Discussion

Peter Ireland

Introduction

As in all of his previous work, Francisco Ruge-Murcia brings state-of-the-art research methods to bear on interesting and important issues in macroeconomics, monetary economics, and, in this case, financial economics. Here, he skillfully constructs, estimates, and analyzes a model of the term structure of interest rates for Canada that goes beyond most others by explicitly accounting for the zero lower bound on the short-term nominal interest rate. In this way, Ruge-Murcia contributes to the literature and to our knowledge by focusing on the role that the zero lower bound has played in shaping term-structure dynamics as seen in the recent Canadian time-series data.

This exercise has immediate intuitive appeal. According to the expectations hypothesis of the term structure, longer-term interest rates reflect private agents' optimal forecasts of future short-term rates. By focusing on term-structure dynamics, therefore, one can draw inferences not only about the likelihood that the zero lower bound will impose a binding constraint on monetary policy today or in the very near future, but also about the probability that the zero lower bound might *become* a binding constraint on monetary policy when we look to more distant horizons.

Ruge-Murcia's results suggest, however, that the zero lower bound has played little if any role in shaping the term-structure dynamics observed in the recent Canadian data. The implications of these results will surely be of interest to at least two important constituencies. First, for economists who are interested in modelling and understanding the behaviour of the term structure of interest rates, the news is good: the results imply that simpler

models that abstract from the zero lower bound provide adequate descriptions of the recent Canadian data. And second, for monetary policy makers and their advisers at the Bank of Canada, the news is also good: the results imply not only that the zero lower bound is not currently imposing constraints on monetary policy in Canada, but also that financial market participants see little if any chance that the zero lower bound will become a problem at any time in the foreseeable future.

Ruge-Murcia's results may also have important implications for monetary policy makers in general, not just in Canada but around the world—and particularly at central banks that have followed or are considering following the Bank of Canada's lead by adopting inflation targeting as their official policy-making strategy. Thus, the comments that follow attempt to tease out some of the more general implications of Ruge-Murcia's results.

Canada and Japan

Step one in generalizing the implications of Ruge-Murcia's results consists of noting that this paper has a companion piece in a previous article by Ruge-Murcia (2003) that estimates and analyzes a very similar model of the term structure of interest rates for the Japanese economy. Not surprisingly, the results from that study stand in sharp contrast to those presented in this paper for Canada by showing that the zero lower bound *has* mattered considerably in governing the term-structure dynamics that appear in the Japanese data.

Step two in this generalization involves considering a simple equation,

$$r = r^* + a(y - y^*) + b(\pi - \pi^*), \tag{1}$$

depicting an interest rate rule for monetary policy of the kind proposed and made famous by John Taylor (1993). In equation (1), r denotes the short-term nominal interest rate, y represents some measure of real economic activity—perhaps detrended output, perhaps some more sophisticated measure of the output gap—π denotes the rate of inflation, and r^*, y^*, and π^* denote the average, or steady-state, values of the same three variables. Thus, this Taylor rule calls for the central bank to raise or lower the short-term nominal interest rate whenever output or inflation rises above or falls below its steady-state level.

In the recent literature that builds on Taylor (1993) by focusing on the behaviour of the economy under interest rate rules like equation (1), including the contributions published in Taylor (1999), much if not all of the emphasis is placed on the central bank's choice of the two response coefficients, labelled in equation (1) as a and b, measuring the

aggressiveness or vigour with which the central bank adjusts its interest rate instrument in response to movements in output and inflation. And, to be sure, by focusing on these two response coefficients, this recent literature has raised, and to a large extent helped resolve, a wide range of important questions concerning the effects of alternative monetary policies on the cyclical behaviour of output and inflation and about the specific features of optimal monetary policies under various assumptions about the workings of the economy. On the other hand, with so much of its emphasis on these two response coefficients, the recent literature on Taylor rules makes it easy to forget that when the central bank adopts an interest rate rule such as the one shown in equation (1), it must take responsibility not only for choosing values for *a* and *b*, but also for choosing a value for π^*, the average, steady-state, or *target* rate of inflation. For while in any given economy or economic model, the interaction between private tastes and technologies typically works to pin down a value for y^* (the steady-state level of output), the same cannot be said for π^*. In fact, *nothing* about private tastes and technologies reveals much about what the average rate of inflation is or will be in any given economy at any given time: the central bank, and the central bank alone, must choose a value for π^*. Hence, the underlying core rate of inflation embedded in π^* is, to echo Milton Friedman's (1968, 39) famous words, "always and everywhere a monetary phenomenon."

