Optimal Monetary and Fiscal Policy for Slovenia under different Exchange Rate Regimes

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Klaus Weyerstrass
University of Klagenfurt, Department of Economics
Universitaetsstrasse 65-67, A-9020 Klagenfurt, Austria
Phone: +43/463/2700-491, Fax: +43/463/2700-6100
e-mail: klaus.weyerstrass@uni-klu.ac.at

1 Introduction

Slovenia has decided to apply for membership in the European Union and was invited by the EU to become one of the six countries to be considered for the first enlargement round. This leads to the question whether it is desirable to take part in the fixed exchange rate mechanism EMS II.

This paper analyses the consequences of flexible and fixed exchange rates for the Slovene economy. Applying the optimal control algorithm OPTCON, quantitative optimal fiscal and monetary policies for Slovenia under the different exchange rate regimes are calculated.

It turns out that fixing the exchange rate forces monetary policy to be more restrictive than under flexible exchange rates, thereby reducing the GDP growth rates and leading to a faster reduction of the inflation rate. Unemployment is higher in this case.

The algorithm OPTCON can be characterized as a tool for determining optimal economic policies for non-linear stochastic dynamic models. The algorithm minimizes an intertemporal objective function of a hypothetical policy maker, subject to the constraints given by an econometric model. This objective function penalizes deviations of objective variables from their desired values. Uncertainties about the coefficients of the econometric model, defined as their standard deviations, can be taken into account; see, e.g., [1], [2].

The constraint to the optimization problem is given by a macroeconometric model of the Slovenian economy. This model is basically of a Keynesian type with emphasis on aggregate demand, enhanced by a production function and the labor and money markets. Besides behavioral equations for aggregate demand, specifically for consumption of private households, investments, and import. the model contains a money demand equation, an exchange rate equation, and a wage-price system. A production function is included to determine potential GDP, connecting the demand side and the supply side of the economy. The labor market is modeled by specifying an employment equation, whereas the labor supply is exogenous to the model.

The model, except for the wage price system, was estimated by OLS, using quarterly data for the period 1992 (where available) to 1997. The wage price system was estimated by 3SLS, thus taking into account the strong interdependencies between the wage and the price equation.

The remainder of the paper is organized as follows: Section 2 contains the econometric model. Section 3 gives an overview of the optimal control algorithm OPTCON and the objective variables and their weights in the optimization problem. Section 4 gives the optimal monetary and fiscal policies under flexible exchange rates. These optimal policies are compared to the results of a model simulation. Section 5 shows the simulation and optimization results for fixed exchange rates. Section 6 concludes the paper with a summary.

2 The Econometric Model

The constraint to the optimization problem is given by a macroeconometric model of the Slovenian economy. This model is basically of a Keynesian type with emphasis on aggregate demand, enhanced by a production function and the labor and money markets. Besides behavioral equations for aggregate demand, specifically for consumption of private households, capital formation of companies, and imports. the model contains a money demand equation, an exchange rate equation, and a wage-price system. A production function is included to determine potential GDP, connecting the demand side and the supply side of the economy. The labor market is modeled by specifying an employment equation, whereas the labor supply is exogenous to the model. Unemployment is given by the difference between the exogenous labor force and the endogenous labor demand by companies. Tension in the goods market is modeled as the capacity utilization rate.
The wage price system can be regarded as an enhanced Phillips curve. Wages are determined by the price level, labor productivity, and the unemployment rate. The price level depends on wages and the capacity utilization rate. Inflation is measured as the annual growth rate of the retail price index, as this approach was followed in Slovenia until the end 1997.

The following table shows the variables of the model. The money supply is an active policy instrument only in the case of flexible exchange rates. Under fixed exchange rates, the money supply is determined by the exchange rate.

