AN OPTIMAL MACRO ECONOMIC POLICY MIX FOR SLOVENIA AFTER EU ACCESSION

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Abstract: This paper analyses the design of macroeconomic policies for Slovenia during the process of full integration into the European Economic and Monetary Union (EMU). "Optimal" monetary and fiscal policies are determined as solutions of optimum control problems with a quadratic objective function and the macroeconometric model SLOPOL as constraint. Several optimization experiments under a flexible exchange rate, a fixed exchange rate and a crawling peg scenario are carried out. It is shown than the best policy results are obtained under a crawling peg regime with a decreasing depreciation rate. *Copyright © 2005 IFAC.*

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1. INTRODUCTION

On May 1, 2004, together with nine other countries, Slovenia joined the European Union. From the first day of membership onwards, these countries have been participating in the European Economic and Monetary Union (EMU), albeit with a derogation, meaning that the new entrants were not given the right not to join ("opt-out clause") as in the case of the UK and Denmark. However, being EMU members does not imply introducing the euro immediately. Before having the right to adopt the common currency, Slovenia and the other accession countries are required to fulfill the criteria set out in the Maastricht Treaty. The choice of the exchange rate regime before adopting the euro is of particular importance. With effect from 28 June 2004, together with Estonia and Lithuania, Slovenia entered the Exchange Rate Mechanism ERM II of the European Monetary System. The ERM II links the currencies of non-euro area member states to the euro. For each participating currency, a central parity against the euro and a standard fluctuation band of +/- 15 percent (+/- 2.25 percent in case of the Danish krone) are defined. Introducing the euro requires, in principle, that the currency has remained within the fluctuation band for two years.

In the Euro System, monetary policy is conducted by the European System of Central Banks and the European Central Bank (ECB) in particular and is therefore no longer available for internal stabilization purposes of the member countries. As a consequence, other economic policy instruments may become more important than hitherto. It is therefore of interest whether macroeconomic policy goals such as a high GDP growth rate, low inflation and unemployment as well as external equilibrium and a balanced budget can be achieved by means of fiscal policy only. Thus, this paper analyses whether the choice of participating in the ERM II in an early stage after EU accession was the best strategy in terms of the macroeconomic performance. For this purpose, "optimal" monetary and fiscal policies for Slovenia

are determined as solutions of optimum control problems with a quadratic objective function and under the constraint of SLOPOL, a macroeconometric model of the Slovenian economy. Several optimization experiments under a fixed exchange rate, a flexible exchange rate, and a crawling peg regime approximating Slovenia's full integration into the European Economic and Monetary Union (EMU) are carried out. It is shown that the best overall economic performance is achieved under a crawling peg regime allowing a depreciation of the Slovenian tolar (SIT) against the euro with a decreasing rate of depreciation. The worst policy results are obtained when the exchange rate is totally fixed at an early stage of EMU integration.

2. THE OPTIMUM CONTROL APPROACH

The aim of this paper is to calculate time paths of macroeconomic policy instruments that are "optimal" according to an objective function of a hypothetical policy-maker for Slovenia. To obtain optimal economic policies, the OPTCON algorithm, developed in (Karbuz, Matulka and Neck, 1994) and (Matulka and Neck, 1992) is applied. OPTCON has been applied to determine optimal fiscal policies for Austria (Neck and Karbuz, 1995, 1997 and 1999). OPTCON determines approximate solutions of optimum control problems with a quadratic objective function and a nonlinear multivariable model. The objective function has to be quadratic in the deviations of the state and control variables from their desired values. The objective function has the following form:

$$L = \frac{1}{2}\sum_{t=1}^{T}\begin{bmatrix}\mathbf{x}_t - \tilde{\mathbf{x}}_t \\ \mathbf{u}_t - \tilde{\mathbf{u}}_t\end{bmatrix}\mathbf{W}_t\begin{bmatrix}\mathbf{x}_t - \tilde{\mathbf{x}} \\ \mathbf{u}_t - \tilde{\mathbf{u}}_t\end{bmatrix}, \qquad (1)$$

