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A QUARTERLY ECONOMETRIC MODEL OF THE SLOVENIAN ECONOMY[1]

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Abstract: The article presents the construction of a quarterly econometric model of the Slovenian economy along with an analysis of the fundamental relationships in the Slovenian economy. For this purpose we formed a system of identities, consistent with the national accounts, and of stochastic equations, consistent with economic theory as well as the institutional and constitutional characteristics of the Slovenian economy. The present econometric model of the Slovenian economy SIQM 2.1 consists of 97 equations and covers the 1997:1 – 2003:4 period. The adequacy of the model, i.e. its ability to reproduce actual economic developments in the period under investigation, was verified by performing dynamic simulations. It was established that the results are econometrically satisfactory and in part even quite favourable.

Key words: Economic transformation; Model construction and estimation; Model evaluation and testing; Simultaneous equation models; Slovenia

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1. INTRODUCTION

The independence of the Republic of Slovenia in 1991 brought about vast changes to the socio-economic and political system that in the past decade have primarily been reflected through economic transformation activities. The latter has resulted in an altered business environment due to the gradually modified economic system and, more importantly, in changing the behaviour of economic agents. Economic policy in such a

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transitory environment is in great need of the support of economic modelling and policy consultancy. Econometric models seem to be the most suitable since they are able to cover both crucial tasks; economic analysis and economic forecasting[2]. However, one has to be very careful in so doing since economic transformation also brings numerous changes in the economic variables that are relevant in newly established socio-economic relationships. In these circumstances, an econometric model could be even more vulnerable to Lucas' (1976) critique of policy regime shifts changing the structure of the economic system under investigation, i.e. quantitative changes of policy instruments influencing the coefficients of the estimated behavioural equations. The idea of this article is therefore to construct a quarterly econometric model of the Slovenian economy, while trying to bear these restrictions in mind as much as possible.

After the introductory works of Tinbergen (1939; 1939a), Klein (1950), and Klein and Goldberger (1955), econometric modelling has been a recognised approach and indispensable tool of economic policy in the world since the 1960s. In the 1970s, the first econometric models were constructed for former Yugoslavia, but since it was not explicitly modelled it could be said that Slovenia substantially lagged behind up until the 1980s when Pfajfar (1980) and Pfajfar and Borak (1983; 1984) started closing the gap in econometric modelling. After the economic transformation started in Slovenia in the 1990s, econometric modelling became increasingly difficult due to the short time series of consistent socio-economic data. Nevertheless, some short-term econometric models have so far been developed, including Cimperman *et al*. (1996), Simončič *et al*. (1999), Kračun (2000), Bole and Rebec (2001), Weyerstrass *et al*. (2001), and the model presented in this article. The latter is a quarterly short-term medium-sized econometric model that embraces the final phase of Slovenia's economic transformation to a market economy.

The outline of the article is as follows. In Chapter 2 a short description of the quarterly econometric model of the Slovenian economy is presented, together with the underlying database of the model. Equations of the model and the corresponding results of the econometric estimation are then stated and discussed in the subsequent chapter, while in Chapter 4 the model is evaluated and tested with *ex post* dynamic simulations. In the final chapter the article's key findings are summarised.

2. MAIN CHARACTERISTICS AND THE DATABASE OF THE MODEL

The quarterly econometric model of the Slovenian economy consists of three econometric blocks representing the real sector, the monetary sector and the foreign trade sector.

[2] There is also a CGE model (Majcen, Verbič and Knežević 2005) and an OLG-GE model (Verbič, Majcen and van Nieuwkoop 2006) of the Slovenian economy available that is intended primarily for economic policy analysis. Readers are invited to consult the cited references in order to obtain an insight of the strengths and weaknesses of both approaches to the modelling of a transition economy.

Further, each econometric block combines related sets of model equations. The real sector comprises three such sets of equations, i.e. domestic expenditure, wages and pensions, and production and employment. The monetary sector consists of only two sets of equations, namely prices, and interest rates and exchange rates, while the foreign trade sector again comprises three sets of equations, i.e. exports of goods, imports of goods, and foreign trade in services. Table 1 enables a quick glance at the main stochastic equations of each set of equations of the model before they are presented and discussed in more detail in the following chapter. Although the model is in principle an aggregate one, some disaggregation is also present. Hence in some sets of equations the economy is first divided in the production sector and the services sector, and then the industry is detached from the production sector and the manufacturing sector is further detached from the industry[3]. Thus we obtain a 'tree structure' representing the key sectors of the economy of interest.

TABLE 1: Structure of the quarterly econometric model of the Slovenian economy

Econometric block	Set of equations	Key stochastic equations
Real sector	Domestic expenditure	Domestic final consumption of households Gross fixed capital formation
	Wages and pensions	Labour costs in the manufacturing sector Labour costs in the services sector Average net pension
	Production and employment	Production volume of manufacturing Employment in the manufacturing sector Employment in the services sector
Monetary sector	Prices	Consumer prices Producer prices of manufacturing
	Interest rates and exchange rates	Average nominal long-term lending interest rate Average euro exchange rate of the Bank of Slovenia Nominal effective exchange rate
Foreign trade sector	Exports of goods	Prices of exports of goods Quantities of exports of goods
	Imports of goods	Prices of imports of goods Quantities of imports of goods
	Trade in services	Quantities of exports of services Quantities of imports of services

[3] To maintain the integrity of the model, the manufacturing sector is then linked to the industry with an appropriate quasi-stochastic equation, and the industry is likewise linked to the production sector.

The present version of the quarterly econometric model of the Slovenian economy, SIQM 2.1, consists of 97 equations; 28 of them are stochastic (behavioural) equations, while the other 69 are identities. 150 variables are actually used in the model (see Tables A1 and A2); 97 of them are endogenous, while the remaining 53 are exogenous variables. There is a number of external variables in the model, i.e. independent of the activity of the economy and economic policy, such as consumer prices in the EU, industrial prices of oil products in the OECD, prices of exports of goods out of the EU, or the long-term lending interest rate in the euro area. There are also several instrumental variables of economic policy in the model, like the final consumption of the general government, the contribution rate for social security, tax revenues of the consolidated general government accounts, the nominal value of base money, or total foreign exchange reserves. Dummy variables in the model are either of a seasonal nature or relate to the introduction of the euro and VAT.

Due to the instability of economic phenomena at the start of the Slovenian economic transformation and the short time spans of officially available time series it has been ascertained that a sufficiently robust econometric model with a satisfactory number of degrees of freedom can only be obtained by analysing quarterly data for the end phase of the economic transformation. That is why the 1997:1 – 2003:4 period is taken as the estimation period, involving 28 observations.

The variables of the model are stated in Tables A1 and A2 in the Appendix and are constructed from monthly and quarterly data. Given that there was no single complete data bank available, the data had to be gathered specifically from different data sources for the purpose of constructing the model. The key references for Slovenian data regarding national accounts, balance of payments, general government accounts and the monetary sector were the Statistical Office of the Republic of Slovenia (SORS), the Bank of Slovenia (BS) and the Ministry of Finance of the Republic of Slovenia (MF). The key reference for foreign data was the Eurostat's reference database NewCronos, now fully integrated into the system of the Eurostat's Databases. Data on world producer prices and energy prices were taken from The Economist of London and the Energy Prices & Taxes of the OECD and the IEA, respectively.

It has to be emphasised that the model's quality is largely determined by the volume and quality of the database. Thus, we can ascertain that our model would have been better if a more detailed and complete database had been available, e.g. in Slovenia there is no data available on the stock of inventories at the quarterly level, while official data on the capital stock are not even available at the annual level. There are also problems with the long-term interest rate because there is no consistent time series available for the whole estimation period due to a lack of long-term bonds and deposits. The interest rate used herein therefore has an average maturity that hardly exceeds one year. Each of these deficiencies represents a deviation for the modeller from their theoretical model.

3. ESTIMATION AND DISCUSSION OF THE MODEL EQUATIONS

Stochastic equations were estimated using the least squares estimator (OLS and GLS). Certain tests were performed with every stochastic equation to determine the statistical properties of the model and validity of the assumptions that guarantee our estimator to be the best linear unbiased estimator (BLUE). The results of these tests were satisfactory at the very least and are listed and described in more detail in Verbič (2005: 22-24), while in this article only the most essential statistics are stated due to the obvious limitations with each stochastic equation, i.e. the standard error of equation (s_e), the value of the determination coefficient of multiple regression (R^2), and the value of the Durbin-Watson statistic (*DW*). When all required characteristics of the least squares estimator were not fulfilled, we tried to eliminate the causes of problematic properties of the regression. When both autocorrelation and heteroscedasticity needed to be handled in the regression, we coped first with the former and then with the latter. It has to be stated, however, that the absence of autocorrelation and the presence of homoscedasticity were not tried to be achieved by all means because the least squares estimator may nevertheless remain an unbiased estimator.

