The Core of a Macro-economic Model for Estonia [*]

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This article presents a macro-econometric model for Estonia currently developed at the Bank of Estonia. It is based on a basic macro-economic framework that integrates both supply and demand side components. With this model we analyse the policy that should be implemented to maintain sustainable growth. The main emphasis is on the need to continue tough fiscal policy in order to maintain public deficit, as well as to avoid inflationary pressures and keep Estonia attractive to foreign investors.

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Introduction

This paper presents a new model for Estonia, which has been developed in the Bank of Estonia. The major objective is to propose a forecasting model aimed to analyse whether the continuation of tough policy is appropriate while Estonia is trying to continue to attract foreign investors.

Before presenting major issues facing Estonian economy it is worth to briefly recall recent economic events. Economic development has resumed in Estonia from the second half of 1999. Stable economic and legal environment and proper policies have supported the rapid return to relatively strong growth after the economic recession partly prompted by the Russian crisis. In particular the government's stability-oriented macroeconomic policy has led to a restructuring and a rapid adjustment to the new conditions by enterprises and other economic agents.

The share of Estonian exports to the EU has been constantly increasing, especially in the aftermath of the Russian crisis. By June 2000, Estonia's export (except transit exports) to the EU accounted for 73% of total exports while imports from the EU accounted for 73% of total Estonian imports. Estonia's main trading partners are Finland, Sweden and Germany and the main exports to the EU are machinery and electrical equipment, wood and mineral products, while most important import products are machinery and electrical equipment, agricultural products including processed foodstuffs and transport equipment.

Estonia has a very liberal external trade and payments regime. In November 1999, it joined the World Trade Organisation (WTO). In January 2000 a limited number of tariffs on a selected number of agricultural products were introduced for countries with which Estonia has no free-trade agreement. Tariffs have been set at rates below the level agreed in the WTO agreement. Some of the few remaining restrictions on foreign direct investment were removed.

All small and medium enterprises (SME) are privately owned, while only a very small number of large companies have yet to be privatised. More than 99% of enterprises in Estonia are SMEs. The share of SMEs is largest in wholesale and retail activities and in construction, while larger enterprises are dominant in industry, energy production and fishing. At the end of 1998, SMEs accounted for about 47% of the total workforce, and for more than 74% of enterprise employment.

Estonia has continued to attract high level of foreign direct investment inflows. Gross foreign direct investment inflow reached 5.96% of GDP in 1999 and 5.7% in the first half of 2000.

Except in the declining number of well-defined areas, there are no significant barriers to market entry. In fact, the number of new companies being entered in the Commercial Register increased from about 4,200 during 1 October 1998–1 June 1999 to about 5,600 in 1999–2000.

Table 1. Some data on Estonia

ESTONIA	1995	1996	1997	1998	1999	2000
GDP growth	4.6	4.0	10.4	5.0	-0.7	6.9
CPI inflation	29.0	23.1	11.2	8.2	3.3	4.0
General government balance to GDP ratio	-1.3	-1.9	2.2	-0.3	-4.7	-0.7
Current account to GDP ratio	-4.4	-9.2	-12.1	-9.2	-4.7	-6.4

Sources: Statistical Office of Estonia, Bank of Estonia

The future developments of Estonian economy will primarily depend on the competitiveness of Estonian goods, which depends on two factors: price and non-price competitiveness. This model emphasises how crucial it is for Estonia to further improve non-price competitiveness. Even if Estonia has already achieved substantial progress that renders possible integration to the EU, there are still some gains to obtain in terms of non-price competitiveness to ensure sustainable development. More precisely it is necessary to continue to attract foreign investors, so that non-price competitiveness continues to improve.

The paper is organised as follows: Section 1 presents the methodology used, and how supply effects are integrated, Section 2 presents the model itself, Section 3 some simulation results, emphasising policy issues and Section 4 draws some conclusions.

1. Methodology

In this Section the methodology used to build the model is described. Starting with very standard equilibrium correction models (see Section 1.1) we discuss the main features of Estonian economy that we would like this model to reflect (see Section 1.2) and the problem of the lack of data on capital stock. We also discuss how we deal with the structural change that has occurred in Estonia (see Section 1.3).

1.1. General Principles

We work with an expenditure based component model:

(1) $$Y = C + I + G + X - M$$

where Y is the GDP, C consumption, I investment, G public expenditures, X exports and M imports. This relationship always holds by identity. We then have to model the components of the GDP. To do so we use a standard equilibrium correction model (ECM) to represent the dynamic of the variables studied:

(2) $$\Delta y_t = \sum_{i=1}^{k} \alpha_i \Delta y_{t-i} + \sum_{i=0}^{k'} \beta i \Delta x_{t-i} - \gamma\left(y_{t-1} - y_{t-1}^{*}\right) + \nu_t$$

where x_t is a vector that represents other variables that influence the dynamic of y_t, $\gamma>0$, $(\alpha_i,\beta_i) \in \Re^2$. y_t^* is the long-run value for y_t, and is a linear combination of different variables and ν_t a white noise. The third term of the equation (2) is the equilibrium correction term. When y_t is above its long-run target, then it tends to render the variation of y_t negative. Therefore y_t moves back to the target.

1.2. The Model

What drives productivity in Estonia? The answer to this question is one of the most crucial factors for understanding the growth path followed by Estonia. Engaged in the process of joining the European Union, Estonia has encountered a sharp increase in the GDP during the last eight years, while employment was slightly decreasing. Hence, a rather simple exploration of data shows that some productivity gains have been obtained.

The source of this productivity gain matters, as it is the key determinant of Estoni''s long-run growth. It has also been widely acknowledge by new growth theories since the seminal contributions of Romer (1986) and Lucas (1988), that capital stock accumulation (physical or human) can be a medium of technological diffusion, which gives foundations to explain convergence issues.

A problem that we had to deal with is the lack of data on capital stock. We therefore modelled our problem in a state-space form that allows estimating the capital stock. We draw from the contribution of Hall and Basdevant (1999) who provide methodology to estimate capital stock using the Kalman filter (see Section 1.1). We extend this methodology to provide a deeper explanation of technological progress, as Hall and Basdevant do not integrate any specific assumption on it. Because of data limitations (see Section 1.3) we had to integrate much more *a priori* knowledge into the model and; therefore, impose *a priori* what were the variables of interest, namely inflation, imports and exports (see Sections 1.2.1 to 1.2.3). The reason why we put a particular emphasis on those variables is that those three are crucially dependent on capital stock, either through the output gap or through labour productivity that both depend on the effective capital stock. In the next two Sections we elaborate on the reasons of this choice, emphasising also some other particularities of Estonia when analysing inflation and trade. We also discuss how we view the long-run prospects of the Estonian economy through the Romer effect induced by the capital stock (see Section 1.2.3), before discussing the econometric and modelling issues (see Section 1.3).

1.2.1. Inflation

As Estonia can obviously be considered a small open economy, inflation is mostly driven by foreign prices. Hence the domestic producer price index is modelled as a dependent on the producer price index of the European Union. This element is particularly important, as some Estonian prices are still lower than the European ones, therefore, one can expect to see further inflation in the future. Namely, inflation will be dependent on a convergence process of Estonian prices towards European prices.

As a result of demand pressures, inflation is also dependent on output gap (see Sepp *et al* (2000)). Hence, we estimated and kept a simple specification where current inflation is dependent on current foreign inflation and the output gap.

1.2.2. The Role of Potential Output

A strong emphasis is put on‘'non-pric'' competitiveness. It is justified because imports of a transitional economy are strongly dependent on a supply-side constraint (see Basdevant (2000)), which applies to the case of Estonia (see Ehrlich *et al* (2001)). As mentioned by Ehrlich *et al* (2001) a substantial part of imported goods come from equipment goods that are required to build competitive productive capacity. Hence, given the fact that most of those exchanges are with the European Union, imports are not likely to depend much on price competitiveness (see Gacs *et al* (2001)), but more on the capacity building process.

Regarding exports the problem is mostly related to the future prospects for the Estonian economy. Actually Estonian companies have little control over their prices, and the pegging of the Estonian kroon to the euro leaves relatively few prospects in terms of price competitiveness in the long run. Hence, besides the demand from the rest of the world (that is for obvious reasons represented by total imports of the European Union), exports are going to be driven by potential productivity gains, proxied by the ratio of potential output to total employment.

Estonian trade structure is of a particular nature, as many imported goods are actually aimed to be re-exported once some value has been added in Estonia (mostly the manufacturing part of the production process, because of lower labour costs). Hence we decided to model imports as a function not only of domestic demand but also of exports, while exports are driven by foreign demand. We found significant coefficients for exports in the import function.

1.2.3. Long-run Growth

There are much more crucial issues that concern Estonian economy in the long run. By explicitly integrating an endogenous technological progress that depends on the capital stock we integrate a key aspect of the transition: by opening frontiers a transitional economy is going to benefit from technological transfers (see Romer (1993, 1994) or Grossman and Helpman (1994)), that will foster long-run growth and ensure sustainable development. This kind of effect has been studied in the literature especially by looking at the direct impact of foreign direct investment (FDI) on productivity gains (see Blanchard *et al* (1991) Hunya (1997) Djankov and Hoekman (1998) or Holland and Pain (1998)). Although FDI may help to provide an access to further technological transfers, we implicitly considered that the channel by which FDI affect the economy is much more indirect, ie transits through their impact on investment[1]. FDI can foster real investment, which will increase capital stock. It is the capital itself that will influence the technological level, while it keeps, of course, its direct impact on the economy as a production factor.

1.3. Structural Change and the State-space Models

Before presenting the specification it is worth discussing the specific issues we had when estimating the effective capital stock. Basically the problem was twofold: data are relatively limited and exhibit structural change. As pointed by other contributions on transition economies (see Hall (1993), Hall and O'Sullivan (1994), Hall and Koparanova (1995), Greenslade and Hall (1996), Basdevant (2000)) econometric modelling can still be a useful tool, but it must take explicit account of the form of change that has taken place.

The first implication of short time series is that we have to integrate much more *a priori* knowledge we have on the economy. This applies even more to a transition economy, were

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[1] The reason lies in that among FDI two types have to be distinguished: those that imply the creation of a new productive capacity, and those that are just the result of acquiring existing firms by foreign investors. For the latter – which are actually relatively important - there is no reason to assume that they can be totally and directly assimilated to productivity gains. In other words, what is really important is how we understand technological progress. A possible way is to consider that it is dependent on FDI. But as we mentioned this assumes probably too much given the structure of FDI. Another way that we preferred to adopt involves understanding technological progress through capital stock accumulation and only thereafter modelling investment as dependent on FDI. It is probably reasonable to consider a situation in between, but given the limited data set we had, we chose arbitrary to estimate a model that is simple, in line with new growth theories and that can be applied to the specific case of Estonia. As the question of productivity and capacity building is obviously a crucial one, we therefore opted for a kind of 'AK' model.

the future growth path of the economy may substantially differ from its past, which by nature renders difficult the usual statistical inference.

One way to capture such a phenomenon is to model explicitly a long-run growth path that is in line with reasonable theory and some main features of the economy. A concrete application of this is that we decided to calibrate some long-run relations so that the elasticity of each variable to its long-run target (defined as another variable or a linear combination of variables) to be equal to one. Another point to consider is that calibrating coefficient and/or imposing restrictions on them is crucial when the number of data is rather limited in order to keep enough degrees of freedom when performing estimations.

Another way, also adopted here, is to use specific econometric methods. Here the choice of estimating relations using a state-space model is justified as we want to derive an estimate of the capital stock, but it can also be integrated in a wider perspective, where a parameter has to be estimated and because of a structural change we have some reasons to believe that this parameter is going to vary in time. Hence, the estimate we provide is not only the best estimator for the capital stock under the specification proposed, but it is also a parameter that captures structural change. This is also in line with other studies (see Hall and Basdevant (1999) or Basdevant (2000)), where structural change in transition economies is substantially captured by the fluctuations of capital stock, as most of productive capacities of formerly centrally planned economies were not valuable at market prices and; therefore, have to be substantially improved to allow a growth recovery.

2. The Model Structure

A first requirement we had when building this model is to have a unique tool that can be used for both forecasting exercises and policy simulations. The former requires the model to fit to data, while the latter requires it to be tractable enough. To do so we adopted a‘'top-dow’' approach, where we defined the general structure, adding economic theory in it, and then estimated parameters. It is rather different from standard statistical inference, where a lot of emphasis is put on the coherence of individual equations, and very few on the consistency of the model as a whole.

This is reflected in all simulation properties (see Section 3), where response functions can be rather easily analysed given the three major transmission mechanisms:

- public deficit influences negatively foreign direct investment;
- private domestic investment is positively related to FDI;
- growth prospects strongly depend on productivity that mostly depends on the potential output and; therefore, on capital stock accumulation and investment.

The model developed is based on five major sectors:

- real sector, including GDP, GDP components, disposable income;
- monetary sector, including nominal prices, interest rates and money demand;
- labour sector;
- external sector, including balance of payment with specific emphasis on the trade balance;
- fiscal sector.

