ECO-LINE: A MACROECONOMETRIC MODEL OF THE HUNGARIAN ECONOMY*

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SUMMARY

This paper provides an overview of ECO-LINE, a quarterly macroeconometric model of the Hungarian economy designed for short and medium term forecasting and policy analysis. The model is a simplified description of the Hungarian economy, mainly based on National Accounts concepts. ECO-LINE consists of four main blocks, such as the demand and supply blocks determining real categories and employment, the block of prices and money and the block of income distribution. The paper provides an outline of the basic structure of ECO-LINE followed by an introduction to the set of stochastic equations. It also reports ex post simulation properties of the model and illustrates its performance by means of some policy simulations.

KEYWORDS: Macroeconomic modelling; Econometrics.

ECO-LINE is a quarterly macroeconometric model of the Hungarian economy designed for short and medium term forecasting and policy analysis. It has been developed and maintained at ECOSTAT, the institute for economic analysis of the Hungarian Central Statistical Office. The model presents a simplified description of the Hungarian economy, mainly based on National Accounts concepts. ECOLINE is considered the first attempt to provide forecasting and policy analysis for the Hungarian economy within a macroeconometric modelling framework.

This paper provides an overview of ECO-LINE as it stands at its current stage of development. It is expected that ECO-LINE will evolve over time not only as a reflection of ongoing efforts to refine already available stochastic equations on the one hand and broaden the stochastic block by constructing and testing additional behavioural equations on the other, but also by means of further increasing the complexity of interactions among the different blocks of the model.

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The paper is organized as follows. The subsequent section outlines the basic structure of ECO-LINE followed by an introduction to the set of stochastic equations in the third section. Next, ex post simulation properties of the model are detailed while the fifth section provides an illustration of the performance of ECO-LINE via some policy simulations. Conclusions close the paper.

1. The basic structure of ECO-LINE

ECO-LINE consists of four main blocks, such as the demand and supply blocks determining real categories and employment, the block of prices and money and the block of income distribution. The 13 stochastic equations lie in the center of the model complemented with 241 identities.[3] This section describes the basic structure of the model whereas the next one introduces the group of stochastic equations in ECO-LINE. Figure 1. provides some details with respect to the connections among the different blocks of the model.

Additional to employment and wage determination, the supply block provides the potential, theoretical supply by means of a production function. GDP is determined from the demand side as a sum of private and public consumption, investments, exports and imports. The demand and supply blocks are connected via the capacity utilization factor defined as the ratio of aggregate demand to potential GDP as generated in the supply block. Real and nominal categories are related by prices determined by stochastic equations.

Labour demand is formulated as a function of the capacity utilization rate and real wages whereas labour supply is dominantly determined by demographic factors. Actual values of labour demand and labour supply imply the corresponding rate of unemployment.

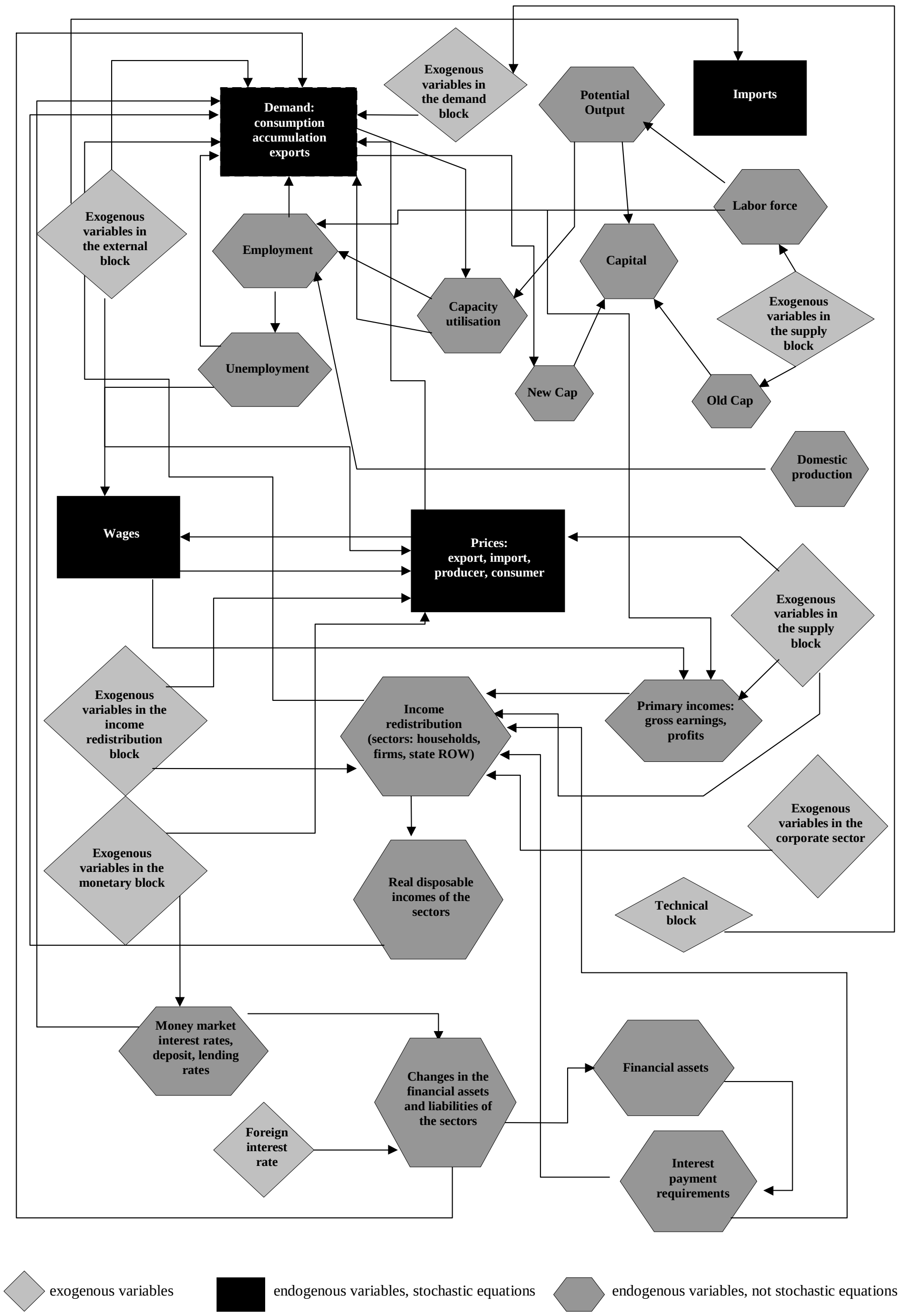
Domestic prices are represented by the consumer price index (CPI) and the producer price index (PPI) while the effect of world markets is transmitted via export and import prices. CPI strongly follows PPI and money supply whereas PPI is dominantly affected by import prices. Export and import prices are driven by world market tendencies.

