Akademie věd České republiky
Ústav teorie informace a automatizace

Academy of Sciences of the Czech Republic
Institute of Information Theory and Automation

RESEARCH REPORT

JAROMÍR BAXA, ROMAN HORVÁTH,
BOŘEK VAŠÍČEK

HOW MONETARY POLICY CHANGES IN INFLATION TARGETING COUNTRIES

Evidence from Time-Varying Parameter Model with Endogenous Regressors

No. 2254 June 2009

ÚTIA AV ČR, P.O. Box 18, 182 08 Prague, Czech Republic
Fax: (+420)(2)86890378, E-mail: utia@utia.cas.cz

How Monetary Policy Changes in Inflation Targeting Countries:

Evidence from Time-Varying Parameter Model with Endogenous Regressors

Jaromír Baxa*
Institute of Economic Studies, Faculty of Social Sciences, Charles University
and Institute of Information Theory and Automation, Academy of Sciences of the Czech Republic, Prague

Roman Horváth
Czech National Bank
and Institute of Economic Studies, Faculty of Social Sciences, Charles University, Prague

Bořek Vašíček
Universitat Autonoma de Barcelona
and Institute of Economic Analysis (CSIC)

This version: June 03, 2009

Abstract

In this paper, we estimate time-varying monetary policy rules for a group of inflation targeting countries (Australia, Canada, Chile, New Zealand, Sweden and the United Kingdom). We apply structural time-varying parameter model with endogenous regressors. This methodology has two basic advantages for estimation of forward-looking policy rules over the Markov-switching model usually employed for estimation of time-varying monetary policy rules so far; first, it addresses with the endogeneity bias and second, it models the policy rule as gradual evolution rather than imposing sudden switches from one regime to another. We find that in the countries we've selected for the analysis all the parameters of the monetary policy rules followed a very similar path: the time varying intercept representing the target interest rate was continuously decreasing from the late 80's. The parameter beta (mearurement of central bank's sensitivity on inflation) was highly volatile during the 80's and very smooth since the late 90's. The IT stabilized expectations of future inflation not because of high interest rates but credibility and thus beta decreased during the IT period.

JEL Classification: E43, E52, E58.
Keywords: Taylor rule, inflation targeting, monetary policy, time-varying parameter model with endogenous regressors.

* The support of the Czech Science Foundation, grant number 402/09/H045, is gratefully acknowledged.
Corresponding author: jaromir.baxa@centrum.cz

1 Introduction

The Taylor-type regressions have been applied extensively in order to describe the monetary policy setting for many countries. The research on the US monetary policy usually assumed that the monetary policy was subject to structural breaks when the FED chairman changed. Clarida et al. (2000) claimed that the US inflation was unleashed during the 1970's because the FED's interest rate response to inflation upsurge was too weak, while the increase of such response in the 1980's was behind the inflation moderation. Although there is ongoing discussion on the sources of this Great moderation (Benati and Surico, 2008), the fact that monetary policy setting evolves over time is generally accepted. While the evidence for the US is vast, the knowledge about the evolution of monetary policy for other countries often does not go beyond the common wisdom (Nelson, 2004).

The evolution of monetary policy setting and exogenous changes in economic system represent a problem for empirical analysis because the coefficient of monetary policy rules estimated over longer periods are structurally unstable. The common solution used in the literature consisted in separate analysis for different sub-periods. The problem of this approach is the assumption that the moments of structural break are known, but also that the policy setting did not evolve within each sub-period. For this reason, there is need to test rather than to assume the presence of structural breaks or more properly, the time variance. The countries that implemented the inflation targeting (IT) regime are especially suitable for such analysis because it is likely that the monetary policy's perception of inflation and real economic activity changed as a consequence of the IT implementation. However, this may not be the end of the story for countries that are open economies, where monetary policy faces additional external constrains. In this case, the evaluation of time-varying response to additional variables such as foreign interest rate or exchange rate can be of additional interest.

Our study aims at the principal countries that have had a long experience with IT regime. In particular, we analyze the time-varying monetary policy rule for Australia, Canada, Chile, New Zealand, Sweden and the United Kingdom. As we are interested in the monetary policy evolution over relatively longer period, we logically exclude countries where the IT was in place for relatively short time (Finland, Spain), or it was introduced recently (such as Armenia, Hungary, Korea, Norway, South Africa, Switzerland).

The paper is organized as follows. Section 2 discusses the related literature. Section 3 describes our data and empirical methodology. Section 4 gives the results. Section 5 concludes. An appendix with additional results follows.

2 Related Literature

2.1 Monetary policy rules and inflation targeting

Although the theoretical literature on optimal monetary policy usually distinguishes between instrument rules (the Taylor rule) and targeting rules (the inflation-targeting based rule), the forward-looking specification of the Taylor rule, sometimes augmented with other variables, and has been used for analysis of decision making of IT central banks.

The UK is the IT country that was subject to most extensive empirical research. Clarida et al. (1998) showed that the monetary policy setting of Bank of England in pre-IT period could be described by Taylor rule, but it was additionally constrained by foreign (German) interest rate setting. Adam et al. (2005) argued that the introduction of IT in 1992 did not represent a major change in monetary policy conduct unlike the granting of instrument independence in 1997. Davradakis and Taylor (2006) pointed to significant asymmetry of the British monetary policy during the IT period; in particular that the Bank of England was concerned with inflation only when it significantly exceeded its target. Assenmacher-Wesche (2006) concluded by means of Markov-switching model that no attention was paid to inflation until the IT was adopted. Conversely, Kishor (2008) found that the response to inflation already increased when Thatcher took over the government (in 1979).

The studies for other IT countries are in general more scant. Huang et al. (2001) provided evidence for New Zealand. In particular, he found that the Reserve Bank consistently responded to inflation since the IT introduction but also that it is hard to say whether the policy was backward- or forward-looking. Plantier and Scrimgeour (2002) found that the response to inflation varied during the IT regime. De Bouwer and Gilbert (2005) found for the Reserve Bank of Australia that its consideration of inflation was very low and concern of real economic activity was clearly predominant in pre-IT period (until 1993). Since then, the response to inflation (both actual and expected) was very strong but there was also consideration for exchange rate and foreign interest rate developments. While the policy rule of Australia Reserve Bank was found asymmetric, there was no such evidence for New Zealand (Leu and Sheen, 2006, Karedekikli and Lees, 2007). García et al. (2005) surveyed the empirical studies on policy setting under the IT in Chile (since 1990). All the results point to existence of policy rule very similar to original Taylor, therefore both consideration of inflation and output gap with coefficients as proposed by Taylor (1993) for the US FED. Gredig (2007) confirmed limited degree of asymmetry in policy making in Chile and Edwards (2006) showed its consideration for exchange rate developments. Demers and Rodríguez (2002) estimated monetary policy rule for Canada with model that allowed time variance in individual generating process of each variable. They found that the response to inflation went up as the IT was introduces (in 1991) but it was much less important than the response to the real economic activity, which is rather surprising for an IT country. Jansson and Vredig (2003) studied the policy rule

of Sveriges Rissbank concluding that the inflation forecast was the only relevant variable. Meirelless-Aurelio (2005) confirmed in her multi-country study on for our six IT countries that the results of estimated time-invariant rules are considerably influenced by the choice of real-time versus historic measures of inflation rate and output gap.