Table 1: List of variables

Endogenous variables	
AGWN	Average wage rate per employee, nominal, SIT / quarter
AGWR	Average wage rate per employee, real
CA	Current account balance, real
CA%	Current account balance as percentage of GDP
CAPR	Capital stock, real
CR	Private household consumption, real
DEF	Budget deficit, real
DEF%	Budget deficit as percentage of GDP
DEMAND	Total final demand, real; GDP + IMPR
EMP	Employment, 000 persons
GDPR	Gross domestic product, real
GR	Government consumption, real
GRGDP	Annual growth rate of real GDP
GRRPI	Annual growth rate of RPI (rate of inflation)
IMPR	Imports, real
INFDIFF	Inflation difference between Slovenia and Germany
INVR	Capital formation, real
M1R	Money stock M1, real
PROD	Labor productivity
RPI	Retail price index, 1997 = 100
SITDEM	Nominal exchange rate, SIT per DEM
SITDEMR	Real exchange rate

Table 1: List of variables	
SRDN	Nominal short term interest rate
SRDR	Real short term interest rate
NETTAXR	Real net tax receipts
UN	Unemployment, 000 persons
UR	Unemployment rate, % of the labor force
UTIL	Capacity utilization rate
YDR	Personal disposable income, real
YPOT	Potential GDP, real
Exogenous variables	
DEPR	Real depreciation of capital stock
EX	Exports, real
FIBOR3M	Frankfurt inter bank offered rate, 3 months
INFLD	Growth rate of German retail price index
LABOR	Labor supply, 000 persons
RPID	German retail price index, 1997 = 100
TIME	Linear time trend
Control variables	
M1N	Nominal money supply M1 (endogenous under flexible exchange rates)
TGER	Total government expenditures, real
TGRR	Total government revenues, real

The behavioral equations, except for the wage price system, were estimated by ordinary least squares (OLS), using quarterly data for the period 1992 (were available) until 1997. As there are strong interdependencies between the wage and the price equations, they were estimated by three stage least squares (3SLS). The data were provided by the Institute for Macroeconomic Analyses and Development (IMAD) in Ljubljana. All real variables are in billions of Slovene Tolar (SIT) at constant 1997 prices.

As the parameter estimations are based on data for the period of transition towards a market economy, the coefficient values may change as Slovenia approaches the structure and institutions of the European Union, hence the Lucas critique apples.

Model equations

Behavioral equations

$$SRDN = -37.513 \log(M1R) + 32.584 \log(GDPR) + 0.316\ SRDN_{-1}$$
$$\quad (12.334) \qquad (10.093) \qquad (0.027)$$
$$\quad \bar{R}^2 = 0.955 \qquad SE = 7.100$$

$$\log(SITDEM) = 0.843 \log(SITDEM_{-1}) + 0.121 \log(M1N) + 0.015\ FIBOR3M_{-1} + 0.001\ INFDIFF_{-1}$$
$$\quad (0.085) \qquad (0.066) \qquad (0.011) \qquad (0.001)$$
$$\quad \bar{R}^2 = 0.940 \qquad SE = 0.023$$

$$\log(AGWN) = 0.597 \log(RPI) + 0.222 \log(PROD) - 0.212 \log(UR) + 0.474 \log(AGWN_{-1})$$
$$\quad (0.341) \qquad (0.122) \qquad (0.088) \qquad (0.201)$$
$$\quad \bar{R}^2 = 0.993 \qquad SE = 0.014$$

$\log(RPI) = 0.186 \log(AGWN) + 0.068 \log(UTIL) + 0.691 \log(RPI_{-1})$
(0.129) (0.015) (0.172)
$\bar{R}^2 = 0.995$ SE = 0.008

$\log(EMP) = 6.289 + 0.108 \log(EMP_{-4}) + 0.064 \log(GDPR) - 0.134 \log(AGWR)$
(1.019) (0.130) (0.028) (0.033)
$\bar{R}^2 = 0.836)$ SE = 0.002

$\log(CR) = 0.514 \log(CR_{-1}) + 0.466 \log(YDR) - 0.194 * 0.01 * SRDR$
(0.130) (0.124) (0.057)
$\bar{R}^2 = 0.939$ SE = 0.016

$\log(INVR) = 0.641 \log(INVR_{-4}) + 0.276 \log(DEMAND) – 0.010 SRDR$
(0.137) (0.098) (0.007)
$\bar{R}^2 = 0.755$ SE = 0.084

$\log(IMPR) = 0.774 \log(GDPR) – 0.278 \log(SITDEMR) + 0.369 \log(IMPR_{-4})$
(0.342) (0.245) (0.247)
$\bar{R}^2 = 0.729$ SE = 0.040

