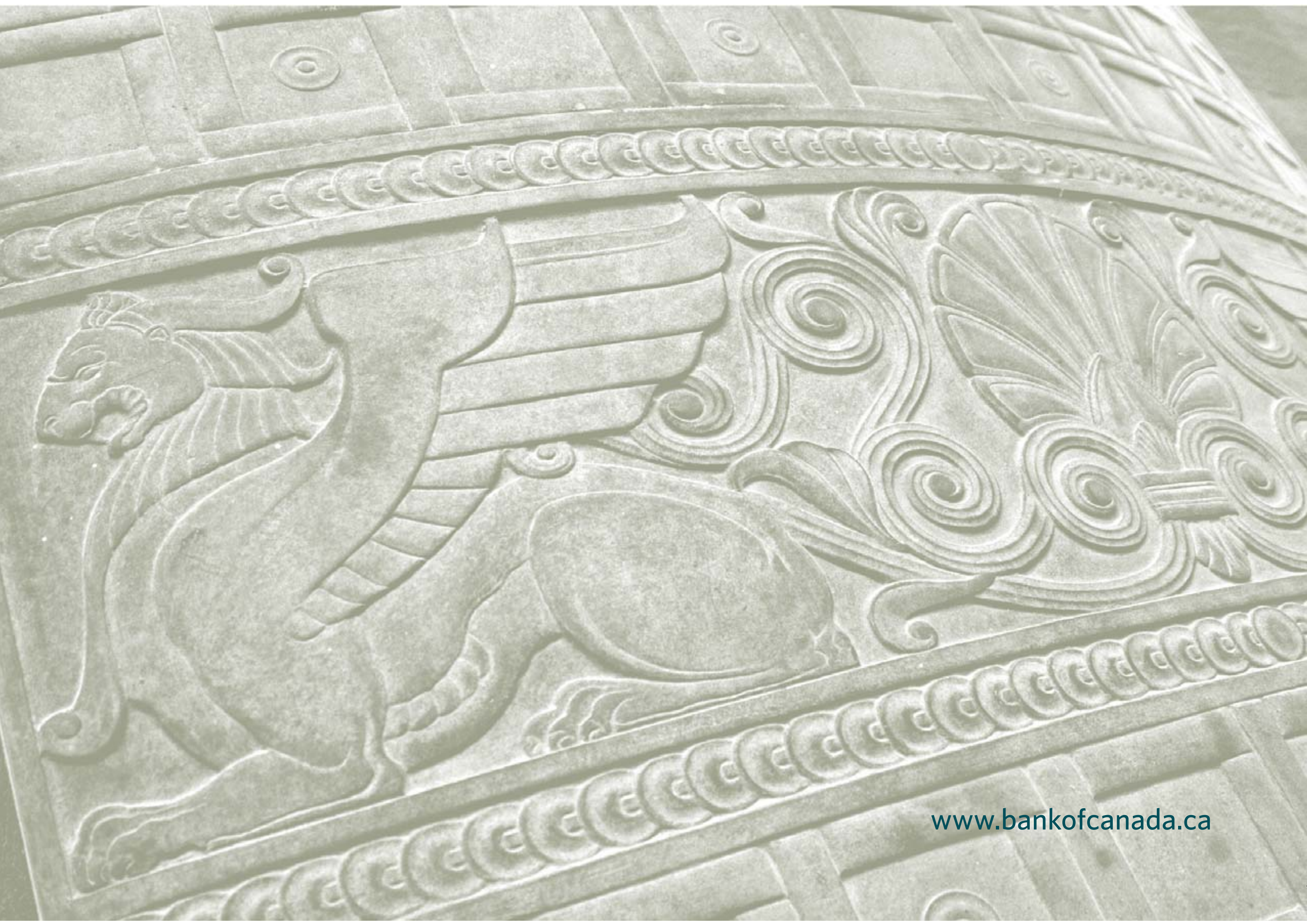
BANK OF CANADA
BANQUE DU CANADA

Publications Catalogue

2006



www.bankofcanada.ca

About the Cover

The cover shows a detail from one of the concave, cast green bronze double doors (12 x 3 feet, or 3.7 x 0.9 metres, each) that the Bank of Canada installed in 1938 at the rear entrance of its newly constructed building. The doors, designed by Ulysses Ricci, of Ricci and Zari of New York, depict traditional classical imagery: winged lions (guardians of important places) flank a central Greek palmette (also a symbol of guardianship). Above and below is a pattern of squares reminiscent of Roman coffered ceilings. The doors were cast by the General Bronze Company of New York. In the late 1970s and early 1980s, during the remodelling of the building and the construction of the Bank's west and east towers, the doors were removed. They were installed in the foyers of the east and west towers in the mid-1990s.

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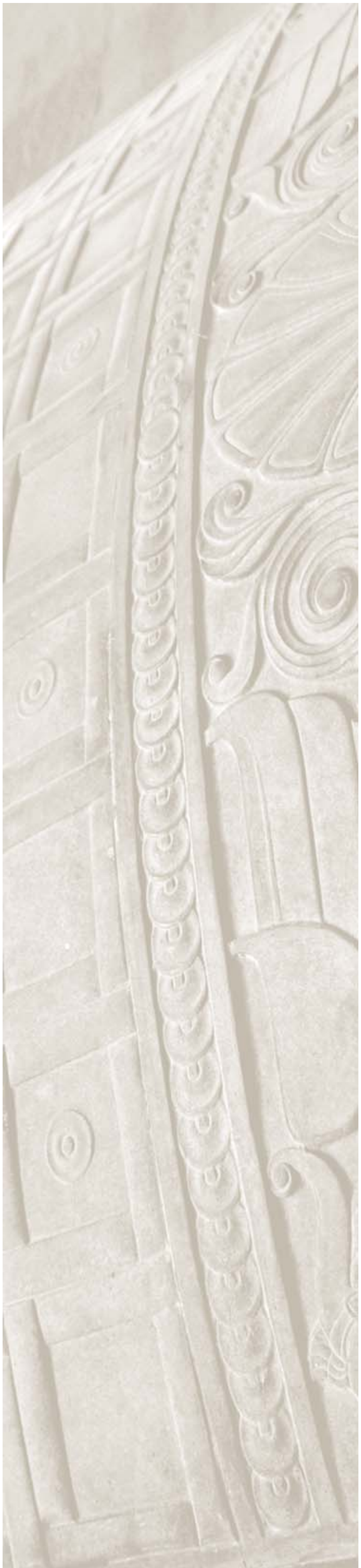

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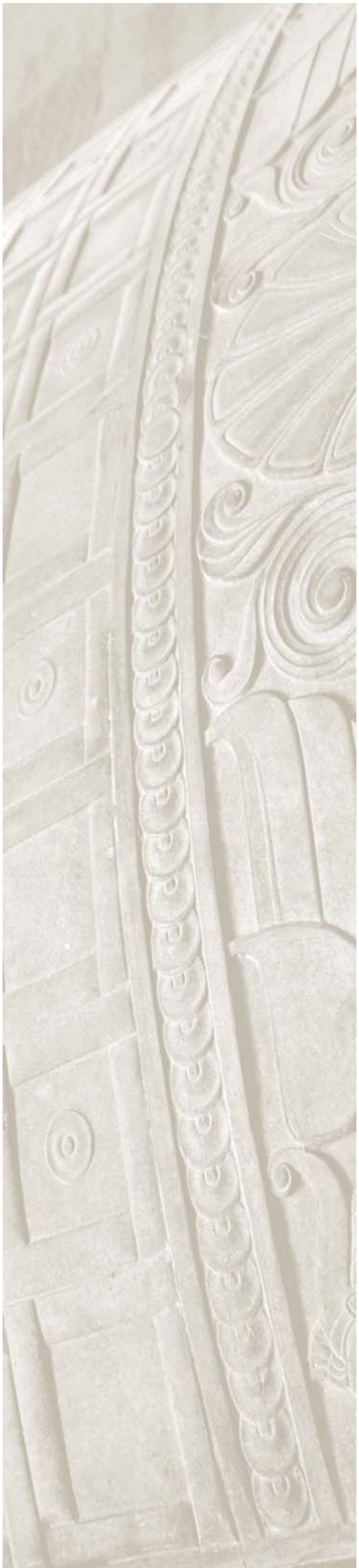


INTRODUCTION

The Bank of Canada produces a wide variety of publications of interest to business and banking professionals, policy-makers, academics, and the general public. In addition to the research documents listed on the following pages, they include:

Annual Report
Published in March. No charge.

Monetary Policy Report
Published in April and October. No charge.

Monetary Policy Report Update
Published in July and January. No charge.

Business Outlook Survey
Published quarterly. No charge.

Financial System Review
Published semi-annually. No charge.

Speeches and Statements by the Governor
No charge.

Bank of Canada Banking and Financial Statistics
Published monthly.*

Weekly Financial Statistics
Published each Friday.*

*For subscription prices see pages 39–40.

Bank of Canada Publications Catalogue
Published annually. No charge.

Bilingualism at the Bank of Canada
Published annually. No charge.

The Bank of Canada: An Illustrated History
Published in 2005. Available at Can$25 taxes included (+$5 shipping in Canada/+$10 shipping in U.S. and international destinations).

The Art and Design of Canadian Bank Notes
Published in 2006. Available at Can$25 taxes included (+$5 shipping in Canada/+$10 shipping in U.S. and international destinations).

A History of the Canadian Dollar
James Powell. Published in 2005. Available at Can$8 (plus GST and PST, where applicable).

About the Bank
Published in 2004. No charge.

Planning an Evolution: The Story of the Canadian Payments Association, 1980–2002
Published in 2003. No charge.

Renewal of the Inflation-Control Target: Background Information
Published in 2001. No charge.

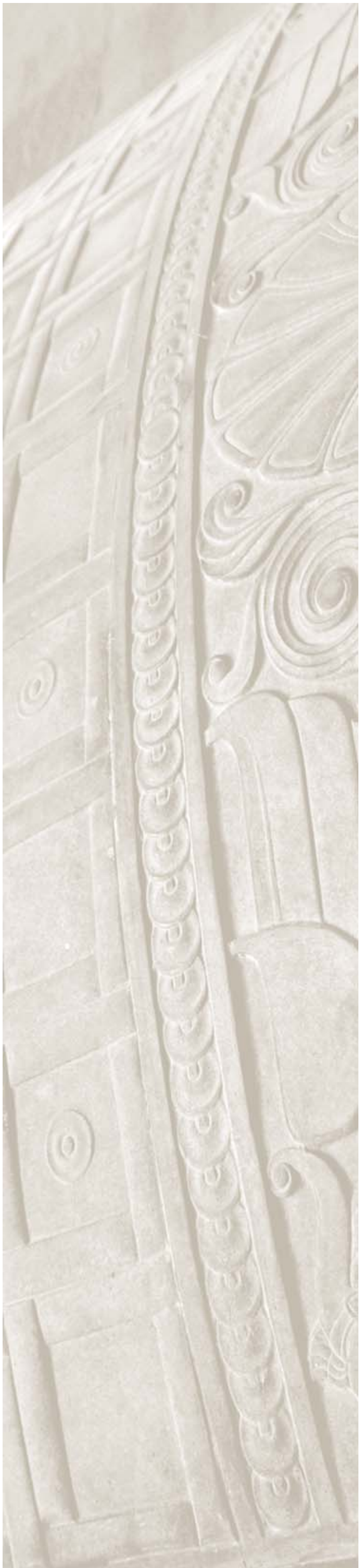
Renewal of the Inflation-Control Target: Background Information—November 2006
Published in 2006. No charge.

