AN ANALYSIS OF THE SLOVENIAN ECONOMY WITH A QUARTERLY ECONOMETRIC MODEL

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Abstract

The paper represents a construction of a quarterly econometric model of the Slovenian economy and an analysis of fundamental relationships of the Slovenian economy. For this purpose we produced a system of identities, consistent with the national accounts, and of stochastic equations, consistent with economic theory as well as institutional and constitutional characteristics of the Slovenian economy. The simultaneous econometric model of the Slovenian economy SIQM 2.1 consists of 96 equations and covers the period of 1997:1 – 2003:4. Adequacy of the model, i.e. its ability to reproduce the 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

JEL Classification: C3, C51, C52, E12

1. INTRODUCTION

The independence of the Republic of Slovenia in 1991 introduced vast changes in the socio-economic and political system, reflected in the past decade primarily through the activities of economic transformation. The latter resulted in altered business environment due to gradually modified economic system and, what is more important, in changing behaviour of economic agents. Economic policy in such transitory environment is in great need of support of economic modelling and policy consultancy. Econometric models seem to be the most suitable, since they are able to cover both crucial tasks comprised herein; economic analysis and economic forecasting. However, one has to be very careful in so doing for economic transformation also brings numerous changes in the economic variables that are relevant in newly established socio-economic relationships. The idea of this paper is therefore to perform an analysis of the Slovenian economy with a quarterly econometric model, constructed specifically for this purpose.

After the introducing works of Tinbergen (1939; 1939a), Klein (1950), and Klein and Goldberger (1955), econometric modelling has been recognized as a renown approach and an indispensable tool of economic policy in the World since as early as the 1960s. In the 1970s, first econometric models were constructed for the former Yugoslavia, but since not being modelled explicitly, it can be said that Slovenia lagged behind substantially 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 short time series of consistent socio-economic data. Nevertheless, some short-term econometric models have been developed so far, 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 paper. The latter is a quarterly short-term medium-sized econometric model, embracing the ending phase of the Slovenian economic transformation to a market economy.

The outline of the paper is as follows. In Chapter 2 a short description of the quarterly econometric model of the Slovenian economy is presented, together with the underlying data base of the model. Equations of the model and the corresponding results of econometric estimation are then stated and discussed in the subsequent chapter, while in Chapter 4 the model is being evaluated and tested by *ex post* dynamic simulations. In the final chapter the essential findings of the paper are being summarized.

2. MAIN CHARACTERISTICS AND THE DATA BASE 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. Furthermore, each econometric block combines related sets of model equations. The real sector comprises four such sets of equations, i.e. final consumption, prices, wages and pensions, and production and employment. The monetary sector only consists of a single set of equations, while the foreign trade sector 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, there is also some disaggregation present. Hence in some sets of equations the economy is first divided to 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[1]. 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	Final consumption	Domestic final consumption of households Gross fixed capital formation
	Prices	Consumer prices Producer prices of manufacturing
	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		Average real 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

The present version of the quarterly econometric model of the Slovenian economy, SIQM 2.1, consists of 96 equations; 28 of them are stochastic (behavioural) equations, while the other 68 are identities. There are 148 variables in the model (see Table 2); 96 of them are endogenous, while the remaining 52 are exogenous variables. There are a number of external variables in the model, i.e. independent of 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, such as the final consumption of the general government, contribution rate for social security, tax revenues of the consolidated general government accounts, the nominal value of base money, or the total foreign exchange reserves. Dummy variables in the model are either of seasonal nature or in relation with the introduction of Euro and VAT.

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

[1] 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.

TABLE 2: 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 mill SIT 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 mill SIT 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
CNPN	Domestic final consumption of private non-profit institutions, current prices, in mill SIT Source: SORS, GDP by quarters, more detailed data, 1995 – 2004 (2005), http://www.stat.si .
CPI	Consumer price index, chain index
CPI95	Consumer price index, 1995 = 100 *Source:* SORS, Rapid Reports (1997 – 2004).
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 mill SIT
DEURO	Dummy variable for the period of introduction of Euro, [1999:1, …, 2003:4] = 1
DEURO99	Dummy variable for the introduction of Euro, 1999:1 = 1
DVAT	Dummy variable for the introduction of VAT, 1999:3 = 1
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 mill SIT
ERG	Domestic expenditure, constant 1995 prices, chain index
ERPENOECD	OECD energy industrial price index, measured through USD exchange rate, chain index *Source*: OECD/IEA, Energy Prices & Taxes (1997 – 2004); own calculations.