2.2 Time variance in monetary policy rules

The original empirical research on monetary policy rules used linear specification with time-invariant coefficients. Instrument variable estimators like GMM gained popularity in this context because they are able to deal with the issue of endogeneity that arises in the forward-looking specification (Clarida et al., 1998).[1] While time-invariant policy rule may be a reasonable approximation when the analyzed period is short, structural stability usually fails over longer period.

The simplest empirical strategy to take the time variance into account is to use a sub-sample analysis (Taylor, 1999, Clarida et al., 2000). The drawback of this approach is rather subjective assumption about the points of structural change and the structural stability within each sub-period. An alternative is to apply an econometric model that allows time variance of the response coefficients. There are various methods dealing with the time variance in the context of estimated monetary policy rules.

The most common option is the Markov-switching VAR method, originally used for business cycle analysis. Valente (2003) employed such model with switches in the constant term representing the evolution of the inflation target (the inflation target together with the real equilibrium interest rate makes the constant term in a simple Taylor rule). Assenmacher-Wesche (2006) used the Markov-switching model with shifts both in the coefficients and the residual variances. Such separation between the evolution of policy preferences (coefficients) and the exogenous changes in economic system (residuals) is important for the continuing discussion on sources of the Great moderation (Benati and Surico, 2008, Canova and Gambetti, 2008). Sims and Zha (2006) presented a multivariate model with discrete breaks in both coefficient and disturbances. Unlike Assenmacher-Wesche they found that the variance of the shock rather than the time variance of the monetary policy rule coefficient has shaped the macroeconomic development in the US in last four decades.

The application of Markov-switching VAR techniques turns complicated for the IT countries, where the policy rules are usually characterized as forward-looking and some regressors become endogenous.

---

[1] Clearly, the exception is when researcher uses real-time central bank forecasts for Taylor-type rule estimation, i.e. the data available to the central bank before the monetary policy meeting. In such a case, endogeneity problem shall not arise and least square estimation may perform well (Orphanides, 2001). However, as we will discuss in more detail below, the use of real-time data may not solve the issue of endogeneity completely.

These studies avoided the endogeneity bias only indirectly by means of backward-looking specification.[2] However, there is another distinct feature of the Markov-switching model that makes its use for the analysis of time variance in monetary policy rule problematic. The model assumes sudden switches from one policy regime to another rather than a gradual evolution of the monetary policy. Although at first sight, one may consider the introduction of inflation targeting as an abrupt change, there are some reasons to believe that smoothed transition of monetary policy is more appropriate description for the IT countries. Firstly, the IT regime is typically based on predictability and transparency, which does not seem to be consistent with the sudden switches. Secondly, it is likely that inflation played already certain role for the interest rate setting even before the IT was introduced because the major decrease of inflation rates in many countries occurred before the IT was implemented. Thirdly, the coefficient of different variables (such as inflation, output gap or exchange rate) in the monetary policy rule may evolve separately than to jump from one regime to another jointly at the same time. For instance, a central bank may give more weight to observed or expected inflation rate when it implements the IT but it does not mean that it immediately disregard the information on real economic activity or foreign interest rate setting. Finally, there is relevant evidence, though mostly for the US, that the monetary policy evolves over time rather smoothly (Boivin, 2006, Canova and Gambetti, 2008). Therefore, a smooth transition seems to be a more adequate description of the reality.

Domenech et al. (2002) accompanied their results of sub-sample analysis for the US and artificial EMU by recursive (GMM) estimates. This analysis provided evidence that the response to expected inflation had slightly increased over the last three decades in both cases, while the response to output gap rather stagnated. Although this strategy may be suitable to give some idea about the stability of the coefficients, it is not a way to obtain consistent time-varying parameter estimates.

There appeared studies rather recently that applied the Kalman filter to estimate a coefficient vector that varies over time. This focus assumes smooth evolution of the monetary policy rule since its parameters are assumed to follow autoregressive process. Such time-varying model is also suitable for reflection of possible asymmetry of the monetary policy rule (Dolado et al., 2004). An example of such asymmetry is that policy maker responds more strongly to inflation rate when it is high than when it is low. Boivin (2006) used such time varying model estimated via the Kalman filter for the US, Elkhoury (2006) Switzerland and Trecrocci and Vasalli (2007) for the US, the UK, Germany, France and Italy. However, none of these studies provided specific econometric treatment to the endogeneity.

Kim (2006) proposed a two-step procedure that is able to deal with the endogeneity problem in the

[2] Psaradakis et al. (2006) proposed solution of the endogeneity problem in context of Markov-switching model in case of the term structure of interest rates.

time-varying parameter model. Kim and Nelson (2006) found with this methodology that the US monetary policy evolved in different manner than previous research suggested. In particular that FED's interest in stabilization of real economic activity significantly increased since early 1990's.[3] Kishor (2008) applied the same technique for analysis of time-varying monetary policy rule of Japan, Germany, the UK, France and Italy. He detected time-varying response not only with respect to inflation rate and output gap but also to foreign interest rate. The relevance of the endogeneity correction can be demonstrated by the difference between Kishor's results and those of Trecrocci and Vasalli (2007) who both studies the same sample of countries.[4] The time-varying parameter model with specific treatment of endogeneity is still relevant when the real-time data are used instead of ex-post data (Orphanides, 2001). When the real-time forecast is not derived under assumption that nominal interest rates will remain constant within the forecasting horizon, the endogeneity may be still present in the model (as in Boivin, 2006). Moreover, this estimation procedure is also viable to reflect the measurement error and the heteroscedasticity in the model (Kim et al., 2006).

3 Data and Empirical Methodology

A starting point for a formal derivation of the monetary policy rule is the reasonable assumption that the central bank targets to set the nominal interest rate in line with the state of the economy (see Clarida *et al.*, 1998, 2000), as postulated in Eq. (1):

$$r_t^* = \bar{r} + \alpha\left(E\{\pi_{t+i}|\Omega_t\} - \pi^*_{t+i}\right) + \beta E\{x_t|\Omega_t\} \qquad (1)$$

where r_t^* denotes the targeted interest rate, $\bar{r}$ is the policy neutral rate, π_{t+i} stands for the central bank forecast of the yearly inflation rate i periods ahead, and π^*_{t+i} is the central bank's inflation target[5]. x_t represents a measure of the output gap. $E(.)$ is the expectation operator and Ω_t is the information set available at the time when interest rates are set. Hereinafter, we set i either equal to 12 months to reflect the CNB's actual targeting horizon[6] or alternatively equal to 0, i.e. using the current

[3] Kim et al. (2006) confirmed this finding with real-time data and additionally detected significant decrease in the response to expected inflation during the 1990's.

[4] Horváth (2008) employed the time-varying model with endogenous regressors for estimation of equilibrium interest rate for the Czech Republic confirming the importance of endogeneity bias correction term.

[5] At the beginning of our sample period, the target has been defined as the band decreasing from 3%-5% to 2%-4% at the end of 2005. For this period, we take the mid-points of target. From 2006 onwards, the target is set in terms of yearly change of headline inflation of 3%. The evolution of target is depicted in Chart A.1 in the Appendix.

