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OVERVIEW OF THE ESTONIAN ECONOMY AND THE PROGRESS OF THE MULTISECTORAL ESTONIAN MODEL

I. INTRODUCTION

Fifteen years ago Estonia regained its independence and began a long transition from being a region of the Soviet Union to become Member State of the European Union. This implied the transformation of its economic system from a central planned economy to a market economy. The present economic system has been achieved with the adoption of the obligations related to the EU membership.

According to the procedures for co-ordination of EU budget policies, the multilateral surveillance procedure dictates the submission of stability programs and convergence programs for each Member States. These programs must primarily refer to the convergence criteria established in the Maastricht Treaty; from an economic point of view, these criteria regard macro economic variables such as budget deficits, inflation and interest rates.

Looking at the economic country problems, the policy maker needs a mesoeconomic representation of the economy. The evaluation of many economic policy decisions may easily be accomplished by means of macroeconomic multisectoral models, where many economic variables are represented with a detail suitable for the policy maker's needs.

This paper is divided in two sections. The first section reports key figures and comments about recent developments of the Estonian economy; the second section contains the cornerstone of a multisectoral macroeconomic model for Estonia together with a limited amount of (sectoral) equations which explain how imports may compete against domestic production and the evolution of labour productivity for a limited number of industry sectors. A set of simulation exercises shows the power of this modelling approach to get policy making insights of the working of the economy.

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II. RECENT DEVELOPMENTS IN THE ESTONIAN ECONOMY

2.1. Economic growth and its main components

Estonia like two other Baltic States – Latvia and Lithuania – are the only former Soviet republics that are the new member countries of the European Union since May 2004. The success of the Estonian economic development as a result of rather stable economic policy¹ which has been developed after regaining independence in 1991 is comparatively highly estimated by various international evaluations. For instance, International Institute of Management Development (IMD) World Competitiveness Yearbook (WCY) named Estonia the most competitive European post-socialist country among 49 leading and emerging world economies included in the IMD competitiveness survey. According to the IMD evaluations 2002, Estonia placed on the 21st position. Since 2003, the IMD has distinguished the countries into two groups: the big countries (population over 20 million) and small countries (population under 20 million), and Estonia placed on the 17th place among 29 small nations (IMD, 2003). Another organization evaluating competition is the World Economic Forum (WEF), whose competitiveness survey includes 120 countries. The WEF competition growth index (grades national economic growth potential per capita for the next 5–8 years) placed Estonia in the 22nd position; microeconomic index (grades national productivity or GDP per capita) gives Estonia 28th position among 120 economies (WEF, 2003). Thus, also according to the WEF evaluations, Estonia got the highest competitiveness grade among the European post-socialist economies.

One of the characteristics that distinguishes Estonia's economy is the high level of economic freedom. The Heritage Foundation's economic freedom index 2004 placed Estonia on the 6th position among 161 other nations. Such a high place was given to Estonia due to the liberal trade and open foreign investment policies, low control over prices and a well-developed banking sector (Heritage Foundation, 2004).

Economic freedom and the openness of the Estonian economy have played an important role in attracting foreign direct investments and promoting economic growth, particularly in the context of preparing the EU accession. Estonia was nominated as an EU candidate country in 1997². Since that time the eco-

¹ After regaining the independence in 1991, Estonian governments have followed economic policy aimed at: 1) liberalization of prices; 2) privatization of state-owned enterprises; 3) introduction of a separate currency by means of a currency board system; 4) maintaining a conservative fiscal policy; 5) implementing a very liberal foreign trade regime.

² The EU candidate countries of the eastward enlargement formed two groups: 1) the Luxembourg group of candidate countries (formed in 1997): Poland, the Czech Republic, Hungary, Esto-

economic growth of the Estonian economy has been faster than that of the Euro area (Figure 2.1). The exceptional periods were only the 4th quarter of 1998 and the first three quarters of 1999 due to the Russian crisis in August 1998. Estonia's economy also continued to grow despite the backdrop of the global economic slowdown and the declining world demand and thus worsening conditions for export in the years 2001–2003.

In 2003 Estonia's economic growth slowed down to 4.7% (Table 2.1). This indicator is lower than the average growth over the last three years but considerably higher than the EU and Euro area economic growth (respectively 0.8% in EU and 0.4% in Euro area). In recent years Estonia's economic growth was mainly supported by investments and private consumption (Table 2.1).

As indicated in the Table 2.1, in 2003, the growth rate of value added has been the most remarkable in industry. It declined in all sectors and turned out to be negative in agriculture sector. The slowdown in industry sector (particularly in processing industry) was caused by inhibited export growth and slow development of sub-contracting industries. At the same time the growth of value added in transport and communications sectors accelerated, due to optimization of costs in transit companies and improved profitability of telecommunications sector. Real growth of real estate and other business related services also showed acceleration, supported by rise of real estate market and good economic results of companies involved in information technology, advertising and other business related services. The decreased growth of value added in construction sector in 2003 can be explained by slowed expansion of construction market, brought on by recession in road construction. Energy sector grew also remarkably due to the domestic consumption and increase of exports³.

Low level of interest rates, high real wages and employment growth in the conditions of declining inflation and increasing investments are the main factors behind the recent economic growth in Estonia. Economic growth of Estonian economy is also supported by the economic development in the Nordic countries, that were growing faster than the EU average during recent years. Finland and Sweden are the main trading partners of Estonia and the majority of FDI came to Estonia from these countries. Thus, the impact of the Nordic countries' neighbourhood on the Estonia's economic development is significant.

nia, Slovenia, Cyprus, and 2) the Helsinki group of candidate countries (formed in 1999): Latvia, Lithuania, Bulgaria, Romania, Slovakia and Malta. The enlargement in May 2004 involved ten countries out of twelve (excluding Bulgaria and Romania).

³ For additional information about the main components of economic growth in Estonia see *Convergence Programme [...] 2004*, pp. 12–13; *Eesti majanduse ülevaade 2003 [...] 2004*, pp. 7–9.

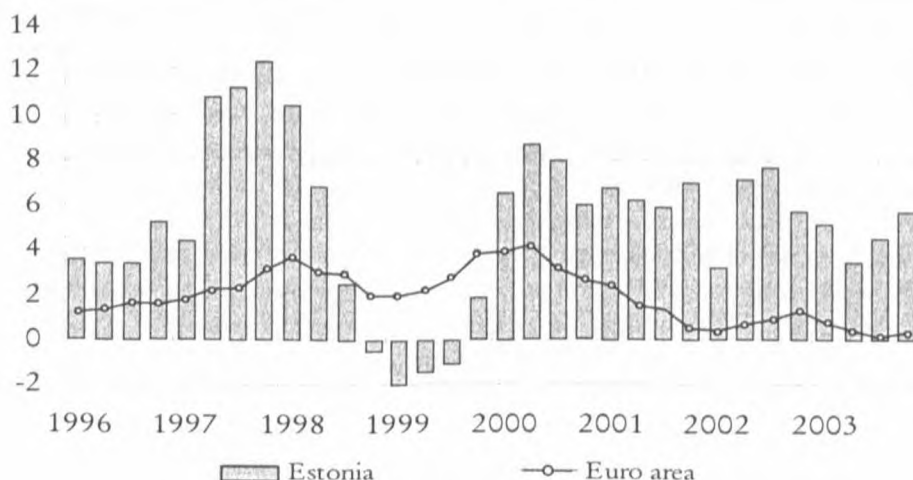


Fig. 2.1. Economic growth in Estonia and Euro area in 1996–2003 (%)

Sources: Convergence Programme 2004; Statistical Office of Estonia; Eurostat; Bank of Estonia.

Table 2.1

The main sources and contributions to economic growth in Estonia in 1997–2003 (in %)

Indicators	1997	1998	1999	2000	2001	2002	2003
GDP real growth	9.8	4.6	-0.6	7.3	6.5	6.0	4.7
Sources of economic growth							
Private consumption	7.8	4.3	-2.9	6.5	4.8	9.1	6.2
General government consumption	1.8	4.5	3.8	1.5	0.9	5.0	5.6
Gross fixed capital formation	17.6	11.3	-14.8	13.3	12.2	16.1	11.5
Change in inventories (% of GDP)	2.9	-0.3	-0.4	2.4	2.4	2.9	-1.4
Export of goods and services	29.5	12.0	0.5	28.6	-0.2	0.6	6.0
Import of goods and services	29.1	12.9	-5.4	27.9	2.1	5.4	9.0
Contribution to GDP growth							
Domestic demand (excl. Inventories)	9.3	9.2	-5.5	4.9	8.4	9.7	8.0
External balance of goods and services	-1.7	-1.7	5.1	-0.5	-2.2	-4.5	-3.4
Growth of value added by the main sectors							
Agriculture	5.8	0.0	-2.5	-1.0	-5.0	1.4	-3.5
Industry	10.8	2.1	-3.6	13.9	8.5	8.6	8.4
Construction	15.2	18.3	-8.2	13.8	4.3	13.9	6.9
Services	8.7	5.3	2.1	5.5	7.2	4.6	3.7

Sources: Ministry of Finance of Estonia, Statistical Office of Estonia, Bank of Estonia.

2.2. Current account deficit as the most problematic Estonia's macroeconomic indicator

The high level of current account deficit is a problematic macroeconomic indicator; it was significantly high in Estonia in 2003: -13.7%. By the way, this is the highest level over the period 1997-2003 (Table 2.2).