$$\mathbf{W}_t = \alpha^{t-1}\,\mathbf{W}\,,\ \mathrm{t} = 1,\ldots,\mathrm{T} \qquad (2)$$

where $\mathbf{x}_t$ denotes the vector of state variables, $\mathbf{u}_t$ denotes the vector of control variables, $\tilde{\mathbf{x}}_t$ and $\tilde{\mathbf{u}}_t$ are the desired values of the state and control variables, $\mathbf{W}_t$ is the matrix containing the weights given to the deviations of the state and control variables from their desired values, respectively, and α denotes the discount factor. The dynamic system has to be given in a state space representation. Although OPTCON can solve deterministic and stochastic optimum control problems, here we confine ourselves to deterministic optimizations only.

3. THE SLOPOL MODEL

SLOPOL (SLOvenian economic POLicy model) is a medium-sized model of the small open economy of Slovenia. It can be characterized as a disequilibrium model, i.e. persistent disequilibria on the markets are possible. This applies especially to the goods market and to the labor market. The capacity utilization rate, i.e. actual output as a percentage of potential output, can be regarded as an indicator for tension on the goods market. An increase in the capacity utilization rate increases inflationary pressure. On the labor market, labor supply by households and labor demand by companies are determined separately. As wage rigidities exist, persistent unemployment is possible.

Besides several identities, in the current version, SLOPOL consists of stochastic equations for household consumption, investment, exports, imports, labor supply and demand, the price level, the wage rate, as well as the government sector, the monetary sector and the foreign exchange market. A detailed description of the first model version may be found in (Weyerstrass, Neck and Haber, 2001).

In the SLOPOL model, the rest of the world is approximated by the euro area as the 12 euro area countries account for almost two thirds of Slovenian foreign trade. As a consequence of this modeling strategy and due to the fact that the aim of this paper is to analyze the implications of Slovenia's EMU membership, the representative exchange rate is the one between the Slovenian tolar and the euro.

In order to explore the implications of the exchange rate system, a regime of completely flexible exchange rates is compared to a crawling peg regime and to a regime of fixed exchange rates. The crawling peg regime ("EMU regime") is meant to mimic Slovenia's membership in the Exchange Rate Mechanism ERM II until 2006 and its full EMU membership from 2007 on. Here, the exchange rate is assumed to be 239 SIT/EUR in 2004, 241 in 2005, 242 in 2006, and 243 from 2007 on. For the optimization runs with fixed exchange rates, the Slovenian tolar is fixed at 239.640 SIT/EUR over the entire optimization period. This is the central parity at which the Slovenian currency entered the ERM II in June 2004. In the flexible exchange rate scenario, the short-term rate of interest is available as an active monetary policy instrument for internal stabilization purposes. In the other regimes, the interest rate and hence monetary policy have to be adjusted to stabilize the exchange rate and can therefore not be considered as an active policy instrument.

4. ECONOMIC POLICY INSTRUMENTS AND TRANSMISSION CHANNELS

In the optimization experiments, different sets of policy variables are considered. As different exchange rate regimes are investigated, there are one scenario with the short-term interest rate as policy instrument (the flexible exchange rate case) and two scenarios without this instrument of monetary policy. In the flexible exchange rate scenario, the short-term

rate of interest is available as an active monetary policy instrument for internal stabilization purposes. In the other regimes, the interest rate and hence monetary policy have to be adjusted to stabilize the exchange rate and can therefore not be considered as an active policy instrument. In all optimizations, fiscal policy instruments comprise government consumption expenditures and transfer payments to private households as well as the average direct ("labor") tax rate which is defined as the difference between the average gross and net wage. "Direct taxes" thus comprise both labor taxes and employees' social security contributions.