[6] This is in line with the CNB main forecasting model – the Quarterly Prediction Model; see Coats *et al.*, 2003. The actual targeting horizon is 12-18 months, but due to data limitations we prefer to work with 12 months. In general, see Batini and Nelson, 1999, for contributions on the optimal targeting horizon. Note also that the policy neutral rate is defined as the real rate plus the expected inflation in period $t+k$, where k is given by the maturity of the interbank rate (in our case k=3). k is thus different from the forecasting horizon i. As argued by Clarida *et al.* (2000), this is not very relevant in practice, as the short-term interbank interest rates at various maturities are strongly linked together. Indeed, the correlation of 3M PRIBOR and 12M PRIBOR – to reflect that i=12 – stands at 0.99 in our sample.

inflation for the sensitivity analysis. Therefore, Eq. (1) links targeted nominal interest rates to a constant (i.e. the interest rate – policy neutral rate – that would prevail when expected inflation and output are at their targeted levels), the deviation of expected inflation from the target and the output gap.

Nevertheless, Eq. (1) is often argued to be too restrictive, as it does not account for interest rate smoothing of central banks. Clarida *et al.* (1998) assume that the central bank adjusts the interest rate sluggishly to the targeted value. This is so for a number of reasons. For example, Goodfriend (1991) puts forward concerns over the stability of financial markets. Sack (1997) highlights uncertainty about the effects of interest rate changes on the economy.[7] Instead of an explicit listing of various factors behind the interest rate smoothing, Clarida *et al.* (1998) assume for simplicity that the actual policy interest rate is a combination of its lagged value and the targeted policy rate as in Eq. (2).

$$r_t = \rho r_{t-1} + (1-\rho) r_t^* + v_t \qquad (2),^{8}$$

where $\rho \in [0,1]$. In line with Clarida *et al.* (1998), substituting Eq. (2) into Eq. (1) and eliminating unobserved forecast variables results in Eq. (3):

$$r_t = (1-\rho)\left[\bar{r} + \alpha(\pi_{t+i} - \pi^*_{t+i}) + \beta x_t\right] + \rho r_{t-1} + \varepsilon_t \qquad (3)$$

The disturbance term ε_t is a combination of forecast errors (i.e., $\varepsilon_t = -(1-\rho)[\alpha(\pi_{t+i} - E\{\pi_{t+i}|\Omega_t\}) + \beta(x_t - E\{x_t|\Omega_t\})]$) and is thus orthogonal to all information available at time t (Ω_t).

Time-varying coefficient forward-looking Taylor rule restated to the form suitable for estimation.

$$i_t = \alpha_t + \beta_t E\pi_{t+j} + \gamma_t(y_t - y_t^*) + \rho i_{t-1} + \varepsilon_t \qquad (1)$$

All parameters are assumed to follow a random walk:

$$\begin{aligned} \alpha_t &= \alpha_{t-1} + u_{1,t} \\ \beta_t &= \beta_{t-1} + u_{2,t} \\ \gamma_t &= \gamma_{t-1} + u_{3,t} \\ \rho_t &= \rho_{t-1} + u_{4,t} \end{aligned} \qquad (2)$$

Augmented time-varying coefficient forward-looking model

$$i_t = \alpha_t + \beta_t E\pi_{t+j} + \gamma_t(y_t - y_t^*) + \rho i_{t-1} + i_t^f + \varepsilon_t \qquad (3)$$

Other possible external regressors: dummy variable indicating periods of financial stress, gap of nominal effective exchange rate extracted using output gap.

Kim (2006) showed that the conventional time-varying parameter model delivers inconsistent estimates when explanatory variables are correlated with the disturbance term, which is indeed relevant when estimating monetary policy rules. Interestingly, the correlation of Eπt+j and (yt – y*) with εt is almost

---

[7] Nevertheless, Rudebusch (2006) recently questioned the extent of monetary policy inertia and argued that the inertia is rather low.

[8] We estimated the monetary policy rules including higher lags of interest rates, but failed to find them significant.

always taken into account in empirical work on time-invariant rules (as typically estimated via GMM), while it is almost never considered in the literature on time-invariant rules (Kim-Nelson, 2006, Kishor, 2006 and Trecroci-Vassalli, 2008, seem to be exceptions). Subsequently Kim (2006) derives a consistent estimator of the time-varying parameter model when regressors are endogenous.

In line with Kim (2006) we estimate the time-varying forward-looking monetary policy rule using the Heckman (1976) 2-step procedure. First, the endogenous regressors, expected inflation $E\pi_{t+j}$ and output gap $(y_t - y^*)$, are regressed on the vector of instrumental variables z_t by

$$\begin{aligned} E\,\pi_{t+j} &= z'_t\delta_1 + \nu_{1t}, \\ (y_t - y_t^*) &= z'_t\delta_2 + \nu_{2t}. \end{aligned} \tag{4}$$

By assumption both residuals ν_{1t} and ν_{2t} are normally distributed with zero mean and variances $\sigma^2_{\nu_1}$ and $\sigma^2_{\nu_2}$. In line with the existing literature the instruments we used were: 1st and 2nd lag of the output gap, 1st and 4th lag of expected inflation, foreign interest rate and the gap of the nominal effective exchange rate.

Kim (2006) and Kim and Nelson (2006) showed that an equivalent way of writing the error term in the equation (1) is:

$$\varepsilon_t = \kappa_1\sigma_\varepsilon\nu^*_{1t} + \kappa_2\sigma_\varepsilon\nu^*_{2t} + \omega_t, \tag{5}$$

where ν^*_{1t} and ν^*_{2t} are standardized residuals from IV regressions and ω_t is uncorrelated with both ν^*_{1t} and ν^*_{2t} (see Appendix for details). In fact ν^*_{1t} and ν^*_{2t} represent the expectation errors associated with the expected inflation and the current level of the output gap. Thus the regression equation (1) transforms into

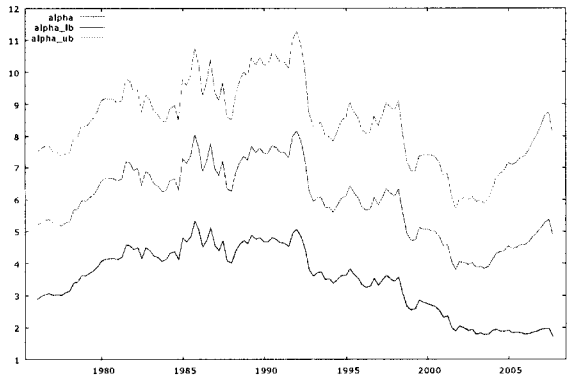
$$i_t = \alpha_t + \beta_t E\pi_{t+j} + \gamma_t\left(y_t - y_t^*\right) + \rho i_{t-1} + \ldots\left(+ i_t^f\right) + \kappa_\pi\omega_{\pi,t} + \kappa_y\omega_{y,t} + \varepsilon_t \tag{6}$$

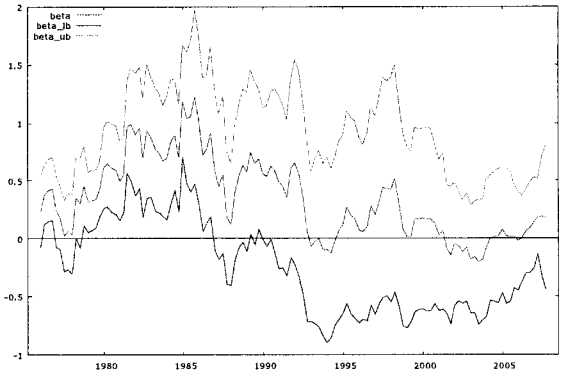
where $\omega_{j,t}$ are standardized residuals of auxiliary regressions of inflation and gdp gap on a set of instruments.