NETTAXR = 24.820 + 0.487 TGRR
(24.387) (0.078)
$\bar{R}^2 = 0.776$ SE = 5.368

GR = 0.052 GDPR + 0.356 TGER
(0.004) (0.008)
$\bar{R}^2 = 0.994$ SE = 1.639

$\log(YPOT) = 0.682 \log(LABOR) + 0.210 \log(CAPR) + 0.011 TIME$

Identities

GDPR = GR + CR + INVR + EX - IMPR
DEMAND = GDPR + IMPR
YDR = GDPR – NETTAXR
$GRGDP = (GDPR-GDPR_{-4})/GDPR_{-4}*100$
PROD = GDPR / EMP*100
AGWR = AGWN / RPI * 100
M1R = M1N / RPI * 100
UN = LABOR – EMP
UR = UN / LABOR * 100
$GRRPI = (RPI-RPI_{-4})/RPI_{-4}*100$
SRDR = SRDN – GRRPI
SITDEMR = SITDEM * RPID / RPI
INFDIFF = GRRPI – INFLD
$CAPR = CAPR_{-1}$ - DEPR + INVR
UTIL = GDPR / YPOT * 100
DEF = TGER – TGRR
DEF% = DEF / GDPR * 100
CA = EX – IMPR
CA% = CA / GDPR * 100

For the optimization experiment with a fixed exchange rate, the exchange rate equation was replaced by the following equation, relating the endogenous money supply M1 to the exchange rate and the inflation difference between Slovenia and Germany, lagged four quarters:

$$M1N = 0.727\ M1N_{-4} + 1.008\ SITDEM - 0.379\ INFDIFF_{-4}$$
$$(0.125) \qquad (0.149) \qquad (0.388)$$
$$\bar{R}^2 = 0.940 \qquad SE = 10.823$$

As Germany is the most important trading partner of Slovenia and due to data availability, the exchange rate between the Slovenian Tolar SIT and the German Mark DEM was taken as the representative exchange rate. Imports depend on the real exchange rate, i.e. the nominal exchange rate, defined as the Tolar price per DEM, deflated with the relation of the German and the Slovene retail price index RPI. The PRI was chosen for the calculation of the real exchange rate and the inflation rate as until the end of 1997 in Slovenia inflation was measured on the basis of the RPI. As no export function with reasonable coefficients could be estimated, exports were taken exogenous. As the import function shows, the Marshall-Lerner condition is fulfilled with an exchange rate elasticity of –0.28 in the short run and –0.44 in the long run. A real depreciation of the SIT leads to a reduction of imports, thereby improving the current account.

3 The Optimal Control Approach

Optimal monetary and fiscal policies are calculated using OPTCON, an algorithm for the optimization of an intertemporal objective function subject to the constraints of a dynamic nonlinear multivariable model, developed in [1] and [2]. OPTCON has been applied to determine optimal fiscal policies for Austria; see, e.g. [3], [4], [5].

The dynamic system has to be given in a state space representation. The optimization can either be deterministic or stochastic. In the latter case, additive error terms of the model equations and uncertainties concerning the estimated coefficients are considered. The objective function to be minimized is quadratic in the deviations of the state and policy variables from their desired values. OPTCON requires as inputs the system function, the initial values of the state, policy, and exogenous variables, a tentative path of the state variables, the expected value and the covariance matrix of the stochastic parameter vector, the covariance matrix of the additive system noise, the weight matrices of the objective function, and the desired paths of the state and control variables. Furthermore, a discount rate of the objective function has to be specified.

If the stochastic model equations are estimated by OLS, no full covariance matrix of the parameters is available. In this case, only a limited stochastic optimization can be run with the estimated standard errors of the coefficients and the standard errors of the regression equations taken into account. In this case, the correlations between model parameters are neglected. A fully stochastic optimizations requires the estimation of the entire model with three stage least squares (3SLS) or full information maximum likelihood (FIML); see, e.g. [4].

For the determination of the approximate solutions to the optimization problem, five main and nine minor objective variables were considered. These variables are shown in table 2, the first row containing the main objectives and the second row giving the minor objectives.

Table 2: Objective variables

DEF		DEF%		GRGDP		UR		GRRPI
CR	INVR	IMPR	NETTAXR	GR	GDPR	SRDR	CA	CA%

In the weight matrix of the objective function, all off diagonal elements were set equal to zero. In addition, all model variables not mentioned in table 2 got the weight zero. The main objectives of the hypothetical policy maker were given the weight 10, whereas a weight of 1 was assigned to the minor objective variables.

For all variables historical 1997 values serve as starting points.