All stochastic equations and identities of the quarterly econometric model of the Slovenian economy are listed in Tables A3 and A4 in the Appendix with the corresponding estimates of parameters and their *p*-values quoted in Table 2. Since the intercept in the majority of stochastic equations in our model has no specific economic meaning, it is not specifically quoted with the results of the econometric estimation (see Verbič 2005 for these estimates). The flowchart diagrams of the model can be found in Verbič (2005: 94-100). As stated in Chapter 2, the estimation period for most equations is 1997:1 – 2003:4. In the following paragraphs we will therefore discuss the theoretical specification and empirical results of the equations by single sets of equations, as presented in Table 1.

Domestic Expenditure. The key stochastic equations of this set of equations are the domestic final consumption of households and the gross fixed capital formation, while the identities represent the gross domestic product by expenditures. By observing the consumption function in expression (1), it can be established that the factors of consumption in the past affect present consumption, implying the validity of the habit-persistence hypothesis, which is in accordance with the findings of Weyerstrass *et al*. (2001: 26). The short-term marginal propensity to consume is 0.43, which may seem quite low, yet the long-term propensity to consume amounts to 0.88, which is in accordance with Keynesian economic theory. December holiday shopping boosts consumption in the fourth quarter on average by 8.78 percentage points, while the increase in consumption in the second quarter following the decline in the first quarter is even higher (24.12 percentage points). One has to mention the introduction of VAT on 1 July 1999, which had a significant detrimental, yet temporary effect on consumption in the third quarter of 1999 (-9.20 percentage points).

From the investment function in expression (2) it can be determined that a one percentage point increase in the production volume of manufacturing, representing both domestic and foreign demand, raises on average gross fixed investments by 1.34 percentage points. The domestic final consumption of the general government has an additional, yet lagged positive effect on investment (0.85 of a percentage point). It is similar with the quantity of goods exports-to-imports ratio affecting investment activity at home (0.30 of a percentage point), where we have to take into account both the lags in effects of changes in contracts in international trade and the lags in effects of investment activity. In addition, gross fixed investments are influenced by the interest rate, whereby a one percentage point increase in the real long-term lending interest rate decreases gross fixed investments on average by 0.78 of a percentage point on account of the more expensive investment loans.

Wages and Pensions. The key stochastic equations of this set of equations are labour costs in the manufacturing sector, labour costs in the services sector and the average net pension, while the identities represent the construction of labour costs. By observing the labour cost function in the manufacturing sector in expression (9), it can be established that labour costs are falling behind both productivity in the manufacturing sector (the corresponding coefficient is 0.79) and consumer prices. Namely, the total effect of a one percentage point increase in the latter is on average composed of a 0.28 percentage point current increase and a 0.64 percentage point lagged increase in the labour costs in the sector (*cf*. McConnell and Brue 1986: 139). The share of labour costs in production value in the manufacturing sector has a positive effect on labour costs in the sector as well (0.81 of percentage point). The effect of the ILO unemployment rate among the active population aged 15-49 on labour costs in the sector is, on the other hand, according to the expectations negative (-0.29 of a percentage point). There is an additional increase in labour costs in the sector in the fourth quarter (2.11 percentage points), which can be attributed to Christmas bonuses and 'thirteenth month' salaries in successful enterprises.

If we now take a look at the labour cost function in the services sector in expression (10), it can be established that the productivity gains of labour in the industry, which give rise to wage claims by labour unions and consequently to wage increases, also have demonstration effects on the services sector (0.41 of a percentage point), where labour unions do not tolerate the lagging of wages in the sector behind wages in the manufacturing sector regardless of any productivity differences. A similar statement can be made for the share of labour costs in production value in the industry (0.36 of a percentage point). However, labour costs in the sector seem to be falling behind consumer prices; the total effect of a one percentage point increase is on average composed of a 0.29 percentage point current increase and a 0.49 percentage point lagged increase in labour costs in the sector. Similar assertions to those in the case of the manufacturing sector can be made about the effects of the ILO unemployment rate on labour costs (-0.39 of a percentage point), and about the autonomous effects in the fourth quarter (4.36 percentage points).

Net pensions are adjusted to the level of gross wages biannually, if necessary (*cf*. Verbič 2004: 74); usually in February (or March), and in September (or October, November, or December). The latter represents a problem by extending over two consecutive quarters. The first increase thus proved to be higher and more certain. From the pension function in expression (11) it can be determined that the average annual increase in net pensions totals 5.98 percent. This happened to undervalue the actual annual increase in net pensions in the starting years and overshoot it in the following years of the estimation period. The consumer price index is the floor for the growth of net pensions.

Production and Employment. The key stochastic equations of this set of equations are the production volume of manufacturing, employment in the manufacturing sector and employment in the services sector. By observing the production volume function of manufacturing in expression (13), it can be established that it is dependent on both domestic and foreign demand. A one percentage point increase in domestic demand, measured through domestic expenditure not including the consumption of private non-profit institutions and changes in inventories and valuables, increases the production volume of manufacturing by 0.17 of a percentage point, while an equivalent increase in foreign demand, measured through exports of goods, increases the production volume of manufacturing by as much as 0.82 of a percentage point on average. This indisputably indicates the importance of foreign demand for domestic production and economic growth.

From the employment function in the manufacturing sector in expression (17) it can be established that employment in the sector is negatively affected by productivity and positively affected by both domestic and foreign demand. Namely, a one percentage point increase in labour productivity in the industry on average decreases employment in the manufacturing sector by 0.12 of a percentage point. A one percentage point increase in domestic demand, measured through (lagged) domestic final consumption of the general government, increases employment in the sector by only 0.02 of a percentage point, while an equivalent increase in foreign demand, measured through exports of goods, increases employment in the sector by as much as 0.10 of a percentage point on average. An increase in employment in the services sector seems to have a considerable substitution effect on employment in the manufacturing sector (-0.25 of a percentage point), which could indicate the defective functioning of the labour market in Slovenia. One should also mention the positive effect on employment of an increase in the number of employed persons per business subject (0.23 of a percentage point), reflecting the effects of economies of scale.

If we now take a look at the employment function in the services sector in expression (18), it can be established foremost that the factors of employment in the sector in the past positively affect present employment, which might indicate rigidity in the sector not exposed to much international competition. An increase in employment in the production sector once again seems to have a considerable substitution effect on em-

ployment in the services sector (-0.35 of a percentage point), where this sector is gaining jobs on account of the manufacturing sector. This could either be a sign of the temporal concurrence of contraction and expansion of activity in the sectors or of seeking skilled workers through the malfunctioning system of employment offices. Further, a one percentage point increase in the productivity of labour in the industry, giving rise to wage rises in the industry, on average decreases employment in the services sector by 0.07 of a percentage point, which is a result of either demonstration effects in the services sector or of the substitution of labour among the sectors. Meanwhile, government consumption has a positive, although weak and lagged effect on employment in the services sector (0.04 of a percentage point). There is also a positive effect of an increase in the number of business subjects outside of the manufacturing sector on employment in the services sector (0.42 of a percentage point).

Prices. The key stochastic equations of this set of equations are consumer prices and the producer prices of manufacturing. From the consumer price function in expression (3) it can be established that producer prices at home, producer prices in the world and the prices of energy in OECD countries all have positive effects on domestic consumer prices. A one percentage point increase in these categories results in an (albeit lagged) 0.19, 0.03 and 0.06 percentage point increase in domestic consumer prices, respectively. The increase in labour costs per employee in the industry also has a positive effect on consumer prices (0.06 of a percentage point) and a parallel indirect disadvantageous effect on economic growth. The effect of the mass of tax revenues of consolidated general government accounts is likewise positive, yet surprisingly low in its intensity (0.01 of a percentage point). This is particularly interesting because of the large share of VAT in the mass of tax revenues.

By observing the producer price function of manufacturing in expression (5), it can be established that domestic producer prices of manufacturing are positively affected by producer prices of exports out of the EU, producer prices in the world, and the prices of energy in European OECD countries. A one percentage point increase in these categories results in a (once again lagged) 0.27, 0.02 and 0.13 percentage point increase in the domestic producer prices of manufacturing, respectively. An increase in unit labour costs in the industry has a lagged positive effect on the producer prices of manufacturing (0.04 of a percentage point), which in this case represents a direct detrimental effect on demand and consequently on economic activity (*cf.* Kuzmin 2001: 25-26). It should, however, be stated here that prices proved to be complex phenomena in need of additional research.