With respect to the income block, disposable incomes of the corporate sector and households, the state budget, foreign disposable income and the balance of payments are all determined by means of their income balances and the balance of payments. There are three income balances in the model such as the income balances of the corporate sector, private households and the state budget. Profits and savings of the corporate sector are calculated by subtracting wages and taxes from the net GDP. This balance includes both the amount of wages as input items to the balance of private incomes and the taxation items of the state budget balance.

Disposable income is determined in the balance of private incomes by adding mixed, proprietor and transfer incomes to the wages paid in the corporate sector and subtracting taxation items. Savings are derived as the difference of disposable income and consumption.

[3] The highly detailed nature of the state budget in the model explains the relatively large number of identities.

Figure 1. The basic structure of ECO-LINE model



Balance of the state budget contains three parts as follows: the central budget and the two social security funds. The revenue side of all sub-balances includes taxes, contributions paid by the corporate sector and households whereas on the disbursement side certain benefits paid for them and transfer income payments. Aggregation of the balances of the three income proprietors complemented by the balance of payments provides the income distribution matrix of the national economy.

The main exogenous determinants of the model are the very items affecting foreign trade turnover (world market prices, the boom of external markets, devaluation) and lending interests in real terms affecting venture investments directly and taxation items (personal income taxes, corporate taxes, taxes related to customs and imports, VAT-rate, etc.).

2. The stochastic equations

This section presents the methods of estimation and testing as well as the estimated stochastic equations of the model.

2.1.Equation specification, diagnostic testing and estimation

Preferred stochastic equations in the model rest upon economic theory, the analysis of historical data and careful diagnostic testing. Theoretical considerations along with temporal patterns of the data formed the basis of the initial specification for each equation. Once an initial specification has been obtained, it might have undergone some further changes in order to meet the requirements of several diagnostic tests and gain a, both theoretically and econometrically acceptable, functional form.

Prior to running any regression each potential variable was tested against the hypothesis of random walk using the Augmented Dickey-Fuller unit root test (*Dickey* and *Fuller*, 1979) and the Phillips–Perron test (*Phillips* and *Perron*, 1988) in order to determine their order of integration. Besides *R*-squared and *t*-statistics, diagnostic tests for white noise errors and functional forms were also conducted for each stochastic equation. For equations where visual inspection of the dependent variable suggested structural change in the parameters, stability tests were run whereas if endogeneity of an independent variable was assumed, tests for the orthogonality of the regressor to the disturbance term were carried out. Precision in predicting historical data was considered as an additional important information to evaluate a particular specification.

In addition to the Durbin–Watson (DW) test against the first order serial correlation in the disturbances, autocorrelations and partial autocorrelations of the equation residuals and the Ljung–Box Q-statistics (*Ljung* and *Box*, 1979), the Breusch–Godfrey Lagrange multiplier (LM) test for autocorrelation (up to order five) was also applied (*Breusch*, 1978; *Godfrey*, 1978). Compared to the DW the advantage of the LM test is that it is applicable to higher order errors and it is valid in the presence of lagged dependent variables in the regression equation. To test heteroscedasticity in the residuals, the test proposed by White (*White*, 1980) was applied.

Regression specification error test (RESET) by *Ramsey* (1969) was run for each stochastic equation to test omitted variables, incorrect functional form and correlation between regressors and disturbances. Normal distribution of residuals was tested by the Jarque–Bera test (*Bera* and *Jarque*, 1981).

The comparison of forecasted and actual values of a dependent variable for the estimation period can provide important information about the predictive power of a stochastic equation. Predictive powers were evaluated based on Mean Absolute Percentage Error (MAPE) values of in-sample forecasts.

Where suspected, structural change in the parameters of an equation were checked by the Chow breakpoint test (*Chow*, 1960). In a few cases, where endogeneity of an independent variable was suggested by economic theory, the version of the Hausman test proposed by Davidson and MacKinnon (1989, 1993) was applied.

Appropriate estimation methods were selected depending on the results of the respective diagnostic tests. Four of the thirteen stochastic equations were estimated by Ordinary Least Squares (OLS) and eight by Nonlinear Lesat Squares (NLS). Given that labour is found to be endogenous in the production function this equation was estimated by Two Stage Least Squares (2SLS). With respect to the used econometric software package, Version 2.1 of EViews (Quantitative Micro Software, 1994–1997) was applied to carry out diagnostic testing and estimation of stochastic equations.

2.2 The demand equations

The so-called Houthakker–Taylor formula is applied to model household consumption behaviour. Real purchased consumption is related to real disposable income (*QDI*), the price level (*CPI*) and the rate of inflation. Additionally, real deposit rate (*IDEPR*) is included to account for the impact of savings on consumption. As shown in equation /1/, there is a significant and negative relationship ($p < 0.05$) between consumption and price level observed in the previous quarter whereas the negative effect of deposit rate turns out to be only marginally significant.