The rest of the Section presents key equations of the model, emphasising how we modelled the points discussed in the previous Section. Some more details on estimation results and equations can be found in Annex 4.

2.1. Output Gap, Productivity and Capital Stock

Now that we have identified the variables of interest and some specific features to be integrated we can move to the concrete specification and proceed the estimation of the model. As we will see, despite its simple structure and some calibrated coefficients, the model can still provide an estimate of the capital stock that captures relatively well Estonia's recent past. In this Section we present the estimate of the capital stock, as well as the methodology used.

2.1.1. Specification

The state-space model we specified could not be directly estimated with the Kalman filter, because of the presence of contemporary variables (namely, current imports are dependent on current exports). Therefore, we had to estimate this model in two steps.

- First, we estimated all the equations separately without state variables. As a result of the limited data set, we added prior information on the specification by assuming that co-integrating vectors are known. The equations were then estimated using two-stages least squares. The approach we took is also an example of the ideas discussed in Greenslade *et al* (2000) in that we imposed theoretical structure on the data and estimated a very particular conditional system. We did this because in a small sample with data exhibiting not enough stability we were not confident of correctly being able to identify the co-integrating vectors that corresponded to the structural relations we were attempting to estimate.
- Second, we took the residuals of each equation, and used a state-space form to filter the impacts of the output gap and productivity. In other words, the residuals taken from the estimated equations still exhibit some pattern that we are able to interpret as the impacts of either the output gap or the labour productivity.

The equations where estimated using quarterly data ranging from the first quarter of 1993 to the first quarter of 2001, provided by the Bank of Estonia and the Statistical Office of Estonia.

2.1.1.1. First Step: Defining Signals

Next we adopted the following convention: lower cases refer to natural logarithms of upper cases, which represent the level of the index considered. Let m be total imports, x total exports, ppi the producer price index, m^{EU} total imports of the European Union, d the domestic demand, e the nominal effective exchange rate and p^* the foreign price index.

(3) $$\Delta m = \alpha^1 + \alpha^2 \Delta x + \alpha^3 \left(m_{-1} - \alpha^4 x_{-1} - \left(1 - \alpha^4\right) d_{-1}\right) + \alpha^5 \left(e_{-1} + p^*_{-1} - ppi_{-1}\right) + u^M$$

(4) $$\Delta ppi = \beta^1 + \beta^2 \left(ppi_{-1} - e_{-1} - p^*_{-1}\right) + u^P$$

(5) $$\Delta x = \gamma^1 + \gamma^2 \Delta x_{-1} + \gamma^3 \left(x_{-1} + \gamma^4 m^{EU}_{-1}\right) + u^X$$

2.1.1.2. Second Step: State-space Model

There are three measurement equations, given by the residuals obtained from previous estimations from which we want to filter some information on the capital stock. We defined the potential output as the level of production compatible with the current level of factors. Hence we *de facto* ignored the problem of the utilisation rate of equipment. We cannot have any information on the utilisation rate of the capital stock. Therefore, we estimated an aggregate that integrates both capital stock and its utilisation rate, and is to be viewed as an‘'effectiv'' capital stock, rather than the capital stock itself.

(6) $$u^M = \alpha^6 \left(y - \left(k + \omega^2 n\right)\right) + \varepsilon^M$$

(7) $$u^P = \beta^3 \left(y - \left(k + \omega^2 n\right)\right) + \varepsilon^P$$

(8) $$u^X = \gamma^5 \left(\left(k + \omega^2 n\right) - n - w - \gamma^6\right) + \varepsilon^X$$

where *y* is the GDP, *n* employment, *k* the capital stock and *w* the real wage. The first two equations evaluate the impact of the output gap on imports and inflation, respectively. The elasticities α^6 and β^3 measure this impact, and are expected to be positive. The last equation evaluates the impact of productivity on exports and the elasticity γ^5 measures this impact. It is expected to be positive. As we explain below, the capital stock is scaled so that the output gap takes the value 0 on average and; therefore, we had to add a constant in the last equation, γ^6, as on average the variable u^X is by construction equal to 0.

Capital stock is defined by the standard accumulation function:

(9) $$K = \left(1 - \delta\right) K_{-1} + I + \varepsilon^K$$

where *K* and *I* are the respective levels of capital stock and investment and δ is the depreciation rate. The problem is that this state equation is not linear in the logarithm of *K*. To linearise the relation we follow the methodology of Hall and Basdevant (1999) by taking the natural logarithm of this relation, and by transforming the capital stock accumulation equation so that the model can be linear in the logarithm of variables:

(10) $$k = k_{-1} - \delta + Ln\left(1 + \tfrac{I}{\overline{K}}\right) + u^k$$

where $\overline{K}$ is a benchmark for the capital stock that represents the long-run value of this index: $\overline{K} = \frac{1}{\delta} I_0$. Hence, having transformed the model in logarithm we now have the specification that can be estimated by the Kalman filter. Since we are modelling in the logs of the variables, the scaling of the unobserved capital stock can be arbitrarily chosen. We therefore calibrated the initial value in the estimations so that the output gap takes the value of 0 on average. The coefficient ω^2 was calibrated to 0.6 so that it represents approximately the share of labour in total revenues. We also calibrated the coefficient δ to 1 per cent, which represents a standard value for quarterly data.

2.1.2 Results

2.1.2.1. First Step

When estimating the equations by 2SLS, we found that some dummies had to be integrated because of structural change (for example, some dummy variables were added to capture the impact of the Russian crisis in 1998). The complete description of the results is shown in Annex 5. As we can see it is rather difficult to estimate some significant impact of variables that are likely to currently influence Estonian economy. For instance, the impact of real exchange rate cannot be found significantly different from zero. This is not surprising as for a long time Estonian imports were mostly dependent on the restructuring of the economy. Nevertheless, there are clear indications that imports are increasingly dependent on the real exchange rate (see Sepp *et al* (2000)). As those equations are estimated in the perspective of integrating them in a forecasting model we, therefore, decided to keep the variable.

Table 2. Results of the first step

PARAMETER	COEFICIENT	STD ERROR	T-STATISTIC
α^2	0.59	0.18	3.35
α^3	-0.53	0.19	-2.82
α^4	0.88	0.10	9.06
α^5	-0.03	0.06	-0.51
β^2	-0.27	0.04	-6.65
γ^2	0.55	0.28	1.97
γ^3	-0.35	0.20	-1.72
γ^4	-1.68	0.17	-9.76

In the following Table some statistics on residuals of measurement equations are provided, showing that they all pass the Bera-Jarque normality test when testing at 5% or 10%, and also that Box-Pierce statistics show a lack of significant correlation of residuals.

Table 3. Residuals statistics

Imports			**Bera-Jarque**	1.161927	
LAG	1	2	3	4	5
BOX P.	0.86	2.68	3.26	3.31	6.02
PPI			**Bera-Jarque**	1.825246	
LAG	1	2	3	4	5
BOX P.	2.02	2.05	2.06	2.74	2.76
Exports			**Bera-Jarque**	0.048838	
LAG	1	2	3	4	5
BOX P.	0.36	0.50	1.17	2.03	2.96

2.1.2.2. Second Step

After estimating those equations we filtered the residuals to estimate capital stock, as discussed in the previous Section.

Table 4. Results of the second step

State space model				
	Coefficient	Std. Error	z-Statistic	Prob.
α^6	0.08	5.9E-5	1563.4	0.00
β^3	0.09	2.0E-5	4851.0	0.00
γ^5	0.20	5.6E-4	355.0	0.00
γ^6	5.02	0.06	87.9	0.00
	Final State	Root MSE	z-Statistic	Prob.
CAP	5.48	0.08	71.6	0.00
Log likelihood	160.5771		Akaike info criterion	-12.5262
Parameters	4		Schwarz criterion	-12.3312
Diffuse priors	1		Hannan-Quinn criterion	-12.4721

In the following Table some statistics on residuals of measurement equations are provided, showing that they all pass the Bera-Jarque normality test when testing at 5% or 10%, and also that Box-Pierce statistic show a lack of significant correlation of residuals.

Table 5. Residuals statistics

Imports			**Bera-Jarque**	0.761900	
LAG	1	2	3	4	5
BOX P.	0.30	1.43	1.76	1.80	6.71
PPI			**Bera-Jarque**	0.673786	
LAG	1	2	3	4	5
BOX P.	1.19	1.20	1.29	1.96	1.98
Exports			**Bera-Jarque**	0.679705	
LAG	1	2	3	4	5
BOX P.	0.26	0.34	0.67	1.32	3.97

It is also interesting to show the estimated value of the capital stock:

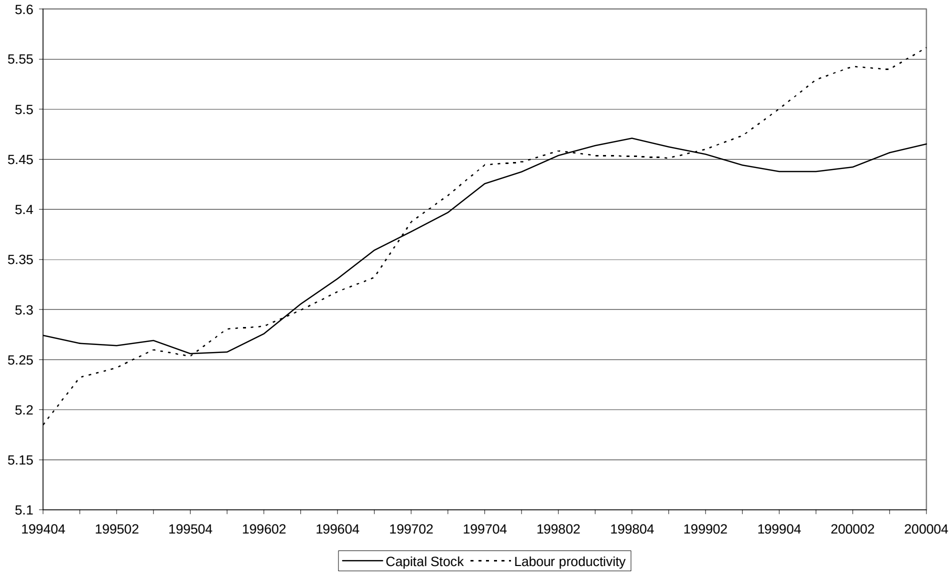

Figure 1. Capital stock

What we can see from this Figure is that the filter has provided an estimate of the capital stock, which explains labour productivity increase that has occurred in Estonia till the beginning of 1999. They diverge in 1999 mainly due to the Russian crisis, when investments into capital stock decreased very sharply. Quite surprisingly, labour productivity continued to grow after the Russian crisis, which may indicate the flexibility of Estonian labour market. This divergence is probably temporal and we expect those lines to move together in the long run. Thus, it emphasises the need to continue reforms aimed at rebuilding domestic productive capacity so that Estonia can continue to benefit from further integration form the European Union.

It is worth noting that the driving forces of the Estonian economy are mostly supply-side forces, which is not surprising given its transitional nature. Despite the substantial progress already achieved by Estonia there are still some further improvements required in order to maintain relatively low inflation rate and sustainable current account deficit. The current paper suggests that this should be achieved through a continuous improvement of the capital stock. These points are further developed in the rest of the paper, especially in Section 3, discussing the simulation results. But before that, we must complete the description of the model structure, which is done in the following Sections.

2.2 Monetary Sector

Regarding the monetary sector, we adopted a simple structure, where prices are driven by foreign prices and the *ppi*. Some specific features of Estonia were integrated, regarding mostly consumer prices. The *cpi* can be split into two parts: the price of tradable goods, p^{CT}, that depends on *ppi* and foreign prices p^{M}, and the price of non-tradable goods, p^{CN}, that is actually mostly dependent on administrated prices and can therefore be treated as exogenous (see Sepp *et al* (2000)). In the following equations the coefficient α actually refers to the constant and dummy variables incorporated in the equations.

(11) $$\Delta p^{CN} = \alpha + 0.6\,\Delta p^{CN}_{-1}$$

(12) $$\Delta p^{CT} = \alpha + 0.9\,\Delta ppi + 0.1\,\Delta p^{M} - 0.3\left(p^{CT}_{-1} - 0.9\,ppi_{-1} - 0.1\,p^{M}_{-1}\right)$$

(13) $$p^{C} = 0.3\,p^{CN} + 0.7\,p^{CT}$$

The GDP deflator – p^{Y} – is linked to the consumer price index, assuming that it is dependent on domestic prices (*ppi*) and administrated prices (p^{CN}). The influence of foreign prices is indirectly captured by its influence on *ppi* and p^{CT}.

(14) $$p^{Y} = \alpha + p^{C}$$

The investment deflator – p^{I} – is modelled as being dependent on *ppi*, again in a very simple manner. As for p^{Y}, the influence of foreign prices is incorporated indirectly through *ppi*.