Table 2.2

Main macroeconomic indicators of the Estonian economy in 1997-2003 (%)

Indicators	1997	1998	1999	2000	2001	2002	2003
GDP (bln EEK)	64.0	73.5	76.3	87.4	97.9	108.0	116.2
GDP deflator	11.3	9.8	4.5	6.7	5.4	4.1	3.0
Consumer price index	11.2	8.2	3.3	4.0	5.8	3.6	1.3
Employment (15-74 years, ths.)	617.2	606.5	579.3	572.5	577.7	585.5	594.3
Employment growth	-0.3	-1.8	-4.5	-1.2	0.9	1.4	1.5
Productivity growth	10.1	6.5	4.0	8.6	5.5	4.4	3.2
Unemployment rate	9.6	9.9	12.2	13.6	12.6	10.3	10.0
Average wages (EEK)	3571	4100	4418	4876	5511	6144	6709
Wage real growth	7.6	6.0	4.3	6.1	6.9	7.0	8.3
Investments & inventories (% of GDP)	28.0	29.3	24.5	27.8	28.9	31.4	32.9
Current account (% of GDP)	-12.1	-9.2	-4.7	-5.8	-6.0	-12.3	-13.7

Source: Ministry of Finance of Estonia, Statistical Office of Estonia, Bank of Estonia.

The high current account deficit is also indicated in the recent World Competitiveness Report as one of the major weaknesses of the Estonian economy (IMD, 2003). Therefore, the nature and causes of its high level are also carefully analyzed by the Estonian government institutions. The growth of trade balance deficit is the most notable component of the current account. Relatively slow growth in export of goods and services in 2002 and also in 2003 (respectively 0.6% and 6%) compared to import (respectively 5.4% and 9%; see Table 2.1) can be explained by the postponed recovery of foreign demand. Imports increased in 2003, regardless of dropping growth of domestic demand, mostly due to the growth of imports of capital goods, necessary for improving the competitiveness of the Estonian products in the world market and preparations for the EU accession. High current account deficit can also be explained by large volume of re-invested revenues, gained from profitable foreign investments (for instance, the re-invested revenues made up 4.8% of GDP in 2003).

The role of investments in economic development of Estonia has significantly increased during the recent years, establishing around 33% of the GDP in 2003 (Table 2.2). The majority of investments were made into the energy sector,

followed by hotels and restaurants and transport (particularly railway transport)⁴, warehousing and communication.

Reasons for the current account deficit may not reflect significantly the balanced growth of the Estonian economy. The reasons of current account deterioration can be summarized as follows: 1) the high economic growth has been caused by the foreign rather than by the domestic demand, and the economic cycles of Estonia and EU have been slightly different so far; 2) Estonian economy needs big investments, particularly investments into infrastructure and energy sector; 3) optimistic expectations and big capital flows connected with the EU accession (see also Convergence Programme, 2004). Thus, in the conditions of rapid development of Estonia as a country with small very open economy, current account deficit may be considered as a so-called 'supplement good' for the high economic growth rate. By the way, the current account deficit was the lowest in 1999 (-4.7%) when the economic growth rate turned out to be negative (-0.6%) due to the consequences of the Russian crisis.

2.3. Convergence programme and joining the EMU

The economic reforms, started after regaining independence and have progressed rapidly during the preparations for the EU accession, are continuing in the conditions of the Estonian full EU membership. The main goal of the current reform process is the convergence to the EU economic development level. The framework for the reform process in order to achieve the convergence goal is set by the Estonian Pre-accession Economic Programme (PEP, approved by the Estonian government in August 2003) and the Convergence Programme prepared by the Ministry of Finance in collaboration with the Bank of Estonia and Ministry of Economic Affairs and Communications in May 2004⁵.

According to the Convergence Programme, the primary macroeconomic objective of Estonia is to facilitate the real convergence of national economy by

⁴ In 2002 and particularly in 2003, large loan-financed investments were made in the railway transport sector in order to rent the oil wagons mainly to Russian companies for transportation oil over the territory of Russian Federation. These investments were financed by the Estonian subsidiaries of Nordic banks. The extraordinariness of these transactions can be described by the fact that in 2003, the total imports of oil wagons increased by more than five times, reaching 4.1 bn EEK (compared with the 0.77 bn in 2002). Those investments are related to few private companies, operating mainly abroad and thus, they do not reflect general trends in the Estonian economy and do not thereby represent extra burden e.g. on labour resources. The latter investments should start to generate export revenues to cover made investments (see also *Eesti majanduse ülevaade 2003...*).

⁵ Information about the forecasts of the main macroeconomic indicators of the Estonian Economy for the years 2004–2008 and the general government budget are presented in the annexes 1–5.

means of sustainable economic growth supported by low inflation and successful policy mix. The Convergence Programme sets out the conditions for sustainable growth in the medium term (2004–2008): prudent fiscal policy, open and flexible markets operating at full capacity, and investment in physical and human capital. The policy mix includes conservative fiscal policy with an explicit rule of nominal budget balance, which is making an effort in complying Estonian monetary policy to that of the EMU, in order to adapt the euro. Sustainable economic growth also means significant investment into human capital (education, health, improvement of demographic situation, etc.) and includes the policy measures and the corresponding structure of general government budget that support development of social security system. Particular attention should be paid to promoting liberal conditions on the labour market, including free movement of labour, reduction of tax burden, active labour market policies and coordination between education and employment policies.

Since June 2004, Estonia participates in ERM II maintaining the present Currency Board system unilaterally. The exchange rate of Estonian *kroon* with euro has been fixed since 1999 (1 euro = 15.647 EEK) and the EU institutions have asserted the conformity of currency board system for the participation in ERM-II. Before the adoption with euro zone, Estonia is not required to abandon the currency board system and the current fixed exchange rate with the euro. Thus, the entrance into ERM II does not entail high policy convergence costs for Estonia. There are no medium-term sustainability issues emerging at the current juncture that should be addressed through the exchange rate system rather than other policy measures. Therefore, there is also no reason to suppose that the currency board arrangement would become a less appropriate arrangement over the medium term (see also *Convergence Programme* 2004, p. 9).

According to the EU Maastricht Treaty rules, Estonia must meet the convergence criteria regarding the budget deficit (not exceeding 3% of GDP), state debt (not exceeding 60% of GDP), inflation and interest rates close to the respective average of the three EU countries' (with the lowest indicators inflation rate must not exceed of three EU member states' lowest inflation by more than 1.5 percentage points), in order to get the final acceptance of euro. The most problematic task for Estonia seems to be keeping of low inflation rate. For achieving the convergence goal, rapid growth of productivity and income is predictable, and as a rule that accompanies with a serious pressure on rapid rise of prices. Estonia's small open economy is vulnerable to the foreign price level, particularly to the comparatively high price level of the Nordic countries. In the conditions of free movement of labour, Estonia will have a serious threat that part of well-qualified labour force may leave the country. Consequently, there will be a serious pressure on wage growth and Estonia can not any longer be a country of low labour costs for the foreign investors. It can be expected that many foreign firms which

have benefited from the advantage of relatively cheap Estonian labour force⁶ should change their business strategy in forthcoming 2–3 years. The country should develop conditions for rapid increase of productivity and significant declining of structural unemployment, in order to be continuously attractive for FDI.

2.4. From investments to innovation based economy as the main task of the Estonia's development

So far, the factors of the productivity growth mainly relied upon the structural and organisational activities; only few investments were made by the Estonian and foreign capital based enterprises into innovative production and qualified labour force. The contribution of private investments into R&D has been marginal, the investment into R&D has mainly been made by the Estonian government, and these amounts formed less than 1% of GDP (1.9% of GDP in EU in 2000; Figure 2.2). In the forthcoming years both, Estonian and foreign capital based enterprises should obviously invest much more in the R&D activities, education and retraining labour force.

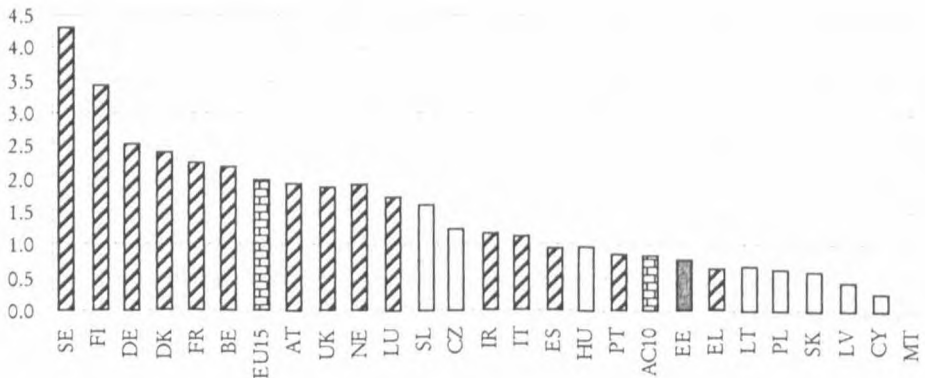


Fig. 2.2. Research and Development (R&D) expenditure in EU-15 and accession countries (AC10) in 2000

Source: Eurostat; Convergence Programme, 2004.

According to the Estonian research and development strategy „Estonia based on knowledge” (approved by the Estonian Parliament on December 6, 2001), Estonia's national's and government's strategic priority is remarkable to support

⁶ The average wages were ca 420 euros in 2003; the growth of nominal wages was around 88% and average yearly wage real growth about 7 during the period 1997–2003 (see Appendix 1).

R&D and innovation activities in order to achieve long-term economic competitiveness and to shift development from the investment based, to the innovation based economy. In order to achieve this goal, it is planned to increase total R&D expenditure to the 1.5% level of GDP in 2006, which would bring Estonia closer to the average of EU members.

The shift of the Estonian economic development from the investment to the innovation based and the fulfilment of the convergence programme oriented on sustainable and balanced economic growth also stresses the necessity to improve the quality of analysis and economic data sets. The comprehensive, internationally comparable and reliable information is necessary in order to predict the main development trends and possible structural changes of the economy in short, medium and long run perspective. Globalization and EU enlargement processes are accompanied not only with the challenges for development of new business but also with the increasing competitiveness and new risks. Therefore, profound argumentation and forecasts are unavoidable for making proper public and private investments in both physical and human capital.