The different policy instruments represent various transmission channels of monetary and fiscal policies. Via the term structure, an increase in the short-term interest rate raises also the long-term interest rate and thus the user cost of capital, exerting a negative influence on private investment. Variations in transfer payments to households influence disposable income and thus private consumption. Government consumption forms by definition part of GDP. Thus, an increase in government spending raises national income, exerting a positive multiplier effect by influencing both private household consumption and investment via increasing demand. On the other hand, increases in government spending exert an inflationary impact which might force the Central Bank to raise interest rates so as to curb inflation or to prevent a depreciation of the tolar.

5. THE OBJECTIVE FUNCTION

In the optimizations, five "main" and several "minor" objectives are considered. The "main" objective variables cover the most important macroeconomic challenges Slovenian policy-makers will face in the medium-term future. With respect to Slovenian participation in the EU, catching-up with the 15 "old" EU members in terms of per-capita GDP is of high importance. In addition, reducing the rates of unemployment and of inflation are obvious goals for the next years. These objectives should be reached with a balanced government budget and at external equilibrium. Several of these objectives can be characterized by a trade-off relationship, i.e. one objective can only be achieved at the expense of at least one of the others. As an example, this applies to the relationship between high GDP growth and low inflation, at least in the short run.

For the optimization experiments a desired real GDP growth rate of 4.5 percent p.a. is assumed. Optimizations are carried out for the period 2004 to 2009, but the final year is neglected to avoid terminal point effects, hence the period of interest is 2004 to 2008. The desired rate of unemployment is assumed to be reduced by one percentage point per year from 8 percent in 2004 to 4 percent in 2008. The desired rate of inflation declines gradually from 5 percent in 2004 to 2 percent in 2008. The government budget and the current account (both in percent of nominal GDP) are assumed to be aimed at being balanced.

As "minor" objective variables, real GDP and its components (consumption of households, government consumption, investment, exports and imports) are considered. For these variables, ideal values consistent with the desired 4.5 percent growth rate of real GDP are specified. The introduction of "minor" objective variables shall reflect the policy-makers' aim of obtaining smooth paths of the main macroeconomic aggregates, but serves also as substitute for introducing inequality constraints on state variables, which is not feasible in OPTCON. In addition, the policy instrument (control) variables are regarded as minor objective variables to reflect costs to the policy makers of changing instruments, but also due to formal requirements of the OPTCON algorithm and in order to prevent erratic fluctuations.

In the weight matrix of the objective function, all off-diagonal elements are set to zero. In addition, all endogenous variables of the model not mentioned get the weight zero, implying that they are not of direct relevance to policy-makers. The "main" variables are assigned the weight 10,000, whereas the "minor" objective variables are given a weight of 1, except for the control variables, which get weights of 1,000 for the short-term interest rate, 100 for the labor tax rate and 10 for the others. These weights reflect both the relative importance of the "main" and "minor" objective variables and their different orders of magnitude.

6. OPTIMISATIONS UNDER DIFFERENT EXCHANGE RATE REGIMES

From the discussion of the trade-off between different objectives, such as high GDP growth and low inflation and the effects of the policy instruments, it is clear that even in medium-sized models an analytical solution is not tractable. The problem is further complicated by non-linearities in the model equations and by the intertemporal character of the decision problem. Furthermore, policy-makers and the public are not only interested in qualitative policy effects but especially in quantitative solutions. Here, optimum control theory can serve to support decisions. In the following subsections, various applications of the SLOPOL model in combination with the optimum control algorithm OPTCON are described that may support Slovenian economic policy-makers in their determination of adequate policies to cope with the challenges of the near future, caused by the continuing transition process and the membership of the European Union.

