Monetary and fiscal policy interactions: Evidence from emerging European economies This paper examines the interactions between fiscal and monetary policy for some former transition, emerging	Các tương tác giữa chính sách tiền tệ và chính sách tài khóa (chính sách tài chính): Dẫn chứng từ các nền kinh tế mới nổi ở châu Âu. Thông qua mô hình chuyển đổi chế độ Markov, bài báo này xem xét các tương tác giữa chính sách tài khóa và

European economies over the 1995Q1-2010Q4 period by using a Markov regime-switching model. We consider the monetary policy rule proposed by Taylor (1993) and the fiscal policy rule suggested by Davig and Leeper (2007) in accounting for monetary and fiscal policy interactions. Empirical results suggest that monetary and fiscal policy rules exhibit switching properties between active and passive regimes and all countries followed both active and passive monetary policies. As for fiscal policy, the Czech Republic, Estonia, Hungary, and Slovenia seem to have alternated between active and passive fiscal regimes while fiscal policies of Poland and the Slovak Republic can be characterized by a single fiscal regime. Although the policy mix and the interactions between monetary and fiscal policy point a diverse picture in our sample countries, the monetary policy seems to be passive in all countries after 2000. This finding is consistent with the constraints imposed by European Union enlargement on monetary policy.

chính sách tiền tệ ở một số nền kinh tế mới nổi châu Âu trong giai đoạn chuyển đổi ban đầu 1995Q1-2010Q4. Chúng ta sẽ xét quy tắc chính sách tiền tệ của Taylor (1993) và các quy tắc chính sách tài khóa của Davig và Leeper (2007) đồng thời cũng xét đến các tương tác giữa chính sách tiền tệ và chính sách tài khóa.

Về chính sách tài khóa, Cộng hòa Séc, Estonia, Hungary, và Slovenia dường như có sự xen kẽ giữa chế độ tài khóa chủ động và thụ động, trong khi đó, Ba Lan và Cộng hòa Slovak có một chế độ tài khóa đặc trưng duy nhất. Mặc dù sự pha trộn giữa các chính sách và sự tương tác giữa chính sách tiền tệ và tài khóa tô điểm thêm bức tranh đa dạng trong các quốc gia mẫu đang xét, nhưng có vẻ như các chính sách tiền tệ đều mang tính thụ động ở tất cả các quốc gia sau năm 2000. Phát hiện này phù hợp với những ràng buộc về chính sách tiền tệ phát sinh trong quá trình mở rộng Liên Minh châu Âu.

1. Introduction

Due to the global financial crisis, a large number of developed and developing countries have focused on economic sta-bilization instead of debt stabilization by using several fiscal stimulus packages and pursuing an active expansionary (mở rộng, nới lỏng) fiscal policy. However, there is no consensus in the literature on the effects of expansionary fiscal policy on economic stabilization. For instance, the non-Ricardian view

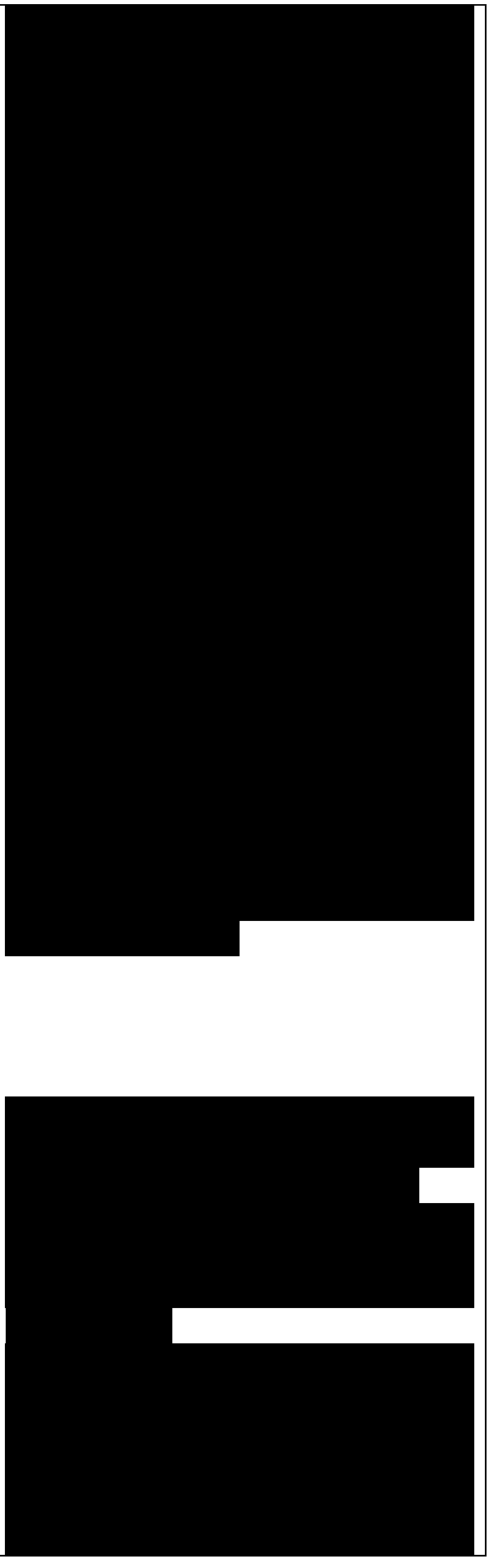
suggests that an expansionary fiscal policy financed by debt raises income (and hence private consumption). However, standard IS-LM approach suggests that without an appropriate monetary expansion, a fiscal stimulus leads to significant increases in aggregate demand which increases long-term interest rates and crowds out private investment. On the empirical front, the results seem to be sensitive to specific statistical methods1and hence the effect of fiscal expansion on crowding out is inconclusive (i.e. Canzoneri et al., 2002; Mountford and Uhlig, 2009; Ardagna, 2009; Afonso and Aubyn, 2009; Furceri and Sousa, 2011). In addition, the Ricardian view contests the effects of expansionary fiscal policy financed by debt on output and consumption because rational individuals would anticipate future tax increases by saving the respective amount. Hence, the usual Ricardian debt neutrality holds where, under broad conditions, government finance and timing of taxes do not matter, because the effect on demand is the same.

Fiscal policy is also relevant in determining the path of prices in an economy and several authors emphasize the effects of fiscal policy on the price level. While the Monetarist theory assumes that the money stock is the most important determinant of the price level in an economy, advocates of the Fiscal Theory of the Price Level (FTPL) contend that price stability requires not only an appropriate monetary

policy but also an appropriate fiscal policy.