(15) $$p^{I} = \alpha + ppi$$

Import deflator, p^{M}, is dependent on foreign prices:

(16) $$p^{M} = \alpha + \left(e + p^{*}\right)$$

Following a standard modelling of price setting *à la* Obstefld and Rogoff (1995) we consider producer currency pricing. Therefore, we ruled out local currency pricing as developed by Krugman (1987), Betts and Devereux (1996, 2000). The underlying assumption here is that Estonia, being a small open economy and the Estonian kroon being pegged to the euro, has a strong tendency for price convergence towards western European prices, especially since the Russian crisis.

Export deflator is linked to *ppi* assuming that Estonian exporters mostly set their price in local currency, reflecting the comparative advantages in terms of prices:

(17) $$p^{X} = \alpha + ppi$$

Regarding interest rates, we considered that real interest rates are exogenous, as Estonia is a small open economy, therefore, we linked nominal interest rate to π, the inflation on *ppi*:

(18) $$\left(r-\pi\right)=\alpha+0.8\left(r_{-1}-\pi_{-1}\right)$$

2.3. Labour Market

Regarding the labour market, we basically built the wage equation as a supply function, while employment is modelled as a demand function. The real wage, *w*, is dependent on a positive deterministic trend, to capture the pressure of workers to improve their purchasing power. Demand for labour is standard and corresponds to the optimal behaviour of the enterprise that equalises marginal productivity of labour to the real wage.

(19) $$w=\alpha+0.02\times trend$$

(20) $$\Delta n=\alpha+0.04\Delta n_{-1}-0.02\left(n_{-1}-y_{-1}+w_{-1}\right)$$

2.4. Real Sector

The real sector is driven by consumption and investment. We modelled private investment, i^r, private consumption, c^r, and regarding public expenditures we assumed that public investment is exogenous while public consumption was modelled as following GDP growth.

Basically private expenditures depend on disposable income y^{dis} and real interest rate. For consistency of the results we constrained the long-run elasticities of those expenditures to GDP to be equal to one.

(21) $$\begin{aligned}\Delta i^r &= \alpha+0.4\Delta i^r_{-1}+0.4\Delta y^{dis}-0.2\left(i^r_{-1}-y^{dis}_{-1}\right)-0.3\left(r_{-1}-\pi_{-1}\right)\\ &+0.1\Delta fdi+0.5\,fdi_{-1}+0.3\,fdi_{-2}+0.1\,fdi_{-3}\end{aligned}$$

Foreign direct investment *fdi* has a positive impact on private investment as it provides additional resources to finance it. Its impact on growth is therefore indirect: direct investments first help private investment and then contribute to capital stock accumulation. Real interest rate $r-\pi$ negatively influences investment, following a standard specification:

(22) $$\Delta c^r=\alpha+0.3\Delta y^{dis}-0.04\left(c^r_{-1}-y^{dis}_{-1}\right)$$

Consumption is assumed to be very Keynesian, basically it depends on current disposable income.

2.5. Balance of Payments

The balance of payments is at this stage rather simply detailed, and we mostly focused on the current account and inward direct investment.

Table 6. Balance of payments structure

Trade balance	*trade=x-m*
Total exports	*xn*
Total imports	*mn*
Incomes received and paid	*inc*
Transfers	*trns*
Current account	*current=trade+inc+trns*
Capital operations	*cap*
Direct investment outward	*dio*
Direct investment inward	*dii*
Portfolio investment	*poi*
Other investment	*oi*
Capital and financial balance	*cafi=cap+dii-dio+poi+oi*
Errors and omissions	*error*
Change in reserves	$\Delta res = current + cafi + error$

Hence the change in reserves, Δres, is so far just dependent on the current account and movements on *fdi*.

Foreign direct investments are modelled as follows:

(23) $$fdi = \alpha + 0.6\, fdi_{-1} - 5.5\pi - def_{-1}$$

where π is the inflation rate, *def* the public deficit in percentage of the GDP[2]. Hence direct investment is made dependent on the stability of the economy that is represented by a nominal anchor (inflation) and a real anchor (public deficit). The less the economy exhibits inflation and public deficit the more it attracts foreign investors.

2.6. Government Operations

The Pre-Accession Economic Programme for Estonia considers the continuity in exchange rate policy, as the present currency board arrangement will remain the nominal anchor for economic policies. Fiscal policy is the sole macroeconomic policy instrument to achieve the necessary external adjustment. In the following we present the structure of the fiscal sector. We basically assumed that public investment is exogenous, taxes follow the GDP growth path and public consumption adjusts for changes in reserves and public deficit to ensure a sustainable deficit.

(24) $$\Delta c^{u} = \alpha - 0.2\left(c^{u}_{-1} - y_{-1}\right) + 0.3 res^{r}_{-1} - 0.2 def_{-1}$$

where c^u is public consumption, res^r is the change in reserves to GDP ratio and, as defined earlier, *def* is the ratio of public deficit to GDP. In this reaction function we assume that fiscal authorities react automatically to a change in reserves. This assumption can be questioned, as

[2] The variable def taking positive or negative values can not be taken in log, but instead the variable 1+def is always positive, therefore, we introduced the variable Ln(1+def) in the equation.

fiscal adjustments will most probably be much more discretionary than systematic. Nevertheless, for the consistency of the model we kept these formulations.

What we basically tried to model is the reaction function of fiscal policy: when deficit grows or when there is a loss in reserves, expenditures are reduced in order to maintain a sustainable growth path. At this stage the reaction function is rather preliminary, and should also be further investigated in the future, for instance, to evaluate what should be the optimal fiscal policy.

Taxes are dependent on the GDP as follows:

(25) $$\Delta t = \alpha + \Delta y - 0.09\left(t_{-1} - y_{-1}\right)$$

Having defined the core structure of the model, we then used it to perform different simulation exercises to investigate how the Estonian economy reacts to supply and demand shocks. This is further described in the following Section.

3. Simulation Results

How Estonia is going to react to further integration to the European Union and what are the implications in terms of economic policy? Those questions are rather crucial as Estonia is engaged in a process of joining the European Union, which represents some development perspectives, as it will provide an access to European markets, but also some constraints as a strict fiscal discipline. What we basically stress in this Section is that the continuation of a tight fiscal policy should help Estonian economy to foster growth, as it could bring the stability required to continue to attract foreign investors (see Section 3.1 on impact of investment). We also stress that growth would be mostly driven by further investments brought to Estonia, rather than increase in foreign demand. As a very large part of Estonia's exports come from subcontracting activities, any increase in exports will lead to an increase in imports as well, as exported goods are also products that are just manufactured in Estonia (see Section 3.2 on the impact of foreign demand).

3.1. Shock on Foreign Direct Investment

As stressed before, the economy is rather sensitive to supply effects, and particularly to productivity effect. First we wanted to explore how the economy would react to an increase in foreign direct investment, because FDI represents almost half of private investments. Although FDI is not necessarily directly linked to further real investment, it represents additional financial resources that are used to some extent to invest. That is the reason why we sought for an effect of FDI on investment. Another interest of FDI is that it also provides additional resources to finance the current account deficit and should help to maintain the sustainability of Estonia's growth path. Therefore, two effects are to be monitored:

- A direct effect on GDP: as FDI increases it also induces an increase in investment, which will directly affect the GDP through a demand effect and indirectly through its impact on productivity.
- Another effect on inflation: as GDP increases there is an inflation pressure that is partly compensated by an increase in potential output.

The reason why those two effects are to be monitored is that, as long as inflation is contained, the positive impact on GDP and potential output will help to attract further direct investments and could lead the economy to a 'virtuous cycle', where an improvement on FDI basically fosters growth and contains inflation, that will attract further FDI and will push the economy further ahead. If the inflationary effect dominates, the ultimate impact will be to put additional pressure on fiscal policy, which will reduce positive impact on growth. Furthermore, high inflation pressure would also lead to a decline in FDI that would contribute to drag the growth path down.

We performed two different simulation exercises: first one investigating the response of an exogenous increase in foreign direct investment to highlight how the economy will benefit from it, and the other investigating a reduction of public expenditures, to highlight how a tight fiscal policy will help in promoting FDI.

Following a shock of one per cent in the first quarter on FDI, the two Figures below indicate the responses of GDP and prices (measured as the impact on *cpi*). Basically, the impact on inflation is very small (the change remains below 0.01 percent), while there is a substantial impact on growth.

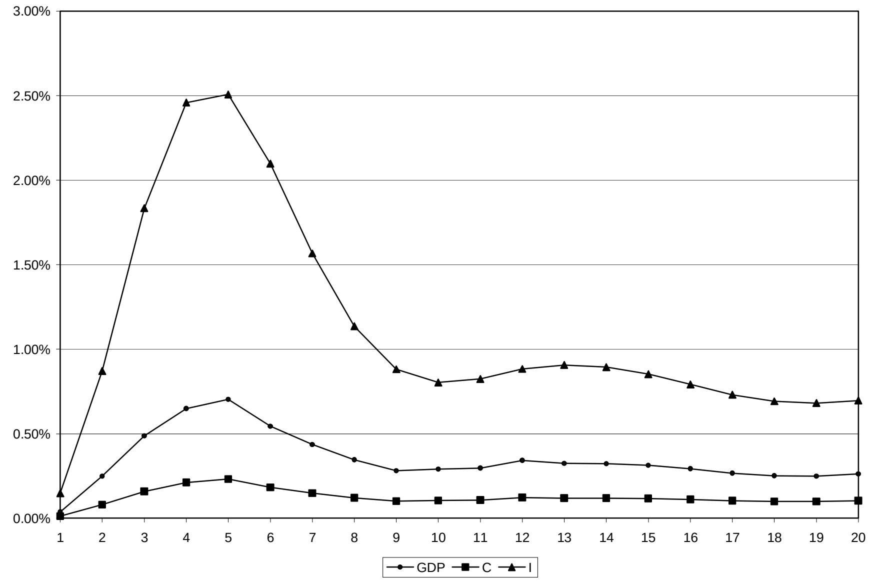

Figure 2. GDP, consumption, investment

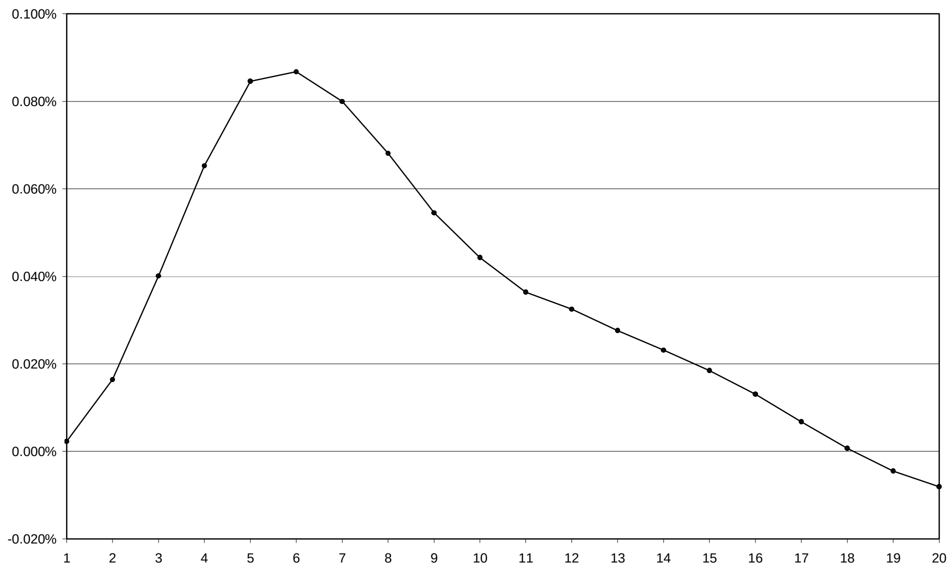

Figure 3. CPI

The reason why it takes few quarters before having the maximum effect on the GDP is twofold. Firstly, the dynamic of FDI itself includes some inertia and; therefore, an exogenous shock on this variable will continue to significantly affect the variable during the first quarters. Secondly, there is an also diffused impact on private investment (the positive impact of FDI on private investment takes also few quarters to have its full effect). The main interesting result of this exercise is the long-run impact of increasing investment. By improving productivity and growth, and maintaining inflation at a relatively low level (because of the increase in potential output that keeps the output gap at a relatively low level) there are additional possibilities to attract FDI and to further promote investment.

From the two Figures below we can see the impact of the productivity gain on exports and imports. Basically, while the short-term effect will be a further increase of imports (especially as compared to the one on exports), it will contribute negatively to the trade balance deficit. Nevertheless, the gains obtained in terms of productivity will help to permanently increase exports, which will help to reduce the trade balance deficit.