Interest Rates and Exchange Rates. The key stochastic equations of this set of equations are the average nominal long-term lending interest rate, the average euro exchange rate of the Bank of Slovenia and the nominal effective exchange rate. By observing the nominal interest rate function in expression (19), which is in considerable accordance with the specification of Delakorda (2000), it can be established that the elasticity of the

TABLE 2: Estimates of parameters of the quarterly econometric model of the Slovenian economy

I	$b_{i,1\ t}$	$b_{i,2\ t}$	$b_{i,3\ t}$	$b_{i,4\ t}$	$b_{i,5\ t}$	$b_{i,6\ t}$	s_e		R^2		DW
1	0.509	0.431	24.12	8.778	–9.202	–	2.180	(log L)	–56.6	(h)	–1.850
	(0.000)	(0.002)	(0.000)	(0.001)	(0.003)						
2	1.335	0.847	0.297	–0.777	–	–	5.122		0.789		1.869
	(0.024)	(0.084)	(0.079)	(0.004)							
3	0.185	0.031	0.056	0.059	0.006	–	0.475		0.676		2.261
	(0.101)	(0.016)	(0.003)	(0.091)	(0.057)						
4	0.905	–	–	–	–	–	0.651		0.577		1.969
	(0.000)										
5	0.271	0.023	0.128	0.042	–	–	0.488		0.712		1.952
	(0.000)	(0.074)	(0.008)	(0.123)							
6	0.378	0.623	–	–	–	–	0.095	(log L)	24.2		1.723
	(0.000)	(0.000)									
7	0.952	–	–	–	–	–	0.248		0.993		2.172
	(0.000)										
8	1.027	–	–	–	–	–	0.178		0.996		2.177
	(0.000)										
9	0.792	0.812	0.278	0.638	–0.294	2.107	0.701		0.958		1.658
	(0.000)	(0.000)	(0.160)	(0.009)	(0.080)	(0.000)					
10	0.407	0.364	0.286	0.450	–0.388	4.355	0.868		0.928		1.658
	(0.000)	(0.000)	(0.190)	(0.099)	(0.078)	(0.000)					
11	0.222	4.216	0.883	–	–	–	1.510		0.494		1.987
	(0.186)	(0.001)	(0.240)								
12	0.872	–	–	–	–	–	1.620		0.911		2.053
	(0.000)										
13	0.819	0.170	–	–	–	–	2.202		0.869		1.663
	(0.000)	(0.018)									
14	0.453	0.547	–	–	–	–	0.034	(log L)	56.9		1.366
	(0.000)	(0.000)									
15	0.902	–	–	–	–	–	0.306		0.772		1.991
	(0.000)										
16	0.987	–	–	–	–	–	0.093		0.978		1.573
	(0.000)										

I	$b_{i,1\ t}$	$b_{i,2\ t}$	$b_{i,3\ t}$	$b_{i,4\ t}$	$b_{i,5\ t}$	$b_{i,6\ t}$	s_e		R^2		DW
17	–0.116	0.104	0.022	–0.252	0.228	–	0.423		0.634		1.929
	(0.015)	(0.039)	(0.024)	(0.098)	(0.025)						
18	0.290	–0.354	–0.072	0.041	0.424	–	0.593		0.578	(*h*)	1.002
	(0.048)	(0.097)	(0.078)	(0.002)	(0.005)						
19	–8.213	6.375	8.088	–	–	–	0.218		0.786		1.411
	(0.000)	(0.007)	(0.064)								
20	0.282	–0.042	–	–	–	–	0.008		0.994		1.444
	(0.000)	(0.106)									
20a	–3.531	–	–	–	–	–	0.856		0.365		1.838
	(0.002)										
21	0.977	0.012	–	–	–	–	0.004		0.998		2.146
	(0.000)	(0.000)									
21a	1.019	–0.012	–	–	–	–	0.004		0.998		2.105
	(0.000)	(0.001)									
22	1.006	0.204	–	–	–	–	0.004		0.998		1.878
	(0.000)	(0.000)									
23	0.827	0.083	0.093	–3.135	–	–	0.654	(log *L*)	–23.7		1.972
	(0.000)	(0.001)	(0.008)	(0.000)							
24	0.359	0.781	–0.354	–	–	–	2.230		0.849		1.710
	(0.071)	(0.000)	(0.064)								
25	0.446	0.445	0.117	–	–	–	1.371	(log *L*)	–43.5		1.331
	(0.002)	(0.001)	(0.039)								
26	1.439	0.732	0.097	–0.531	–18.65	–	3.983		0.884		2.232
	(0.000)	(0.083)	(0.069)	(0.054)	(0.000)						
27	–0.348	0.795	0.640	29.14	39.86	–	4.188		0.951	(*h*)	0.089
	(0.006)	(0.063)	(0.016)	(0.000)	(0.000)						
28	–0.870	1.154	–17.68	–55.29	36.07	–	3.009		0.990	(*h*)	0.738
	(0.000)	(0.011)	(0.047)	(0.000)	(0.000)						

Notes: each estimate includes the value of the regression coefficient and the respective *p*-value (in brackets). Index *i* corresponds to the denotation of the respective equation in the main text. Where appropriate, the R^2 value and the value of *DW*-statistic are replaced with the log *L* value and the value of Durbin's *h*-statistic, respectively.

interest rate with respect to the real value of the monetary aggregate M3 is -8.21, while the lagged elasticity of the interest rate with respect to the money multiplier of the monetary aggregate M3 amounts to 6.38. Namely, a current increase in the volume of t broadly defined money lowers its current price, while a past increase in the volume of base money indeed has immediate multiplicative effects on broadly defined money, but can only result in an increased current interest rate with an unchanged present volume of broadly defined money. As can be seen, the first effect prevails. Further, the income elasticity of the interest rate is 8.09, which is expected in an inverse money demand function for greater economic activity requires more money; if the required increase does not occur, the price of money rises. One should observe that monetary variables respond faster than do the variables of the real sector.

Before proceeding to the exchange rate function of the model we need to mention some particularities of exchange rate policy in Slovenia. Since the Bank of Slovenia had no mentionable quantity of government securities available after the independence of Slovenia in 1991, it started issuing its own bills. However, these central bank bills were not only denominated in tolars and sold at home, but also denominated in foreign currencies and sold to domestic economic agents (*cf.* Ribnikar 1999a). This was done for two purposes[4]. On one hand, the Bank of Slovenia was able to intervene in the foreign exchange market to prevent the tolar from appreciating too much and, on the other, it was able to supervise the liquidity and solvency of banks receiving deposits in a foreign currency (Ribnikar 1999), which then needed to have no less than 60 percent of their long-term liquidity assets in a foreign currency in the form of short-term foreign currency bills of the Bank of Slovenia (somewhat incorrectly labelled the 'foreign exchange' minimum).

Because of the complexity of exchange rate policy in Slovenia two different specifications of the exchange rate function were tested. In the first one, the euro exchange rate in the spot exchange market was linked to the euro exchange rate of the Bank of Slovenia and the latter was then explained by the dynamics of money supply and monetary reserves, while in the second version the euro exchange rate of the Bank of Slovenia was linked to the euro exchange rate in the spot exchange market and the latter was explained by the uncovered interest parity theory as suggested by MacDonald and Nagayasu (1999). The first specification, represented by expressions (20) and (21), turned out to be more efficient which is why it is used in our model and will now be explained in more detail. The second version is nevertheless presented here by expressions (20a) and (21a), and documented in Verbič (2005: 71-74).

[4] Both particularities described hereinafter greatly affected the structural position of the money market as defined by Ribnikar (1999a) and will need to be abolished before formal introduction of the euro.

From the exchange rate function in expression (20) it can finally be determined that the elasticity of the average euro exchange rate of the Bank of Slovenia with respect to the nominal value of the monetary aggregate M3 is 0.28, while the lagged elasticity of the average euro exchange rate of the Bank of Slovenia with respect to total foreign exchange reserves amounts to -0.04. An increased domestic money supply means that foreign currency becomes relatively scarce so its price in tolars has to increase. The increased supply of foreign exchange on the other hand decreases its price in the domestic currency. However, it has to be mentioned that, compared to the estimates of Cimperman *et al*. (1996: 52), the values of the respective elasticities decreased during the economic transformation in Slovenia. One should add here that even though the effects of introducing the euro on 1 January 1999 were small in size, they were statistically significant as can be seen from expression (21). Both the euro exchange rate of the Bank of Slovenia and the euro exchange rate in the spot exchange market were thereupon converging on one another.