It was assumed that the main objectives of the Slovenian economic policy are a high GDP growth rate, as well as a reduction of inflation and unemployment. These aims should be achieved with a balanced budget and at external equilibrium. Therefore, the desired values of the objective variables are zero for the budget deficit and the current account balance, and a GDP growth rate of 5 percent p.a. In addition, it was assumed that the hypothetical policy maker aims at a gradual reduction of the inflation rate and the unemployment rate over the optimization horizon.

The policy instruments total government revenues TGRR and expenditures TGER and, in the case of flexible exchange rate, the money supply M1N, were given the weight 1.

The discount rate of the objective function was set equal to one, meaning that all time periods of the optimization horizon get the same weight.

The planning horizon was chosen as the period 1998 to 2003. Because of the Lucas critique, the econometric model should not be used for policy analyses reaching too far into the future. The year 2003 was chosen as Slovenia has applied for membership in the EU, and optimistic projections expect the first round of the EU enlargement for 2002 or 2003.

The algorithm requires starting values for the state and control variables over the entire planning period to initialize the iterative determination of their optimal values. Here, the values given by the simulation of the model were taken. In addition, projections for the exogenous variables over the optimization horizon are required. For the labor force, expert projections from IMAD were taken. Regarding the German retail price index, an annual growth rate of 1.5 percent until the end of 2001 and 2 percent p.a. for the last two years were assumed. For the 3 month FIBOR, a constant value of 3.5 over the entire planning horizon was assumed. The exports were expected to grow at a rate of 5 percent p.a. during the optimization period.

For the simulation of the model, the same assumptions concerning the exogenous variables were taken. In addition, when simulation the model, the policy instruments are exogenous variables. It was assumed that total government revenues grow at a constant rate of 4 percent p.a., whereas total government expenditures grow at 3.5 percent p.a. In the simulation with flexible exchange rates, monetary policy was assumed to become tighter during the simulation period, as reflected in the gradual reduction of the money growth rate from 16 percent in 1998 to 5.5 percent in 2003.

4 Flexible Exchange Rates

In the first experiment, it was assumed that the exchange rates are flexible, thus the money supply can be used as an active policy instrument.

The following tables 3a and 3b show the results for the most important state variables and policy instruments of the simulation and optimization run, respectively, under flexible exchange rates. The optimization was deterministic in the sense that neither uncertainties concerning the estimated model parameters nor the correlations between the equations or the estimated standard errors of the equations were taken into account. This is equivalent to the assumption that all parameters are known with certainty.

Table 3a: Simulation results, flexible exchange rates

	1998	1999	2000	2001	2002	2003
GRGDP	4.58	4.74	4.73	4.44	4.36	4.43
UN	124.60	130.45	134.87	138.47	141.85	146.43
UR	14.35	14.92	15.33	15.67	15.97	16.39
GRRPI	7.28	5.17	3.54	2.61	2.03	1.60
SITDEM	100.38	109.48	117.37	124.09	129.85	134.70
SITDEMR	94.90	99.91	105.00	109.82	114.89	119.66
DEF%	0.84	0.62	0.41	0.20	0.00	-0.20
CA	-66.50	-62.83	-45.60	-20.05	11.53	43.43
CA%	-2.13	-1.92	-1.33	-0.56	0.31	1.11
NETTAXR	755.46	781.70	809.00	837.39	866.91	897.62
GR	651.04	675.82	701.57	727.79	754.87	783.10
TGER	1372.32	1420.35	1470.06	1521.51	1574.77	1629.88
TGRR	1346.19	1400.04	1456.04	1514.28	1574.86	1637.85
M1N	284.36	318.48	347.15	367.97	388.21	409.56

Table 3b: Optimization results, flexible exchange rates

	1998	1999	2000	2001	2002	2003
GRGDP	4.21	5.06	5.27	5.15	5.17	5.75
UN	123.00	129.13	133.67	137.35	140.80	145.36
UR	14.16	14.77	15.20	15.54	15.86	16.27
GRRPI	8.98	6.45	4.64	3.71	3.18	2.89
SITDEM	84.69	92.66	100.42	107.70	114.58	121.68
SITDEMR	90.10	94.01	98.82	103.74	109.10	114.86
DEF%	-0.03	-0.04	-0.05	-0.05	-0.07	-0.09
CA	37.86	26.66	32.33	46.34	65.47	78.96
CA%	1.29	0.86	0.99	1.35	1.82	2.07
NETTAXR	707.96	740.31	774.34	810.24	848.57	886.71
GR	597.45	628.63	661.85	696.79	733.77	772.03
TGER	1247.97	1313.80	1383.28	1456.87	1534.88	1612.03
TGRR	1248.75	1315.12	1384.94	1458.60	1537.22	1615.48
M1N	221.68	255.88	286.07	310.59	336.12	373.31

A comparison of the tables shows that, except for the first year, GDP grows at a higher rate under optimal monetary and fiscal policies than projected. In the last year, the GDP grows rate is 1.5 percentage points higher than projected. Over the entire planning horizon, unemployment is reduced, but inflation is approximately 1 percentage point above its projected value in each year.