Variable	Description of the variable and source of data
ERPPIW	World producer price index, measured through USD exchange rate, chain index *Source*: The Economist (1997 – 2004); own calculations.
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
EXGN	Exports of goods, current prices, in mill SIT *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 mill SIT *Source*: SORS, GDP by quarters, more detailed data, 1995 – 2004 (2005), http://www.stat.si .
GDP	Gross domestic product, current prices, in mill SIT
GDP95	Gross domestic product, constant 1995 prices, in mill SIT *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 mill SIT *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 mill SIT *Source*: SORS, GDP by quarters, more detailed data, 1995 – 2004 (2005), http://www.stat.si .
GRG	Domestic final consumption of the general government, constant 1995 prices, chain index
ICAN	Changes in inventories and valuables, current prices, in mill SIT *Source*: SORS, GDP by quarters, more detailed data, 1995 – 2004 (2005), http://www.stat.si .
IFAN	Gross fixed capital formation, current prices, in mill SIT *Source*: SORS, GDP by quarters, more detailed data, 1995 – 2004 (2005), http://www.stat.si .
IFAR	Gross fixed capital formation, constant 1995 prices, in mill SIT *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 mill SIT *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 mill SIT *Source*: SORS, GDP by quarters, more detailed data, 1995 – 2004 (2005), http://www.stat.si .
M0	Base money, nominal value, in mill SIT *Source*: Bank of Slovenia, Financial Statistics (2004), internal data.
M3	Monetary aggregate M3, nominal value, in mill SIT *Source*: Bank of Slovenia, Monthly Bulletin (1997 – 2004).
MINC	Mass of net receipts of employees and pensioners, current prices, in mill SIT
MINCRG	Mass of net receipts of employees and pensioners, constant 1995 prices, chain index
MM	Money multiplier between monetary aggregate M1 and the monetary base
MOINC	Mass of net other receipts from employment, current prices, in mill SIT *Source*: Bank of Slovenia, Monthly Bulletin (1997 – 2004).
MOINCRG	Mass of net other receipts from employment, constant 1995 prices, chain index
MP	Mass of net pensions, current prices, in mill SIT
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.
MW	Mass of net wages, current prices, in mill SIT
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).

Variable	Description of the variable and source of data
NEMPEEG	Persons in employment, employees, chain index
NEMPG	Persons in employment, chain index
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
NEMPISE	Persons in employment in the industry, self-employed and employed by self-employed *Source:* SORS, Rapid Reports (1997 – 2004).
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
NEMPMSE	Persons in employment in the manuf. sect., self-employed and employed by 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.
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
NEMPRSE	Persons in employment in the prod. sect., self-employed and employed by self-employed *Source:* SORS, Rapid Reports (1997 – 2004).
NEMPS	Persons in employment in services
NEMPSE	Persons in employment, self-employed and employed by self-employed *Source:* SORS, Rapid Reports (1997 – 2004).
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
NEMPSG	Persons in employment in the services sector, chain index
NEMPSSE	Persons in employment in the serv. sect., self-employed and employed by 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.
NP	Average net pension, current prices, in SIT *Source:* SORS, Rapid Reports (1997 – 2004).
NPENS	Number of pensioners *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 mill SIT
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).
PEX	Price index of exports of goods, in EUR, chain index *Source*: Bank of Slovenia, Financial Statistics (2004), internal data; own calculations.
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
PIM	Price index of imports of goods, in EUR, chain index *Source*: Bank of Slovenia, Financial Statistics (2004), internal data; own calculations.
POILOECD	OECD oil products industrial price index, chain index *Source*: OECD/IEA, Energy Prices & Taxes (1997 – 2004).
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
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.
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.
REEN	Nominal effective exchange rate, index *Source*: Bank of Slovenia, Monthly Bulletin (1997 – 2004); 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.
REXIM	Quantity of goods exports-to-imports ratio, chain index
RLA	Average quarterly real long-term Commercial Banks' lending interest rate, in per cent *Source*: Bank of Slovenia, Monthly Bulletin (1997 – 2004); own calculations.
RLAEURO	Average quarterly real long-term lending interest rate in the Euro area, in per cent *Source*: Eurostat, NewCronos (2004), http://europa.eu.int/newcronos ; own calculations.
RLAG	Average quarterly real long-term lending interest rate, chain index
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
ULCIG	Unit labour cost in the industry, chain index
ULCMG	Unit labour cost in the manufacturing sector, chain index
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 per cent *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).
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 explicitly stated source of data were computed using the identities of the model.