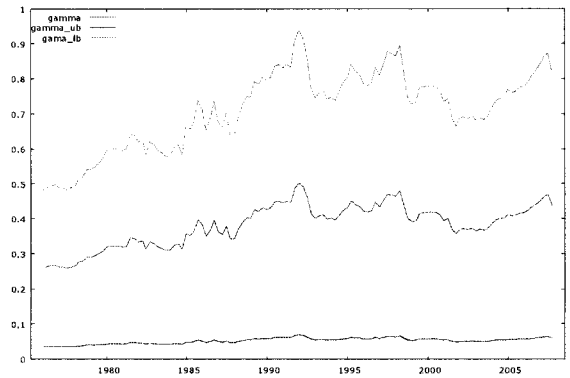
Contrary to the main empirical work on time-varying parameters we've used the varying coefficients estimator introduced in Schlicht (1988), Schlicht and Ludsteck (2006) instead of the more popular Kalman filter approach. This approach differs from the Kalman filter in two main aspects. First, it uses all past, present and future realizations for estimation rather than only the past and present values as in the Kalman filtering. Second, it was designed in order to produce estimates of the time-varying parameters with their means corresponding to the time-invariant estimate as obtained using the Aitken (1936) GLS estimator. Thanks to these two properties the approach proposed by Schlicht is less sensitive on improper choice of initial values in comparison with Kalman filtering.

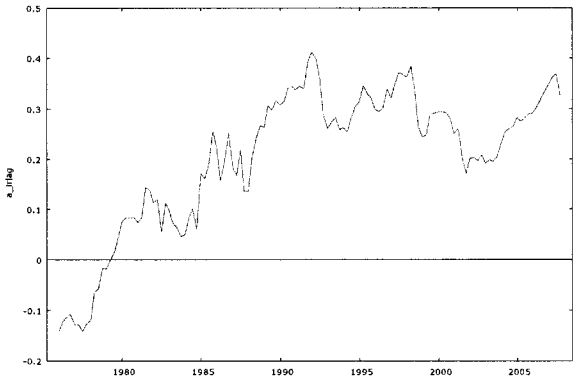
4 Results

UK without endogenity (alpha, beta, gamma, rho)

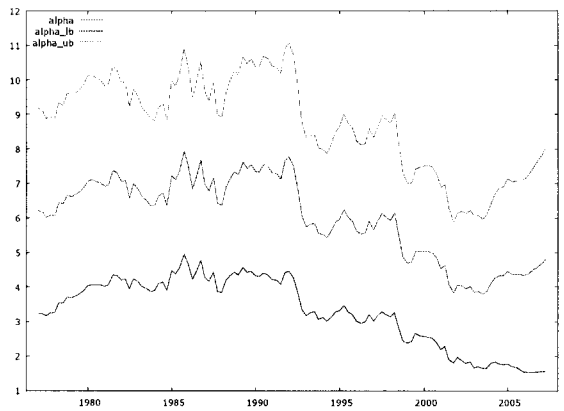


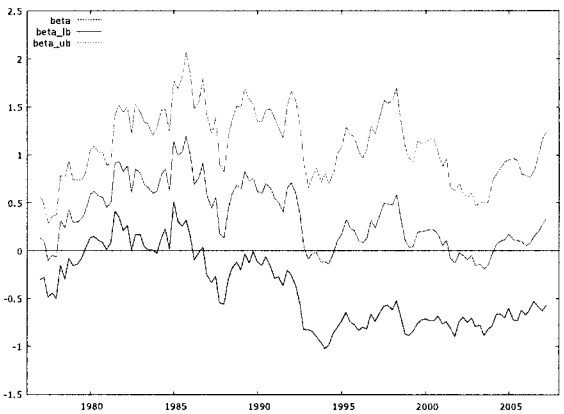


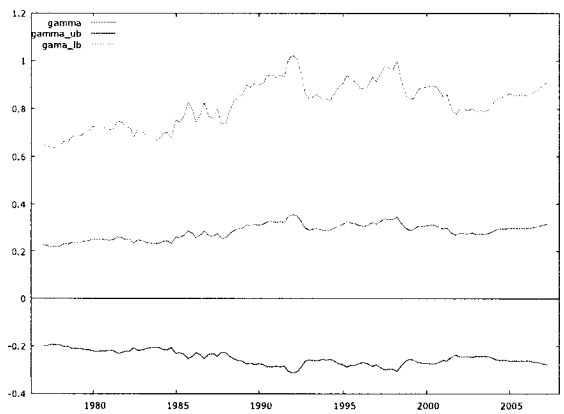


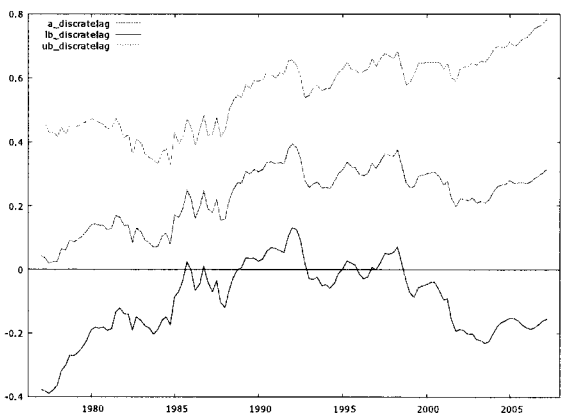


UK with endogenity bias correction terms (alpha, beta, gamma, rho)

