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EMPIRICAL MACRO-ECONOMIC MODEL OF THE FINNISH ECONOMY (EMMA)

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Empirical Macroeconomic Model of the Finnish Economy (EMMA)*

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Abstract

This paper provides a review of the empirical macroeconomic model (EMMA) built for forecasting purposes at the Finnish Labour Institute for Economic Research. The model is quite small, consisting of 71 endogenous and 70 exogenous variables. The number of behavioural equations is 15. The basis of the model is Keynesian, although the model has some novel properties. They are the treatment of the supply side and prices that follow the routes of the neoclassical synthesis. The parameters of the model are estimated from quarterly data that cover the years 1990-2005. The model also contains a Kalman-filtered variable to control the deep recession in Finland at the beginning of the ’90s. This special feature brings the model closer to the new calibrated models.

1. Motivation

Earlier, it was considered self-evident that most macroeconomic variables can be forecasted relatively accurately if the forecasters have the necessary data and proper models. Thus, investing in forecasting would pay off. Hence, for instance, the development of larger and more complicated models would be useful. After the rational expectations revolution in the 1970s things are no longer that simple. We have learned that in many cases random walk forecast cannot be beaten by structural models and other sort of forecasting techniques. That is because variables which are contingent on wealth variables basically depend on current expectations of the future path of prices. Thus, if we want to beat the random walk forecast (a forecast where the current value is used as the best proxy for the next period's value) we ought to know how expectations will change. That sounds impossible. Even if this is the case with certain variables, it is not, however, true with all. In many cases there are various market frictions which can be exploited in forecasting. Thus, prices and wages may be sticky, adjustment cost may dictate the path of adjustment with volume variables and, finally, the forecasters may have some information advantage compared with the general public.

Against this background it seems self-evident that the quality of forecasts can be improved by using more resources in the forecasting process. This is true with the development of models, in particular. Models automatically impose some necessary adding-up and homogeneity restrictions which make the forecast logically consistent. Moreover, models also allow comparison of alternative time-paths of exogenous variables and policy rules. Finally, models provide meaningful estimates of uncertainty which is related to future time paths of different variables. Without a proper model these necessary steps cannot be taken and forecasting looks like guessing the right numbers. In this case, the outcome of forecasting process must also be limited to a few indicators, like the GDP. Although, the media is usually only interested in (future) GDP growth rates that is not the same as the future economic situation. Take for instance, the public sector. The growth rate of GDP tells very little on the size of the public sector, the deficit and debt ratios, and the structure of taxation and expenditures. Obviously these numbers can be forecasted (guessed?) separately but there is absolutely no guarantee that the outcomes correspond to any internally consistent set of values.

One may outline these causalities in one's own head, but in practice the most sensible thing to do is to formulate a model that includes the essential dependences. This kind of simultaneous economic models has been generally used throughout the western world since the days of Jan Tinbergen (1939), the pioneer of macroeconomic model building. Nevertheless, forecasting and policy analysis with macro models is poorly rooted in the Finnish culture. Only the Bank of Finland has continually used and cultivated its macro models. In the other research institutes the models have played a secondary role and they have been used occasionally (in the 1970s and 1980s the models of the Ministry of Finance's (entitled KESSU) and the Research Institute of the Finnish Economy ought to be mentioned here). Except for the Bank of Finland, all the forecasts in Finland are made without a formal model framework and rest, at the highest, on the standard computation schemes of the national accounts system.

The decision of Labour Institute to build a macro economic model basically derives from an aim to increase the analytical elements in the Institution's forecasting process. As stated above, modelling improves the inner consistence of a forecast and gives an opportunity to track down the ideas behind the forecast estimates. The experienced difficulties to foresee the turning points in the economic development are closely related to this. Without a model, the turning points are really hard to forecast, instead, it is very common that forecasters just continue the historical path and even mimic the forecasts made by other institutions.

In addition, the macroeconomic model can be used as a device to make various kinds of simulations. We can then investigate, for example, the outcomes of specified policy measures. Even the effects of a change in any exogenous variable can be examined.

2. The model

As has already been said, the history of macroeconomic modelling begins from the 1930s. The traditional macro models are Keynesian. The rise of neoclassical theory and rational expectations have made the builders of macroeconomic models improve their models. The supply side of the economy has received more attention and there have been attempts to incorporate rational expectations in macroeconomic models. Theoretical development has also given rise to the new dynamic general equilibrium models.[1] A general view about the macro models built recently can be received in the table below. The table shows the name, the owner, the frequency, the size, and the basic properties of a model.[2]

Table 1. Some recent macro models

Model name	Owner	Frequency	Size	Theoretical basis
A-LMM	WIFO/IHS[3]	Yearly	109 equations	Neoclassical synthesis
ADAM	Danmarks Nationalbank	Yearly	1400 equations	Neoclassical synthesis
AINO	Bank of Finland	Quarterly	Medium	DSGE[4]
AJKA	HSE[5]	Yearly	65 equations	Neoclassical synthesis
AQM	Austrian National Bank	Quarterly	145 equations	Neoclassical synthesis
AWM	European Central Bank	Quarterly	84 equations	Neoclassical synthesis
BEQM	Bank of England	Quarterly	130 equations	DSGE
BOF5[6]	Bank of Finland	Quarterly	360 equations	Neoclassical synthesis
EDGE	Bank of Finland	Quarterly	42 equations	DSGE
ETLA	ETLA[7]	Yearly	70 equations	Neoclassical synthesis
FRB/GLOBAL	The Federal Reserve	Quarterly	1440 equations	Neoclassical synthesis, multi-country model
FRB/US	The Federal Reserve	Quarterly	c. 300 equations	Neoclassical synthesis
HEIMDAL	Economic Council of Labour Movements[8]	Yearly	1413 equations	Neoclassical synthesis, multi-country model
HERMIN	The Economic and Social Research Institute[9]	Yearly	261 equations	Neoclassical synthesis
KESSU IV[10]	Fin. Ministry of Finance	Yearly	c. 950 equations	Neoclassical synthesis
LIMA	IHS	Yearly	78 equations	Neoclassical synthesis
MAKMODEL	National Bank of the Republic of Macedonia [11]	Yearly	38 equations	Neoclassical synthesis

[1] More about history of macro models, see Valadkhani (2004). About structure of the models, Hall & Henry (1989).
[2] A more detailed description of the models in the table, and further information about the model documents, see Lehmus (2006).
[3] Austrian Institute of Economic Research / Institute for Advanced Studies.
[4] Dynamic Stochastic General Equilibrium (model).
[5] Helsinki School of Economics.
[6] This is the latest version of the BOF models.
[7] Research Institute of the Finnish Economy.
[8] A Danish institute.
[9] And Technical University of Wroclaw & Wroclaw Regional Development Agency.
[10] This is the latest version of the KESSU models.
[11] The model has been developed with the assistance of the Central Bank of the Netherlands.

Medium-Size Macro-economic Model for the Brazilian Econ.	Bank of Brazil	Yearly	38 equations	Neoclassical synthesis
MEMMOD	Central Bank of Germany	Quarterly	480 equations	Neoclassical synthesis, multi-country model
MM	Bank of England	Quarterly	111 equations	Neoclassical synthesis
MODAG	Statistics Norway	Yearly	c. 4000 equations	Neoclassical synthesis
MODUX	STATEC[12]	Yearly	300 equations	Neoclassical synthesis
MONA	Danmarks Nationalbank	Quarterly	336 equations	Neoclassical synthesis
MORKMON II	Bank of the Netherlands	Quarterly	360 equations	Neoclassical synthesis
MULTIMOD MarkIII	IMF	Yearly	Large	DSGE,multi-country model
MZE	INSEE & Direction de la Prévision[13]	Quarterly	Relatively small	Neoclassical synthesis
NIGEM	NIESR[14]	Quarterly	Large	Neoclassical synthesis, multi-country model
NTZM	New Zealand Treasury	Quarterly	101 equations	DSGE
Oxford World Macro-economic model	Oxford Economic Forecasting	Quarterly	Large	Neoclassical synthesis, multi-country model
QPM	Bank of Canada	Quarterly	329 equations	DSGE
QPSFM	Polish Ministry of Finance	Quarterly	119 equations	Neoclassical synthesis
Quarterly macro-econometric model of the Spanish economy	Central Bank of Spain	Quarterly	59 equations	Neoclassical synthesis
SAFE	CPB[15]	Quarterly	1920 equations	Neoclassical synthesis
TRYM	Australian Treasury	Quarterly	130 equations	Neoclassical synthesis
WIFO-Macromod	WIFO	Yearly	134 equations	Neoclassical synthesis

With traditional macro models the tendency is toward smaller, more practical models. The model described in this paper can be seen to follow this route: its emphasis is not on theoretical complexity but on practicality as a forecasting and simulation tool. Yet it is also theoretically justified. When thinking of analogous macro models that have been built recently, one could mention either the AWM built at the European Central Bank or the QPSFM built at the Polish Ministry of Finance.[16]

The theoretical basis of our model is Keynesian, although the treatment of the supply side and prices is based on neoclassical economic theory. For this reason the model can be seen to follow the standard routes of neoclassical synthesis. The model is backward-looking; for the purpose of generating short-term forecasts, this is usually considered adequate. Most parameters of the model have been estimated from data.

[12] Service central de la statistique et des études économiques (Luxembourg).
[13] National Institute for Statistics and Economic Studies (France) and French Ministry of Finance.
[14] National Institute of Economic and Social Research.
[15] Central Planning Bureau (the Netherlands).
[16] AWM, see Gabriel, F., Henry, J. & Mestre, R. (2001) and QPSFM, see Virén, M. & Pachucki, D. & Dudek, S. (2003).

The model consists of 71 endogenous and 73 exogenous variables. The number of behavioural equations is 15. The public sector identities, in particular, enlarge the model. The nature of the model is quite aggregated: the economy consists of the private and public sectors. The equations of the model can be divided into four blocks: production function and factor demand equations, aggregate demand equations, price and wage equations, and public sector identities. The production function is modelled with the conventional Cobb-Douglas function. The model also includes the output gap which is based on the NAIRU rate. The NAIRU rate is assumed to depend on long-term unemployment.

The model equations are estimated with OLS (ordinary least squares). The long-run equilibrium relationships and short-term dynamic corrections of the behavioural equations are estimated using an error correction model (ECM) framework. From the point of view of time-series analysis, these correspond to the two-stage Engle-Granger (1987) method.