Real household consumption /1/:

$$\underset{}{\mathrm{LOG}(QCPUR)} = \underset{(0.837)}{1.490} + \underset{(1.133)}{0.278}\cdot\mathrm{LOG}(QCPUR(-1)) + \underset{(1.597)}{0.445}\cdot\mathrm{LOG}(QDI(-1))$$

$$\underset{(-2.581)}{-0.131}\cdot\mathrm{LOG}(CPI(-1)) \underset{(-0.204)}{- 0.179}\cdot\mathrm{DLOG}(CPI(-1)) \underset{(-2.032)}{- 0.013}\cdot IDEPR(-1) +$$

$$+ \underset{(4.235)}{0.279}\cdot DUMMY2 + \underset{(5.188)}{0.271}\cdot DUMMY3 + \underset{(7.344)}{0.324}\cdot DUMMY4 + [AR(2) = \underset{(-1.779)}{-0.576}]$$

Estimation Method: Nonlinear Least Squares
Number of Observations: 20

R-squared = 0.963			MAPE = 1.892		
Breusch–Godfrey	*F*-statistic = 0.583	*P* = 0.716	White	*F*-statistic = 0.609	*P* = 0.787
Jarque–Bera = 1.826		*P* = 0.401	RESET	*F*-statistic = 2.410	*P* = 0.152

Note: Here and in the following equations *t*-statistics are in parentheses; for the description of the variables see Appendix.

Business investment is modelled as being positively related to real income measured by real GDP (*QGDP*), foreign direct investment (*DIHD*) and the rate of capacity utilization (*UT*). On the other hand, it is supposed to be negatively associated with real deposit rate (*ICREDR*). With the exception of the non-significant but negative effect of real deposit rate, all the remaining variables enter the equation with highly significant parameters and the expected sings.

At the current stage of model building (mainly due to an insufficient number of observations to yield econometrically satisfactory equations), direct exports and public investments are considered exogenous in ECO-LINE.

Real private investment /2/:

$$\underset{}{DLOG(QINVBU)} = \underset{(-2.891)}{-\,0.260} + \underset{(15.605)}{6.972}\cdot DLOG(QGDP(-4)) - \underset{(-0.921)}{1.001}\cdot DLOG(ICREDR) +$$

$$+\ \underset{(2.815)}{0.139}\cdot DLOG(DIHD(-6)) + \underset{(2.276)}{7.615}\cdot D(UT(-2)) + \underset{(5.445)}{0.674}\cdot DUMMY2$$

Estimation Method: OLS					
Number of Observations: 18					
R-squared = 0.975			MAPE = 16.225		
Breusch–Godfrey	F-statistic = 0.866	P = 0.547	White	F-statistic = 2.073	P = 0.159
Jarque–Bera = 0.565		P = 0.754	RESET	F-statistic = 1.080	P = 0.376

2.3 The supply equations

As shown in equation /3/, real potential GDP (*QGDPPT*, calculated as *QGDP/UT*) is modelled within the Cobb-Douglas production function framework and determined by the stock of capital (*CAP*) and the level of employment (*L*).

Real potential GDP /3/:

$$D(LOG(QGDPPT)) = \underset{(-1.478)}{-0.080} - \underset{(-0.427)}{1.564}\cdot D(LOG(OLDCAP)) +$$

$$+\underset{(3.461)}{1.625}\cdot DLOG(NEWCAP) + \underset{(7.631)}{6.628}\cdot DLOG(L)$$

Estimation Method: 2SLS			Instruments: DLOG(*OLDCAP*), DLOG(*CELMKER*) DLOG(*W*), DLOG(*NEWCAP*)		
Number of Observations: 24					
R-SQUARED = 0.858			MAPE = 5.585		
Breusch–Godfrey	F-statistic = 2.478	P = 0.079	White	F-statistic = 1.770	P = 0.163
Jarque–Bera = 0.275		P = 0.872			

Given that aggregate data on the capital stock have not been collected since 1990 a specific calculation method should be introduced to make the aggregate production function estimable. Starting with 1990, quarterly values of *OLDCAP* are generated by subsequently subtracting depreciation and adding investments aiming at the modernization of old capital to the known value of capital stock in 1989. NEWCAP is generated for each quarter as the respective sum of the values of greenfield investments in the 1990s. *L* and *NEWCAP* enter the production function with the expected positive parameters with low levels of significance ($p < 0.01$) whereas the parameter of *OLDCAP* is negative but insignificant.

Real quarterly values of direct import depend on aggregate domestic demand (QBELF, defined as the sum of consumption and investments) on the one hand and the world price index on the other. It is indicated in equation /4/, that both parameters are significant and have the expected signs: positive for aggregate domestic demand and negative for the world price index.

Real direct import /4/:

$$\mathrm{DLOG}(QMDIR) = \underset{(1.729)}{0.026} + \underset{(3.694)}{0.649}\cdot \mathrm{DLOG}(QBELF) - \underset{(-2.451)}{1.578}\cdot \mathrm{DLOG}(WPI/PPID) + [\mathrm{AR}(1)=\underset{(-4.365)}{-0.672}]$$

Estimation Method: Nonlinear Least Squares					
Number of Observations: 28					
R-squared = 0.572			MAPE = 16.164		
Breusch–Godfrey	*F*-statistic = 0.584	*P* = 0.712	White	*F*-statistic = 1.148	*P* = 0.359
Jarque–Bera = 0.213	*P* = 0.899		RESET	*F*-statistic = 1.029	*P* = 0.374

Equation /5/ to /7/ describe the labour market. According to equation /5/, labour demand increases in the rate of capacity utilization (*UT*) and decreases in real wages (*W/CPI*). As indicated by the positive and very significant value of the respective parameter in equation /6/, labour supply is determined by the total number of potential workers (*MFORR*). Nominal wages are modelled with an error correction equation. Beside the error correction term (*RESBERH*), lagged value of the dependent variable as well as the consumer price index (*CPEI*2) and the unemployment rate (*U*) are included in the equation. As shown in equation /7/, the highly significant effects of the adjustment to the long run equilibrium on the one hand and the lagged dependent variable on the other are strong enough to determine the actual nominal wage rate with a very good regression fit (*R*-squared = 0.99).