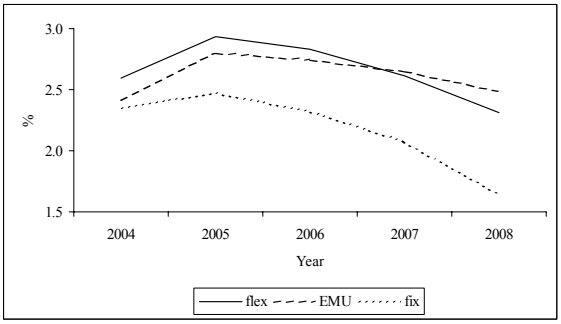

Fig. 1. Growth rate of real GDP

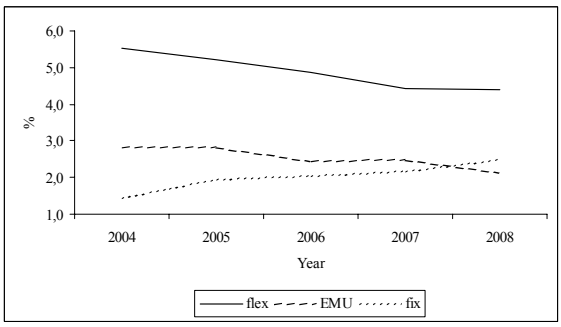

Fig. 2. Inflation rate

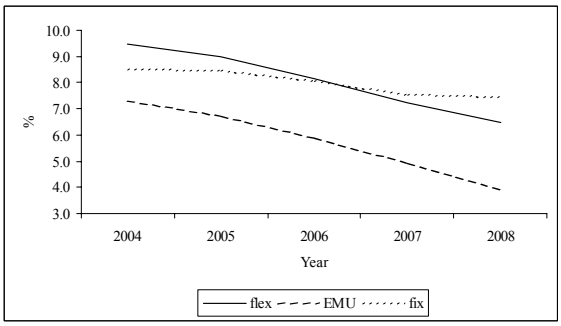

Fig. 3. Unemployment rate

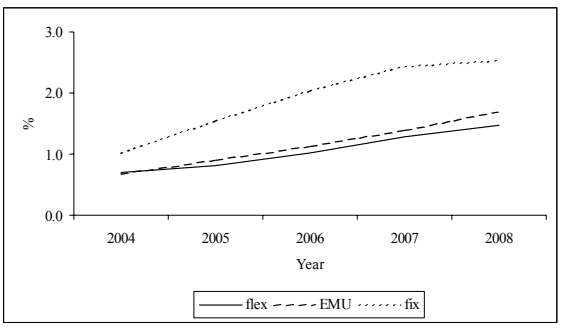

Fig. 4. Budget deficit in percent of GDP

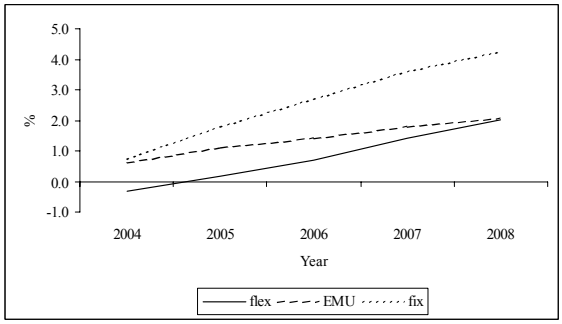

Fig. 5. Current account balance in percent of GDP

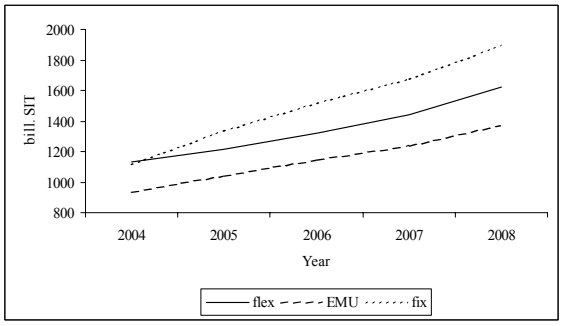

Fig. 6. Government consumption

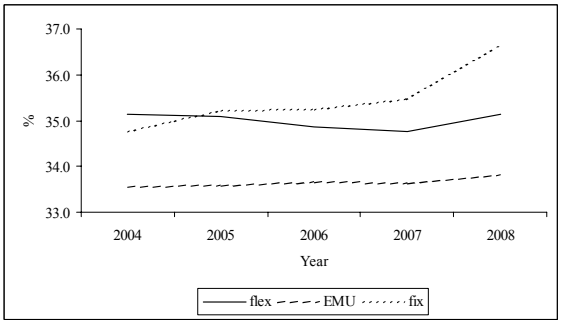

Fig. 7. Labor tax rate

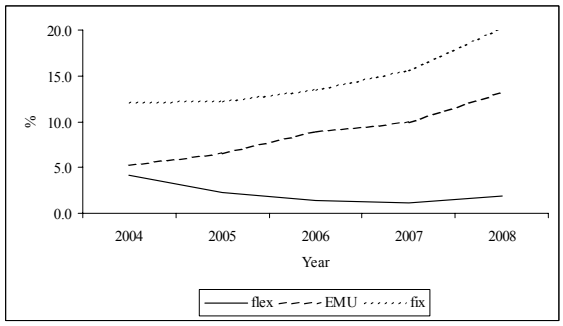

Fig. 8. Short-term interest rate

In particular, three optimizations are carried out, differing in the exchange rate system and thus in the set of available policy instruments. A system of totally flexible exchange rates is compared to a fixed exchange rate system and a scenario with a crawling peg. In the latter case, the exchange rate between the Slovenian tolar and the euro depreciates at a decreasing rate until 2007. From this date onwards it is held constant, approximating the assumed full EMU integration and introduction of the common currency in 2007. In the following, the optimization results are described for the different exchange rate systems. Graphical representations of the trajectories of the main objective variables and the policy instruments can be found in figures 1 to 8, where "flex" denotes the flexible exchange rate scenario, "fix" the case of fixed exchange rates, and "EMU" stands for the crawling peg scenario, mimicking Slovenia's full EMU integration from 2007 onwards.

6.1 Flexible exchange rates

In the *flexible exchange rates* scenario, real GDP grows at the rate of 2.7 percent p.a. on average over the period 2004 to 2008. Unemployment and inflation are gradually reduced. On average, the inflation rate amounts to 4.9 percent and the average unemployment rate reaches 8.1 percent. The current account improves over the optimization horizon, turning from a marginal deficit in 2004 into a surplus in 2005 and the following years, reaching 2.0 percent of nominal GDP in 2008. During the entire period, the government budget exhibits a moderate but slowly increasing deficit, amounting to 1.5 percent of GDP in the final year. From 2004 to 2008, the Slovenian currency depreciates by 11 percent in nominal terms, but the real exchange rate remains virtually constant, which is due to the lower inflation in the euro area, the representative foreign country block. The labor tax rate is distinctly lower than its last actual value of 37.5 percent. Over the five year period it exhibits only little variation around its average of 35.0 percent. Nominal government consumption increases more than transfer payments, implying a shift from redistributive to absorptive government expenditures. Monetary policy is expansionary; between 2004 and 2007, the short-term interest rate is reduced from 4.1 percent to 1.1 percent, before being raised somewhat to 1.9 percent in the final year.