The most demanding part in modelling the Finnish economy in the period 1990-2005 is the deep recession in years 1991-1994. Owing to the recession, it is almost impossible to get reasonable estimates for the coefficients of the equations. To solve this problem, we use the Kalman filter to estimate a time-varying parameter included in the scale of the production function. This parameter is used later on as a ”recession dummy” variable in many equations. This way the shock caused by the recession is controlled. The solution can be regarded as an indispensable compromise to deal with one of the deepest recessions in western countries during modern times. Other methods, for instance the use of different dummies indicating structural change, would have probably led to unpractical and complicated applications. This novel feature also brings this traditional model closer to the new calibrated macro models.

The model described in this discussion paper is a beta version and will be developed further. In the near future, we intend to concentrate on the labour market and fiscal blocks of the model. Then, especially the relationship between labour supply and taxes (the tax wedge) is considered. The data bank links, computation, and simulation routines will also be developed so that the practial use of the model will be relatively easy. The paper is organized as follows. First we briefly describe the data. Then we analyse the main structure of the four equation blocks of the model. Finally, we do some simulations with the model.

3. The Data

The data of the macroeconomic model covers the years 1990-2005. The data is quarterly and is based mainly on the national accounts of Statistics Finland. Other data sources have been the Bank of Finland, VATT, Eurostat, and the World Bank. The two latter ones have been used to collect the data from foreign countries. The money and interest rate series come from the Bank of Finland. The tax rate data is based on the calculation of the Government Institute for Economic Research (VATT). Our aim has been to use the series that are seasonally adjusted by Statistics Finland as much as possible. In some cases only unadjusted time series exists. These series have been seasonally adjusted with the Tramo/Seats method (which is the same method that is used in Statistics Finland).[17]

In addition, some sectoral accounts are only available on a yearly basis. These series have been disaggregated with the help of relevant reference series. This has been done with the Ecotrim program developed in Eurostat. The model system operates in the Eviews environment but some calculations have been done outside the actual model. This mainly concerns the public sector and the foreign environment.[18] These ”satellite calculations” are found in Excel. Chapters 5 and 7 and Appendix 2 will illustrate the public sector and foreign sector calculations further.

4. The production function and potential output

Neoclassical theory emphasizes the role of the supply side in the economy. The supply is usually determined by the production function. When constructing the production function, the familiar question is: Should it be the CES or the Cobb-Douglas function? Before answering this, we start from some presumptions.

We make an assumption that value added is a relevant measure for the volume of production. In our model the production is divided into two separate sectors: the private sector and the public sector. There are also two factors of production, capital and labour (measured in working hours). First we generate a time series for the net capital stock of the private sector. This is done by accumulating investments, and to put it explicitly:

[17] The basic idea of this method is to describe a series to be adjusted as a relevant ARIMA-process, Gómez & Maravall (1997).

[18] Country weights: appendix 2.

$$KP_t = (1-\delta)KP_{t-1} + I \ . \qquad (1)$$

KP is the net capital stock of the private sector, δ is the depreciation rate of capital and I refers to the private investments. By accumulating the investments, we incorporate quarterly dynamics in the net capital stock series. When specifying the private sector's working hours, we assume that these hours cover all the economy's working hours except the hours done in sectors L-Q and X defined by Statistics Finland. (These sectors compose the public sector.)

The problem regarding the optimal production function form is widely discussed in the literature. Because it turned out to be more convenient to operate with the Cobb-Douglas function, the production is modelled with this function.[19] With the Cobb-Douglas production function the elasticity of substitution between labour and captital is unity. We also assume that technical development is Hicks-Neutral and the returns to scale are constant. Nevertheless, the deep recession in Finland in the early years of the '90s causes problems, a fall in production and other volumes. To solve this problem, we use the Kalman filter to estimate a time-varying parameter in the scale of the production function. The straightforward interpretation of this parameter is a negative technologic shock. Later on, this parameter is used as a dummy in many model equations to control the deep recession.

The factor shares of the production function have been calibrated so that the share of labour is assumed to be 0.6 and that of capital 0.4.[20] The final form of the production function in our model is then:

$$VAQP = Ae^{GF*t}\left((LHP)^{0.6} KP^{1-0.6}\right) \qquad (2)$$

$VAQP$ is the volume of production in the private sector, LHP denotes private labour (in hours), and KP is the net capital stock of the private sector. A is a parameter of scale and t is a trend. GF is the Kalman-filtered coefficient of the trend. As already mentioned, the technical progress parameter comes down in the recession but is constant during the last years when it gets the quarterly value of 0.006. That means 2.4% technical progress in a year.

[19] The explicit form of CD is $Q = A(L^b K^{1-b})$. CES is $Q = Ae^{\lambda t}\left[\left(\lambda K^{\frac{\sigma-1}{\sigma}} + (1-\lambda)L^{\frac{\sigma-1}{\sigma}}\right)\right]^{\frac{\sigma}{\sigma-1}}$

[20] This is a standard assumption in economic theory.

When considering the CES production function, the first-order conditions with respect to capital and labour lead to the following demand equations.[21]

$$\log(KP) = k_0 + \log(VAQP) - \sigma \log(UCC) + \lambda(\sigma - 1)t \quad (3)$$

$$\log(LHP) = n_0 + \log(VAQP) - \sigma \log(WPQ) + \lambda(\sigma - 1)t \quad (4)$$

where UCC is the user cost of capital and WPQ is the real wage. To formulate explicitly: $k_0 = \sigma \log\left((1-\lambda)A^{\frac{\sigma-1}{\sigma}}\right)$ and $n_0 = \sigma \log\left(\lambda A^{\frac{\sigma-1}{\sigma}}\right)$. Thus, constant terms are functions of the parameters of the production function. In the Cobb-Douglas case, the elasticity parameter of $\sigma = 1$.

Defining the user cost of capital is ambiguous. The user cost of capital can be calculated in many ways depending on how we define the relative price and the real interest rate of capital. Another problem is the volatility of the series.[22] In our model the user cost of capital is as follows:

$$UCC = (pi / pqp) * (r10 * 0.01 - \log(cpi / cpi(-4)) + depr), \quad (5)$$

where UCC is the user cost of capital, pi is the investment deflator, pqp is the private sector value added deflator, $r10$ is the interest rate, cpi is the consumer price index and $depr$ symbols the depreciation rate of private capital.

To obtain a reasonable estimate for capital formation, we have to model investments instead of capital stock; this is due to the problems with the Finnish capital stock data. Yet the net capital stock is endogenous and depends on investments (equation 1). All the parameters of the investment and labour demand equations are estimated from the data. Nevertheless, the obtained parameters are consistent with the production function because the elasticities of substitution corresponding these parameters are close to unity. Actually, the elasticities we get are quite close to the outcomes of Kiander et al. (2005).[23]

There is one special feature with the investment equation in our model. We model the ”real investments”, meaning the domestic investments plus net direct investments abroad. To put it explicitly, the dependent variable in the investment equation is $IPQ + 0.25(DI / PI)$, where IPQ is the private investments, DI the direct investments abroad, and PI the private investment prices.

[21] See for instance Szeto (2001).
[22] See Chirinko (1993).
[23] This study uses micro data.

This formulation implies that the direct investments abroad display the domestic investments, although with a relatively small weight (0.25).

The production function gives the private sector supply. Also, the output gap is included in the model structure. We assume that potential output is defined by the NAIRU rate; the NAIRU rate is derived from using data on long-term unemployed. The result is a time-varying series, flatter than the actual unemployment rate series, but still affected by the economic recession at the beginning of the '90s. The output gap constructed actually mimics the difference between unemployment and long-term unemployment. NAIRU is exogenous in our model.

Only the private sector production is modelled with the production function. The public sector production is modelled in a simplier way. It has been explained by the public sector's working hours and the real level of income in this sector. Thus, the output gap of the private sector also represents the output gap of the whole economy and the public sector size (working hours) is regarded as an exogenous policy instrument.

Despite the well defined supply, the basis of the model is Keynesian; demand defines the output in the short run. Nevertheless, because the prices and wages depend on the output gap (difference between unemployment and long-term unemployment), demand equals supply in the long run.

5. Aggregate demand

Aggregate demand consists of consumption, investments, and net exports. We begin with household consumption. There are assumed to be two different consumer groups in our model: those who are liquidity constrained and those who are not. The consumption of the former group depends on disposable income, whereas people in the latter group maximize their utility intertemporarily and their consumption follows the predictions of the permanent income life-cycle hypothesis. For the latter group, consumption follows the changes of their wealth, though, for the former group, consumption does not straightforwardly follow their disposable income either, as their consumption depends on the history of their disposable income too. To put this analysis formally, we have a convex combination of the following kind:

$$CQ = \lambda\big((YHQ_t / PC_t + YHQ_{t-1} / PC_{t-1} + \ldots + YHQ_{t-6} / PC_{t-6}) / 7\big) + (1-\lambda)HW \, , \tag{6}$$

where CQ is the private consumption, YHQ symbols the disposable income, PC is the deflator of consumption and HW is the real wealth. The estimation results give the parameter λ a value of 0.89.

There are some measuring problems with respect to the household wealth. In the model its value is assumed to follow the apartment prices index. This is because there does not exist any official time series on wealth in Finland, except only the occasional wealth study of the Statistics Finland. Still, we can motivate the use of the apartment price index with the fact that the wealth of Finnish people mainly consists of apartments. Also, compared to other indicators, for instance the stock prices, this indicator is clearly more plausible.[24]

The former analysis only concerns the private sector. Public consumption is modelled as an identity which sums up real wages paid in the public sector and government purchases (residual term).

For export and import, long-run homogeneity in terms of scale variable(s) has been imposed on the equations. Import is modelled as a convex combination of domestic demand and export volume. The connection from export to import is based on the fact that export industries use a lot of imported inputs. Both export and import are also affected by the the prices term which measures the price competitiveness of export and import items in their markets. Thus, the import volume is affected by the ratio between the import prices and the domestic value added prices, and, the export volume by the ratio between the export prices and the foreign prices.

Still, there are some special features in our export equation that are worth mentioning. The foreign demand reflects the weighted average of the GDPs in the most important countries for the Finnish export. Respectively, the foreign price level, the determinant of the evaluated price competitiveness, is obtained from the weighted average of the import prices of these countries. In this calculation important prices are converted into euro denomination units. Exported is then modelled:

$$\log(XQ) = \alpha + \log(IMU29) - \gamma \log\left(\frac{PX}{PWI29}\right) + \kappa(GF), \tag{7}$$

where XQ is the export volume, $IMU29$ is the combination of the gross domestic product of 29 countries and $PWI29$ is the combination of the import prices (in euro denomination) of the same countries. PX is the domestic export prices and GF is the recession dummy described earlier.