Labour demand /5/:

$$\mathrm{DLOG}(L) = \underset{(-7.253)}{-0.129} + \underset{(6.546)}{0.154}\cdot UT - \underset{(-2.224)}{0.037}\cdot \mathrm{D}(\mathrm{LOG}(W(-1)/CPI(-1))) + \underset{(8.783)}{0.032}\cdot DUMMY3 + [\mathrm{AR}(3)=\underset{(-8.221)}{-0.852}]$$

Estimation Method: Nonlinear Least Squares					
Number of Observations: 24					
R-squared = 0.866			MAPE = 0.665		
Breusch–Godfrey	*F*-statistic = 0.303	*P* = 0.903	White	*F*-statistic = 0.847	*P* = 0.534
Jarque–Bera = 0553		P = 0.759	RESET	*F*-statistic = 2.679	*P* = 0.098

Labour supply /6/:

$$\text{LOG}(SL) = \underset{(512.650)}{8.226} + \underset{(3.031)}{0.005}\cdot\text{LOG}(MFORR) + \underset{(3.847)}{0.003}\cdot TR964 + \underset{(21.593)}{[\text{AR}(4)=0.715]}$$

Estimation Method: Nonlinear Least Squares
Number of Observations: 24

R-squared = 0.976			MAPE = 0.396		
Breusch–Godfrey	*F*-statistic = 1.187	*P* = 0.361	White	*F*-statistic = 0.692	*P* = 0.607
Jarque–Bera = 0.386		*P* = 0.825	RESET	*F*-statistic = 1.392	*P* = 0.274

Nominal wages /7/:

$$\text{DLOG}(W) = \underset{(-4.590)}{-0.344}\cdot RESBERH(-1) + \underset{(24.590)}{0.884}\cdot\text{DLOG}(W(-4)) + \underset{(0.607)}{0.032}\cdot\text{DLOG}(CPIE2) -$$
$$- \underset{(-1.284)}{0.097}\cdot\text{DLOG}(U) + \underset{(-2.778)}{[\text{AR}(1)=-0.526]}$$

Estimation Method: Nonlinear Least Squares
Number of Observations: 24

R-squared = 0.989			MAPE = 1.400		
Breusch–Godfrey	*F*-statistic = 0.861	*P* = 0.534	White	*F*-statistic = 0.545	*P* = 0.803
Jarque–Bera = 0.386		*P* = 0.824	RESET	*F*-statistic = 0.333	*P* = 0.722

2.4 The price equations

Equation /8/ and /9/ present the estimated stochastic equations of the Consumer Price Index (*CPI*) and the Producer Price Index (*PPI*), respectively.

CPI is determined by producer prices, the money supply (*MON*201) and by consumer price expectations (*CPIE*2), however the latter enters the equation with a less significant parameter.

Consumer price index /8/:

$$\text{DLOG}(CPI) = \underset{(0.442)}{0.006} + \underset{(2.423)}{0.471}\cdot\text{DLOG}(PPIFT(-1)) + \underset{(1.832)}{0.443}\cdot\text{DLOG}(CPIE2) -$$
$$- \underset{(-2.466)}{0.002}\cdot TR95Q3 + \underset{(0.967)}{0.027}\cdot\text{DLOG}(QDI(-1)) +$$
$$+ \underset{(2.121)}{0.266}\cdot\text{DLOG}(MON201(-2))$$

Estimation Method: OLS
Number of Observations: 21

R-squared = 0.723			MAPE = 1.103		
Breusch–Godfrey	*F*-statistic = 1.075	*P* = 0.429	White	*F*-statistic = 1.039	*P* = 0.477
Jarque–Bera = 0.440		*P* = 0.802	RESET	*F*-statistic = 0.005	*P* = 0.948

As shown in equation /9/, producer prices are highly dependent on import prices (*PIMPD*) as well as wage and salary income (*EARNING*).

Equation /10/ to /13/ provide details on the determination of export and import prices. The result suggest that export and import prices are being dominantly determined by exogenously given world prices. This appears to be a highly plausible observation for a small open economy.

Producer price index /9/:

$$\mathrm{DLOG}(\mathit{PPIFT}) = \underset{(2.777)}{0.019} + \underset{(1.928)}{0.235}\cdot \mathrm{DLOG}(\mathit{PIMPD}(-1)) +$$

$$+ \underset{(4.157)}{0.169}\cdot \mathrm{DLOG}(\mathit{PIMPD}(-2)) + \underset{(3.220)}{0.029}\cdot \mathit{DUM95Q1} +$$

$$+ \underset{(5.189)}{0.066}\cdot \mathrm{DLOG}(\mathit{EARNING}(-1)) + \underset{(3.550)}{0.231}\cdot \mathrm{DLOG}(\mathit{PPIFT}(-2)) +$$

$$+ \underset{(2.150)}{0.028}\cdot \mathit{DUMMY}4$$

Estimation Method: OLS
Number of Observations: 27

R-squared = 0.750			MAPE = 1.927		
Breusch–Godfrey	*F*-statistic = 0.419	*P* = 0.828	White	*F*-statistic = 0.556	*P* = 0.826
Jarque–Bera = 0.443		*P* = 0.801	RESET	*F*-statistic = 2.452	*P* = 0.114

Direct export price index /10/:

$$\mathrm{DLOG}(\mathit{PXDIRD}) = \underset{(-10.473)}{-0.115} + \underset{(2.849)}{0.616}\cdot \mathrm{DLOG}(\mathit{WPI}(-1)) + \underset{(15.657)}{0.401}\cdot \mathit{DUMMY}3 +$$

$$+ \underset{(2.746)}{0.070}\cdot \mathit{DUMMY}4 + \underset{(-5.422)}{[\mathrm{AR}(1)=-0.774]}$$

Estimation Method: Nonlinear Least Squares
Number of Observations: 27

R-squared = 0.907			MAPE = 4.347		
Breusch–Godfrey	*F*-statistic = 0.957	*P* = 0.417	White	*F*-statistic = 0.783	*P* = 0.549
Jarque–Bera = 1.405		*P* = 0.495	RESET	*F*-statistic = 0.327	*P* = 0.725