In choosing a value for π^*, however, the central bank may face a difficult trade-off. On the one hand, by choosing a value that is too high, the bank unnecessarily imposes welfare costs on private agents in the economy. And an extensive body of work in monetary economics, starting with early contributions by Bailey (1956) and Friedman (1969) and continuing with more recent papers by Cooley and Hansen (1989) and Lucas (2000), attempts to identify the sources of, and quantify the magnitude of, those welfare costs of inflation. On the other hand, since the Fisher equation $r^* = \rho^* + \pi^*$ determines the average nominal interest rate r^* as the sum of the steady-state real interest rate ρ^* (which, like the steady-state level of output y^*, is largely determined through the interaction of private tastes and technologies) and the central bank's choice of π^*, if the central bank chooses a value for π^* that is too low, it risks leaving too little room for monetary easing in the form of reductions in the short-term nominal interest rate in the event that the economy is hit by a series of adverse shocks. Far too little is known about the costs imposed by the zero lower bound when it becomes a binding constraint on monetary policy: two very different views on this subject are offered up in Krugman (1998), among the first in a series of recent papers to associate the zero lower bound with the Keynesian liquidity trap, and Meltzer (2001), which reviews the monetarist argument that the effects of monetary policy are transmitted to the real economy

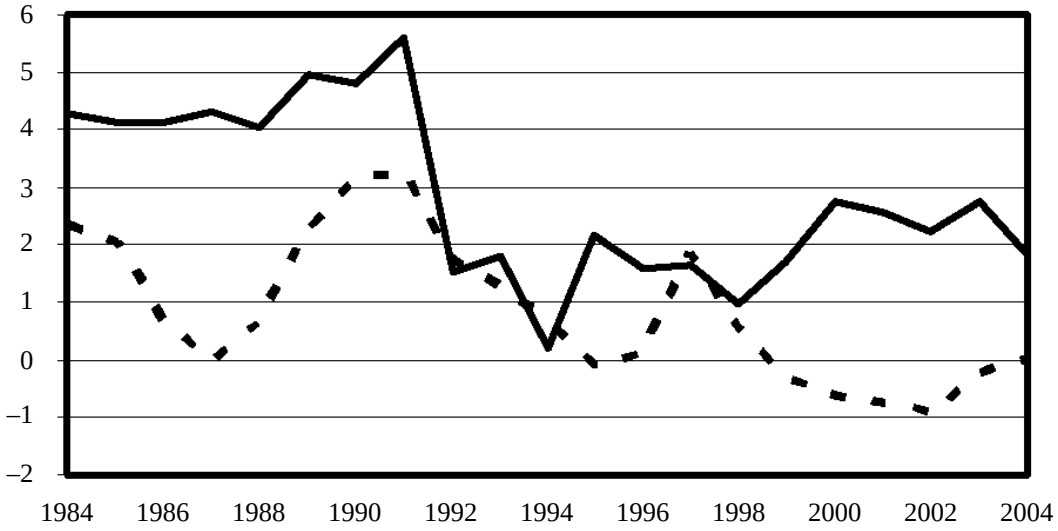
through a variety of channels involving a variety of variables, not just the short-term interest rate. Until further research clarifies the sources and magnitudes of these costs, however, prudence dictates that central banks adopt policies that steer away from the zero lower bound.