The Thiessen Lectures
Published in 2001. No charge.

The Transmission of Monetary Policy in Canada
Published in 1996. Available at Can$20 (plus GST and PST, where applicable).

Copies of Bank of Canada documents may be obtained from Publications Distribution, Communications Department, Bank of Canada, Ottawa, Ontario, Canada K1A 0G9; telephone 1 877 782-8248 (toll free in North America); email address: publications@bankofcanada.ca.

All Bank publications, except for the *Bank of Canada Banking and Financial Statistics, The Bank of Canada: An Illustrated History*, and *The Art and Design of Canadian Bank Notes*, are available on our website: **<http://www.bankofcanada.ca>**.



BANK OF CANADA REVIEW

The* Review *is a quarterly publication of interest to business and banking professionals, academics and educational institutions, libraries, and the general public. It features economic commentary and articles related to the Canadian economy and to central banking. The* Review *is available on the Bank's website (http://www.bankofcanada.ca/en/review/index.html).

Winter 2005–2006

70 Years of Central Banking: The Bank of Canada in an International Context, 1935–2005
Michael D. Bordo and Angela Redish

Bordo and Redish examine the evolution of central banking over the past 70 years and identify periods where Canada was either a notable innovator with regard to central banking practices or appeared to be following a slightly different course. They note that global forces seemed to play an important role in determining inflation outcomes throughout the 70-year period, and that Canada and the United States experienced roughly similar inflation rates despite some important differences in their monetary policy regimes. Canada, for example, established a central bank comparatively late, long after most other industrial countries. Canada also operated under a flexible exchange rate through much of the Bretton Woods period, unlike any other country in the 1950s and early 1960s; adopted inflation targets well before most other central banks; and introduced a number of other innovative changes with regard to the implementation of monetary policy in the 1990s.

Free Banking and the Bank of Canada
David Laidler

Economists in the nineteenth century spent considerable time discussing the merits of a free-banking system, in which each commercial bank would be able to issue its own notes and deposits, subject to a convertibility requirement backed by its own gold reserves. Such a system, the proponents argued, would be able to deliver price-level stability yet be flexible enough to withstand the vicissitudes of the business cycle. Moreover, there would be no need for central banks. While this idea has received less attention in recent years, some economists still put it forward as a practical alternative to the current system. Laidler suggests that the centralizing tendencies in banking would inevitably undermine competition within a free-banking system, and lead to the natural emergence of one dominant bank. Other developments in the twentieth century, most notably the demise of the gold standard and widespread agreement that governments should play a determining role in setting monetary policy goals, have also limited the practicality of such a system. Laidler examines the Bank of Canada's history from the free-banking perspective and concludes that the current system of inflation targeting provides a much better anchor for orderly price-level behaviour than the free-banking system's convertibility could ever guarantee.

Towards a Made-in-Canada Monetary Policy: Closing the Circle
John Chant

When the Bank of Canada was first established in 1935, it had two very different models to choose from—the Bank of England and the U.S. Federal Reserve—in terms of the instruments that it might use for implementing monetary policy. Although some aspects of the Bank's early monetary policy practices, including the role of discount facilities and moral suasion, reflect the British example, other important differences shaped a distinctly Canadian approach. Chant describes what he argues are distinctively Canadian innovations: the Bank's favoured means of managing chartered bank liquidity through transfers of government deposits, the adoption of lagged reserve requirements, and the two periods in which it decided to float the Bank Rate. He also describes the series of bold initiatives that were undertaken in the 1990s with regard to simplifying clearing and settlement procedures, reducing reserve requirements, and setting the Bank's target for the overnight rate. Chant suggests that these changes have improved market efficiency, reduced risk and uncertainty, and strengthened the Bank's influence over its short-term operating target.

From Flapper to Bluestocking: What Happened to the Young Woman of Wellington Street?
John F. Helliwell

Helliwell traces the changes that have occurred at the Bank of Canada since the early 1960s, when he first began a long and extensive relationship with the institution and its staff. He begins with his work on the Royal Commission on Banking and Finance (the Porter Commission) and continues over the next 40 years, giving particular focus to the Bank's analytic and research activities. Although he is careful to note the benefits of alternative analytical and information-gathering techniques, such as the extensive mail and direct interview survey that he and his colleagues conducted as part of the Royal Commission, Helliwell devotes most of his attention to the Bank's econometric modelling efforts, starting with RDX1 and RDX2 in the late 1960s and early 1970s. He cites some of the internal, as well as external, obstacles that had to be overcome as the Bank's modelling efforts advanced, and how shifting trends in the economics profession have sometimes posed a challenge. Helliwell concludes that these developments helped the Bank to come of age and take its place in the front ranks of the world's evidence-based policy-research institutions.

Spring 2006

Global Imbalances—Just How Dangerous?
Bruce Little and Robert Lafrance

The combination of rising current account surpluses in Asia and a growing current account deficit in the United States has raised concerns that the resulting imbalances pose a threat to the world economy, especially if they are reversed in a disorderly manner. Some experts believe that normal market forces will resolve these imbalances over time; others argue that policy-makers should facilitate the adjustment with policies that curb domestic demand in deficit countries and stimulate it in surplus countries. Little and Lafrance provide a guide to the major issues and controversies involved in the debate.

Issues in Inflation Targeting: A Summary of the Bank of Canada Conference Held 28–29 April 2005
Robert Amano and Raphael Solomon

The Bank of Canada's 2005 conference focused on two critical issues: price-level targets versus inflation targets, and the appropriate level of inflation. Session topics included new methodological approaches to examining the validity of the New Keynesian Phillips curve for Canada; the monetary policy implications of border effects and the financial-accelerator model; the zero lower bound on nominal interest rates; and inflation and welfare in general-equilibrium macroeconomic models. A panel of invited speakers discussed the issues of each session, and two distinguished speakers gave their perspectives on inflation.

Trends in Retail Payments and Insights from Public Survey Results
Varya Taylor

While the volume and value of bank notes have continued to increase, the use of cash as a payment method has been affected by the growing use of electronic alternatives. Taylor reports on a 2004 Bank of Canada survey of consumers' payment habits and their perceptions of cash and its alternatives, including their confidence in the security of bank notes. Analysis of the survey results shows that numerous factors affect the demand for bank notes, including income, age, education, gender, the use of debit and credit cards, and the perceived convenience of cash. Taylor also includes a report on the construction of a bank note confidence index that will serve as a benchmark for future surveys.

The Evolution of the Government of Canada's Debt Distribution Framework
Marc Pellerin

This overview includes a brief history highlighting the government's use of the primary and secondary markets to develop a framework for distributing its debt securities to financial market intermediaries and end investors. The framework is also intended to meet the government's debt-strategy objectives of raising stable, low-cost funding and maintaining a well-functioning debt market. Pellerin reviews the government's adoption of a new framework in 1998 as well as the 2005 modifications aimed at attracting continued broad and competitive participation in government auctions.

Summer 2006

Credibility with Flexibility: The Evolution of Inflation-Targeting Regimes, 1990–2006

Graydon Paulin

Beginning with a review of the adoption of inflation targeting in a broad group of countries, Paulin focuses on changes in the design of inflation-targeting frameworks in light of fifteen years of accumulated experience. Included in the discussion are the use of numerical targets and ranges, the policy horizon, supporting institutional policy structures, and communication, including the publication of forecasts. A recurring theme is how much flexibility an inflation-targeting regime allows. The article concludes that the changes made to the frameworks have been relatively modest since their adoption, but in concert with the improved credibility that has resulted from central banks meeting their inflation-control targets, they have allowed an increasingly nuanced response to economic shocks.

Evaluating Measures of Core Inflation

Thérèse Laflèche and Jamie Armour

Since the Bank of Canada adopted inflation targeting in 1991, it has focused on a measure of core inflation as a shorter-term guide for monetary policy. When the targets were renewed in 2001, the Bank adopted CPIX as its measure of core inflation because of the advantages it offered. Laflèche and Armour review the experience with CPIX and whether the criteria used to select it in 2001 still favour the measure today. They describe the various measures of core inflation monitored by the Bank and evaluate them on the basis of the volatility of the components, the volatility of the core measures themselves, absence of bias relative to total CPI, predictive power, and certain practical criteria, including timeliness and credibility. They conclude that CPIX still satisfies all the empirical and practical criteria.

Another Look at the Inflation-Target Horizon

Don Coletti, Jack Selody, and Carolyn Wilkins

The conduct of monetary policy within an inflation-targeting framework requires the establishment of an inflation-target horizon, which is the average time it takes inflation to return to the target. Policy-makers have an interest in communicating this horizon, since it is likely to help anchor inflation expectations. This article focuses on the determination of the appropriate policy horizon by reporting on two recent Bank of Canada studies. The evidence suggests that the current target horizon of six to eight quarters remains appropriate. It is important to note that the duration of the optimal inflation-target horizon varies widely, depending on the combination of shocks to the economy. In rare cases when the financial accelerator is triggered by a persistent shock, such as an asset-price bubble, it may be appropriate to take a longer view of the inflation-target horizon.

Autumn 2006

ToTEM: The Bank of Canada's New Projection and Policy-Analysis Model

Paul Fenton and Stephen Murchison

The Terms-of-Trade Economic Model, or ToTEM, replaced the Quarterly Projection Model (QPM) in December 2005 as the Bank's principal projection and policy-analysis model for the Canadian economy. Benefiting from advances in economic modelling and computer power, ToTEM builds on the strengths of QPM, allowing for optimizing behaviour on the part of firms and households, both in and out of steady state, in a multi-product environment. The authors explain the motivation behind the development of ToTEM, provide an overview of the model and its calibration, and present several simulations to illustrate its key properties, concluding with some indications of how the model is expected to evolve.

MUSE: The Bank of Canada's New Projection Model of the U.S. Economy

Marc-André Gosselin, René Lalonde, and Nicolas Parent

Staff projections provided for the Bank of Canada's monetary policy decision process take into account the integration of Canada's very open economy within the global economy, as well as its close real and financial linkages with the United States. To provide inputs for this projection, the Bank has developed several models, including MUSE, NEUQ (the New European Quarterly Model), and BoC-GEM (Bank of Canada Global Economy Model), to analyze and forecast economic developments in the rest of the world. The authors focus on MUSE, the model currently used to describe interaction among the principal U.S. economic variables, including gross domestic product, inflation, interest rates, and the exchange rate. Brief descriptions are also provided of NEUQ and BoC-GEM.

