

Conference Summary: New Developments in Payments and Settlement

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The Bank of Canada's annual economic conference, held in November 2011, brought together leading researchers from universities, central banks and other institutions from around the world to discuss the issue of New Developments in Payments and Settlement. The conference covered such topics as the use of cash and other means of payment in retail transactions, large-value payments systems, and over-the-counter markets and central counterparties.

Over the past few decades, payment and settlement systems, the backbone of a modern financial system, have undergone major changes. On the retail side, the pace of innovation has picked up markedly, providing consumers with access to new payment instruments such as contactless, mobile and Internet payments. Central banks need to be concerned about the robustness and efficiency of the retail payments system, since it is a key element in a well-functioning economy. In addition, central banks need to be able to assess the effects of innovations in retail payments on the future demand for cash. For large-value payments, safe and efficient interbank settlement systems helped to ensure that financial systems in Canada and elsewhere withstood the turbulence of recent years, and allowed central banks to intervene when necessary. Large-value payments systems worldwide continued to function well during the 2007–09 financial crisis, even in an environment marked by large-scale liquidity problems and the default of major financial institutions. This experience highlights the importance of building robust market infrastructures to ensure financial stability and efficiency.

The Bank of Canada's 2011 economic conference comprised four sessions and included the John Kuszczak Memorial Lecture and a keynote address. The remainder of this article summarizes the papers presented and the discussions that followed.

Session 1: Cash and Means of Payment

As the sole issuers of bank notes, central banks need to understand the reasons for changes in the demand for notes. However, it has been difficult to conduct research on the use of cash, because relevant data have not been readily available. Researchers, especially those in central banks, have recently begun to conduct surveys to collect data on the use of different retail payment instruments. These surveys help researchers to carry out

empirical studies on the use of cash and other means of payment and allow those who model the demand for cash or the choice of payment method to test the implications of their models.

In their paper “The Demand for Liquid Assets with Uncertain Lumpy Expenditures,” **Fernando Alvarez** (University of Chicago) and **Francesco Lippi** (University of Sassari and the Einaudi Institute for Economics and Finance, in Italy) study the implications of large and uncertain purchases for liquidity management in inventory models. In their model, an agent has to pay in cash for consumption, which consists of two components: one that is small and occurs with certainty, and one that is large and occurs with a positive probability (a lumpy purchase). The agent has to decide on the optimal amount and frequency of cash withdrawals because withdrawing cash entails an adjustment cost and keeping cash on hand entails a holding cost. The addition of lumpy purchases significantly complicates the mathematical analysis of the resulting inventory model and the characterization of the optimal inventory policy.

One strategy for the agent is to withdraw and hold enough cash to cover both purchases. The authors show that, as the size of the lumpy purchase increases and its probability of occurrence decreases, the agent will make additional cash withdrawals to cover the lumpy purchase only when it occurs. In this case, the lumpy purchase has no effect on the average cash holdings, but it does affect the average size of withdrawals. The model results are then tested with a data set based on a survey diary of the cash-management practices of Austrian households, as well as a data set based on panel information on the management of liquid assets by Italian investors. The authors find that their model can explain some empirical regularities, for example, the frequency and size of cash withdrawals relative to average cash holdings, better than traditional models.

David Andolfatto (Federal Reserve Bank of St. Louis and Simon Fraser University) found the work to be an impressive technical achievement. Although the authors focus on understanding a particular detail in the cash-management practices of households, he noted that this work could be important because the welfare implications of changes in monetary policy can frequently hinge on the details of the underlying microstructure of the model. **Brian Peterson** (Bank of Canada) noted that lumpy purchases often underpin cyclical movements of the economy and are likely sensitive to fluctuations in interest rates. As such, financial innovation and nominal interest rates would influence how lumpy purchases affect the demand for money and the transmission of monetary policy. On one hand, financial innovation that reduces the cost of withdrawing cash could eliminate these effects. On the other hand, decreasing nominal interest rates cause banks to move to a fee-based system, so that lumpy purchases may affect the demand for money once again. In this situation, policy-makers may need to re-evaluate the importance of the demand for money in formulating monetary policy.

In their paper “How Do You Pay? The Role of Incentives at the Point of Sale,” **Carlos Arango**, **Kim Huynh** and **Leonard Sabeti** (Bank of Canada) use discrete-choice models and a survey data set of Canadian households to study the choice of using cash, debit cards or credit cards at the point of sale. The Bank conducted the survey in 2009 to develop a microdata set for empirical research on payment choices in Canada. Adult Canadians were asked to complete a survey questionnaire and keep a three-day shopping diary of personal transactions. The results of the study suggest that payment choices are a function of the attributes of different payment

instruments, such as fees, rewards, interest rates, speed and security. For example, because of its ease of use, cash is used predominantly for transactions below \$25. There is also a strong tendency to substitute credit cards for debit cards for transactions above \$25 because of the rewards programs associated with credit cards. The effect of rewards on the use of cash, however, is relatively small. Finally, debit cards are most commonly used by consumers who do not have to pay fees for each transaction. Overall, however, consumers prefer cash because it is easy to use and widely accepted.

