Part 2: Current Trends in Economic Research on Systemic Risk

A conference session on current research directions featured three papers examining market-based crises—crises in which financial institutions are affected by shocks that propagate through asset prices and market liquidity.[1] In these crisis models, shocks affect financial institutions through the prices of securities that the institutions hold in common—not through chains of connections between institutions, as in a payments network.

While market-oriented models of financial crises differ from the traditional bank-oriented models in the way shocks are propagated, they share with bank models the possibility of multiple equilibria and transitions driven by positive feedback. Thus, a shock can cause a transition from a normal state to a crisis state from which the system need not recover endogenously. Indeed, the models often feature path-dependent behavior in which the transition out of a crisis state entails a path different from the one leading to the crisis and may require some form of external intervention. These characteristics of market-based models—and the dynamics of the models more generally—are the subject of the three papers presented.

As the discussion that followed the presentations made clear, the papers open some potentially productive new avenues for research. More insight is needed into how financial markets recover from crisis states and what policies or regulatory regimes would speed that recovery and contribute to a more robust financial system.[2] A related issue that merits further research is the trade-off in risk management practices between the objective of limiting risk ex ante and the effects of risk management constraints in the midst of a crisis. For instance, mark-to-market accounting is a risk management practice that makes trading performance transparent and prevents managers and traders from concealing losses while trying to gamble their way out of losing positions.[3] Further, marking to market the value of trading positions, combined with risk management loss limits that force a closeout of a losing position, can prevent a loss from becoming large enough to bring down a firm. (Some bank failures and catastrophic investment fund losses are attributable to the failure to adhere to this basic risk management discipline.) However, as the papers presented suggest, the collective and mechanical exercise of such discipline on a widespread scale after a large market shock can create the type of liquidity spiral that leads to a market crisis.

[1]The large literature on systemic risk and financial crisis cannot be represented in any set of three papers. The papers in this session of the conference were selected to illustrate current thinking about financial crises that propagate through securities markets (for example, the bond and stock markets). Further, the conference organizers sought out analytical or theoretical papers that would show the conceptual underpinning of the literature on financial crises; empirical analyses of financial crises were not included.

[2]For examples of research on these issues, see Allen and Gale (1994, 2005) and Holmstrom and Tirole (1998).

[3]Mark-to-market accounting requires that the value of an investment, which might vary over the period for which it is held, be assigned the current market price of such an investment.

Wealth Transfers and Portfolio Constraints

The first paper, by Anna Pavlova of the London Business School and Roberto Rigobon of MIT (presented by Rigobon), examined the transmission of shocks between countries with cross-border trade and investment. Pavlova and Rigobon (2006) began studying this issue after they uncovered a divergence of views on a simple question: Would it be good for the stock market in the United States if the dollar depreciated? They found that the answer depended on whether the initial shock was a supply or a demand shock and also on the effects of wealth redistribution arising from the changes in the relative prices of goods and financial assets. The presentation focused on how a shock plays out in the real side of the economy and in the financial system and how the two sectors interact through the effects of wealth redistribution.

The paper highlights the ways in which financial market imperfections and institutional features of the financial system affect the transmission of shocks across countries. The model presented has a center country and two peripheral countries; significantly, it also includes a constraint on the center country's financial sector that can be interpreted as a risk management constraint on that country's investors—for instance, a constraint against concentration risk. With this model, Pavlova and Rigobon seek to understand how the exchange rates, interest rates, and stock markets in the three countries evolve in response to shocks. Is there comovement in asset prices of the peripheral countries and, if so, does it depend on the tightness of the constraint? The analysis uses a general equilibrium framework that illuminates the role of wealth redistribution in the transmission of shocks.[4]

Would it be good for the stock market in the United States if the dollar depreciated?

In the model, the constraint creates a common risk factor or covariation in stock prices and terms of trade (the exchange rate). In the presence of shocks, the portfolio constraint leads to wealth transfers that create comovement among the terms of trade and stock prices in the peripheral countries, while reducing the comovement between the stock markets of the center country and the peripheral countries. These results are consistent with empirical findings documenting contagion among the stock prices and exchange rates of countries belonging to the same asset class (for example, emerging markets). One of the model's implications for policy is that during a crisis, interventions that relax the portfolio constraint in the center country's financial system could be a more effective response to a systemic crisis than providing assistance to the country suffering the initial shock. The alleviation of the constraint short-circuits the wealth transfers that transmit the shock to others, reducing the likelihood of contagion.