Modelling Financial Channels for Monetary Policy Analysis

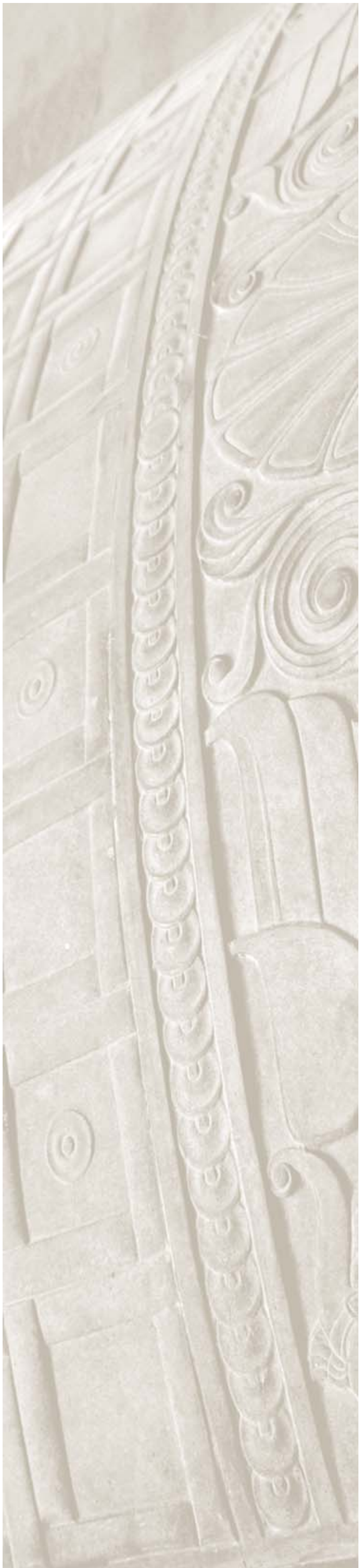
Ian Christensen, Ben Fung, and Césaire Meh

The Bank of Canada considers a wide range of information and analysis before making a monetary policy decision, and uses carefully articulated models to produce economic projections and to examine alternative scenarios. This article describes an ongoing research agenda at the Bank to develop models in which financial variables play an active role in the transmission of monetary policy actions to economic activity. Such models can help to analyze information from the financial side of the economy and to provide an overall view of the implications of financial developments for the current economic outlook. The authors also explain how this research can help address other issues relevant to the objectives of monetary policy, including how asset-price movements should be taken into account in the monetary policy framework.

A New Effective Exchange Rate Index for the Canadian Dollar

Janone Ong

An effective exchange rate is a measure of the value of a country's currency vis-à-vis the currencies of its most important trading partners. The Bank of Canada has created a new Canadian-dollar effective exchange rate index (CERI) to replace the C-6 index that it currently uses. The CERI uses multilateral trade weights published by the International Monetary Fund and includes the six currencies of countries or economic zones with the largest share of Canada's international trade. As such, it better reflects the recent changes in Canada's trade profile, including the rise in the importance of China and Mexico and the relative decline in importance of Europe and Japan in Canada's international trade. The author describes the methodology and construction of the new index and reviews the advantages it offers over the C-6, particularly the use of multilateral trade weights, the inclusion of trade in services, and the use of more recent trade data.



CONFERENCE **PROCEEDINGS**

Issues in Inflation Targeting

28–29 April 2005

This conference focused on two critical issues: price-level targets versus inflation targets, and the appropriate level of inflation. Session topics included new methodological approaches to examining the validity of the New Keynesian Phillips curve for Canada; the monetary policy implications of border effects and the financial-accelerator model; the zero lower bound on nominal interest rates; and inflation and welfare in general-equilibrium macroeconomic models. A panel of invited speakers discussed the issues of each session, and two distinguished speakers gave their perspectives on inflation.

The Road Ahead for Canadian Inflation Targeting
Christopher Ragan (Bank of Canada and McGill University)

The author reviews the evidence for the success of inflation targeting, with a particular emphasis on Canada. He examines the level and volatility of inflation, the volatility of output growth, and the anchoring of inflation expectations. The author comes out in favour of renewing the Canadian inflation targets beyond 2006, not least because of the logical coherence of the overall policy framework. He also discusses two substantive ways in which the inflation targets might be amended in the future, but about which more research needs to be done: the adoption of price-level targeting and the reduction of the inflation target to 1 per cent. Finally, the author provides a simple framework for thinking about the need for central bank communications, and makes a case for the Bank of Canada placing more emphasis on longer-term education and less on the short-term signalling of its policy intentions.

The New Keynesian Phillips Curve When Inflation Is Non-Stationary: The Case for Canada

Bergljot Bjørnson Barkbu (International Monetary Fund) and Nicoletta Batini (International Monetary Fund)

The New Keynesian Phillips curve (NKPC) has conventionally been estimated under the assumption that inflation is stationary—a questionable assumption for Canadian data. Using a method developed by Johansen and Swensen, the authors show that when appropriately cast in a system, Canadian inflation indeed seems to have a unit root—a finding that invalidates maximum-likelihood and generalized method of moments (GMM) estimates. Estimation of the NKPC based on this method yields broadly similar estimates to those of previous studies, although the estimated coefficient of the forward-looking component for Canada tends to be higher than what has been found before. Contrary to much of the previous literature, our estimates also support the superneutrality result for Canada. Importantly, estimation of the NKPC using this method overcomes the problem of identification associated with GMM estimation, and the authors can discern empirically between pure forward-looking and hybrid versions of the NKPCs.

Factor-Market Structure, Shifting Inflation Targets, and the New Keynesian Phillips Curve

Robert Amano (Bank of Canada) and Stephen Murchison (Bank of Canada)

The authors evaluate the ability of the New Keynesian Phillips curve to capture important features of aggregate Canadian inflation. In contrast to the earlier New Keynesian Phillips curve literature, the authors modify three assumptions. First, they relax the assumption of a constant historical inflation target. Second, they replace the usual proxy for marginal cost, labour's share of income, with a definition that allows for non-Cobb-Douglas production, adjustment costs to labour, and an explicit role for imported intermediate goods. Finally, in contrast to the standard assumption of a rental market for capital, they assume that capital is firm specific. The authors estimate the model using a moment-matching approach. Overall, they find that the first two modifications to the standard set-up lead to a better fit of the data, while the third change yields a more reasonable average duration between price reoptimizations. The model, however, continues to require the presence of lagged inflation to match the persistence found in aggregate Canadian inflation data.

Exchange Rate Volatility, Pass-Through, Trade Patterns, and Inflation Targets

Steven Globerman (Western Washington University) and Paul Storer (Western Washington University)

The authors present empirical evidence suggesting that nominal exchange rate volatility has increased in Canada since the mid-1990s. The possible links between this increased volatility and reduced pass-through of exchange rate fluctuations are discussed. This leads to a consideration of the contributions of monetary policy and changing trade patterns to the observed reduction in exchange rate pass-through. These results have several implications for the choice of an inflation-target policy. First, inflation targets yield greater exchange rate volatility when pass-through is low, and so we may see continued increases in exchange rate volatility if pass-through continues to decline. The central bank may also need to reassess the optimality of the weight it places on exchange rate fluctuations if exchange rates no longer have an indirect impact on policy through their effect on inflation.

Monetary Policy, Asset Prices, and Misspecification

Robert Tetlow (Board of Governors of the Federal Reserve System)

The period from 1995Q1 to 2000Q2 was an unusual one for the U.S. economy. Labour productivity growth, which had averaged 1 1/4 per cent per year over the previous 20 years, nearly doubled. Over the same boom period, the federal funds rate was remarkably stable—perhaps in response to core inflation rates that mostly fell. From 1952 to 1994, stock market capitalization fluctuated between 30 and 100 per cent of nominal GDP. From there, it rocketed to a peak of 185 per cent of GDP in 2000Q1. Over the next two years, however, the stock market retraced a significant portion of its previous gains as the economy slid into recession, and the subsequent recovery was a halting one. The question arises as to the role of the apparent stock market bubble in bringing about the recession and whether there was more that the Fed could have done to forestall that outcome.

Bernanke and Gertler argue the laissez-faire view that the quiescence of monetary policy was the correct response, that monetary policy should respond only to the projected effects of stock market movements on inflation and perhaps output, but not to perceived stock market bubbles per se. Cecchetti et al. disagree, advancing the interventionist view that, in the words of Mussa, central banks “can, should and do” respond (directly) to bubbles. Both Bernanke and Gertler and Cecchetti et al. rely primarily on ad hoc augmentations of Taylor-type policy rules to examine model properties in response to shocks that are carefully constructed to isolate bubble phenomena. This obliges them to only loosely infer the implications of being wrong about the existence, nature, persistence, and implications of a bubble. In this paper, the author uses a variant of the Bernanke-Gertler-Gilchrist model to reassess the case for responding to bubbles. The paper makes three contributions. First, the author embellishes the Bernanke-Gertler-Gilchrist model to see if the optimistic conclusion offered by Bernanke and Gertler is sensitive to changes in specification. Second, he adds more rigour regarding what is an optimal policy given the beliefs of the monetary authority. And third, the author considers robust responses by the policy-maker to uncertainty about aspects of the bubble process.

John Kuszczak Memorial Lecture
The Inflation-Targeting Debate

Frederic Mishkin (Columbia University)

The author discusses five questions raised by the inflation-targeting debate: (i) Does inflation targeting improve economic performance? (ii) Is inflation targeting consistent with the dual mandate? (iii) Can central bank transparency go too far? (iv) Would a price-level target be better than an inflation target? (v) Would a point target be better than a target range?

The author concludes from the empirical evidence that inflation targeting is associated with an improvement in overall economic performance and that it is consistent with the dual mandate in which a central bank promotes both price stability and full employment. The author cautions, however, that central banks must make this objective clearer in their communication strategies. Central bank transparency does go too far when central banks announce their projections of the future policy path or announce their objective function. Recent research and ongoing events in Japan suggest that a price-level target can be an important tool for monetary policy-makers. Target ranges for inflation appear to be an excellent way to cope with the time-inconsistency problem and provide incentives to bring monetary policy much closer to optimal policy, where time inconsistency is avoided altogether.

The Zero Lower Bound on Interest Rates and Monetary Policy in Canada

Francisco Ruge-Murcia (Université de Montréal)

The author constructs a limited-dependent rational-expectations (LD-RE) model of the term structure to capture the idea that nominal interest rates are bounded below by zero. This non-negativity constraint induces a non-linear and convex relationship between long- and short-term interest rates. This, in turn, implies an asymmetric response of the long rate to changes in the short rate: a decrease in the short rate produces a smaller response in the long rate than does an increase of the same magnitude. Furthermore, the response of the long rate to a change in the short rate—whether an increase or a decrease—is smaller in the neighbourhood of the zero lower bound. The author examines the model's predictions using recent Canadian data and finds that while Canadian interest rates are low by historical standards, they are sufficiently high above the zero lower bound that the predictions of the LD-RE model are not verified.