The variables of the model, which are stated in Table 2, are constructed from monthly and quarterly data. Given that there was no single complete data bank available, the data had to be gathered specifically for the purpose of model construction from different data sources. The key references for Slovenian data regarding national accounts, balance of payments, general government accounts and 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 data base NewCronos, now integrated into the Eurostat's main system. Data on World producer prices and energy prices were taken from The Economist of London and the Energy Prices & Taxes of OECD and IEA, respectively.

It has to be emphasized that the quality of the model is in great part determined by the volume and quality of the data base. Thus we can ascertain that our model would have been better if a more detailed and complete data base had been available, e.g. in Slovenia there is no data available on stock of inventories on the quarterly level, while the official data on capital stock are not even available on 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 lack of long-term bonds and deposits. The interest rate used herein therefore has an average maturity that hardly exceeds one year. Each such deficiency represents a deviation for the modeller from his theoretical model.

3. ESTIMATION AND DISCUSSION OF THE EQUATIONS OF THE MODEL

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 paper only the most essential statistics are stated due to obvious reasons 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 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 heteroskedasticity 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 homoskedasticity were not tried to be achieved by all means, because the least squares estimator may nevertheless remain unbiased estimator.

All stochastic equations and identities of the quarterly econometric model of the Slovenian economy are listed frontwards in this chapter with the corresponding estimates of parameters and their p-values quoted in Table 3. 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 econometric estimation (see Verbič 2005 for these estimates). The flowchart diagrams of the model can be found in Verbič (2005: 94-100). As already stated in Chapter 2, the estimation period for most equations is 1997:1 – 2003:4. In the following paragraphs we will therefore discuss theoretical specification and empirical results of equations by single sets of equations, as presented in Table 1.

Final Consumption. 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 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 rather low, yet the long-term propensity to consume amounts to 0.88, which is in accordance with the Keynesian economic theory. December holiday shopping increases the 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, increases on average gross fixed investments by 1.34 percentage points. Domestic final consumption of the general government has an additional, yet lagged positive effect on investment (0.85 percentage points). It is similar with the quantity of goods exports-to-imports ratio affecting the investment activity at home (0.30 percentage points), 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 the investment activity. In addition, the gross fixed investments are influenced by the interest rate, where a one percentage point increase in the real long-term lending interest rate decreases gross fixed investments on average by 0.78 percentage points on account of more expensive investment loans.

Prices. The key stochastic equations of this set of equations are the 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 prices of energy in the OECD 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. Increase in labour cost per employee in the industry also has a positive effect on consumer prices (0.06 percentage points) and a parallel indirect disadvantageous effect on economic growth. The effect of the mass of tax revenues of the consolidated general government accounts is likewise positive, yet surprisingly low in its intensity (0.01 percentage points). This is particularly interesting because of 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 prices of energy in the 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 domestic producer prices of manufacturing, respectively. Increase in unit labour costs in the industry has a lagged positive effect on producer prices of manufacturing (0.04 percentage points), 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.