In the non-Ricardian view, it is assumed that the primary surplus is adjusted by the government to guarantee solvency for any price level. On the other hand, the FTPL argues that if governments adjust primary surpluses independently of government debt, the presence of significant effects of fiscal shocks on the price level may be expected and hence, FTPL suggests the possibility that the primary surplus can be set independently from government debt. Hence, the price level will adjust to make government's intertemporal budget constraint hold at any point of time. These two cases of fiscal authority behavior (namely, the traditional theory and FTPL) are dubbed ''Ricardian'' and ''non-Ricardian'' in Woodford (1995), or ''passive'' and ''active'' in the terminology of Leeper (1991) where the fiscal authority sets primary surpluses due to government debt in the passive (''Ricardian'') fiscal policy and the active or ''non-Ricardian'' fiscal policy refers to the other case. It should be noted that intertemporal budget constraint may hold in equilibrium in both cases.

Therefore, when monetary policy is active and fiscal policy is passive, fiscal policy shocks cannot affect the price level and the policy combination (active monetary and passive fiscal policy) is appropriate



for inflation targeting.

In a sense, the behavior of fiscal authority is as important as the monetary authority in conducting desirable monetary policy rules, particularly monetary policy rules that involve inflation targeting.

Moreover, expansionary fiscal policy can affect monetary policy and lead to deviations from policy targets in developed and developing countries. It is well known that several developed and developing countries started pursuing inflation targeting policies at the beginning of 1990s. For instance, monetary authorities in the Czech Republic and Poland have pursued inflation targeting regimes since 1998. Hungary and the Slovak Republic have started to conduct an inflation targeting regime as a monetary policy rule in 2001 and 2005, respectively (Mishkin, 2008; Siklos, 2008). At the end of 2011, deviations from inflation targets are observed in these countries except for the Slovak Republic and this lends support to the FTPL approach as expansionary fiscal policy makes it difficult to control the price level.

Recent studies that focus on fiscal policy and monetary policy rules indicate that fiscal and monetary policy regimes are not fixed over time and hence fiscal and monetary rule equations should be estimated in a

stochastic framework (Favero and Monacelli, 2005; Davig and Leeper, 2007, 2011; Afonso et al., 2001; Doi et al., 2012; Thams, 2006; Dewatcher and Toffano; 2011; Ito et al., 2011).

These studies employ a two-state Markov regime-switching model to examine active and passive fiscal and monetary regimes. Steuerle (2006) emphasized two political views that cause regime changes in fiscal policy (Davig and Leeper, 2007). The first one was named ‘‘bargain lunch’’ and implies that policy makers try to make tax cuts or expenditure increases appear to be costless. The latter is called ‘‘green eye-shade’’ in which policy makers are ever-wary of the balance- sheet requirements associated with fiscal choices and hence this view suggests taxes rise with increases in government debt. In addition, Davig and Leeper (2007) indicate that monetary and fiscal policy rules show dramatic changes between wartime and peacetime. Also, local and global financial crises may cause changes in fiscal and monetary policy rules.

The main objective of this paper is to contribute to the literature by examining the interactions between fiscal and monetary policy rules for some former transition, emerging European economies by using a Markov regime-switching model. We consider the monetary policy rule proposed by Taylor (1993) and the

fiscal policy rule suggested by Davig and Leeper (2007) in accounting for monetary and fiscal policy interactions. To the best of our knowledge, this is the first investigation of the interactions between fiscal and monetary policy regimes for the Czech Republic, Estonia, Hungary, Poland, Slovenia, and the Slovak Republic. Our focus on former transition economies is motivated by several factors. First, the Czech Republic, Hungary, Poland, and the Slovak Republic have pursued 'inflation targeting' as a monetary policy rule and hence it is important to understand interactions between fiscal and monetary policy regimes for these countries. Second, these countries are part of the European Union and those which are not part of the euro zone are aspiring to adopt the Euro. Hence understanding interactions between policy regimes are particularly important in the absence of monetary policy instruments which would disappear if those countries were to join the Euro zone. Finally, given the ongoing problems associated with the sovereign debt crisis in Europe, understanding the dynamics of fiscal and monetary policy would provide a framework for understanding the limits of such policies.

2. Econometric methodology

In order to examine policy interactions between monetary and fiscal rules we employ a Markov regime-switching model. To that end, we consider the monetary policy rule proposed by Taylor (1993) and the

fiscal policy rule suggested by Davig and Leeper (2007).

Taylor (1993) proposed a reaction function for the Federal Reserve Bank of the U.S. (the Fed hereafter) for the 1987-1992 periods as follows:

iT = r + p* + «1(nt - p*) + «2(yt -y*) (1)

where i‘t is the desired interest rate, ris the equilibrium real rate, pt is inflation rate, p* is the target value of inflation and (yt - y*) is the output gap. Taylor considered the short term interest rate as the monetary policy instrument and hypothesized that the federal funds rate would increase if inflation rises above target or if output increases above its trend value. It should be noted that Taylor did not estimate Eq. (1) econometrically but set a1 and a2 equal to 0.5. After the seminal work by Taylor (1993), central bank (CB) reaction functions have been widely examined across countries and over different time periods and coefficients for deviations of inflation from target and output gap are found to vary across countries and over time. Note that the deviation of inflation over the last four quarters from its target is considered in the original Taylor rule. On the other hand, it is well known that CB generally considers expected inflation as a target rather than past or current inflation. In this context, Clarida et al. (1998) proposed a forward-looking version of the Taylor rule due to rational expectations. Clarida et al. (1998) suggested that the desired interest rate relies on both the deviation of k periods ahead expected inflation from its target and

the p periods ahead expected output gap. Hence, forward-looking policy rule can be formulated as follows:

iT = r + p* + a (EPt+k - p*) + a2(Eyt+p - y*+p) (2)

where Ept+k is the expected accumulated inflation rate that can be calculated as next k quarters forecast for inflation and Eyt+p is the expected output that indicates forecast for p quarters ahead. One interpretation of the Taylor rule is that the weight on the inflation gap should exceed unity and the coefficient on the output gap should be positive to stabilize monetary policy. Moreover, when the estimated coefficient for the inflation gap is greater than unity, the CB pushes up the real rate in response to higher inflation and this is dubbed an active monetary policy. A positive coefficient on the output gap entails a lower interest rate in situations where output is below normal and thus has a stabilizing effect on the economy.