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[24] See Mayes & Virén (2001).

6. Prices and Wages

All variables which determine GDP on the demand side are expressed in real and nominal values. For that reason, we also need to model the prices. The price block in our model is based on the law of one price. Thus, static homogeneity has been imposed, which is equivalent to expressing the long-run equations in terms of relative prices.

Prices are usually combinations of (private) value added prices and foreign/import prices. The weights of individual prices have been estimated from data in all but the investment price equation. In this equation the weights have been calibrated. It is assumed that PWI29 defined in the previous chapter approximates to the foreign prices. Despite PWI29 also explains the export price level, our export price equation's fit in terms of R2 remains rather poor. For the same reason import prices are regarded as an exogenous variable in the current version of the model.

In the price block, there is also a connection from wages to other prices. Private value added prices are assumed to follow private sector wages (positively) and average productivity (negatively). Then, private consumption prices react to the changes in the value added prices. This induces a degree of sluggishness in the response of private consumption prices to changes in the wage rate.

There are also some other (volume) variables that affect the prices in the model. For instance, the output gap, measured as a difference between unemployment and long-term unemployment, affects investment prices. In addition, export prices are also affected by the recession dummy and dollar/euro exchange rate.

Traditionally, wages are modelled with the Phillips curve relationship (1958), in which wages depend on the previous period's inflation and output gap. We notice that wage formation in Finland contains the familiar Scandinavian features: wages are negotiated in a centralized way together with employer and employee organisations and the government. As a result, wages are quite rigid and inelastic. This is why in our equation for (private) wages actually the wage drifts is an explanatory variable. The wage equation looks like this:

$$\log(WRP) = \alpha + \log(PWS) + \beta \log(PROD) - \gamma(UGAP) - \mu(DI / IPV(-1)), \tag{8}$$

where WRP is the private wage rate index, PWS is the standard private wage rate index, $PROD$ the productivity of labour, $UGAP$ the unemployment gap, DI the net direct investment abroad (in current prices) and IPV private investments (in current prices). Thus, the unemployment gap affects wages negatively. The last term, net direct investments abroad as a share of private investments, demands further explanation. Despite the rigidities in Finnish wage formation it has been assumed that direct investments abroad create a negative pressure on domestic wages. According to the data the impact is rather small, but statistically significant.

To capture the labour market effects properly, we also endogenise the standard private wage rate index. It is explained by the combination of its lagged value and the private consumption prices, and the output gap (its one-year moving average). In our model the public sector wages follow the private sector wages and the output gap has a negative effect on the public sector wages.

7. Income accounting and public sector

The public sector, its revenues and expenditures, is mainly modelled with identities. The same applies to the income accounting of households. Since the model has been planned to be used as a forecasting tool at the Labour Institute for Economic Research, the identities are constructed with the help of the Institute's forecasting system. To avoid of making the model system too complicated, some identities have been constructed outside the model. For instance, employers contributions to the social security was originally calculated in Excel by adding up the employer's actual and imputed social contributions.

When the public sector and income accounting identities were being constructed, the main aim was to make them consistent with the national accounts data. The identities also describe the legal and institutional framework of the public sector. Public sector linkages are important in all policy simulations.

In the public sector, behavioural equations are estimated only for value added, wages, and consumption prices. Still, this is not the whole truth, since the parameters in the public sector identities are usually estimated from the data. The residual terms received from the estimations are added in the public sector identities. The typical form of a public sector identity then is

$$\log(TAXQM) = \alpha + \beta \log(CV) + RESID, \tag{9}$$

where $TAXQM$ denotes the production and import taxes collected by the public sector. They depend on private consumption in current terms (CV); the parameter β has been estimated from the data. $RESID$ is the residual term which makes the right side of the equation consistent with the left side.

8. Some policy simulations with EMMA

The following illustrative policy simulations are reported in this paper
- an increase of government purchases by 1 per cent (of GDP)
- an increase of government investments by 1 per cent
- an increase of labour supply by 1 per cent
- an increase of NAIRU rate by 1 percentage point
- an increase of interest rates by 1 percentage point
- an increase of foreign demand by 1 per cent
- an increase of VAT rate by 1 percentage point
- a revaluation of euro/dollar exchange rate by 10 per cent

All simulations are carried out in the case of fixed exchange rate and without any policy rules. The simulations show that the model has reasonable short-term and medium-term properties. Although the short-run effects are definitely Keynesian (see eg the fiscal multipliers), the long-run effects are dominantly supply oriented. Thus, in the long run, expansive fiscal policies - increases in government purchases and government investments - lead to contradictory output effects. This is mainly due to the deterioration of the real exhange rate. We also notice that the increase in the public deficit affects the yield on government bonds; this way it affects the other parts of the economy, private investments for instance. In addition, the fiscal shocks lead to major public sector imbalances in the long run. Nevertheless, one has to remember that in the current version of the model there is no link between public sector investments and private sector productivity. If it is assumed that the public investments increase the private productivity, the (public investment) shock's impact on output may not be contradictory in the long run.

Also, some labour market shocks are scrutinized. At first, a 1% increase in labour supply goes to the unemployment; at the same time, the output gap of the economy becomes smaller (economy is further from its potential). As a consequence, the negotiation power of the employee organizations decreases and the wages start to fall. This improves the demand for labour and boosts the total supply in the economy. In the long run, also other prices in the economy fall due to the decrease in the nominal wages. The decrease in the domestic price level advances the export sector competitiveness and increases the real wages. In the long run, a shock on labour supply is matched by nearly proportional increase in the output volume. This is a standard outcome in the small open economy model.

The impact of 1 percentage point increase in NAIRU (Non-Accelerating Inflation Rate of Unemployment) rate is inverse compared to that of the labour supply shock. This is because as a consequence of the shock, output gap grows (economy is closer to its potential). Again, the prices adjust and supply oriented effects dominate in the long-run. The new balance is reached at a lower level of output; also the unemployment rate is higher than before the shock.

Also interest rates have relatively large long-run effects. This is mainly due to adverse effects on the capital stock and productive capacity. When scrutinizing the demand side of the GDP, we notice that the long-run effects are negative in all variables. The shock's impact on investments is remarkable; investments decrease more than 10 per cent. This is because the interest rates directly affect the user cost of capital. However, the short-run effect of the shock on the export volume is positive. This is due to the lower domestic price level which improves the competitiviness of the export sector. Though, in the long run, the contradictory effects start to dominate even in the export sector. This is mainly due to the decrease in the economy's potential output which creates inflationary pressures to the economy, and then, weakens the competitiveness of the export sector in the long run.

First, a positive world demand shock boosts the export demand. This improves the employment and also the output of the economy. In the long run, the real exchange rate deteroriates due to the inflationary pressures which also makes the export sector less competitive in the world markets. On the other hand, increased exports rise the import volume. As a consequence, the long run effect of the demand shock on output is positive but converges to zero.

Then, a 1 percentage point increase in VAT rate is scrutinized. The rise of VAT rate produces inflationary pressures; the main impact comes via the consumption prices. The higher price level dampens the private consumption and deteroriates the competitiveness of the export sector. Nominal wages increase but real wages decrease because of increased unemployment. Increased inflation leads to deterioration of competitiveness and that in turn creates stong adverse output effects. As expected, the shock has positive effects on the public finances, thus the deficit clearly decreases. Also, interest rates decrease slightly, mainly due to the lower public deficit.

Finally, we simulate a 10% revaluation shock on the euro / U.S. dollar exchange rate. More specifically, we also assume a 10% revaluation of the euro against the currencies that have the fixed exchange rate with the U.S. dollar (the Chinese Yuan and the Honkong dollar in our model). Above all, the exchange rate shock reduces the competitiviness of the Finnish export sector. This immediately reduces the total demand in the economy. In the long run, the prices adjust (fall) and the shocks's effect on the export volume is slightly dampened. However, the long-run effect on the output is negative because the shock reduces both the capital stock and the demand for labour. Thus, after 35 years, GDP is more than 1% lower than before the shock.

9. Concluding remarks

Forecasting models are never ready. This is also true with the Labour Institute's model. Even so, the current model can already be used in actual forecasting work. This practical work also gives valueable information for the future development of the model. It is hoped that a more complete model version can be constructed during the year 2007. After doing that, also a more complete report on the structure and properties of the model can be published.