The Welfare Implications of Inflation versus Price-Level Targeting in a Two-Sector, Small Open Economy

Eva Ortega (Bank of Canada) and Nooman Rebei (Bank of Canada)

The authors analyze the welfare implications of simple monetary policy rules in the context of an estimated model of a small open economy for Canada with traded and non-traded goods, and with sticky prices and wages. They find statistically significant heterogeneity in the degree of price rigidity across sectors.

The authors look for the welfare-maximizing specification of an interest rate reaction function that allows for a specific price-level target. They find, however, that, overall, the higher welfare is achieved, given the estimated model for the Canadian economy, with a strict inflation-targeting rule where the central bank reacts to the next period's expected deviation from the inflation target and does not target the output gap.

Learning and the Welfare Implications of Changing Inflation Targets

Kevin Moran (Université Laval)

The author computes the welfare consequences, for a representative agent, of a decrease in the inflation target of monetary authorities. The welfare computations are conducted by first comparing the two steady states that the different inflation targets entail, and second, by accounting for the transition from the initial steady state to the new, low-inflation one. The computations allow this transition to be characterized by incomplete information, under which private agents learn about the inflation target shift using Bayesian updating. To test the robustness of the results, the author repeats the analysis in a variety of model specifications.

The author reports that the welfare benefits of reducing the target rate of inflation from 2 per cent initially to zero can appear significant: when measured by comparing steady states, these benefits are worth up to 0.5 per cent of steady-state consumption. However, accounting for the transition towards the new, low-inflation steady state significantly reduces the computed benefits, by at least one-half, and by up to 85 per cent. These reductions are particularly significant when the transition occurs under incomplete information and learning about the inflation-target shift.

Panel Discussion

Discussion 1

In light of the research presented at the conference, Paul Beaudry (University of British Columbia) discussed four issues. First, why should a central bank adopt inflation targeting if its objective is to foster a stable monetary and financial environment that promotes economic well-being? Is inflation targeting the best policy? Over the past 15 years, inflation-targeting countries have not had markedly different economic outcomes (economic growth or inflation) than comparable industrialized countries that do not explicitly target inflation. Therefore, the data suggest that alternative policies may perform equally well at promoting economic well-being.

Second, what are the advantages and disadvantages of inflation targeting as opposed to price-level targeting? Inflation targeting aids medium-term planning, allowing people to sign multi-year contracts. But price-level targeting aids long-term planning, allowing people to save for retirement without worrying about the erosion of their savings owing to inflation. Beaudry suggested that a proper examination of this question needs to model incentives to plan for the long term.

Third, what level of inflation should be chosen as the target? Is 2 per cent better than any other level? What are the costs associated with moving to a lower target? He highlighted a paradox for monetary policy makers. On the one hand, if the zero lower bound on nominal interest rates is not problematic for a range of inflation targets around 2 per cent, the target could be decreased, and economic outcomes may improve. On the other hand, there may be an important role for stasis: if there is a costly transition to a new policy, it might be best to retain the present policy.

Finally, Beaudry asked how an inflation target should be implemented. The most common way to achieve the target is via a feedback rule that specifies how to adjust interest rates in response to different economic outcomes. Inflation and output are the usual elements included in a feedback rule (a Taylor rule). A new question of interest is whether the monetary authority should react to asset prices. Beaudry acknowledged Tetlow's conclusion that monetary policy should not do so, but he noted that business cycle fluctuations are mostly driven by non-monetary disturbances, implying that the Bank should have a clear position on how it will respond to non-monetary shocks.

Discussion 2

The discussion by Pierre Duguay (Bank of Canada) centred on two themes: the target and challenges in meeting the target. On the first point, he noted that the success of inflation targeting in anchoring expectations and dampening fluctuations should encourage consideration of further progress towards price stability. At the most recent renewal of the inflation target (May 2001), theoretical arguments supported a reduction in the target rate, but the benefits were difficult to quantify. Since then, search-theoretic models (by Shi, Wright, and others) have increasingly been used to quantify welfare gains under different frameworks. Moran used a more conventional DGE model. All point to positive benefits from a lower target. Ragan noted that the only way to quantify the gains is with a DGE model with multiple sectors and relative prices. Ortega and Rebei took a good first step in that direction. The challenge for central bankers is to determine which model is closest to the real world and to communicate results clearly to the public and the government.

Duguay agreed with Ragan that long-run price certainty is too important an issue to dismiss price-level targeting without a careful consideration of its costs and benefits. The conventional view used to be that price-level targeting would induce more variability in inflation, output, and nominal interest rates. New studies show that, when agents are forward looking and monetary policy is credible, price-level targeting can lower the variability of inflation, output, and the nominal interest rate. When demand increases, the price level rises above the target, and agents' anticipation of prices returning to target raises the real interest rate, thus helping to curb demand, and ultimately requiring a smaller reaction from nominal interest rates. The reverse occurs under a contractionary shock. Price-level targeting thus allows monetary policy greater room to manoeuvre without hitting the zero lower bound. In the case of a supply shock, however, the trade-off between output and price stabilization (which disappeared under credible inflation targeting) may re-emerge.

Duguay listed three key challenges for the conduct of monetary policy: asset-price movements, vanishing exchange rate pass-through, and reduced inflation persistence. On asset-price movements, Duguay noted Tetlow's conclusion that, in normal times, monetary policy had little to gain by reacting to asset prices over and above their effect on the inflation forecast. However, he felt that Tetlow did not fully address the question being debated in central banking circles, namely, whether to allow for a longer horizon to meet the target when faced with a "non-fundamental" asset-price shock. Given our limited ability to forecast beyond 18 months and to foretell the bursting of a bubble, he concluded that it would be imprudent to trade off the achievement of the inflation target over a six-to-eight-quarter horizon for a possible better outcome later.

Duguay then remarked on vanishing exchange rate pass-through: Globerman and Storer pointed to growing intrafirm and intraindustry trade as sources of reduced pass-through, given that exchange rate fluctuations have offsetting effects on revenues and costs of firms. This could also explain the increased variability of exchange rates: larger variations are needed to achieve required reallocations of resources if some sectors are insulated from exchange rate movements. Duguay asked whether there is a link between lower pass-through of other cost increases (energy, raw materials) and increased variability of relative prices now that inflation is under control.

On reduced inflation persistence, Duguay argued that the main breakthrough in the NKPC literature is an acknowledgement of the roles played by central bank behaviour and agents' learning in affecting inflation persistence. Duguay opined that the puzzle noted by Amano and Murchison, that there is much lower persistence of inflation than marginal cost, raises questions about assumptions underlying the construction of the marginal-cost variable. Amano and Murchison's NKPC can outperform other popular models for forecasting inflation; however, extracting "deep parameters" requires arbitrary manipulations. It may be premature to conclude that the Bank has good models of inflation. Finally, Duguay noted that the NKPC framework misses the central relationship between demand pressures and wage growth, a point acknowledged by Barkbu and Batini.

Discussion 3

Peter Howitt (Brown University) divided his discussion into two parts: What have we learned? and What have we yet to learn? On the first question, Howitt began by noting that inflation stabilization has not been destabilizing for economic activity. He pointed out that Ragan's paper showed that real output variability has declined during the period of inflation targeting in Canada. Output variability has also declined in the United States and other countries that have stabilized inflation, despite the absence of explicit inflation targets. Howitt would have expected this to be the case only if most of the shocks were demand shocks. If supply shocks are dominant, then they are less important than real-business-cycle theorists claimed. Another possibility is that an inflation-targeting regime is inherently stabilizing and mitigates the trade-off between output and inflation variability in the face of supply shocks. Anchoring inflation expectations allows an economy to absorb negative supply shocks without a round of wage and price increases. The fact that so many countries share similar experiences shows that stabilizing inflation at a low rate has a smaller adverse real effect than originally predicted. Inflation targeting may even be the best way to promote stable growth.

Amano and Murchison showed that the fall in persistence began at the start of inflation targeting, even though the persistence of real marginal cost did not decline. This suggests a change in the process of forming expectations. It appears that, since targeting has anchored expectations and hence dampened the effect of shocks, the central bank can afford to take a more accommodating approach to supply shocks without unwanted movement in inflation.

As well, the exchange rate can be left alone, since exchange rate movements need not undermine inflation-targeting policy. There have been large fluctuations in the Canada-U.S. exchange rate since 1991, without derailing policy. Globerman and Storer point out that exchange rate pass-through, which has been historically slow and gradual in Canada, has become even more so under inflation targeting. This again suggests well-anchored expectations.

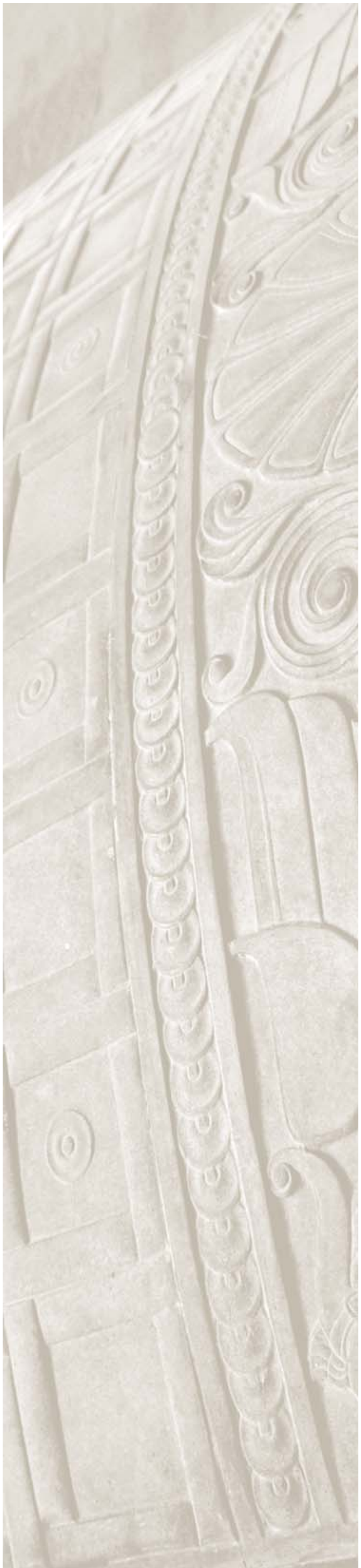
Finally, the success of policy has as much to do with communication and politics as with economics. Communication is facilitated by the clarity of the inflation-targeting framework, as emphasized by Ragan. Communication sharpens expectations. It also helps to make policy changes transparent, boosting credibility. When news arrives, private agents understand that the policy changed because of new information, not because of a surreptitious change of course. Politics plays a role, since the government had to agree to inflation targeting.

However, inflation targeting gives the Bank a degree of independence, which adds to its credibility. Howitt remarked that this is why central banks that adopted inflation targeting were those that had been the least independent.