Joanna Stavins (Federal Reserve Bank of Boston) noted that the Canadian survey results are quite similar to those from a survey of U.S. households conducted by the Federal Reserve Bank of Boston. Compared with Canadian households, however, a greater number of U.S. households carry a balance on their credit cards. Moreover, U.S. households are charged smaller fees for their credit cards and lower interest rates for carrying a balance on the card. **Victor Aguirregabiria** (University of Toronto) suggested that identifying supply factors might be useful, if information on merchants' acceptance of various means of payment at the transaction level is available, since that would make it easier to separate demand and supply factors in the choice of means of payment. He also noted a potential endogeneity problem, since consumers might choose merchants based on whether they accept their preferred method of payment.

Session 2: Credit and Means of Payment

Recent policy debates on regulating the retail payments system are motivated in part by concerns about the welfare implications of different payment instruments. In their paper "On the Welfare Effects of Credit Arrangements," **Jonathan Chiu, Mei Dong and Enchuan Shao** (Bank of Canada) examine the effects on social welfare of using credit as a means of payment. They construct an economic model in which users of cash face a liquidity constraint because their consumption is limited to their holdings of cash. In this model, the availability of credit arrangements can generate two opposite effects on welfare. The access to credit relaxes liquidity constraints and, as a result, agents can consume more. In this case, the use of credit can generate a private gain to those who have access to it. However, higher consumption among credit users can also generate a negative externality. Specifically, increased consumption will drive up market prices, tightening the liquidity constraints on those who do not have access to credit, thereby reducing their consumption. Thus, the net social welfare consequence depends on the relative strengths of these two effects. The authors derive conditions under which using credit can be welfare reducing, and illustrate how this inefficiency can be corrected by charging different prices to cash and credit users, for example, by providing a discount to cash users or surcharging credit users.

William Roberds (Federal Reserve Bank of Atlanta) noted that monetary theory appears to suggest that using credit cards to make payments is welfare improving. In real life, however, using credit cards as a means of payment involves fees and monopolistic behaviour. He also pointed out that the model's result—that cash users receive a discount—is at odds with reality, since credit card users may actually pay less because of the rewards attached to the cards. **Charles Kahn** (University of Illinois at Urbana-Champaign) argued that welfare comparisons based on holding steady-state monetary policy constant are problematic because the central bank

cannot react optimally to the change in the demand for money caused by the introduction of credit. He suggested that this issue may account for the paper's counterintuitive result that credit is welfare reducing.

In their paper "Why Do Banks Reward Their Customers to Use Their Credit Cards?" **Sumit Agarwal** (Federal Reserve Bank of Chicago), **Sujit Chakravorti** (The Clearing House) and **Anna Lunn** (Federal Reserve Bank of Chicago) use a data set from a large national U.S. financial institution to study the effects of rewards and lower interest rates on credit card spending and debt. The data set contains a representative sample of about 12,000 credit card accounts from June 2000 to June 2002. It includes monthly information from account statements on credit card spending, repayment, balance, debt, interest rate and credit limit. The authors estimate the impact of a 1 per cent cash-back reward on the payment behaviour of consumers before and after enrolment in the program. The results suggest that, while the offer of cash-back rewards increases spending and debt on that particular credit card, the overall balance held across all credit cards does not change. This implies that consumers switch their debt to cards that provide rewards, as well as use them for spending. The authors conclude that cash-back rewards are an effective tool for issuers to increase consumer spending on a specific card and to lure customers away from competitors.

Nadia Massoud (York University) noted that it is also important to examine the switch from other methods of payment to credit cards offering rewards and to perform more robustness tests. **Ben Tomlin** (Bank of Canada) noted that even a small monetary incentive could affect a consumer's choice of credit card. He also wondered whether the results are economically significant and whether the rewards program is profitable for the financial institution offering it.

John Kuszczak Memorial Lecture

In his lecture "The Changing Payments Landscape," **Richard Schmalensee** (Massachusetts Institute of Technology) discussed the challenges and issues raised by the recent dramatic increase in the pace of innovation related to payments. Key factors driving the innovations in retail payments include the introduction of new technologies such as smart phones and open, cloud-based software platforms, as well as new business models based on potential profits from the merging of data sets to enhance marketing capabilities. Since payments systems are multi-sided platforms that facilitate interactions between members of different groups such as consumers and merchants, the success of a new system depends on its adoption by all user groups. Despite a number of promising and exciting innovations in retail payments systems, many of them have failed because they were not adopted by all participants.