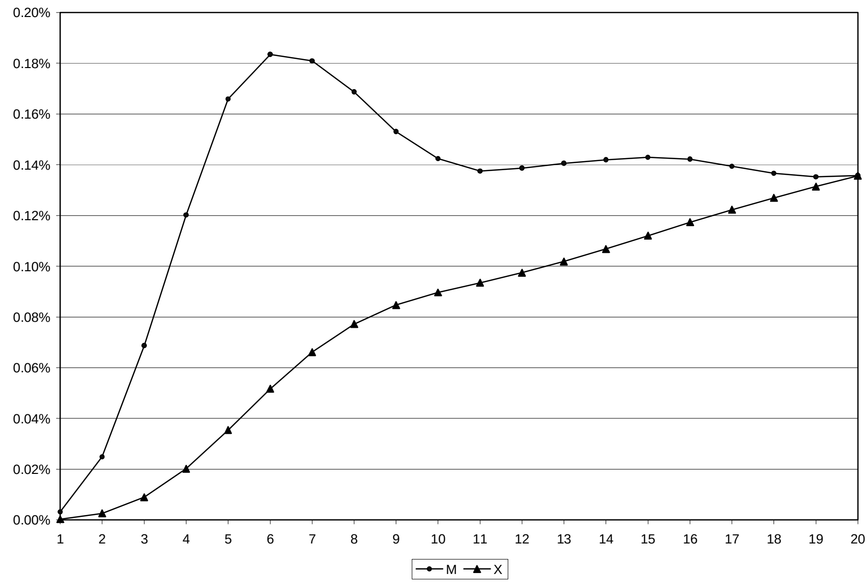

Figure 4. Imports and exports

As we stressed before, imports are modelled as largely dependent on exports. Therefore, an increase in exports will also contribute to increase imports. If we look at the change in reserves (expressed in millions of Estonian kroons) we can see that in the long-run (ie five years after the shock) there is a decline in reserves that actually reflects the negative impact on imports as the increase in demand is still dominant.

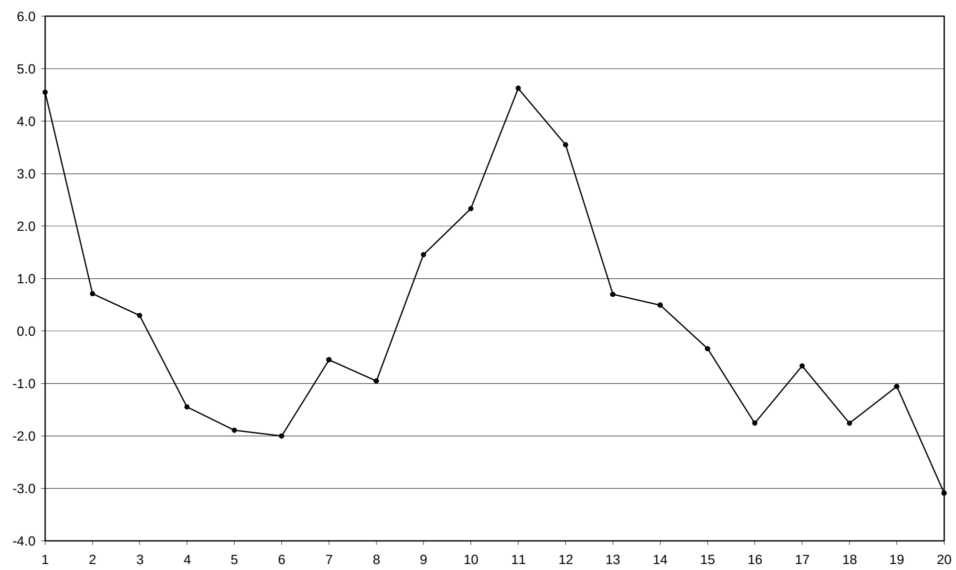

Figure 5. Change in reserves

Of course, this is rather counter-intuitive, as we would expect further improvements on the trade balance in the long run. What we must stress here is the limitation of such a model in analysing a transition economy. Although we believe that the model fits quite well to current and forthcoming years, it assumes a specific structure of the economy. But Estonian economy is still a transition economy in the sense that the productive sector is still restructuring itself. Therefore, it is also likely that, as investment will continue to flow within Estonia, the economy will continue to change and will hopefully become less dependent on imported goods, and the trade balance should logically be less dependent on subcontracting exports. In other words, some elasticities (the imports' elasticities to exports and domestic demand) should change as the economy benefits from additional investment.

Having performed this analysis a question remained how is it possible to attract further FDI? Is there a specific policy that should be implemented? The answer to those questions is the continuation of a tight fiscal policy. If the government were to decide to increase deficit in order to boost demand, and eventually investment, the impact would be rather quickly dominated by a reverse effect with higher inflation rate and trade balance deficit. Instead, as we show in the results below, a reduction in public expenditures (here we considered a decrease in public investment) exhibits positive impact rather quickly, that proves to be long lasting.

Again, we can see that inflation will be contained, and what will dominate is the positive impact of a tight fiscal policy on FDI. When public expenditures are reduced, there is a short-term impact that drags the GDP down. Nevertheless, from the second quarter after the shock the GDP begins to grow again. This is a result of two things: firstly a 'mechanical' growth recovery following the shock (the economy tends to go back to its initial state), but also an increase in investment as a result of increasing FDI. The reduction of the fiscal deficit renders the economy even more attractive to foreign investors and provides, therefore, additional resources to finance the current account deficit and real investment.

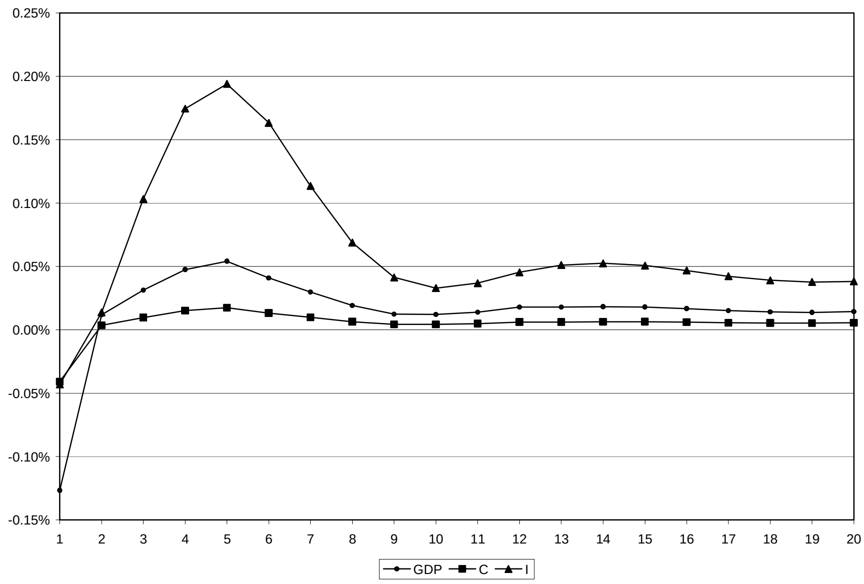

Figure 6. GDP, consumption, investment

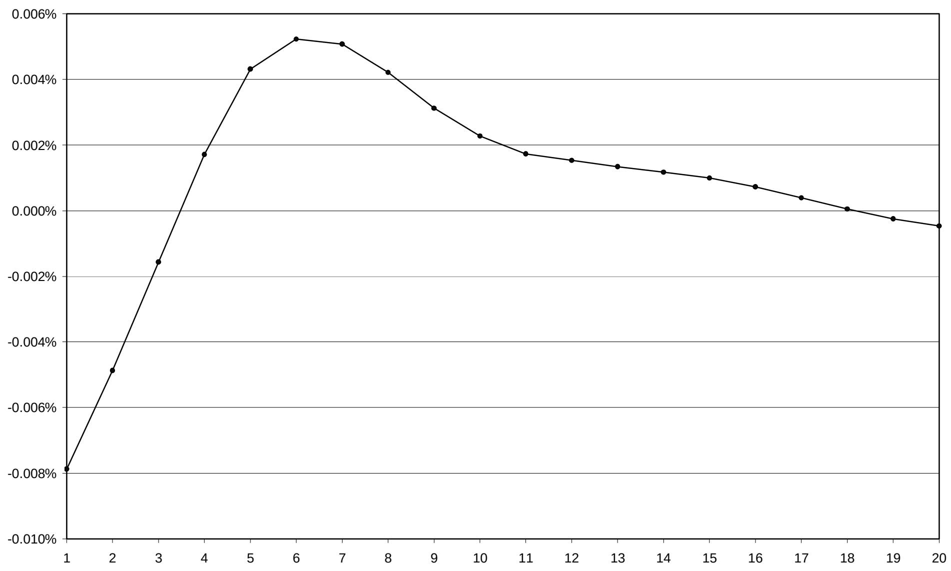

Figure 7. CPI

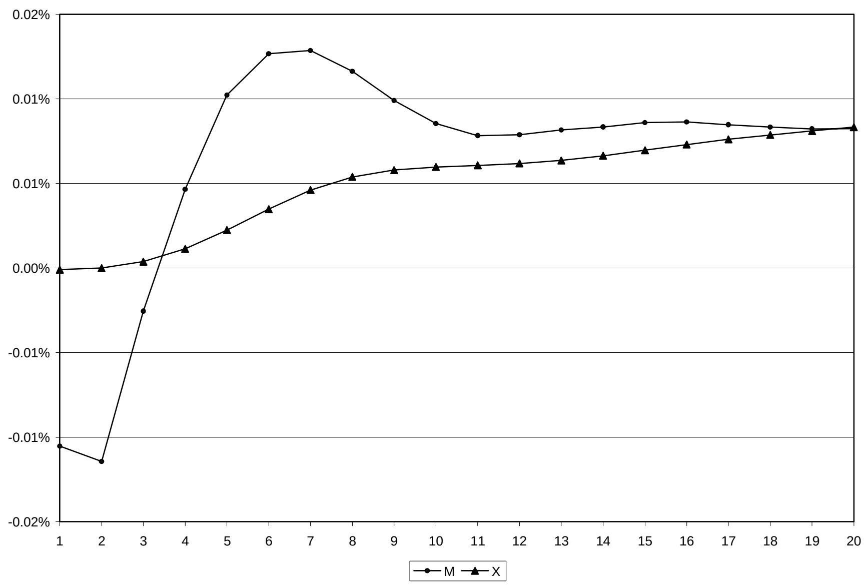

Figure 8. Imports and exports

Hence the continuation of a tight fiscal policy is highly recommended to maintain Estonia as an attractive economy. Therefore, the gains from joining the European Union will continue to mostly depend on the application of such a policy.

3.2. Increasing Foreign Demand

We now turn to the impact of increasing foreign demand by one per cent in the first quarter. We see that the positive effect is short lasting and vanishes within few quarters (see Figures below). Most important are the following two features.

- The impact on GDP is rather limited (under 0.2 per cent), while foreign demand increases by one per cent, and exports by 0.8 per cent at maximum. This impact on

GDP seems limited simply because the model includes sub-contracting exports. Therefore, when foreign demand increases imports also increase, which tends to reduce the positive impact on GDP.

- The impact on GDP turns rather quickly (after 3 quarters) to a negative effect, before going back to its original level.

