Integration of macroeconomic behavioural relationships and the input-output block: Romanian modelling experience

Dobrescu, Emilian

Romanian Academy

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Integration of Macroeconomic Behavioural Relationships and the Input-Output Block (Romanian Modelling Experience)*

Emilian Dobrescu**

Abstract

The last version of the Romanian macromodel (Dobrescu 2005b) incorporates the experience accumulated through the utilisation of its previous forms - either experimental (Dobrescu 1991-1994) or operational (Dobrescu 1996-2005a). At the same time, it introduces some methodological and informational improvements.

The most significant of them is the structural decomposition of economy, according to the input-output techniques. Output and absorption are divided into: a) agriculture, sylviculture, forestry, hunting, and fishing; b) mining and energy; c) manufacturing industry; d) construction; e) transport, post and communications; f) trade and services. These categories can be easily translated into the classical three-sectors classification: primary (a+b), secondary (c+d), and tertiary (e+f).

Due to the relatively advanced stage of the transitional processes in Romania, the behavioural functions were modelled - as much as possible - by the standard relationships. Besides, unlike the previous versions (that used statistical series beginning with 1980) the present one is based exclusively on information regarding the period 1989-2004.

Since the input-output tables are defined yearly, the model contains only annual indicators. They are expressed in denominated local currency (RON). The export, import, and exchange rate series were transformed in Euro. When there were several informational sources for the same indicator, the data extracted or derived from national accounts have been adopted.

The statistical series are relatively short and often fractured (because of the transforming processes of transition). Although, it is known that ADF test of stationarity does not offer reliable results in the case of limited number of observations, generally the series satisfying it were used. The simplest regression methods were also preferred. The structural breaks in evolution of some series have been dealt by the inclusion of dummies. Obviously, all these circumstances weaken the stability of econometric coefficients that must be continuously updated.

The first two chapters of the paper characterise the main macroeconomic behavioural relationships and input-output coefficients. The third one discusses a possible scenario for the Romanian economy during 2005-2010. A set of simulations is presented in the final part of the paper; these reveal some operational features of the macromodel.

Key words: model, input-output analysis, econometric relationships, simulations

JEL Classification: C5, E2-E6, H6

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**Senior researcher, member of the Romanian Academy
Address: Str. Uruguay Nr. 2, Bl. 8, Ap. 2
011445 Bucharest, Sector 1 - Romania
Tel:, 0040 21 222 28 50, Fax: 0040 21 411 93 38
e-mail: edobrescu @ rdslink.ro

Content

Integration of Macroeconomic Behavioural Relationships and the Input-Output Block
(Romanian Modelling Experience)

The last version of the Romanian macromodel (Dobrescu 2005b) incorporates the experience accumulated through the utilisation of its previous forms - either experimental (Dobrescu 1991-1994) or operational (Dobrescu 1996-2005a). At the same time, it introduces some methodological and informational improvements.

The most significant of them is the structural decomposition of economy, associated with input-output techniques. Being the first such attempt, a reduced number of sectors have been preferred. Consequently, the output and absorption are divided into: a) agriculture, sylviculture, forestry, hunting, and fishing; b) mining and energy; c) manufacturing industry; d) construction; e) transport, post, and communications; f) trade and services. These are computationally interconnected through input-output coefficients, derived from extended tables for 105 branches. The adopted structure can be easily translated into the classical three-sectors classification: primary (a+b), secondary (c+d), and tertiary (e+f).

Due to the relatively advanced stage of transition from centrally planned to market economy (which begun in 1989), the behavioural functions were modelled - as much as possible - by the standard relationships. Besides, unlike the previous versions that used statistical series having 1980 as a start, the present one is based exclusively on information regarding the period 1989-2004.

The model refers to annual indicators since the input-output tables are defined yearly. They are expressed in denominated local currency (RON). The export, import, and exchange rate series were transformed in Euro, taking into account the integration of Romania into European Union.

The macromodel contains 181 relationships that may be groupped into six main blocks namely:

Table no. 0.1

Block	Econometric relationships	Accounting relationships (identities, technical definitions)	Total
I-O coefficients	36	0	36
Output	1	48	49
Production factors and labour income	4	16	20
Domestic absorption and foreign trade	17	31	48
Prices and exchange rate	3	14	17
Financial and monetary variables	1	10	11
Total	62	119	181

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Chapter I: Macroeconomic Behavioural Relationships

Regarding behavioural relationships, the present version of model has retained those specifications which:

a) are consistent with standard macroeconomic theorems;

b) correctly describe the peculiarities of the Romanian market economy;

c) generate plausible results in simulations.

They refer to labour market, output, domestic absorption, foreign trade, prices, exchange rate, and interest rate.