Export price index /11/:

$$\mathrm{DLOG}(\mathit{PEXPD}) = \underset{(-1.573)}{-\,0.014} + \underset{(2.402)}{0.463}\cdot \mathrm{DLOG}(\mathit{WPI}(-1)) + \underset{(1.595)}{0.518}\cdot \mathrm{DLOG}(\mathit{PPID}) +$$

$$+\underset{(4.133)}{0.075}\cdot \mathit{DUMMY}3$$

Estimation Method: OLS
Number of Observations: 27

R-squared = 0.583			MAPE = 3.732		
Breusch–Godfrey	*F*-statistic = 0.859	*P* = 0.527	White	*F*-statistic = 0.780	*P* = 0.575
Jarque–Bera = 0.541		*P* = 0.763	RESET	*F*-statistic = 0.017	*P* = 0.899

Direct import price index /12/:

$$\mathrm{DLOG}(\mathit{PMDIRD}) = \underset{(-4.922)}{-0.055} - \underset{(-4.126)}{0.472}\cdot \mathrm{DLOG}(\mathit{PMDIRD}(-1)) + \underset{(4.617)}{1.087}\cdot \mathrm{DLOG}(\mathit{WPI}) +$$

$$+ \underset{(5.064)}{0.223}\cdot \mathit{DUMMY}2 + [\mathrm{MA}(1)=\underset{(-10.797)}{-0.935}]$$

Estimation Method: Nonlinear Least Squares
Number of Observations: 28

R-squared = 0.895			MAPE = 7.369		
Breusch–Godfrey	F-statistic = 2.479	P = 0.071	White	F-statistic = 0.832	P = 0.541
Jarque–Bera = 0.007		P = 0.997	RESET	F-statistic = 0.602	P = 0.621

Import price index /13/:

$$\mathrm{DLOG}(\mathrm{PIMPD}) = \underset{(-3.681)}{-0.028} + \underset{(8.108)}{0.801}\cdot \mathrm{DLOG}(\mathrm{WPI}) +$$

$$+ \underset{(4.478)}{0.132}\cdot \mathrm{DUMMY4} + [\mathrm{MA}(1)=\underset{(-733.198)}{-0.990}]$$

Estimation Method: Nonlinear Least Squares
Number of Observations: 26

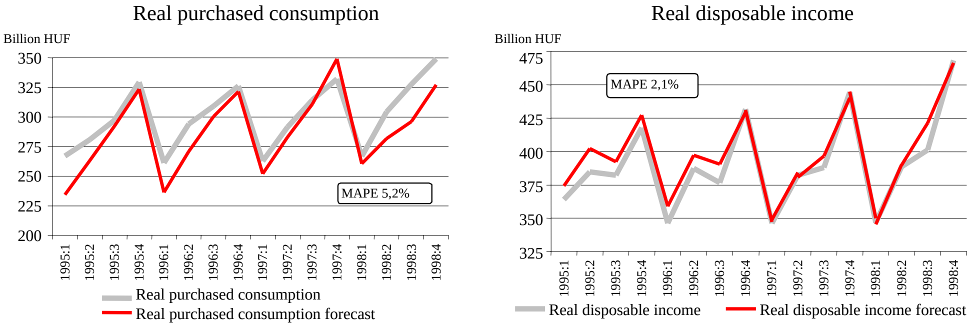
R-squared = 0.648			MAPE = 3.720		
Breusch–Godfrey	F-statistic = 1.989	P = 0.132	White	F-statistic = 0.325	P = 0.807
Jarque–Bera = 0.861		P = 0.650	RESET	F-statistic = 0.647	P = 0.595

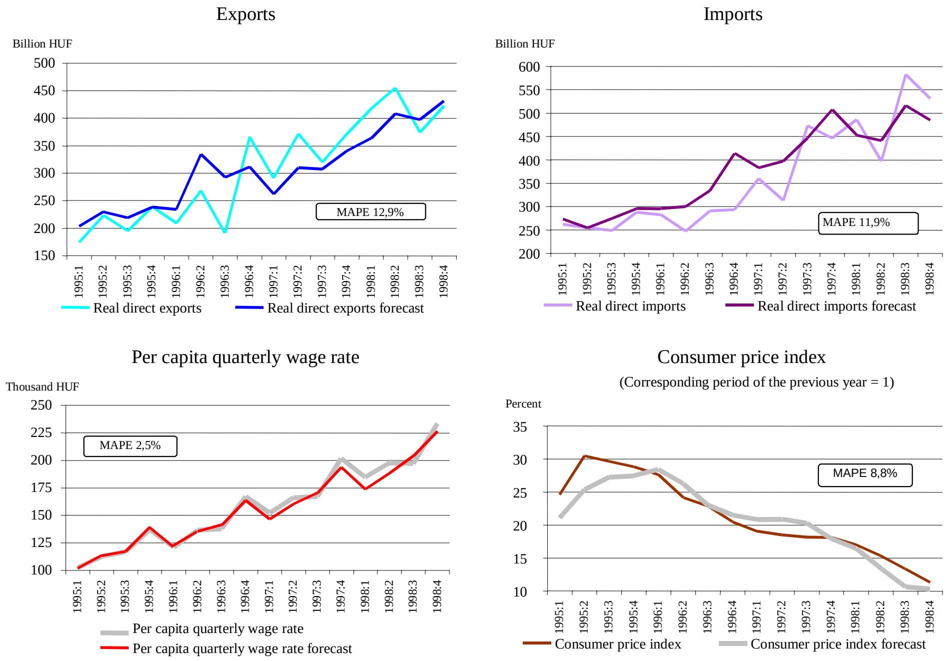
3. Ex post simulation properties of the model

The simulation properties of the model are illustrated in Figure 2. The model simulation was applied for the 1995:1–1998:4 period. The actual data were used for the exogenous assumptions.

The dynamic simulation results seem to be rather acceptable especially in view of the fact that the structure of the Hungarian economy was not completely stable in the examined period (especially the foreign trade sector).