Howitt then reflected on what we have yet to learn. It is not clear why inflation targeting works. Why have expectations become anchored? Why has persistence fallen? Although dynamic stochastic general-equilibrium (DSGE) models are being developed to answer this question, unresolved issues linger. Kozicki noted that the least well-developed or most ad hoc elements of most DSGE models are persistence issues (e.g., indexation, rule-of-thumb, and habit persistence). "Learning" may be a fruitful avenue to generate persistence, but the literature on learning in DSGE models is still in its infancy.

The next question is, how do we fly blind? How does a central bank formulate policy without good indicators of inflation pressure? Policy that efficiently stabilizes inflation six to eight quarters from now makes inflation per se orthogonal to information six to eight quarters earlier. The Bank must act without the benefit of feedback, so it may be the case that the Bank will not see an inflationary spiral immediately. It may also be the case that if expectations are really stuck at 2 per cent, monetary policy should take advantage of this inertia.

It has been difficult to find convincing evidence that reducing inflation below double-digit levels yields significant benefits. "Shoe-leather" costs were never quantitatively significant in a world that counted non-interest-bearing money as a small fraction of wealth. The advantage of DSGE models is that money is not merely a store of value but plays a role in the pricing process: money magnifies the wedge that arises between the marginal rates of substitution through the random timing of price changes. Ortega and Rebei, however, showed that even this friction does not produce very large welfare losses. Howitt pointed to other important frictions in the economy, such as the non-indexation of long-term debt contracts as a source of significant cost. Non-indexation allows inflation to impede otherwise mutually beneficial contracts, such as those for long-term investments. More work is needed on the role played by non-indexation of the tax and accounting systems. More real-world monetary economics is needed in models before quantifying the benefits of targeting lower inflation.



WORKING PAPERS AND TECHNICAL REPORT

Working papers report on research work in progress. Technical reports present studies on economic and financial subjects. Both series are of interest to business and banking professionals, academics and educational institutions, and libraries.

The Bank's website contains working papers from 1994 on (http://www.bankofcanada.ca/en/res/wp/index.html), and technical reports from 1982 on (http://www.bankofcanada.ca/en/res/tr/index.html).

Working Papers

2006-1
The Institutional and Political Determinants of Fiscal Adjustment
Robert Lavigne

The author empirically assesses the effects of institutional and political factors on the need and willingness of governments to make large fiscal adjustments. In contrast to earlier studies, which consider the role of political economy determinants only during periods of fiscal consolidation, the author expands the field of analysis by examining periods when governments should be making fiscal efforts but fail to do so (or do not try), as well as periods when no adjustment is required. To analyze this greater range of fiscal situations, a multinomial logit framework is applied to a panel of 61 advanced and developing countries, generating a sample size significantly larger than previous work. A key finding is that the political economy factors favouring the maintenance of sensible fiscal policies are different from those that increase the probability of achieving an exceptional adjustment. For instance, the results for developing countries indicate that sound economic institutions help governments avoid dire fiscal situations; however, those countries that actually succeed in making lasting adjustments in the face of a serious need tend to have weak institutions. There is also some evidence that high levels of transfers and subsidies diminish the probability of successful adjustment in developing countries, and that legislative majorities improve the odds. In advanced countries, strong democratic institutions appear to increase the likelihood of avoiding situations of fiscal distress.

2006-2

Structural Change in Covariance and Exchange Rate Pass-Through: The Case of Canada

Lynda Khalaf and Maral Kichian

The authors define pass-through within a correlated vector autoregression (VAR) framework as the response of domestic inflation to an impulse in import price inflation. This approach allows them to examine changes in both the amount and the duration of pass-through. The authors develop a test to establish the presence of structural breaks in the error covariance matrix of a multivariate system of equations. The results of the test reveal evidence of breaks in the covariance matrix in 1984Q3 and in 1991Q1. Estimating the VAR and examining impulse responses over the relevant subsamples, the authors find that, while the initial impact of pass-through is quantitatively similar across the two samples, the impact dissipates twice as fast in the later subsample. In other words, the duration of pass-through has declined from about a two-year period to a one-year period. The authors also document important changes over time in the estimated correlation between domestic and import inflation, both in terms of magnitude and sign.

2006-3

Money and Credit Factors

Paul D. Gilbert and Erik Meijer

The authors introduce new measures of important underlying macroeconomic phenomena that affect the financial side of the economy. These measures are calculated using the time-series factor analysis (TSFA) methodology introduced in Gilbert and Meijer. The measures appear to be both more interesting and more robust to the effects of financial innovations than traditional aggregates. The general ideas set out in Gilbert and Pichette are pursued, but the improved estimation methods of TSFA are used. Furthermore, four credit aggregates are added to the components of the monetary aggregates, resulting in the possibility of extracting more common factors. This extended data set gives a fairly complete picture of the asset and liability sides of the economy. As might be expected, credit data are largely explained by the same factor that explains investment (since investment provides the capital for credit). Contrary to traditional thinking about monetary aggregates, however, personal chequing deposits do not behave like currency, and thus require a separate factor to explain them.

2006-4

Forecasting Canadian Time Series with the New Keynesian Model

Ali Dib, Mohamed Gammoudi, and Kevin Moran

The authors document the out-of-sample forecasting accuracy of the New Keynesian model for Canada. They estimate their variant of the model on a series of rolling subsamples, computing out-of-sample forecasts one to eight quarters ahead at each step. They compare these forecasts with those arising from simple vector autoregression (VAR) models, using econometric tests of forecasting accuracy. Their results show that the forecasting accuracy of the New Keynesian model compares favourably with that of the benchmarks, particularly as the forecasting horizon increases. These results suggest that the model could become a useful forecasting tool for Canadian time series. The authors invoke the principle of parsimony to explain their findings.

2006-5

Are Currency Crises Low-State Equilibria? An Empirical, Three-Interest-Rate Model

Christopher M. Cornell and Raphael H. Solomon

Suppose that the dynamics of the macroeconomy were given by (partly) random fluctuations between two equilibria: "good" and "bad." One would interpret currency crises (or recessions) as a shift from the good equilibrium to the bad. In this paper, the authors specify a dynamic investment-savings-aggregate-supply (IS-AS) model, determine its closed-form solution, and examine numerically its comparative statics. The authors estimate the model via maximum likelihood, using data for Argentina, Canada, and Turkey. Since the data show no support for the multiple-equilibrium explanation of fluctuations, the authors cast doubt on the third-generation models of currency crisis.

2006-6

Regime Shifts in the Indicator Properties of Narrow Money in Canada

Tracy Chan, Ramdane Djoudad, and Jackson Loi

Financial innovations and the removal of the reserve requirements in the early 1990s have made the distinction between demand and notice deposits arbitrary. This classification issue has affected those narrow monetary aggregates (gross and net M1) that rely on a proper distinction for their definition, and may have eroded their value as indicators. The authors examine whether the indicator properties of various narrow aggregates for the growth of real output have changed over time. They find evidence of a regime shift in the relationship between real and narrow monetary aggregates and the growth of real output, which seems to have occurred in 1992. More specifically, their results show that real M1+, the definition of which is not based on the distinction between demand and notice deposits, has become a more useful indicator in predicting the growth of real output over the more recent period.

2006-7

Ownership Concentration and Competition in Banking Markets

Alexandra Lai and Raphael Solomon

Many countries prohibit large shareholdings in their domestic banks. The authors examine whether such a restriction restrains competition in a duopolistic loan market. Blockholders may influence managers' output decisions by choosing capital structure, as in Brander and Lewis. For the blockholder, debt has an additional benefit: it "disciplines" a manager by reducing the amount of free cash flow from which the manager can divert funds. A larger blockholder can exert more control. The authors show that an economy with blockholders often leads to a more competitive banking sector. Hence, a restriction on the size of blockholdings has anti-competitive results.

2006-8

A Structural Error-Correction Model of Best Prices and Depths in the Foreign Exchange Limit Order Market

Ingrid Lo and Stephen G. Sapp

The authors use a structural error-correction model to examine the dynamics of the relationship between the best bid price, the best ask price, and their associated depths. They incorporate measures of the market depth behind the best quotes as regressors. They report four main findings. First, best prices and their associated depths are contemporaneously related to each other. More specifically, an increase in the ask (bid) price is associated with a drop (rise) in the ask (bid) depth. This suggests that sell traders avoid the adverse-selection risk of selling in a rising market. Second, when the spread—the error-correction term—widens, the bid price rises and the ask price drops, returning the spread to its long-term equilibrium value. Further, the best depth on both sides of the market drops, due to increased market uncertainty. Third, the lagged best depth impacts the price discovery on both sides of the market, with the effect being strongest on the same side of the market. Fourth, changes in the depth behind the best quotes impact both the best prices and quantities, even though those changes are unobservable to market participants.

2006-9

Monetary Policy in an Estimated DSGE Model with a Financial Accelerator

Ian Christensen and Ali Dib

The authors estimate a sticky-price dynamic stochastic general-equilibrium model with a financial accelerator, à la Bernanke, Gertler, and Gilchrist, to assess the importance of financial frictions in the amplification and propagation of the effects of transitory shocks. Structural parameters of two models, one with and one without a financial accelerator, are estimated using a maximum-likelihood procedure and post-1979 U.S. data. The estimation and simulation results provide some quantitative evidence in favour of the financial-accelerator model. The financial accelerator appears to play an important role in investment fluctuations, but its importance for output depends on the nature of the initial shock.

2006-10

An Evaluation of Core Inflation Measures

Jamie Armour

The author provides a statistical evaluation of various measures of core inflation for Canada. The criteria used to evaluate the measures are lack of bias, low variability relative to total CPI inflation, and ability to forecast actual and trend total CPI inflation. The author uses the same methodology as Hogan, Johnson, and Laflèche and thus provides updated empirical results. The findings are that most traditional measures of core inflation are unbiased and all continue to be less volatile than total inflation. They nevertheless display some volatility and have limited predictive ability. Overall, CPIW seems to have a slight advantage over the other measures, but the differences across measures are not large. (CPIW uses all components of total CPI but adjusts the weight of each component by a factor that is inversely proportional to the component's variability.) Compared with the results of Hogan, Johnson, and Laflèche, CPIW's relative performance has improved. The distribution of price changes for 54 CPI subcomponents is also examined, and substantial increases in both the skewness and kurtosis of this distribution since 1998 are found.

2006-11

The Federal Reserve's Dual Mandate: A Time-Varying Monetary Policy Priority Index for the United States

René Lalonde and Nicolas Parent

In the United States, the Federal Reserve has a dual mandate of promoting stable inflation and maximum employment. Since the Fed directly controls only one instrument—the federal funds rate—the authors argue that the Fed's priorities continuously alternate between inflation and economic activity. In this paper, the authors assume that the effective weights put by the Fed on different indicators vary over time. To test this assumption, they estimate a monetary policy priority index by adding nonlinear endogenous weights to a conventional Taylor-type rule. The authors' results are intuitive and corroborated by historical evidence. Indeed, the monetary policy indexes show that the Fed's focus was mainly on inflation over the first 10 years of Greenspan's term as Fed chairman. Then, around 1998, economic activity became the Fed's main focus. This is consistent with the gain in the Fed's credibility over the Greenspan era.