1. The market mechanisms penetrated slower in the interaction of labour supply-demand. Nevertheless, step-by-step they became dominant in this field. As it is known, the macromodelling research dedicated to these problems are characterised by several explanatory approaches. Concerning labour force dynamics, the changes in output (different variants of the so-called Okun's law) or in aggregate demand are frequently invoked; the trend of employment is also referred to [Holden; Jula and Jula; Scheneider, Hofreither, and Neck; Artus and Bismut; Kawasaki; Chung; de Bondt, van Els, and Stokman; Mattei; Christ; Fair; Gaburro (1985, 1986); Fidrmuc and Pichelmann; Olexa, Holuska, Orsagova, Klein and Sasinek; Abel and Bernanke; Naohiro, Akira, Makoto, and Mitsuo; Stockhammer; Jahnke et al; Layard, Nickell, and Jackman; Elmeskov and Pichelmann; Elmeskov; Malcolm, Kerrison, and Menzies]. Labour demand (employment) is correlated in many models with the change in the unit labour cost [Belot and van Ours; Scheneider, Hofreither, and Neck; Naohiro, Akira, Makoto and Mitsuo; Verbeek]. Some researchers approximate it using its dependence on utilisation rate of productive capacity, unemployment inertia, number of vacancies in the economy [van Miltenburg (1997a, b), Lahti, Spanikova; Elmeskov]; According to Elmeskov and Pichelmann, "The data...point towards a negative long-run relation – both in levels and in changes – between unemployment and labour-force participation, suggesting that with rising open unemployment its <hidden component> may increase as well."(p.11). Regarding the wage equation, the literature insists, as explicative factors, on unemployment, labour productivity, tax „wedge", different indices of inflation [Logeay and Tober; Blanchard and Katz; Nymoen; Holden and Nymoen; Johansen; Holden; Whelan; Bradley and Morgenroth; Fidrmuc and Pichelmann; Brunia; Karbuz; Olexa, Holuska, Orsagova, Klein and Sasinek].

For the Romanian economy, three relationships have been selected: the labour force participation rate, the unemployment, and the nominal labour income per employed person.

1.1. The labour force participation rate (prap) – as a ratio of labour force to population over 15 years - is defined depending on employment (E) in previous period. There were retained the first lag for prap and the second one for E, which reflect the relatively high inertia of the labour market processes. Therefore:

$$prap=f(prap(-1), E(-2) \quad (I.1.1)$$
$$(+) \quad (+)$$

1.2. Such sluggishness is also present in the case of unemployment rate (ru). In addition, it appears to be mainly influenced by the evolution of unit labour cost (ULC), determined as a ratio between the labour income and the labour productivity. Consequently, the following specification has been adopted:

$$ru=f(ru(-1), ULC) \quad (I.1.2)$$
$$(+) \quad (+)$$

1.3. With respect to the nominal labour income per employed person (LIE), two explicative factors seem to be essential: the unemployment rate (ru) and consumer price index (CPI). One lag is also involved:

$$LIE=f(LIE(-1), ru, CPI) \quad (I.1.3)$$
$$(+) \quad (-) \quad (+)$$

These relationships generate, also for the Romanian economy, standard slopes of the labour supply and labour demand (as a function of labour income per employed person).

2. The proposed production function tries to combine the classical framework with the recent modelling approaches [Aghion and Howitt; Apel and Jansson; Banca d'Italia; Baxter and King; Blanchard; Burnside, Eichenbaum, and Rebelo; Cechetti; Claus (2000a, b); European Commission 1995 and 2000; Eurostat 1999; Forni and Reichlin; Gerlach and Smets; Gordon (1997 and 2000); Griliches (1994 and 1996); Hodrick and Prescott; Hulten; Kuttner; Nordhaus; OECD 2000; Prescott; Schreyer; Scott; Solow; Turner, Richardson, and Rauffet; Gundlach; Kawasaki; Iancu; Ekstedt and Westberg; Pindyck and Rubinfeld; Artus, Avouyi-Dovi, and Laffargue; Nemenyi; Froyen; Bradley and Morgenroth; Allen; Harvey; Denis, Mc Morrow and Rõger; Elmeskov; Proietti, Mussoy, and Westermanny].

2.1. The starting point is an usual production function with capital and labour, expressed in yearly indices. Since the series of tangible fixed assets was estimated using indirect methods, they are named "conventional tangible fixed assets". Therefore,

$$IGDPc=IE^{alpha}*ICKc^{(1-alpha)}*ITFP \quad (I.2.1)$$

where:

IGDPc – index of gross domestic product at constant prices,
IE – index of employment,
alpha – elasticity of output with respect to labour,
ICKc - index of conventional tangible fixed assets at constant prices, and
ITFP – index of the total factor productivity.