Figure 2. Ex post simulation properties

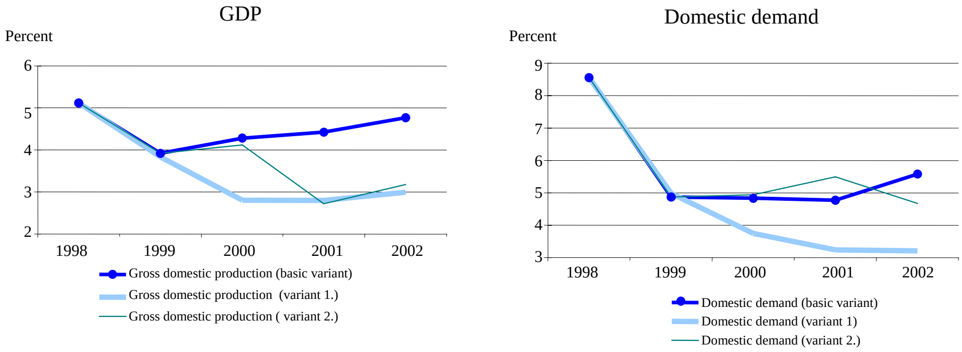




4. Ex ante policy simulation analyses using the model – an illustration

To illustrate the performance of ECO-LINE, the main results of three policy simulations are summarized subsequently. The following scenarios are considered: the base scenario which is characterized by a high accumulation rate; the external shock variant which models the effects of undesirable changes in the world economy and the scenario of an expansive fiscal policy. Forecasted values of some important variables are presented in Figures 3a and 3b.

Figure 3a. Ex ante simulations using ECO-LINE
(Annual growth rates)



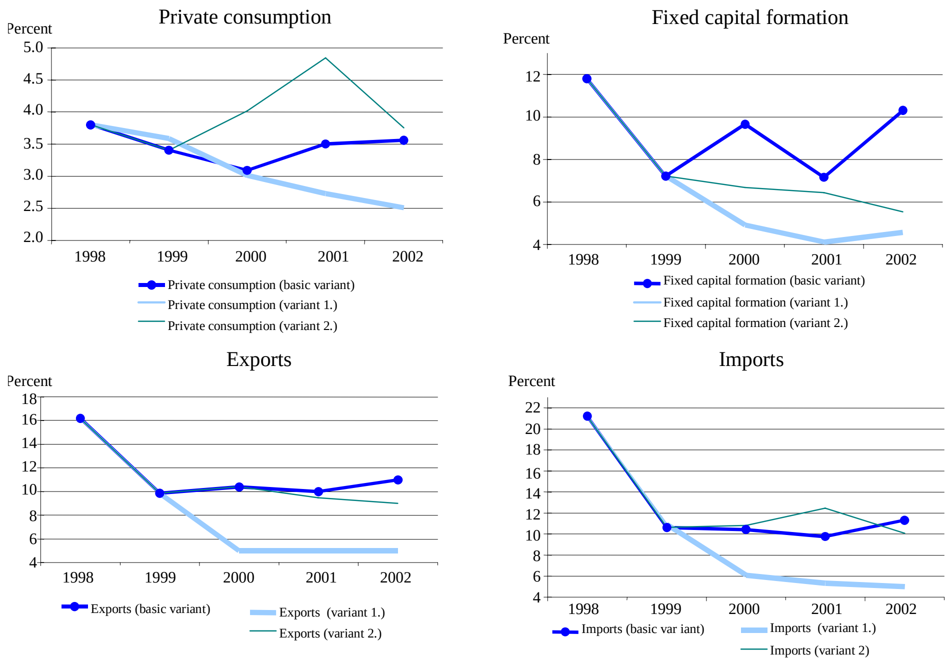
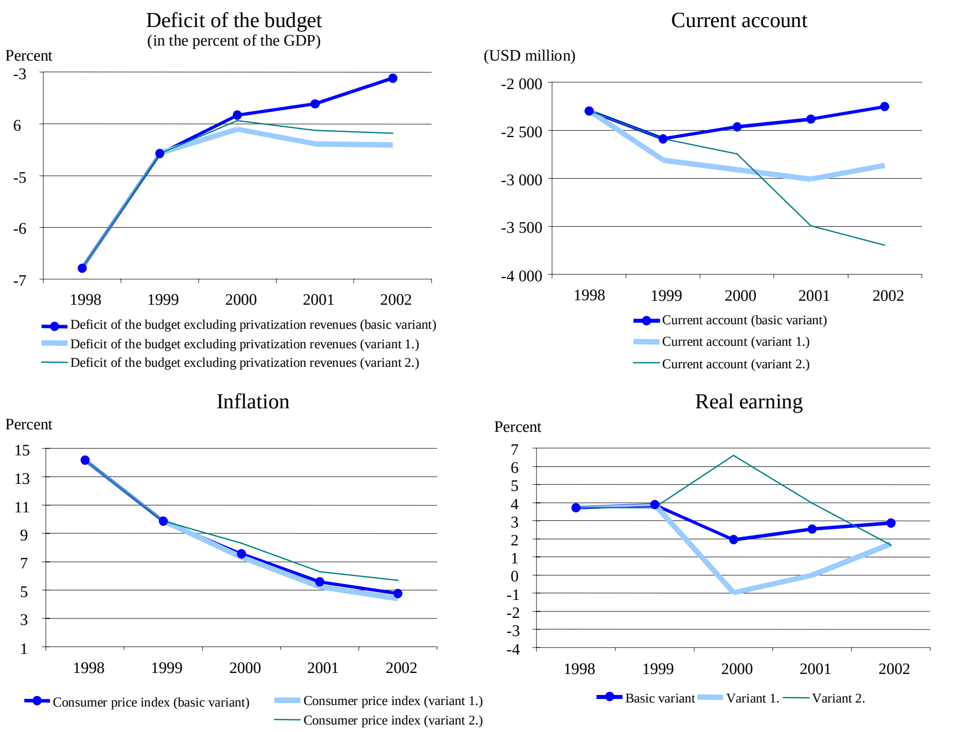
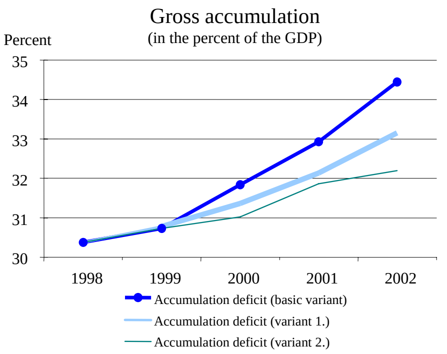
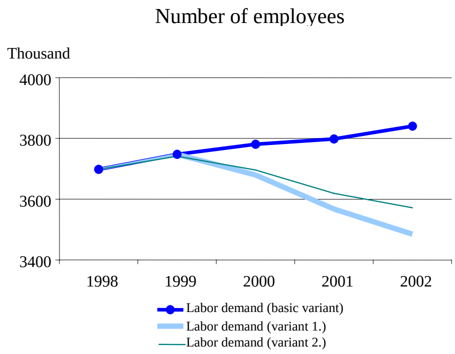