Figure 1. GDP, actual and simulated (total demand) 1990-2006

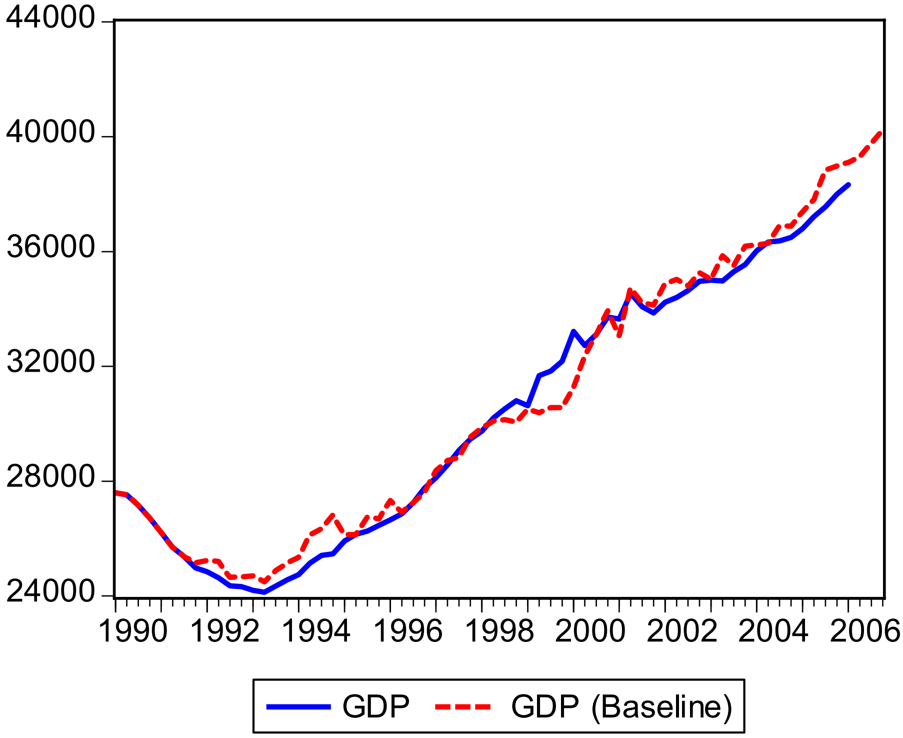


Figure 2. GDP, actual and simulated (total supply) 1990-2006

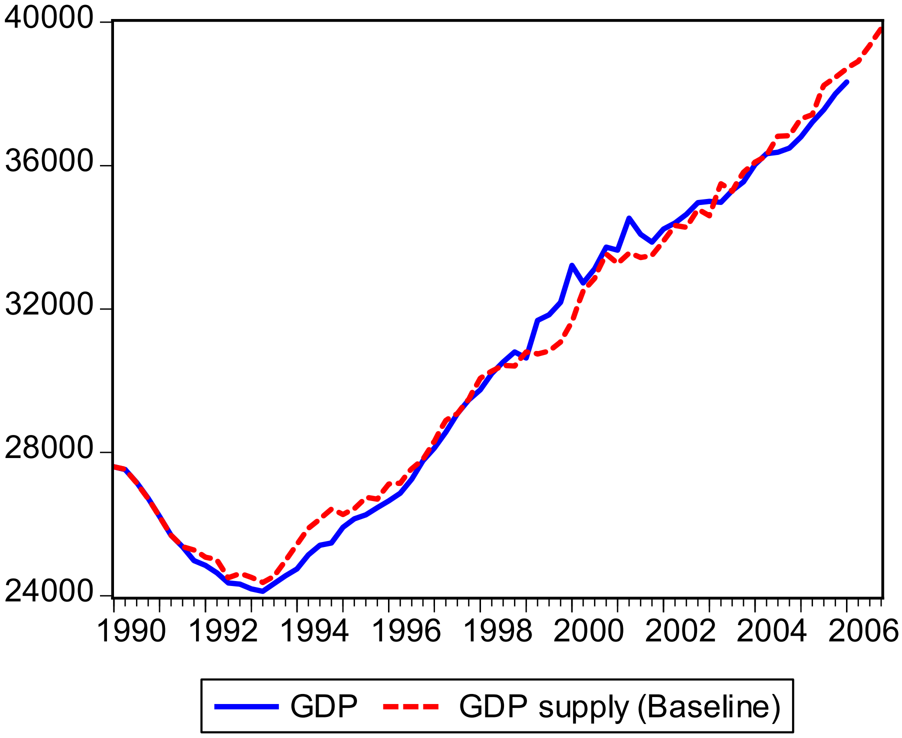


Figure 3. Simulated total supply and demand 1990-2040

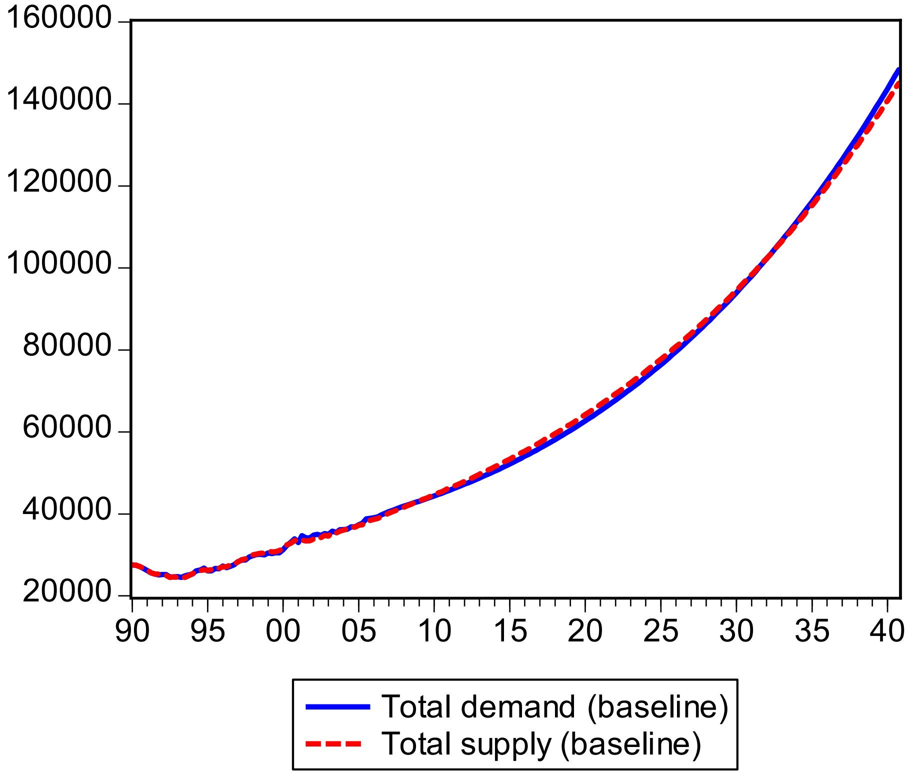
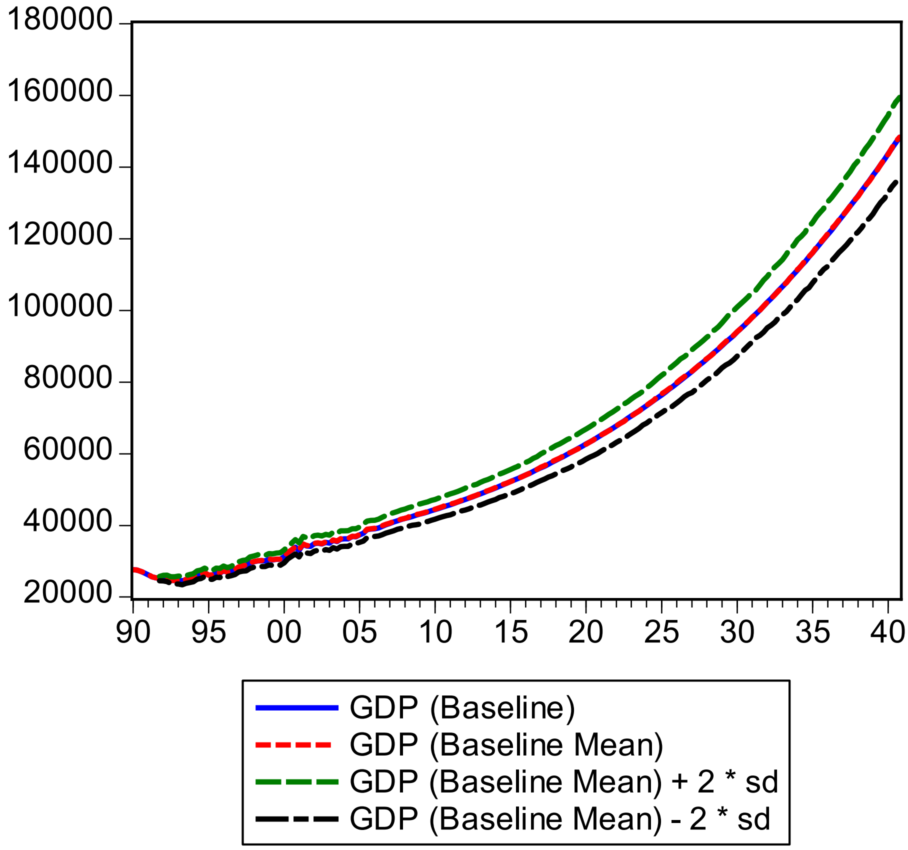


Figure 4. Stochastic simulations of GDP (mean and confidence intervals) 1990-2040



<u>**Effect of permanent macro shocks**</u>

Effect of 1% increase (of GDP) in government purchases

Figure 5.

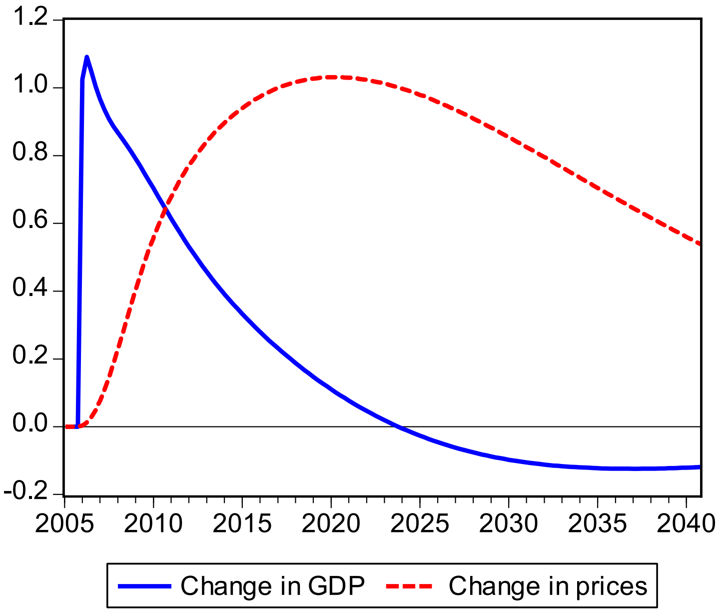
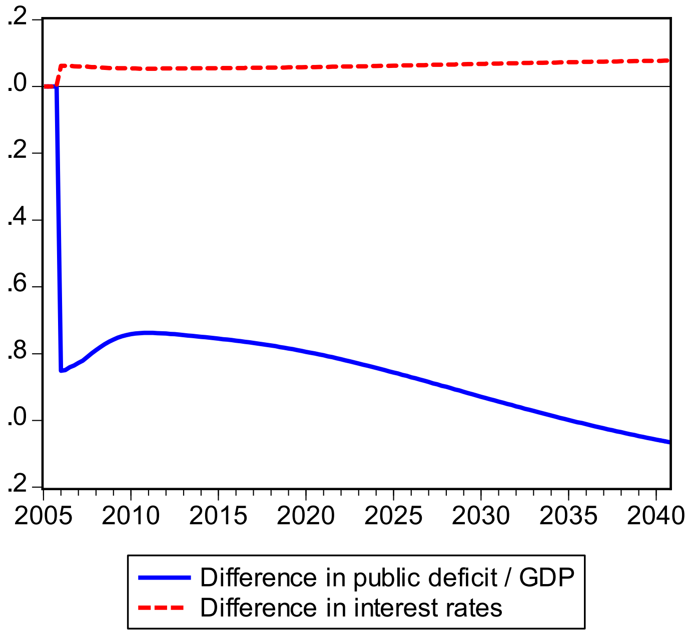


Figure 6.



