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The asymmetric reaction of monetary policy to inflation and the output gap: Evidence from Canada

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ABSTRACT

This paper empirically analyzes the interest rate behavior of the Canadian monetary authorities by taking into account possible asymmetries in the loss function. We employ a switching regime framework using two estimation strategies: First, we follow Caner and Hansen's (2004) threshold approach. Under this procedure we estimate, using the Taylor empirical rules, the threshold values. Second, to infer the monetary policy preferences and have the best interpretation of the parameters, we use these threshold values to estimate the specification of asymmetric policy reaction function following Favero and Rovelli's (2003) approach. The results reveal that the Canadian monetary authorities showed asymmetric preferences; hence its reaction function can be better modeled as a nonlinear model. The results also imply that the monetary authorities' preferences have changed between different subperiods and different regimes. In particular, the parameter associated with the implicit target of inflation has been reduced significantly. We find strong statistical support for this decline, a result that is consistent with previous findings by Favero and Rovelli (2003) for the case of US and Rodríguez (2008) for Canada. The main contribution of this paper is to make out the presence of nonlinearities and asymmetries in the Canadian reaction function and to be able to interpret the parameters associated with the preferences of the central bank. This provides empirically interesting extension to Rodriguez (2008).

1. Introduction

The positive theory of monetary policy in industrial countries has reached a broad consensus since the influential paper of Taylor (1993). Monetary policy is conceptualized as follows: policy authorities minimize a linear combination of the quadratic central bank loss function of inflation and output from their respective targets (the inflation and the output gaps in what follows), and the main policy instrument is the short term rate of interest. The majority of the literature of the last decade has implemented this perspective by estimating Taylor rules or reaction functions in which the short term rate is a linear function of the, currently expected, future values of the inflation and of the output gaps (Clarida et al., 1998, 2000). It is well known that, as a theoretical matter, such linear reaction functions are obtained when the expected value of a loss function that is quadratic in the inflation and output gaps is minimized subject to a linear dynamic structure of the economy.

More recently some of the literature has considered the possibility that, as a positive matter, the loss function of monetary policymakers may not be quadratic and consequently the Taylor rules derived from such functions are not necessarily linear. For example, monetary authorities may dislike positive inflation deviations more than negative ones, or make more efforts to reduce the output gap when the inflation goal has been achieved. The public dislikes unemployment more than inflation, especially when inflation rates are low; then, during recessions voters may prefer an increase in inflation (to reduce unemployment) that is larger than the decrease in inflation they would want (to increase unemployment) during booms. Since central bankers respond in part to the political power of policymakers, they may reflect some of these preferences. Blinder (1998) for instance suggests that political demands may lead to asymmetric central bank behavior.[1] This suggests that during normal times the central banks may be more averse to negative than to positive output gaps. In fact, despite its analytical convenience, a quadratic loss function that penalizes positive and negative output gaps to the same extent does not appear to be realistic.

Evidently, policymakers are averse to negative output gaps but it is less evident that they are, given inflation, equally averse to positive output gaps. They may even, for a given inflation rate, be indifferent between different magnitudes of positive output gaps. Cukierman (2000, 2002) shows that in the last case, and in the presence of

[1] In most situations, the central bank will take far more political heat when it tightens preemptively to avoid higher inflation than when it eases pre-emptively to avoid higher unemployment.

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uncertainty and rational expectations, there is an inflation bias even if the output target of the central banks is equal to the potential level. Cukierman and Muscatelli (2008) refer to central bank loss functions that display this type of asymmetry as recession avoidance preferences (RAP). In the presence of uncertainty about future shocks such an asymmetry leads the central bank to take more precautions against negative than against positive output gaps. In their papers, Cukierman and Gerlach (2003) and Ruge-Murcia (2003) test this hypothesis empirically. Using a natural rate framework and cross sectional data for the OECD countries, Cukierman and Gerlach (2003) find evidence supporting a half quadratic specification of output gap losses.[2] In a similar study, Doyle and Falk (2006) arrive at the same conclusions. Ruge-Murcia (2003), using a natural rate framework and time series data for the US, finds that it provides a better explanation for the behavior of US inflation than does the Barro and Gordon (1983) inflation bias model.

On the other hand, during periods of inflation stabilization in which monetary policymakers are trying to build up credibility, they may be more averse to positive than to negative inflation gaps of equal size. Following Cukierman and Muscatelli (2008), we refer to objective functions that display this type of asymmetry as inflation avoidance preferences (IAP). In the presence of uncertainty about future shocks this leads policymakers to react more vigorously to positive than to negative inflation gaps.

Most studies about the so-called asymmetric preferences are concentrated on the U.S. and European cases. To the best of our knowledge, no similar work has been done for Canada. We allow asymmetric preferences for the central bank loss function. In addition, we employ an intertemporal specification of the reaction function, which is derived from the central bank's objective function.