2006-12

The Welfare Implications of Inflation versus Price-Level Targeting in a Two-Sector, Small Open Economy

Eva Ortega and Nooman Rebei

The authors analyze the welfare implications of simple monetary policy rules in the context of an estimated model of a small open economy for Canada with traded and non-traded goods, and with sticky prices and wages. They find statistically significant heterogeneity in the degree of price rigidity across sectors. They also find welfare gains in targeting only the non-traded-goods inflation, since prices are found to be more sticky in this production sector, but those gains come at the cost of substantially increased aggregate volatility. The authors look for the welfare-maximizing specification of an interest rate reaction function that allows for a specific price-level target. They find, however, that, overall, the higher welfare is achieved, given the estimated model for the Canadian economy, with a strict inflation-targeting rule where the central bank reacts to the next period's expected deviation from the inflation target and does not target the output gap.

2006-13

Guarding Against Large Policy Errors under Model Uncertainty

Gino Cateau

How can policy-makers avoid large policy errors when they are uncertain about the true model of the economy? The author discusses some recent approaches that can be used for that purpose under two alternative scenarios: (i) the policy-maker has one reference model for choosing policy but cannot take a stand as to how that model is misspecified, and (ii) the policy-maker, being uncertain about the economy's true structure, entertains multiple distinct models of the economy. The author shows how these approaches can be implemented in practice using as benchmark models simplified versions of Fuhrer and Moore and Christiano, Eichenbaum, and Evans.

2006-14

Forecasting Commodity Prices: GARCH, Jumps, and Mean Reversion

Jean-Thomas Bernard, Lynda Khalaf, Maral Kichian, and Sebastien McMahon

Three econometric specifications are considered that cover the most up-to-date models in the recent literature on commodity prices: (i) random-walk models with autoregressive conditional heteroscedasticity (ARCH) or generalized ARCH (GARCH) effects, and with normal or student-*t* innovations, (ii) Poisson-based jump-diffusion models with ARCH or GARCH effects, and with normal or student-*t* innovations, and (iii) mean-reverting models that allow for uncertainty in equilibrium price. The mean-reverting model with stochastic convenience yield outperforms, to a large extent, all other competing models for all forecast horizons, with high-frequency (daily and weekly) data; within the non-mean-reverting GARCH class of processes analyzed for these frequencies, models with jumps or asymmetries fare best, yet the latter remain dominated by the mean-reverting models. With monthly data, the mean-reverting model still fares well in comparison with the random-walk GARCH class; nevertheless, depending on the forecast horizon and evaluation criteria, non-mean-reverting models with GARCH-in-mean effects dominate to some extent, suggesting that expected risk has a non-negligible effect on price behaviour.

2006-15

LVTS, the Overnight Market, and Monetary Policy

Nadja Kamhi

Operational events in the Large Value Transfer System (LVTS) almost always result in a disturbance of the regular flow of payments. The author explores the link between payment flows and the overnight interest rate. She also explores the way that payments system frictions affect the overnight interest rate. Payments system frictions arise because LVTS participants lack full information on their own payment flows and those of others. This uncertainty diminishes as the final end-of-day settlement nears. By borrowing earlier in the day in the overnight market, however, participants can insure against being short at the final end-of-day settlement. The author first develops a general framework describing the role that payment flows and payments system frictions have on the overnight rate and then empirically tests the implications of this model. She finds that LVTS payment flows are an important determinant of pressure on the overnight interest rate.

2006-16

Benchmark Index of Risk Appetite

Miroslav Misina

Changes in investors' risk appetite have been used to explain a variety of phenomena in asset markets. And yet, popular indicators of changes in risk appetite typically have scant foundation in theory, and give contradictory signals in practice. The question is which popular indicator, if any, captures these changes. Kumar and Persaud offer an intuitively appealing argument regarding the effects of changes in risk appetite on asset prices in a portfolio, and Misina (2003) establishes the conditions under which these effects will be present. The author proposes a method that empirically implements these conditions and thus ensures that the resulting index can identify changes in risk appetite in the data. This index is then used to assess other risk appetite indexes used in practice. An example illustrates how the index can be used to help interpret price movements in foreign exchange markets.

2006-17

Risk-Cost Frontier and Collateral Valuation in Securities Settlement Systems for Extreme Market Events

Alejandro García and Ramazan Gençay

The authors examine how the use of extreme value theory yields collateral requirements that are robust to extreme fluctuations in the market price of the asset used as collateral. In particular, they study the risk and cost attributes of market risk measures by constructing a risk-cost frontier for the collateral pledged to cover exposures in a securities settlement system. The frontier can be used as a diagnostic tool to understand the risk-cost trade-off of different methodologies to calculate collateral value (haircuts) and select the most efficient alternative in a variety of settings.

2006-18

Working Time over the 20th Century

Alexander Ueberfeldt

From 1870 to 2000, the workweek length of employed persons decreased by 41 per cent in industrialized countries. The employment rate, employment per working age person, displays large movements but no clear secular pattern. This motivated the question: What accounts for the large decrease in the workweek length and developments in the employment rate over the past 130 years? The answer is given in a dynamic general-equilibrium model with supervisory and production workers. Over time, both types of workers become more productive. In a calibrated version of the model, productivity gains of supervisors account for a large fraction of the decline in the workweek length in Japan, the United Kingdom, and the United States. The model, augmented to include taxes, government spending, and technological progress, captures the movement in the employment rates of the three countries.

2006-19

Institutional Quality, Trade, and the Changing Distribution of World Income

Brigitte Desroches and Michael Francis

Conventional wisdom holds that institutional changes and trade liberalization are two main sources of growth in per capita income around the world. However, recent research suggests that the Frankel and Romer trade and growth finding is not robust to the inclusion of institutional quality. In this paper, the authors argue that this “trade and growth puzzle” can be explained once institutional quality is acknowledged as a determinant of the willingness to save and invest, and hence acknowledged as a determinant of long-run comparative advantage. The paper consists of two parts. First, the authors develop a theoretical model which predicts that institutions determine a country’s underlying comparative advantage: countries that have good institutions will tend to export relatively more capital-intensive (or sophisticated) goods compared with countries that have poor institutions; trade can magnify the effect of institutional quality on income, leading to greater income divergence than if countries remain in autarky. Second, using a panel of over 80 countries and 20 years of data, the authors find empirical support for their hypotheses.

2006-20

Examining the Trade-Off between Settlement Delay and Intraday Liquidity in Canada's LVTS: A Simulation Approach

Neville Arjani

The author explores a fundamental trade-off that occurs between settlement delay and intraday liquidity in the daily operation of large-value payment systems (LVPS), with specific application to Canada's Large Value Transfer System (LVTS). To reduce settlement delay, participants generally must maintain greater intraday liquidity in the system. Intraday liquidity and settlement delay can be costly for LVPS participants, and improvements in the trade-off are desirable. The replacement of standard queuing arrangements with a complex queue-release algorithm represents one such improvement. These algorithms are expected to lower intraday liquidity needs and speed up payments processing in an LVPS. Simulation analysis is used to empirically test this proposition for the case of Canada's LVTS. The analysis is conducted using a payment system simulator developed by the Bank of Finland, called the BoF-PSS2. The author shows that increased use of the LVTS central queue (which contains a complex queue-release algorithm) reduces settlement delay associated with each level of intraday liquidity considered, relative to a standard queuing arrangement. Some important issues emerge from these results.

2006-21

The International Monetary Fund's Balance-Sheet and Credit Risk

Ryan Felushko and Eric Santor

The authors examine the characteristics of International Monetary Fund (IMF) lending from the 1960s to 2005. They find that there has been an increase in portfolio concentration, that lending terms have effectively lengthened, and that the proportion of total lending that occurs due to exceptional access has risen dramatically. Moreover, the typical IMF borrower represents a greater risk burden than in previous periods. The authors estimate a model of expected credit loss for the IMF's portfolio and find that the credit risk being borne on the IMF's balance sheet is rising over time. This increase in the risk burden is supported by the use of alternative measures of balance-sheet risk: both the Basel II capital requirement approach and the market-based interest rate approach produce similar results.

2006-22

Launching the NEUQ: The New European Union Quarterly Model, A Small Model of the Euro Area and U.K. Economies

Anna Piretti and Charles St-Arnaud

The authors develop a projection model of the euro area and the United Kingdom. The model consists of two country blocks, endogenous to each other via the foreign demand channel. Each country block features an aggregate IS curve, a forward-looking Phillips curve, and an estimated forward-looking monetary policy reaction function. Potential output is estimated by means of a Hodrick-Prescott filter, conditioned by an equilibrium path generated by a structural vector autoregression. The Phillips curve is specified in terms of the output gap, and inflation dynamics are described by the polynomial adjustment cost (PAC) approach, as in Kozicki and Tinsley. The model delivers relatively accurate projections at a variety of forecast horizons and provides a useful tool for policy analysis. The authors' simulation results suggest that output and inflation exhibit a greater degree of persistence to shocks in the euro area than in the United Kingdom.

2006-23

Convergence in a Stochastic Dynamic Heckscher-Ohlin Model

Partha Chatterjee and Malik Shukayev

The authors show that, when trade is balanced period-by-period, the per capita output and consumption of a small open economy converge to an invariant distribution that is independent of the initial wealth. Further, at the invariant distribution, with probability one there are some periods in which the small economy diversifies. These results are in sharp contrast with those of deterministic dynamic Heckscher-Ohlin models, in which permanent specialization and non-convergence occur. One key feature of the authors' model is the presence of market incompleteness as a result of the period-by-period trade balance. Further, numerical simulations show that the convergence occurs more quickly as the magnitude of the shocks increases. Thus, the results extend the predictions of income convergence, standard in one-sector neoclassical growth models, to the dynamic multi-country Heckscher-Ohlin environment.

2006-24

Are Average Growth Rate and Volatility Related?

Partha Chatterjee and Malik Shukayev

The empirical relationship between the average growth rate and the volatility of growth rates, both over time and across countries, has important policy implications, which depend critically on the sign of the relationship. Following Ramey and Ramey, a wide consensus has been building that, in the post-World War II data, the correlation is negative. The authors replicate Ramey and Ramey's result and find that it is not robust to either the definition of growth rate or the composition of the sample. They show that the use of log difference as growth rates, as in Ramey and Ramey, creates a strong bias towards finding a negative relationship. Further, they exhaustively investigate this relationship, for various growth rates, across time, countries, within groups of countries, and within states of the United States. The authors use different methods and control variables for this inquiry. Their analysis suggests that there is no significant relationship between the two variables in question.