Stochastic Equations of the Quarterly Econometric Model of the Slovenian Economy

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$\begin{aligned} NEMPMEEG_t = {} & b_{17,0t} + b_{17,1t}\, PRODGI_t + b_{17,2t}\, QEXG_t + b_{17,3t}\, GRG_{t-2} + \\ & + b_{17,4t}\, \overline{NEMPSG}_t + b_{17,5t}\, \overline{NEMPNENTG}_{t-1} + e_{17,t}\,, \end{aligned} \quad (17)$$

$$NEMPSEEG_t = b_{18,0t} + b_{18,1t}\, NEMPSEEG_{t-1} + b_{18,2t}\, NEMPREEG_t + \\ + b_{18,3t}\, PRODGI_t + b_{18,4t}\, GRG_{t-2} + b_{18,5t}\, \overline{NENTSG}_t + e_{18,t}\,, \tag{18}$$

$$RLA_t = b_{19,0t} + b_{19,1t} \log\left(\frac{M3_t}{CPI95_t}\right) + b_{19,2t} \log\left(\frac{M3_{t-1}}{\overline{M0}_{t-1}}\right) + \\ + b_{19,3t} \log(GDP95_{t-1}) + b_{19,4t}\, CPI_t + e_{19,t}\,, \tag{19}$$

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

$$EUROG_t \frac{\overline{CPIEURO}_t}{CPI_t} = b_{20a,0t} + b_{20a,1t}\,(RLA_{t-1} - \overline{RLAEURO}_{t-1}) + e_{20a,t}\,, \tag{20a}$$

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

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

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

$$PEX_t = b_{23,1t}\, \overline{CPIEU}_t + b_{23,2t}\, \overline{POILOECD}_{t-2} + b_{23,3t}\, USDEUROBSG_{t-1} + \\ + b_{23,4t}\, \overline{DEURO99}_t + e_{23,t}\,, \tag{23}$$

$$QEXG_t = b_{24,0t} + b_{24,1t}\, \overline{QIMEUCEEG}_t + b_{24,2t}\, QIND_t + b_{24,3t}\, ELCMG_t + e_{24,t}\,, \tag{24}$$

$$PIM_t = b_{25,1t}\, \overline{CPIEU}_t + b_{25,2t}\, \overline{PENOECDE}_{t-2} + b_{25,3t}\, USDEUROG_{t-1} + e_{25,t}\,, \tag{25}$$

$$QIMG_t = b_{26,0t} + b_{26,1t}\, QIND_t + b_{26,2t}\, MWRG_t + b_{26,3t}\, MOINCRG_{t-1} + \\ + b_{26,4t}\, \overline{REERPPI}_t + b_{26,5t}\, \overline{DVAT}_t + e_{26,t}\,, \tag{26}$$

$$QEXS_t = b_{27,0t} + b_{27,1t}\, QEXS_{t-1} + b_{27,2t}\, \overline{QIMEUG}_t + b_{27,3t}\, \overline{REERULC}_t + \\ + b_{27,4t}\, \overline{D2}_t + b_{27,5t}\, \overline{D3}_t + e_{27,t}\,, \tag{27}$$

$$QIMS_t = b_{28,0t} + b_{28,1t}\, QIMS_{t-1} + b_{28,2t}\, MINCRG_{t-1} + b_{28,3t}\, \overline{CPISEU}_{t-1} + \\ + b_{28,4t}\, \overline{D1}_t + b_{28,5t}\, \overline{D3}_t + e_{28,t}\,. \tag{28}$$

Identities of the Quarterly Econometric Model of the Slovenian Economy

$$GDP_t = CHN_t + \overline{CNPN}_t + IFAN_t + \overline{ICAN}_t + GN_t + NX_t\,, \tag{29}$$