[4]In a general equilibrium analysis, all decision makers behave optimally relative to others (subject to constraints such as budget limitations), and supply and demand in all markets are in balance at the equilibrium prices.

Risk and Liquidity in a System Context

Hyun Song Shin of Princeton University examined how liquidity shocks can propagate through the linkages between balance sheets of financial institutions and securities prices. The starting point of Shin's (2006) analysis is the fact that most of the assets on the balance sheets of financial institutions are claims against other parties. This fact leads to interesting and possibly complex interrelationships in which asset prices can fluctuate together. How creditworthy one party's liabilities are depends on the strength of the assets on its balance sheet, which in turn depends on the creditworthiness of other parties' liabilities, and so on.

In Shin's analysis, the financial system is a system of interlinked balance sheets. An objective of the study is to analyze fluctuations in apparent risk appetites that arise endogenously from solvency constraints and financial institutions' interlinked balance sheets. In the model, all assets are marked to market, and economic agents are assumed to be risk neutral so that the analyst can observe how asset prices respond to the liquidity effects arising from market participants' interlinked balance sheets, rather than to changes in risk preferences or risk aversion.

In the model, the market value of each firm's debt depends on the value of the firm's assets. Since some of these assets are the debt of other firms, linkages arise in the value of the debt of all the firms. An equilibrium is a fixed point of these asset value equations. With the addition to the model of a target leverage ratio determined by, for instance, a risk management constraint, financial institutions will shrink or expand their balance sheets in response to shocks to their capital—actions that will set off liquidity drains and lending booms. In this model, supply and demand curves have counterintuitive shapes, and a fall in prices can actually increase the supply of assets. In such a case, a negative shock to bank capital raises a

bank's leverage ratio above its target; to reduce leverage, the bank must sell assets. These sales depress prices even more, causing a further negative shock to all banks' capital and setting in motion additional asset sales and a downward spiral in asset prices.

A policy-related implication of this analysis is the potential for feedback effects to arise from mark-to-market accounting. Now that a much wider range of assets can be marked to market, will such an accounting convention enhance stability or undermine it? Accounting is absolutely crucial for thinking about incentive problems because gains and losses are recognized on the balance sheet, and it is the unit of account that drives decisions.

A policy-related implication . . . is the potential for feedback effects to arise from mark-to-market accounting. Now that a much wider range of assets can be marked to market, will such an accounting convention enhance stability or undermine it?

In thinking about systemic risk, Shin considers the difference between domino effects and price effects. In domino scenarios, shocks propagate between banks through the payments system or through cascading defaults. Price effects, however, can propagate shocks even when no balance sheet or payment linkages exist. Further, price effects operate even in the absence of large players. Price changes are a lightning rod that coordinates expectations and actions and that affects the system through the similarity of positions across firms regardless of firm size or the lack of direct linkages between the firms.

Market Liquidity and Funding Liquidity

In the session's last paper, Markus Brunnermeier of Princeton University (presenter) and Lasse Pedersen of New York University explored the relationship between market liquidity and funding liquidity, giving particular attention to how they interact through risk management practices at financial institutions. Market liquidity is the ease of trading an asset and is asset-specific, while funding liquidity is the availability of funds and is agent- or borrower-specific. Brunnermeier and Pedersen's (2006) paper links the two liquidity concepts by arguing that they are mutually reinforcing: when funding liquidity is abundant, traders have the resources to finance trading positions that smooth out price shocks, and markets will be liquid. This process is self-reinforcing because liquid markets are less volatile and assets become better collateral—conditions that lead to a relaxation of funding constraints on trading activity. This feedback loop is what Brunnermeier and Pedersen set out to study.

They construct a model that would explain four stylized facts about market liquidity. The first fact is the most important one for the systemic risk question—the sudden loss or fragility of liquidity. Second is the commonality of liquidity and the way market liquidity comoves across different assets. Third is the apparent correlation between liquidity and volatility: whenever volatility is high, liquidity is low. The last is the flight-to-quality phenomenon, whereby traders flock to low-volatility securities when their capital is eroded, causing the liquidity of riskier assets to deteriorate.