2006-25

Linear and Threshold Forecasts of Output and Inflation with Stock and Housing Prices

Greg Tkacz and Carolyn Wilkins

The authors examine whether simple measures of Canadian equity and housing price misalignments contain leading information about output growth and inflation. Previous authors have found that the information content of asset prices in general, and equity and housing prices in particular, are unreliable in that they do not systematically predict future economic activity or inflation. However, earlier studies relied on simple linear relationships that would fail to pick up the potential non-linear effects of asset-price misalignments. The authors' results suggest that housing prices are useful for predicting GDP growth, even within a linear context. Moreover, both stock and housing prices can improve inflation forecasts, especially when using a threshold specification. These improvements in forecast performance are relative to the information contained in Phillips-curve type indicators for inflation and IS-curve type indicators for GDP growth.

2006-26

Using Monthly Indicators to Predict Quarterly GDP

Isabel Yi Zheng and James Rossiter

The authors build a model for predicting current-quarter real gross domestic product (GDP) growth using anywhere from zero to three months of indicators from that quarter. Their equation links quarterly Canadian GDP growth with monthly data on retail sales, housing starts, consumer confidence, total hours worked, and U.S. industrial production. The authors use time-series methods to forecast missing observations of the monthly indicators; this allows them to assess the performance of the method under various amounts of monthly information. The authors' model forecasts GDP growth as early as the first month of the reference quarter, and its accuracy generally improves with incremental monthly data releases. The final forecast from the model, available five to six weeks before the release of the National Income and Expenditure Accounts, delivers improved accuracy relative to those of several macroeconomic models used for short-term forecasting of Canadian output. The implications of real-time versus pseudo-real-time forecasting are investigated, and the authors find that the choice between real-time and latest-available data affects the performance ranking among alternative models.

2006-27

Can Affine Term Structure Models Help Us Predict Exchange Rates?

Antonio Diez de los Rios

The author proposes an arbitrage-free model of the joint behaviour of interest and exchange rates whose exchange rate forecasts outperform those produced by a random-walk model, a vector autoregression on the forward premiums and the rate of depreciation, and the standard forward premium regression. In addition, the model is able to reproduce the forward premium puzzle.

2006-28

Estimation of the Default Risk of Publicly Traded Canadian Companies

Georges Dionne, Sadok Laajimi, Sofiane Mejri, and Madalina Petrescu

The authors investigate the hybrid contingent claims approach with publicly traded Canadian companies listed on the Toronto Stock Exchange. The authors' goal is to assess how their ability to predict companies' probability of default is improved by combining the companies' continuous market valuation (structural model) with the value given in their financial statements (non-structural model). The authors' results indicate that the predicted structural probabilities of default (PDs from the structural model) contribute significantly to explaining default probabilities when PDs are included alongside the retained accounting variables in the hybrid model. The authors also show that quarterly updates to the PDs add a large amount of dynamic information to explain the probabilities of default over the course of a year. This flexibility would not be possible with a non-structural model. The authors conduct a preliminary analysis of correlations between structural probabilities of default for the firms in their database. Their results indicate that there are substantial correlations in the studied data.

2006-29
The Turning Black Tide: Energy Prices and the Canadian Dollar
Ramzi Issa, Robert Lafrance, and John Murray

The authors revisit the relationship between energy prices and the Canadian dollar in the Amano and van Norden equation, which shows a negative relationship such that higher real energy prices lead to a depreciation of the Canadian dollar. Based on structural break tests, the authors find a break point in the sign of this relationship, which changes from negative to positive in the early 1990s. The break in the effect between energy prices and the Canadian dollar is consistent with major changes in energy-related cross-border trade and in Canada's energy policies.

2006-30
Multinationals and Exchange Rate Pass-Through
Alexandra Lai and Oana Secrieru

The authors examine the impact of multinational enterprises (MNEs) on exchange rate pass-through in an environment where an MNE engages in Cournot (quantity) competition with domestic and foreign rivals. When it locates all its production domestically, it engages in intrafirm trade (IT) in final goods. Otherwise, it is said to engage in international production (IP). Consistent with other studies on exchange rate pass-through under imperfect competition, the authors' analysis shows that exchange rate pass-through into domestic and foreign prices is incomplete. Moreover, the presence of an MNE increases the sensitivity of domestic market prices, and reduces the sensitivity of foreign market prices, to exchange rate movements, relative to arm's-length trade. Furthermore, IT domestic and foreign prices are more sensitive to exchange rate movements than their IP counterparts, and react in the opposite direction.

2006-31
Assessing and Valuing the Non-Linear Structure of Hedge Fund Returns
Antonio Diez de los Rios and René Garcia

Several studies have put forward the non-linear structure and option-like features of returns associated with hedge fund strategies. The authors provide a statistical methodology to test for such non-linear features with the returns on any benchmark portfolio. They estimate the portfolio of options that best approximates the returns of a given hedge fund, account for this search in the statistical testing of the contingent claim features, and test whether the identified non-linear features have a positive value. The authors find that not all categories of funds exhibit significant non-linearities, and that only a few strategies as a group provide significant value to investors. Individual funds may still provide value in an otherwise poorly performing category.

2006-32
Governance and the IMF: Does the Fund Follow Corporate Best Practice?
Eric Santor

The governance challenges facing the International Monetary Fund (IMF) are not simply limited to representation and voice, and the associated question of quota allocation. The author identifies governance issues that hitherto remained largely ignored by the literature and policy-makers alike. Specifically, he examines the governance issues that arise when (i) one or more shareholders hold controlling voting blocks, and (ii) principal-agent problems exist between the Executive Board and the Managing Director. Unsurprisingly, he finds that the IMF does not follow best practice. The author offers several proposals for governance reforms, including that the IMF should implement a form of "constrained discretion." Under this framework, the Executive Board would set the objectives and rules for the IMF on an annual basis. The Managing Director and the staff would be free to pursue these objectives, conditional on the rules. These respective reforms would improve accountability and hence the legitimacy of the IMF.

2006-33
Are Canadian Banks Efficient? A Canada–U.S. Comparison
Jason Allen, Walter Engert, and Ying Liu

The authors compare the efficiency of Canada's largest banks with U.S. commercial banks over the past 20 years. Efficiency is measured in three ways. First, the authors study key performance ratios, and find that Canadian banks are as productive as U.S. banks. Second, they investigate whether there are economies of scale in the production functions of Canadian banks and broadly comparable U.S. bank-holding companies (BHCs). They find larger economies of scale for Canadian banks than for the U.S. BHCs, which suggests that Canadian banks are less efficient in terms of scale, and have more to gain in terms of efficiency benefits from becoming larger. Third, the authors measure cost-inefficiency in Canadian banks and in U.S. BHCs relative to the domestic efficient frontier in each country (the domestic best-practice institution). They find that Canadian banks are closer to the domestic efficient frontier than are the U.S. BHCs.

2006-34
The Macroeconomic Effects of Non-Zero Trend Inflation
Robert Amano, Steve Ambler, and Nooman Rebei

The authors study the macroeconomic effects of non-zero trend inflation in a simple dynamic stochastic general-equilibrium model with sticky prices. They show that trend inflation leads to a substantial reduction in the stochastic means of output, consumption, and employment. It also leads to an increase in the variability and persistence of most aggregates. Price dispersion across firms unambiguously increases the welfare costs of inflation. The effects hold qualitatively no matter how sticky prices are modelled, but they are quantitatively much stronger under Calvo pricing.

2006-35
Survey of Price-Setting Behaviour of Canadian Companies
David Amirault, Carolyn Kwan, and Gordon Wilkinson

In many mainstream macroeconomic models, sticky prices play an important role in explaining the effects of monetary policy on the economy. Various theories have been set forth to explain why prices are sticky. The Bank of Canada's regional offices surveyed 170 Canadian firms for their views on price dynamics. The authors find that the most important motivators of price changes are price changes by competitors, changes in domestic input costs, and changes in demand. Surprisingly, but consistent with the results reported in Bils and Klenow, the survey evidence suggests that more than 50 per cent of firms change their prices more than four times a year. Moreover, the survey indicates that prices change more frequently than they did ten years ago, because of more intense competition and advances in information technology.

2006-36
Credit in a Tiered Payments System
Alexandra Lai, Nikil Chande, and Sean O'Connor

Payments systems are typically characterized by some degree of tiering, with upstream firms (clearing agents) providing settlement accounts to downstream institutions that wish to clear and settle payments indirectly in these systems (indirect clearers). The authors construct a model of a clearing agent with an indirect clearer to examine the clearing agent's incentives to lever off its upstream position to gain a competitive advantage in the retail payment services market. The model demonstrates that a clearing agent can attain this competitive advantage by raising the indirect clearer's costs, but that the incentive to raise these costs is mitigated by credit risk to the clearing agent from the provision of uncollateralized overdrafts to its indirect clearer. The results suggest that tiered payments systems, which require clearing agents to provide overdraft facilities to their indirect clearers, may result in a more competitive retail payment services market.

2006-37
Endogenous Borrowing Constraints and Consumption Volatility in a Small Open Economy
Carlos de Resende

Consumption volatility relative to output volatility is consistently higher in emerging economies than in developed economies. One natural explanation is that emerging economies are more likely to face borrowing constraints and, as a consequence, find it more difficult to use international capital markets to smooth consumption. The author investigates how much this mechanism alone can account for the relative consumption volatility differential between emerging and developed economies. His theoretical approach relies on a standard dynamic general-equilibrium model of a small open endowment economy that is subject to an endogenous borrowing constraint. The model for the constrained economy is calibrated to match Brazilian data during the period 1980–2001. The author's findings suggest that the model is capable of accounting for more than half of the observed relative consumption volatility differential.

2006-38
Conditioning Information and Variance Bounds on Pricing Kernels with Higher-Order Moments: Theory and Evidence
Fousseni Chabi-Yo

The author develops a strategy for utilizing higher moments and conditioning information efficiently, and hence improves on the variance bounds computed by Hansen and Jagannathan, and by Gallant, Hansen, and

Tauchen (the GHT bound). The author's bound incorporates variance risk premia. It reaches the GHT bound when non-linearities in returns are not priced. The author also provides an optimally scaled bound with conditioning information, higher moments, and variance risk premia that improves on the Bekaert and Liu optimally scaled bound. The author empirically illustrates the behaviour of the bounds using Bekaert and Liu's econometric models. He also uses higher moments and conditioning information to provide distance measures that improve on the Hansen and Jagannathan distance measures. The author uses these distance measures to evaluate the performance of asset-pricing models.

2006-39

Short-Run and Long-Run Causality between Monetary Policy Variables and Stock Prices

Jean-Marie Dufour and David Tessier

The authors examine simultaneously the causal links connecting monetary policy variables, real activity, and stock returns. Their interest lies in the fact that the dynamics of asset prices can provide key insights—in terms of information—for the conduct of monetary policy, since asset prices constitute a class of potentially leading indicators of either economic activity or inflation. This is of particular interest in the context of an inflation-targeting regime, where the monetary policy stance is set according to inflation forecasts. For the United States, the authors find no support for stock returns as a leading indicator of the macroeconomic variables considered, or for stock returns being influenced by those macroeconomic variables, except for one case: fluctuations in M1 tend to anticipate fluctuations in stock returns. For Canada, the results are much different. The authors show that there is a potential role for asset prices as a predictor of some important macroeconomic variables, namely interest rates, inflation, and output at policy-relevant horizons.

