (e.g., stocks, bonds, or futures), and then use arbitrage pricing to derive the risk-neutral or Martingale measure, i.e., Arrow–Debreu prices for contingencies. The only tricky parts are: the number and type of factors chosen (Brownian, Poisson etc.); and the estimation of the predictable coefficients or volatilities. Once these components are in place, one can price, in theory at least, any derivative security. We have seen some examples of this methodology here.

There are two weaknesses in this method:

- It is only as good as the model estimation. When models do not fit the data, discussions of stochastic volatilities and the addition of more factors are standard responses. Model specification is important for hedging as well as for derivative pricing, because a misspecified model introduces unhedged risks;

- Although reasonably successful at pricing derivative assets, the model simply cannot address any underlying structural economy; that economy is simply not specified.

Of course it is possible to construct a set of general-equilibrium models that are consistent with any arbitrage-pricing model—see Milne and Turnbull (1997) for a general structure along those lines. The problem is that the underlying structural models may vary significantly in important ways, even though they have the same reduced-form arbitrage models.

This brings me to the second major area of discussion at this conference: Monetary policy modelling.

Monetary Policy, Theoretical Modelling, Data, and Information

One of the major difficulties in formulating monetary policy today is anticipating the reaction of the private players in an infinite regress of 'they know that I know that they know, etc.' This is a complex problem of strategic credibility, given that most monetary authorities have the dual responsibilities of ameliorating major shocks to the real and financial system and running a stable price level policy.

There is an underlying tension between these two policy objectives. However, recent monetary policy discussions have accepted that price stability is the major objective, and the arguments revolve around the best instruments and indicators to achieve this objective. Much of this conference concerned the use of high-frequency asset-pricing models as indicators of private sector expectations about underlying inflation. In the case of small countries, e.g., Canada, this problem is compounded by the actions of other major monetary players (e.g., the Fed) and by Canadian financial integration with the United States and the rest of the world.

Let me elaborate on the use of financial modelling and data as a signal and feedback mechanism mirroring the actions and expectations of private players. Of course, in any game theoretic structure this feedback requires further rounds of anticipated reactions from the bank and the private players, hopefully converging to some Nash equilibrium—or more embarrassingly, many Nash equilibria. The evidence is more akin to a multi-agent learning model; there are lags as the players adapt slowly, never completely trusting the signals nor the structural forms they use to interpret the data and other players' strategies. (For an excellent discussion of this and its implications see Woodford [1994] on an update of the Lucas critique.)

It seems to me that, as these models become more and more sophisticated, they may never converge to an equilibrium, but instead oscillate as the players focus on a slowly shifting array of variables emphasizing different indicators in an evolving strategic process. Although one can hope for reasonable consensus, the evolution of the system always casts a disconcerting air of uncertainty over the players.

A major problem is that the asset-pricing models and the monetary policy models are not well integrated. The frictionless asset-pricing models sit uneasily with the more pragmatic macro models that attempt to fit the short-run swings in activity. This class of models have ad hoc frictions or more-sophisticated frictions buried in consistent general-equilibrium structures. (Eichenbaum [1997] discusses these modelling tensions, and the conflict they cause in monetary policy.)

This tension is important at the moment as the Fed and the Bank of Canada confront the implications of the Asian crisis, disconcertingly high stock market values in North America and Europe, and the introduction of the euro. This mixture of old-style shocks and structural change is difficult to untangle with any accuracy by monetary authorities or private sector forecasters. Furthermore, this uncertainty raises the spectre of major short-run stabilization pressures in the near future, jeopardizing hard-earned nominal price stability.

Where Do We Go from Here?

The connections between the asset-pricing models and monetary policy models are not clearly delineated. The former models usually assume symmetric information and trivial monetary rules. There is no strict learning from prices by any of the players. To make the link, there must be asymmetric information and strategic play in the theory. We can see the theoretical outlines and some simple versions of this model, but more has to be done theoretically and empirically to make the connections believable.

I think that high-frequency data such as stock prices should be treated with caution for monetary policy, as they contain a lot of noise generated by hedging and trading strategies that have little to do with inflationary expectations. More studies on fixed-interest securities and term structures would be sensible, particularly studies that try to untangle the relationships between the U.S. and Canadian markets. These markets should mirror inflationary expectations and sovereign risk between the two markets, as well as noise generated by hedging demands. The market micro structure literature has made considerable progress in discussing the components of this trading noise—see O'Hara (1995) for a theoretical survey and Campbell, Lo, and MacKinlay (1997) for a discussion of the empirical evidence.

Expectations-driven asset-pricing bubbles cannot be discussed in representative agent models. Such models exclude that phenomenon by assumption, and conclude that government and the allocation Pareto Optimal play trivial roles. On the other hand, bubbles are almost surely driven by private agents' irrational expectations or faulty government policies that eventually collapse, or both. The first class of model requires some form of private sector learning and externalities of the herding variety to generate systemic expectation variations from fundamentals. Variations on the latter class of models have loose bank and financial intermediary supervision or loose monetary policy, or both. A richer model would combine both stories.

In summary, high-frequency asset-pricing models and their empirical versions are inputs into the much more complex and loosely specified monetary policy models. The links between these models need to be clarified theoretically and subject to further careful empirical testing.

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