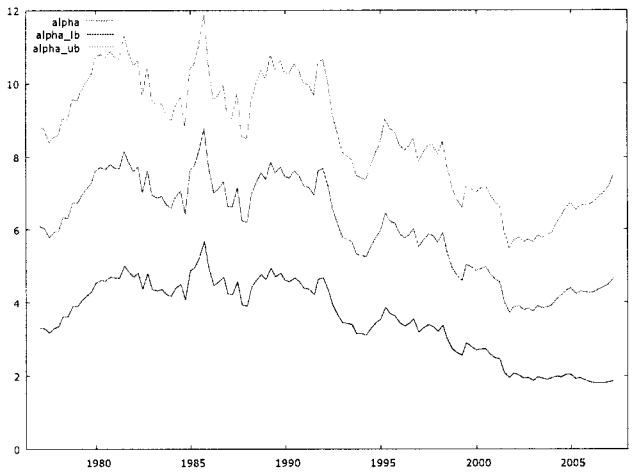


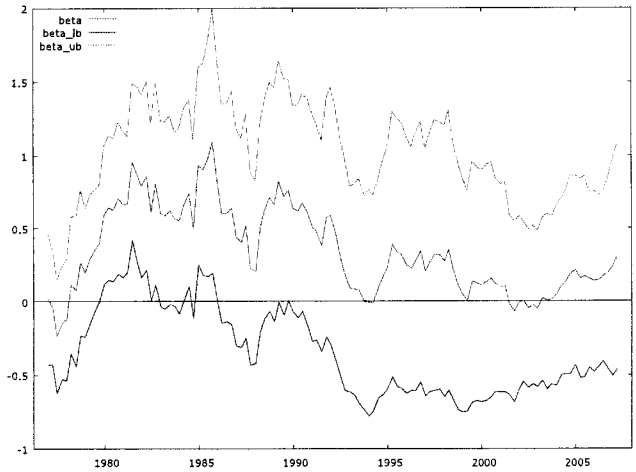


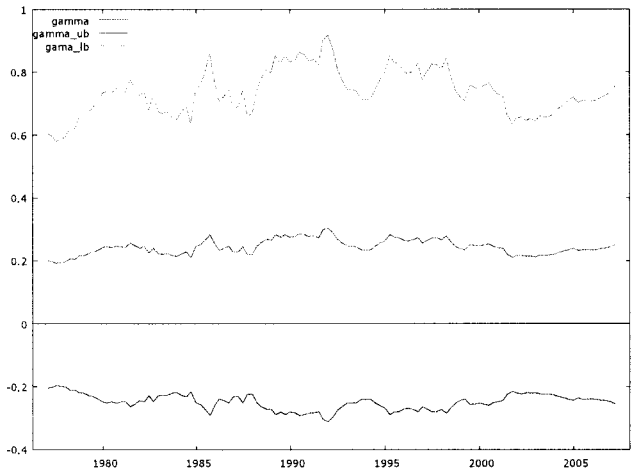


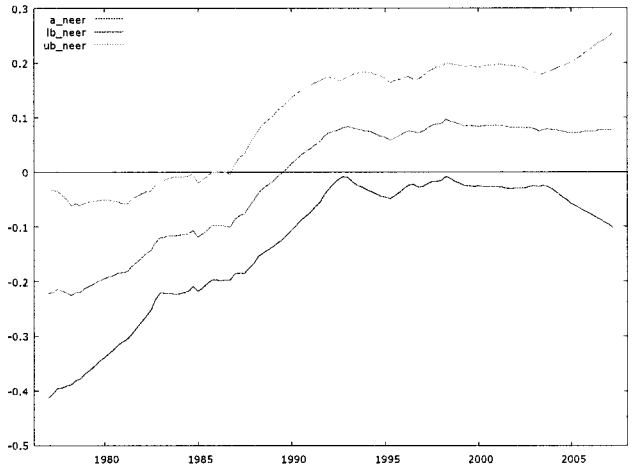


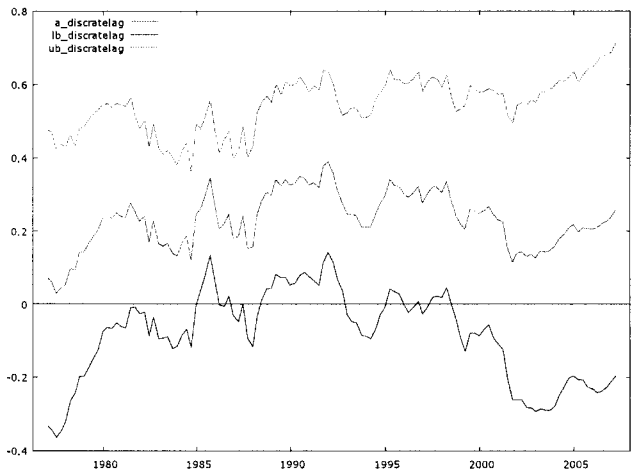
UK with endogenity bias correction terms and NEER gap in regressors (alpha, beta, gamma, NEER coef., rho)