2006-40

Education and Self-Employment: Changes in Earnings and Wealth Inequality

Yaz Terajima

The author quantitatively studies the interaction between education and occupation choices and its implication for the relationship between the changes in earnings inequality and the changes in wealth inequality in the United States over the 1983–2001 period. Among households whose head is a college graduate, the ratio of average household earnings between the self-employed and workers increased by 57 per cent. At the same time, the ratio of the average household wealth increased by 137 per cent. These findings suggest that both earnings and wealth inequality increased over this period. Did this change in relative average earnings lead to the change in relative average wealth? The author builds on a model of wealth distribution to include education and occupation choices, where earnings opportunities are dictated by productivity processes that are education-occupation specific. The results show that this exercise leads to one-third of the change in the relative average wealth between college self-employed and college worker households.

2006-41

An Optimized Monetary Policy Rule for ToTEM

Jean-Philippe Cayen, Amy Corbett, and Patrick Perrier

The authors propose a monetary policy rule for the Terms-of-Trade Economic Model

(ToTEM), the Bank of Canada's new projection and policy-analysis model for the Canadian economy. They consider simple instrument rules such as Taylor-type and inflation-forecast-based rules. The proposed rule minimizes a loss function that reflects the assumed preferences of the monetary authority over inflation and output, as well as over the variability of its instrument. The authors also investigate how robust the proposed rule is with respect to a particular realization of shocks that differs from the historical distribution used to find the optimized rule.

2006-42

Linking Real Activity and Financial Markets: The Bonds, Equity, and Money (BEAM) Model

Céline Gauthier and Fu Chun Li

The authors estimate a small monthly macro-econometric model (BEAM, for bonds, equity, and money) of the Canadian economy built around three cointegrating relationships linking financial and real variables over the 1975–2002 period. One of the cointegrating relationships allows the identification of a supply shock as the only shock that permanently affects the stock market, and a demand shock that leads to important transitory stock market overvaluation. The authors propose a monetary policy reaction function in which the impact of a permanent inflation shock on the overnight rate is simulated and the future path of the overnight rate adjusted accordingly, to prevent any forecast persistent deviation from the inflation target. They introduce a technical innovation by showing under which conditions permanent shocks can be identified in a vector-error-correction model with exogenous variables.

2006-43

Efficient Hedging and Pricing of Equity-Linked Life Insurance Contracts on Several Risky Assets

Alexander Melnikov and Yuliya Romanyuk

The authors consider a policy that pays the maximum of the values of n risky assets at some maturity date T, provided that the policyholder survives to T. Such contracts incorporate financial risk, which stems from the uncertainty about future prices of the underlying financial assets, and insurance risk, which arises from the policyholder's mortality. The authors show how efficient hedging can be used to minimize expected losses from imperfect hedging under a particular risk preference of the hedger. They also prove a probabilistic result, which allows one to calculate analytic pricing formulas for equity-linked payoffs with n risky assets. To illustrate its use, explicit formulas are derived for optimal prices and expected hedging losses for payoffs with two risky assets. Numerical examples highlighting the implications of efficient hedging for the management of financial and insurance risks of equity-linked life insurance policies are also provided.

2006-44

The Long-Term Effects of Cross-Listing, Investor Recognition, and Ownership Structure on Valuation

Michael R. King and Dan Segal

The authors show that the widening of a foreign firm's U.S. investor base and the improved information environment associated with cross-listing on a U.S. exchange each have a separately identifiable effect on a firm's valuation. The increase in valuation associated with cross-listing is transitory, not permanent. Valuations of Canadian firms peak in the year of cross-listing and fall monotonically thereafter, regardless of the level of U.S. investor holdings or the ownership structure of the firm. Cross-listed firms with a 20 per cent or more blockholder attract a similar number of U.S. institutional investors as widely held firms, on average, but experience a lower increase in valuation at high levels of investor recognition. While U.S. investors are less willing to invest in firms with dual-class shares, these firms benefit more from cross-listing even when they fail to widen their U.S. investor base, suggesting that the reduction in information asymmetry between controlling and minority investors has a separate impact on valuation for firms where agency problems are greatest.

2006-45
The Role of Debt and Equity Finance over the Business Cycle
Francisco Covas and Wouter J. den Haan

The authors show that debt and equity issuance are procyclical for most listed U.S. firms. The procyclicality of equity issuance decreases monotonically with firm size. At the aggregate level, however, the authors' results are not conclusive: issuance is countercyclical for very large firms that, although few in number, have a large effect on the aggregate because of their enormous size. If firms use the standard one-period contract, then the shadow price of external funds is procyclical and the cyclicality decreases with firm size. This property generates equity to be procyclical and—as in the data—the procyclicality decreases with firm size. Other factors that cause equity to be procyclical in the model are a countercyclical price of risk and a countercyclical cost of equity issuance. The model (i) generates a countercyclical default rate, (ii) magnifies shocks, and (iii) generates a stronger cyclical response for small firms, whereas the model without equity does the exact opposite.

2006-46
Survey-Based Estimates of the Term Structure of Expected U.S. Inflation
Sharon Kozicki and P.A. Tinsley

Surveys provide direct information on expectations, but only short histories are available at quarterly frequencies or for long-horizon expectations. Longer histories typically contain only semi-annual observations of short-horizon forecasts. The authors fill in the gaps by constructing a 50-year monthly history of expected inflation at all horizons from one month to 10 years that is consistent with inflation data and infrequent survey data. In the process, some models that fit inflation well are found to generate forecasts that bear little resemblance to survey data. Also, survey data on near-term expectations are found to contain considerable information about long-horizon views. The estimated long-horizon forecast series, a measure of the private sector's perception of the inflation target of monetary policy, has shifted considerably over time and is the source of some of the persistence of inflation. When compared with estimates of the effective inflation goal of policy, these perceptions suggest that monetary policy has been less than fully credible historically.

2006-47

Stress Testing the Corporate Loans Portfolio of the Canadian Banking Sector

Miroslav Misina, David Tessier, and Shubhasis Dey

Stress testing, at its most general level, is an investigation of the performance of an entity under abnormal operating conditions. The authors focus on one set of entities—the Canadian banking sector—and investigate losses in the loans portfolio of this sector as a function of changing circumstances in the different industries in which these loans reside. These circumstances are characterized by means of one summary measure—sectoral probabilities of default—and this measure is modelled as a function of macroeconomic variables. Using this model, the authors assess the interrelationship between the macroeconomic environment and sectoral defaults, and perform a series of stress tests under different scenarios that are thought to be most pertinent to Canada. The tools underlying the authors' analysis are general and can be applied to other countries, as well as to other macroeconomic scenarios.

2006-48

Modelling Term-Structure Dynamics for Risk Management: A Practitioner's Perspective

David Jamieson Bolder

The author, in attempting to find a relatively simple term-structure model that does a reasonable job of describing interest rate dynamics for risk-management purposes, examines two sets of models. The first set involves variations of the Gaussian affine term-structure model by modestly building on the recent work of Dai and Singleton, and Duffee. The second set includes and extends Diebold and Li. After working through the mathematical derivation and estimation of these models, the author compares and contrasts their performance on a number of in- and out-of-sample forecasting metrics, their ability to capture deviations from the expectations hypothesis, and their predictions in a simple portfolio-optimization setting. He finds that the extended Nelson-Siegel model and an associated generalization, what he terms the "exponential-spline model," provide the most appealing modelling alternatives when considering the various model criteria.

2006-49

Canadian City Housing Prices and Urban Market Segmentation

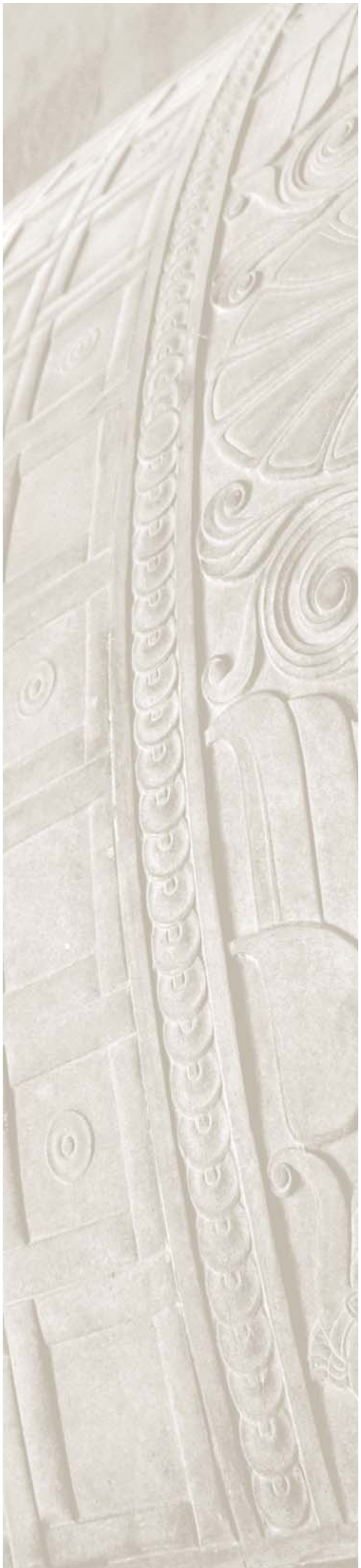
Jason Allen, Robert Amano, David P. Byrne, and Allan W. Gregory

The authors provide a detailed empirical analysis of Canadian city housing prices. They examine the long-run relationship between city house prices in Canada from 1981 to 2005 as well as idiosyncratic relations between city prices and city-specific variables. The results suggest that city house prices are only weakly correlated in the long run, and that there is a disconnect between house prices and interest rates. City-specific variables such as union wage levels, new-housing prices, and the issuance of building permits tend to be positively related to city existing-house prices. Surprisingly, there is mixed evidence with respect to standard measures of economic activity, such as labour force and per capita GDP.

Technical Report

No. 97
ToTEM: The Bank of Canada's New Quarterly Projection Model
Stephen Murchison and Andrew Rennison

The authors provide a detailed technical description of the Terms-of-Trade Economic Model (ToTEM), which replaced the Quarterly Projection Model (QPM) in December 2005 as the Bank's principal projection and policy-analysis model for the Canadian economy. ToTEM is an open-economy, dynamic stochastic general-equilibrium model that contains producers of four distinct finished products: consumption goods and services, investment goods, government goods, and export goods. ToTEM also contains a commodity-producing sector. Indeed, ToTEM adopts most of the features that distinguished QPM from its predecessors, including a well-defined steady state, an explicit separation of intrinsic and expectational dynamics, an endogenous monetary policy rule, and an emphasis on the economy's supply side. However, ToTEM extends this basic framework, allowing for optimizing behaviour on the part of households and firms, both in and out of steady state, in a multi-product environment.



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