Asymmetric objectives generally lead to nonlinear reaction functions. To understand the meaning of such theoretical nonlinearities for the loss functions of monetary policymakers, this research provides an empirical assessment of the monetary policy rules in Canada for the period 1961:1 to 2008:4. We are trying to answer the question of whether the preferences for inflation and output gap of the Bank of Canada are asymmetric. In other words, this study investigates whether there is any evidence of asymmetries in the revealed preferences of the Canadian monetary policymaker. Our analysis introduces a threshold effect in a central bank loss function and then we test the relevance of the underlying nonlinearity hypothesis. The contribution of this paper is to provide empirical evidence supporting the idea that the preferences of the Bank of Canada may not be symmetric.

There is a growing literature that explores both the existence and the effects of asymmetries or nonlinearities in monetary policy rules. Most of this research has focused on the estimation of nonlinear policy reaction functions exploiting the well-known result that if an asymmetry in central bank preferences exists, then the optimal policy rule is nonlinear (see Bec et al., 2000; Kim et al., 2002; Martin and Milas, 2004). However, evidence of nonlinearity in policy reaction functions may be ultimately uninformative about the asymmetry of the policymaker's loss function. The reason is that policy reaction coefficients, as complex convolutions of the structural parameters, do not reveal the policymaker's preferences. Dealing with this issue requires the specification of a structural model of the economy so as to uncover the coefficients of the policymaker's loss function. Empirical studies using this structural approach are much more scarce, and seem limited to Dolado et al. (2005) and Surico (2003, 2007a,b). Assuming a linex function for the central bank's loss function and allowing for nonlinearities in the AS curve, Dolado et al. (2005) find that the optimal monetary policy rule must include the conditional variance of inflation as an argument. However, their model induces asymmetric responses only when the AS curve is nonlinear. Their empirical estimations for the U.S. suggest the existence of a nonlinear Fed's monetary policy reaction during the Volcker–Greenspan period (post-1982) driven by asymmetric preferences regarding inflation deviations instead of convexities in the AS curve. According to this result, over this period the Fed would have weighted more severely positive inflation deviations than negative ones. For the previous Burns–Miller period (pre-1979), their estimations cannot reject the existence of quadratic preferences. Surico (2007a,b) shows that if the central bank has a cubic specification for the loss function and takes discretionary actions in a standard New Keynesian Model, then the optimal monetary policy reaction must add squared terms of inflation deviations and output gap. Using U.S. data, he finds asymmetric preferences of the Fed with respect to the output gap in the pre-Volcker era. During this period, this kind of preferences induced stronger reactions to output contractions than expansions of the same magnitude.

Both these papers, however, seem to have some drawbacks. Dolado et al. (2000) have to restrict their policymaker loss function to a regime of strict inflation targeting and thus are not able to test for Cukierman's asymmetry.[3] Furthermore, their econometric strategy is not a truly simultaneous estimation of macro systems, as the conditional variance of inflation included in the optimal policy reaction function is generated in a first step prior to the rule estimation. In turn, Surico (2003, 2007) models the structure of the economy with purely forward-looking equations and with the instantaneous transmission of interest rate changes to output and inflation. The resulting lack of persistence and of policy lags implies that his model is not data-consistent. Outstanding to these problems, it is hard to assess whether Dolado et al.'s and Surico's empirical results on the US case are incompatible or complementary.

While the literature of formal analysis of central bank preference asymmetry, just briefly reviewed, exposes the need for methodological contributions, it also reveals that the Canadian case has barely been studied to date. Considering these developments, our contribution to this literature is to find new evidence on the revealed preferences of the Canadian monetary policymakers. This evidence is extracted using a framework that allows for testing for asymmetries in the central bank loss function in a given macroeconomic structure. Our framework extends the models of Favero and Rovelli (2003) and Rodríguez (2008) which take into account nonlinearities in the central bank loss function. Such nonlinearities are clearly identified with asymmetries in the policymaker's loss function. In doing so, we are able to identify and, thus, retrieve the coefficients of the policymaker's preferences and of the macroeconomic structure. Moreover, to discriminate between recession avoidance preferences and inflation avoidance preferences,[4] the framework may also detect asymmetries in interest rate smoothing, which are not taken into account by Cukierman and Muscatelli (2008).

The paper is organized as follows. Section 2 presents the Canadian's monetary policy framework. Section 3 sets up the model and solves the optimization problem of to the central bank. Section 4 describes the data and discusses the empirical results. Section 5 concludes.

2. Canadian's monetary policy framework: a brief history

In response to the persistence of high inflation during the 1970s and the beginning of 1982, the Bank of Canada adopted a narrowly defined monetary aggregate (M_1) as its intermediate target variable during the period 1975–1982. When this aggregate became increasingly unreliable and turned out not to have been all that helpful in achieving the desired lessening of inflation pressures, it was eventually dropped as a target in 1982. Because of the long lags and indirect connections between the instrument(s) and the ultimate goal of monetary policy, central banks have found it helpful to make use of intermediate targets or indicators. Over the years, the Bank of Canada moved away from the use of monetary aggregates as intermediate targets because financial market

[2] In this specification losses from negative output gaps are quadratic and, given inflation, there are no losses from positive output gaps.

[3] See Cukierman (2000, 2002).

[4] See Cukierman and Muscatelli (2008) for more detail.