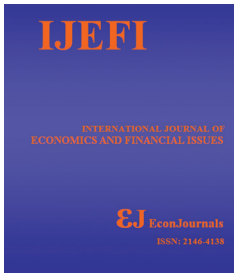

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Monetary Policy Response to Exchange Rates: An Empirical Investigation

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ABSTRACT

Notwithstanding exchange rate stability concerns in practice, exchange rate arguments are often omitted from monetary policy analysis and simple interest rate rules do not comprise exchange rate arguments even in small open economy set-ups. In order to identify the role of exchange rates in monetary policy conduct, we append them into a Taylor type of rule and examine their effect on policy interest rates in the US, UK, Canada, and Norway by utilizing general method of moments (GMM). The results suggest that for big and relatively closed economies, such as the US, exchange rate movements do not lead to significant response in policy interest rates. Nevertheless, for small open economies, both exchange rate variability and exchange rate levels are significant in monetary policy conduct.

Keywords: Exchange Rate Stability, Monetary Policy, General Method of Moments Method
JEL Classifications: E43, E52, E58, F31

1. INTRODUCTION

Concerns about exchange rate stability and its management play a significant role in practice. It has often been at the center of major global and regional economic systems and a source of controversy at national policy arrangements. For instance, in 1944 the Bretton Woods System (BWS) was established to rebuild the financial and price stability and international economic integration that had ceased to exist during the interwar years. A major component of the BWS was pegging the currencies of participating countries to the U.S. dollar (USD) which entitled USD to assume the role of gold under the gold standard era.

After the collapse of the BWS in 1971, currencies of major industrial countries were allowed to flow freely against the USD. This promptly raised concerns among European policy makers regarding exchange rate stability; though it wasn't until 1979 that a regional monetary arrangement, The European Monetary System (EMS), could be established. Two principal components of this arrangement were the definition of the European Currency Unit and the introduction of the European exchange rate mechanism (ERM). The EMS was aimed at promoting monetary and exchange rate stability by closer monetary policy cooperation among the member countries. However, ERM also came to a halt due to some speculative attacks in 1992 and 1993.

Today most countries follow "managed floating" or "limited flexibility" exchange rate systems (rather than "free floating"), where central banks (CB) keep foreign currencies in their reserves and occasionally intervene in foreign exchange markets. Moreover, Calvo and Reinhart (2002) show that even emerging market economies that claim to follow floating exchange rate regimes, in practice try to stabilize their exchange rates either by direct intervention in the forex markets or through policy interest rate adjustments.

At the national level, China, for instance, has long been criticized for keeping its currency under-valued (weak yuan has been blamed as a source of recessions in many countries). Despite the continuous appreciation of yuan since 2005, the USA especially continues to ask China to allow the yuan be at its "true" or "freely floating" level[1]. Likewise, Swiss National Bank (SNB) abandoned their floating exchange rate regime by releasing a

1 In February 2014, the Central Bank of China decided to weaken the yuan by allowing it to float around a benchmark, which is set each morning by the bank; the bank decided to lower the benchmark gradually.

"communication" in September 2011. Due to the global financial crisis and the subsequent debt crisis in the Eurozone, Switzerland turned out to be a safe haven for the region. The corresponding capital flow to Switzerland elevated the value of franc. Considering the competitiveness of Swiss exporters, the SNB eventually announced that it would take any necessary measures to keep the euro/franc exchange rate below 1.20[2]. An even more explicit declaration of exchange rate stability concerns came from a former Bank of England (BOE) Governor Eddie George. In a speech, George noted that the Bank is concerned about exchange rate stability as it recognizes its role in promoting more balanced economics growth (George, 1999).

Hence, exchange rate stability seems to be a major concern for monetary policy makers. In spite of its central role in practice, however, exchange rate stability concerns are often omitted from theoretical arguments. For instance, in his seminal paper, Taylor (1993) shows that the Federal Reserve System (Fed) adjusts policy interest rates in response to deviation of inflation from a target level and deviation of output from its natural level, without any reference to exchange rates. While for a big and relatively closed economy, such as the US, exchange rates may not have a significant role in monetary policy conduct, exchange rate arguments are also neglected in the monetary policy analysis of small open economies, where exchange rate level and its stability is a major concern (Svensson, 2003).