Since central banks do not adjust short term interest rates to their desired level (due to interest rate smoothing), the presence of autocorrelation in interest rate may be expected. Therefore, the dynamics of adjustment of the actual level of the interest rate to the target interest rate is modeled as follows:

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The lag length for the interest rate in Eq. (3) is determined to render residuals white noise. If Eq. (2) is substituted into Eq. (3), the following policy rule model may be written:

it = Į^1 - X'.Pi'j [r + p* + a1 (Ept+k- p*) + a2(Eyt+p- y*^] + XXPiit

As in Assenmacher-Wesche (2006), we assume that the long-run real interest rate and the inflation target are embedded in the constant term such that a0 = r - (a - 1)p*. Furthermore, as in Clarida et al. (1998), if we eliminate the unobserved forecast variables from Eq. (4), the policy rule can be written in terms of realized variables as follows:

it = (1 - XPi] j [“0 + “1 Pt+k + «2Xt+p] + XPiit-i + e (5)

where xt+p indicates the output gap and the error term can be defined as the linear combination of the forecast errors of inflation and output gap as follows:

et = -1 - XPij [“1 (p* - EPt+k) + “2(y*+p - Eyt+p)j + tt

A large body of literature shows that the monetary policy rule exhibits regime-switching properties (Altavilla and Landolfo, 2005; Clarida et al., 1998, 2000; Kuzin, 2006; Assenmacher-Wesche, 2006; Zheng et al., 2012). For instance, Muscatelli et al. (2002) confirmed the presence of structural breaks in estimated interest rate rules for a number of countries. Clarida et al. (2000) and Judd and Rudebusch (1998) showed that the Fed’s reaction function depends on the chair of the Fed and hence the weights for inflation and output gap displayed changing properties. Neumann and von Hagen (2002) showed that the weights for inflation and the output gap have changed due to introduction of inflation targeting regimes in six countries that followed such policies.

In addition, Demers and Rodriguez (2001), Kuzin (2006) and Assenmacher-Wesche (2006) found that a Markov regime-switching model outperforms a single regime in estimating monetary policy reaction functions. Based on this evidence, we employ the following model in estimating monetary policy rules in our sample:

it = ao(St) + a1 Pt+k(st) + «2xt+p(st) + ^pât-i{st) + e (6) i=1

where it is the nominal interest rate, nt+k is the inflation rate for the next k quarters at time t, xt+p is the p quarters ahead output gap and et is the innovation process. As in Doi et al. (2012) and Ostry et al. (2012), the trend real GDP is calculated by using HP filter. In Eq. (6), if the estimated coefficient on the inflation rate is greater than one it would suggest an active monetary policy regime (a-1 P 1). On the other hand, the regime can be deemed a passive monetary policy regime if the estimated coefficient for the inflation rate is less than one (a! < 1).

The most important problem for the estimation of Eq. (6) is that the inflation rate and output gap variables are correlated with the disturbance term et. It is well known that this problem can be solved by using the generalized method of moments (GMM) method for the linear version of Eq. (6). However, the GMM estimation procedure cannot be applied in the regime- switching model. Hence, we consider an estimation procedure for the regime-switching model suggested by Kim (2004). Kim (2004) showed that if there are endogenous explanatory

variables in the Markov switching model, the Hamilton filter cannot be applied directly and hence the estimation procedure requires an appropriate transformation. The transformed model allows for a vector of bias correction terms as additional regressors, and the new disturbance term is uncorrelated with all regressors in the transformed model. In this case, the monetary policy rule with bias correction for endogenous explanatory variables can be written as follows:

it = a0(St) + a1 nt+k(st) + a2xt+p(st) + g (n+k - ztÕ1)(st)+ g2(xt+p - ztÕ2)(st) + Pịit-i(st) + e (7) i=1

where zt is a vector of instrumental variables that include four lags of the interest rate, output gap and inflation. The estimates for inflation and output gap can be obtained by using the instrumental variables as follows:

nt+k = z't ÕÑ1(st) + t

, (8)

xt+p = z't ÕÑ2(st) + t2

where t1 and t2 are disturbance terms and a maximum likelihood estimation procedure based on the Hamilton filter can be applied to Eq. (7). In addition, Kim (2004) showed that the usual Wald or the likelihood ratio statistics for the null hypothesis of gi = 0 in both states can be used to test endogeneity.

Although there is no widely accepted model for fiscal policy rules, the specification proposed by Davig and Leeper (2007) has been widely utilized to characterize fiscal policy regimes in the literature. As such, we

employ the following fiscal policy rule suggested by Davig and Leeper (2007):

$$S_t = C_0(S_t) + C_1(S_t)b_{t-1} + C_2(S_t)y_t + C_3(S_t)g_t + \sum_{i=1}^{k} J_2\pi_i(S_t)S_{t-i} + e \quad (9)$$

where st is the ratio of tax revenue to GDP, bt-1 is lagged debt to GDP ratio, yt is output gap (output gap is calculated as deviation from real GDP by using Hodrick-Prescott filter), gt is the government expenditures to GDP ratio and et is the innovation process. We also include lags of the ratio of tax revenue to GDP in the fiscal policy rule in order to remove autocorrelation from residuals. According to the terminology adopted by Leeper (1991), a ‘‘passive fiscal policy regime’’ requires that the estimated coefficient of lagged debt to GDP ratio be positive and statistically significant ($c > 0$) so that an increase in the stock of public debt outstanding leads to a significant decrease in government deficit. Conversely, if c 6 0, the state can be dubbed an ‘‘active fiscal policy’’ regime where the policymaker does not feel constrained by the level of government debt.

The unobserved state variable in the monetary and fiscal policy rule model, st, evolves according to a first order Markov- switching process described in:

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where pij are the fixed transition probabilities of being in the first or second state, respectively. Note that the mean duration of staying in a regime can also be calculated as d =

1/(1 - pii).

Davig and Leeper (2007 and 2011) proposed that the joint transition matrix for monetary and fiscal policy can be calculated as follows:

P = PM <g> PF (11)

where PM and PF indicate the transition matrix for monetary and fiscal policy, respectively and the joint transition matrix (P) gives us policy mix of monetary and fiscal policy rules as in the following table:

For instance, Davig and Leeper (2007 and 2011) proposed that an active monetary and passive fiscal regime combination is ‘‘Ricardian’’ while a passive monetary regime and an active fiscal regime can be called ‘‘Fiscal Theory’’. If both monetary and fiscal policy regimes are active, the monetary and fiscal policy combination cannot be sustained and hence this policy mix (sự pha trộn chính sách, sự kết hợp chính sách) is ‘‘explosive’’. Finally, when both monetary and fiscal policies are passive, the policy mix is referred to as “indeterminacy.”