$$GDP95_t = \frac{GDP_t}{\overline{PGDP95}_t} \cdot 100\,, \tag{30}$$

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

$$CHN_t = \frac{CHR_t \cdot \overline{PC95}_t}{100}, \quad (32)$$

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

$$IFAN_t = \frac{IFAR_t \cdot \overline{PI95}_t}{100}, \quad (34)$$

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

$$GN_t = \frac{GR_t \cdot \overline{PG95}_t}{100}, \quad (36)$$

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

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

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

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

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

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

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

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

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

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

$$NW_t = BW_t \cdot (1 - \overline{CR1}_t - \overline{TR}_t), \quad (47)$$

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

$$NWR_t = BWR_t \cdot (1 - \overline{CR1}_t - \overline{TRR}_t), \quad (49)$$

$$NWS_t = BWS_t \cdot (1 - \overline{CR1}_t - \overline{TRS}_t), \quad (50)$$

$$NWI_t = BWI_t \cdot (1 - \overline{CR1}_t - \overline{TRI}_t), \quad (51)$$

$$NWM_t = BWM_t \cdot (1 - \overline{CR1}_t - \overline{TRM}_t), \quad (52)$$

$$BW_t = \frac{ELC_t}{1 + \overline{CR2}_t}, \quad (53)$$

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

$$BWR_t = \frac{ELCR_t}{1+\overline{CR2_t}}\,, \tag{55}$$

$$BWS_t = \frac{ELCS_t}{1+\overline{CR2_t}}\,, \tag{56}$$

$$BWI_t = \frac{ELCI_t}{1+\overline{CR2_t}}\,, \tag{57}$$

$$BWM_t = \frac{ELCM_t}{1+\overline{CR2_t}}\,, \tag{58}$$

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

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

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

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

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

$$ULCIG_t = \frac{ELCIG_t \cdot NEMPIEEG_t}{QIND_t}\,, \tag{64}$$

$$ULCMG_t = \frac{ELCMG_t \cdot NEMPMEEG_t}{QMAN_t}\,; \tag{65}$$

$$NEMP_t = NEMPEE_t + \overline{NEMPSE_t}\,, \tag{66}$$

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

$$NEMPR_t = NEMPREE_t + \overline{NEMPRSE_t}\,, \tag{68}$$

$$NEMPS_t = NEMPSEE_t + \overline{NEMPSSE_t}\,, \tag{69}$$

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

$$NEMPI_t = NEMPIEE_t + \overline{NEMPISE_t}\,, \tag{71}$$

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

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

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

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

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

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

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

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

$$M3_t = \overline{M0}_t \cdot \overline{MM}_t + \overline{DEP}_t, \tag{80}$$

$$RLAG_t = \frac{RLA_t}{RLA_{t-1}} \cdot 100, \tag{81}$$

$$USDEURO_t = \frac{\overline{USDBS}_t}{EUROBS_t}, \tag{82}$$

$$EUROG_t = \frac{EURO_t}{EURO_{t-1}} \cdot 100, \tag{83}$$

$$EUROBSG_t = \frac{EUROBS_t}{EUROBS_{t-1}} \cdot 100, \tag{84}$$

$$USDEUROG_t = \frac{USDEURO_t}{USDEURO_{t-1}} \cdot 100, \tag{85}$$

$$CPI95_t = \frac{CPI95_{t-1} \cdot CPI_t}{100}; \tag{86}$$

$$NX_t = EXGN_t + EXSN_t - IMGN_t - IMSN_t, \tag{87}$$

$$EXGN_t = \frac{EXGN_{t-1} \cdot EXG_t}{100}, \tag{88}$$

$$IMGN_t = \frac{IMGN_{t-1} \cdot IMG_t}{100}, \tag{89}$$

$$EXG_t = \frac{PEX_t \cdot EUROBSG_t \cdot QEXG_t}{10000}, \tag{90}$$

$$IMG_t = \frac{PIM_t \cdot EUROBSG_t \cdot QIMG_t}{10000}, \tag{91}$$

$$EXSN_t = \frac{EXSN_{t-1} \cdot EXS_t}{100}, \tag{92}$$

$$IMSN_t = \frac{IMSN_{t-1} \cdot IMS_t}{100}, \tag{93}$$

$$EXS_t = \frac{\overline{CPISEU}_t \cdot EUROBSG_t \cdot QEXS_t}{10000}, \tag{94}$$

$$IMS_t = \frac{\overline{CPISEU}_t \cdot EUROBSG_t \cdot QIMS_t}{10000}, \tag{95}$$

$$REXIM_t = \frac{QEXG_t}{QIMG_t} \cdot 100. \tag{96}$$

Wages and Pensions. The key stochastic equations of this set of equations are the labour costs in the manufacturing sector, the 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 the labour cost fall behind both the productivity in the manufacturing sector (the corresponding coefficient is 0.79) and the 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 the labour costs in the sector as well (0.81 percentage points). The effect of the ILO unemployment rate among active population aged 15 – 49 on labour costs in the sector is on the other hand, according to the expectations, a negative one (–0.29 percentage points). There is an additional increase in the labour costs in the sector in the fourth quarter (2.11 percentage points), which can be attributed to Christmas bonuses and thirteenth salaries in successful enterprises.