If we now take a look at the nominal effective exchange rate in expression (22), it can be established that the elasticity of the nominal effective exchange rate with respect to the average euro exchange rate of the Bank of Slovenia is 1.01, while the elasticity of the nominal effective exchange rate with respect to the average euro exchange rate in New York amounts to 0.20. The former elasticity indicates that the euro is a very good approximation of the basket of currencies used by the Bank of Slovenia for calculating the effective exchange rate of the tolar. The latter elasticity indicates that the strengthening of the euro against the US dollar decreases the nominal effective exchange rate, thus representing a proxy of the inter-currency ratios. One can therefore conclude that in Slovenia the exchange rate was an endogenous variable, dependent on the monetary policy of the Bank of Slovenia.

Exports of Goods. The key stochastic equations of this set of equations are the prices of exports of goods and the quantities of exports of goods, while the identities represent the division of nominal foreign trade values on prices and quantities. By observing the function of prices of exports of goods in expression (23), it can be established that both consumer prices in the EU (0.83 of a percentage point) and the industrial prices of oil products in OECD countries (0.08 of a percentage point) have significant though lagged effects on export prices. Namely, the rising of these prices represents an increase in the costs for domestic producers, which is at least partly offset in prices for the end-user. Further, a one percentage point increase in the average euro exchange rate in New York has on average a 0.09 percentage point impact on export prices, which is expected; since the majority of Slovenian exports is denominated in euros, the strengthening of the US dollar against the euro has little impact on euro export prices. One should mention that although the effect of introducing the euro seems substantial (-3.14 percentage points), it was largely smoothed by the euro exchange rate incorporated in tolar export prices.

From the function of quantities of exports of goods in expression (24) it can be determined that a one percentage point increase in the quantities of imports of goods to the four most important Slovenian trade partners (Germany, France, Austria, and Italy) from all Central and Eastern European countries (CEECs) on average increases Slovenian exports of goods by 0.36 of a percentage point, while an equivalent increase in the production volume of the industry, representing the clearly established correlation between domestic and foreign demand, increases Slovenian exports of goods by as much as 0.78 of a percentage point. Of course, this only appears to be in contrast with the hypothesis of exports being the crucial factor of production and not *vice versa* for the foreign demand variable in our model relates to all Central and Eastern European countries and not just Slovenia. The effect is therefore small, yet significant[5]. One should also observe that even a small increase in labour costs in the manufacturing sector decreases Slovenian exports of goods and Slovenian competitiveness as a whole considerably (the corresponding coefficient is -0.35).

Imports of Goods. The key stochastic equations of this set of equations are the prices of imports of goods and the quantities of imports of goods. If we take a look at the function of prices of imports of goods in expression (25), it can be established that both consumer prices in the EU (0.45 of a percentage point) and industrial prices of energy in the European OECD countries (0.44 of a percentage point) have significant effects on import prices. Namely, the rising of imported merchandise and energy prices represents an increase in the costs for domestic consumers and producers, respectively. Further, a one percentage point increase in the average euro exchange rate in New York has on average a 0.12 percentage point impact on import prices, which is once again expected for the reasons already mentioned above.

By observing the function of quantities of imports of goods in expression (26), it can be established that a one percentage point increase in the production volume of the industry increases Slovenian imports of goods on average by 1.44 percentage points. Since the approximate elasticity of exports of goods with respect to the production volume of the industry was only 0.78, this result implies the unfavourable incidence of trade deficits in the analysed period. As expected, both the mass of real net wages (0.73 of a percentage point) and the mass of real net other incomes (0.10 of a percentage point) have positive effects on imports of goods. The effect of the former is higher than the effect of the latter since the marginal propensity to import (goods) from permanent incomes is higher than the marginal propensity to import (goods) from transitory incomes. Further, a one percentage point increase in the real effective exchange rate, deflated by industrial producer prices, decreases imports of goods by 0.53 of a percentage point. One also has to mention here the introduction of VAT on 1 July 1999, which

[5] It can be inferred from the parameters of expression (13) that, given more appropriate quarterly data, the foreign demand elasticity of exports would be higher than the domestic production elasticity of exports.

hardly affected exports of goods, while the quantities of imported goods increased greatly in the second quarter of 1999 and then decreased by as much as 18.65 percentage points in the next quarter.

Foreign Trade in Services. The key stochastic equations of this set of equations are the quantities of exports of services and the quantities of imports of services. From the function of quantities of exports of services in expression (27) it can be determined that the factors of exports of services in the past affect present exports of services, implying the seasonal characteristics of services. A one percentage point increase in the quantities of imports of goods to the EU increases Slovenian exports of services on average by 0.80 of a percentage point, which implies that exports of services are in connection with exports of goods. Further, a one percentage point increase in the real effective exchange rate, deflated by unit labour costs, increases exports of services by 0.64 of a percentage point. Both dummy variables explain in more detail the already indicated seasonal effects; the quantities of exports of services increase on average each year by 29.14 percentage points in the second quarter and by 39.86 percentage points in the third quarter.

We shall conclude our overview of the model by examining the remaining stochastic equation, i.e. the function of quantities of imports of services in expression (28). To start with, one can observe that the factors of imports of services in the past affect present imports of services, once again implying the seasonal characteristics of services. A one percentage point increase in the mass of real net receipts of employees and pensioners increases on average quantities of imports of services by 1.15 percentage points. The result seems high, but one needs to keep in mind that the imported goods are not only intended for final consumption but also for production, where the accompanying services are needed. Further, a one percentage point increase in the consumer prices of services in the EU, which are quite stable compared to Slovenian consumer prices of services, on average decreases Slovenian imports of services by as much as 17.68 percentage points. The already implied seasonal effects can once again be observed; the quantities of imports of services decrease on average each year by 55.29 percentage points in the first quarter and increase by 36.07 percentage points in the third quarter.

4. EVALUATING AND TESTING THE MODEL

The suitability of a model for analysing relationships in the economy is usually judged on basis of its ability to reproduce actual developments in the economy. By solving the model one can observe the values of its endogenous variables in the past and compare them with their actual values. We then say that a simulation has been performed. However, this can be done in two ways; when actual values of exogenous and lagged endogenous (predetermined) variables are used in every quarter the simulation is static, but when lagged endogenous variables, obtained in solutions of the model for previous

quarters, are used for solving the model for the current quarter, the simulation is dynamic. The second procedure evidently represents a better test of the model and shall therefore be used here, although the results of static simulations can be found in Verbič (2005: 101-107). Namely, the conditions for solving the model for a past time period are thus the same as in the case of solving the model for a future time period (*cf.* Borak *et al.* 1989: 23-24); both times we proceed merely from the equations of the model and the values of exogenous variables.

A clear assessment of the suitability of the model can be obtained by producing graphic representations of both actual and forecasted values of endogenous variables, which is omitted here due to obvious limitations but well documented in Verbič (2005: 108-114). Therefore, we shall evaluate the model by calculating some of the most widely used analytical measures of reliability of the model, such as the root mean squared error (*RMSE*), the mean absolute error (*MAE*), the mean absolute percentage error (*MAPE*), and the Theil inequality coefficient (*THEIL*). These so-called error statistics are presented in Table 3 for the most important variables, i.e. economic growth, domestic prices, labour costs, wages, pensions, industrial activity, employment, interest rate, exchange rate, prices in foreign trade, and quantities in foreign trade. The simulation period is abridged to 1998:1 – 2003:4 due to time lags in stochastic equations, yet still sums up to 24 observations.

TABLE 3: Error statistics of the ex post dynamic simulations of the model

Variable	***RMSE***	***MAE***	***MAPE***	***THEIL***
CPI	0.428	0.328	0.322	0.002
ELCG	1.117	0.797	0.774	0.006
EUROBS	1.906	1.398	0.696	0.005
GDP95G	1.238	1.091	1.104	0.006
NEMPG	0.293	0.214	0.214	0.001
NPG	1.402	1.083	1.055	0.007
NWG	1.093	0.814	0.794	0.005
PEX	0.557	0.396	0.394	0.003
PIM	1.216	0.897	0.886	0.006
PPI	0.619	0.505	0.499	0.003
QEXG	2.224	1.657	1.635	0.011
QEXS	3.391	2.630	2.650	0.016
QIMG	4.813	3.753	3.667	0.023
QIMS	2.252	1.734	1.780	0.011
QIND	1.930	1.506	1.499	0.009
RLA	0.144	0.109	6.652	0.037

Note: values of *MAPE* and *THEIL* of the average real long-term lending interest rate (*RLA*) are not directly comparable with the respective values of other variables, as the interest rate is measured in percent while other variables are measured in percentage points (*cf.* Bank of Finland 1990: 34-35).