Schmalensee pointed out that these developments have raised a number of regulatory concerns related to such issues as competition, interchange fees and consumer protection. Some countries have regulated interchange fees and pricing. Such regulations, however, may affect payment choices and inhibit the entry of new payments systems. He suggested that although the introduction of new technology-based devices is continuing, compelling technology alone does not address the challenges of establishing a successful payments platform, since consumers will have to adopt the innovative product. Merchants will be the key to successful payments innovations,

because they need to pay for the installation of new payments terminals. While it remains to be seen which new retail payments technologies will be adopted, Schmalensee noted that all of these developments will reduce the use of cash.

Session 3: Large-Value Payments Systems

In the wake of the global financial crisis, the private sector, governments, regulatory agencies and central bankers are moving to address the vulnerabilities that were exposed in the financial system. Efficient and resilient payment and settlement systems are critical to building a more-robust financial system. For large-value payments, liquidity in the financial system is essential to facilitate the settlement of transactions, including those related to activities involving the transformation of assets and maturities that support the efficient allocation of resources. Moreover, policy-makers need to ensure that these payment and settlement systems are resilient to operational risk and default.

In their paper “Settlement Liquidity and Monetary Policy Implementation: Lessons from the Financial Crisis,” **Morten Bech, Antoine Martin and James McAndrews** (Federal Reserve Bank of New York) review the liquidity of the payments activity on the Fedwire Funds Service (the primary U.S. network for large-value or time-critical domestic and international payments) during the financial crisis of 2007–09. The authors find that settlement liquidity, measured by the time of day that payments were sent (with payments made earlier in the day suggesting fewer delays), increased during the financial crisis. This was because reserve balances increased substantially, since participants wanted to hold their cash in a safe place, and the Federal Reserve purchased and reinvested US\$1.725 trillion in securities, crediting reserve accounts. Data analysis shows that this increase appears to be highly correlated with a remarkable acceleration in the rate of payments settled on the Fedwire Funds Service, leading to a much higher level of settlement liquidity in the U.S. payments system.

The authors conclude that the provision of high levels of reserves can significantly improve the functioning of payments systems. They also consider implications for monetary policy operations. First, with respect to the efficiency of the payments system, monetary authorities should reduce the opportunity cost of the marginal level of reserve balances. Second, monetary authorities should balance the benefits of allocating higher reserves for the efficiency of the payments system with the increased interest rate risk associated with larger holdings of assets.

Julio J. Rotemberg (Harvard Business School) suggested that, in examining this issue, it is important to understand why the market for intraday immediacy of settlement may not work well, and to know the costs of the delays in settlements. Banks currently have discretion on when to submit customer requests to a large-value payments system. Rotemberg questioned whether it would be more efficient if all customers posted their requests directly to a central system that eliminates cycles.

David Longworth (Queen’s University, Carleton University and former Deputy Governor of the Bank of Canada) compared the experiences of institutions in the U.S. and Canadian payments systems, noting that “any measure of settlement liquidity that also takes behaviour into account is likely to be . . . system-specific.” He also discussed certain implications for

researchers and policy-makers in Canada. First, he said, it would be useful to undertake decile-based research on the time of payments in Canada to deepen our understanding of the policy effects on the Large Value Transfer System (LVTS). Second, policy-makers should examine both the micro and macro effects of providing large settlement balances, and reconsider whether it is appropriate to reduce settlement balances in the LVTS to as low as possible in normal times to minimize the cost to direct clearers and the size of the Bank of Canada's balance sheet.

Given the increasing linkages among many payments systems, potential spillovers across systems are an important policy concern. In "Information Asymmetries and Spillover Risk in Settlement Systems," **Elizabeth Foote** (London School of Economics and Political Science) constructs a game-theoretical model to study spillovers when potential problems in a system remain private information among its participating banks. She argues that, in a world where two payments systems are linked by a dual-system bank, the bank may withhold information about a potential problem in one system, causing the problem to be transmitted to the other system. She suggests that the solution to the problem of spillover risk is better dissemination of information or the adoption of liquidity-saving mechanisms.

Stephen Williamson (Washington University in St. Louis) suggested that Foote's model should be more explicit about important features of payments systems, such as asset prices, central banking and central bank intervention, the role of collateral, the balance sheets of banks, and the descriptions of actual payments, since these features may have important implications for the risk of spillovers. **Rodney Garratt** (University of California, Santa Barbara) suggested improving the model by endogenizing the initial liquidity choices of banks. He also suggested that the author clarify the model's relevance to systems with priced credit (such as Fedwire since 2011) and to the new regulations on double counting issued by the Financial Services Authority and the Bank of England.