3. Data and empirical results

In this study, we examine the interactions between monetary and policy regimes and determine the policy mix regimes for the Czech Republic, Estonia, Hungary, Poland, Slovenia and the Slovak Republic. The sample country selection is based on data availability. Quarterly data are used for monetary and fiscal variables over the 1995Q1-2010Q4 period. The sample period starts in 1995 to remove the impact of the

early transition period during which there had been major fluctuations in data. Fiscal variables such as the ratio of tax revenue to GDP, debt to GDP ratio are obtained from the OECD database and variables that are related to monetary policy rule are collected from the IMF's International Financial Statistics CD-ROOM, and Euro- stats database. Due to data availability, the data set starts from 1995Q4 for Estonia, Hungary and Slovenia. Since the Slovak Republic and Slovenia adopted the Euro at the beginning of 2009 and 2007, respectively, we estimate the Taylor rule for these countries separately where the sample period ends at 2006Q4 for Slovenia and 2008Q4 for the Slovak Republic. In order to account for any seasonal effects, the data are seasonally adjusted using the Tramo/Seats method.

We start our analysis by estimating a two-state Markov regime-switching model for the monetary policy rule to determine active and passive policy regimes. Hence, we first employ Eq. (8) with instrumental variables to obtain estimates of $\tilde{O}1$ and $\tilde{o}2$ and then Eq. (7) is estimated with different numbers of k and p (i.e. taking values 0,1, 2, 3, 4). We choose the model that minimizes the Akaike information criterion (AIC) for the forward-looking monetary policy rule. The selected k and p according to AIC are reported in Table 1. The results in Table 1 indicate that except for Poland and the Slovak Republic,

Central Banks of all sample countries adjust their short term interest rate according to four- period- ahead inflation rate (k = 4). On the other hand, we find p to be 0 for all countries except for the Slovak Republic and Slovenia, which implies Central Banks generally consider the current output gap in the policy reaction functions. These results are consistent with empirical results found in Clarida et al. (1998).

Then, we calculate a LR statistic to test model specification (i.e., Markov regime-switching model vis-à-vis the linear model) for the monetary policy rule. The LR test statistic presented in Table 2 soundly rejects the null hypothesis of no regime-switching in monetary policy rule for all countries. These results suggest the presence of a nonlinear (regime-switching) relationship in the policy reaction functions. Thus, a linear model would be misspecified; as such, it is necessary to employ regime switching model to examine monetary policy rules.

Maximum likelihood estimates of the Markov regime-switching model for the monetary policy rule are presented in Table 3. The estimated coefficients for the Central Bank reaction functions are quite different across regimes and countries. The states can be classified as ‘active’ and ‘passive’ monetary regimes because the interest rate reaction to inflation exceeds one in the first regime. However, the estimated coefficient the interest rate reaction to inflation is

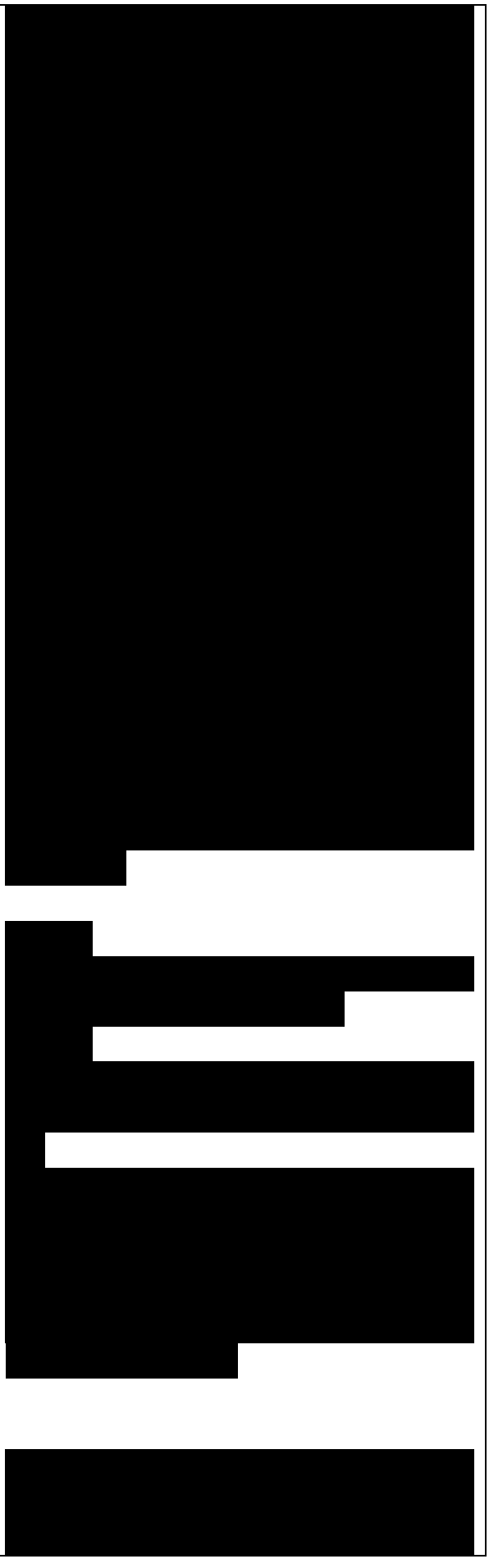
less than one in the second state; hence, the second state can be characterized as a passive monetary regime. Notice that the coefficients for inflation and output gap in both regimes are positive and these results are consistent with a priori expectations for all countries. In the active monetary policy regime, the reaction of the interest rate to inflation range from about 1.3 in Hungary to 11.9 in the Czech Republic. We also examine whether the effect of inflation on the interest rate is equal to unity in the active monetary policy regime by means of a Wald test for all countries. In this test, the null hypothesis is that weights on inflation are equal to one with the alternative hypothesis that weights exceed one. The test results are presented in Table A1 in the Appendix. The test statistics suggest that the estimated coefficient for inflation is not different from one in the active monetary policy regime

Table 1
Optimal k and p for forward-looking monetary policy rule model.

Table 2
Tests for linearity over nonlinearity (monetary policy rule).

Note: The v2 column displays the p-value of the LR test under the standard chi-square distribution; and the ‘‘Davies p-value’’ column presents the results obtained from Davies’ (1987) upper-bound p-value calculation.

at 5% level for all countries except for the Czech and Slovak Republics. Wald test result for the Czech and



Slovak Republics shows that weight of inflation in the active regime is significantly higher than one.

In the passive monetary regime, the estimated coefficients for the interest rate response to inflation range from 0.37 for the Slovak Republic to 0.80 for Hungary. Specifically, the weight of inflation in the Central Bank reaction function is not statistically significant (không có ý nghĩa thống kê, không đủ độ tin cậy thống kê) in the passive monetary regime for Estonia and Hungary. Note that Central Banks seem to have focused on the output gap instead of inflation in passive monetary regimes as the weights for the output gap are higher than those of inflation for the Czech Republic, Estonia, Hungary and Poland. This phenomenon is noted by Owyang and Ramey (2004) who dubbed it a ‘‘dove regime’’ where output stabilization relative to inflation targets receives higher attention by the Central Bank .