This paper investigates whether the observed aggregate exchange rate concerns in monetary policy arrangements could be identified in the monetary policy conduct of a sample of small open economies. Accordingly, we test whether the CBs of England, Canada and Norway take the exchange rate into consideration while setting their policy interest rates. As a reference point, we also investigate whether monetary policy makers in the US are concerned about the exchange rate level.

Owing to its accuracy in predicting policy interest rates, Taylor types of rules have become a popular tool for monetary policy analysis. We also employ a Taylor rule in our analysis and we utilize the generalized method of moments (GMM) method in order to determine whether exchange rate concerns (in addition to output and inflation) entail changes in policy interest rates. The results suggest that, besides their concerns about main economic variables, the BOE, the Bank of Canada (BOC), and the CB of Norway (Norges Bank, NB) are all concerned about exchange rate stability and they tend to keep their exchange rates competitive against other major currencies. On the other hand, for the US, while exchange rate concerns seem to be important in interest rate setting practices, the exchange rate coefficient is not significant at 10 percent significance level.

The paper is organized as follows: The following section reviews the current monetary policy frameworks that major CBs utilize. Section three presents the methodology and the data. Empirical results are presented in section four. The final section presents the conclusion.

2. EXCHANGE RATE ARGUMENTS IN MONETARY POLICY FRAMEWORKS

Despite its imperative role in small open economies, exchange rate arguments are seldom included in monetary policy frameworks or in simple interest rate rules. For instance, inflation targeting (IT) has become a popular monetary policy framework and has been utilised by a number of countries since it was first introduced by New Zealand in 1990[3]. The basics of the IT framework constitute setting an explicit inflation rate target by the CB; advising the public that price stability is the primary goal of monetary policy; enhancing the transparency of the CB regarding its plans, objectives, and decision making for the monetary policy; and improving the accountability of the CB for the target inflation rate. In effect, IT does not specify a formula for the operating practices of CBs; it imposes only a long term constraint on monetary policy objectives.

While the IT framework allows for short term discretion for viable policy concerns, such as output, employment and external competitiveness, Mishkin (2002) argues that the implication of IT requires a flexible exchange rate regime and as such it is a drawback of the framework, especially for emerging market economies. Brenner and Sokoler (2010) also note that an IT regime cannot coexist with any governmental intervention to foreign exchange markets; according to them, for IT policy to be sustainable, the exchange rate has to be determined solely by market forces. In accordance with these arguments, within the IT framework, the exchange rate is typically considered only by reference to its effect on inflation.

As an exception, Svensson (2000) analyzes IT in an open-economy set-up and considers exchange rate stability to be an integral part of the decision making process. The author analyzes effects of strict IT where inflation is the only objective of monetary policy and flexible IT, where monetary policy may have additional objectives, such as output stabilization. He finds that while strict IT effectively stabilizes inflation, it generates a significant fluctuation in real exchange rates and other variables due to the active use of instruments to achieve the target inflation rate. Flexible IT, on the other hand, generates less variability in macro variables and still stabilizes inflation over the long term. Even though the author does not introduce an exchange rate variability argument into CB loss function, he still suggests applying flexible IT as it produces less exchange rate variability in open economies.

Regarding the countries that are analyzed in this paper, Canada is one of the first countries that adopted IT (in 1992). Following the breakdown of the exchange rate peg in Europe, the UK also adopted IT in 1992 as a nominal anchor to maintain a disciplined monetary policy (Bernanke and Mishkin, 1997). NB also maintains

2 In January 2015 SNB announced that it abandoned the 1.20 currency ceiling. One reason for abandoning the currency ceiling was the announcement of European Central Bank's quantitative easing (QE) plans. The SNB would not be able to manage gross flow of capital that would emanate from the QE.

3 Martinez (2008) lists 22 industrial, emerging and transition market economies that have adopted inflation targeting after New Zealand.

IT policy. While the US used to follow implicit IT until 2012, the Fed also introduced explicit IT commencing from 2012. Hence, the IT framework and the relevance of the exchange rate argument within this context is most relevant for our subject countries.