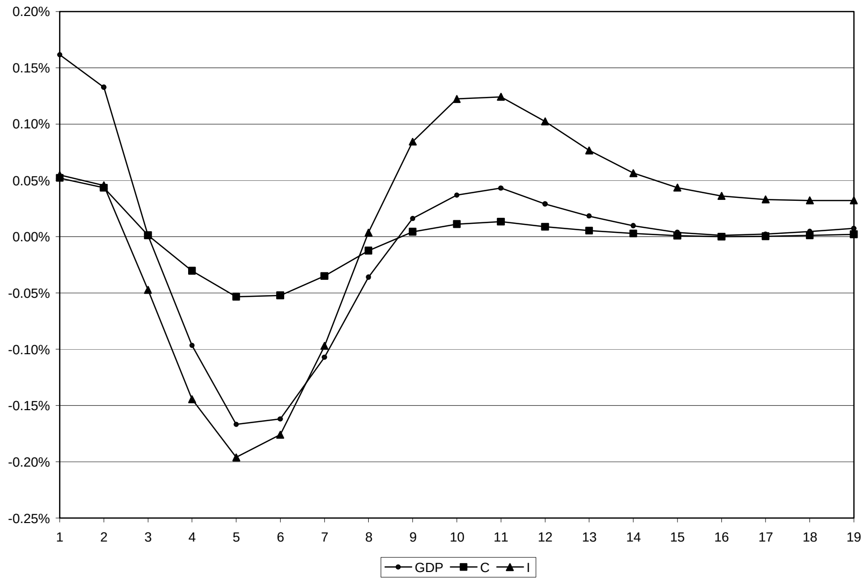

Figure 9. GDP, consumption, investment

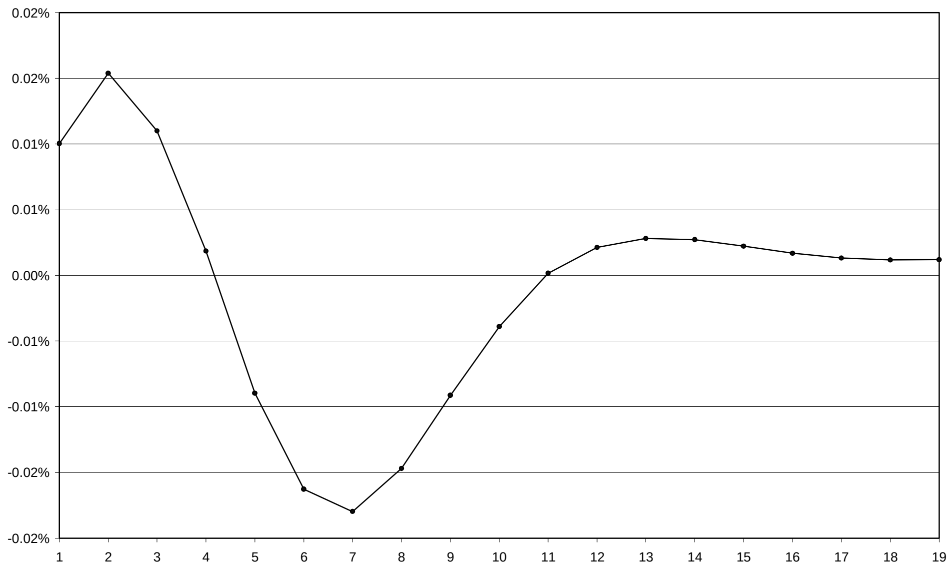

Figure 10. CPI

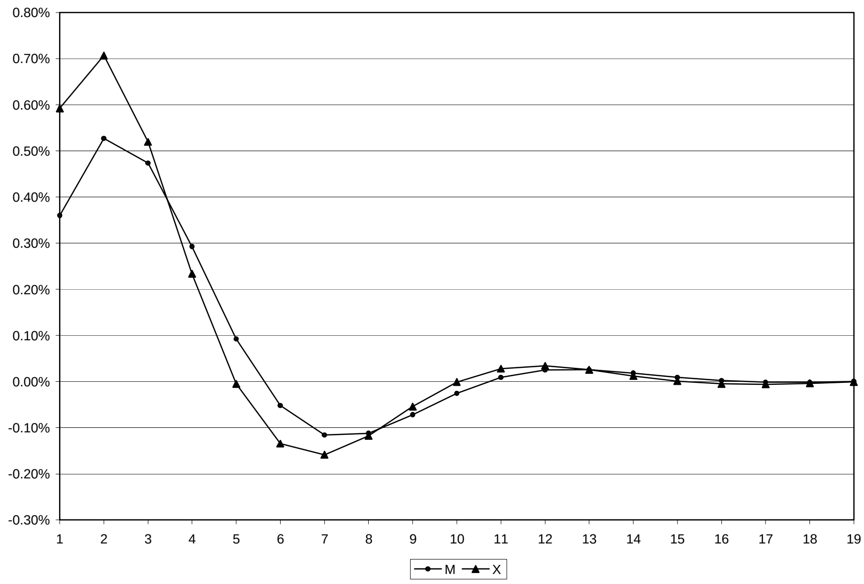

Figure 11. Imports and exports

Those two features come from the impact of exports on imports, because of those subcontracting exports. Hence, the Estonian economy does not fully benefit from an increase in foreign demand. This emphasises once more the importance of defining a policy aimed at developing domestic productive capacities by promoting investment.

This requirement on investment, together with the strong dependency on imports, raises the main issue for Estonia's future. As the country will continue to rebuild its productive capacity, there will be pressures on the trade balance deficit. Hence the equilibrium, even when totally sustainable, will be fragile as it will then depend on the possibilities to attract stable capitals, ie FDI (rather than speculative capitals) to finance this deficit. The continuation of a tight fiscal policy means then strong requirement to maintain the economy trustworthy for foreign investors.

3.3. Increasing Foreign Prices

Another simulation exercise emphasises the need to improve productivity. In this Section we considered an increase of one per cent of foreign prices in the first period. As we can see, the initial results seem in line with a standard J-curve, where after negative impact on GDP there is some recovery, while there is some imported inflation (see Figures below).

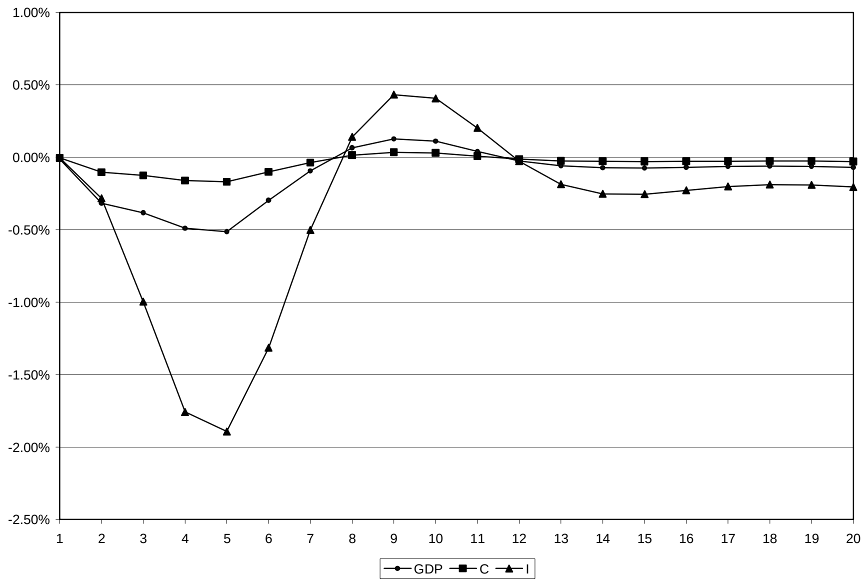

Figure 12. GDP, consumption, investment

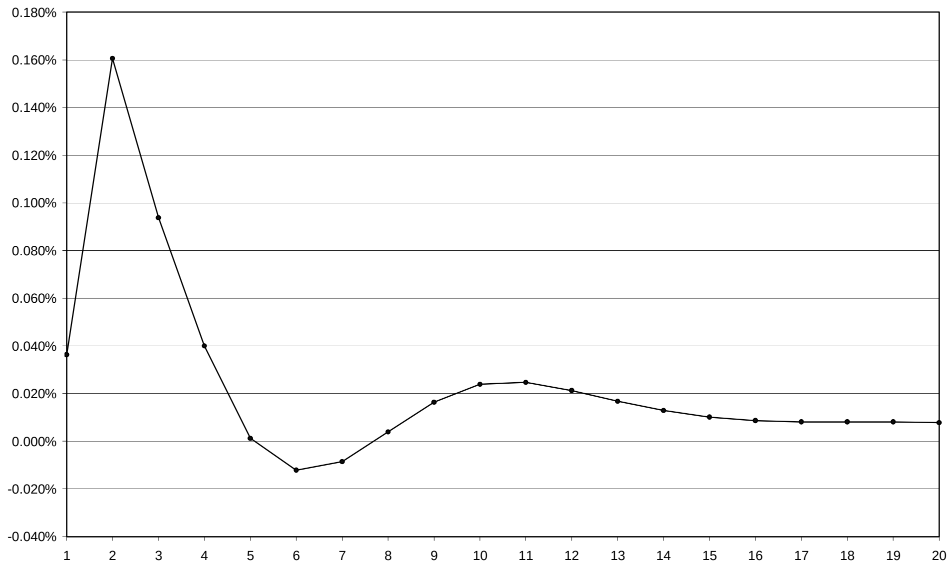

Figure 13. CPI

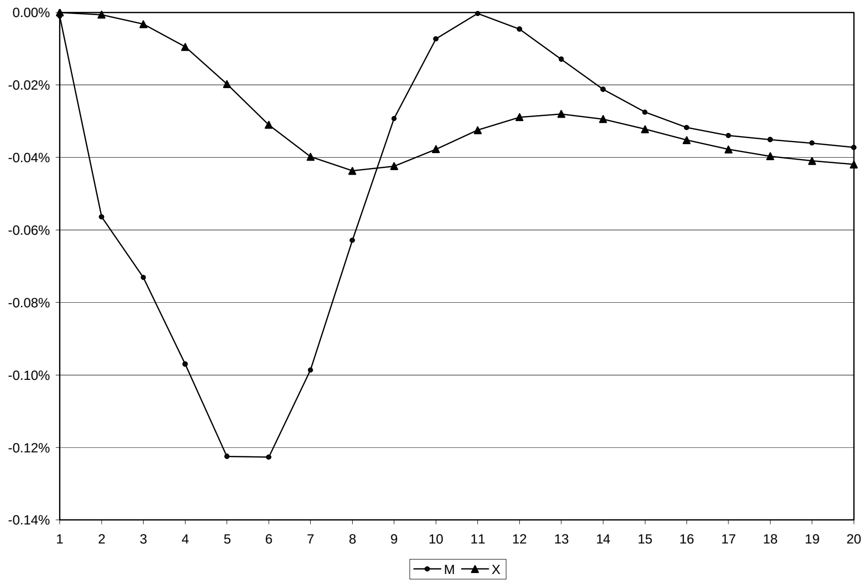

Figure 14. Imports and exports

Nevertheless, after 10 quarters this positive impact vanishes. This comes from the fact that the loss in reserves induced by the increase in foreign prices is actually going to dominate the dynamic, that will eventually impose tougher fiscal policy and will, therefore, reduce demand to ensure the sustainability of the growth path.

4. Conclusion

In this paper we have proposed a simple model for Estonia that integrates main features of Estonian economy. What we showed is that, despite the structural change and instability of data, it is still possible to build a rather simple and consistent model that can help to provide forecasts and policy simulations.

Future prospects of Estonian economy depend mostly on the improvement of non-price competitiveness of enterprises. As Estonia is still in the process of rebuilding a competitive productive capacity, any demand shock will put some pressure on the trade balance deficit. Hence, some further progress has to be made in the perspective of improving productivity and attracting stable capitals to finance the current account deficit.

Moreover, the exchange rate seems so far sustainable as Estonia benefits from rather lower prices, which provides further help in competitiveness while the private sector is restructuring.

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Annex 1. State-space models and the Kalman filter

State-space models

This Section briefly describes the implementation of the Kalman filter (see Kalman (1960) and (1963); Hall, Cuthbertson and Taylor (1992); Hall (1993), Harvey (1987) and (1989); and Shumway (1988)). First, a general structure for a state-space model is given; second, the algorithm proposed by Kalman to estimate the state vector is discussed and estimation of the other parameters is explained.

Let

(26) $$Y_t = ZA_t + \varepsilon_t$$

be the measurement equation, where Y_t is a vector of measured variables, A_t is the state vector of unobserved variables, Z is a matrix of parameters and $\varepsilon_t \sim N(0, H_t)$. The state equation is then given as:

(27) $$A_t = TA_{t-1} + \eta_t$$

where T is a matrix of parameters and $\eta_t \sim N(0, Q_t)$.

Q_t and H_t are sometimes referred to as the hyper-parameters of the model, to distinguish them from other parameters.

The Kalman filter

Let a_t be the optimal estimator of A_t based on the observations up to and including y_t, and $a_{t|t-1}$ the estimator based on the information available in $t-1$[3].

Furthermore, we define:

(28) $$P_{t-1} = E\left((A_{t-1} - a_{t-1})(A_{t-1} - a_{t-1})' \right)$$

Given a_{t-1} and P_{t-1}, the optimal estimator of A_t is:

(29) $$a_{t|t-1} = Ta_{t-1}$$

while the covariance matrix of the estimator is:

(30) $$P_{t|t-1} = E\left((A_t - a_{t|t-1})(A_t - a_{t|t-1})' \right) = TP_{t-1}T' + Q_t$$

When Y_t is known, the estimator can be updated:

(31) $$a_t = a_{t|t-1} + P_{t|t-1}Z'F_t^{-1}(Y_t - Za_{t|t-1})$$

and

(32) $$P_t = P_{t|t-1} - P_{t|t-1}Z'(ZP_{t|t-1}Z' + H_t)^{-1} ZP_{t|t-1}$$

where F_t is defined as:

(33) $$F_t = Z_t P_{t|t-1} Z_t' + H_t$$

Equations (29) to (32) jointly represent the Kalman filter equations[4].

---

[3] The specification of the state space system is completed by two further assumptions: first, that the initial vector A_0 has a mean a_0 and covariance matrix P_0 and second that the disturbances ε_t and η_t are uncorrelated with each other in all time periods, and uncorrelated with the initial state. This implies that: $\forall(s,t)$ $E(\varepsilon_t.\eta'_s)=0$ and $\forall t$ $E(\varepsilon_t.A'_0)=0$.

[4] In the Gaussian model, the Kalman filter yields the mean and covariance matrix of the distribution of A_t

In general, the Kalman filter will provide estimates of the unobserved variable A_t, while estimates of any other desired parameters are obtained by MLE algorithm adapted by Shumway and Stoffer (1982). The Kalman Filter is an estimation technique, which either allows for the estimation of time-varying parameter models by interpreting A_t as a vector of parameters to be estimated, or it allows for A_t to be viewed as a set of unobserved variables.

Annex 2. List of variables

In the following, the variable DDyyq refers to a dummy variable that takes the value 1 in the year yy and quarter q, while Dyyq refers to a dummy variable that takes the value 1 from the quarter q of the year yy onwards.