III. THE SKELETON OF THE MULTISECTORAL ESTONIAN MODEL

3.1 The Input-output table and the basic data base

The basic purpose of the model is to make long-term projections for the Estonian economy. Most of the data used in the present version are from the input-output table made available by the Estonian Statistical Office for the year 1997⁷. The data on final demand and value added components are not yet available in time series with a sectoral detail similar to that of the IO table. Furthermore, the Estonian Statistical Office has not used the IO table as benchmark for the product accounts.

At present, we notice two significant discrepancies: a) differences between the column and row totals of the IO table and the flows in the national accounts, and b) discrepancies in the product account between resources and intermediate and final consumption components.

With the available data, mostly from the IO table, a skeleton of the Estonian model has been built with a minimum of equations. The IO table distinguishes domestic and imported flows; contains 6 final demand components (personal consumption expenditure, investments, inventory changes, exports, government expenditure and collective consumption expenditure), no value added component is available at sectoral level.

⁷ The first description of the Estonian input-output table is in Dedekgajeva (2000).

Matrices and vectors supporting the Estonian model are collected in a file (a vam file described in Interdyme⁸) which constitute the basic data base. The matrices and vectors which come from the IO table and are used in the present version of the Estonian model are:

am	: input-output coefficients matrix
mm	: import shares matrix
gm	: value added shares matrix
out	: sectoral output vector
pceio	: private consumption expenditure vector
ccp	: private collective consumption vector
gov	: government consumption vector
pde	: investment by producers vector
ven	: inventory changes vector
ex	: exports vector
imp	: imports vector
taxprodv	: net taxes on products vector
wagv	: compensation of employees vector
indtaxv	: other net taxes on production vector
rgev	: operating surplus and other income
vad	: value added vector

Besides these vectors and matrices obtained directly or through very simple manipulation from the IO table, there are other vectors such as:

emp : the employment vector

and others which represents exogenous (for the standing alone model) variables such as:

pim : the import prices vector

as well as vectors generated during the solution of the model:

cim : the cost of imported materials vector

unitva : the value added per unit of output vector

pdm : the domestic prices vector

pmix : the domestic consumption prices vector (IO sectoral classification)

Bridge matrices for personal consumption and investment are not yet available. Consequently, investments by investors and personal consumption classified on the side of the consumer are not yet introduced in the Estonian vam file.

⁸ The following acronyms are from the configuration file of the Estonian vam file. This file, named vamest.cfg, is reproduced in the Appendix 7. This file drives the construction of the vam file by using G7.

3.2. Equation formulation

The model contains equations for a) import shares, and b) very simple (labour) productivity functions.

a) import share equations

Whatever the analytical structure of a sectoral import equation may be, total (sectoral) output appears among the explanatory variables. In fact, total real resources (imports plus output) vary to match the total (intermediate plus final) real demand. An increase (decrease) of total demand generates an increase (decrease) in total resources; then, an increase (decrease) in domestic output is expected to be associated to an increase (decrease) of imports. In other words, total demand is satisfied with domestic and foreign productions; however, the shares of these two 'resources' may vary. Imports substitution means that imports take the place of domestic production; imports elasticity (not equal to one) evokes that, as GDP increases, imports may increase (elasticity greater than one) or decrease (elasticity less than one) its weight over domestic resources.

As for any economic variable, there may be many analytical forms suggested by the pure economic theory, by the econometric assumptions about the 'probability generating function', and by the economic wisdom. The pure economic theory, which is a synonymous of neoclassical theory, leads to analytical forms deduced through an optimization process applied to rarely observed functions (such as utility functions and production functions), but widely available from economic textbooks. The econometric assumptions may ignore the economic theory in favour of a rich and sophisticated description of the random error attached to any analytical form. For a given economic phenomenon, the economic wisdom suggests a list of determinants supported by economic theories and by the model builder's experience.

Anyhow, sectoral output is expected to be always among the explanatory variables; this implies a simultaneous solution of sectoral import and sectoral total output⁹. However, the choice of the analytical form is up to the model builder.

In the present case, sectoral import share equations have been implemented. The import share is related to the total resource (imports plus total output). The analytical form is very naive; given the sectoral import share at the base year, $impsh_0$, it varies following a trend. Then for each sector, the import share equation has the following form:

$$impsh_t = impsh_0 + a * t$$

where the parameter a may be positive or negative interpreting respectively the case of import penetration or domestic output expansion.

⁹ The Interdyme code fulfils this property in the Seidel function.

b) Labour productivity equations

The labour productivity equations have been estimated for a subset of IO sectors. The Estonian Statistical Office publishes data on employment and data on industrial production indexes. Both data do not match the IO sectoral classification. However, some data may be easily related to the IO sectors; other data do not offer sufficient hints to be related to well defined sectors. Time series of indexes of industrial production, applied to the sectoral output from the IO table, have made possible the production of time series of sectoral total output at constant prices. Both employment and total output time series have been used to estimate labour productivity equations in the framework of the Verdoorn's law. Not all the sectors have a labour productivity equations, neither cross-over effects on price formation have been implemented. Anyway, these equations enlighten the impact of the output growth on the sectoral labour requirements over time.

3.3. The 'past' and future scenarios

The Estonian Statistical Office has not yet harmonized the IO table with the national account statistics. The Office is in the process to revise the construction of the Estonian IO tables and the production of time series strictly related to the IO final demand and value added components. Meanwhile, the macro variables of the national accounts are the only time series available. They have been used to design the 'past' scenarios. The 'past' fills the time span up to the present time. Of course, it must include the IO table base year¹⁰.

Table 3.2 shows the macro variables used to reconstruct the 'past' from year 1993 to 2003. Table 3.3 shows the rate of growth of the data of Table 3.2.

The macro variables from Table 3.1 have been used as indexes and applied to the corresponding vectors of the IO table. The rate of growth of each element of a vector as well as its total sum is equal to that of the macro variable.

This 'updating' has not been applied to the inventory changes vector. This vector contains negative and positive flows, which are expected to change sign over time. It does not make any sense to 'move' the vector preserving the sign of each flow, because this imply a constant decay or a constant accumulation of inventories at sectoral level. The sectoral inventory change deserves a modelling approach rather a simple indexation¹¹.

¹⁰ The IO table base year is the year which the table refers to. In the present case, the base year is 1997. Notice that the data base spans from 1990 to 2015 (the first active line of the vam configuration file); it contains the available time series and provides room to project up to year 2015.

¹¹ See, for example, the modelling approach suggested in Almon *et al.* (1974).

Furthermore, the 'statistical discrepancy' is not present in the IO table; hence, it has not been used to complete the re-construction of the past. This makes the GDP computed from the national account not comparable with the GDP from the IO table. Table 3.3 shows the GDP rate of growth without the 'statistical discrepancy'. The difference between the GDP rates of growth is noticeable; it stresses the importance of the rates of growth of the variable in the product accounts in determining the GDP rate of growth.

The 'future' has been designed following the economic perspectives prepared by the Ministry of Finance of Estonia, the Statistical Office of Estonia and the Bank of Estonia and shown in the Source of growth section of Appendix 2 table. The following Table 3.1 contains the data used for designing the 'future' scenario.

Table 3.1

The rates of growth driving the 2004–2010 scenario

	2004	2005	2006	2007	2008	2009	2010
Private Consumption	6.2	6.0	6.3	5.4	5.3	5.3	5.3
Government expenditure	6.5	3.9	3.6	3.3	3.1	2.9	2.7
Investments	6.7	9.1	7.8	7.7	7.7	7.7	7.7
Exports of goods and services	7.4	8.5	9.9	9.3	9.3	9.3	9.3
Imports of goods and services	7.2	7.9	8.9	8.7	8.5	8.5	8.5

Source: Own calculations.

The rates of growth from 2004 to 2008 are taken from Appendix 2; the rates of growth in years 2009 and 2010 are a simple extension of those recorded in the year 2008 with the exception of the Government expenditure rate of growth. This has been reduced to the levels of 2.9 and 2.7 respectively for the years 2009 and 2010 following a trend which should interpret the tightening of the Government expenditure in the view to join the euro area or to behave according to the euro area fiscal monetary constraints.

The skeleton of the Estonian model allows us to start a preliminary evaluation of the model performance.

All the final demand components are assumed exogenous; each sector of any final demand components follows the corresponding total. Figure 3.1 shows in a multigraph box the scatter of Personal consumption expenditure, Investments and Exports. The graphs of these final demand components are the same in all the sectors.

In the present version of the model, both imports and output are endogenous variables. Since imports have processed as any other final demand component, their simulated values may now be compared with the 'past' and 'future' reconstructed values.

Figures 3.2–3.7 show the behaviour of the naive import equations described above. In general, they generate good simulations of the sectoral imports time series. These figures show the values in the time interval 1993–2010; up to year 1997, the model does not compute any simulation value. In the years 1998 to 2010, assuming that the scenario variables (ImpSce) be really observed, the scatter of their simulated values (ImpSim) show the power of the model to mimic the ‘observed’ economy. Wearing apparel, Leather and leather products, Products of agriculture and machinery and equipment imports appears to be well predicted by the model; wood and product of wood and pulp, paper and paper products imports are respectively over and under predicted.

Figures 3.8–3.11 compare the imports and total output indexes (1997 = 1) at sectoral level. These figures show the composition of the sectoral total resources requirements. All final demand components are assumed to grow (Table 3.2) and consequently total resources will grow at their average rate. Their composition is expected to change over time. Because of the assumed scenario and its implementation in the model framework, imports grow faster than output in all the sectors. Sectoral performance is influenced by the sectoral “openness”. Pulp, paper and paper products and chemicals, chemical products show a remarkable increase of imports and a declining output; as reported above, Pulp, paper and paper products sector has a very high import share and the chemicals, chemical products sector belongs to the seriously unsheltered sectors with an import share of 69%. Other mining products sector with an import share of 47% maintains a constant output level over time while product of agriculture with its 25% may lightly expand its output.