Optimal monetary policy is more restrictive than projected, thus the Tolar depreciates less, both nominal and real, relative to the DEM. This would cp. result in higher imports. As on the other hand GDP is slightly under its projected value (not sown in the tables), imports are lower than projected. Overall, imports are below their projected value, thus the current balance is more positive under optimal policies. In the projection, the current account is in a deficit in the years 1998 to 2001 In the optimization run, on the other hand, the current account remains in a surplus over the entire planning horizon. In 1998, the optimal current account balance is a surplus of 1.3 percent of GDP, compared to a projected deficit of 2.1 percent of GDP.

Both optimal total government expenditures and revenues are below their base values over the entire planning horizon. In the projection, the government budget is slightly in a deficit, except for the last two years. In contrast, under optimal fiscal policy, the budget is nearly balanced during the optimization period.

5 Fixed Exchange Rates

For the next experiment, the exchange rate was assumed to be fixed at 100 SIT per DEM during the planning period 1998 to 2003. Now, monetary policy can no longer be used for internal stabilization purposes, as the money supply has to be adjusted so as to hold the nominal exchange rate constant.

The simulation and optimization results are shown in tables 4a and 4b, respectively. Again, the optimization was deterministic, i.e. all model parameters were assumed to be known with certainty.

A comparison of the simulation results, i.e. of tables 3a and 4a, reveals substantial differences in the GDP growth rate and the inflation rate between the cases of flexible and fixed exchange rates. When the exchange rate is fixed, GDP grows slower, though the gap, which is biggest in 1999, becomes smaller towards the end of the simulation period. This reduced growth is due to the sharp inflation reduction. According to purchasing power parity theory, the depreciation rate between two countries should, at least in the long run, be equal to the inflation difference; see, e.g., [6]. Fixing the exchange rate therefore results in a convergence of the inflation rates. Though inflation is reduced substantially in both cases, under fixed exchange rates this process is brought about more rapidly. Total government expenditures and revenues where assumed to be identical in both simulations, so this is also true for the budget deficit. As GDP is different in the two experiments, there are minor differences in relation of the budget deficit to GDP. The current account is more positive under fixed exchange rates. Whereas under flexible exchange rates the Tolar depreciates in nominal terms as well as in real terms over the entire simulation horizon, in the case of fixed nominal exchange rates the Tolar appreciates in real terms from 1998 to 2000. Afterwards, it depreciates slightly. Overall, the real exchange rate in the second experiment lies considerably under its projected value in the first simulation. This would result in higher imports. On the other hands, as the respective equation shows, the elasticity of imports with respect to GDP is higher than the import elasticity with respect to the real exchange rate. Due to the more restrictive monetary policy, GDP is lower under fixed exchange rates, thus reducing imports. The net effect on imports is that they are lower under fixed exchange rates. Together with the exogenous exports, which are identical in all cases, this results in a more positive current account in the second simulation experiment.

Table 4a: Simulation results, fixed exchange rates						
	1998	**1999**	**2000**	**2001**	**2002**	**2003**
GRGDP	3.93	2.44	2.59	3.34	3.75	3.70
UN	124.79	130.88	135.32	138.67	141.78	146.19
UR	14.37	14.97	15.38	15.69	15.97	16.36
GRRPI	6.89	4.03	1.67	0.68	0.46	0.30
SITDEM	100.00	100.00	100.00	100.00	100.00	100.00
SITDEMR	95.05	92.73	92.58	93.33	94.76	96.37
DEF%	0.85	0.64	0.43	0.22	0.00	-0.22
CA	-46.73	-44.24	-23.87	-0.84	22.33	48.63
CA%	-1.52	-1.40	-0.74	-0.03	0.64	1.35
NETTAXR	755.46	781.70	809.00	837.39	866.91	897.62
GR	649.08	670.08	692.05	716.00	741.48	767.79
TGER	1372.32	1420.35	1470.06	1521.51	1574.77	1629.88
TGRR	1346.19	1400.04	1456.04	1514.28	1574.86	1637.85
M1N	271.81	296.11	315.07	329.76	340.81	349.12