Regarding acronyms, the following system was used that should render rather easy to understand to which variable they relate to:

Letter position										
1	**N**	Nominal	**P**	Price	**R**	Real	**M**	Monetary variable		
2 to 4	**name of the variable**									
5	**T**	Total	**G**	Government	**P**	Private	**S**	Excluding subcontracting (exports and imports only)	**B**	Balance of payments
6	**N**	Non seasonally adjusted	**A**	Seasonally adjusted						

conditional on the information available at time t. Thus: $a_t=E(A_t|Y_t)$ and $P_t=E_t([A_t-E_t(A_t)][A_t-E_t(A_t)]')$. The conditional mean is a minimum mean square estimate of A_t. The expression of this estimator applies to any set of observations. This estimator minimises the mean square errors when the expectation is taken over all the variables in the information set rather than being conditional on a particular set of values (see Anderson and Moore (1979) or Harvey (1989) for a detailed discussion). Thus the conditional mean estimator, a_t, is the minimum mean square estimator of A_t. This estimator is unconditionally unbiased and the unconditional covariance matrix of the estimator is the P_t matrix given by the Kalman filter. Proof of these results can be found in Anderson and Moore (1979), Ducan and Horn (1972) or Harvey (1981).

NCONGA	Gov. nominal consumption
NCONPA	Consumption, private, nominal
NGDPTA	GDP, nominal
NGVRTA	Government revenues
NINVGA	Gov. nominal investment
NINVTA	Investment, private, nominal
NXPTTA	Exports, total, nominal
NMPTTA	Imports, total, nominal
REMPTA	Employment, total
PNEETN	Nominal effective exchange rate
PREETN	Real effective exchange rate
PPFOTN	Foreign prices
RMPTEU	EU imports, real
PPPIEU	PPI EU
PPPITN	PPI Estonia
PCTRTN	Consumer price tradable goods
PCNTTN	Consumer price non tradable goods

Many variables were constructed using raw data (see below). Seasonally adjusted variables were obtained by applying an X-11 method.

NCONTA=NCONGA+NCONPA
NINVPA=NINVTA-NINVGA

NCONTN=NCONGN+NCONPN
NINVPN=NINVTN-NINVGN

Definition of real variables

RGDPTA=NGDPTA/PGDPTN
RCONTA=NCONTA/PCONTN
RCONGA=NCONGA/PCONTN
RCONPA=NCONPA/PCONTN
RINVTA=NINVTA/PINVTN
RINVGA=NINVGA/PINVTN
RINVPA=NINVPA/PINVTN
RXPTTA=NXPTTA/PXPTTN
RMPTTA=NMPTTA/PMPTTN
RGVRTA=NGVRTA/PGDPTN

RGDPTN=NGDPTN/PGDPTN
RCONTN=NCONTN/PCONTN
RCONGN=NCONGN/PCONTN
RCONPN=NCONPN/PCONTN
RINVTN=NINVTN/PINVTN
RINVGN=NINVGN/PINVTN
RINVPN=NINVPN/PINVTN
RXPTTN=NXPTTN/PXPTTN
RMPTTN=NMPTTN/PMPTTN
RGVRTN=NGVRTN/PGDPTN

Government operations

Deficit
NGVDTA=NCONGA+NINVGA-NGVRTA
RGVDTA=RCONGA+RINVGA-RGVRTA

NGVDTN=NCONGN+NINVGN-NGVRTN
RGVDTN=RCONGN+RINVGN-RGVRTN

Others

residual on national account identity
NDISTA=NGDPTA-NCONTA-NINVTA-NXPTTA+NMPTTA
RDISTA=RGDPTA-RCONTA-RINVTA-RXPTTA+RMPTTA

NDISTN=NGDPTN-NCONTN-NINVTN-NXPTTN+NMPTTN
RDISTN=RGDPTN-RCONTN-RINVTN-RXPTTN+RMPTTN

Balance of payments

residual on trade balance
RTRRBN=NTRRBN/PGDPTN

trade balance
NTRATN=NXPTTA-NMPTTA+NTRRBN
RTRATN=RXPTTA-RMPTTA+RTRRBN

current account
NCURBN=NTRATN+NINCBN+NTRSBN

capital and financial account
NCAFBN=NCAPBN+NDIOBN+NDIIBN+NPOIBN+NOTIBN

change in reserves
NRESBN=NCURBN+NCAFBN+NERRBN

Annex 3. Model code

```
*NAME  MACRO MODEL OF ESTONIA - EESTI PANK
*RESID MULTIPLICATIVE
```

National accounts

```
*I RGDPTA=(RCONTA+RINVTA+RXPTTA-RMPTTA+RDISTA)

*NM NDISTA=(49.9100537+0.624417829*RDISTA)*PGDPTN
```

Definition of Nominal variables

```
*I NGDPTA=RGDPTA*PGDPTN
*I NCONTA=RCONTA*PCONTN
*I NCONPA=RCONPA*PCONTN
*I NINVTA=RINVTA*PINVTN
*I NINVGA=RINVGA*PINVTN
*I NINVPA=RINVPA*PINVTN
*I NXPTTA=RXPTTA*PXPTTN
*I NMPTTA=RMPTTA*PMPTTN
```

Monetary sector

```
*AC INFLATION
* PPPITN=PPPITN(-1)*EXP(
* -0.2734793766*(LOG(PPPITN(-1)/(PNEETN(-1)*PPFOTN(-1)))-0.3516382599)
* -0.02579901517*DD952+0.03297014168*(DD951-DD962)
* +0.094*(LOG(RGDPTA)-CAP-0.6*LOG(REMPTA))
* )

*AC consumer prices non tradable goods
* PCNTTN=PCNTTN(-1)*EXP(
* 0.0139930898
* +0.5627447524*LOG(PCNTTN(-1)/PCNTTN(-2))
* )

*AC consumer prices tradable goods
* PCTRTN=PCTRTN(-1)*EXP(
* 0.01304646735
* +0.9468993274*LOG(PPPITN/PPPITN(-1))
* +(1-0.9468993274)*LOG(PMPTTN/PMPTTN(-1))
* -0.3212226325*(LOG(PCTRTN(-1))-0.9468993274*LOG(PPPITN(-1))
*  -(1-0.9468993274)*LOG(PMPTTN(-1)))
```

```
* )

*AC consumer price index
* PCONTN=EXP(
* 0.2992577166*LOG(PCNTTN)
* +(1-0.2992577166)*LOG(PCTRTN)
* )

*AC GDP deflator
* PGDPTN=EXP(
* 0.04248421877
* +LOG(PCONTN)
* -0.0234835077*D962S
* +0.02506043483*D984
* -0.02970487564*DD991
* )

*AC investment deflator
* PINVTN=EXP(
* 0.06925241552
* +LOG(PPPITN)
* +0.07398169536*D984
* )

*AC Imports deflator
* PMPTTN=EXP(
* 0.290864169
* +LOG(PNEETN*PPFOTN)
* +0.07589636081*D984-0.05418454192*D962S
* )

*AC Exports deflator
* PXPTTN=EXP(
* 0.05136782172
* +LOG(PPPITN)
* +0.03358810516*D984
* -0.04747741032*DD984
* )

*AC interest rates
*NM MLIRTN=
* LOG(PPPITN/PPPITN(-1))
* +0.01152278731
* +0.8831864872*(MLIRTN(-1)-LOG(PPPITN(-1)/PPPITN(-2)))
```

Labour market

```
*AC wages
* PWAGTN=EXP(
* 7.536978012+LOG(PCONTN)+0.01522438612*TREND
* )

*AC employment
*NM REMPTA=REMPTA(-1)*EXP(
* 0.07955965789
```

* +0.03687314253*LOG(REMPTA(-1)/REMPTA(-2))
* -0.01618340825*LOG(REMPTA(-1)/RGDPTA(-1)*PWAGTN(-1)/PPPITN(-1))
* -0.04423338872*DD951
*)

Real Sector

---

*AC CAPITAL STOCK ACCUMULATION FUNCTION
*NM CAP=CAP(-1)-0.01+LOG(1+RINVPA/200000)

*AC total investment
*I RINVTA=RINVGA+RINVPA

*AC INVESTMENT
* RINVPA=RINVPA(-1)*EXP(
* -6.052777582
* +0.4*LOG(RINVPA(-1)/RINVPA(-2))
* +0.4*LOG((RGDPTA-RGVRTA)/(RGDPTA(-1)-RGVRTA(-1)))
* -0.3*(MLIRTN(-1)-LOG(PINVTN(-1)/PINVTN(-2)))
* -0.2*LOG(RINVPA(-1)/(RGDPTA(-1)-RGVRTA(-1)))
* +0.1*LOG((NDIIBN/NDIIBN(-1))/(PINVTN/PINVTN(-1)))
* +0.5*LOG(NDIIBN(-1)/PINVTN(-1))
* +0.3*LOG(NDIIBN(-2)/PINVTN(-2))
* +0.1*LOG(NDIIBN(-3)/PINVTN(-3))
*)

*AC total consumption
*I RCONTA=RCONGA+RCONPA

*AC consumption
* RCONPA=RCONPA(-1)*EXP(
* 0.008048931097
* +0.3230078657*LOG((RGDPTA-RGVRTA)/(RGDPTA(-1)-RGVRTA(-1)))
* -0.004428700737*LOG(RCONPA(-1)/(RGDPTA(-1)-RGVRTA(-1)))
* +0.04003844004*DD994-0.05818930661*DD011
* -0.05758617554*(DD001-DD002)
*)

Balance of payments

---

*AC real exchange rate
*I PREETN=PNEETN*PPFOTN/PCONTN

*AC REAL IMPORTS
* RMPTTA=RMPTTA(-1)*EXP(
* 0.05882155801
* +0.5865185503*LOG(RXPTTA/RXPTTA(-1))
* -0.5297925631*(LOG(RMPTTA(-1))
* -0.8844194296*LOG(RXPTTA(-1))
* -(1-0.8844194296)*LOG(RINVTA(-1)+RCONTA(-1)))

```
* -0.03004942086*LOG(PREETN(-1))
* +0.083*(LOG(RGDPTA)-CAP-0.6*LOG(REMPTA))
* )

*AC REAL EXPORTS
* RXPTTA=RXPTTA(-1)*EXP(
* -1.389784116
* +0.5453172941*LOG(RXPTTA(-1)/RXPTTA(-2))
* -0.3522427021*(LOG(RXPTTA(-1))
* -1.683273021*LOG(RMPTEU(-1)))
* -0.0857314879*(DD991-DD001)
* +0.201*((CAP-0.4*LOG(REMPTA)
*   -LOG(PWAGTN/PGDPTN))+5.016730)
* )

*AC residual on trade balance nominal
*NM NTRRBN=NTRRBN(-4)

*AC residual on trade balance real
*I RTRRBN=NTRRBN/PGDPTN
```

```
*AC trade balance nominal
*I NTRATN=NXPTTA-NMPTTA+NTRRBN
```

```
*AC income received/paid
* NINCBN=NINCBN(-1)*(
* 1.08271633+18.27168636*DD971
* )

*AC transfers received/paid
* NTRSBN=NTRSBN(-1)*(
* 1.059000072-0.4196501896*DD991
* )
```

```
*AC current account
*I NCURBN=NTRATN+NINCBN+NTRSBN
```

```
*AC capital account
*NM NCAPBN=3.356796923+0.7109423288*NCAPBN(-1)

*AC Direct investment inward
* NDIIBN=EXP(
* 2.863063735
* +0.5998980604*LOG(NDIIBN(-1))
* -5.47398199*LOG(PPPITN/PPPITN(-1))
* -LOG(1+NGVDTA(-1)/NGDPTA(-1))
* )

*AC Direct investment outward
* NDIOBN=NDIOBN(-1)*(
* 0.7968237109+251.3142873*DD992
* )

*AC portfolio investment total
* NPOIBN=NPOIBN(-4)*(
* 3.187479484-244.8961407*DD002-63.84644311*DD981
```

*)

*AC Other investment total
* NOTIBN=NOTIBN(-4)*(
* 0.6972899778+11.56696757*DD994
*)

---

*AC capital and financial account
*I NCAFBN=NCAPBN+NDIOBN+NDIIBN+NPOIBN+NOTIBN

---

*AC net error and ommissions
*NM NERRBN=-0.3574557385*NERRBN(-1)-0.2861625007*NERRBN(-2)

*AC change in reserves
*I NRESBN=NCURBN+NCAFBN+NERRBN

Government operations

---

*AC deficit nominal
*I NGVDTA=NCONGA+NINVGA-NGVRTA

*AC deficit real
*I RGVDTA=RCONGA+RINVGA-RGVRTA

*AC Government revenues nominal
* NGVRTA=NGVRTA(-1)*EXP(
* -0.1043012351
* +LOG(NGDPTA/NGDPTA(-1))
* -0.09357829098*LOG(NGVRTA(-1)/NGDPTA(-1))
* -0.3934101606*DD973
*)

*AC Government revenues real
*I RGVRTA=NGVRTA/PGDPTN

*AC Government consumption nominal
* NCONGA=NCONGA(-1)*EXP(
* -0.3433458449
* -0.2382223066*LOG(NCONGA(-1)/NGDPTA(-1))
* +LOG(1+NRESBN(-1)/NGDPTA(-1))
* -0.2*LOG(1+NGVDTA(-1)/NGDPTA(-1))
* -0.05729924468*(DD964-DD971)
* -0.07178225799*(DD952-DD951)
* +0.07010737179*D962S
* +0.1102440054*(DD944+DD963)
*)

*AC Government consumption real
*I RCONGA=NCONGA/PCONTN

Annex 4. Estimations

First step estimation

Here are the complete results of the first step estimation. The main difference with previous Tables is that we provide the full specification, ie we integrate the statistics on dummy variables.