The calculated error statistics convey the ability of the estimated structural equations of the model to represent actual economic developments in the framework of simultaneous interactions in a satisfactory manner. On basis of the error statistics in Table 3 it can be established that the quarterly econometric model of the Slovenian economy offers quite a satisfactory explanation of the economy. Many of the key macroeconomic variables, such as prices, the euro exchange rate, wages and employment, are estimated with a mean absolute percentage error of considerably less than one percent. The gross domestic product and pensions are estimated with a mean absolute percentage error of approximately one percent, while the mean absolute percentage error of the estimates of quantity of industrial production and exports of goods is in the range of one-and-a-half percent. The mean absolute error of the interest rate hardly exceeds one tenth of a percent. Of course, one needs to take into account that those aggregates with higher volatility, such as imports of goods and exports of services, are being estimated with less accuracy. Nonetheless, one should always project alternative specifications in order to improve the model.

5. CONCLUSION

The article represents a construction of a quarterly econometric model of the Slovenian economy and an analysis of the fundamental relationships in the Slovenian economy. For this purpose we formed a system of identities, consistent with the national accounts, and of stochastic equations, consistent with economic theory as well as the institutional and constitutional characteristics of the Slovenian economy. The economy is described by eight sets of equations covering domestic expenditure, prices, wages and pensions, production and employment, interest rates and exchange rates, exports of goods, imports of goods, and foreign trade in services. The Slovenian economy turned out in the analysed period still to be the subject of quite extensive transformation processes, which can be seen on the basis of several parameters that worked out to be statistically significant in the model, yet need not be relevant and *vice versa*. In addition, there are still several problems with the integrity and consistency of the available time series. Nevertheless, we can ascertain that the findings of the present econometric model are more in accordance with the concept of a market economy than are most of the econometric models of the past decade quoted before.

The adequacy of the model, i.e. its ability to reproduce actual economic developments in the period under investigation, was verified by performing dynamic simulations. It was established that the short-run results are econometrically satisfactory and in part even quite favourable. However, the model's structure should be broadened and primarily deepened in the future while the evaluation of the model should be extended by calculating static and dynamic model multipliers and by performing some *ex ante* dynamic simulations as soon as this becomes feasible.

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APPENDIX

TABLE A1: Endogenous variables of the quarterly econometric model of the Slovenian economy

Variable	Description of the variable and source of data
BW	Average gross wage, current prices, in SIT *Source:* SORS, Rapid Reports (1997 – 2004); own calculations.
BWG	Average gross wage, current prices, chain index
BWI	Average gross wage in the industry, current prices, in SIT *Source:* SORS, Rapid Reports (1997 – 2004); own calculations.
BWM	Average gross wage in the manufacturing sector, current prices, in SIT *Source:* SORS, Rapid Reports (1997 – 2004); own calculations.
BWR	Average gross wage in the production sector, current prices, in SIT *Source:* SORS, Rapid Reports (1997 – 2004); own calculations.
BWS	Average gross wage in the services sector, current prices, in SIT *Source:* SORS, Rapid Reports (1997 – 2004); own calculations.
CHN	Domestic final consumption of households, current prices, in SIT million *Source:* SORS, GDP by quarters, more detailed data, 1995 – 2004 (2005), http://www.stat.si.
CHR	Domestic final consumption of households, constant 1995 prices, in SIT million *Source:* SORS, GDP by quarters, more detailed data, 1995 – 2004 (2005), http://www.stat.si.
CHRG	Domestic final consumption of households, constant 1995 prices, chain index
CPI	Consumer price index, chain index
CPI95	Consumer price index, 1995 = 100 *Source:* SORS, Rapid Reports (1997 – 2004).
ELC	Labour cost per employee, current prices, in SIT
ELCG	Labour cost per employee, current prices, chain index
ELCI	Labour cost per employee in the industry, current prices, in SIT
ELCIG	Labour cost per employee in the industry, current prices, chain index
ELCM	Labour cost per employee in the manufacturing sector, current prices, in SIT
ELCMG	Labour cost per employee in the manufacturing sector, current prices, chain index
ELCR	Labour cost per employee in the production sector, current prices, in SIT
ELCRG	Labour cost per employee in the production sector, current prices, chain index
ELCS	Labour cost per employee in the services sector, current prices, in SIT
ELCSG	Labour cost per employee in the services sector, current prices, chain index
ER	Domestic expenditure, constant 1995 prices, in SIT million
ERG	Domestic expenditure, constant 1995 prices, chain index
EURO	Average euro exchange rate on the spot exchange market, in SIT per EUR *Source*: Bank of Slovenia, Monthly Bulletin (1997 – 2004).
EUROBS	Average euro exchange rate of the Bank of Slovenia, in SIT per EUR *Source*: Bank of Slovenia, Monthly Bulletin (1997 – 2004).
EUROBSG	Average euro exchange rate of the Bank of Slovenia, in SIT per EUR, chain index
EUROG	Average euro exchange rate on the spot exchange market, in SIT per EUR, chain index
EXG	Exports of goods, current prices, chain index

Variable	Description of the variable and source of data
EXGN	Exports of goods, current prices, in SIT million *Source*: SORS, GDP by quarters, more detailed data, 1995 – 2004 (2005), http://www.stat.si.
EXS	Exports of services, current prices, chain index
EXSN	Exports of services, current prices, in SIT million *Source*: SORS, GDP by quarters, more detailed data, 1995 – 2004 (2005), http://www.stat.si.
GDP	Gross domestic product, current prices, in SIT million
GDP95	Gross domestic product, constant 1995 prices, in SIT million *Source*: SORS, GDP by quarters, more detailed data, 1995 – 2004 (2005), http://www.stat.si.
GDP95G	Gross domestic product, constant 1995 prices, chain index
GN	Domestic final consumption of the general government, current prices, in SIT million *Source*: SORS, GDP by quarters, more detailed data, 1995 – 2004 (2005), http://www.stat.si.
GR	Domestic final consumption of the general government, constant 1995 prices, in SIT million *Source*: SORS, GDP by quarters, more detailed data, 1995 – 2004 (2005), http://www.stat.si.
IFAN	Gross fixed capital formation, current prices, in SIT million *Source*: SORS, GDP by quarters, more detailed data, 1995 – 2004 (2005), http://www.stat.si.
IFAR	Gross fixed capital formation, constant 1995 prices, in SIT million *Source*: SORS, GDP by quarters, more detailed data, 1995 – 2004 (2005), http://www.stat.si.
IFARG	Gross fixed capital formation, constant 1995 prices, chain index
IMG	Imports of goods, current prices, chain index
IMGN	Imports of goods, current prices, in SIT million *Source*: SORS, GDP by quarters, more detailed data, 1995 – 2004 (2005), http://www.stat.si.
IMS	Imports of services, current prices, chain index
IMSN	Imports of services, current prices, in SIT million *Source*: SORS, GDP by quarters, more detailed data, 1995 – 2004 (2005), http://www.stat.si.
M3	Monetary aggregate M3, nominal value, in SIT million *Source*: Bank of Slovenia, Monthly Bulletin (1997 – 2004).
MINC	Mass of net receipts of employees and pensioners, current prices, in SIT million
MINCRG	Mass of net receipts of employees and pensioners, constant 1995 prices, chain index
MOINCRG	Mass of net other receipts from employment, constant 1995 prices, chain index
MP	Mass of net pensions, current prices, in SIT million
MW	Mass of net wages, current prices, in SIT million
MWRG	Mass of net wages, constant 1995 prices, chain index
NEMP	Persons in employment
NEMPEE	Persons in employment, employees *Source:* SORS, Rapid Reports (1997 – 2004).
NEMPEEG	Persons in employment, employees, chain index
NEMPG	Persons in employment, chain index