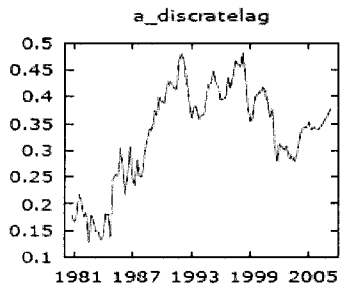


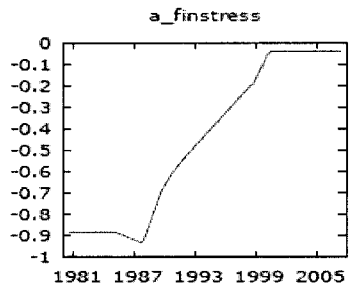


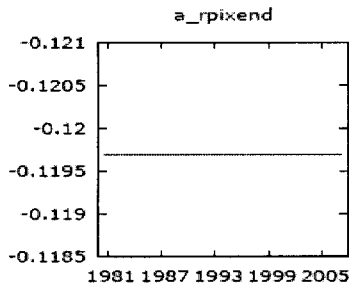


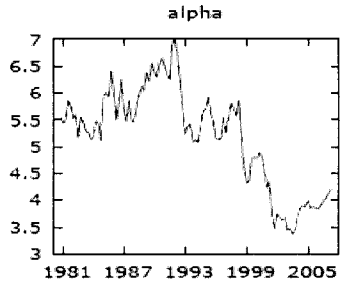


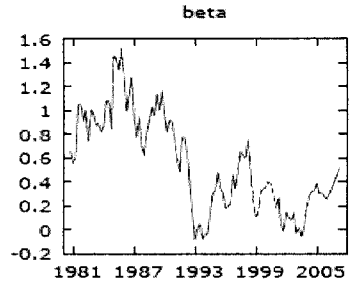
Financial stress dummy added

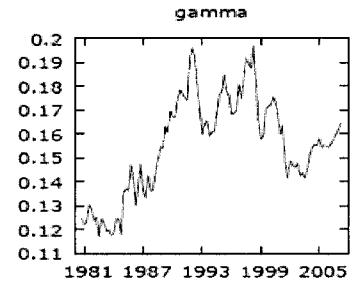




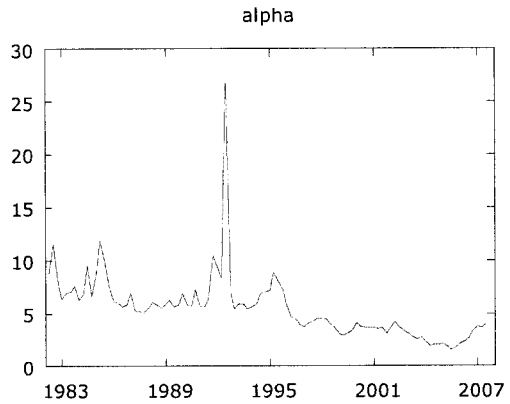


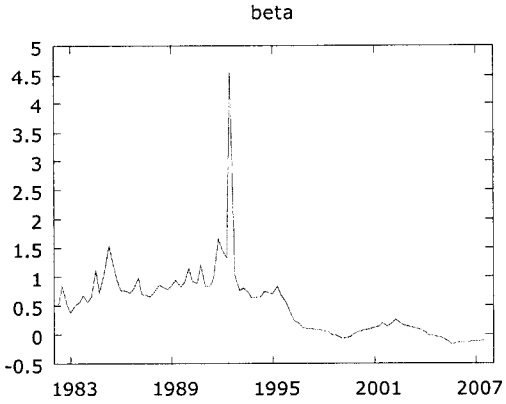


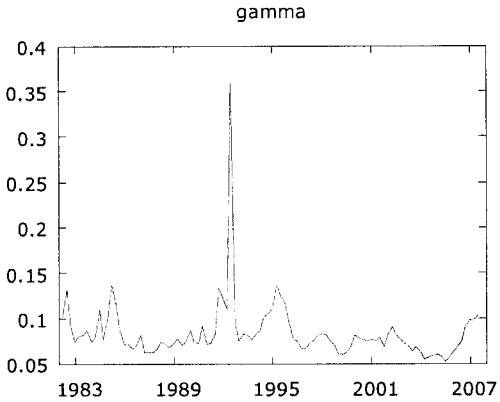


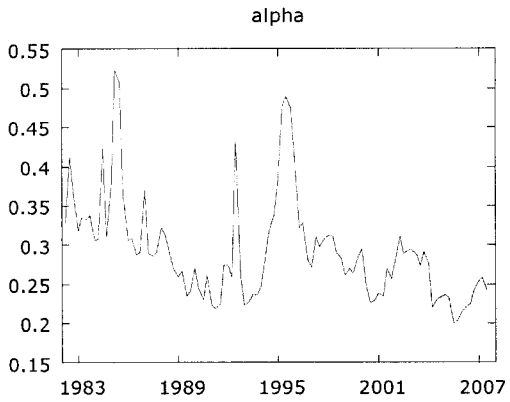


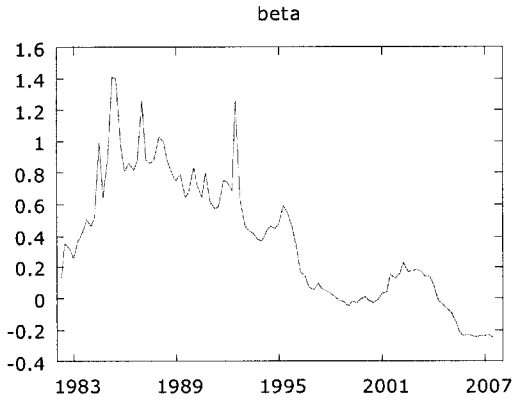
Sweden

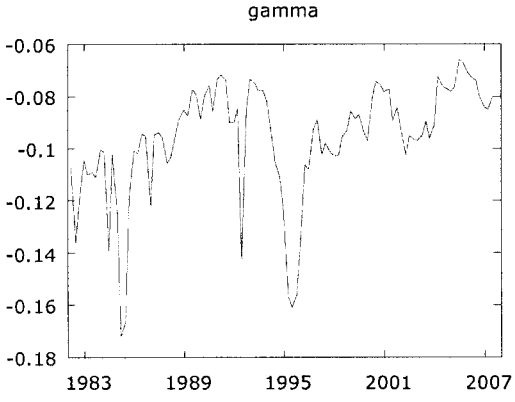

alpha
30
25
20
15
10
5
0
1983
1989
1995
2001
2007

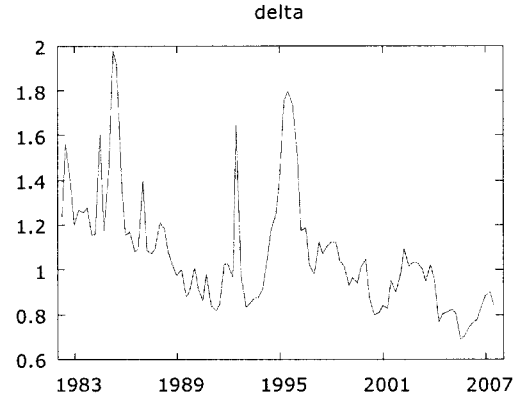

beta
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
1983
1989
1995
2001
2007


gamma
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
1983
1989
1995
2001
2007

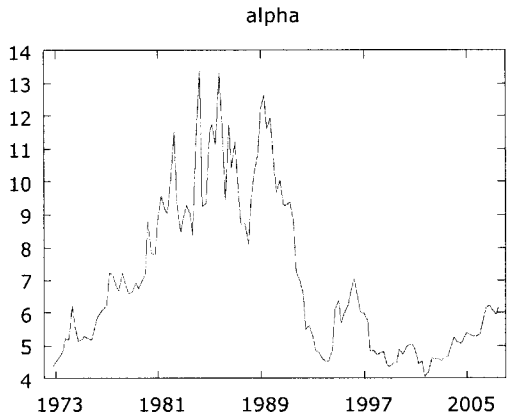

alpha
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
1983
1989
1995
2001
2007

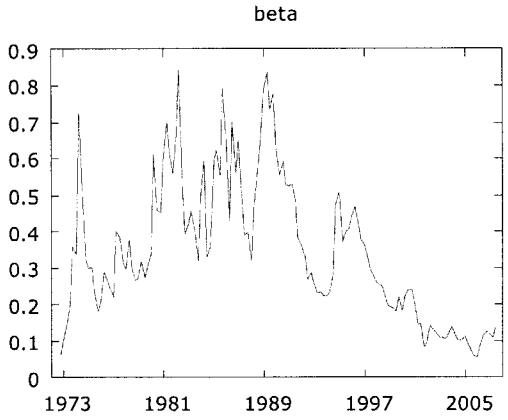

beta
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
1983
1989
1995
2001
2007

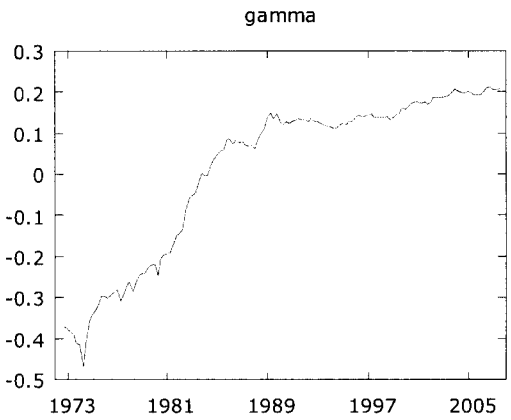

gamma
-0.06
-0.08
-0.1
-0.12
-0.14
-0.16
-0.18
1983
1989
1995
2001
2007

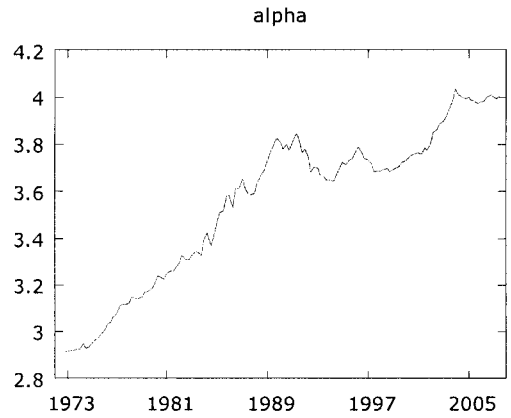

delta
2
1.8
1.6
1.4
1.2
1
0.8
0.6
1983
1989
1995
2001
2007

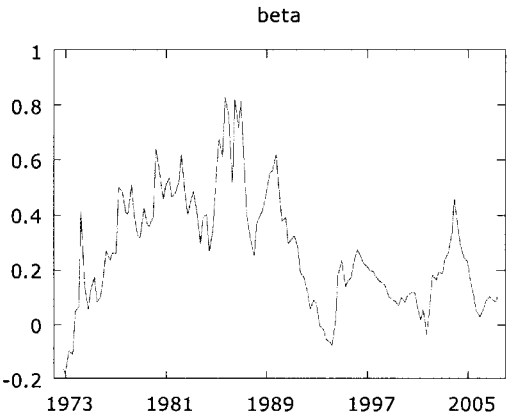
Australia

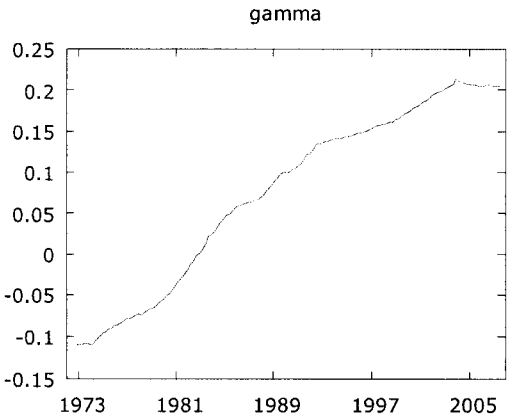

alpha
14
13
12
11
10
9
8
7
6
5
4
1973
1981
1989
1997
2005

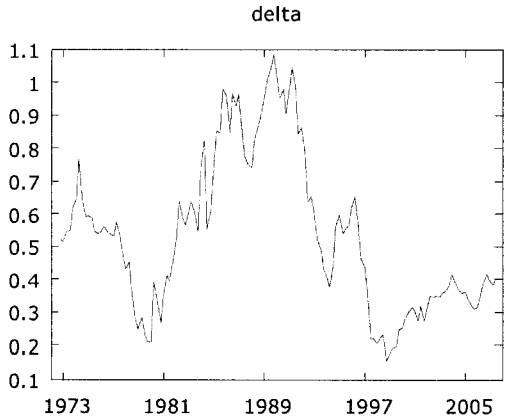

beta
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1973
1981
1989
1997
2005


gamma
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
1973
1981
1989
1997
2005