Effect of 1% increase in government investments

Figure 7.

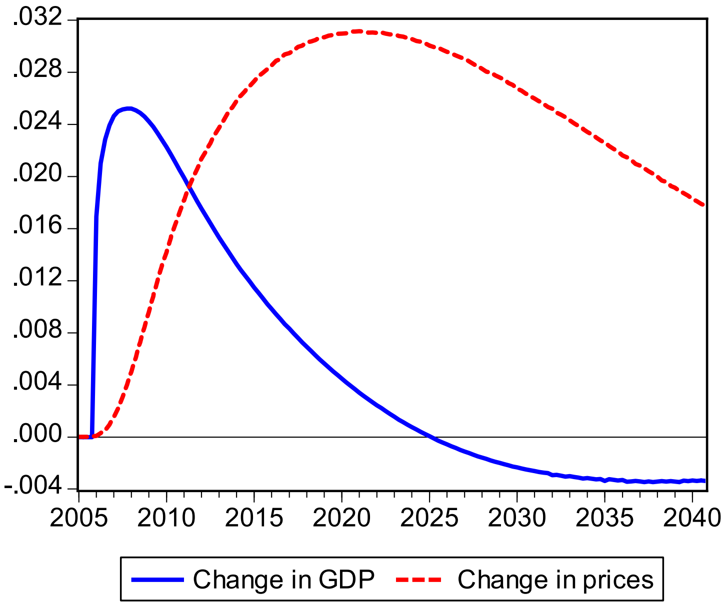
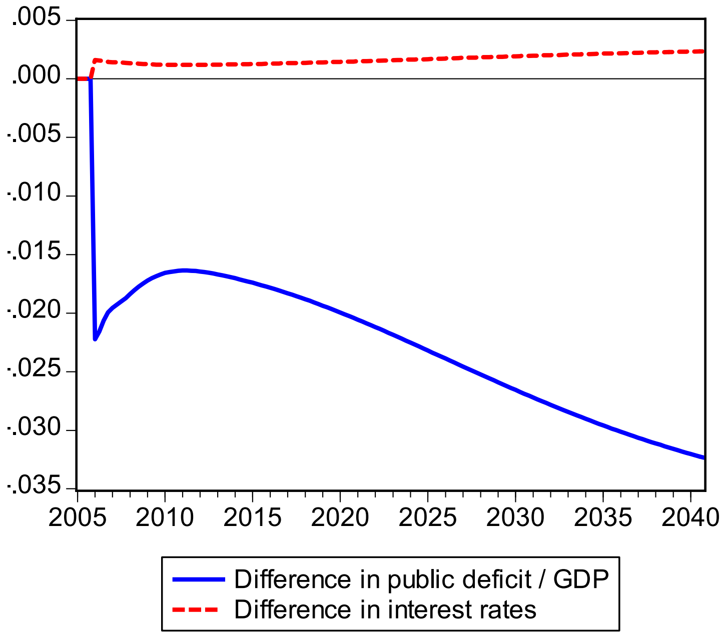


Figure 8.



Effect of 1% increase in labour supply

Figure 9.

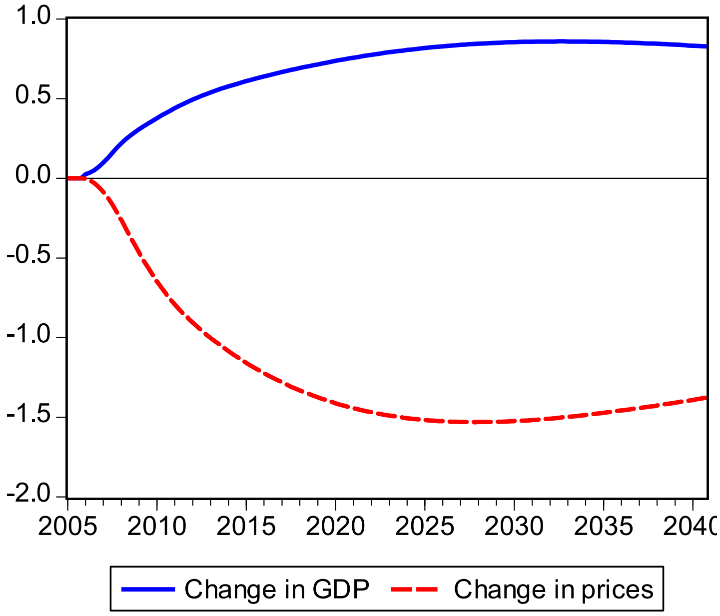
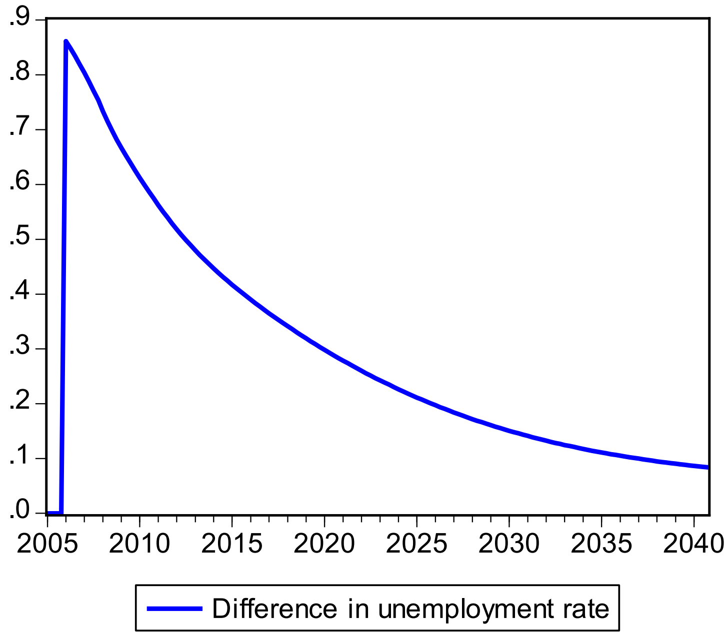


Figure 10.



Effect of 1 percentage point increase in NAIRU rate

Figure 11.

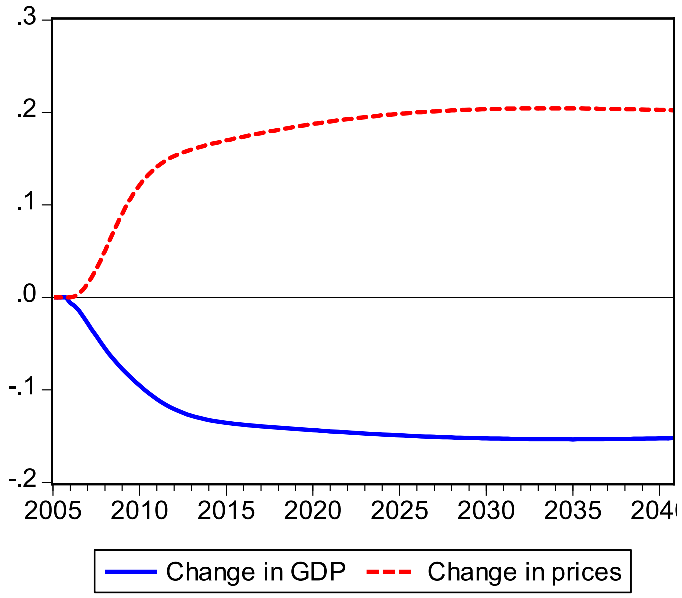
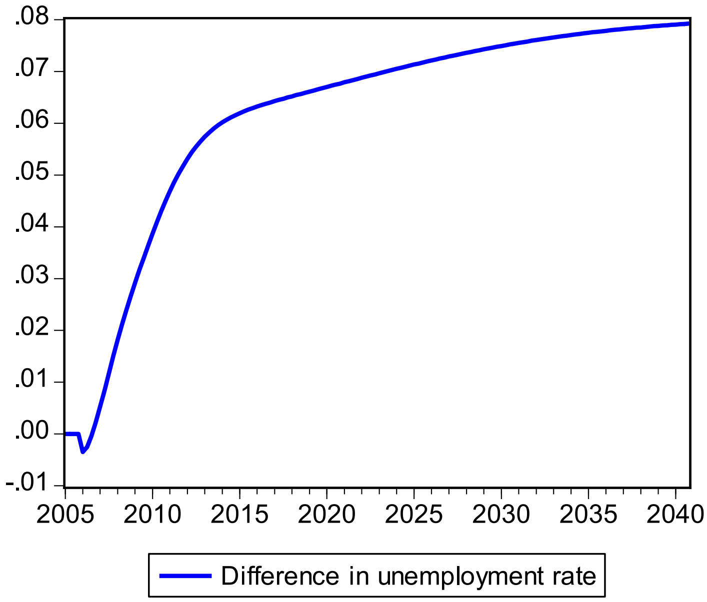


Figure 12.



Effect of 1% point increase in government (10 years) bond

Figure 13.