Variable	Description of the variable and source of data
NEMPI	Persons in employment in the industry
NEMPIEE	Persons in employment in the industry, employees *Source:* SORS, Rapid Reports (1997 – 2004).
NEMPIEEG	Persons in employment in the industry, employees, chain index
NEMPM	Persons in employment in the manufacturing sector
NEMPMEE	Persons in employment in the manufacturing sector, employees *Source:* SORS, Rapid Reports (1997 – 2004).
NEMPMEEG	Persons in employment in the manufacturing sector, employees, chain index
NEMPR	Persons in employment in the production sector
NEMPREE	Persons in employment in the production sector, employees *Source:* SORS, Rapid Reports (1997 – 2004).
NEMPREEG	Persons in employment in the production sector, employees, chain index
NEMPS	Persons in employment in services
NEMPSEE	Persons in employment in the services sector, employees *Source:* SORS, Rapid Reports (1997 – 2004).
NEMPSEEG	Persons in employment in the services sector, employees, chain index
NP	Average net pension, current prices, in SIT *Source:* SORS, Rapid Reports (1997 – 2004).
NPG	Average net pension, current prices, chain index
NW	Average net wage, current prices, in SIT *Source:* SORS, Rapid Reports (1997 – 2004); own calculations.
NWG	Average net wage, current prices, chain index
NWI	Average net wage in the industry, current prices, in SIT *Source:* SORS, Rapid Reports (1997 – 2004); own calculations.
NWM	Average net wage in the manufacturing sector, current prices, in SIT *Source:* SORS, Rapid Reports (1997 – 2004); own calculations.
NWR	Average net wage in the production sector, current prices, in SIT *Source:* SORS, Rapid Reports (1997 – 2004); own calculations.
NWS	Average net wage in the services sector, current prices, in SIT *Source:* SORS, Rapid Reports (1997 – 2004); own calculations.
NX	Net exports of goods and services, current prices, in SIT million
PEX	Price index of exports of goods, in EUR, chain index *Source*: Bank of Slovenia, Financial Statistics (2004), internal data; own calculations.
PIM	Price index of imports of goods, in EUR, chain index *Source*: Bank of Slovenia, Financial Statistics (2004), internal data; own calculations.
PPI	Producer price index, chain index *Source:* SORS, Rapid Reports (1997 – 2004).
PPM	Producer price index of manufacturing, chain index *Source:* SORS, Rapid Reports (1997 – 2004).
PRODGI	Productivity of labour in the industry, chain index
PRODGM	Productivity of labour in the manufacturing sector, chain index
QEXG	Quantity index of exports of goods, chain index
QEXS	Quantity index of exports of services, chain index
QIMG	Quantity index of imports of goods, chain index
QIMS	Quantity index of imports of services, chain index
QIND	Production volume index of industry, chain index *Source:* SORS, Rapid Reports (1997 – 2004); own calculations.
QMAN	Production volume index of manufacturing, chain index *Source:* SORS, Rapid Reports (1997 – 2004); own calculations.

Variable	Description of the variable and source of data
REEN	Nominal effective exchange rate, index *Source*: Bank of Slovenia, Monthly Bulletin (1997 – 2004); own calculations.
REXIM	Quantity of goods exports-to-imports ratio, chain index
RLA	Average quarterly real long-term Commercial Banks' lending interest rate, in percent
RLAG	Average quarterly real long-term lending interest rate, chain index
RLAN	Average quarterly nominal long-term Commercial Banks' lending interest rate, in percent *Source*: Bank of Slovenia, Monthly Bulletin (1997 – 2004); own calculations.
ULCIG	Unit labour cost in the industry, chain index
ULCMG	Unit labour cost in the manufacturing sector, chain index
USDEURO	Average euro exchange rate in New York, in EUR per USD
USDEUROG	Average euro exchange rate in New York, in EUR per USD, chain index

Note: variables without an explicitly stated source of data were computed using the identities of the model.

TABLE A2: Exogenous variables of the quarterly econometric model of the Slovenian economy

Variable	Description of the variable and source of data
CNPN	Domestic final consumption of private non-profit institutions, current prices, in SIT million *Source:* SORS, GDP by quarters, more detailed data, 1995 – 2004 (2005), http://www.stat.si.
CPIEU	Consumer price index in the EU, chain index *Source*: Eurostat, NewCronos (2004), http://europa.eu.int/newcronos.
CPIEURO	Consumer price index in the euro area, chain index *Source*: Eurostat, NewCronos (2004), http://europa.eu.int/newcronos.
CPISEU	Consumer price index of services in the EU, chain index *Source*: Eurostat, NewCronos (2004), http://europa.eu.int/newcronos.
CR1	Employee's contribution rate for social security from the gross wage *Source*: Official Gazette of the Republic of Slovenia (5/96; 34/96; 3/98; 81/00; 97/01).
CR2	Employer's contribution rate for social security on the gross wage *Source*: Official Gazette of the Republic of Slovenia (5/96; 34/96; 3/98; 81/00; 97/01).
D1	Dummy variable for the first quarter
D2	Dummy variable for the second quarter
D3	Dummy variable for the third quarter
D4	Dummy variable for the fourth quarter
DEP	Deposits, repurchase agreements and debt securities, nominal value, in SIT million
DEURO	Dummy variable for the period of introducing the euro, [1999:1, …, 2003:4] = 1
DEURO99	Dummy variable for the introduction of the euro, 1999:1 = 1
DVAT	Dummy variable for the introduction of VAT, 1999:3 = 1

Variable	Description of the variable and source of data
ERPENOECD	OECD energy industrial price index, measured through USD exchange rate, chain index *Source*: OECD/IEA, Energy Prices & Taxes (1997 – 2004); own calculations.
ERPPIW	World producer price index, measured through USD exchange rate, chain index *Source*: The Economist (1997 – 2004); own calculations.
GRG	Domestic final consumption of the general government, constant 1995 prices, chain index
ICAN	Changes in inventories and valuables, current prices, in SIT million *Source*: SORS, GDP by quarters, more detailed data, 1995 – 2004 (2005), http://www.stat.si.
M0	Base money, nominal value, in SIT million *Source*: Bank of Slovenia, Financial Statistics (2004), internal data.
MM	Money multiplier between monetary aggregate M1 and the monetary base
MOINC	Mass of net other receipts from employment, current prices, in SIT million *Source*: Bank of Slovenia, Monthly Bulletin (1997 – 2004).
MR	Total foreign exchange reserves, in mill USD *Source*: Bank of Slovenia, Monthly Bulletin (1997 – 2004).
MTAXRG	Mass of tax revenues of the consolidated general government accounts, constant 1995 prices, chain index *Source*: Ministry of Finance, General Government Operations (2004), internal data.
NEMPISE	Persons in employment in the industry, self-employed and employed by self-employed *Source:* SORS, Rapid Reports (1997 – 2004).
NEMPMSE	Persons in employment in the manufacturing sector, self-employed and employed by the self-employed *Source:* SORS, Rapid Reports (1997 – 2004).
NEMPNENTG	Number of employed persons per business subject, chain index *Source:* SORS, Monthly Statistical Review (1997 – 2004); own calculations.
NEMPRSE	Persons in employment in the production sector, self-employed and employed by the self-employed *Source:* SORS, Rapid Reports (1997 – 2004).
NEMPSE	Persons in employment, self-employed and employed by the self-employed *Source:* SORS, Rapid Reports (1997 – 2004).
NEMPSG	Persons in employment in the services sector, chain index
NEMPSSE	Persons in employment in the services sector, self-employed and employed by the self-employed *Source:* SORS, Rapid Reports (1997 – 2004).
NENTSG	Number of business subjects outside of the manufacturing sector, chain index *Source:* SORS, Monthly Statistical Review (1997 – 2004); own calculations.
NPENS	Number of pensioners *Source:* SORS, Rapid Reports (1997 – 2004).
PC95	Implicit price index of domestic final consumption of households, 1995 = 100
PENOECDE	OECD Europe energy industrial price index, chain index *Source*: OECD/IEA, Energy Prices & Taxes (1997 – 2004).
PEXEUER	Price index of exports of goods out of the EU, in SIT, chain index *Source*: Eurostat, NewCronos (2004), http://europa.eu.int/newcronos; own calculations.

Variable	Description of the variable and source of data
PG95	Implicit price index of domestic final consumption of the general government, 1995 = 100
PGDP95	Implicit price index of gross domestic product, 1995 = 100
PI95	Implicit price index of gross fixed capital formation, 1995 = 100
POILOECD	OECD oil products industrial price index, chain index *Source*: OECD/IEA, Energy Prices & Taxes (1997 – 2004).
QIMEUG	Quantity index of imports of goods to the EU, chain index *Source*: Eurostat, NewCronos (2004), http://europa.eu.int/newcronos.
QIMEUCEEG	Quantity index of imports of goods to the four most important Slovenian trade partners (EU member states) from all Central and Eastern European countries, chain index *Source*: Eurostat, NewCronos (2004), http://europa.eu.int/newcronos; own calculations.
REERPPI	Real effective exchange rate, deflated by industrial producer prices, 1995 = 100 *Source*: Bank of Slovenia, Monthly Bulletin (1997 – 2004); own calculations.
REERULC	Real effective exchange rate, deflated by unit labour costs, 1995 = 100 *Source*: Bank of Slovenia, Monthly Bulletin (1997 – 2004); own calculations.
RLAEURO	Average quarterly real long-term lending interest rate in the euro area, in percent *Source*: Eurostat, NewCronos (2004), http://europa.eu.int/newcronos; own calculations.
TOM	tolar indexation clause, in percent *Source*: Bank of Slovenia, Monthly Bulletin (1997 – 2004).
TR	Average personal income tax rate out of gross wage
TRI	Average personal income tax rate out of gross wage, the industry
TRM	Average personal income tax rate out of gross wage, the manufacturing sector
TRR	Average personal income tax rate out of gross wage, the production sector
TRS	Average personal income tax rate out of gross wage, the services sector
ULCSLIG	Share of labour costs in production value, the industry, chain index *Source:* SORS, Rapid Reports (1997 – 2004); own calculations.
ULCSLMG	Share of labour costs in production value, the manufacturing sector, chain index *Source:* SORS, Rapid Reports (1997 – 2004); own calculations.
UR1549	Labour Force Survey unemployment rate among active population aged 15 – 49, in percent *Source:* SORS, Monthly Statistical Review (1997 – 2004); own calculations.
USDBS	Average USD exchange rate of the Bank of Slovenia, in SIT per USD *Source:* SORS, Rapid Reports (1997 – 2004).