In the following Tables the variable DDyyq refers to a dummy variable that takes the value 1 in the year yy and quarter q, while Dyyq refers to a dummy variable that takes the value 1 from the quarter q of the year yy onwards.

Table 7. Imports

Dependent Variable: LOG(RMPTTA/RMPTTA(-1))

Method: Two-Stage Least Squares

LOG(RMPTTA/RMPTTA(-1))=C(1)+C(2)*LOG(RXPTTA/RXPTTA(-1))
+C(3)*(LOG(RMPTTA(-1))+C(4)*LOG(RXPTTA(-1))-(1+C(4))
*LOG(RINVTA(-1)+RCONTA(-1)))+C(5)*LOG(PREETN(-1))

Instrument list: C LOG(RXPTTA(-1)) LOG(RINVTA(-1)+RCONTA(-1))
LOG(PREETN(-1)) LOG(RMPTTA(-1)) LOG(RGDPTA(-1))
LOG(RMPTEU(-1)) DD984 D984

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.059	0.033	1.779	0.088
C(2)	0.587	0.175	3.353	0.003
C(3)	-0.530	0.188	-2.823	0.009
C(4)	-0.884	0.098	-9.062	0.000
C(5)	-0.030	0.059	-0.507	0.617

R-squared	0.635393	Mean dependent var	0.025843
Adjusted R-squared	0.574625	S.D. dependent var	0.050262
S.E. of regression	0.032781	Sum squared resid	0.025791
Durbin-Watson stat	1.632868		

Table 8. PPI

Dependent Variable: LOG(PPPITN/PPPITN(-1))

Method: Two-Stage Least Squares

LOG(PPPITN/PPPITN(-1))=C(1)*(LOG(PPPITN(-1)/(PNEETN(-1)
*PPFOTN(-1)))+C(2))+C(3)*DD952+C(4)*(DD951-DD962)

Instrument list: C LOG(PPPITN(-3)) LOG(PPPITN(-2)/(PNEETN(-2)
*PPFOTN(-2))) DD952 (DD951-DD962)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.27	0.04	-6.65	0.00
C(2)	-0.35	0.02	-22.58	0.00
C(3)	-0.03	0.01	-1.81	0.08
C(4)	0.03	0.01	3.32	0.00

R-squared	0.755803	Mean dependent var	0.021086
Adjusted R-squared	0.722504	S.D. dependent var	0.026249
S.E. of regression	0.013827	Sum squared resid	0.004206
Durbin-Watson stat	1.442544		

Table 9. Exports

Dependent Variable: LOG(RXPTTA/RXPTTA(-1))

Method: Two-Stage Least Squares
LOG(RXPTTA/RXPTTA(-1))=C(1)+C(2)*LOG(RXPTTA(-1)/RXPTTA(-2))
+C(3)*(LOG(RXPTTA(-1))+C(4)*LOG(RMPTEU(-1)))+C(5) *(DD991-DD001)
Instrument list: LOG(RXPTTA(-3)) C LOG(RGDPTA(-1))
LOG(RMPTEU(-2)) (DD991-DD001)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-1.38	0.82	-1.69	0.10
C(2)	0.55	0.28	1.97	0.06
C(3)	-0.35	0.20	-1.72	0.10
C(4)	-1.68	0.17	-9.76	0.00
C(5)	-0.09	0.03	-2.82	0.01
R-squared	0.48686	Mean dependent var		0.028648
Adjusted R-squared	0.39356	S.D. dependent var		0.052354
S.E. of regression	0.04077	Sum squared resid		0.036568
Durbin-Watson stat	2.03652			

Real variables

Taxes

Dependent Variable: LOG(NGVRTA/NGVRTA(-1))
Method: Two-Stage Least Squares
Date: 01/16/02 Time: 11:52
Sample(adjusted): 1993:3 2001:2
Included observations: 32 after adjusting endpoints
LOG(NGVRTA/NGVRTA(-1))=C(1)+LOG(NGDPTA/NGDPTA(-1))+C(3)
*LOG(NGVRTA(-1)/NGDPTA(-1))+C(5)*DD973
Instrument list: C LOG(NGVRTA(-2)) LOG(NGDPTA(-2)) DD973

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.1043	0.309612	-0.33688	0.7386
C(3)	-0.09358	0.249634	-0.37486	0.7105
C(5)	-0.39341	0.108364	-3.63045	0.0011
R-squared	0.373417	Mean dependent var		0.047349
Adjusted R-squared	0.330204	S.D. dependent var		0.130209
S.E. of regression	0.106564	Sum squared resid		0.329323
Durbin-Watson stat	2.639965			

Government consumption

Dependent Variable: LOG(NCONGA/NCONGA(-1))
Method: Least Squares
Date: 01/16/02 Time: 14:35
Sample(adjusted): 1993:2 2001:2
Included observations: 33 after adjusting endpoints
LOG(NCONGA/NCONGA(-1))=C(1)+C(3)*LOG(NCONGA(-1)/NGDPTA(-1))
+0.3*LOG(1+NRESBN(-1)/NGDPTA(-1))-0.2*LOG(1+NGVDTA(-1)
/NGDPTA(-1))+C(10)*(DD964-DD971)+C(11)*(DD952-DD951)
+C(12)*D962S+C(13)*(DD944+DD963)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.34335	0.119117	-2.88242	0.0076
C(3)	-0.23822	0.080208	-2.97004	0.0062
C(10)	-0.0573	0.025191	-2.27461	0.0311
C(11)	-0.07178	0.024979	-2.87368	0.0078
C(12)	0.070107	0.012684	5.527276	0
C(13)	0.110244	0.026536	4.154438	0.0003

R-squared	0.725838	Mean dependent var	0.051659
Adjusted R-squared	0.675067	S.D. dependent var	0.061283
S.E. of regression	0.034933	Akaike info criterion	-3.70781
Sum squared resid	0.032948	Schwarz criterion	-3.43571
Log likelihood	67.17881	Durbin-Watson stat	2.329372

Private consumption

Dependent Variable: LOG(RCONPA/RCONPA(-1))
Method: Two-Stage Least Squares
Date: 01/16/02 Time: 11:37
Sample(adjusted): 1995:2 2001:2
Included observations: 25 after adjusting endpoints
LOG(RCONPA/RCONPA(-1))=C(1)+C(3)*LOG((RGDPTA-RGVRTA)
/(RGDPTA(-1)-RGVRTA(-1)))+C(4)*LOG(RCONPA(-1)/(RGDPTA(-1)
-RGVRTA(-1)))+C(10)*DD994+C(11)*DD011+C(12)*(DD001 -DD002)
Instrument list: C LOG(RCONPA(-3)) LOG(RCONPA(-4))
LOG(RGDPTA(-2)-RGVRTA(-2)) LOG(RGDPTA(-3)-RGVRTA(-3))
DD994 DD011 (DD001-DD002)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.008049	0.021652	0.371733	0.7142
C(3)	0.323008	0.150974	2.139491	0.0456
C(4)	-0.00443	0.143556	-0.03085	0.9757
C(10)	0.040038	0.025413	1.575499	0.1316
C(11)	-0.05819	0.023651	-2.46032	0.0236
C(12)	-0.05759	0.018682	-3.0825	0.0061

R-squared	0.402596	Mean dependent var	0.013374
Adjusted R-squared	0.245385	S.D. dependent var	0.02432
S.E. of regression	0.021126	Sum squared resid	0.00848
Durbin-Watson stat	2.910996		

Private investment

Dependent Variable: LOG(RINVPA/RINVPA(-1))
Method: Least Squares
Date: 01/17/02   Time: 11:49
Sample(adjusted): 1994:2 2001:2
Included observations: 29 after adjusting endpoints
LOG(RINVPA/RINVPA(-1))=C(1)+0.4*LOG(RINVPA(-1)/RINVPA(-2))
+0.4*LOG((RGDPTA-RGVRTA)/(RGDPTA(-1)-RGVRTA(-1)))-0.3
*(MLIRTN(-1)-LOG(PINVTN(-1)/PINVTN(-2)))-0.2*LOG(RINVPA(-1)
/(RGDPTA(-1)-RGVRTA(-1)))+0.1*LOG((NDIIBN/NDIIBN(-1))
/(PINVTN/PINVTN(-1)))+0.5*LOG(NDIIBN(-1)/PINVTN(-1))+0.3
*LOG(NDIIBN(-2)/PINVTN(-2))+0.1*LOG(NDIIBN(-3)/PINVTN(-3))

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-6.05278	0.088944	-68.0518	0

R-squared	-78.3714	Mean dependent var	0.009907
Adjusted R-squared	-78.3714	S.D. dependent var	0.053763
S.E. of regression	0.478977	Akaike info criterion	1.399544
Sum squared resid	6.423719	Schwarz criterion	1.446692
Log likelihood	-19.2934	Durbin-Watson stat	0.313708

Employment

Dependent Variable: LOG(REMPTA/REMPTA(-1))
Method: Two-Stage Least Squares
Date: 12/12/01   Time: 20:43
Sample(adjusted): 1994:4 2000:4
Included observations: 25 after adjusting endpoints
LOG(REMPTA/REMPTA(-1))=C(1)+C(2)*LOG(REMPTA(-1)/REMPTA(-2))
+C(3)*LOG(REMPTA(-1)/RGDPTA(-1)*PWAGTN(-1)/PPPITN(-1)) +C(10)*DD951
Instrument list: LOG(REMPTA(-3)) C LOG(RGDPTA(-2)*PPPITN(-2)
/PWAGTN(-2)) DD951

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.07956	0.296792	0.268066	0.7913
C(2)	0.036873	0.203884	0.180854	0.8582
C(3)	-0.01618	0.057615	-0.28089	0.7815
C(10)	-0.04423	0.008887	-4.97717	0.0001

R-squared	0.548343	Mean dependent var	-0.00567
Adjusted R-squared	0.483821	S.D. dependent var	0.012047
S.E. of regression	0.008655	Sum squared resid	0.001573
Durbin-Watson stat	1.764886		

Prices

Consumer price, non tradable goods

Dependent Variable: LOG(PCNTTN/PCNTTN(-1))
Method: Least Squares
Date: 12/11/01 Time: 12:46
Sample(adjusted): 1994:3 2001:2
Included observations: 28 after adjusting endpoints
LOG(PCNTTN/PCNTTN(-1))=C(1)+C(2)*LOG(PCNTTN(-1)/PCNTTN(-2))

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.013993	0.005671	2.467363	0.0205
C(2)	0.562745	0.08402	6.697763	0

R-squared	0.633079	Mean dependent var	0.041761
Adjusted R-squared	0.618967	S.D. dependent var	0.033173
S.E. of regression	0.020477	Akaike info criterion	-4.87028
Sum squared resid	0.010902	Schwarz criterion	-4.77512
Log likelihood	70.18389	Durbin-Watson stat	1.814783

Consumer price index, tradable goods

Dependent Variable: LOG(PCTRTN/PCTRTN(-1))
Method: Two-Stage Least Squares
Date: 12/11/01 Time: 12:47
Sample(adjusted): 1994:4 2001:1
Included observations: 26 after adjusting endpoints
Convergence achieved after 13 iterations
LOG(PCTRTN/PCTRTN(-1))=C(1)+C(2)*LOG(PPPITN/PPPITN(-1))+(1
-C(2))*LOG(PMPTTN/PMPTTN(-1))+C(3)*(LOG(PCTRTN(-1))-C(2)
*LOG(PPPITN(-1))-(1-C(2))*LOG(PMPTTN(-1)))
Instrument list: C LOG(PPPITN(-2)) LOG(PPPITN(-3)) LOG(PCTRTN(-2))

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.013046	0.008791	1.48415	0.1513
C(2)	0.946899	0.517628	1.829303	0.0803
C(3)	-0.32122	0.180057	-1.78401	0.0876

R-squared	0.638492	Mean dependent var	0.020019
Adjusted R-squared	0.607057	S.D. dependent var	0.022553
S.E. of regression	0.014138	Sum squared resid	0.004597
Durbin-Watson stat	1.442713		

Consumer price index

Dependent Variable: LOG(PCONTN)
Method: Least Squares
Date: 12/11/01 Time: 12:46
Sample(adjusted): 1994:1 2001:2
Included observations: 30 after adjusting endpoints
LOG(PCONTN)=C(1)*LOG(PCNTTN)+(1-C(1))*LOG(PCTRTN)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.299258	0.004105	72.8943	0