Table 4b: Optimization results, fixed exchange rates						
	1998	**1999**	**2000**	**2001**	**2002**	**2003**
GRGDP	5.67	2.03	1.91	3.12	3.87	3.92
UN	122.62	129.66	134.64	138.23	141.45	145.92
UR	14.12	14.83	15.31	15.64	15.93	16.33
GRRPI	11.73	7.25	3.30	1.52	1.01	0.77
SITDEM	100.00	100.00	100.00	100.00	100.00	100.00
SITDEMR	102.59	97.07	95.38	95.36	96.29	97.47
DEF%	-0.45	-0.34	-0.17	-0.04	0.10	0.19
CA	25.06	-1.15	9.75	28.32	45.30	63.29
CA%	0.80	-0.04	0.30	0.85	1.31	1.76
NETTAXR	718.02	743.74	772.11	803.46	838.13	882.58
GR	609.05	632.27	658.00	687.70	721.51	762.13
TGER	1255.33	1311.43	1374.77	1443.36	1519.44	1613.68
TGRR	1269.40	1322.16	1380.37	1444.69	1515.81	1607.00
M1N	236.56	268.65	293.90	313.75	328.85	340.22

A comparison of the optimal policies under the different exchange rate regimes (tables 3b and 4b) reveals the fact that total government expenditures and revenues are almost identical. In the case of flexible exchange rates, the government budget in the year 2003 is in surplus by 3.5 Bill. SIT in real terms or 0.09 percent of GDP. With the nominal exchange rate fixed at 100 SIT/DEM, the budget is in a deficit of 6.7 Bill. SIT or 0.19 percent of GDP. From 1998 to 2000, in contrast, the budget surplus under fixed exchange rates exceeds the surplus in the first experiment. The money supply grows faster under fixed exchange rates in the period 1998 to 2001 and less in the last two years of the planning horizon. Optimal GDP growth rates are lower under fixed exchange rates, except for 1998. Inflation is higher in the beginning of the planning horizon, but is reduced more rapidly. Unemployment is higher, except for the first year. When the exchange rate is fixed, optimal imports are higher than projected, thus, as exports are taken exogenous, the current account balance is smaller. Except for 1998 and 1999, the real exchange rate with the nominal exchange rate fixed at 100 SIT/DEM under optimal fiscal policies is lower. This has a positive effect on imports.

When comparing the optimal and the projected development of the macroeconomic aggregates under fixed exchange rates (tables 4a and 4b), it can be seen that the GDP growth rate is higher with optimal fiscal policies in the years 1998, 2002 and 2003. Thus the attenuation of economic growth in the years 1999 and 2000 is more accentuated with optimal fiscal policies. This is brought about by the fact that the hypothetical policy maker not only considers GDP growth as important, but also other variables enter his objective function. Inflation is higher over the entire optimization horizon with optimal fiscal polices. The current account balance is considerably higher with optimal fiscal policies than projected. This is brought about by the higher real exchange rate, which has a negative effect on imports, thus improving the current account, as the exports are taken exogenous. Under optimal policies, the money supply grows less, though the optimal and the projected money stock converge towards the end of the planning horizon. Total government expenditures and revenues are below their projected values. Until 2001, the projected government budget is in a deficit, whereas with optimal fiscal policies, the budget exhibits a surplus. The reverse is true in the last year of the planning period. Overall, with optimal policies, the government budget comes close to the desired value of zero.

The following figures 1 to 3 show comparisons of the simulated and optimal GDP growth rates, inflation rates, and budget deficits, respectively. In the figures, *s* means simulation, *o* stands for optimization, *fix* means fixed exchange rates, and *flex* flexible exchange rates.