With these basic ideas in mind, one can now ask how the Bank of Canada and the Bank of Japan's choices of π^* have shaped the results presented in Ruge-Murcia's two papers. To help answer this question, Figure 1 plots the observed rates of inflation—corresponding to the variable π in equation (1)—in the two countries. The figure reveals that since 1994—over the past decade, that is—inflation has fluctuated around an average value of 0 per cent in Japan and 2 per cent in Canada. Based on these observations, one might reasonably conclude that $\pi^* = 0$ in Japan and $\pi^* = 2$ in Canada; and the institutional knowledge that, in fact, the Bank of Canada's official inflation target has stood at exactly 2 per cent over most of this period helps confirm the accuracy of these rough estimates from the raw data. These observations combine with Ruge-Murcia's results to suggest that the Bank of Japan's choice of $\pi^* = 0$ is probably too low, while the Bank of Canada's choice of $\pi^* = 2$ is high enough, to avoid the problems associated with the zero lower bound.

Again, these conclusions provide good news not only for policy-makers at the Bank of Canada, who can use them to gain assurance that their choice of a 2 per cent inflation target has helped them steer clear of the zero lower bound, but also for central bankers more generally. A 2 per cent inflation target would appear to be low enough so as not to impose unduly large welfare costs of inflation on private agents in the economy, but at the same time high enough to avoid the zero lower bound on the short-term nominal interest rate. Hence, the results suggest that the trade-off faced by central bankers when choosing an inflation target π^* can be satisfactorily managed and acceptably resolved.

Of course, unlike the Bank of Canada, the Bank of Japan does not publicly announce its inflation target—and this by itself may be a source of its recent problems with the zero lower bound. And so one might also ask whether the adoption of a formal inflation-targeting strategy can help a central bank avoid the zero lower bound. To answer this question, it would be useful to extend Ruge-Murcia's analysis by applying his model and methods to data from a wider sample of countries that includes those with inflation-targeting and non-inflation-targeting central banks and by looking for evidence of differing term-structure dynamics across those two groups of countries. Surely this task ranks high as a priority for future research.

Figure 1
Annual rates of consumer price inflation (in percentage)
for Canada (solid line) **and Japan** (broken line)



Data source: *Economic Report of the President* (2005).

Persistence and Volatility in the Short-Term Rate

In deriving his key results, Ruge-Murcia presents a number of preliminary findings that raise additional questions about how those results and their implications might be generalized. In his conference paper, for instance, he estimates this law of motion linking the shadow short-term nominal interest rate r_t^*, measuring the Bank of Canada's desired setting for the short-term rate in the absence of the zero lower bound, to lagged values of the actual short-term rate r_t and a random disturbance or error term ε_t:

$$r_t^* = 0.007 + 0.977 r_{t-1} - 0.053 r_{t-2} + 0.074 r_{t-3} + \varepsilon_t. \quad (2)$$

Likewise, for Japan, Ruge-Murcia (2003) reports estimates of a similar law of motion:

$$r_t^* = 0.019 + 0.598 r_{t-1} + 0.127 r_{t-2} + 0.214 r_{t-3} + \varepsilon_t. \quad (3)$$

Treating these equations as more conventional autoregressions for the short-term nominal interest rate—that is, temporarily ignoring the zero lower bound by assuming that $r_t^* = r_t$ for all $t = 1, 2, \ldots, T$, one finds that the largest roots of the autoregressive processes (2) and (3) equal 0.998 for Canada and 0.962 for Japan. These figures imply that while movements in short-term interest rates display considerable persistence in both countries,

somewhat more persistence is to be found in the Canadian than in the Japanese data.

What role, if any, does this additional persistence play in keeping the Canadian economy away from the zero lower bound? It would be useful to dig deeper into Ruge-Murcia's analysis to answer this question, not just for the sake of completeness but for substantive reasons, as well. Bernanke, Reinhart, and Sack (2004), for instance, view the Federal Open Market Committee's (FOMC) August 2003 announcement of its intent to maintain a policy of monetary accommodation for a "considerable period" as part of a broader strategy directed at minimizing the chances that its federal funds rate target would bump up against the zero lower bound. Thus, Ruge-Murcia's estimates of equations (2) and (3) for Canada and Japan might usefully shed light on the effectiveness of the FOMC's policy of adding persistence to downward movements in the short-term rate as a way of avoiding the problems associated with the zero lower bound.