The transition probabilities for the monetary policy rule in Table 2 indicate that the passive monetary policy regime is more persistent than the active monetary policy regime in all countries except for Poland. The probability of remaining in an active monetary policy regime at time t, when the series is also in an active monetary policy rule regime at time t - 1 is below 80% for all countries except for Poland. On the other hand, the probability of remaining in a passive monetary policy regime at time t when the series is also in a passive monetary policy rule regime

at time t - 1 is above 90% for all countries. Also, the mean duration of an active monetary policy regime varies between 1.50 (in Slovenia) and 10.00 (in Poland) quarters. On the other hand, the passive monetary policy regime duration is generally longer than ten quarters.

As a result, the passive monetary policy rule is more persistent than the active monetary policy regime for all countries. Our results also show that weight on inflation in the active monetary policy regime is higher than 2 in the Czech Republic, Estonia and the Slovak Republic. Finally, residual diagnostics such as normality, serial correlation and heteroskedasticity of the Markov regime-switching model are also reported in Table 2. These tests indicate that the Markov regime switching model passes all diagnostic tests.

Next, we test whether a Markov regime-switching model or the linear model are more appropriate for the fiscal policy rule. The test results in Table 4 strongly favor a regime-switching model for fiscal policy rules.

Maximum likelihood estimates of the fiscal policy rule are presented in Table 5. We assume that fiscal policy follows two states as in monetary policy and the states can be characterized as ‘active’ and ‘passive’ fiscal policy regimes. Empirical results in Table 5 confirm the presence of two regimes in fiscal policy for all countries except for Poland and the Slovak Republic. While the estimated coefficient of the lagged debt to GDP ratio is negative

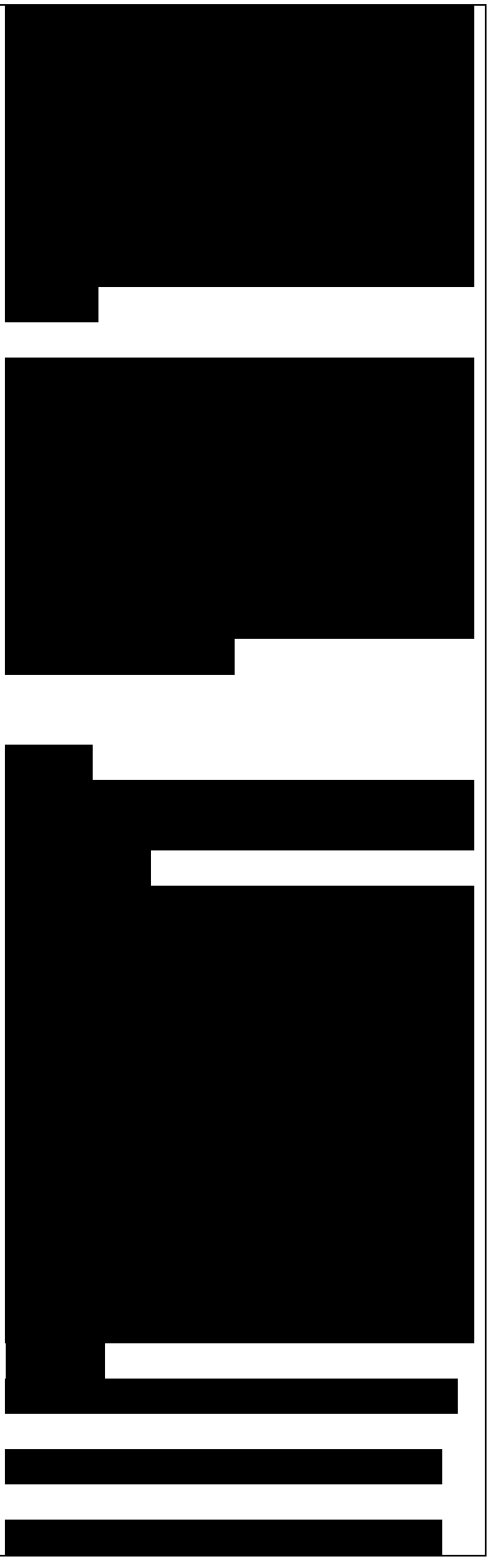
or statistically insignificant in the first state (this result implies an active fiscal policy regime), the estimated coefficient of lagged debt to GDP ratio is positive and statistically significant in the second state (and hence the second state is a passive fiscal policy regime) for all countries except for the Poland and the Slovak Republic.

The estimated coefficients for the government expenditure to GDP ratio are positive and statistically significant in the active fiscal regime for all countries. These results imply that an increase in government expenditure to GDP ratio raises tax revenue in the active fiscal regime. Moreover, the relationship between the government expenditure-GDP ratio and

Table 3
Markov regime-switching model results for the monetary policy rule.

Note: The figures in parentheses give the standard errors of coefficients. r (St) gives the standard error of regression for the regimes. pii indicate regime transition probabilities. d is the mean duration of regimes. P-v2 indicates the Portmanteau serial correlation test, N-v2 indicates the normality test and H-v2 indicates the heteroskedasticity test of the residuals (for more details on these tests, see Krolzig (1997)).

*** Indicate statistical significance at the 1% level, respectively.
** Indicate statistical significance at the 5% level, respectively.
* Indicate statistical significance



at the 10% level, respectively.