6.2 Fixed exchange rates

With *fixed exchange rates*, the nominal exchange rate is held constant at 239.640 SIT/EUR over the five-year period. Now real GDP on average grows at a rate of 2.2 percent p.a. only. From 2005 onwards, the GDP growth rate even declines, reaching just 1.6 percent in the final year of the optimization period. With 8.0 percent, the average unemployment rate is almost identical to the flexible exchange rates scenario, but the trajectory differs substantially. While in the case of flexible exchange rates the unemployment rate is reduced by three percentage points over the five year period, in the scenario with fixed exchange rates it only declines by one percentage point. Compared to the first scenario, inflation now is significantly lower in each year, but it increases over time while in the flexible exchange rates case it exhibits a decreasing trend. The average inflation rate of 2.0 percent is almost three percentage points lower than in the first scenario. The current account improves significantly over the optimization horizon from 0.7 percent of GDP in 2004 to 4.3 percent in 2008. The government budget exhibits a less favorable development than in the other scenarios and deteriorates into a considerable (though still Maastricht-compatible) deficit between 2004 and 2008. The Slovenian tolar appreciates marginally in real terms. The labor tax rate is higher than in the scenario with flexible exchange rates, and it is raised over time. Its average value over the entire five-year period is 35.5 percent. Nominal government consumption is increased by the highest amount, transfer payments to households by the lowest amount over the entire five-year period among all scenarios considered in this paper. Monetary policy is considerably more restrictive in order to keep the nominal exchange rate fixed. Over the entire optimization horizon the short-term interest rate is significantly higher than under flexible exchange rates, and it increases substantially over time. The value of 20 percent in 2008 reveals that this monetary policy stance is economically implausible, but it shows clearly the high costs of adjustment that would be associated with fixing the exchange rate entirely at too early a stage in the process of EMU integration.

6.3 Crawling peg

The scenario simulating full accession to the *EMU* with the introduction of the euro in 2007 gives the best overall economic performance. Interestingly, both unemployment and inflation are reduced more than in every other scenario. The budget deficit remains below 2 percent of GDP, the current account improves, and the average growth rate of real GDP is 2.6 percent on average which is considerably better than in the fixed exchange rate scenario and only marginally lower than under flexible exchange rates. In the last two years of the optimization horizon, the GDP growth rate is even higher than under flexible exchange rates. This favorable macroeconomic performance is brought about mainly by low values of the labor tax rate, combined with only moderate increases of government consumption and transfers: both are lower than in the flexible exchange rates case. Employment is stimulated by supply-side measures in the form of cuts in direct taxes, rather

than by demand-side fiscal policies. Monetary policy is considerably more restrictive than under flexible exchange rates, but less so than in the fixed exchange rates scenario.

6.4 Summary of optimization results

As is to be expected, the optimization experiments show that the fastest immediate reduction of inflation is brought about if the exchange rate is fixed to the currency of a low-inflation region, but the path into the EMU results in a similar (and even more sustainable) inflation trajectory. In all cases where exchange rates are not flexible, the loss of monetary policy as an instrument of stabilization policies resulting from fixing or pegging the exchange rate can at least partially be compensated for by cutting labor taxes once and (more or less) for all at the beginning of the optimization period. This policy, which has both favorable supply-side and demand-side effects, reduces the wedge between gross and net wages, thus lowering upward pressure on gross wages, thereby stimulating employment and reducing inflationary pressure at the same time. Thus, optimal policies require not only counter-cyclical demand-side reactions (either through automatic stabilizers or through discretionary policies) but also structural (supply-side) reforms, such as a shift of government expenditures from transfers to purchases and a reduction of the level of labor income taxation.

It is clearly shown that the best macroeconomic performance can be achieved when the exchange rate is pegged, though not totally fixed, to the euro as a currency of a low-inflation region. In this case, GDP growth does not deviate significantly from the case of totally flexible exchange rates, and both inflation and unemployment are considerably lower, while the general government budget shows a similar development. On the other hand, the high economic costs resulting from totally fixing the exchange rate as long as the integration into the Common European Market is not completed reveals the importance of retaining at least a limited degree of monetary independence during the process of EMU integration.

7. CONCLUSIONS

This paper showed how the application of optimum control theory in combination with an econometric model may serve as a tool for supporting the decisions of economic policy-makers.

It has to be stressed that only those variables contained in the SLOPOL model could be taken into account in the optimizations. Several aspects that might also be of interest to Slovenian policy-makers, like the owner structure of the companies or the income distribution, have to be neglected in an aggregated macroeconomic model like SLOPOL. Furthermore, the model was estimated using data from the transition period, hence the coefficients of the equations may change when Slovenia approaches the structure of the European Union.

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