Ruge-Murcia's analysis also makes clear that the *volatility*, as well as the average level, of the short-term nominal interest rate figures importantly in determining the probability that the zero lower bound will become a binding constraint on future policy. But, from a central banker's perspective, the level and volatility of the short-term nominal interest rate can be heavily influenced if not directly controlled by monetary policy actions. It might therefore be useful to extend Ruge-Murcia's analysis by adding more structure to his model for the short-term rate, perhaps by replacing the exogenous processes in equations (2) and (3) with Taylor-type rules more closely resembling equation (1) and, more important, by thinking harder about the fundamental sources of volatility in the Canadian and Japanese short-term interest rates. These topics, too, rank high on a list of priorities for future research.

Conclusion

The Taylor rule shown in equation (1), like Milton Friedman's (1968) famous "always and everywhere" dictum, makes clear that *every* central bank *must* choose an inflation target π^*. The only question that remains is whether a central bank should officially inform the public about its choice of π^*, as the Bank of Canada and other inflation-targeting central banks have done, or whether it should keep π^* hidden, as the Federal Reserve and the Bank of Japan still do.

I share Frederic Mishkin's view—reiterated in his contribution to this conference volume (Mishkin 2006)—that central banks benefit by providing more, rather than less, information about their choices of π^*. Mishkin's own

work, described, for example, in Bernanke, Laubach, Mishkin, and Posen (1999), provides compelling evidence that inflation-targeting strategies help improve economic performance by keeping nominal interest rates low. This new paper by Francisco Ruge-Murcia contributes to the same side of the debate by suggesting that inflation-targeting strategies can also help improve economic performance by avoiding the problems associated with the zero lower bound—that is, by keeping nominal interest rates low, but not *too* low.

References

Bailey, M.J. 1956. "The Welfare Cost of Inflationary Finance." *Journal of Political Economy* 64 (2): 93–110.

Bernanke, B.S., T. Laubach, F.S. Mishkin, and A.S. Posen. 1999. *Inflation Targeting: Lessons from the International Experience*. Princeton: Princeton University Press.

Bernanke, B.S., V.R. Reinhart, and B.P. Sack. 2004. "Monetary Policy Alternatives at the Zero Bound: An Empirical Assessment." *Brookings Papers on Economic Activity* (2): 1–78.

Cooley, T.F. and G.D. Hansen. 1989. "The Inflation Tax in a Real Business Cycle Model." *American Economic Review* 79 (September): 733–48.

Economic Report of the President. 2005. Washington: United States Government Printing Office, February.

Friedman, M. 1968. "Inflation: Causes and Consequences." In *Dollars and Deficits: Living with America's Economic Problems*, 21–71. Englewood Cliffs: Prentice-Hall.

———. 1969. "The Optimum Quantity of Money." In *The Optimum Quantity of Money and Other Essays*, 1–50. Chicago: Aldine Publishing Company.

Krugman, P.R. 1998. "It's Baaack: Japan's Slump and the Return of the Liquidity Trap." *Brookings Papers on Economic Activity* 0 (2): 137–87.

Lucas, R.E., Jr. 2000. "Inflation and Welfare." *Econometrica* 68 (2): 247–74.

Meltzer, A.H. 2001. "The Transmission Process." *The Monetary Transmission Process: Recent Developments and Lessons for Europe*, edited by Deutsche Bundesbank, 112–30. New York: Palgrave.

Mishkin, F.S. 2006. "The Inflation-Targeting Debate." This volume.

Ruge-Murcia, F.J. 2003. "Some Implications of the Zero Lower Bound on Interest Rates for the Term Structure and Monetary Policy." Université de Montréal.

Taylor, J.B. 1993. "Discretion Versus Policy Rules in Practice." *Carnegie-Rochester Conference Series on Public Policy* 39 (December): 195–214.

———. 1999 (ed.). *Monetary Policy Rules*. Chicago: University of Chicago Press.