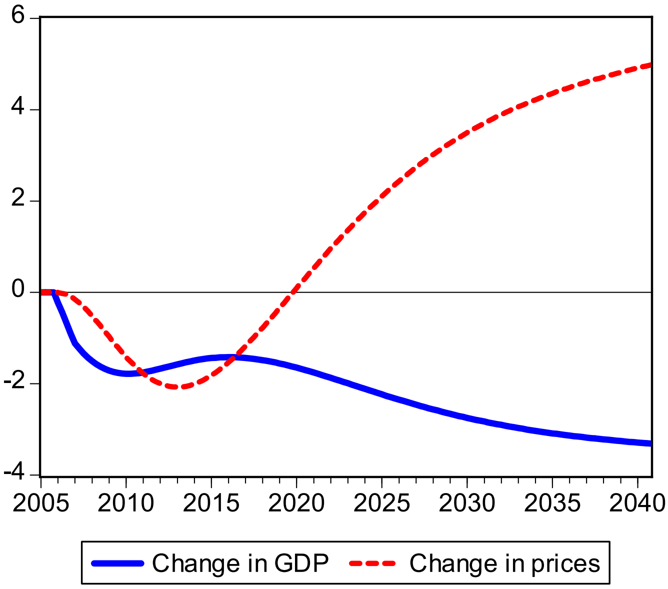
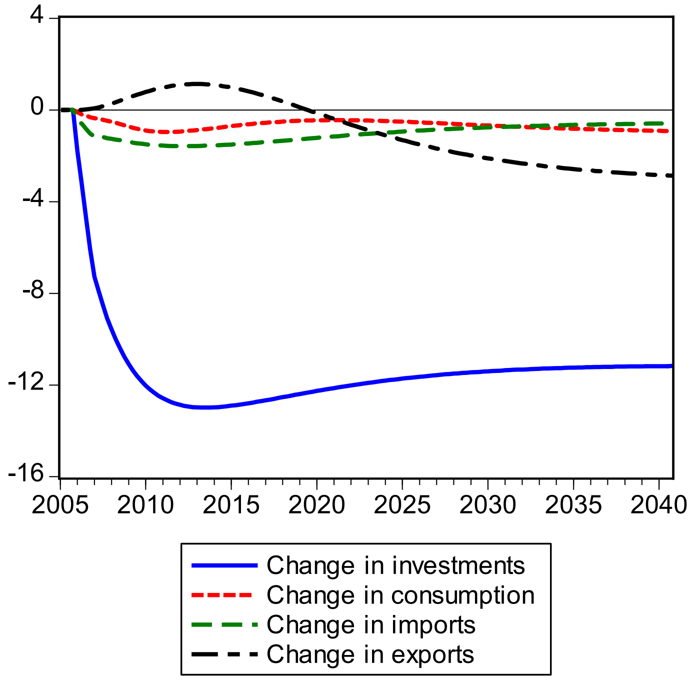


Figure 14.



Effect of 1% increase in foreign demand

Figure 15.

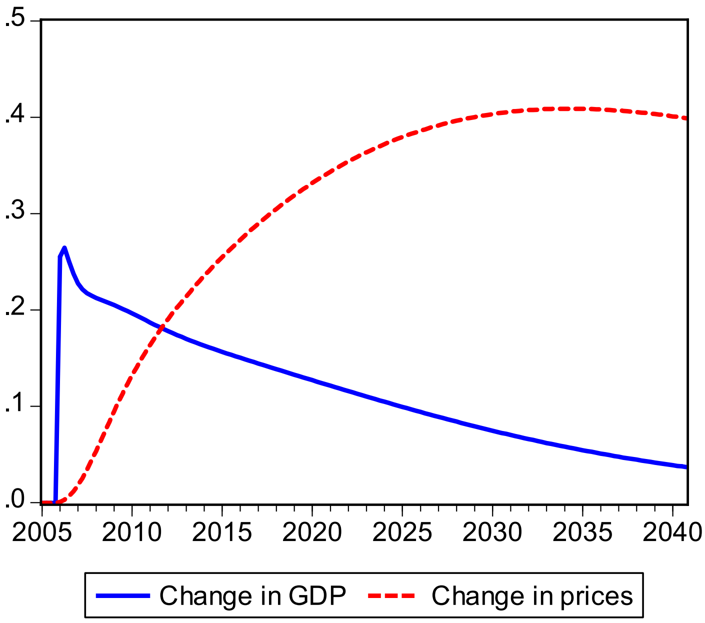
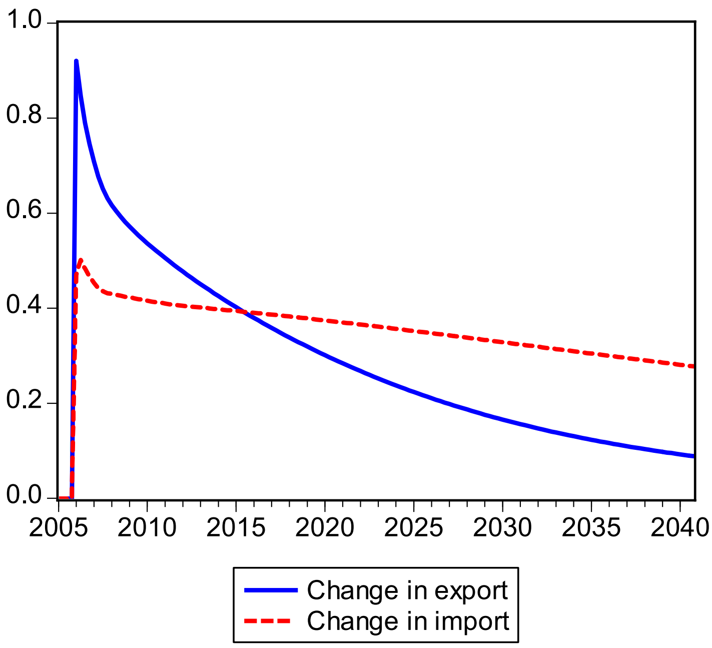


Figure 16.



Effect of 1 percentage point increase in VAT rate

Figure 17.

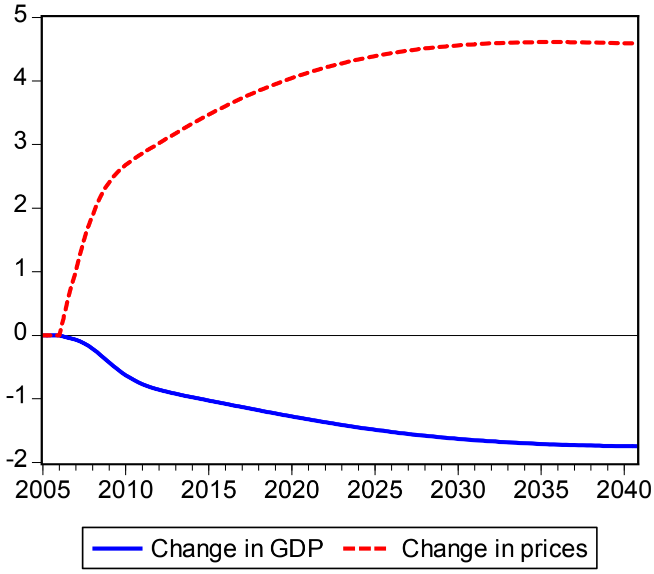
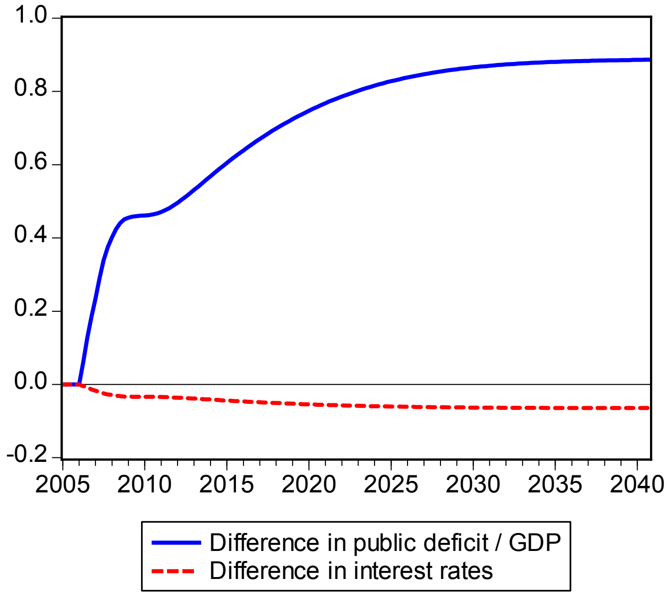


Figure 18.



Effect of 10% revaluation of euro/dollar exchange rate

Figure 19.

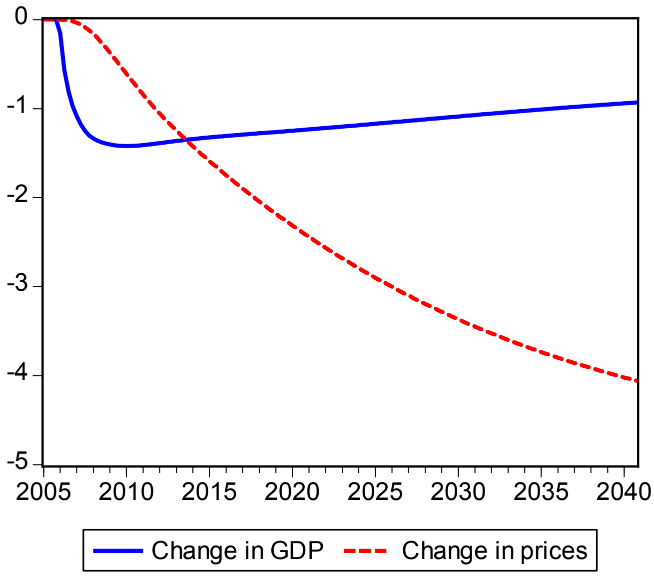
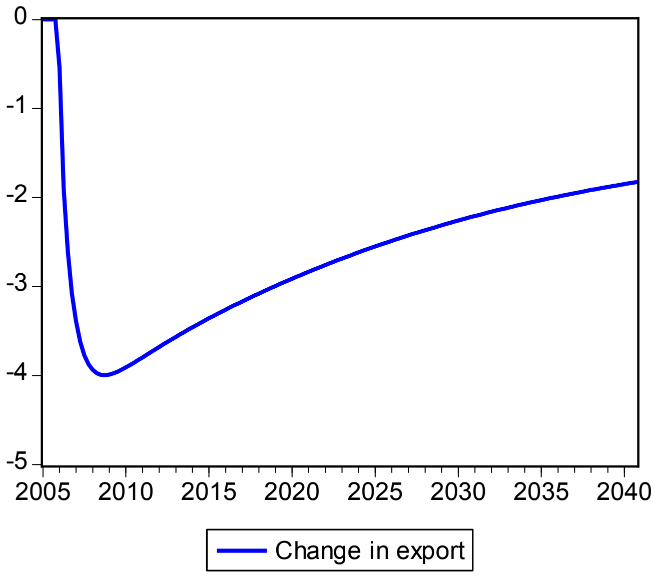


Figure 20.



APPENDIX 1

THE EQUATIONS OF THE MODEL

The following section reports the whole model system and the coefficient estimates of the model equations. The explanations for the variable symbols are listed below. With respect to behavioural equations, adjusted coefficients of determination (R2), Durbin-Watson values (DW), and t-values are reported. Regarding the estimates of the long-run equations, no t values have been reported. However, for the residual series of the long-run equations, ADF values have been calculated; for those, the critical 5 per cent value is 2.91.