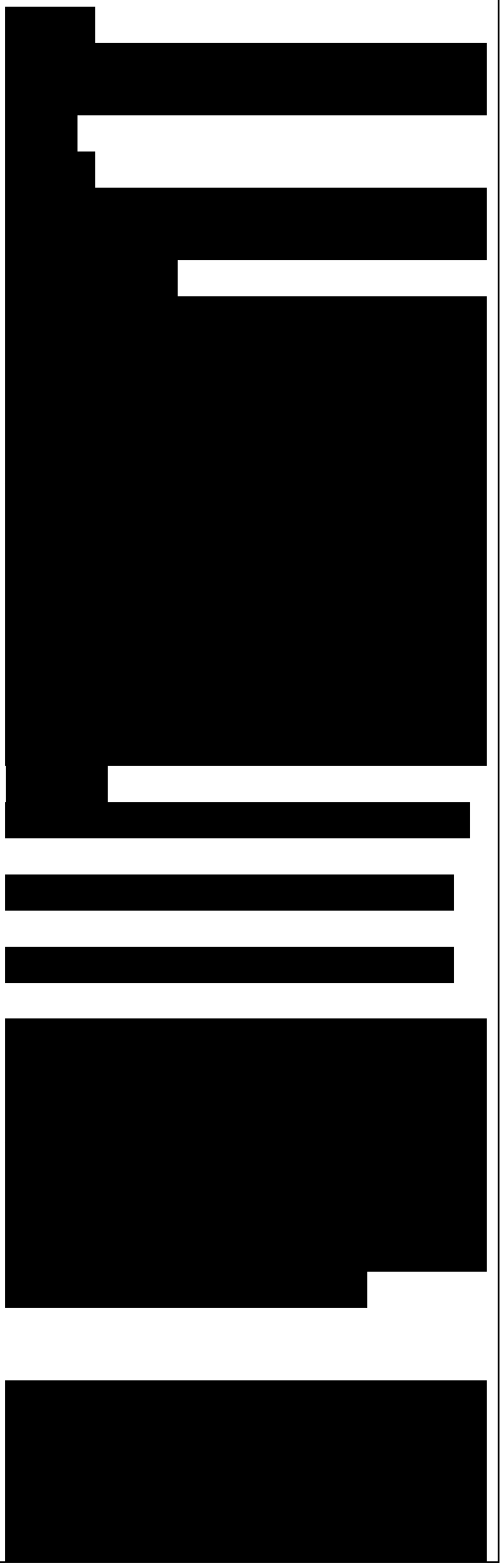
Table 4
Tests for linearity over nonlinearity (fiscal policy rule).

Table 5
Markov regime-switching model results for the fiscal policy rule.

Note: The figures in parentheses give the standard errors of coefficients. r (st) gives the standard error of regression for the regimes. pii indicate regime transition probabilities. d is the mean duration of regimes. P-v2 indicates the Portmanteau serial correlation test, N-v2 indicates the normality test and H-v2 indicates the heteroskedasticity test of the residuals (for more details on these tests, see Krolzig (1997)).
*** Indicate statistical significance at the 1% level, respectively.
** Indicate statistical significance at the 5% level, respectively.
* Indicate statistical significance at the 10% level, respectively.

The tax revenue-GDP ratio is not statistically significant in the passive fiscal regime for the Czech Republic, Estonia and Slovenia. On the other hand, the estimated coefficient of the government expenditure -GDP ratio is positive and statistically significant in the passive fiscal regime for Hungary, Poland and the Slovak Republic.

As Leeper (1991) emphasized, monetary and fiscal policy must be consistent to sustain the policy rule; as such, regime switches between fiscal and monetary rule should be



synchronized. Note that monetary policy in general in the Slovak Republic is consistent with fiscal policy results. Even though we find both active and passive monetary policy in the Slovak Republic, the passive monetary regime seems to be short lived (about three years). Hence one can conclude that active fiscal policy over the sample is likely to have required active monetary policy to be short lived in the Slovak Republic.

The estimated transition probabilities in Table 5 show that the active fiscal policy regime is more persistent than the passive fiscal policy regime for all countries except for the Czech Republic. On the other hand, the passive fiscal policy regime seems to be more persistent for the Czech Republic. The mean duration of an active fiscal policy regime varies between 1.94 (in Slovenia) and 13.00 (in Poland) quarters. Also, the passive fiscal policy regime lasts between 1.41 and 9.00 quarters. Note that an active fiscal policy where tax revenues fall in response to increases in government debt is not necessarily unsustainable since the intertemporal budget constraint can still hold if the monetary authority ‘‘acts passively.’’ Monetary authority acting passively will allow the price level to adjust appropriately so as to equate the value of outstanding government debt to the discounted present value of future expected primary surpluses (and this is consistent with the fiscal theory of the price

level). Debt sustainability hence requires looking at the interactions of monetary and fiscal policy and discerning policy mixes that allow for such revenue and/or price adjustments.

We present smoothed transition probabilities for the first regime (active monetary and fiscal policy regime) obtained from the monetary and fiscal policy rule models (equations 7 and 9 above) in Fig. 1. The smoothed transition probabilities in Fig. 1 present a clear picture regarding the timing of regime switches of monetary and fiscal policies in each country. According to results in Fig. 1, countries seem to have followed an active monetary policy regime at beginning of sample which implies monetary authorities in all these countries conducted an active policy on the eve of the transition.

To investigate the policy mix and monetary fiscal policy interactions, we calculate the joint transition matrix in Eq. (11) and the results on the timing of joint monetary-fiscal regimes are illustrated in Figs. 2-7.

The results in Fig. 2 show that monetary policy was generally passive over the sample period. Although the policy mix was indeterminate (passive monetary and fiscal policy) on the eve of transition, it turned into the Fiscal Theory (passive monetary and active fiscal policy) at the end of 1996. There seems to be two periods where the policy mix is explosive using the Leeper terminology and these periods are correlated with the crisis in the

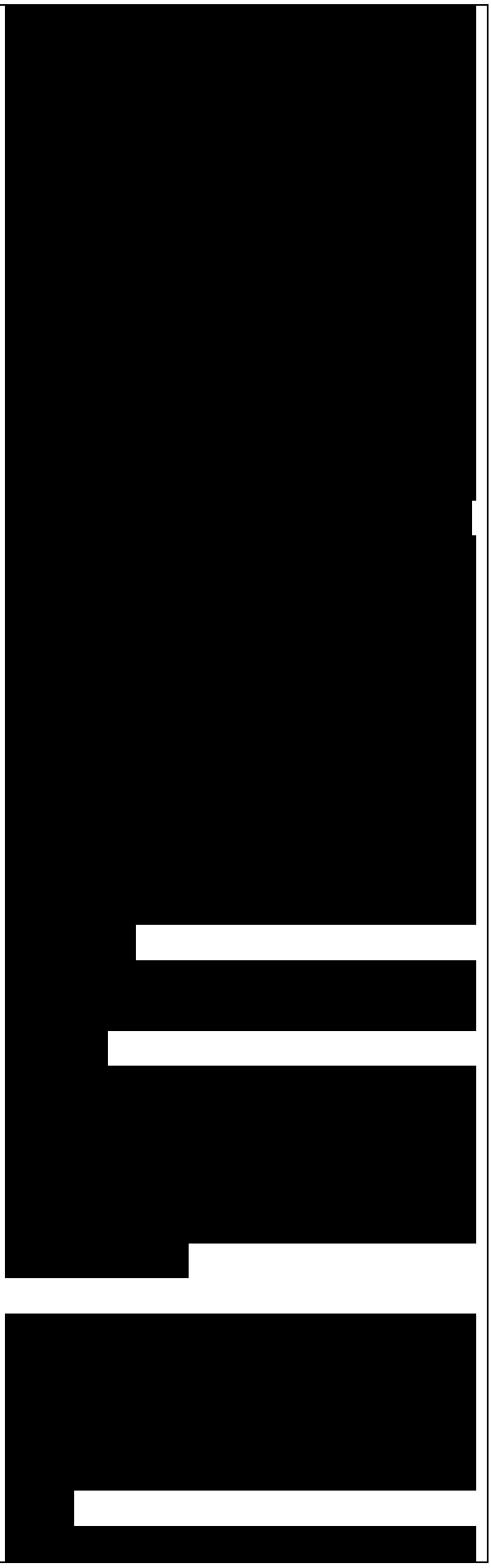
Czech Republic and the global financial crisis. More specifically, monetary policy was always passive after 2002 except for 2009 in the Czech Republic. On the other hand, we observe an active fiscal policy regime in the 2003-2004 and 2008-2009 periods. Note that both monetary and fiscal policies were active one in 2009 due to the global financial crisis. Finally, regime switches in monetary and fiscal policy were not well coordinated in the Czech Republic in the 2000s.