Session 4: Over-the-Counter Markets and Central Counterparties

During the recent financial crisis, the opacity and interconnectedness of the derivatives markets amplified and transmitted financial shocks. To address this vulnerability, leaders of the G-20 countries have mandated central clearing for all standardized over-the-counter (OTC) derivatives to help control systemic risk. Through novation, risk mutualization and orderly close-out procedures, central clearing with proper risk controls can reduce the knock-on effects and contagion risks within systems in times of stress, thus dampening private liquidity cycles. The central clearing system must be carefully designed to ensure appropriate risk-proofing, while sidestepping unintended consequences.

In the paper "Emergence and Fragility of Repo Markets," **Hajime Tomura** (Bank of Canada) presents a framework where cash investors and dealers participate in an OTC bond market. In the model, bilateral OTC trade leads to an endogenous bond-liquidation cost for cash investors. This cost induces dealers and cash investors to enter into repo transactions, and also discourages cash investors from entering into repos in a repo-market collapse. Thus, it helps to explain both the emergence and the fragility of repo markets. The author describes policy experiments demonstrating that a

central bank loan facility for dealers, such as the Federal Reserve's Primary Dealer Credit Facility, or a central counterparty (CCP) could prevent the collapse of repo markets.

Christine Parlour (University of California, Berkeley) pointed out that the paper's policy implications suggest that regulators should try to enforce anonymity through the use of intermediaries such as asset managers. She also suggested that the model could be extended to incorporate differences in tri-party repo markets,¹ for example, by adding clearing banks. **David Skeie** (Federal Reserve Bank of New York) suggested empirically testing the model's counterintuitive result that liquidity in spot bond markets leads to the fragility of repo markets.

Keynote Address

In his keynote address, "Replumbing the Financial System: Uneven Progress," **Darrell Duffie** (Stanford University) offered a critique of the measures taken by central banks and regulatory agencies following the recent financial crisis to ensure the financial system's ability to transfer risk and provide credit. He highlighted the difficult trade-offs involved in ensuring that three key areas of the financial system's "plumbing"—clearing banks in tri-party repo markets, prime brokers and clearing houses for trading derivatives—function effectively, even under stressful market conditions.

Regulatory changes that decrease the time between settlements of the two sides and the administrator of a tri-party repo contract reduce, but do not eliminate, the credit risk faced by the clearing house. As well, these regulatory changes do not address agency problems between clearing houses and dealers. Duffie argued that solutions to these problems might be achieved by centralizing the provision of repo services, although such a solution could lead to the service provider becoming "too big to fail."

Duffie also pointed out that regulation in the United States that limits the use by prime brokers of securities pledged by hedge funds as sources of funding did not prevent runs arising from a loss of confidence in the brokers' solvency. While such runs could be prevented by "ring-fencing" the securities deposited by the hedge funds in a custodian's account, this would raise the cost of prime brokerage services.

Drawing on his research with Haoxiang Zhu, Duffie noted that regulations on centralized clearing could increase total margin requirements when margin calculation based on global netting of positions is not feasible because of contracts with multiple CCPs. He concluded by citing work undertaken by a study group of the Committee on the Global Financial System of the Bank for International Settlements, which details the supervisory and efficiency trade-offs involved in the various CCP configurations.²

¹ At the centre of the U.S. repo market sits the tri-party model, where a custodian bank, either the Bank of New York Mellon or J.P. Morgan, helps to administer a repo agreement between two parties. An investor places its money with the custodian bank, which in turn lends it to another institution. Assets are then pledged as collateral for the loan.

² See "The Macrofinancial Implications of Alternative Configurations for Access to Central Counterparties in OTC Derivatives Markets," CGFS Papers No. 46, Bank for International Settlements, 2011.

List of Conference Papers³

Agarwal, S., S. Chakravorti and A. Lunn. 2011. “Why Do Banks Reward Their Customers to Use Their Credit Cards?”

Alvarez, F. and F. Lippi. 2011. “The Demand for Liquid Assets with Uncertain Lumpy Expenditures.”

Arango, C., K. P. Huynh and L. M. Sabetti. 2011. “How Do You Pay? The Role of Incentives at the Point of Sale.”

Bech, M., A. Martin and J. McAndrews. 2011. “Settlement Liquidity and Monetary Policy Implementation: Lessons from the Financial Crisis.”

Chiu J., M. Dong and E. Shao. 2011. “On the Welfare Effects of Credit Arrangements.”

Foote, E. 2011. “Information Asymmetries and Spillover Risk in Settlement Systems.”

Tomura, H. 2011. “Emergence and Fragility of Repo Markets.”

³ The slides of the presentations discussed in this article are available on the Bank’s website at <http://www.bankofcanada.ca/publications-research/research/conferences-seminars-and-workshops/new-developments-payments-settlement-conference-17-18-nov-2011/>.