While conducting monetary policy, the main instrument that all major CBs use is policy interest rates; Taylor type of interest rate rules are widely used to describe their interest rate setting behavior. Taylor (1993) shows that the Fed's interest rate setting practices can be represented by adjustments in policy interest rates in response to deviation of inflation from a target level and deviation of output from its natural level. The corresponding simple monetary policy rule reads:

$$i_t = r + \pi_t + g_\pi \bar{\pi}_t + g_y \bar{y}_t + \varepsilon_t \quad (1)$$

Where, i is the policy interest rate; r is the neutral real interest rate; $\bar{\pi}$ is the inflation rate; $\bar{\pi}$ is the deviation of inflation from its target level; $\bar{y}$ is deviation of output from its natural level and ε is stochastic error term.

The underlying loss function reads:

$$\min \frac{1}{2}\gamma(\pi-\pi^*)^2 + \frac{1}{2}(y-y_n)^2 \quad (2)$$

Where π^* is the target level of inflation and y_n is the natural level of output. That is, the CB minimizes the deviation of output from its natural level and deviation of inflation from its target level.

As in the IT framework, however, exchange rate concerns are mostly omitted from Taylor type of rules even in open economy settings: The exchange rate does not enter the policy makers' loss function and the policy interest rate does not react to exchange rates. While the omission of exchange rate concerns in monetary policy rules is recognized in the literature, it is often explained by the implicit effect of exchange rate movements on policy interest rates. For instance, Clarida et al. (2001) explain the omission of the exchange rate in monetary policies with reference to the isomorphism between closed and open economies. That is, the authors argue that the difference between closed and open economies arises from terms of trade considerations, where the exchange rate affects flows of export and import. Nevertheless, the authors show that under certain conditions, the terms of the trade gap is proportionate to the output gap and hence, an open economy CB's loss function may take the standard closed economy form: A quadratic loss function in the output gap and inflation that approximates household preferences.

In this line of argument, Taylor (2001) argues that an exchange rate appreciation would subsequently result in a reduction in GDP due to the expenditure switching effect and a fall in inflation owing to lower import prices and lower domestic production. With rational expectations in effect, the anticipated fall in GDP and inflation would lead market participants to expect a reduction in policy interest rates, which in return results in lower long-term interest rates. Since the indirect effects of exchange rate movements already alter long term interest rates, Taylor (2001) concludes that an explicit exchange rate argument in interest rate rule would be redundant or may even harm monetary policy performance.

While such arguments account for the effect of exchange rate on the overall economy, they do not consider exchange rate as a separate variable in CBs' loss function. Hence, these arguments may underestimate the cost of exchange rate fluctuations in small open economies (Taylor, 2002).

Indeed, there have been some attempts to include the exchange rate into simple interest rate rules. For instance, pointing out the significance of exchange rate channel (in addition to interest rate channel) in open economies, Ball (1998) appended (a change in the real) exchange rate into open-economy interest rate rules. As the author recognizes, the interest rate rule that he suggests is in essence a monetary condition index (MCI). MCI was first developed by the BOC in the early 1990s in an attempt to incorporate exchange rate directly into the conduct of monetary policy. The rationale for developing MCI is that, if variables other than the interest rate (such as exchange rates or equity prices) are also important in affecting the output gap and/or inflation, then they should also be used in monetary policy implementation. After conducting some extensive research that indicated the importance of exchange rates in determining the output gap and inflation, the BOC started using MCI as its policy instrument. MCI was formulated as a weighted average of the interest rate and the exchange rate in a chosen period:

$$MCI_t = \omega(e_t - e_0) + (1-\omega)(i_t - i_0) \quad (3)$$

Where the weight, ω, depends on the elasticity of aggregate demand to real exchange rate (e) and interest rate (i)[4]. Changes in MCI indicate degree of tightening or easing the monetary conditions with respect to the chosen time period.

First, the BOC and subsequently the Reserve Bank of New Zealand used MCI as an operating target; some other small open economies such as Sweden, Finland, Iceland, and Norway used MCI rather as an indicator of monetary policy stance. Gerlach and Smets (2000) point out two difficulties in conducting MCI. First, exchange rates and interest rates may not affect aggregate demand equally fast. Second, exchange rate changes can be due to either demand shock or credibility shock and each type of shock may require a different response from monetary policy makers. Specifically, if appreciation is due to excess demand for domestic goods, the target level of the MCI would increase and the CB may want to accommodate this change. On the other hand, if a change in the exchange rate is due to a shift in the credibility of monetary and fiscal policy, then exchange rate change can be offset by adjusting the MCI. If policy makers cannot distinguish the source of change on a timely basis, they may not be able to take appropriate policy action and this would impair the monetary policy stance. Guender (2005) also argues that the existence of exchange rate in the open economy Philips curve was complicating the construction and

4 In Canada exchange rate had a weight about one third of the interest rate.

operation of MCI. According to the author, due to such problems MCI ceased to exist after a decade in use.