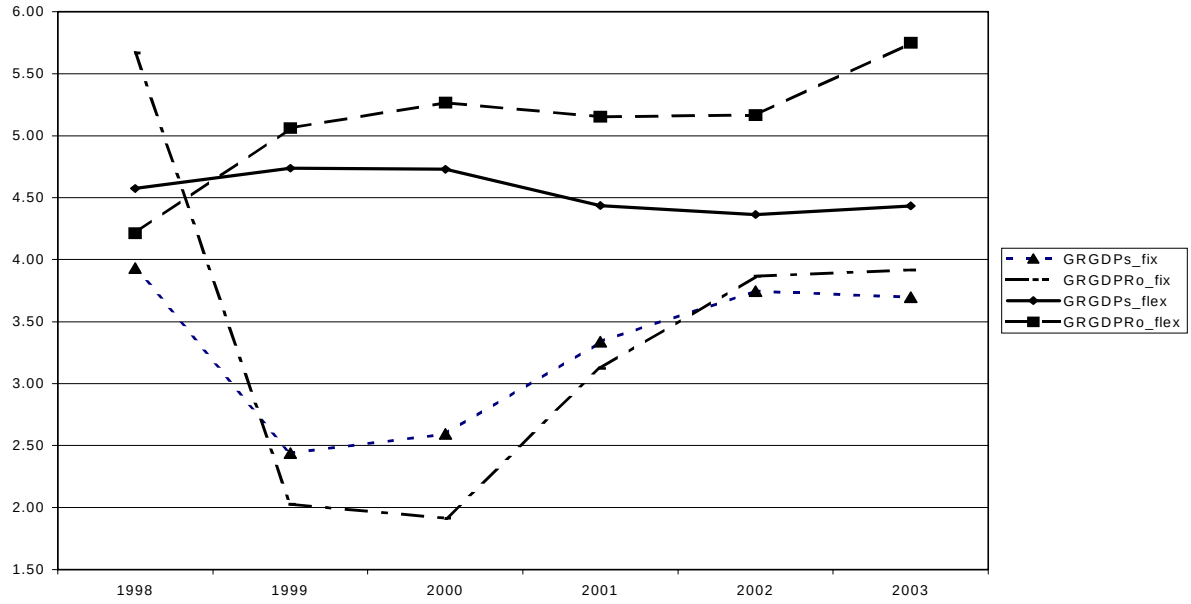

Figure 1: GDP growth rates

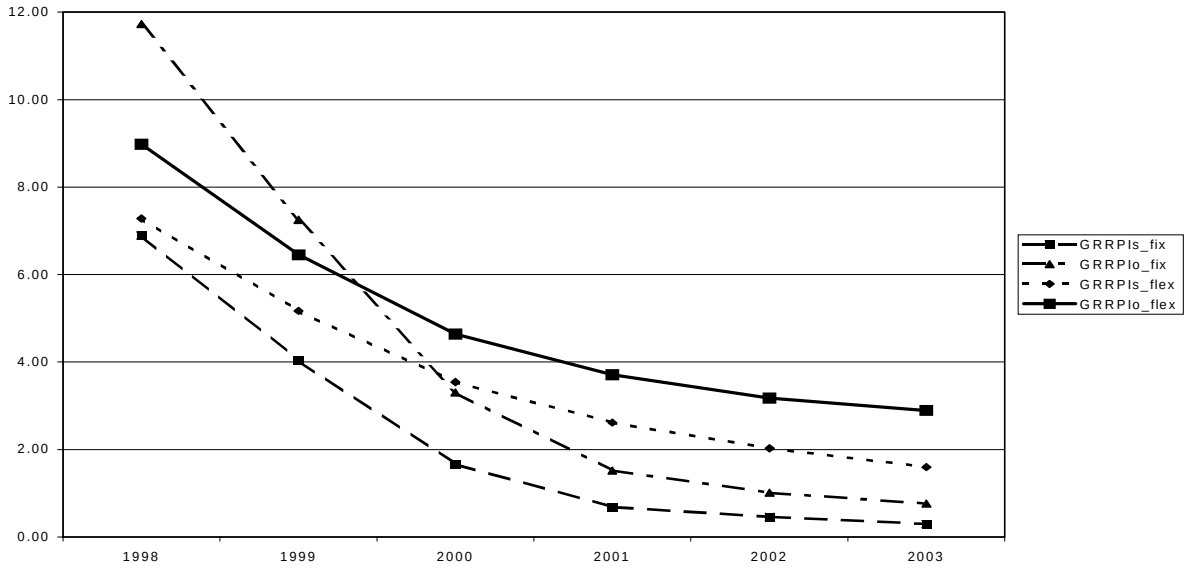

Figure 2: Inflation rates

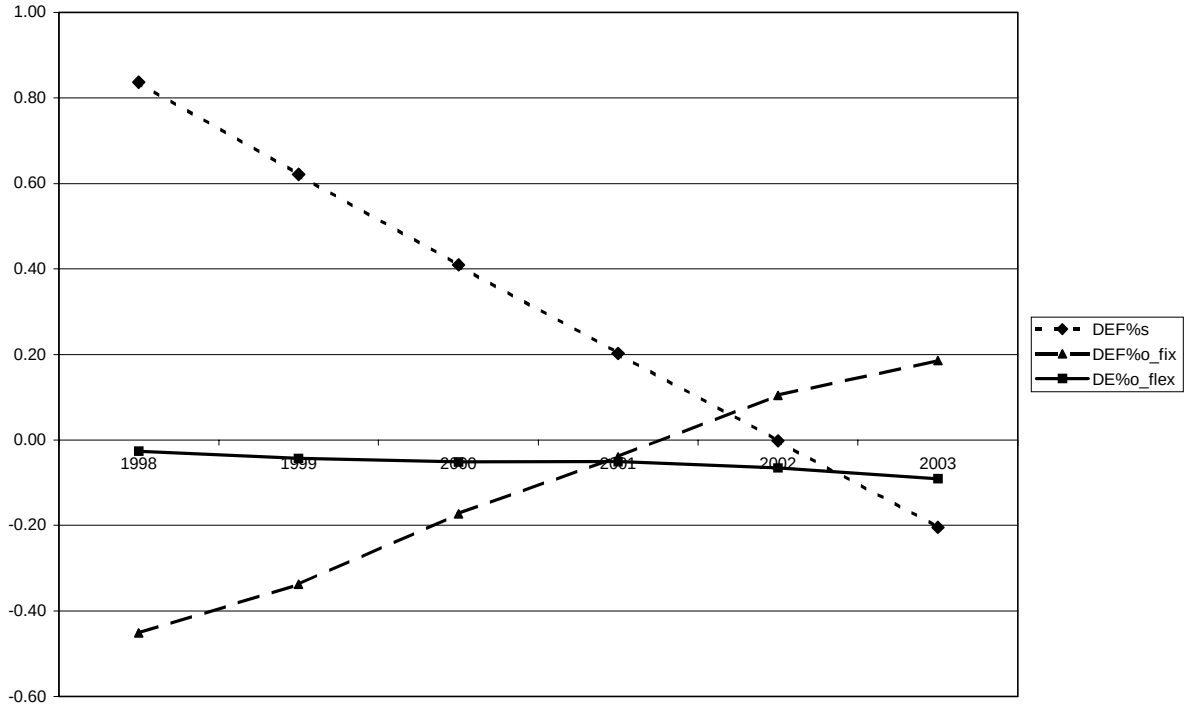

Figure 3: Budget deficits as percentage of GDP

6 Summary

In this paper, the optimal control algorithm OPTCON was applied to determine quantitative optimal fiscal and monetary policies for Slovenia under the constraints given by an econometric model. The consequences of fixing the exchange rate were analyzed. It turned out that under flexible exchange rates, an optimal combination of monetary and fiscal policy can be applied to achieve a higher GDP growth compared to a projected economic development. Unemployment can be reduced with a nearly balanced government budget and a current account being slightly in a surplus. Inflation is slightly higher than projected if the optimal policy mix is pursued.

When the nominal exchange rate is fixed, monetary policy has to be used to impede exchange rate fluctuations. This has a significant effect on macroeconomic variables, especially on GDP growth. This is in contrast to related studies for Austria as described in [3], where the exchange rate was taken exogenous.
Under fixed exchange rates, money grows slower than with fixed exchange rates, resulting not only in reduced GDP growth rates, but also in a more rapid inflation reduction. Unemployment is higher in this case. With optimal fiscal policy, inflation is slightly higher than projected. The GDP growth rate is below its projected value in the years 1999 to 2001, but higher in the beginning and in the end of the planning period. The government budget starts in a steadily declining surplus that turns into a deficit in the last two years, but overall the budget is nearly balanced during the entire period. Unemployment can be reduced slightly compared to the projected value, and the current account is more positive.

Summing up, it can be concluded that the exchange rate regime has an important influence on the Slovene economy. GDP growth is lower and unemployment higher if the exchange rate is fixed. On the other hand, inflation is reduced rapidly and, in the end of the simulation period, vanishes nearly completely.

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