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Optimal exchange-rate policy in a low interest rate environment

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This paper examines optimal monetary policy with an explicit zero lower bound in a small open-economy model. The paper finds that the gains from commitment are increasing in the openness of the economy while the optimal rate of inflation is decreasing in the openness of the economy. These results imply that the main findings of Adam and Billi (2007) for a closed-economy model are also true for an open-economy model. Finally, the paper finds that the effectiveness of the exchange-rate channel as a stabilization tool in the low interest rate environment depends on whether the central bank can make a credible commitment. If the central bank cannot commit and makes monetary-policy decisions on a discretionary basis, the optimal path of the nominal exchange rate will exhibit an appreciation, rather than depreciation as suggested in the literature. *J. Japanese Int. Economies* **23** (3) (2009) 264–282. Department of Economics, University of North Florida, 1 UNF Drive, Jacksonville, FL 32224, USA.

1. Introduction

The recent experience of low interest rates in many countries has led to considerable interest in the design of monetary policy in the presence of a zero lower bound on nominal interest rates. Such a low interest rate environment presents a particular problem for monetary policy since the effectiveness of

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short-term nominal interest rates, a main instrument for most central banks, could be limited by the zero lower bound. Particularly, the central bank will not be able to offset severe contractionary disturbances by lowering the nominal interest rate by the desired amount. Thus, the central bank will not be able to stimulate the economy via the standard interest-rate channel.

Academics and policymakers alike have made proposals regarding the conduct of monetary policy in the presence of such a constraint. One interesting approach that has been widely studied is for the central bank to resort to the exchange-rate channel and use exchange rates as a policy instrument, if the interest-rate channel becomes ineffective due to the zero lower bound. Prominent studies based on this approach include Orphanides and Wieland (2000), Svensson (2001), McCallum (2002) and Coenen and Wieland (2003, 2004). In a broader context, this is also related to a growing literature in which many authors have emphasized the importance of exchange rates as a distinct policy instrument in managing aggregate demand.[1]

This is indeed the strategy pursued by many real-world central banks,of which the most interesting are those in the Far East. Having experienced one of the lowest short-term nominal interest rates in the recent years, several Asian central banks have actively pursued several measures to influence their exchange rates. Even so, it appears that these central banks, especially those under floating exchange rates, have failed to achieve exchange rates that are deemed to be appropriate for their economic conditions. This raises a question whether such exchange-rate policy is desirable, especially if the attempt to achieve the target exchange rates leads to a conflict with other policy objectives. And in the case that such policy is indeed desirable, what is the implementation strategy that will allow the central banks to achieve their target exchange rates?

This paper sets forth a framework to study optimal monetary policy in a small-open economy when the nominal interest rate is constrained by the zero lower bound. This paper relies on a full dynamic model with an explicit bound, under the standard assumptions of uncertainty and rational expectations, and derives optimal monetary policy under commitment as well as under discretion. Thus, this paper is closely related to Adam and Billi (2006, 2007) who studied optimal monetary policy in the presence of the zero lower bound but in a closed-economy model. It should be noted that extending the analysis of Adam and Billi into the open-economy setting is not straightforward. For one thing, with the standard assumptions of uncertainty and rational expectations, there exists no closed-form solution to the problem of optimal monetary policy with an explicit zero lower bound. To solve such problems, one has to resort to numerical analysis. In this paper, I rely on the collocation method, which is also used in Adam and Billi (2006, 2007).[2]

Like most algorithms in numerical analysis, a drawback of the collocation method is that the method may not work when applied to a model larger than the canonical closed-economy DSGE model. This is known as the *curse of dimensionality*, a situation in which numerical-analysis algorithms fail when applied to a large system of equations. As a contribution to the literature, this paper presents a strategy to cope with the curse of dimensionality when applying the collocation method to multi-sector models, such as an open-economy DSGE model.

This paper derives three main results. First, the gains from commitment are increasing in the openness of the economy. This result implies that the main finding of Adam and Billi (2007) for a closed-economy model, that the welfare gains from policy commitment are more important once the zero lower bound is taken into account, is true for an open-economy model.

Second, the optimal rate of inflation is decreasing in the openness of the economy. This result is consistent with the main finding of Billi (2007) for a closed-economy model that the optimal rate of inflation may not be as high as normally thought by policymakers.

Finally, in response to a contractionary disturbance, the nominal exchange rate depreciates under the commitment equilibrium; however, under the discretionary equilibrium, the nominal exchange rate appreciates. Svensson (2004) finds, in a stylized, three-period model, that when the central bank pursues optimal policy under commitment, it is optimal to create a nominal depreciation to offset a decline in the natural interest rate. The result in this paper that when the central bank instead follows

[1] See for example Taylor (2001), Edwards and Yeyati (2005) and Edwards (2006).

[2] Several other methods to solve the class of problems considered in the paper are also available. See for example the general interpolation method developed by Billi (2007).