Hence, despite the attempts to include exchange rate concerns into monetary policy practices, exchange rate arguments are largely omitted in the present literature. Moreover, there are only a limited number of studies that analyze whether monetary policy makers are concerned about exchange rates while conducting monetary policies. For instance, Lubik and Schorfheide (2007) investigate whether CB respond to exchange rate movements within a small scale structural general equilibrium model for a small economy where the subject countries of the study are Australia, Canada, New Zealand and the UK between 1983 and 2002. The authors find that while BOC and BOE respond to exchange rate movements, the CB of Australia and New Zealand do not.

Alstadheim et al. (2013) criticize Lubik and Schorfheide (2007) on the basis that over the analysis period of their study, many countries went through multiple regime changes; time-invariant reaction function and constant volatility assumption may bias the results of the study. Accordingly, utilizing Markov switching dynamic stochastic general equilibrium model that explicitly allows for parameter changes, the authors explore whether IT CBs' weight on exchange rate stabilization remain constant throughout the period, independent of the known regime changes and the volatility of shocks. The authors find that the CBs of Sweden and the UK switched from responding to the exchange rate and output in the 1980s to inflation and output after they started implementing IT in the early 1990s. While Canada also lessened its response to the exchange rate in 1997/98, the lessening was relative to an increase in responding to inflation and output[5]. For Norway, the results indicate that the CB responded to the exchange rate both before and after it started implementing IT.

In the next section utilizing a GMM model, we also investigate whether exchange rates play a role in the conduct of policy interest rate setting in our subject countries.

3. METHODOLOGY AND DATA

3.1. Baseline Policy Reaction Function and the GMM

We have argued above that Taylor type interest rate rules, such as equation (1), appropriately represent the interest rate setting practices of monetary policy makers, particularly in closed economies. In order to investigate whether exchange rates play a decisive role in interest rate decision processes in small open economies, we incorporate the real effective exchange rate (REER) into the Taylor rule as an explanatory variable. The REER is a weighted average of a country's real exchange rate relative to its major trading partners, where the weights are determined with respect to the trade shares of each partner. We have chosen the REER in our analysis because economists and policy makers are mostly interested in this rate when measuring a currency's overall alignment (Catao, 2007).

When the exchange rate is incorporated into equation (1), the policy reaction function in open economies takes the following form:

$$i_t = r + \pi_t + g_\pi \bar{\pi}_t + g_y \bar{y}_t + g_e e_t + v_t \quad (4)$$

Where, e_t, is the REER and the rest of the variables are defined as in equation (1).

We have utilized the GMM in our analysis[6]. The GMM is a very general class of estimators such that the OLS is a special version of the GMM. The logic of GMM is to choose parameter estimates so that the theoretical relation is satisfied as closely as possible; the method also accounts for possible serial correlation and heteroskedasticity[7]. The parameters of the GMM estimation should satisfy the following orthogonality condition between function of parameters and the set of instrumental variables:

$$E_t(f(\theta)' Z) = 0 \quad (5)$$

Where θ is the set of parameters to be estimated and Z is the vector of variables within the CB's information set when the interest rate decision is made. The GMM estimators are produced so that the correlation between the instruments and the f function are as close to zero as possible, as defined by the criterion function:

$$J(\theta) = [f(\theta)' Z)' A (f(\theta)' Z] \quad (6)$$

Where A is a weighting matrix that accounts for possible serial correlation in v_t.

3.2. Data

The subject countries of this study are the UK, Canada and Norway. Even though the US is a big and relatively closed economy, due to its leading role in the world economy and the role of the USD as a vehicle currency in international transactions we also present the analysis for the US. The UK is an important actor in the world economy; policies of the BOE are closely followed in international markets and are of interest both for academicians and financial markets. Canada is a small open economy that is closely tied to the US. It would therefore be instructive to see if this close tie between the US and Canada could be demonstrated in our analysis. Norway is another small open economy closely tied to Europe. Comparing the results for Canada and Norway would also be instructive.