The symbol D in equations means difference. T = n means a dummy variable which gets a value of 1 in the period n. In addition, there are some other dummies. The explanations for them are found in the variable list. Their usage usually derives from institutional, legislative or production related breaks. For instance, the dummies for years 1993 and 1995 in the private consumption equation capture the effect of the dual tax rebate accomplished in 1994 and the dummy in the production function captures the effect of the paper stoppage in 2005. Abbreviation ECT at the end of the symbol name denotes that the series is disaggregated with the Ecotrim program.

1. Production fuction and factor demand

Production function

LOG(VAQP_S) = - 0.603 + .6 * LOG(LHP) + .4 * LOG(KP) + GF_CD * T - 0.007 * DPAP

Potential output

QPQPOT = EXP(-0.603 + .6 * LOG(LHP + ((UN - UN_PITK) * LHS / 100)) + .4 * LOG(KP) + GF_CD * T - 0.007 * DPAP)

Output gap

QPQ_GAP = 100 * (VAQP - QPQPOT) / QPQPOT

Public sector value added

LOG(VAQG) = 0.395 + 0.749*LOG(LHG) + 0.480*LOG(WRG/PQ)

R2=0.91 DW=0.83 t1=0.72 t2=7.45 t3=5.46

Private sector value added

VAQP = GDPQ - VAQG - DEP

Private labour demand (in working hours)

DLOG(LHP) = 0.544*DLOG(VAQP) - 0.185*DLOG(WRP/PQP) - 14.2*D(GF_CD) - 0.0238*D(T=38) - 0.447*(LOG(LHP(-1))-0.735*LOG(VAQP(-1))+0.174*LOG(WRP(-1)/PQP(-1))+9.455*GF_CD(-1)+0.0031*T(-1)-2.57)

R2=0.75 DW=1.85 t1=5.75 t2=-2.86 t3= -20.02 t4=-7.26 ADF= -5.20

Total working hours

LH = LHG + LHP

Total labour (in persons)

LOG(LN) = - 1.35 + 0.987 * LOG(LH) + 0.000231 * T + .0336 * (T = 38) - .0204 * (T = 9) + LN_RES

R2=0.97 DW=0.96 t1=-4.23 t2=28.3 t3=2.19 t4=15.3 t5=-5.35

Private investments

DLOG(IPQ) = 0.888*DLOG(VAQP(-1)) - 0.0666*DLOG(UCC) - 14.3*D(GF_CD) + 2.64*D(GF_CD(-4))-0.102*(LOG(IPQ(-1)+0.25*@MOVAV(DI(-1)/PI(-1),4))-0.753*LOG(VAQP(-2))+0.448*LOG(UCC(-1))+39.7*GF_CD(-1)-29.3*GF_CD(-5)+0.0034*T(-1))

R2=0.17 DW=2.24 t1=2.91 t2=-1.50 t3=-3.06 t4=0.65 t5= -1.10 ADF= -4.61

2. Aggregate demand

Private consumption

DLOG(CQ) = 0.173*DLOG(YHQ_/PC) + 0.151*DLOG(HW) + 0.00477 - 0.00945*D(D93) - 0.0893*DLOG(PC) - 0.267*(LOG(CQ(-1))-0.515-0.892*LOG(@MOVAV(YHQ_(-1)/PC(-1),7))-(1-0.892)*LOG(HW(-1))-4.320*GF_CD(-4)+0.0459*D93(-1)-0.0262*D95(-1)+0.00429*R12(-1))

R2=0.58 DW=1.61 t1=2.66 t1=4.46 t2=4.18 t3= 4.26 t4=-4.32 t5=-0.72 t6=-3.66 ADF=-4.66

Export

DLOG(XQ) = 1.30*DLOG(IMU29) - 0.668*DLOG(PX/PWI29) + 15.1*D(GF_CD) + 0.00561 - 0.273*(LOG(XQ(-1))-LOG(IMU29(-1))+1.55*LOG(PX(-1)/PWI29(-1))+2.80-32.9*GF_CD(-1))

R2=0.50 DW=2.63 t1=2.44 t2=-6.88 t3=4.90 T4=1.40 t5= -4.20
ADF=-4.48

Import

DLOG(MQ) = 0.000623 + 0.504*DLOG(XQ) + 0.694*DLOG(CQ+IPQ+IGQ) - 0.272*(LOG(MQ(-1))+0.563-0.589*LOG(XQ(-1))-(1-0.589)*LOG(CQ(-1)+IPQ(-1)+GQ(-1))+0.407*LOG(PM(-1)/PQP(-1)))

R2=0.43 DW=2.35 t1=0.18 t2=4.99 t3= 3.05 t4=-2.41 ADF=-3.29

3. Prices and wages

Private sector wages

DLOG(WRP) = 0.949*DLOG(PWS_SA) - 0.000687*D(DI/IPV(-1)) + 0.0439*DLOG(PROD) + 0.275*DLOG(WRP(-1)) - 0.113*(LOG(WRP(-1))-LOG(PWS_SA(-1))+0.00160*(UN(-1)-UN_PITK(-1))+0.138+0.00974*DI(-1)/IPV(-2)-0.318*LOG(PROD(-1)))

R2=0.54 DW= 2.60 t1=3.05 t2=-1.76 t3=2.28 t4= 1.53 t5=-2.49 ADF=-3.93

Public sector wages

DLOG(WRG) = 0.875*DLOG(WRP) - 0.000540*D(QPQ_GAP) - 0.138*(LOG(WRG(-1))-LOG(WRP(-1))-0.000133+0.000928*T(-1)+0.00221*QPQ_GAP(-1)

R2=0.65 DW=1.84 t1= 13.4 t2=-1.60 t3= -2.37 ADF=-2.40

Standard wage rate index

LOG(PWS_SA)=0.198+.04*LOG(PC(1))+0.000872*@MOVAV(QPQ_GAP,4)+(1-.04)*LOG(PWS_SA(-1))+0.00709*D(T=32)

R2=0.999 DW=1.31 t1=250.32 t2=4.61 t3=2.73

Private value added prices

DLOG(PQP)= 0.430*DLOG(WRP) - 0.301*(LOG(PQP(-1))-LOG(WRP(-1))+@MEAN(LOG(PROD(-1))-4.58*GF_CD(-1)+0.00584*T(-1)+3.70)

R2=0.16 DW= 2.13 t1=2.45 t2=-4.24 t3=-3.52 ADF=-4.01

Private consumption prices

DLOG(PC) = 0.143*DLOG(PQP) + 0.114*DLOG(PM) + 0.295*DLOG(PC(-4)) + 0.197*DLOG(PC(-1)) - 0.134*(LOG(PC(-1))+1.232-0.855*LOG(PQP(-1))-(1-0.855)*LOG(PM(-1))-0.00111*T(-1)-0.398*LOG(ALV(-1)))

R2=0.18 DW=2.38 t1=2.61 t2= 4.69 t3=3.50 t4=1.82 t5=-3.36 ADF=-3.00

Private investment prices

DLOG(PI) = 0.362*DLOG(PQP) + 0.118*DLOG(PM) - 0.00619*D(UN-UN_PITK) - 0.250*(LOG(PI(-1))-0.0757-.7*LOG(PQP(-1))-.3*LOG(PM(-1))+0.0114*(UN(-1)-UN_PITK(-1))+0.001393*T(-1))

R2=0.24 DW=1.29 t1=2.74 t2=1.45 t3=-2.70 t4=-3.59 ADF=-4.04

Public consumption prices

DLOG(PG) = 0.82*DLOG(WRG) - 0.41*(LOG(PG(-1))+4.59-0.94*LOG(WRG(-1)))
R2=0.23 DW=1.94 t1=6.82 t2=-4.25 ADF=-3.79

Export prices

DLOG(PX)=0.38*DLOG(PWI29)+(1-0.38)*DLOG(PQP)+4.93*D(GF_CD)-0.86*(LOG(PX(-1))+2.96-0.65*LOG(PWI29(-1))-(1-0.65)*LOG(PQP(-1))+0.00422*T(-1)-6.33*GF_CD(-1)-0.26*LOG(EUR_DOL(-1)))

R2=0.55 DW=2.13 t1=3.24 t2=5.58 t3=-5.12 ADF=-4.04

Interest rates of government (10 years) bonds

R10 = R12 + 0.82 + 215.06*GF_CD - 7.26*T14/GDPV - 0.71*(T>31) - 0.39*D(R12)

R2=0.60 DW=1.00 T1=3.64 T2=5.72 T3=-1.40 T4=-1.48 T5=-3.80

INCOME ACCOUNTING AND PUBLIC SECTOR IDENTITIES

Public sector net tax revenues

T1 = TAX_YHTEISO + KOTITULOVERO_SA + TAXQM + T1B - T1C

Employer's social contributions collected by the public sector

T2 = TANSOS_ECT - Y5 - Y7

Employee's social contributions collected by the public sector

T3 = VAKSOSTU_ECT - Y6

Public sector net deficit

T14 = T1 + T2 + T3 + T4 - T5 - T6 - T7 + T8 + T9 - T10 - GV - IGV + T13 - T9_KOROT

Income taxes of the household sector

(KOTITULOVERO_SA) = - 1926.404 + 1.183 * (TAX_APW * 0.01 * ANSIOTULOVEROPOHJA) + 1 * (TAX_K * 0.01 * OMATULO_ECT) + RESID_KOTITULOVERO

Communal taxes of the household sector

KUNTIEN_TULOVERO_SA = 173.347 + 0.719 * TAX_L * 0.01 * ANSIOTULOVEROPOHJA + 118.320 * DUMMY94 - 17757.779 * VAHENNYKSET / ANSIOTULOVEROPOHJA + RESID_TULOVERO_KUNNAT