R-squared	0.999116	Mean dependent var	0.30183
Adjusted R-squared	0.999116	S.D. dependent var	0.236986
S.E. of regression	0.007047	Akaike info criterion	-7.03967
Sum squared resid	0.00144	Schwarz criterion	-6.99296
Log likelihood	106.5951	Durbin-Watson stat	1.612983

GDP deflator

Dependent Variable: LOG(PGDPTN)
Method: Two-Stage Least Squares
Date: 12/11/01 Time: 12:45
Sample(adjusted): 1995:1 2001:2
Included observations: 26 after adjusting endpoints
LOG(PGDPTN)=C(1)+LOG(PCONTN)+C(3)*D962S+C(4)*D984+C(5) *DD991
Instrument list: LOG(PGDPTN(-1)) C LOG(PPPITN(-1)) D962S D984 DD991

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.042484	0.003503	12.1272	0
C(3)	-0.02348	0.005539	-4.23961	0.0003
C(4)	0.02506	0.004829	5.189731	0
C(5)	-0.02971	0.011023	-2.6949	0.0132

R-squared	0.996942	Mean dependent var	0.418691
Adjusted R-squared	0.996525	S.D. dependent var	0.178293
S.E. of regression	0.01051	Sum squared resid	0.00243
Durbin-Watson stat	2.238702		

Investment deflator

Dependent Variable: LOG(PINVTN)
Method: Two-Stage Least Squares
Date: 01/04/02 Time: 15:19
Sample(adjusted): 1994:2 2001:1
Included observations: 28 after adjusting endpoints
LOG(PINVTN)=C(1)+LOG(PPPITN)+C(3)*D984
Instrument list: LOG(PINVTN(-2)) C LOG(PPPITN(-1)) D984

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.069252	0.007462	9.28095	0
C(3)	0.073982	0.012486	5.925197	0

R-squared	0.976197	Mean dependent var	0.283238
Adjusted R-squared	0.975281	S.D. dependent var	0.201356
S.E. of regression	0.031658	Sum squared resid	0.026057
Durbin-Watson stat	1.144793		

Imports deflator

Dependent Variable: LOG(PMPTTN)
Method: Two-Stage Least Squares
Date: 01/07/02 Time: 11:20
Sample(adjusted): 1995:1 2001:2
Included observations: 26 after adjusting endpoints
LOG(PMPTTN)=C(1)+LOG(PNEETN*PPFOTN)+C(4)*D984+C(5) *D962S
Instrument list: C LOG(PMPTTN(-1)) LOG(PNEETN(-1)*PPFOTN(-1)) D984 D962S

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.290864	0.007149	40.68829	0
C(4)	0.075896	0.009639	7.873749	0
C(5)	-0.05419	0.011303	-4.79385	0.0001

R-squared	0.966691	Mean dependent var	0.258404
Adjusted R-squared	0.963794	S.D. dependent var	0.112708
S.E. of regression	0.021446	Sum squared resid	0.010578
Durbin-Watson stat	1.513728		

Exports deflator

Dependent Variable: LOG(PXPTTN)
Method: Two-Stage Least Squares
Date: 12/11/01 Time: 12:43
Sample(adjusted): 1994:2 2001:1
Included observations: 28 after adjusting endpoints
LOG(PXPTTN)=C(1)+LOG(PPPITN)+C(4)*D984+C(5)*DD984
Instrument list: LOG(PXPTTN(-1)) C LOG(PPPITN(-1)) LOG(PMPTTN) D984 DD984

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.051368	0.004004	12.83042	0
C(4)	0.033588	0.006934	4.843671	0.0001
C(5)	-0.04748	0.017905	-2.65168	0.0137

R-squared	0.99141	Mean dependent var	0.249231
Adjusted R-squared	0.990723	S.D. dependent var	0.176353
S.E. of regression	0.016986	Sum squared resid	0.007213
Durbin-Watson stat	1.970439		

Wage

Dependent Variable: LOG(PWAGTN)
Method: Two-Stage Least Squares
Date: 12/12/01 Time: 21:10
Sample(adjusted): 1994:1 2001:2
Included observations: 30 after adjusting endpoints
LOG(PWAGTN)=C(1)+LOG(PCONTN)+C(4)*TREND
Instrument list: C LOG(PWAGTN(-2)) LOG(PCONTN(-2)) TREND

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	7.536978	0.01025	735.2879	0
C(4)	0.015224	0.000502	30.33575	0

R-squared	0.995944	Mean dependent var	8.120459
Adjusted R-squared	0.995799	S.D. dependent var	0.367099
S.E. of regression	0.023792	Sum squared resid	0.01585
Durbin-Watson stat	1.21242		

Balance of payments

Current account

Residual on the trade balance (mostly integrates the seasonal pattern)

Dependent Variable: NTRRBN
Method: Least Squares
Date: 01/10/02 Time: 12:26
Sample(adjusted): 1994:1 2001:3
Included observations: 31 after adjusting endpoints
NTRRBN=NTRRBN(-1)+C(1)+C(2)*(NTRRBN(-2)-NTRRBN(-3))+C(3)
*(NTRRBN(-1)-NTRRBN(-4))

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-51.588	54.90553	-0.93958	0.3555
C(2)	-0.1149	0.093196	-1.2329	0.2279
C(3)	-0.97421	0.098536	-9.88681	0

R-squared	0.606214	Mean dependent var	-32.8538
Adjusted R-squared	0.578086	S.D. dependent var	469.96
S.E. of regression	305.262	Akaike info criterion	14.37198

Income received and paid

Dependent Variable: NINCBN/NINCBN(-1)
Method: Least Squares
Date: 01/10/02 Time: 12:44
Sample(adjusted): 1993:2 2001:3
Included observations: 34 after adjusting endpoints
NINCBN/NINCBN(-1)=C(1)+C(2)*DD971

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	1.082716	0.436495	2.480477	0.0186
C(2)	18.27169	2.545183	7.178929	0

R-squared	0.616936	Mean dependent var	1.620119
Adjusted R-squared	0.604966	S.D. dependent var	3.989505
S.E. of regression	2.507474	Akaike info criterion	4.733452
Sum squared resid	201.1977	Schwarz criterion	4.823237
Log likelihood	-78.4687	Durbin-Watson stat	1.62646

Net transfers

Dependent Variable: NTRSBN/NTRSBN(-1)
Method: Least Squares
Date: 01/10/02 Time: 12:46
Sample(adjusted): 1996:1 2001:3
Included observations: 23 after adjusting endpoints
NTRSBN/NTRSBN(-1)=C(1)+C(2)*DD991

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	1.059	0.032193	32.89547	0
C(2)	-0.41965	0.154392	-2.71809	0.0129

R-squared	0.260251	Mean dependent var	1.040754
Adjusted R-squared	0.225025	S.D. dependent var	0.171525
S.E. of regression	0.150998	Akaike info criterion	-0.86016
Sum squared resid	0.478808	Schwarz criterion	-0.76142
Log likelihood	11.89183	Durbin-Watson stat	2.367928

Capital and financial account

Capital

Dependent Variable: NCAPBN
Method: Least Squares
Date: 01/10/02 Time: 12:41
Sample(adjusted): 1993:2 2001:3
Included observations: 34 after adjusting endpoints
NCAPBN=C(1)+C(2)*NCAPBN(-1)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	3.356797	3.330113	1.008013	0.321
C(2)	0.710942	0.123643	5.749945	0

R-squared	0.50816	Mean dependent var	10.78824
Adjusted R-squared	0.49279	S.D. dependent var	25.12778
S.E. of regression	17.89566	Akaike info criterion	8.664016
Sum squared resid	10248.15	Schwarz criterion	8.753802
Log likelihood	-145.288	Durbin-Watson stat	1.808656

Direct investment inward

Dependent Variable: LOG(NDIIBN)
Method: Least Squares
Date: 01/17/02 Time: 10:29
Sample(adjusted): 1994:2 2001:1
Included observations: 28 after adjusting endpoints
LOG(NDIIBN)=C(1)+C(2)*LOG(NDIIBN(-1))+C(3)*LOG(PPPITN
/PPPITN(-1))-LOG(1+NGVDTA(-1)/NGDPTA(-1))

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	2.863064	1.235535	2.317266	0.029
C(2)	0.599898	0.174755	3.4328	0.0021
C(3)	-5.47398	4.584449	-1.19403	0.2437

R-squared	0.449245	Mean dependent var	6.797104
Adjusted R-squared	0.405185	S.D. dependent var	0.760914
S.E. of regression	0.586849	Akaike info criterion	1.872859
Sum squared resid	8.609795	Schwarz criterion	2.015595
Log likelihood	-23.22	Durbin-Watson stat	2.149283

Direct investment outward

Dependent Variable: NDIOBN/NDIOBN(-1)
Method: Least Squares
Date: 01/10/02 Time: 12:37
Sample(adjusted): 1993:2 2001:3
Included observations: 34 after adjusting endpoints
NDIOBN/NDIOBN(-1)=C(1)+C(2)*DD992

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.796824	0.705397	1.12961	0.267
C(2)	251.3143	4.113136	61.1004	0

R-squared	0.991501	Mean dependent var	8.18842
Adjusted R-squared	0.991236	S.D. dependent var	43.28437
S.E. of regression	4.052198	Akaike info criterion	5.693418
Sum squared resid	525.4498	Schwarz criterion	5.783204
Log likelihood	-94.7881	Durbin-Watson stat	1.891877

Other investment

Dependent Variable: NOTIBN/NOTIBN(-4)
Method: Least Squares
Date: 01/10/02 Time: 12:39
Sample(adjusted): 1997:1 2001:3
Included observations: 19 after adjusting endpoints
NOTIBN/NOTIBN(-4)=C(1)+C(2)*DD994

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.69729	0.355772	1.959935	0.0666
C(2)	11.56697	1.550774	7.458834	0

R-squared	0.76595	Mean dependent var	1.306078
Adjusted R-squared	0.752183	S.D. dependent var	3.032092
S.E. of regression	1.509413	Akaike info criterion	3.760619
Sum squared resid	38.73156	Schwarz criterion	3.860034
Log likelihood	-33.7259	Durbin-Watson stat	2.240538

Portfolio investment

Dependent Variable: NPOIBN/NPOIBN(-4)
Method: Least Squares
Date: 01/10/02 Time: 12:39
Sample(adjusted): 1995:1 2001:3
Included observations: 27 after adjusting endpoints
NPOIBN/NPOIBN(-4)=C(1)+C(3)*DD002+C(4)*DD981

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	3.187479	1.237165	2.576439	0.0166
C(3)	-244.896	6.308328	-38.8211	0
C(4)	-63.8464	6.308328	-10.121	0

R-squared	0.985053	Mean dependent var	-8.24743
Adjusted R-squared	0.983807	S.D. dependent var	48.61085
S.E. of regression	6.185824	Akaike info criterion	6.586837
Sum squared resid	918.3461	Schwarz criterion	6.730819

Residual

Error and omissions

Dependent Variable: NERRBN
Method: Least Squares
Date: 01/10/02 Time: 12:56
Sample(adjusted): 1993:3 2001:3
Included observations: 33 after adjusting endpoints
NERRBN=C(1)*NERRBN(-1)+C(2)*NERRBN(-2)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.35746	0.178273	-2.0051	0.0538
C(2)	-0.28616	0.175871	-1.62711	0.1138

R-squared	0.135789	Mean dependent var	-34.6364
Adjusted R-squared	0.107911	S.D. dependent var	377.5904
S.E. of regression	356.6359	Akaike info criterion	14.65
Sum squared resid	3942864	Schwarz criterion	14.7407
Log likelihood	-239.725	Durbin-Watson stat	1.919992

Others

Interest rate

Dependent Variable: MLIRTN
Method: Two-Stage Least Squares
Date: 12/11/01 Time: 12:42
Sample(adjusted): 1996:1 2001:1
Included observations: 21 after adjusting endpoints
MLIRTN=LOG(PPPITN/PPPITN(-1))+C(1)+C(3)*(MLIRTN(-1)
-LOG(PPPITN(-1)/PPPITN(-2)))
Instrument list: MLIRTN(-2) LOG(PPPITN(-3)) C RTRATA(-1)/RGDPTA(
-1)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.011523	0.020858	0.55244	0.5871
C(3)	0.883186	0.18662	4.732551	0.0001

R-squared	0.495438	Mean dependent var	0.122717
Adjusted R-squared	0.468882	S.D. dependent var	0.021773

Residual on national account identity

Dependent Variable: NDISTA
Method: Least Squares
Date: 12/11/01 Time: 12:33
Sample(adjusted): 1993:1 2001:2
Included observations: 34 after adjusting endpoints
NDISTA=(C(1)+C(2)*RDISTA)*PGDPTN

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	49.91005	31.07105	1.60632	0.118
C(2)	0.624418	0.078675	7.936693	0

R-squared	0.681158	Mean dependent var	105.8375
Adjusted R-squared	0.671195	S.D. dependent var	435.6077
S.E. of regression	249.7842	Akaike info criterion	13.93609
Sum squared resid	1996549	Schwarz criterion	14.02588
Log likelihood	-234.914	Durbin-Watson stat	1.606541