While quarterly data is also commonly used in the literature, we use monthly data in the Taylor rule analysis. Indeed monetary policy committees in our subject countries meet more often than a quarter: Fed target rates are determined in Federal Open Market Committee meetings that are scheduled in every 6 weeks (twice a quarter) and additional meetings may be held if economic conditions persist. Likewise, BOE's Monetary Policy Committee meets in the 1st week of each month; BOC announces its key

5 Note that, the indicated change in BOC's policy conduct corresponds to the withdrawal of MCI by the bank.

6 The GMM framework is developed by Hansen (1982). See also Clarida et al. (1998) for application of GMM in Taylor rule analysis.

7 For further discussion on this issue see Binder et al. (2005).

policy interest rate at eight fixed dates within a year, and finally NB's executive board normally meets six times a year in order to set its key interest rate. Therefore, a monthly analysis is more appropriate than a quarterly one.

For our analysis we use the following data set: Policy interest rates of the CBs, inflation rates, REER and industrial production index (IPI). We use IPI data and HP filter in order to derive output gap data. The data for our subject countries is extracted from the Federal Reserve System, Federal Reserve Bank of St. Louis, U.S Bureau of Labor Statistics, Organization for Economic Co-operation and Development, Bank of International Settlements, BOE, the UK Office for National Statistics, BOC, Statistics Norway and Bank of Norway databases.

4. RESULTS

4.1. The US Analysis

The success of the Taylor rule in representing the Fed's policy interest rate adjustment is widely recognized; it would also be illuminating to see how the Taylor rule would perform with an exchange rate argument for the US. Hence, as a point of reference, we present the US analysis first.

Our US data starts from January-1987 and ends in December-2007. The beginning of the US data is chosen simply to conform with the literature; in particular to the original study of Taylor (1993). As in other subject countries, the onset of the sub-prime mortgage crisis marks the end of our data.

We have incorporated the REER into the standard Taylor rule, as shown in equation (4) and we have utilized the following instrumental variables: The constant, the first six lags of output gap, average CPI over the past 6 months and the REER. For the GMM analysis we use heteroskedasticity and autocorrelation consistent covariance matrix estimation and we choose Barlett weights to ensure positive definiteness of the estimated variance-covariance matrix. The following results are obtained by implementing GMM in E-views (Table 1).

In GMM estimation, the validity of the instruments and overall specification of the model is often tested by the Hansen's J-test for over-identifying restrictions[8]. The P-value of the J-statistics (0.86, given on the right bottom end of the table) does not reject the null hypothesis that instruments are valid or the model is correctly specified. Hence, we conclude that our instrument set is robust and monetary policy rule specification does not omit important variables that enter the CB rule.

Coefficients for output gap and inflation have expected signs and both of them are statistically significant as in the standard Taylor rule. Coefficient for the REER also has expected signs; an increase in the REER indicates an appreciation of the exchange rate and if the CB prefers to reverse the movement in exchange rates it is expected to cut policy interest rates (or, vice-versa). However, the REER coefficient is not significant at 10% significance level; this may be due to the size and level of openness of the US economy. That is, the US is considered to be a large and a relatively closed economy and the Fed may not be overly concerned with the value of the USD. Moreover, the role of the USD as a reserve currency and the fact that it is widely traded in foreign exchange markets may limit the Fed's desire and ability to prevent fluctuations in the value of dollar.

In summary, our analysis for the US suggests that a closed economy Taylor rule specification represent the Fed's monetary policy conduct quite successfully. As predicted, exchange rate movements do not indicate a significant response in the Fed's policy interest rates.

4.2. The UK Analysis

Analyzing the UK's monetary policy conduct is illuminating for our purposes due to its open economy structure and its significant role in the world financial markets. Because we intend to carry out our analysis over a period where there is no major change in monetary policy conduct, our analysis for the UK starts from January 1993 and ends in December 2007. The UK's withdrawal from the ERM and the implementation of IT, commencing from the end of 1992, indicates the beginning of our analysis. The onset of the global financial crisis dictates the end date of our analysis as the Taylor rule is suggested for a systematic response to the explanatory variables in normal times.