Figures 3.12–3.16 show the relationship between total output and employment at sectoral level. Only a limited number of sectors have a labour productivity equation as above described. At present, there is no employment feedback with the rest of the model. Hence, only a cursory analysis of the employment over the scenario horizon may be given. Leather and leather products and wood and products of wood sectors show an increasing output and a declining level of employment. Chemicals, chemical products sector has both output and employment declining; the first two sectors show the effect of a labour productivity equation interpreting a clear labour productivity improvement over time while the third sector shows an unclear increase in labour productivity in presence of a declining level of output. The motor vehicle sector shows a strong unsatisfactory labour productivity equation; if the total output remains constant over time, it is unrealistic to assume that no labour productivity gain is going to take place. Construction sector shows the interesting case of a good trend in output which is strong enough to maintain a constant level of employment under a good improvement of labour productivity.

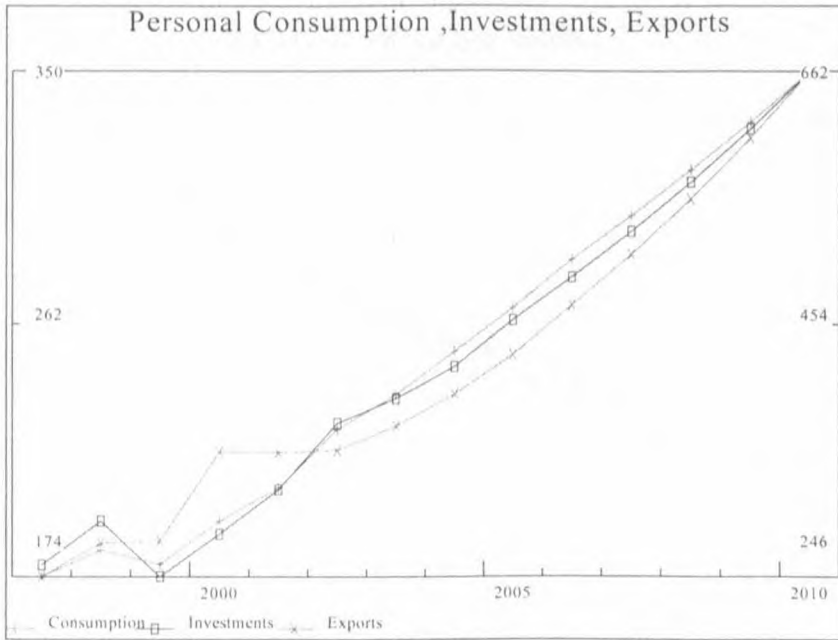


Figure 3.1

Source: Own calculations.

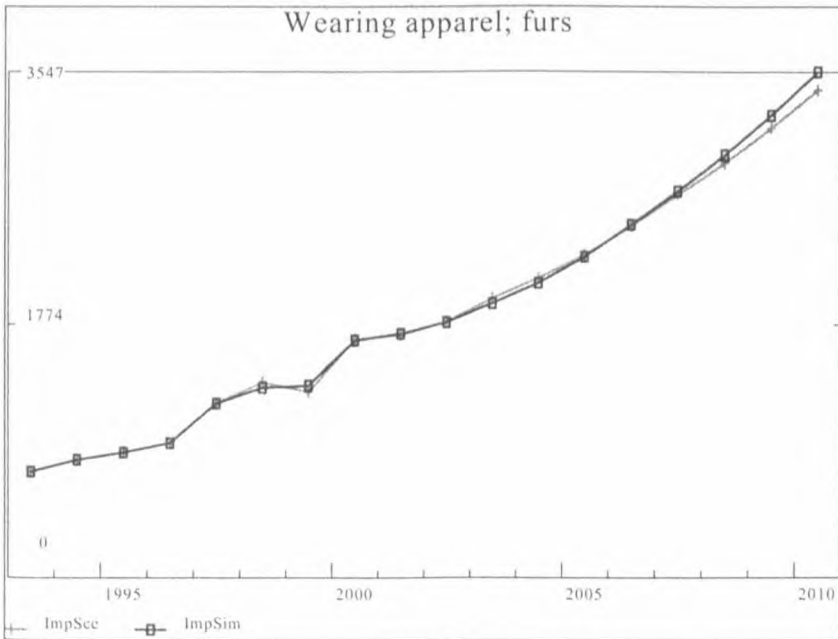


Figure 3.2

Source: Own calculations.

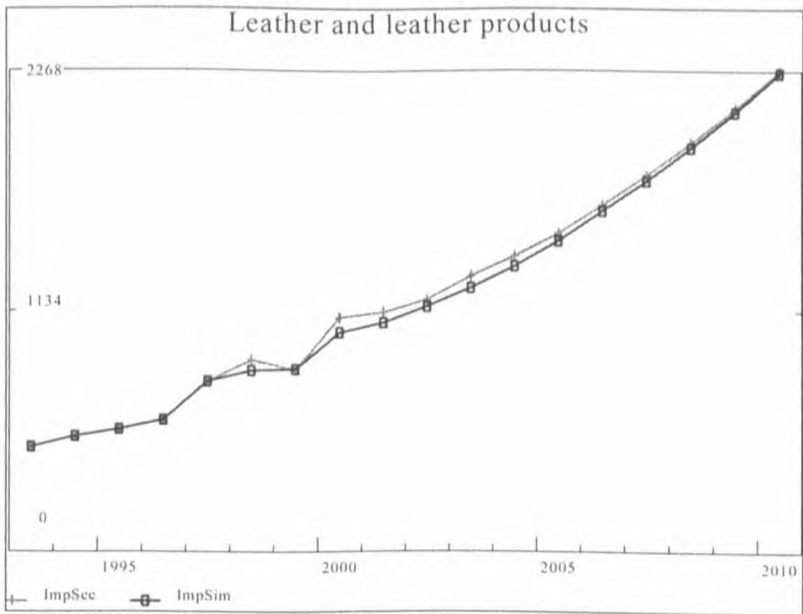


Figure 3.3

Source: Own calculations.

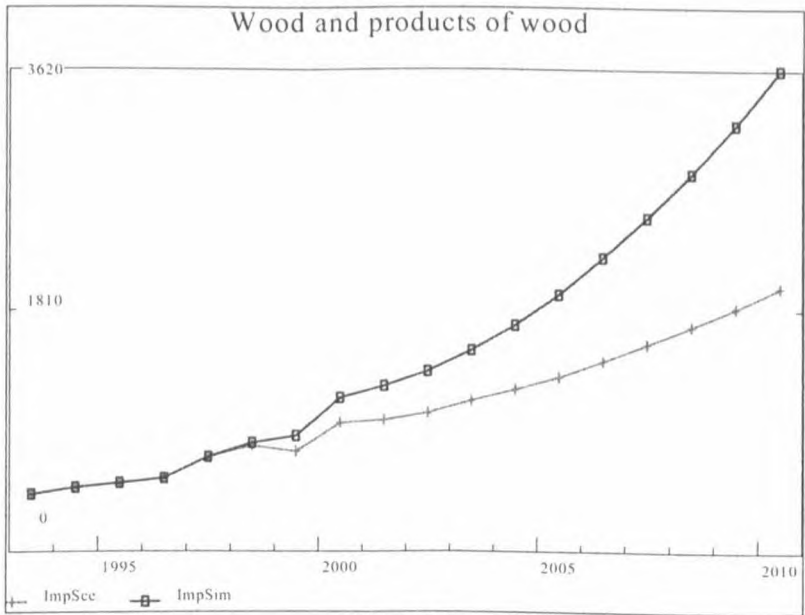


Figure 3.4

Source: Own calculations.

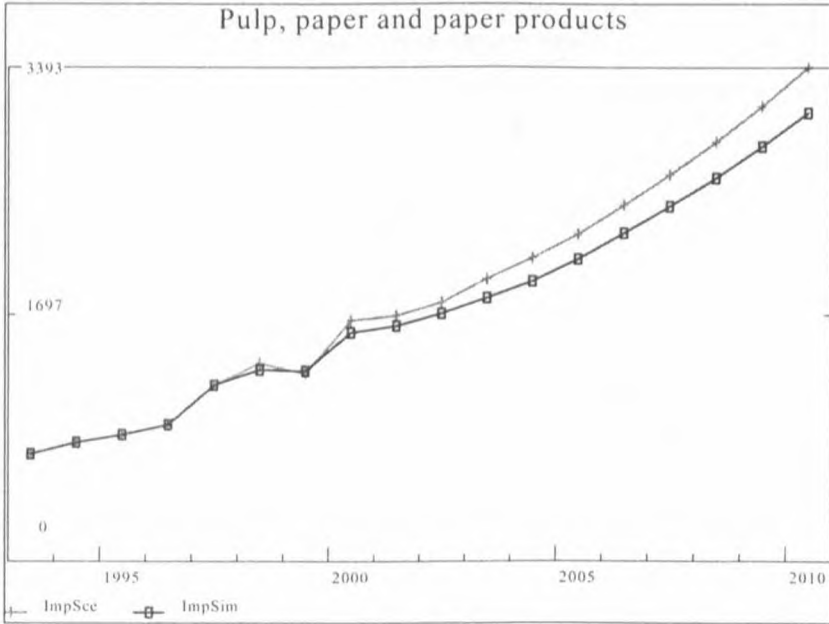


Figure 3.5

Source: Own calculations.