In the model, a market liquidity shock is defined as the price deviation from the fair value of an asset. To examine endogenous illiquidity effects, the researchers assume that offsetting liquidity shocks exist: thus, in the initial period, a liquidity shock causes the price to deviate from fair value and, in the subsequent period, an offsetting shock occurs that restores the price to its initial fair value.[5] In addition to liquidity shocks, a source of risk in the model is a fundamental shock that changes the fair value of the asset. Traders in the model buy and sell securities in an attempt to profit from the liquidity shocks and, in so doing, provide liquidity to the market. This liquidity provision is risky, however, because of the fundamental shocks that change the fair value of the asset. Traders are constrained by their net worth and need to finance their trading positions subject to a margin or "haircut" on the amount they can borrow, where the margin is a credit risk mitigation device imposed by the lender and is determined by the volatility of the fundamental value of the asset. The traders face funding liquidity risk because a fall in their net worth or a rise in the margin required for trading positions may deprive them of funds needed for trading.

In this model, the relationship between the margin requirement and the asset's price and volatility will influence whether equilibrium outcomes with fragile market liquidity and illiquidity spirals occur. Trader losses from price shocks can lead to self-perpetuating falls in market liquidity as trading is endogenously curtailed because of the difficulty of funding the margin required for trading positions.

[5] Liquidity shocks are price shocks that are unrelated to fundamental value. For example, an investor may sell bonds to meet a need for cash, placing downward pressure on the bond price; at a different moment, an investor who has experienced a cash windfall may buy bonds, producing an opposite effect on the price.

Discussion

Herdlike Behavior and Incentives for Contrarian Trading Strategies

The three papers presented in this conference session highlighted the positive feedback effects that produce herdlike behavior in markets, and the subsequent discussion focused in part on means of encouraging heterogeneous investment strategies to counter such behavior. Investors who sit on the sidelines during boom times will not be weakened by the inevitable downturn and will be well positioned to profit by entering the market to buy assets at distressed prices. Such contrarian investment behavior would mitigate the sort of systemic collapse that was analyzed in the papers presented. A number of conference participants asked, what incentives for this type of stabilizing behavior do fund managers have? Would fund managers who were content to hold cash and low-yielding liquid assets when the markets were flourishing be able to convince their investors to stay with them when everyone else was earning tremendous profits riding the upside of a bubble? Which investors are willing to earn very little in anticipation of realizing high returns by purchasing undervalued assets after a market crash?

The three papers presented in this conference session highlighted the positive feedback effects that produce herdlike behavior in markets, and the subsequent discussion focused in part on means of encouraging heterogeneous investment strategies to counter such behavior.

If it is costly to hold liquid assets in order to be a buyer and to provide liquidity in a market crash, why *would* anyone choose to do it? In an equilibrium analysis that accounts for the incentives to sit on the sidelines in a boom, the market crash must be big enough to assure liquidity providers that they will earn sufficient profits buying at distressed prices to compensate them for forgone profits. So, in the absence of government or central bank intervention, the paradox is that the inducement to adopt contrarian investment strategies is greater when the severity of the crash is greater.[6]

[6]Allen and Gale (1994, 2005) study these issues.

The conference participants discussed the role the central bank or government might play in encouraging the sort of contrarian behavior that would stabilize failing markets. Collateralized lending by the central bank could be one way to short-circuit the feedback in asset prices and distress-driven selling of those assets; investors could acquire liquidity by borrowing against assets instead of selling them.[7] However, the type of assets that investors might want to offer as collateral could be different from the asset types normally used as collateral when borrowing from the central bank—especially in a situation in which investors' best assets have already been used in collateralized borrowing from the markets. Further, there could also be incentive effects—such as moral hazard—that change behavior in boom times in undesirable ways. If investors anticipate that illiquidity would be mitigated in a crash, they may have even more reason to ignore the risks in an emerging price bubble.

Another policy option mentioned in the discussion in this session would be to change reserve requirements and capital requirements to counteract the positive feedback effects—that is, to raise requirements in boom times and lower them in bad times. Alternatively, when markets are prospering, banks could be required to increase their liquid asset holdings so that they can provide liquidity more effectively when markets fail. The problem here, of course, is that these requirements act like a tax on these institutions, and taxes are always unpopular and would place the institutions at a disadvantage relative to other market participants—at least in the good times.

The Range of Economic Models in the Study of Systemic Risk

Participants in the session also discussed the types of models used to study systemic risk and commented on the challenges and trade-offs researchers face in developing their models. One type of model is the falling domino model. When applied to data on the linkages among banks through interbank loans and exposures in the payments system, for example, the model is used to study how cascading losses following the collapse of a bank propagate through the banking or payments system. In such an event, what would happen to other banks and how would liquidity in the payments system be affected? Another type of model takes into account the optimal behavior of market participants in analyses of their response to shocks.