Table 1: GMM Estimation for the US data

Variable	Coefficient	Standard error	t-statistic	P
C	3.239166	2.192190	1.477594	0.1408
Output gap	0.719640	0.108823	6.612942	0.0000
Inflation	1.197563	0.195005	6.141203	0.0000
REER	−0.022606	0.019598	−1.153479	0.2499
R-squared	0.5,28,362	Mean dependent variable		4.819675
Adjusted R^2	0.5,22,516	S.D. dependent variable		2.130000
Standard error of regression	1.4,71,835	Sum squared residual		524.2444
Durbin-Watson statistic	0.073296	J-statistic		9.280121
Instrument rank	19	P (J-statistic)		0.862421

REER: Real effective exchange rate, GMM: General method of moments

Table 2: GMM estimation for the UK

Variable	Coefficient	Standard error	t-statistic	P
C	10.10200	1.122827	8.996930	0.0000
Output gap	0.120434	0.114140	1.055141	0.2929
Inflation	−0.140176	0.212362	−0.660082	0.5101
REER	−0.047926	0.010060	−4.764185	0.0000
R^2	0.168704	Mean dependent variable		5.361034
Adjusted R^2	0.154034	Standard deviation dependent variable		1.021393
Standard error of regression	0.939440	Sum squared residual		150.0332
Durbin-Watson statistic	0.048350	J-statistic		18.43982
Instrument rank	25	P (J-statistic)		0.621026

REER: Real effective exchange rate, GMM: General method of moments

8 If the model is correctly specified GMM should be consistent and hence over-identifying restrictions should be close to zero.

GMM results for the UK data are presented in Table 2.

While the p-value of the J-statistics (0.62) indicates an accurate specification of the model, the coefficient of determination (R^2) shows that the regression line approximates the real data weakly. This may be due to the fact that the BOE considers a wider set of variables while deciding its policy interest rates. Specifically, BOE quarterly inflation reports states that in policy counselling the bank considers the growth rate of the UK as well as the growth rate in the rest of the world, asset prices, the value of the USD against the Euro, exports and imports, past and expected changes in the Fed's official interest rates, and the REER.

Moreover, Taylor and Davradakis (2006) find that the linear Taylor rule model is rejected against a nonlinear Taylor rule for the UK data. Specifically, the authors show that the Taylor rule describes interest rate changes of the BOE only when inflation rate is more than about half percent above the stated target level; otherwise, the interest rate follows a random walk process unrelated to expected inflation but with a small link to output gap. Cukierman and Muscatelli (2008) also find that before the IT period the BOE was applying the Taylor rule mainly to avoid recessions; after the Bank started implementing IT, positive inflation shocks began to bring about more vigorous changes in the interest rates than negative inflation shocks.

Hence, the poor performance of the above Taylor rule, in terms of the low R^2 value and insignificant coefficient values for output and inflation, may be explained by a wider set of variables that the BOE takes into consideration as well as the nonlinearities in its monetary policy conduct. Nevertheless, the significance of the REER and its expected (negative) sign indicates that the BOE takes exchange rate changes into consideration while setting its policy interest rates and it tends to mitigate exchange rate fluctuations.

4.3. Canada Analysis

Canada is a small open economy and its economy is highly integrated with that of the United States. In addition to the effect of the REER, it would be enlightening to see if the close economic relation between the US and Canada could be detected in monetary policy conduct of the BOC. To this end, we add the Fed's policy interest rates as an additional explanatory variable to the policy specification of the BOC.

Starting from 1996, the BOC began using overnight interest rates as its key policy interest rate (during 1980-1996 the BOC was following a floating rate). Hence, our analysis for Canada starts from 1996 and ends in December 2007. Implementing the GMM estimation method, we get the following results (Table 3).

The P-value for the J-statistics indicates a correct model specification of the BOC's interest rate setting policies. Regarding the coefficients, while REER and the Fed Rates are both significant and have the expected signs, output gap is not significant and the inflation coefficient is smaller than one (i.e., it doesn't meet the Taylor principle for maintaining stable inflation). Insignificance of output gap and the weak response to the inflation coefficient might stem from the presence of the coefficients for REER and the fed rates.