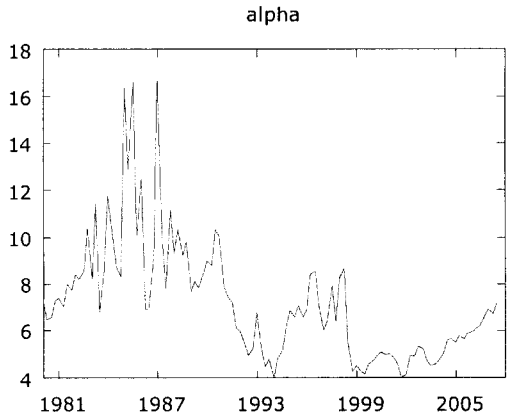

alpha
4.2
4
3.8
3.6
3.4
3.2
3
2.8
1973
1981
1989
1997
2005

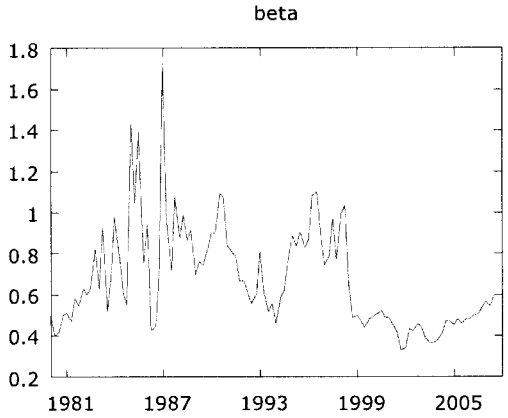

beta
1
0.8
0.6
0.4
0.2
0
-0.2
1973
1981
1989
1997
2005

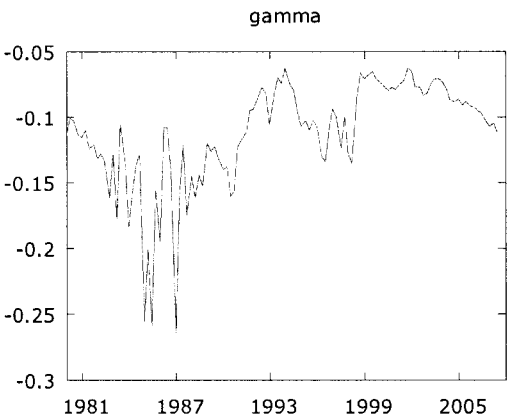

gamma
0.25
0.2
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
1973
1981
1989
1997
2005

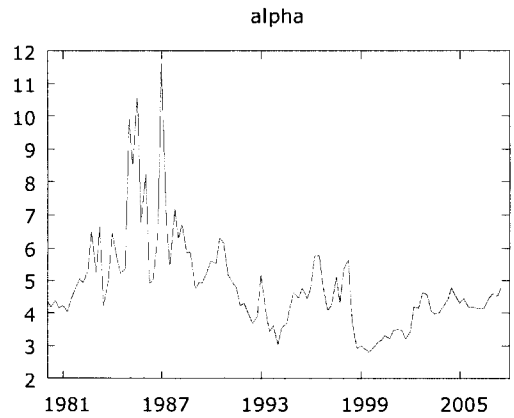

delta
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
1973
1981
1989
1997
2005

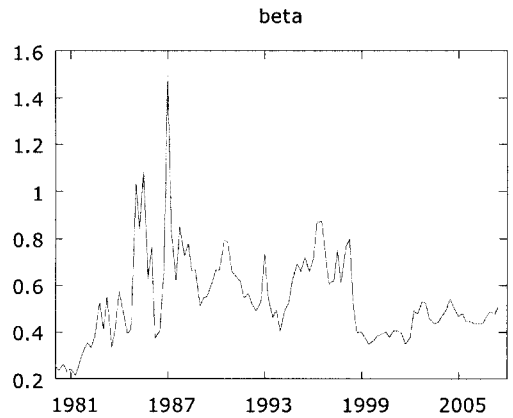
New Zealand

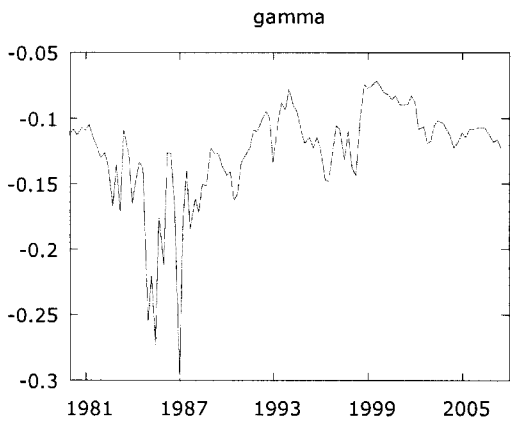

alpha
18
16
14
12
10
8
6
4
1981
1987
1993
1999
2005

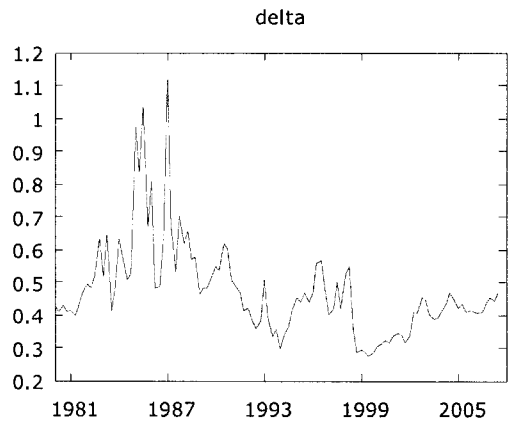

beta
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
1981
1987
1993
1999
2005


gamma
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
1981
1987
1993
1999
2005


alpha
12
11
10
9
8
7
6
5
4
3
2
1981
1987
1993
1999
2005


beta
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
1981
1987
1993
1999
2005


gamma
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
1981
1987
1993
1999
2005


delta
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
1981
1987
1993
1999
2005

5 Conclusions

We find that in the countries we've selected for the analysis all the parameters of the monetary policy rules followed a very similar path: the time varying intercept representing the target interest rate was continuously decreasing from the late 80's. The parameter beta (mearurement of central bank's sensitivity on inflation) was highly volatile during the 80's and very smooth since the late 90's. The IT stabilized expectations of future inflation not because of high interest rates but credibility and thus beta decreased during the IT period. These results are robust over various specifiation of the model: the choice of different types of interest rates or inflations did not affect our results. Also the trajectories are very similar if we control for impact of additional variables in the monetary policy rule such as nominal exchange rate, foreign exchange rate or financial stress indicator.