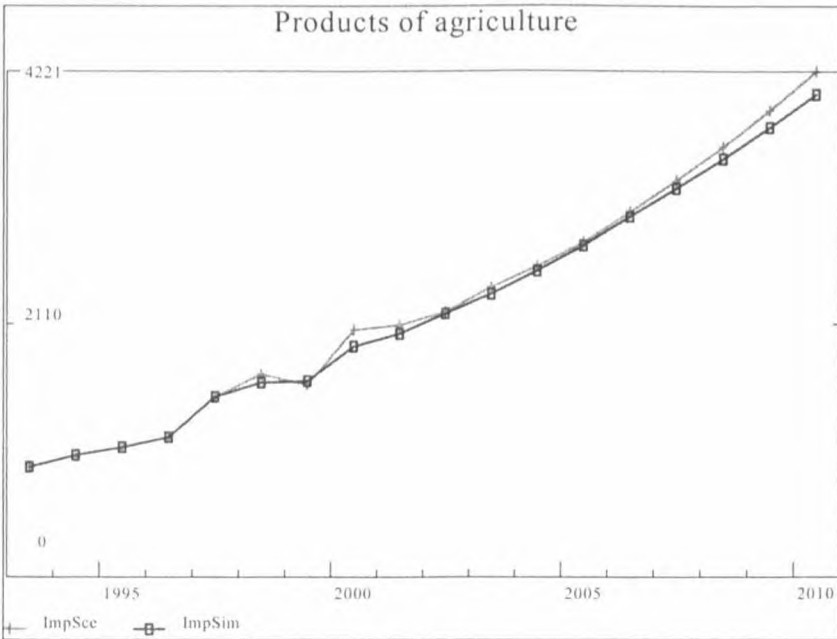


Figure 3.6

Source: Own calculations.

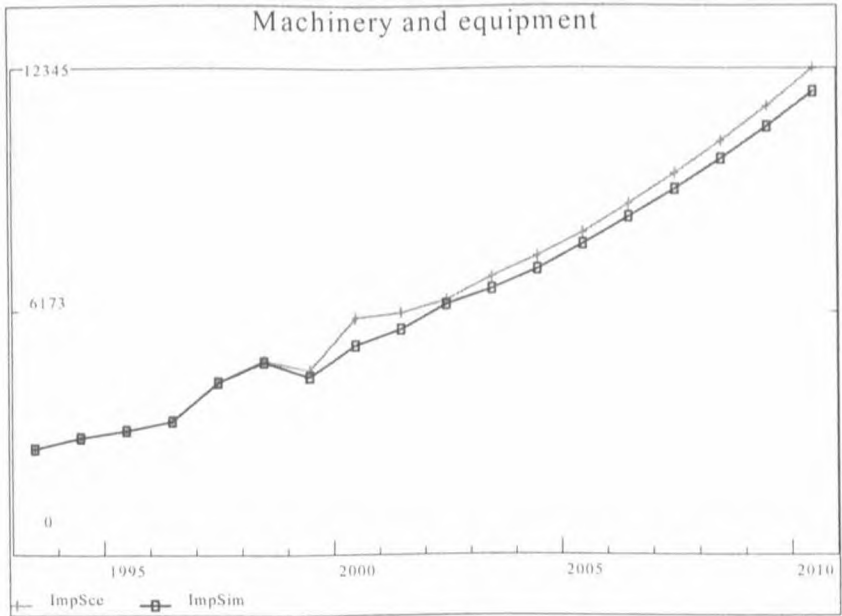


Figure 3.7

Source: Own calculations.

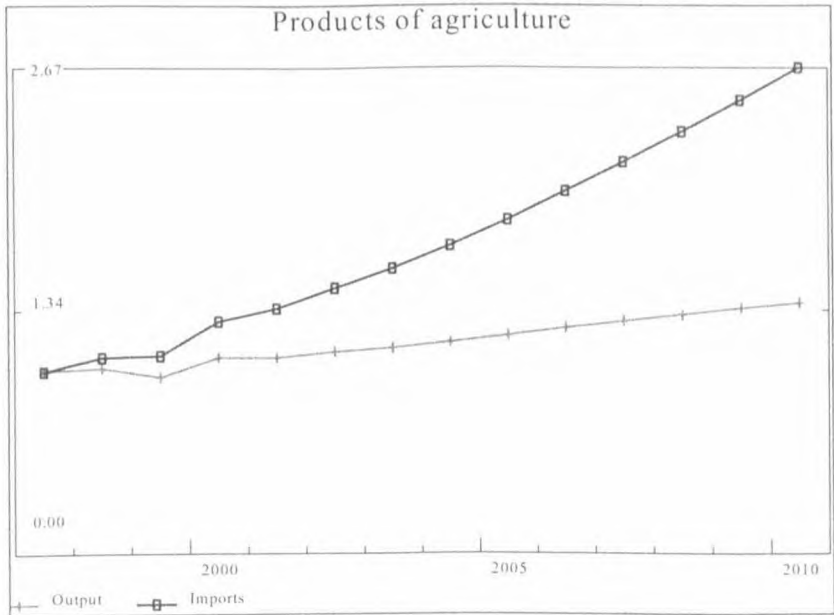


Figure 3.8

Source: Own calculations.

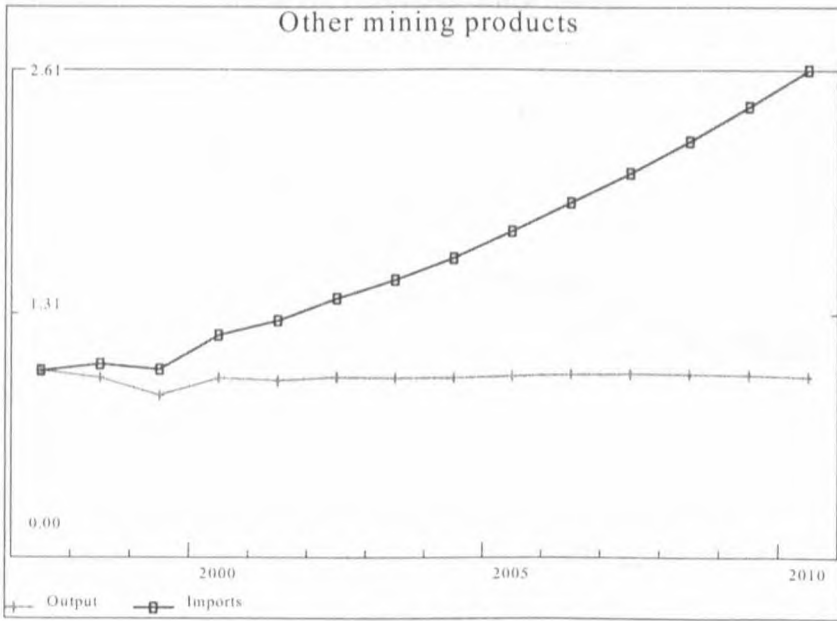


Figure 3.9

Source: Own calculations.

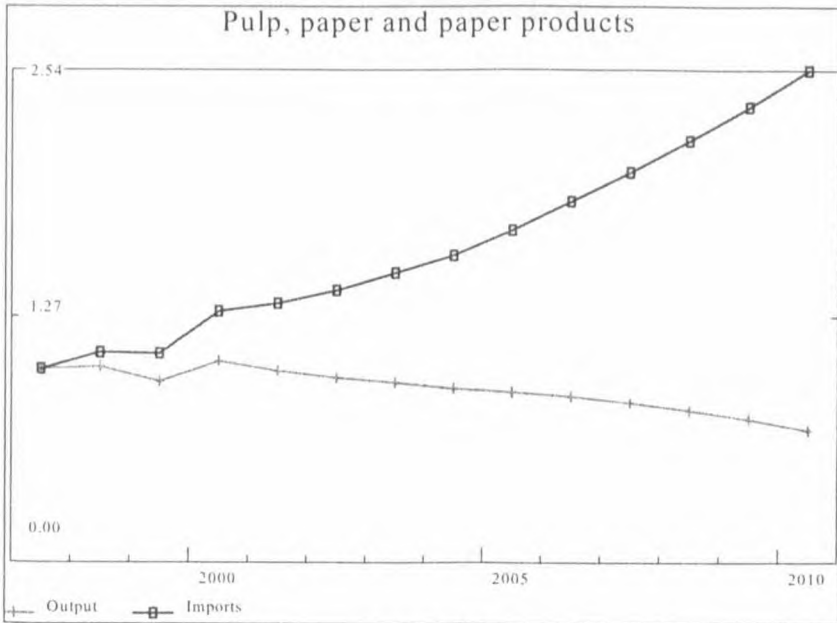


Figure 3.10

Source: Own calculations.

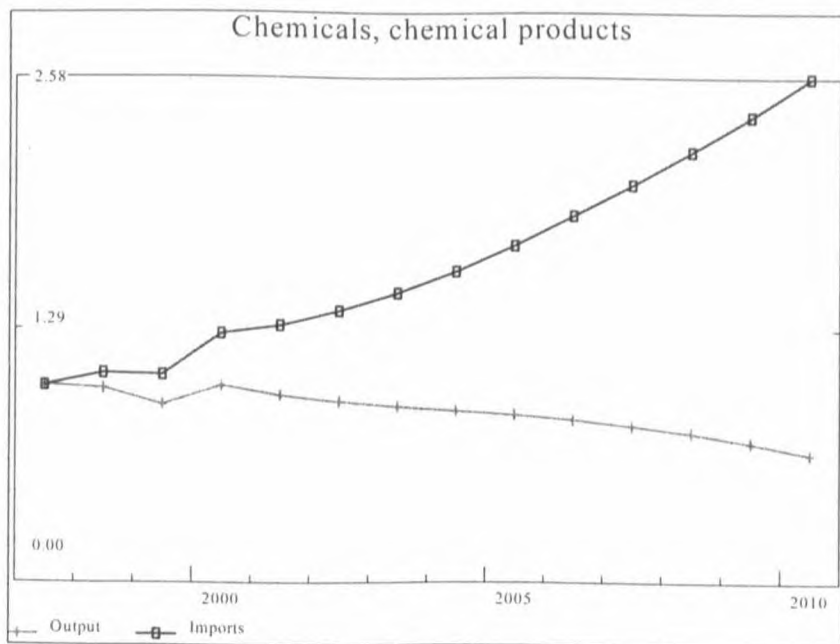


Figure 3.11

Source: Own calculations.