Note: variables without an explicitly stated source of data were computed using the identities of the model.

TABLE A3: Stochastic Equations of the Quarterly Econometric Model of the Slovenian Economy

$$CHRG_t = b_{1,1t}\, CHRG_{t-1} + b_{1,2t}\, MINCRG_t + b_{1,3t}\, \overline{D2}_t + b_{1,4t}\, \overline{D4}_t + b_{1,5t}\, \overline{DVAT}_t + e_{1,t}, \quad (1)$$

$$IFARG_t = b_{2,0t} + b_{2,1t}\, QMAN_t + b_{2,2t}\, GRG_{t-2} + b_{2,3t}\, REXIM_{t-4} + b_{2,4t}\, RLAG_{t-1} + e_{2,t}, \quad (2)$$

$$CPI_t = b_{3,0t} + b_{3,1t}\, PPI_{t-1} + b_{3,2t}\, \overline{ERPPIW}_{t-1} + b_{3,3t}\, \overline{ERPENOECD}_{t-2} + b_{3,4t}\, ELCIG_{t-1} + b_{3,5t}\, \overline{MTAXRG}_{t-2} + e_{3,t}, \quad (3)$$

$$PPI_t = b_{4,0t} + b_{4,1t}\, PPM_t + e_{4,t}, \quad (4)$$

$$PPM_t = b_{5,0t} + b_{5,1t}\, \overline{PEXEUER}_{t-2} + b_{5,2t}\, \overline{ERPPIW}_{t-1} + b_{5,3t}\, \overline{PENOECDE}_{t-1} + b_{5,4t}\, ULCIG_{t-1} + e_{5,t}, \quad (5)$$

$$ELCG_t = b_{6,1t}\, ELCRG_t + b_{6,2t}\, ELCSG_t + e_{6,t}, \quad (6)$$

$$ELCRG_t = b_{7,0t} + b_{7,1t}\, ELCIG_t + e_{7,t}, \quad (7)$$

$$ELCIG_t = b_{8,0t} + b_{8,1t}\, ELCMG_t + e_{8,t}, \quad (8)$$

$$ELCMG_t = b_{9,0t} + b_{9,1t}\, PRODGM_t + b_{9,2t}\, \overline{ULCSLMG}_t + b_{9,3t}\, CPI_t + b_{9,4t}\, CPI_{t-1} + b_{9,5t}\, \overline{UR1549}_t + b_{9,6t}\, \overline{D4}_t + e_{9,t}, \quad (9)$$

$$ELCSG_t = b_{10,0t} + b_{10,1t}\, PRODGI_t + b_{10,2t}\, \overline{ULCSLIG}_t + b_{10,3t}\, CPI_t + b_{10,4t}\, CPI_{t-1} + b_{10,5t}\, \overline{UR1549}_t + b_{10,6t}\, \overline{D4}_t + e_{10,t}, \quad (10)$$

$$NPG_t = b_{11,0t} + b_{11,1t}\, BWG_t + b_{11,2t}\, \overline{D1}_t + b_{11,3t}\, \overline{D3}_t + e_{11,t}, \quad (11)$$

$$QIND_t = b_{12,0t} + b_{12,1t}\, QMAN_t + e_{12,t}, \quad (12)$$

$$QMAN_t = b_{13,0t} + b_{13,1t}\, QEXG_t + b_{13,2t}\, ERG_t + e_{13,t}, \quad (13)$$

$$NEMPEEG_t = b_{14,1t}\, NEMPREEG_t + b_{14,2t}\, NEMPSEEG_t + e_{14,t}, \quad (14)$$

$$NEMPREEG_t = b_{15,0t} + b_{15,1t}\, NEMPIEEG_t + e_{15,t}, \quad (15)$$

$$NEMPIEEG_t = b_{16,0t} + b_{16,1t}\, NEMPMEEG_t + e_{16,t}, \quad (16)$$

$$NEMPMEEG_t = b_{17,0t} + b_{17,1t}\, PRODGI_t + b_{17,2t}\, QEXG_t + b_{17,3t}\, GRG_{t-2} + \\ + b_{17,4t}\, \overline{NEMPSG_t} + b_{17,5t}\, \overline{NEMPNENTG_{t-1}} + e_{17,t}, \quad (17)$$

$$NEMPSEEG_t = b_{18,0t} + b_{18,1t}\, NEMPSEEG_{t-1} + b_{18,2t}\, NEMPREEG_t + \\ + b_{18,3t}\, PRODGI_t + b_{18,4t}\, GRG_{t-2} + b_{18,5t}\, \overline{NENTSG_t} + e_{18,t}, \quad (18)$$

$$RLAN_t = b_{19,0t} + b_{19,1t} \log\left(\frac{M3_t}{CPI95_t}\right) + b_{19,2t} \log\left(\frac{M3_{t-1}}{M0_{t-1}}\right) + \\ + b_{19,3t} \log(GDP95_{t-1}) + e_{19,t}, \quad (19)$$

$$\log(EUROBS_t) = b_{20,0t} + b_{20,1t} \log(M3_t) + b_{20,2t} \log(\overline{MR_{t-1}}) + e_{20,t}, \quad (20)$$

$$EUROG_t \frac{\overline{CPIEURO_t}}{CPI_t} = b_{20a,0t} + b_{20a,1t}\,(RLA_{t-1} - \overline{RLAEURO_{t-1}}) + e_{20a,t}, \quad (20a)$$

$$\log(EURO_t) = b_{21,0t} + b_{21,1t} \log(EUROBS_t) + b_{21,2t}\, \overline{DEURO_t} + e_{21,t}, \quad (21)$$

$$\log(EUROBS_t) = b_{21a,0t} + b_{21a,1t} \log(EURO_t) + b_{21a,2t}\, \overline{DEURO_t} + e_{21a,t}, \quad (21a)$$

$$\log(REEN_t) = b_{22,0t} + b_{22,1t} \log(EUROBS_t) + b_{22,2t} \log(USDEURO_t) + e_{22,t}, \quad (22)$$

$$PEX_t = b_{23,1t}\, \overline{CPIEU_t} + b_{23,2t}\, \overline{POILOECD_{t-2}} + b_{23,3t}\, USDEUROBSG_{t-1} + \\ + b_{23,4t}\, \overline{DEURO99_t} + e_{23,t}, \quad (23)$$

$$QEXG_t = b_{24,0t} + b_{24,1t}\, \overline{QIMEUCEEG_t} + b_{24,2t}\, QIND_t + b_{24,3t}\, ELCMG_t + e_{24,t}, \quad (24)$$

$$PIM_t = b_{25,1t}\, \overline{CPIEU_t} + b_{25,2t}\, \overline{PENOECDE_{t-2}} + b_{25,3t}\, USDEUROG_{t-1} + e_{25,t}, \quad (25)$$

$$QIMG_t = b_{26,0t} + b_{26,1t}\, QIND_t + b_{26,2t}\, MWRG_t + b_{26,3t}\, MOINCRG_{t-1} + \\ + b_{26,4t}\, \overline{REERPPI_t} + b_{26,5t}\, \overline{DVAT_t} + e_{26,t}, \quad (26)$$

$$QEXS_t = b_{27,0t} + b_{27,1t}\, QEXS_{t-1} + b_{27,2t}\, \overline{QIMEUG_t} + b_{27,3t}\, \overline{REERULC_t} + \\ + b_{27,4t}\, \overline{D2_t} + b_{27,5t}\, \overline{D3_t} + e_{27,t}, \quad (27)$$

$$QIMS_t = b_{28,0t} + b_{28,1t}\, QIMS_{t-1} + b_{28,2t}\, MINCRG_{t-1} + b_{28,3t}\, \overline{CPISEU_{t-1}} + \\ + b_{28,4t}\, \overline{DI_t} + b_{28,5t}\, \overline{D3_t} + e_{28,t}. \quad (28)$$

Note: exogenous variables of the model are denoted by overbars.