If we take a look now at the labour cost function in the services sector in expression (10), it can be established that the productivity of labour in the industry, which increases labour costs, also has a demonstration effect on the services sector (0.41 percentage points), where labour unions do not tolerate lagging of the wages in the sector behind the wages in the manufacturing sector, regardless of the productivity differences. Similar statement can be made for the share of labour costs in production value in the industry (0.36 percentage points). However, labour costs in the sector seem to fall behind the 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 points lagged increase in the labour costs in the sector. Similar assertions to the ones in case of the manufacturing sector can be made about the effects of the ILO unemployment rate on labour costs (–0.39 percentage points), 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 adds up to 5.98 per cent. 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.

Production and Employment. The key stochastic equations of this set of equations are the production volume of manufacturing, the employment in the manufacturing sector and the 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 consumption of private non-profit institutions and changes in inventories and valuables, increases the production volume of manufacturing by 0.17 percentage points, while an equivalent increase in foreign demand, measured through exports of goods, increases the production volume of manufacturing by as much as 0.82 percentage points 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 in negatively affected by the productivity and positively affected by both domestic and foreign demand. Namely, a one percentage point increase in the productivity of labour in the industry decreases on average employment in the manufacturing sector by 0.12 percentage points. A one percentage point increase in domestic demand, measured through (lagged) domestic final consumption of the general government, increases employment in the sector only by 0.02 percentage points, while an equivalent increase in foreign demand, measured through exports of goods, increases employment in the sector by as much as 0.10 percentage points on average. Increase in employment in the services sector seems to have a considerable substitution effect on employment in the manufacturing sector (–0.25 percentage points), which could indicate defective functioning of the labour market in Slovenia. One should also mention a positive effect on employment of an increase in the number of employed persons per business subject (0.23 percentage points), reflecting the effects of economies of scale.

If we take a look now 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 subdued to much international competition. Increase in employment in the production sector seems once again to have a considerable substitution effect on the employment in the services sector (–0.35 percentage points), where this sector is gaining jobs on account of the manufacturing sector. This could either be a sign of temporal concurrence of contraction and expansion of activity in the sectors or of seeking skilled workers past the malfunctioning system of employment offices. Furthermore, a one percentage point increase in the productivity of labour in the industry, giving rise to wages in the industry, decreases on average employment in the services sector by 0.07 percentage points, which is a results either of demonstration effects in the services sector or of substitution of labour among the sectors. Meanwhile, the government consumption has a positive, although weak and lagged effect on employment in the services sector (0.04 percentage points). 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 percentage points).

Monetary Economy. The key stochastic equations of this set of equations, which is also a complete econometric block, are the average real long-term lending interest rate, the average Euro exchange rate of the Bank of Slovenia and the nominal effective exchange rate. By observing the real interest rate function in expression (19), which is in considerable accordance with the specification of Delakorda (2000), it can be established that elasticity of the interest rate with respect to real value of the monetary aggregate M3 is –4.51, while lagged elasticity of the interest rate with respect to money multiplier of the monetary aggregate M3 amounts to 4.29. Namely, a current increase in the volume of the broadly defined money lowers its current price, while a past increase in the volume of the base money indeed has immediate multiplicative effects on the broadly defined money, but can only result in an increased current interest rate at unchanged present volume of broadly defined money and unaffected present prices. As can be seen, the first effect prevails.

Furthermore, the income elasticity of interest rate is 2.87, which is expected for the greater economic activity requires more money; if the required increase does not occur, the price of money rises. The price elasticity of interest rate amounts to 0.10, which can also be

quite easily explained. That is to say, both interest rate and consumer prices represent opportunity costs of holding money, hence prices are able to influence the real interest rate through a version of speculative motive for holding money; given that the demand for holding real balances is proportionate to the difference between expected rate of inflation and expected yield of money (Friedman 1956), persistent increases in prices positively affect the yield of money at unchanged demand for holding real balances. 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 make mention of some particularities of the 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 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[2]. On the one hand, the Bank of Slovenia was able to intervene at the foreign exchange market to prevent the Tolar from appreciating too much, and on the other it was able to supervise liquidity and solvency of banks receiving deposits in foreign currency (Ribnikar 1999), which now needed to have no less than 60 per cent of their long-term liquidity assets in foreign currency in the form of short-term foreign currency bills of the Bank of Slovenia (somewhat incorrectly labelled as 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 on 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 on 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 turned out to be more efficient, that is why it is used in our model and will now be explained in more detail. The second version is all the same presented here by expressions (20a) and (21a), and documented in Verbič (2005: 71-74).