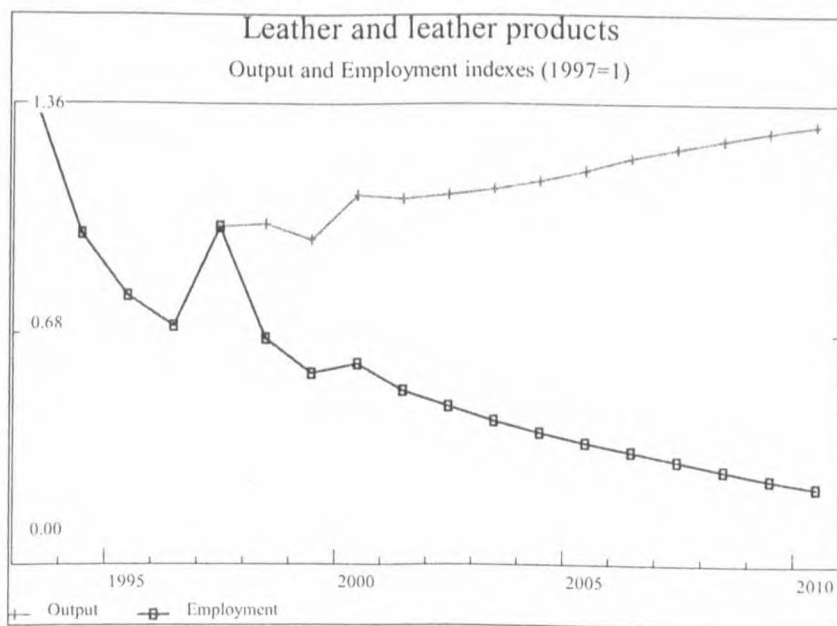


Figure 3.12

Source: Own calculations.

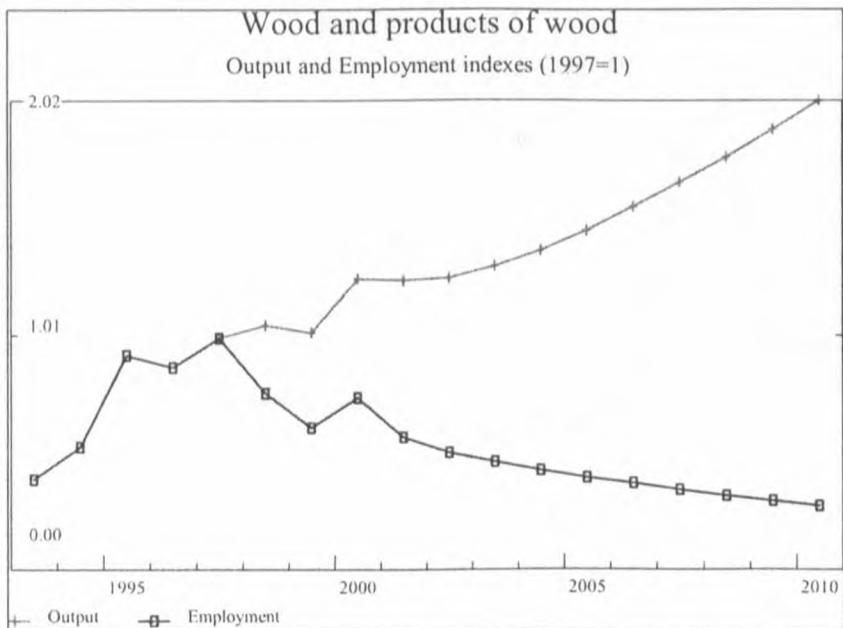


Figure 3.13

Source: Own calculations.

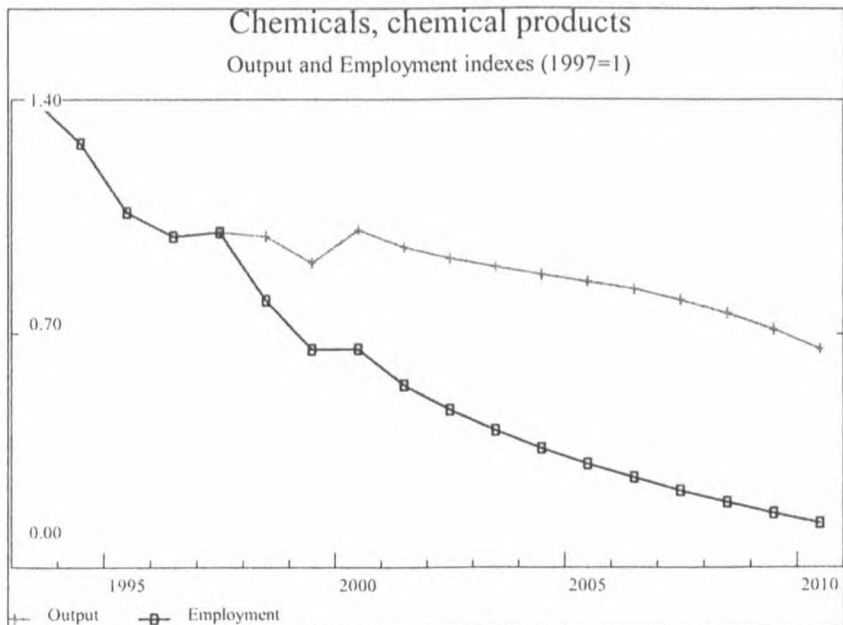


Figure 3.14

Source: Own calculations.

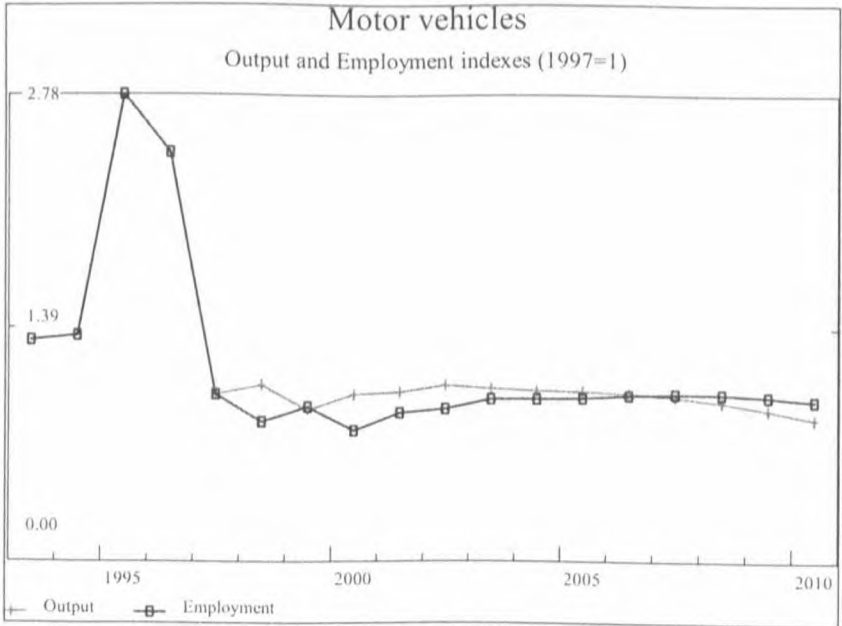


Figure 3.15

Source: Own calculations.

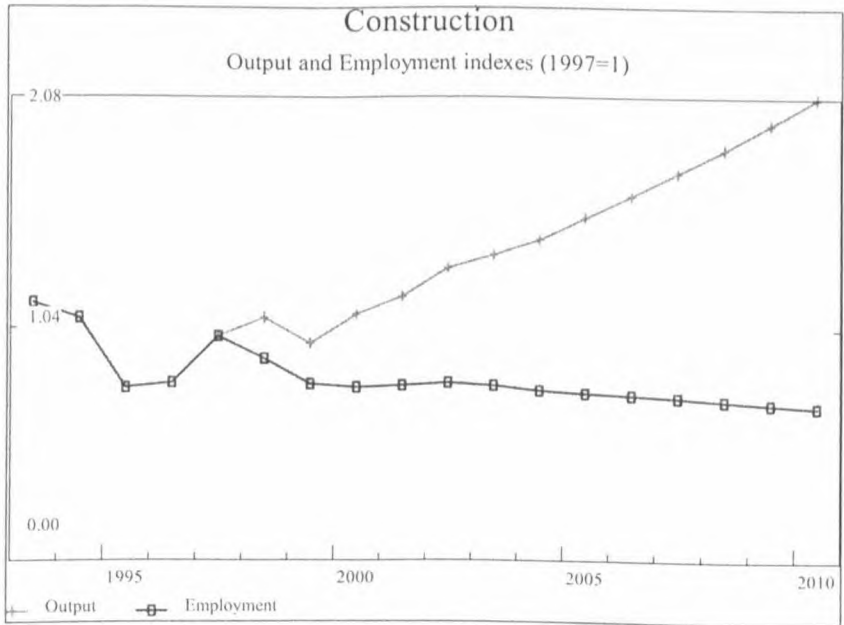


Figure 3.16

Source: Own calculations.