Figure 3b. Ex ante simulations using ECO-LINE







4.1. The base scenario

The baseline variant considers the conditions of a balanced path based on a high accumulation rate needed for a successful catching up process. Economy is assumed to grow under favourable external circumstances without any considerable danger to the macroeconomic equilibrium. A rather high accumulation rate accompanied by an acceptable deficit of the foreign trade balance assigns a relatively slow disinflationary path. Table 1 details the major results of this scenario.

Table 1

Main macroeconomic indicators of the base scenario
(Constant price growth indices)

Item	1998	1999	2000	2001	2002
Gross domestic production (GDP)	5,1	3,9	4,3	4,4	4,8
Final consumption	3,8	3,2	3,0	3,4	3,5
Private consumption	3,8	3,4	3,1	3,5	3,6
Public consumption	3,8	2,4	2,2	3,0	3,0
Accumulation of fixed assets	11,8	7,2	9,7	7,2	10,3
Accumulation, gross	23,2	9,1	9,4	7,9	10,2
Domestic demand	8,6	4,9	4,8	4,8	5,6
Exports	16,2	9,9	10,4	10,0	11,0
Imports	21,2	10,6	10,4	9,8	11,3
Inflation	14,2	9,9	7,6	5,6	4,8
Producer price index	11,5	5,5	5,0	4,3	4,1
Exchange rate (HUF/USD)	214,4	235,9	249,4	256,8	263,0
Current account balance of payment (USD, million)	-2297,0	-2589,2	-2461,9	-2384,1	-2254,5
Current account balance (in percentage of GDP)	-4,8	-5,1	-4,6	-4,2	-3,7
Central government balance (HUF billion)	-553,9	-436,9	-410,4	-429,3	-410,5
Central government balance (in percentage of GDP)	-5,4	-3,7	-3,1	-2,9	-2,6
General government balance (HUF billion)	-694,0	-546,9	-510,4	-529,3	-500,5
General government balance (in percentage of GDP)	-6,8	-4,6	-3,8	-3,6	-3,1

The average growth rate amounts to 4–5 percent whereas accumulation increases by 9–10 percent annually. Assuming the utilization of considerable EU transfers, the latter figure may even exceed 10 percent in 2002. Consumption is expected to increase by 3 percent on average. Considering the cyclic effect of elections, the corresponding figure for 2001–2002 may exceed this value.

Exports are projected to increase dynamically by 10 percent annually. Because of the high accumulation, imports are projected to grow similarly. Consequently, the deficit of the trade balance may amount to USD 4 billion in 2002. Based on our calculations this figure is not expected to involve further significant deterioration of the balance of payments since other current items (e.g. the performance of tourism) and transfers projected by the accession to the EU may compensate for the deterioration of the trade balance. However, this trend has to be broken in the long run. Financing of the current account is of a favourable pattern. The annual inflow of active foreign capital is expected to amount to USD 1.5–2 billion. Regarding portfolio investments, the increment is projected to a total of USD 1 billion annually.

The deficit of the state budget would decline continuously. The GDP-rated deficit is projected to amount to 3.1 percent by 2002. The number of employees increases slightly since the recovery of high productivity areas of the competitive sector is expected to be accompanied by an employment drop in the public sector. The increase in the retirement age limit does not modify the unemployment rate considerably. Inflation is expected to approach 4–5 percent by 2002 whereas real incomes are projected to grow about 2.7–3.7 percent annually.

4.2. The external shock variant

The possibility of unfavourable foreign market relations remaining far below the world economic environment assumed in the basic scenario cannot be ruled out completely. Our second variant considers these undesirable conditions. This would apparently affect growth and equilibrium relations and require different economic policy reactions. Table 2 provides a summary of the major macroeconomic results of the simulation.

A considerable slowdown of the world economy would involve a significant decline in the growth of exports to 5 percent. Imports would increase more rapidly than exports would, though the dynamics of growth would decline as well. Foreign trade deficit would increase extremely resulting in the slowdown of economic growth (induced by the contraction in export demand).

Deceleration of economic growth would involve the increase of state budget deficit by means of decreasing revenues. Considerable growth in the foreign trade deficit would result in an increase in the government deficit. Should this trend remain stable, economic policy would have to intervene and revise exchange rate policy in the form of a single action, like by increasing the scrawling peg devaluation rate or by the postponement of devaluation. Under unfavourable conditions, the recent disinflation path may be broken. A higher inflationary path, a greater deficit of the state budget and the account would increase the interest level both in nominal and in real terms. This would incline the costs of debt financing and decelerate the long-term growth potential by means of restricting the accumulation rate.