Taxes of communities and corporations

TAX_YHTEISO = - 236.197 + 0.904 * TAX_C * 0.01 * YHTEISOVEROPOHJA + 117.141 * D92 + RESID_TAXYHTEISO

Municipalities' approximate share of taxes of communities and corporations

YHTEISOVERO_KUNNAT = (1 - 0.79) * TAX_YHTEISO

Current taxes of households

LOG(MAKVALITVERO) = - 0.159 + 1.024 * LOG(KOTITULOVERO_SA) + RESID_MAKVALITVERO

Income tax base

ANSIOTULOVEROPOHJA = WS + YRTTULO_ECT - ASTULO_ECT + RAHSOS + SOSAV_ECT + MUUTTILS - VAKSOSTU_ECT

Operating surplus

TOIMINTAYLIJAAMA = GDPV - WS - TANSOS_ECT - TAXQM + TUKIP_ECT - KDEPR_ECT

Communal tax base

YHTEISOVEROPOHJA = TOIMINTAYLIJAAMA - YRTTULO_ECT

Enterpreneurial income from inputed rent of owner occupiers

LOG(ASTULO_ECT) = 0.505 + 0.929 * LOG(ASTULO_ECT(-1)) + RESID_ASTULO

Other transfers received by households

LOG(MUUTTILS) = 0.388 - 0.000667 * T + 0.919 * LOG(MUUTTILS(-1)) + RESID_MUUTTILS

Subsidies received by households

LOG(TUKIP_ECT) = 0.790 + 0.879 * LOG(TUKIP_ECT(-1)) + RESID_TUKIP

Employee's social contributions

VAKSOSTU_ECT = 161.346 + 1.198*TEKSOVA*0.01*WS + RESID_VAKSOSTU

Capital depreciation

LOG(KDEPR_ECT) = - 0.0130 + 0.0201 * LOG(IPV + IGV) + 0.982 * LOG(KDEPR_ECT(-1)) + RESID_KDEPR

Household property expenditures

LOG(OMAMENO_ECT) = 0.790 + 0.0128 * R12 + 0.860 * LOG(OMAMENO_ECT(-1)) + RESID_OMAMENO

Household property incomes

LOG(OMATULO_ECT) = - 1.935 + 0.958 * LOG(VAP - WSP) + 0.0629 * R12 + RESID_OMATULO

Funded and unfunded social benefits received by households

LOG(RAHSOS) = 8.369 + 1.585 * LOG(PC) + 0.00543 * UN + RESID_RAHSOS

Social assistance benefits received by households

LOG(SOSAV_ECT) = - 1.387 + 0.0627 * UN + 1.607 * LOG(WRP) + RESID_SOSAV

Employer’s social contributions

LOG(TANSOS_ECT) = - 1.338 + 0.939 * LOG(WS) + 0.0229 * TANSOVA + RESID_TANSOS

Production and import taxes

LOG(TAXQM) = - 1.152 + 0.986 * LOG(CV) + RESID_TAXQM

Disposable incomes of non-profit institutions serving households

LOG(YHQ_NON_ECT) = - 7.862 + 1.415 * LOG(VA) + RESID_YHQ_NON

Enterpreneurial income

LOG(YRTTULO_ECT) = 2.454 + 0.421 * LOG(VAP) + 0.535 * LOG(VUOKRA) + RESID_YRTTULO

Disposable income of households

YHQ_ = WS + OMATULO_ECT - OMAMENO_ECT + YRTTULO_ECT + RAHSOS + SOSAV_ECT + MUUTTILS - MAKVALITVERO - VAKSOSTU_ECT + YHQ_NON_ECT

OTHER IDENTITIES

Value added in constant prices

VAQ = VAQP + VAQG

Value added in current price

VA = VAP + VAG

Private value added in current price

VAP = VAQP * PQP

Public value added in current price

VAG = PQG * VAQG

Total Supply

GDPQ_S = VAQP_S + VAQG + DEP

GDP deflator

PQ = GDPV / GDPQ

GDP in current prices

GDPV = PI * IPQ + PIG * IGQ + PC * CQ + PG * GQ + PX * XQ - PM * MQ + INVV

GDP in constant prices

GDPQ = IPQ + IGQ + CQ + GQ + XQ - MQ + INVQ

Private sector net capital stock

KP = IPQ + (1 - DEPR) * KP(-1)

Unemployment rate

UN = 100 * (LS - LN) / LS

Public sector wage sum

WSG = WSG_RES + (WRG / 100 * 10.847 * LHG / 10)

Private sector wage sum

WSP = WSP_RES + (WRP / 100 * 8.276 * LHP / 10)

Total wage sum

WS = WSP + WSG

Public consumption

GQ = GQP + (WSG / PG)

Productivity

PROD = VAQP / LHP

Trade balance

TB = PX * XQ - PM * MQ

Production taxes less subsidies

LOG(DEP) = 1.074 * LOG(VAQ) - 0.00207 * T - 2.526 + RESID_DEP

Tax wedge

WEDGE = TANSOVA + TAX_APW + TEKSOVA

Private consumption in current prices

CV = PC * CQ

Public investments in current prices

IGV = IGQ * PIG

Public consumption in current prices

GV = PG * GQ

Private investments in current prices

IPV = PI * IPQ

User cost of capital

UCC = (PI / PQP) * (R10 * 0.01 - LOG(CPI / CPI(-4)) + DEPR)

Public sector property expenditures

T9_KOROT = 83.215 + 0.884 * ((R10 / 100) * DEBT(-1)) + T9_ERO

Government debt

DEBT = DEBT(-1) - T14 + DEBT_ERROR

<u>Variables of the model:</u>

ALV	Effective VAT rate
ANSIOTULOVEROPOHJA	Income tax base
ASTULO_ECT	Enterpreneurial income from inputed rent of owner occupiers
CPI	Consumer price index
CQ	Private consumption, 2000 prices
CV	Private consumption, current prices
D92	Dummy for year 1992
D93	Dummy for year 1993
D95	Dummy for year 1995
DEBT	Public debt (EMU)
DEBT_ERROR	Residual of debt equation
DEP	Production taxes less subsidies
DEPR	Depreciation rate of private capital
DI	Direct investments abroad
DPAP	Dummy for paper industry stoppage
DUMMY94	Dummy from year 1994 onwards
EUR_DOL	Euro/dollar exchange rate

GDPQ	Gross Domestic product at market price, 2000 prices
GDPQ_S	Gross Domestic product at market price (supply), 2000 prices
GDPV	Gross Domestic product at market price, current prices
GF_CD	Recession dummy
GQ	Public consumption, 2000 prices
GQP	Public purchases, 2000 prices
HW	Apartment price index, real prices,1983=100
IGQ	Public investments, 2000 prices
IGV	Public investments, current prices
IMU29	Weighted GDP index of 29 main export countries
INVQ	Inventories and stastical difference, 2000 prices
INVV	Inventories and stastical difference, current prices
IPQ	Private investments, 2000 prices
IPV	Private investments, current prices
KDEPR_ECT	Depreciation of capital
KOTITULOVERO_SA	Income taxes paid by households
KP	Private sector net capital stock
KUNTIEN_TULOVERO_SA	Communal taxes paid by households
LH	Working hours
LHG	Public sector working hours
LHP	Private sector working hours
LHS	Working hours, supply
LN	Employment
LN_RES	Employment, residual series
LS	Labour supply
MAKVALITVERO	Current taxes paid by households
MQ	Import, 2000 prices
MUUTTILS	Other transfers received by households, net
OMAMENO_ECT	Household property expenditures
OMATULO_ECT	Household property incomes
PC	Private consumption prices
PG	Public consumption prices
PI	Private investment prices
PIG	Public investment prices
PM	Import prices
PQ	GDP deflator
PQP	Private value added prices

PROD	Private sector productivity
PWI29	Weighted import price index of 29 main export countries
PWS_SA	Standard wage rate index
PX	Export prices
QPQ_GAP	Output gap
QPQPOT	Potential output
R10	Interest rate of government bonds (10 years)
R12	12 month Euribor interest rate
RAHSOS	Funded and unfunded social benefits received by households
SOSAV_ECT	Social assistance benefits received by households
T	Trend
T1	Taxes collected by public sector
T10	Subsidies paid by public sector
T13	Other capital use in public sector
T14	Public deficit
T1B	Other taxes collected by public sector
T1C	Current taxes paid by public sector
T2	Employer's social contributions received by public sector
T3	Employees' social contributions received by public sector
T4	Net (other) transfers from other domestic sectors to public sector
T5	Net other transfers from public sector to the EU, other countries, and non-governmental organisations
T6	Funded and unfunded social benefits paid by public sector
T7	Social assistance benefits paid by public sector
T8	Net non-life insurance and other premiums received by public sector
T9	Public sector operating surplus less property expenditures
T9_ERO	Resdiual of public sector property expenditure equation
T9_KOROT	Public sector property expenditures
TANSOS_ECT	Employer's social contributions
TANSOVA	Employer's social contributions rate
TAX_APW	Average paid worker's income tax rate
TAX_C	Corporate and communal tax rate
TAX_K	Capital tax rate
TAX_L	Communal tax rate (average)
TAX_YHTEISO	Corporate and communal taxes received by public sector
TAXQM	Production and import taxes
TB	Trade balance

TEKSOVA	Employees’ social contributions rate
TOIMINTAYLIJAAMA	Operating surplus
TUKIP_ECT	Subsidies paid by public sector
UCC	User Cost of Capital
UN	Unemployment rate (trend)
UN_PITK	NAIRU
VA	Value added, current prices
VAG	Public value added, current prices
VAHENNYKSET	Reductions from local taxes
VAKSOSTU_ECT	Employees’ social contributions
VAP	Private value added, current prices
VAQ	Value added, 2000 prices
VAQG	Public value added, 2000 prices
VAQP	Private value added, 2000 prices
VAQP_S	Private sector supply
VUOKRA	Rent price index
WEDGE	Tax wedge
WRG	Public sector income level index, 90=100
WRP	Private sector income level index, 90=100
WS	Wage sum
WSG	Public sector wage sum
WSP	Private sector wage sum
XQ	Export, 2000 prices
Y5	Employer’s actual social contributions received by corporations
Y6	Insured persons’ social contributions received by corporations
Y7	Imputed social contributions received by corporations
YHQ_	Household disposable income, current prices
YHQ_NON_ECT	Disposable income of non-profit institutions serving households, current prices
YHTEISOVERO_KUNNAT	Corporate and communal taxes received by municipalities
YHTEISOVEROPOHJA	Corporate and communal tax base
YRTTULO_ECT	Enterpreneurial income

APPENDIX 2

The 29 most important countries for Finnish exports and their contributions (%) to the total exports

Sweden	11.1
Germany	10.7
Russia	8.9
Great-Britain	7
USA	6.4
Netherlands	5.1
China	4
France	3.5
Italy	3
Norway	3
Estonia	2.8
Belgium	2.6
Spain	2.6
Denmark	2.2
Japan	2
Poland	1.7
Switzerland	1
Canada	1
Austria	0.9
Turkey	0.9
Hungary	0.9
Australia	0.8
Hong Kong	0.8
Latvia	0.7
Greece	0.6
Brasil	0.6
South Africa	0.6
South Korea	0.6
India	0.5

Source: Finnish Customs (2004)

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