Table 3.2

Gross Domestic Product by Expenditure Approach at 2000 Constant Prices (million kroons)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Private consumption expenditure	35708,7	35927	37715,9	41539,8	45946,3	48338,3	47023,3	51036,5	54057,5	59428,6	62614,9
General government final consumption expenditure	15412,3	16031,6	18195,7	17640,4	17411,2	17703,2	18213,5	18406,7	18744,3	19848,4	21002,4
Consumption expenditure of non-profit institutions	649,7	635,1	673,8	742,6	787,5	818	928	1023,6	1225,2	1536,7	1796
Gross fixed capital formation	14265,2	15582,6	16452,8	18024,8	21612,4	24642,6	20796,7	23769,4	26856,2	31475,2	33176,7
Change in inventories	1088,5	303,1	428,4	657,4	2141,3	326	146,3	2059,8	2262,9	3473,9	3303
Domestic demand	67124,4	68479,4	73466,6	78605	87898,7	91828,1	87107,8	96296	103146,1	115762,8	121893
Exports of goods and services (f.o.b.)	39131,4	40498,8	42663,2	43874,7	56569,9	63336	63777,8	81831,7	81686,7	82185,6	87107,2
..exports of goods	22877,8	24228,9	25809,9	26170,5	35315	41079,5	40128,8	56345,9	53226,8	55070,3	58445,5
..exports of services	16253,6	16269,9	16853,3	17704,2	21254,9	22256,5	23649	25485,8	28459,9	27115,3	28661,7
Imports of goods and services (f.o.b.)	38088,7	42321	45019,2	48378,3	62543,8	70245,4	66586,3	85400,7	87167	91847,3	100130,7
..imports of goods	29664,6	33619,9	35999,3	38438,8	51463,8	56690,8	52236,7	69489,5	69685,1	73302	83046,8
..imports of services	8424,1	8701,1	9019,9	9939,5	11080	13554,6	14349,6	15911,2	17481,9	18545,3	17083,9
Statistical discrepancy	685,8	1091,1	-286,2	-79,7	-113,5	1152,1	1705,4	-9,9	979,1	-309,9	2364,1
TOTAL	68852,9	67748,3	70824,4	74021,7	81811,3	86070,8	86004,7	92717,1	98644,9	105791,2	111233,6

Source: Ministry of Finance of Estonia, Statistical Office of Estonia, Bank of Estonia. Own calculations.

Table 3.3

Change of Gross Domestic Product Compared with Previous Year by Expenditure Approach at 2000 Constant Prices* (in %)

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Private consumption expenditure	0.6	5.0	10.1	10.6	5.2	-2.7	8.5	5.9	9.9	5.4
General government final consumption expenditure	4.0	13.5	-3.1	-1.3	1.7	2.9	1.1	1.8	5.9	5.8
Consumption expenditure of non-profit institutions	-2.2	6.1	10.2	6.0	3.9	13.4	10.3	19.7	25.4	16.9
Gross fixed capital formation	9.2	5.6	9.6	19.9	14.0	-15.6	14.3	13.0	17.2	5.4
Change in inventories	-72.2	41.3	53.5	225.7	-84.8	-55.1	1307.9	9.9	53.5	-4.9
Domestic demand	2.0	7.3	7.0	11.8	4.5	-5.1	10.5	7.1	12.2	5.3
Exports of goods and services (f.o.b.)	3.5	5.3	2.8	28.9	12.0	0.7	28.3	-0.2	0.6	6.0
exports of goods	5.9	6.5	1.4	34.9	16.3	-2.3	40.4	-5.5	3.5	6.1
exports of services	0.1	3.6	5.0	20.1	4.7	6.3	7.8	11.7	-4.7	5.7
Imports of goods and services (f.o.b.)	11.1	6.4	7.5	29.3	12.3	-5.2	28.3	2.1	5.4	9.0
imports of goods	13.3	7.1	6.8	33.9	10.2	-7.9	33.0	0.3	5.2	13.3
imports of services	3.3	3.7	10.2	11.5	22.3	5.9	10.9	9.9	6.1	-7.9
GDP	-1.6	4.5	4.5	10.5	5.2	-0.1	7.8	6.4	7.2	5.1
GDP without Statistical Discrepancy	-2.2	6.7	4.2	10.6	3.7	-0.7	10.0	5.3	8.6	2.6
Difference	0.6	-2.1	0.3	0.0	1.6	0.7	-2.2	1.1	-1.4	2.5

* The data for 1993-2003 have been revised on 18.05.2004. Due to the accession with the European Union the methodology of macroeconomic statistics changed. The changes concerned the calculation methodology of imputed rent and consumption of fixed capital, and changed also the level of Gross domestic product and gross national income in the period 1993-2003.

S o u r c e: Ministry of Finance of Estonia, Statistical Office of Estonia, Bank of Estonia. Own calculations.

Table 3.4 shows the rates of growth of the variables from Table 3.1 and the GDP rate of growth in a product account which does not include inventory changes and statistical discrepancies.

Table 3.4

Product account

	2003– 2004	2004– 2005	2005– 2006	2006– 2007	2007– 2008	2008– 2009	2009– 2010
Personal Consumption	6.0	5.8	6.1	5.3	5.2	5.2	5.2
Government Expenditure	6.3	3.8	3.5	3.2	3.1	2.9	2.7
Investments	6.5	8.7	7.5	7.4	7.4	7.4	7.4
Imports	7.5	8.6	9.0	8.5	8.5	8.5	8.5
Exports	7.1	8.2	9.4	8.9	8.9	8.9	8.9
GDP	4.3	5.1	5.5	4.9	4.9	4.9	4.9

Source: Own calculations.

IV. CONCLUSIONS

The paper shows the first steps toward the construction of a modern input-output model for Estonia. The objective is a full fledged macroeconomic multisectoral model based on the input output table and the institutional accounts. The sectoral time series of final demand and value added components and the time series of the (nominal) flows collected in the institutional accounts will be largely used for econometric estimation of sectoral and macro equations.

The present paper shows an implementation of the real side of the model with sectoral import equations and sectoral labour productivity equations. The import equations assume that the sectoral import shares on (sectoral) total resources will continue to grow in the near future. This assumption is suggested by the past experience and the economic perspectives assumed by Estonian official institutions.

Time series on employment made available by the Estonian Statistical Office present a detail which matches only a subset of input-output sectors. Then, labor productivity equations have been estimated for a group of sectors. In the simple multisectoral model presented in this paper, sectoral output, import and employment are endogenously determined. The comparing these three variables at sectoral level along an horizon which cover the past (up to year 2003) and the future (up to year 2010) allows us to appreciate the insight offered by this modelling approach.

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Main data sources:

- Eurostat (www.europa.int/comm/eurostat)
- Ministry of Finance of Estonia (www.fin.ee)
- Statistical Office of Estonia (www.stat.ee)
- The Bank of Estonia (www.ee/epbe)

APPENDIXES

Appendix 1 – Main macroeconomic indicators of the Estonian economy in 1997–2003 (%)

	1997	1998	1999	2000	2001	2002	2003
GDP real growth	9.8	4.6	-0.6	7.3	6.5	6.0	4.7
GDP (bln EEK)	64.0	73.5	76.3	87.4	97.9	108.0	116.2
GDP deflator	11.3	9.8	4.5	6.7	5.4	4.1	3.0
Consumer price index	11.2	8.2	3.3	4.0	5.8	3.6	1.3
Employment (15–74 years, ths)	617.2	606.5	579.3	572.5	577.7	585.5	594.3
Employment growth	-0.3	-1.8	-4.5	-1.2	0.9	1.4	1.5
Productivity growth	10.1	6.5	4.0	8.6	5.5	4.4	3.2
Unemployment rate	9.6	9.9	12.2	13.6	12.6	10.3	10.0
Average wages (EEK)	3571	4100	4418	4876	5511	6144	6709
Wage real growth	7.6	6.0	4.3	6.1	6.9	7.0	8.3
Investments and inventories (% of GDP)	28.0	29.3	24.5	27.8	28.9	31.4	32.9
Current account (% of GDP)	-12.1	-9.2	-4.7	-5.8	-6.0	-12.3	-13.7

Source: Ministry of Finance of Estonia, Statistical Office of Estonia, Bank of Estonia.

Appendix 2. Main macroeconomic forecasts for the years 2002–2008 (%)

	2004	2005	2006	2007	2008
GDP real growth	5.3	5.8	5.6	5.9	5.8
GDP (bln EEK)	126.9	139.2	151.7	165.4	180.1
GDP deflator	3.8	3.6	3.2	3.0	2.9
Consumer price index	3.1	3.0	2.8	2.8	2.8
Employment (15–74 years, ths)	598.4	602.6	604.1	605.2	606.4
Employment growth	0.9	0.7	0.3	0.2	0.2
Productivity growth	4.3	5.1	5.4	5.7	5.6
Unemployment rate	10.0	9.4	9.5	9.4	9.4
Average wages (EEK)	7260	7762	8291	8914	9715
Wage real growth	5.1	3.8	3.9	4.6	6.0
Investments and inventories (% of GDP)	33.3	33.4	33.9	34.2	34.7
Sources of growth					
Current account (% of GDP)	-13.0	-11.4	-10.8	-9.6	-8.7
Private consumption	6.2	6.0	6.3	5.4	5.3
General government consumption	6.5	3.9	3.6	3.3	3.1
Gross fixed capital formation	6.7	9.1	7.8	7.7	7.7
Change in inventories (% of GDP)	2.5	1.9	1.6	1.4	1.3
Export of goods and services	7.4	8.5	9.9	9.3	9.3
Import of goods and services	7.2	7.9	8.9	8.7	8.5
Contribution to GDP growth					
Domestic demand (excl. inventories)	6.5	6.9	7.1	6.8	6.4
Change in inventories	-0.3	-0.5	-0.2	-0.1	0.0
External balance of goods and services	-0.9	-0.6	-1.2	-0.8	-0.5
Growth of value added					
Agriculture	1.4	1.8	2.6	2.8	2.9
Industry	8.5	8.9	7.5	7.9	7.1
Construction	7.4	6.6	6.8	6.4	6.7
Services	4.2	4.7	4.9	5.3	5.4

Source: Ministry of Finance of Estonia, Statistical Office of Estonia, Bank of Estonia.