From the exchange rate function in expression (20) it can finally be determined that elasticity of the average Euro exchange rate of the Bank of Slovenia with respect to nominal value of the monetary aggregate M3 is 0.28, while lagged elasticity of the average Euro exchange rate of the Bank of Slovenia with respect to total foreign exchange reserves amounts to –0.04. Increased domestic money supply means that the foreign currency becomes relatively scarce, so its price in Tolars has to increase. Increased supply of the foreign exchange on the other hand decreases its price in 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 economic transformation in Slovenia. One should add that even though the effects of introduction of 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 on the spot exchange market were converging on one another thereupon.

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

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

TABLE 3: Estimates of parameters of the quarterly econometric model of the Slovenian economy (continued)

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
16	0.987 (0.000)	–	–	–	–	–	0.093	0.978	1.573
17	–0.116 (0.015)	0.104 (0.039)	0.022 (0.024)	–0.252 (0.098)	0.228 (0.025)	–	0.423	0.634	1.929
18	0.290 (0.048)	–0.354 (0.097)	–0.072 (0.078)	0.041 (0.002)	0.424 (0.005)	–	0.593	0.578 (*h*)	1.002
19	–4.513 (0.000)	4.285 (0.000)	2.868 (0.064)	0.100 (0.043)	–	–	0.168	0.853	1.352
20	0.282 (0.000)	–0.042 (0.106)	–	–	–	–	0.008	0.994	1.444
20a	–3.531 (0.002)	–	–	–	–	–	0.856	0.365	1.838
21	0.977 (0.000)	0.012 (0.000)	–	–	–	–	0.004	0.998	2.146
21a	1.019 (0.000)	–0.012 (0.001)	–	–	–	–	0.004	0.998	2.105
22	1.006 (0.000)	0.204 (0.000)	–	–	–	–	0.004	0.998	1.878
23	0.827 (0.000)	0.083 (0.001)	0.093 (0.008)	–3.135 (0.000)	–	–	0.654	(log L) –23.7	1.972
24	0.359 (0.071)	0.781 (0.000)	–0.354 (0.064)	–	–	–	2.230	0.849	1.710
25	0.446 (0.002)	0.445 (0.001)	0.117 (0.039)	–	–	–	1.371	(log L) –43.5	1.331
26	1.439 (0.000)	0.732 (0.083)	0.097 (0.069)	–0.531 (0.054)	–18.65 (0.000)	–	3.983	0.884	2.232
27	–0.348 (0.006)	0.795 (0.063)	0.640 (0.016)	29.14 (0.000)	39.86 (0.000)	–	4.188	0.951 (*h*)	0.089
28	–0.870 (0.000)	1.154 (0.011)	–17.68 (0.047)	–55.29 (0.000)	36.07 (0.000)	–	3.009	0.990 (*h*)	0.738

Notes: Each estimate includes the value of the regression coefficient and the respective *p*-value (in brackets). Index *i* corresponds to denotation of 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.

If we take a look now at the nominal effective exchange rate in expression (22), it can be established that elasticity of the nominal effective exchange rate with respect to average Euro exchange rate of the Bank of Slovenia is 1.01, while elasticity of the nominal effective exchange rate with respect to 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 calculation of effective exchange rate of the Tolar. The latter elasticity indicates that 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 percentage points) and industrial prices of oil products in the OECD (0.08 percentage points) have significant, though lagged effects on export prices. Namely, 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. Furthermore, 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 the Euro, strengthening of the US Dollar against the Euro has little impact on Euro export prices. One should mention that although the effect of introduction of 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 increases on average Slovenian exports of goods by 0.36 percentage points, while an equivalent increase in the production volume of industry increases Slovenian exports of goods by as much as 0.78 percentage points. 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[3]. One should also observe that even a small increase of 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 percentage points) and industrial prices of energy in the European OECD countries (0.44 percentage points) have significant effects on import prices. Namely, rising of imported merchandise and energy prices represents an increase in the costs for domestic consumers and producers, respectively. Furthermore, a one percentage

[3] 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.