Table 2

Main macroeconomic indicators of the external shock variant
(Constant price growth indices)

Item	1998	1999	2000	2001	2002
Gross domestic production (GDP)	5,1	3,8	2,8	2,8	3,0
Final consumption	3,8	3,4	2,9	2,8	2,6
Private consumption	3,8	3,6	3,0	2,7	2,5
Public consumption	3,8	2,4	2,2	3,0	3,0
Gross fixed capital formation	11,8	7,2	4,9	4,1	4,6
Gross capital formation	23,2	9,1	5,9	4,4	4,7
Domestic demand	8,6	5,0	3,7	3,2	3,2
Exports	16,2	9,9	5,0	5,0	5,0
Imports	21,2	10,9	6,1	5,3	5,0
Inflation	14,2	9,9	7,3	5,2	4,4
Producer price index	11,5	5,5	4,5	3,8	3,6
Exchange rate (HUF/USD)	214,4	235,9	249,4	256,8	263,0
Current account balance of payment (USD, million)	-2297,0	-2810,5	-2910,3	-3007,1	-2865,9
Current account balance (in percentage of GDP)	-4,8	-5,6	-5,6	-5,5	-5,0
Central government balance (HUF, billion)	-553,9	-435,8	-436,5	-515,6	-569,9
Central government balance (in percentage of GDP)	-5,4	-3,6	-3,3	-3,7	-3,8
General government balance (HUF, billion)	-694,0	-545,8	-536,5	-615,6	-659,9
General government balance (in percentage of GDP)	-6,8	-4,6	-4,1	-4,4	-4,4

4.3. The fiscal expansion variant

The main precondition of the base scenario is the realization of certain fiscal and income policy targets as referred to. However it is worth demonstrating the macroeconomic consequences of a fiscal policy being more expansive than considered necessary.

According to the calculations of the model, a considerable growth of expenditures accompanied by the current rate of public investments would result in a rapid increase of private consumption. Either a growth in paid transfers or an increase in the payments to public institutions (generated dominantly by the growth of wages in the public sector) would increase household disposable income. A significant part of this increment would be spent on consumption goods considering the great extent of consumption postponed in the past years. This would not necessarily generate problems itself since the recovery of internal demand could improve the positions of indigenous companies as well. However, increasing state budget deficit caused by a significant growth in government expenditures would impose major burden on the state budgets of subsequent years. Private savings would increase at a rate slower than the deterioration of state deficit (decreasing investments in the competitive sector and/or growing the demand for external financing). In other words, the increment of demand would result in lower investment and higher consumption growth rates.

Another important effect would be a higher level of inflation induced by the fact that the supply side could meet the increasing demand only partially. However, economic effects described above might be restrained slightly by two additional effects: a higher level of inflation causes smaller growth in real earnings on the one hand and a less rapidly increasing government budget deficit on the other.

Table 3

Main macroeconomic indicators of the fiscal expansion variant
(Constant price growth indices)

Item	1998	1999	2000	2001	2002
Gross domestic production (GDP)	5,1	3,9	4,1	2,7	3,2
Final consumption	3,8	3,2	4,0	4,7	3,8
Private consumption	3,8	3,4	4,0	4,8	3,8
Public consumption	3,8	2,4	4,0	4,0	4,0
Accumulation of fixed assets	11,8	7,2	6,7	6,4	5,5
Accumulation, gross	23,2	9,1	7,2	7,3	6,7
Domestic demand	8,6	4,9	4,9	5,5	4,7
Exports	16,2	9,9	10,4	9,5	9,0
Imports	21,2	10,6	10,8	12,5	10,1
Inflation	14,2	9,9	8,3	6,3	5,7
Producer price index	11,5	5,5	7,0	5,8	6,2
Exchange rate (HUF/USD)	214,4	235,9	249,4	256,8	263,0
Current account balance of payment (USD, million)	-2297,0	-2589,2	-2746,7	-3492,2	-3695,0
Current account balance (in percentage of GDP)	-4,8	-5,1	-5,1	-6,1	-6,0
Central government balance (HUF, billion)	-553,9	-438,1	-427,2	-507,6	-586,9
Central government balance (in percentage of GDP)	-5,4	-3,7	-3,2	-3,4	-3,6
General government balance (HUF, billion)	-694,0	-548,1	-527,2	-607,6	-676,9
General government balance (in percentage of GDP)	-6,8	-4,6	-3,9	-4,1	-4,2

5. Conclusions and plans for further developments

In this paper we have provided an outline of ECO-LINE, a macroeconometric model of the Hungarian economy.

Besides an overview of the general structure of the model and the connections among its different blocks, an introduction to the set of stochastic equations (positioned at the heart of ECO-LINE) was provided. In addition to ex post simulations demonstrating the model's satisfactory performance in forecasting historical data, ex ante simulations for three different scenarios of the Hungarian economy illustrated the way ECO-LINE can be utilized for policy purposes.

ECO-LINE is planned to evolve over time both by refining some of the already specified stochastic equations and by developing some additional equations for the stochastic block.

Besides necessary improvements in the stochastic section, some of the important interrelations among different blocks of ECO-LINE should be further developed. With respect to necessary refinements in the stochastic section, improvements in the equations of private investment and direct exports are planned on the one hand and developing a money demand function on the other. Regarding interrelations between certain blocks, a more detailed structure of interactions between the monetary block and the real block should be developed in the near future.

APPENDIX

List of variables in the stochastic equations

ECO-LINE Notation	Description
CPI	Consumer price index
CPIE2	Expected *CPI*
DIHD	Net direct foreign investments
*DUMMY_*	Quarterly dummy variable
EARNING	Wages and salaries
ICREDR	Real credit rate
IDEPR	Real deposit rate
L	Total employment
MFORR	Number of potential workers
MON201	Money supply - currency
NEWCAP	New capacities
OLDCAP	Old capacities
PEXPD	Export price index (USD)
PIMPD	Import price index (USD)
PPIFT	Producer price index (HUF)
PMDIRD	Direct import price index (USD)
PXDIRD	Direct export price index (USD)
QBELF	Aggregate domestic demand
QCPUR	Real household consumption
QDI	Disposable real income (in 1991 prices)
QGDP	Real GDP (in 1991 prices)
QGDPPT	Real potential GDP (in 1991 prices)
QINVBU	Real private investment (in 1991 prices)
QMDIR	Real direct import s
QCPUR	Real purchased consumption (in 1991 prices)
SL	Labour supply
TRXXQY	Trend variable starting with year XX quarter Y
UT	Capacity utilization rate
W	Per capita quarterly wage rate
WPI	World price index

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