TABLE A4: Identities of the Quarterly Econometric Model of the Slovenian Economy

$$GDP_t = CHN_t + \overline{CNPN_t} + IFAN_t + \overline{ICAN_t} + GN_t + NX_t, \quad (29)$$

$$GDP95_t = \frac{GDP_t}{\overline{PGDP95_t}} \cdot 100, \quad (30)$$

$$GDP95G_t = \frac{GDP95_t}{GDP95_{t-1}} \cdot 100, \quad (31)$$

$$CHN_t = \frac{CHR_t \cdot \overline{PC95_t}}{100}, \quad (32)$$

$$CHR_t = \frac{CHR_{t-1} \cdot CHRG_t}{100}, \quad (33)$$

$$IFAN_t = \frac{IFAR_t \cdot \overline{PI95_t}}{100}, \quad (34)$$

$$IFAR_t = \frac{IFAR_{t-1} \cdot IFARG_t}{100}, \quad (35)$$

$$GN_t = \frac{GR_t \cdot \overline{PG95_t}}{100}, \quad (36)$$

$$GR_t = \frac{GR_{t-1} \cdot \overline{GRG_t}}{100}, \quad (37)$$

$$ER_t = CHR_t + IFAR_t + GR_t, \quad (38)$$

$$ERG_t = \frac{ER_t}{ER_{t-1}} \cdot 100, \quad (39)$$

$$MINC_t = MW_t + MP_t + \overline{MOINC_t}, \quad (40)$$

$$MW_t = \frac{3 \cdot NW_t \cdot NEMP_t}{1000000}, \quad (41)$$

$$MWRG_t = \frac{MW_t}{MW_{t-1} \cdot CPI_t} \cdot 10000, \quad (42)$$

$$MINCRG_t = \frac{MINC_t}{MINC_{t-1} \cdot CPI_t} \cdot 10000, \quad (43)$$

$$MOINCRG_t = \frac{MOINC_t}{MOINC_{t-1} \cdot CPI_t} \cdot 10000, \quad (44)$$

$$MP_t = \frac{3 \cdot NP_t \cdot \overline{NPENS_t}}{1000000}, \quad (45)$$

$$NP_t = \frac{NP_{t-1} \cdot NPG_t}{100}, \quad (46)$$

$$NW_t = BW_t \cdot (1 - \overline{CRI_t} - \overline{TR_t}), \quad (47)$$

$$NWG_t = \frac{NW_t}{NW_{t-1}} \cdot 100, \quad (48)$$

$$NWR_t = BWR_t \cdot (1 - \overline{CRI_t} - \overline{TRR_t}), \quad (49)$$

$$NWS_t = BWS_t \cdot (1 - \overline{CRI_t} - \overline{TRS_t}), \quad (50)$$

$$NWI_t = BWI_t \cdot (1 - \overline{CRI_t} - \overline{TRI_t}), \quad (51)$$

$$NWM_t = BWM_t \cdot (1 - \overline{CRI_t} - \overline{TRM_t}), \quad (52)$$

$$BW_t = \frac{ELC_t}{1 + \overline{CR2_t}}, \quad (53)$$

$$BWG_t = \frac{BW_t}{BW_{t-1}} \cdot 100, \quad (54)$$

$$BWR_t = \frac{ELCR_t}{1 + \overline{CR2_t}}, \quad (55)$$

$$BWS_t = \frac{ELCS_t}{1 + \overline{CR2_t}}, \quad (56)$$

$$BWI_t = \frac{ELCI_t}{1 + \overline{CR2_t}}, \quad (57)$$

$$BWM_t = \frac{ELCM_t}{1 + \overline{CR2_t}}, \quad (58)$$

$$ELC_t = \frac{ELC_{t-1} \cdot ELCG_t}{100}, \quad (59)$$

$$ELCR_t = \frac{ELCR_{t-1} \cdot ELCRG_t}{100}, \quad (60)$$

$$ELCS_t = \frac{ELCS_{t-1} \cdot ELCSG_t}{100}, \quad (61)$$

$$ELCI_t = \frac{ELCI_{t-1} \cdot ELCIG_t}{100}, \quad (62)$$

$$ELCM_t = \frac{ELCM_{t-1} \cdot ELCMG_t}{100}, \quad (63)$$

$$ULCIG_t = \frac{ELCIG_t \cdot NEMPIEEG_t}{QIND_t}, \quad (64)$$

$$ULCMG_t = \frac{ELCMG_t \cdot NEMPMEEG_t}{QMAN_t}, \quad (65)$$

$$NEMP_t = NEMPEE_t + \overline{NEMPSE_t}, \quad (66)$$

$$NEMPG_t = \frac{NEMP_t}{NEMP_{t-1}} \cdot 100, \quad (67)$$

$$NEMPR_t = NEMPREE_t + \overline{NEMPRSE_t}, \quad (68)$$

$$NEMPS_t = NEMPSEE_t + \overline{NEMPSSE_t}, \quad (69)$$

$$NEMPSG_t = \frac{NEMPS_t}{NEMPS_{t-1}} \cdot 100, \quad (70)$$

$$NEMPI_t = NEMPIEE_t + \overline{NEMPISE_t}, \quad (71)$$

$$NEMPM_t = NEMPMEE_t + \overline{NEMPMSE_t}, \tag{72}$$

$$NEMPEE_t = \frac{NEMPEE_{t-1} \cdot NEMPEEG_t}{100}, \tag{73}$$

$$NEMPREE_t = \frac{NEMPREE_{t-1} \cdot NEMPREEG_t}{100}, \tag{74}$$

$$NEMPSEE_t = \frac{NEMPSEE_{t-1} \cdot NEMPSEEG_t}{100}, \tag{75}$$

$$NEMPIEE_t = \frac{NEMPIEE_{t-1} \cdot NEMPIEEG_t}{100}, \tag{76}$$

$$NEMPMEE_t = \frac{NEMPMEE_{t-1} \cdot NEMPMEEG_t}{100}, \tag{77}$$

$$PRODGI_t = \frac{QIND_t}{NEMPIEEG_t} \cdot 100, \tag{78}$$

$$PRODGM_t = \frac{QMAN_t}{NEMPMEEG_t} \cdot 100, \tag{79}$$

$$M3_t = \overline{M0_t} \cdot \overline{MM_t} + \overline{DEP_t}, \tag{80}$$

$$RLA_t = RLAN_t - \overline{TOM_t}, \tag{81}$$

$$RLAG_t = \frac{RLA_t}{RLA_{t-1}} \cdot 100, \tag{82}$$

$$USDEURO_t = \frac{\overline{USDBS_t}}{EUROBS_t}, \tag{83}$$

$$EUROG_t = \frac{EURO_t}{EURO_{t-1}} \cdot 100, \tag{84}$$

$$EUROBSG_t = \frac{EUROBS_t}{EUROBS_{t-1}} \cdot 100, \tag{85}$$

$$USDEUROG_t = \frac{USDEURO_t}{USDEURO_{t-1}} \cdot 100, \tag{86}$$

$$CPI95_t = \frac{CPI95_{t-1} \cdot CPI_t}{100}, \tag{87}$$

$$NX_t = EXGN_t + EXSN_t - IMGN_t - IMSN_t, \tag{88}$$

$$EXGN_t = \frac{EXGN_{t-1} \cdot EXG_t}{100}, \tag{89}$$

$$IMGN_t = \frac{IMGN_{t-1} \cdot IMG_t}{100}, \tag{90}$$

$$EXG_t = \frac{PEX_t \cdot EUROBSG_t \cdot QEXG_t}{10000}, \tag{91}$$

$$IMG_t = \frac{PIM_t \cdot EUROBSG_t \cdot QIMG_t}{10000}, \tag{92}$$

$$EXSN_t = \frac{EXSN_{t-1} \cdot EXS_t}{100}, \tag{93}$$

$$IMSN_t = \frac{IMSN_{t-1} \cdot IMS_t}{100}, \tag{94}$$

$$EXS_t = \frac{\overline{CPISEU_t} \cdot EUROBSG_t \cdot QEXS_t}{10000}, \tag{95}$$

$$IMS_t = \frac{\overline{CPISEU_t} \cdot EUROBSG_t \cdot QIMS_t}{10000}, \tag{96}$$

$$REXIM_t = \frac{QEXG_t}{QIMG_t} \cdot 100. \tag{97}$$

Note: exogenous variables of the model are denoted by overbars.