The policy mix for Estonia in Fig. 3 shows that policy mix switched between Fiscal Theory and indeterminacy in the 2000s in Estonia. According to transition probabilities, there was only a period in which both monetary and fiscal policy were active which may be related to Russian crisis in 1998. After the Russian crisis, fiscal policy turned passive and policy mix was

Figă 2ê Estimated monetary and fiscal regimes for the Czech Republic. Note: AM indicates active monetary regime, PM indicates passive monetary regime, AF indicates active fiscal regime and PF indicates passive fiscal regime.

Figê 3ê Estimated monetary and fiscal regimes for Estonia. Note: AM indicates active monetary regime, PM indicates passive monetary regime, AF indicates active fiscal regime and PF indicates passive fiscal regime.

Figê 4ê Estimated Monetary and



Fiscal Regimes for Hungary. Note: AM indicates active monetary regime, PM indicates passive monetary regime, AF indicates active fiscal regime and PF indicates passive fiscal regime.

Ricardian until 2000 in Estonia. Although fiscal policy was passive specifically for the periods of 2007-2008, it switched to active one due to global financial crisis.

The policy mix seems to have alternated mainly between three policy combinations (Indeterminacy, Fiscal Theory and Ricardian) in Hungary as can be seen in Fig. 4. Note that, monetary and fiscal policy do not seem to have been well coordinated in Hungary over the sample. For example, Hungary seems to have followed active monetary and passive fiscal regime on the eve of transition, after which both monetary and fiscal policy switched to a passive one (indeterminacy mix).

Thereafter the policy mix was consistent with the Fiscal Theory of the Price Level between 1999 and 2001. It was only a brief period where the policy mix was ‘‘explosive’’ in 2004. Fiscal policy was generally active after 2007 where the policy mix turned into Fiscal Theory of the Price Level in Hungary.

The results in Fig. 5 show that the policy mix is consistent with the Fiscal Theory (monetary policy was passive and fiscal policy was active) at the beginning of the sample period in Poland. Since our results indicate a single regime in fiscal policy (active fiscal regime), the policy mix was explosive in Poland for the 1997-

2002 period. After that, monetary policy switched

Fig. 5. Estimated monetary and fiscal regimes for Poland. Note: AM indicates active monetary regime, PM indicates passive monetary regime, AF indicates active fiscal regime and PF indicates passive fiscal regime.

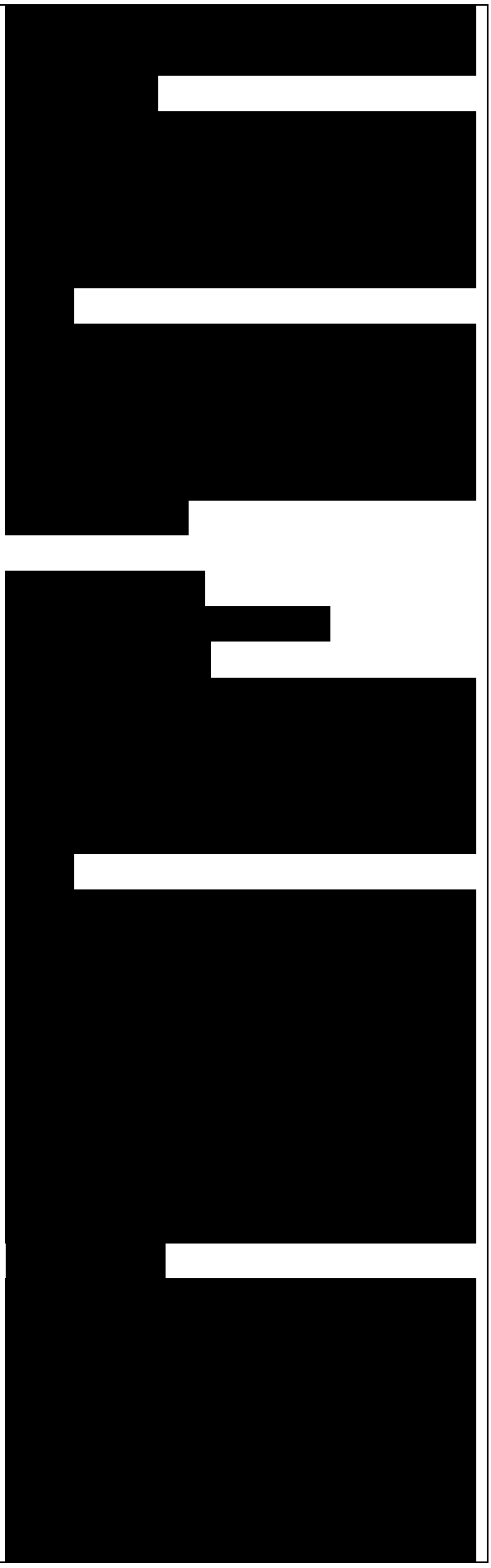
Fig. 6. Estimated monetary and fiscal regimes for the Slovak Republic. Note: AM indicates active monetary regime, PM indicates passive monetary regime, AF indicates active fiscal regime and PF indicates passive fiscal regime.

PM/PF Indeterminacy PM/AF Fiscal Theory "AM/AF Explosive

Fig. 7. Estimated monetary and fiscal regimes for Slovenia. Note: AM indicates active monetary regime, PM indicates passive monetary regime, AF indicates active fiscal regime and PF indicates passive fiscal regime.

to a passive one and the policy mix was Fiscal Theory for the 2003-2008 period. With this policy mix the intertemporal budget constraint holds and debt is sustainable; however, the price level adjusts so as to satisfy the intertemporal budget constraint. Note that the global financial crisis caused to policy mix to turn into an explosive one in Poland.