Appendix 3. Basic assumption of forecast of the Estonian economic development for the years 2002–2008

	2002	2003	2004	2005	2006	2007	2008
Short-term interest rate (annual average)	3.3	2.3	2.2	2.7	3.3	3.7	3.7
Long-term interest rate (annual average)	4.9	4.1	4.3	4.5	4.6	4.9	4.9
USD/EUR exchange rate (annual average)	0.95	1.13	1.28	1.22	1.10	1.00	1.00
EEK exchange rate vis-à-vis the EUR (annual average)	15.647	15.647	15.647	15.647	15.647	15.647	15.647
World GDP growth	3.0	3.5	4.1	4.0	4.0	4.0	4.0
United States, GDP growth	2.5	2.8	3.8	3.3	3.0	3.0	3.0
EU-15 GDP growth	1.1	0.8	2.0	2.4	2.5	2.5	2.5
Oil prices (Brent, USD/barrel)	25.0	28.3	25.5	25.0	25.0	25.0	25.0

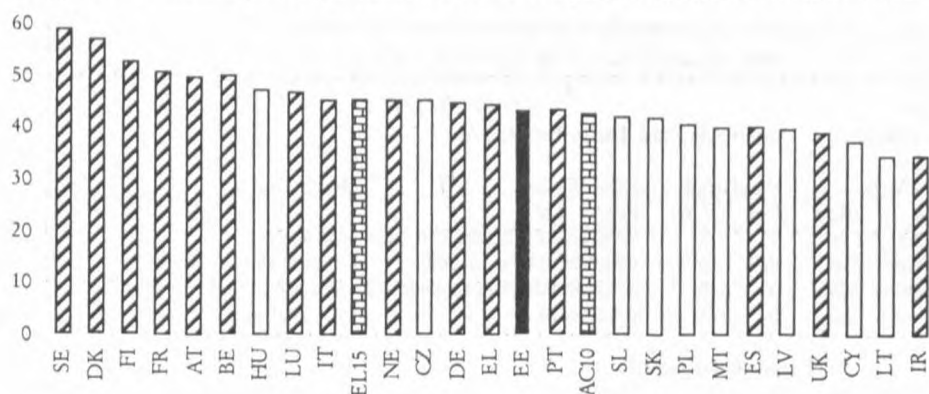
Source: Ministry of Finance of Estonia.

Appendix 4 – Comparison of economic forecasts of the Estonian economy for the years 2004 and 2005

	GDP growth, %		Consumer price index, %		Current account, % of GDP	
	2004	2005	2004	2005	2004	2005
Ministry of Finance of Estonia	5.3	5.8	3.1	3.0	-13.0	-11.4
European Commission	5.4	5.9	2.8	2.9	-11.5	-9.1
IMF	5.5	5.0	3.0	2.5	-11.0	-7.5
Bank of Estonia	5.2	5.8	4.0	3.4	-11.1	-9.2
Estonian Institute of Economic Research	6.0		3.5		-13.0	

Source: Ministry of Finance of Estonia; European Commission. Economic Forecast. Spring 2004; IMF. World Economic Outlook. Advancing Structural Reforms. April 2004; Bank of Estonia. Economic Forecast. November 2003; Estonian Institute of Economic Research, Vol. 1. March 2004.

Appendix 5. Estonian general government revenues compared with other EU Member States



Source: Ministry of Finance of Estonia, Statistical Office of Estonia, European Commission.

Appendix 6. General government budget of Estonia in 2003 and forecasts for 2004–2008 (% of GDP)

	2003	2004*	2005*	2006*	2007*	2008*
Budget balance by sub-sectors						
General government	2.6	0.7	0.0	0.0	0.0	0.0
Central government	2.4	0.6	0.1	0.1	0.1	0.1
Of which: pension insurance contribution	0.2	-0.3	-0.5	-0.7	-0.7	-0.6
State government	-	-	-	-	-	-
Local government	-0.5	-0.3	-0.2	-0.2	-0.2	-0.2
Social security funds	0.7	0.4	0.1	0.1	0.1	0.1
General government						
Total receipts	41.9	44.0	42.7	41.9	40.3	39.7
Total expenditures	39.3	43.3	42.7	41.9	40.3	39.7
Budget balance	2.6	0.7	0.0	0.0	0.0	0.0
Interest payments	0.3	0.3	0.3	0.3	0.3	0.3
Primary balance	2.9	1.0	0.3	0.3	0.3	0.3
Components of revenues						
Taxes	23.3	23.7	23.5	22.5	21.8	21.7
Social contributions	12.3	12.0	11.4	11.2	11.1	11.1
Other revenues	6.3	8.2	7.9	8.2	7.4	6.9
Total receipts	41.9	44.0	42.7	41.9	40.3	39.7
Components of expenditures						
Collective consumption	8.8	9.4	9.3	9.0	8.2	8.0
Social benefits in kind	9.8	10.2	10.0	9.9	9.9	9.8
Social transfers other than in kind	13.8	14.6	14.6	14.5	14.4	14.4
Interests	0.3	0.3	0.3	0.3	0.3	0.3
Subsidies	1.2	1.4	1.6	1.6	1.6	1.6
Gross fixed capital formation	4.1	5.0	4.7	4.6	4.2	4.2
Other expenditures	1.3	2.3	2.2	2.0	1.7	1.4
Total expenditures	39.3	43.3	42.7	41.9	40.3	39.7

Source: Ministry of Finance of Estonia, Statistical Office of Estonia

Appendix 7. The (ASCII) file VAMEST.CFG

```

# *****
# *      Matrices and Vectors of the ESTONIAN MODEL      *
# *****
#
1990 2015      #start date e last date in the VAM file
#
#Name          Number of   Files of titles          Description
#   Row   Col   Lag   Row   Col
am   56   56   0   ttl\en\set.ttl ttl\en\set.ttl # input-output matrix
mm   56   62   0   ttl\en\set.ttl ttl\en\ic_fd.ttl # import shares matrix
gm   56   4    0   ttl\en\set.ttl ttl\en\vadcomp.ttl # value added matrix
out  56   1    5   ttl\en\set.ttl          # sectoral output
#
# Final demand components
pceo 56   1    0   ttl\en\set.ttl          # Private consumption expenditure
ccp  56   1    0   ttl\en\set.ttl          # Private collective consumption
gov  56   1    0   ttl\en\set.ttl          # Total Public consumption
pde  56   1    0   ttl\en\set.ttl          # Investment by producers
ven  56   1    0   ttl\en\set.ttl          # Inventory Changes
ex   56   1    0   ttl\en\set.ttl          # Exports
imp  56   1    0   ttl\en\set.ttl          # Imports
fd   56   1    0   ttl\en\set.ttl          # Final demand
dump 56   1    0   ttl\en\set.ttl          # scratch
#
# Employment and Labour productivity
emp  56   1    3   ttl\en\set.ttl          # Employment
#
# Value added components and their related per unit of output
wag  56   1    0   ttl\en\set.ttl          # Wages
taxprod 56   1    0   ttl\en\set.ttl          # Net taxes on products
indtax 56   1    0   ttl\en\set.ttl          # Indirect taxes (on production)
rge   56   1    0   ttl\en\set.ttl          # Profits
#
# Value added components in flows
wagv 56   1    0   ttl\en\set.ttl          # Wages
rgev 56   1    0   ttl\en\set.ttl          # Profits
taxprodv 56   1    0   ttl\en\set.ttl          # Net taxes on products
indtaxv 56   1    0   ttl\en\set.ttl          # Indirect taxes
vad   56   1    0   ttl\en\set.ttl          # Value added
unitva 56   1    0   ttl\en\set.ttl          # Value added after distribution
#
# Foreign prices
pim  56   1    5   ttl\en\set.ttl          # Import
cim  56   1    0   ttl\en\set.ttl          # Cost of imported materials
#
# Home prices
pdm  56   1    5   ttl\en\set.ttl          # Domestic (production) prices
pmix 56   1    0   ttl\en\set.ttl          # Domestic (consumption) prices
#
# File delle fixes
fix  200  1    0   fix.ttl                  # ausiliary
sdc  56   1    0   ttl\en\set.ttl          # discrepancies

```

Maurizio Grassini, Tiit Paas

SPRAWOZDANIE O STANIE GOSPODARKI ESTONII ORAZ POSTĘPACH W ZAKRESIE BUDOWY WIELOSEKTOROWEGO MODELU ESTOŃSKIEJ GOSPODARKI

W opracowaniu przedstawiono rozwój gospodarki Estonii w ostatnich latach w świetle danych International Institute of Management Development (IMD) World Competitiveness Yearbook (WCY) oraz wskaźnika wzrostu konkurencyjności szacowanego przez Światowe Forum Ekonomiczne. Estonia jawi się jako najbardziej konkurencyjny spośród europejskich krajów postsocjalistycznych. Gospodarka Estonii opiera się na wolności ekonomicznej i otwartości. Do szybkiego rozwoju tego bałtyckiego kraju przyczyniły się liberalizacja gospodarki, wsparcie finansowe Unii Europejskiej oraz duża ilość bezpośrednich inwestycji zagranicznych. Obecnie estońska polityka finansowa i dług publiczny w pełni odpowiada kryteriom strefy euro. Wprowadzenie tej waluty jest jednym z priorytetów rządu, i można się spodziewać, że w najbliższym okresie stanie się faktem.

Druga część opracowania zawiera opis makroekonomicznego, wielosektorowego modelu gospodarki Estonii w jego obecnym kształcie. Powstaje on w ramach współpracy naukowej pomiędzy Uniwersytetem Tartu i Uniwersytetem Florenckim. Model ten korzysta z podejścia INFORUM. Pomimo, że dostępność danych dla Estonii jest wciąż niewielka (jak to zresztą jest w przypadku wielu nowych członków UE, wprowadzających dopiero standardy Eurostatu), udało się oszacować bloki równań opisujące udziały importu oraz wydajność pracy. Bloki te zostały włączone do modelu, opartego na tablicy input-output. Wyniki symulacji otrzymane przy zastosowaniu scenariusza zaproponowanego przez estońskie ministerstwo gospodarki wskazuje możliwości wykorzystania tego typu podejścia modelowego dla celów polityki ekonomicznej.