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 industry increases Slovenian imports of goods on average by 1.44 percentage points. Since the approximate elasticity of the exports of goods with respect to production volume of industry was only 0.78, this result implies unfavourable incidence of trade deficits in the analyzed period. As expected, both the mass of real net wages (0.73 percentage points) and the mass of real net other incomes (0.10 percentage points) have positive effects on imports of goods. The effect of the former is higher than the effect of the latter for the marginal propensity to import (goods) from permanent incomes is higher than marginal propensity to import (goods) from transitory incomes. Furthermore, a one percentage point increase in the real effective exchange rate, deflated by industrial producer prices, decreases imports of goods by 0.53 percentage points. One also has to mention the introduction of VAT on 1 July 1999, which hardly affected exports of goods, while the quantities of imports of 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 percentage points, which implies that the exports of services are in connection with exports of goods. Furthermore, a one percentage point increase in the real effective exchange rate, deflated by unit labour costs, increases exports of services by 0.64 percentage points. Both dummy variables explain in more detail 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, implying once again 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. Furthermore, 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, decreases on average 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. EVALUATION AND TESTING OF THE MODEL

Suitability of the model for analysis of relationships in the economy is usually judged on basis of its ability to reproduce the 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 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 at 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 herein, 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 reasons, but well documented in Verbič (2005: 108-114). Therefore we shall evaluate the model by calculating some 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 4 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 summing up to 24 observations.

TABLE 4: Error statistics of the ex post dynamic simulations of the model

Variable	*RMSE*	*MAE*	*MAPE*	*THEIL*
CPI	0.422	0.324	0.318	0.002
ELCG	1.096	0.817	0.797	0.005
EUROBS	1.906	1.397	0.696	0.004
GDP95G	1.379	1.140	1.126	0.006
NEMPG	0.258	0.216	0.215	0.001
NPG	1.401	1.083	1.055	0.006
NWG	1.095	0.817	0.797	0.005
PEX	0.557	0.396	0.394	0.002
PIM	1.215	0.896	0.885	0.006
PPI	0.621	0.506	0.500	0.003
QEXG	2.121	1.580	1.560	0.010
QEXS	3.391	2.629	2.650	0.016
QIMG	4.813	3.752	3.666	0.023
QIMS	2.255	1.736	1.782	0.011
QIND	1.926	1.500	1.490	0.009
RLA	0.148	0.113	6.954	0.040

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 per cent 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 4 it can be established that the quarterly econometric model of the Slovenian economy offers quite satisfactory explanation of the economy. Many of the key macro-economic variables, such as prices, the Euro exchange rate, wages and employment, are estimated with mean absolute percentage error of considerably less than one per cent. The gross domestic product and pensions are estimated with mean absolute percentage error of approximately one per cent, 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 per cent. The mean absolute error of the interest rate hardly exceeds one tenth of a per cent. Of course, one needs to take into account that the 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 paper represents a construction of a quarterly econometric model of the Slovenian economy and an analysis of fundamental relationships of the Slovenian economy. For this purpose we produced a system of identities, consistent with the national accounts, and of stochastic equations, consistent with economic theory as well as institutional and constitutional characteristics of the Slovenian economy. The economy is being described by eight sets of equations, covering final consumption, prices, wages and pensions, production and employment, monetary economy, exports of goods, imports of goods, and foreign trade in services. Slovenian economy turned out in the analyzed period still to be subjected to quite extensive transformation processes, which can be seen on basis of several parameters that turned 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 available time series. Nevertheless, we can ascertain that findings of the present econometric model are more in accordance with the conception of market economy than are most econometric models of the past decennium quoted hereinbefore.

Adequacy of the model, i.e. its ability to reproduce the 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 structure of the model should be broadened and above all deepened in the future, while the evaluation of the model should be extended at least by the calculation of static and dynamic model multipliers.

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