[7]Examples of such liquidity provision are the discount window lending facilities at central banks that provide emergency liquidity to banks, and the repo options that the Federal Reserve made available to nonbanks to address concerns about liquidity shocks associated with the Y2K vulnerability in computing systems.

These models can be general equilibrium or game-theoretic models: the former look at the interaction between financial asset markets through, say, investors' portfolio choices; the latter examine strategic interaction between economic agents in which agents act in anticipation of how others will behave. In addition, the models can be either comparative static models or dynamic models: the former analyze differences between the pre-shock and post-shock equilibrium states of the financial system, while the latter examine what occurs in the transition from one equilibrium state to the other.

The work by Pavlova and Rigobon is representative of the current literature on international crises involving exchange rates and cross-border shocks to financial systems and economic activity. The studies by Shin and by Brunnermeier and Pedersen are illustrative of the models that look at feedback effects to clarify the interactions between market prices and the behavior of financial institutions. These papers highlight the importance of the financial system's institutional features—mark-to-market accounting, margin requirements in trading, and risk management constraints more generally—to an understanding of systemic risk. The papers are stripped-down approaches examining the equilibrium of a system of price determination equations to simplify the analysis of feedback effects. Adding to the analysis a consideration of heterogeneity among investment strategies, as in the discussion above, increases the complexity of the effort considerably. For instance, one could step back and ask how investors would choose their initial portfolios if they anticipated the feedback effects and linked sequences of events in possible future scenarios. Or one could ask what incentives or compensation arrangements would motivate an investor or fund manager to act on that anticipation.

Participants in the session also discussed the types of models used to study systemic risk and commented on the challenges and trade-offs researchers face in developing their models.

The challenge in these and other models is the trade-off between analytical tractability and realism. Given the current state of the art, significant simplification and abstraction are required to build models that can be used to answer practical questions. Yet the simplicity of a model by its nature means that potentially important factors can be missed. Indeed, a key goal of the conference was to determine whether there are modeling techniques in other disciplines that can deal with complexity yet still keep sight of the important features of the system under study.

Adequacy of Buffers against Systemic Shocks in the Financial System

A third discussion topic that drew considerable interest was whether competitive pressures and risk management practices are undermining the robustness of the financial system. More sophisticated methods of assessing collateral and margin requirements in the financing of trading positions may be lowering the overall margin and collateral amounts held against these exposures. For instance, the use of portfolio margining allows the netting and offsetting of positions and results in a lower margin on posted collateral. Certainly, the technique has advantages: netting of margin across gaining and losing positions in a portfolio can alleviate the liquidity shocks from margin-driven selling of the losing position, reducing the positive feedback effects analyzed above. At the same time, however, portfolio margining reduces the amount of overall margin, resulting in a smaller cushion if correlated shocks occur simultaneously across the whole range of margined investments.

A critical risk management issue here is the treatment of correlation assumptions in determining margin amounts for a portfolio of diverse assets. Correlations among asset prices can change radically in a crisis. A conference participant observed that truly sophisticated risk managers would set portfolio margin requirements that take into account how those correlations can change in a crisis, and not look myopically at the average correlations of the last three years. Whether such an approach would be rewarded, however, brings us back to the earlier discussion of incentives and contrarian behavior: Do risk managers have meaningful incentives to use conservative portfolio margin requirements when their competitors are basing their margins on optimistic assumptions about correlations of margined positions?

References

Allen, F., and D. Gale. 1994. "Limited Market Participation and Volatility of Asset Prices." American Economic Review 84, no. 4 (September): 933-55.

———. 2005. "From Cash-in-the-Market Pricing to Financial Fragility." Journal of the European Economic Association 3, no. 2-3 (April-May): 535-46. Papers and Proceedings of the 19th Annual Congress of the European Economic Association.

Brunnermeier, M. K., and L. H. Pedersen. 2006. "Market Liquidity and Funding Liquidity." Unpublished paper, Princeton University, November.

Holmstrom, B., and J. Tirole. 1998. "Private and Public Supply of Liquidity." Journal of Political Economy 106, no. 1 (February): 1-40.

Pavlova, A., and R. Rigobon. 2006. "The Role of Portfolio Constraints in the International Propagation of Shocks." Unpublished paper, MIT Sloan, December.

Shin, H. S. 2006. "Risk and Liquidity in a System Context." Bank for International Settlements Working Paper no. 212, August.