As in Poland, our results indicate a single regime in fiscal policy (an active fiscal regime) for the Slovak republic and the policy mix generally is consistent with the Fiscal Theory except for 1996-1998. Note that monetary and fiscal policies were active on the eve of the transition and



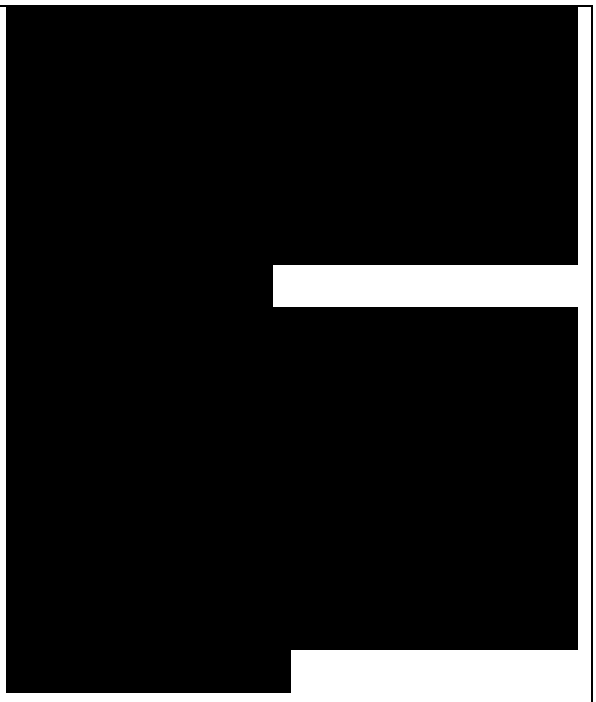
hence policy mix was explosive for 1996-1998. Thereafter the policy mix seems to have turned into that consistent with the Fiscal Theory of the Price Level in the Slovak Republic.

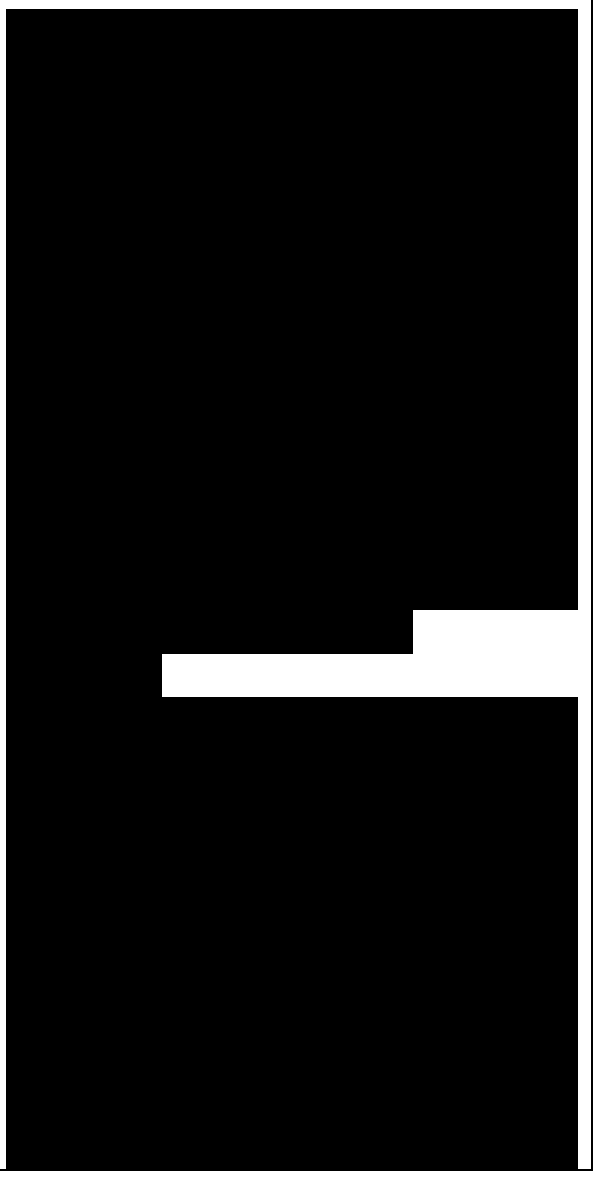
Finally, the results in Fig. 7 show that there were two periods in which the policy mix was explosive in Slovenia and these periods were at beginning of sample and in 1999. The policy mix seems to have alternated between two possible policy spec-ifications (Indeterminacy and Fiscal Theory) in the new millennium in Slovenia.

In general the results in Figs. 2-7 show that monetary policy has been passive after 2000 in all countries except for Poland. Perhaps an active monetary policy in Poland was due to the global financial crisis and hence this can be explained by extenuating circumstances. The fact that monetary policy is passive in all countries except Poland is interesting in that it may be explained by the European Union enlargement where the latter seems to have imposed constraints on monetary policy.

4ề Conclusions

In this paper, we examine the interactions between fiscal and monetary policy rules for some former transition, emerging European economies by using a Markov regime-switching model. As the basis for monetary policy, we estimate a variant of the monetary policy rule proposed by Taylor (1993). For the fiscal policy rule, and in order to account for monetary and fiscal





policy interactions we use the framework proposed by Davig and Leeper (2007). Our sample consists of the Czech Republic, Estonia, Hungary, Poland, Slovenia and the Slovak Republic in the post-transition period and choice of countries was dictated by data availability.

Empirical results suggest that Central Banks of all countries followed both active and passive monetary policies rules in the sample. Also passive monetary policy regimes seem more persistent and have higher duration than active monetary regimes for all countries except for Poland. Except for the Slovak Republic and Slovenia, all countries pursued ‘‘dove regimes’’ per Owyang and Ramsey (2004), where output stabilization took priority over inflation targets in the passive monetary regime. As for fiscal policy, the Czech Republic, Estonia, Hungary, and Slovenia seem to have alternated between active and passive fiscal regimes while the Slovak Republic and Poland fiscal policies can be characterized by a single (active) fiscal regime. Moreover, active fiscal policy is more persistent in Estonia, Hungary, Poland and Slovenia than in other countries. The global financial crisis seems to have forced fiscal policy to an active regime in all countries.

The policy mix and the interactions between monetary and fiscal policy point a diverse picture in our sample countries. These findings are consistent with work on other European countries. For instance, Thams (2006) finds the presence of an unsustainable policy combination for Spain. In addition, Semmler and

Zang (2004) show that interactions between monetary and fiscal policies are not strong for Germany and France. They also indicate that the two policies have not been accommodative but counteractive to each other. Our results show that monetary policy was passive in general in all countries after 2000. This may be due to the European Union enlargement where the latter may impose constraints on monetary policy.