References (relevant papers)

Adam, Christopher, Cobham, David, Girardin, Eric, 2005. Monetary Frameworks and Institutional Constraints: UK Monetary Policy Reaction Functions, 1985-2003. Oxford Bulletin of Economics and Statistics 67, 497-516.

Assenmacher-Wesche, Katrin, 2006. Estimating Central Banks' Preferences from a Time-varying Empirical Reaction Function. European Economic Review 50, 1951-1974.

Batini, Nicoletta, Nelson, Edward, 1999. Optimal Horizons for Inflation Targeting. Journal of Economic Dynamics and Control 25, 891-910.

Benati, Luca, Surico, Paolo, 2008. VAR Analysis and the Great Moderation. ECB Working Paper No. 866.

Boivin, Jean, 2006. Has U.S. Monetary Policy Changed? Evidence from Drifting Coefficients and Real-Time Data. Journal of Money, Credit and Banking 38(5), 1149-1173.

Canova, Fabio, Gambetti, Luca, 2008, Structural changes in the US economy: is there a role for monetary policy?, mimeo.

Clarida, Richard, Galí, Jordi, Gertler, Mark, 1998. Monetary Policy Rules in Practice: Some International Evidence. European Economic Review 42, 1033-1067.

Clarida, Richard, Galí, Jordi, Gertler, Mark, 2000. Monetary Policy Rules and Macroeconomic Stability: Evidence and Some Theory. The Quarterly Journal of Economics 115, 147-180.

Davradakis, Emmanuel, Taylor, Mark, P., 2006. Interest Rate Setting and Inflation Targeting: Evidence of a Nonlinear Taylor Rule for the United Kingdom, Studies in Nonlinear Dynamics & Econometrics, 10(4), Article 1.

De Brouwer, Gordon, Gilber, James, 2005. Monetary Policy Reaction Functions in Australia. The Economic Record 81(253), 124-134.

Demers, Fréderick, Rodríguez, Gabriel, 2002. Estimation of the Taylor Rule for Canada Under Multiple Structural Changes. Working Paper, University of Ottawa.

Dolado, Juan José, María-Dolores, Ramon, Ruge-Murcia, Francisco, 2004. Nonlinear Monetary Policy Rules: Some New Evidence for the U.S. Studies in Nonlinear Dynamics & Econometrics 8(3), Article 2.

Domenech, Rafael, Ledo, Mayte, Taguas, David, 2002. Some New Results on the Interest Rate Rules in EMU and in the US. Journal of Economics and Business 54, 431-446.

Edwards, Sebastian, 2006. The Relationship Between Exchange Rates and Inflation Targeting Revisited. NBER Working Paper No. 12163.

Elkhoury, Marwan, 2006. Time-Varying Parameter Model of a Monetary Policy Rule in the Switzerland. HEI Geneva, Working Paper No.01.

Gerdesmeier, Dieter, Roffia, Barbara, 2004. Empirical Estimates of Reaction Functions for the Euro

Area. Swiss Journal of Economics and Statistics 140, 37-66.

García, Macarena, García, Pablo, Piedrabuena, Bernadita, 2005. Fiscal and Monetary Policy Rules: The Recent Chilean Experience. Central Bank of Chile, Working Paper No. 340.

Gredig, Fabián, 2007. Assymetric Monetary Policy Rules and the Achievements of the Inflation Target. The Case of Chile. Central Bank of Chile, Working Paper No. 451.

Horváth, Roman, 2008. The Time-Varying Policy Neutral Rate in Real Time: A Predictor for Future Inflation? Economic Modelling, forthcoming.

Huang, Angela, Margaritis, Dimitri, Mayes, David, 2001. Monetary Policy Rules in Practice: Evidence for New Zealand. Multinational Finance Journal 5(3), 175-2000.

Jansson, Per, Vredin, Anders, 2003. Forecast-Based Monetary Policy: The Case of Sweden. International Finance 6:3, 349-380.

Karedekikli, Ozer, Lees, Kirdal, 2007. Do the Central Banks of Australia and New Zealand Behave Asymmetrically? Evidence from Monetary Policy Reaction Functions. The Economic Record 83(261), 131-142.

Kim, Chang-Jin, 2006. Time-Varying Parameter Models with Endogenous Regressors. Economics Letters 91, 21-26.

Kim, Chang-Jin, Nelson, Charles R., 2006. Estimation of a Forward-Looking Monetary Policy Rule: A Time-Varying Parameter Model Using Ex-post Data,. Journal of Monetary Economics 53, 1949-1966.

Kim, Chang-Jin, Kishor, Kundan, Nelson, Charles, 2006. A Time-Varying Parameter Model for a Forward-Lokking Monetary Policy Rule based on Real-Time Data, mimeo.

Kishor, Kundan, 2008. International Evidence on Time Variation in a Forward-Looking Monetary Policy Rule, mimeo.

Leu, Shawn Chen-Yu, Sheen, Jeffrey 2006. Asymmetric Monetary Policy in Australia The Economic Record 82 (Special Issue), 85-96.

Longworth, David, O'Reilly, Brian, 2000. The Monetary Policy Transmission Mechanims and Policy Rules in Canada. Central Bank of Chile, Working Paper No. 72.

Meireless-Aureliano, Marcela, 2005.Do We Really Know How Inflation Targeters Set Interest Rates? Federal Reserve Bank of Kansas City, Research Working Paper No. 02.

Nelson, Edward, 2004. Monetary Policy Neglect and the Great Inflation in Canada, Australia, and New Zealand. Federal Reserve Bank of St. Louis, Working Paper No. 08.

Orphanides, Athanasios 2001. Monetary Policy Rules Based on Real-Time Data. American Economic Review 91, 964-985.

Plantier, L. Christopher, Scrimgeour, Dean, 2002. Estimating a Taylor Rule for New Zealand with a Time-Varying Neutral Real Rate. Reserve Bank of New Zealand, Discussion Paper No. 06.

Psaradakis, Zacharias, Sola, Martin, Spagnolo, Fabio, 2006, Instrumental-Variables Estimation in

Markov Switching Models with Endogenous Explanatory Variables: An Application to the Term Structure of Interest Rates. Studies in Nonlinear Dynamics & Econometrics 10(2), Article 1.

Rudebusch, Glenn, 2006. Monetary Policy Inertia: Fact or Fiction? International Journal of Central Banking 2(4), 85-136.

Sims, Christopher, Zha, Tao, 2006, Were there Regime Switches in US Monetary Policy, American Economic Review 96(1), 54-81.

Taylor, John B., 1993. Discretion versus Policy Rules in Practice. Carnegie-Rochester Conference Series on Public Policy 39, 195-214.

Taylor, John B. (Ed.), 1999. Monetary Policy Rules. The University of Chicago Press: Chicago.

Taylor, John, B., 2001. The Role of Exchange Rate in Monetary-Policy Rules. American Economic Review 91, 263-267.

Trecrocci. Carmine , Vassalli, Matilde, 2007. Monetary Policy Regime Shifts: New Evidence from Time-Varying Interest-Rate Rules, mimeo.

Trehan, Bharat, Wu, Tao, 2007. Time-Varying Equilibrium Real Rates and Monetary Policy Analysis. Journal of Economic Dynamics and Control 31, 1584-1609.

Valente, Giorgio, 2003. Monetary Policy Rules and Regime Shifts. Applied Financial Economics 13, 525-535.