The coefficients indicate that the BOC decreases its policy interest rate in response to an increase in the REER (or an appreciation). Moreover, the Fed Rates coefficient indicates that the BOC tends to synchronize its interest rate adjustments with that of the Fed's. When the Fed changes its policy interest rate, the BOC also tends to change its interest rate. Therefore, in addition to the fluctuation in the exchange rate, the BOC is also concerned about the levels of its exchange rate. Keeping the interest rates in conformity would prevent divergence in the two countries' exchange rates due to interest rate differentials.

4.4. Norway Analysis

Like Canada, Norway is another small open economy and it is highly integrated with the European market (Norway is a member of the European Economic Area, EEA). In order to analyze the influence of the European CB (ECB) on NB's monetary policy conduct, we incorporate the ECB's policy interest rates as an additional explanatory variable to the policy specification of the NB. Accordingly, our analysis starts from January 1999, a few months after the ECB was established and the euro was introduced (Table 4).

Table 3: GMM estimation for Canada

Variable	Coefficient	Standard error	t-statistic	P
C	3.323820	0.773251	4.298501	0.0000
Output gap	0.046883	0.044061	1.064059	0.2892
Inflation	0.309907	0.111203	2.786852	0.0061
REER	−0.031567	0.008023	−3.934444	0.0001
Fed rates	0.632051	0.050316	12.56158	0.0000
R^2	0.738803	Mean dependent variable		3.829710
Adjusted R^2	0.730947	Standard deviation dependent variable		1.172598
Standard error of regression	0.608230	Sum squared residual		49.20254
Durbin-Watson statistic	0.109300	J-statistic		10.56329
Instrument rank	25	P (J-statistic)		0.956771

REER: Real effective exchange rate, GMM: General method of moments

Table 4: GMM estimation for Norway

Variable	Coefficient	Standard error	t-statistic	P
C	3.825163	3.333906	1.147352	0.2541
Output gap	0.069384	0.044347	1.564556	0.1210
Inflation	0.606309	0.135644	4.469863	0.0000
REER	−0.035912	0.032378	−1.109145	0.2701
ECB rates	1.440026	0.144715	9.950738	0.0000
R^2	0.640998	Mean dependent variable		4.435644
Adjusted R^2	0.626039	Standard deviation dependent variable		2.039502
Standard error of regression	1.247203	Sum squared residual		149.3294
Durbin-Watson statistic	0.086818	J-statistic		15.05276
Instrument rank	33	P (J-statistic)		0.977873

REER: Real effective exchange rate, GMM: General method of moments

The P-value of the J-statistic again implies a correct model specification for NB's conduct of monetary policy. As in Canada, output gap and inflation have expected signs but the coefficient for output gap is statistically insignificant and the inflation coefficient does not meet the Taylor principle as it is smaller than 1. The REER and ECB rates also have the expected signs. Even though REER is not statistically significant, the ECB Rates are statistically and economically significant, with a coefficient of 1.44.

Hence, the results for Norway also indicate concerns for the level and the volatility of the exchange rates while setting policy interest rates.

5. CONCLUSION

In this chapter we have argued that, despite the fact that exchange rate concerns are central to both national and international monetary policy arrangements, they are often omitted from theoretical and empirical monetary policy arguments, even in open economy set-ups. Hence, we investigated whether monetary policy makers in small open economies do indeed take exchange rates into consideration while setting policy interest rates. To this end, we added the REER as an additional explanatory variable into a simple monetary policy rule and analyzed monetary policies of the US, the UK, Canada and Norway.

For the US, a large and relatively closed economy, we didn't find REER to be significant. For the UK, we found that exchange rate concern is quite significant. For Canada and Norway, due to their close integration with the US and Europe respectively, we also incorporated policy interest rates of the Fed and ECB as explanatory variables. For Canada, we found that both the REER and the Fed rates are quite significant. For Norway, the results indicate that even though monetary authorities are concerned about the REER, the coefficient is not statistically significant; though ECB rates are both statistically and economically significant. Therefore we conclude that exchange rate concerns, both in terms of alignment and level, explicitly enter the decision making processes of small open economies.

Full-fledged economic models already take the exchange rate into consideration. Nevertheless, being at the center of monetary policy conduct and owing to its importance in small open economies, exchange rates should also be incorporated into simple interest rules. This would provide more realistic interest rates rules and improve predictability of CB policies.

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