The capital is interpreted in its largest sense, including here not only technological equipments and direct productive buildings, but also infrastructure and other tangible fixed assets, taking into account that all of them influence the performances of the economy. We maintain the assumption that the production function may include the real capital stock as such, without corrections derived from a disputable "normal" utilization rate.

As in other similar approaches, the share of labour income in gross value added will approximate the coefficient alpha.

Two categories of variables are main determinants of the total factor productivity: the level of alpha itself and, on the other hand, several indicators, which essentially influence the technologies and the utilisation rate of the productive capacities.

2.2. Regarding the first factor, it seems realistic to assume that:

• when actual alpha is less than its long-run (equilibrium) level, the labour force is not stimulated to reach the highest potential output;

• conversely, if alpha surpasses such an optimal level, the firms are obliged to restrain their activity, which has also negative repercussions on total factor productivity.

Starting from these considerations, the econometric relationship of the index of total factor productivity will be built corresponding to the following restrictions:

- if alpha=0 or =1 (that is when the production would be nonsensical for the labour force or, respectively, for capital), ITFP tends to zero;

- ITFP depends non-linearly on alpha, admitting a maximum when alpha is equal to its long-run (equilibrium) level.

We suggest the simplest functional form for ITFP, which incorporates these conditions:

$$ITFP=(alpha-alpha^{a})*RV \quad (I.2.1)$$

where RV captures the effect of the rest of the variables.

The first adopted assumption (when alpha=0 or =1, ITFP=0) is automatically observed. The second one is also satisfied for a>1. The question is: How to determine parameter a?

The long-run (equilibrium) level of alpha will be noted alphao. It is estimated separately using a specific procedure. From

$$\partial ITFP/\partial alpha=0 \qquad (I.2.2)$$

we have:

$$1-a*alfao^{(a-1)}=0 \qquad (I.2.3)$$

$$1/a=alfao^{(a-1)} \qquad (I.2.41)$$

$$(1/a)^{(1/(a-1))}=alfao \qquad (I.2.5)$$

For Romania, alphao=0.653821, which is close enough to the average alpha registered in consolidated market economies. Correspondingly, the parameter a is equal to 4.58235724.

If such an approach proves correct, it would be interesting to investigate in the future its similarities and differences versus standard output-gap theorem [Akerlof, Dickens, and Perry; Ball; Bårdsen and Nymoen; Baxter and King; Betcherman; Beveridge and Nelson; Blanchard and Katz; Blanchflower and Oswald; Claus (2000a, b); Cochrane; Conway and Hunt; Denis, Mc Morrow, and Rõger; Doménech and Gomez; Elmeskov and Mac Farlan; Estrella and Mishkin; Evans; Gerlach and Smets; Giorno, Richardson, Roseveare, and van der Noord; Gordon (1996, 1997); Guarda; Herz and Röger; Holden; Kichian; Kuttner; Layard, Nickell, and Jackman; Logeay and Tober; Nymoen; Proietti, Mussoy, and Westermanny; Rennison; Rõõm; Staiger, Stock and Watson; Stiglitz; Stockhammer].

2.3. Concerning RV, several factors have been retained:

a) The investment intensity is one of them, because of its decisive role in the technological improvement of the production of goods and services; it is approximated by the gross fixed capital formation in real terms (GFCFc).

b) The following is the domestic demand pressure (DDP), defined thus:

$$IDAD=DAD/DAD(-1) \quad (I.2.6)$$

$$IGDP=GDP/GDP(-1) \quad (I.2.7)$$

$$DDP=IDAD/IGDP \quad (I.2.8)$$

where:

DAD – domestic absorption, current prices, billion RON

GDP – gross domestic product, current prices, billion RON

Normally, the demand pressure does not affect immediately the utilisation rate of productive capacities; its effect becomes more visible in the next period. Consequently, the first lag of this factor was included in the specification.

c) A positive correlation has been also identified between the total factor productivity and unemployment rate, which probably reflects the pressing influence of the last on labour-intensity of the employed workers.

d) The influence of the transitional reforms is captured by the time. The Hodrick-Prescott filter suggests that the initial unfavourable effects of institutional changes are resorbed quickly enough.

e) The constant is included to reflect the trend of total factor productivity.

2.4. The following specification was, therefore, adopted:

$$ITFP=f(alpha, GFCFc, DDP(-1), ru(-1), t, c) \quad (I.2.9)$$
$$(+,-) \quad (+) \quad (+) \quad (+) \quad (+)$$

3. The main component of domestic absorption is, certainly, the private consumption.

3.1. Usually, the macromodelling practice relates absorption to the current income. In general, disposable income is used instead [Lord; Malinvaud; Duesenberry; Neck and Matulka; Fidrmuc and Pichelmann; Klein and Goldberger; Dombrecht; Brunia; Jahnke et al; Kawasaki; de Bondt, van Els, and Stokman; Ekstedt and Westberg; Karbuz; Bergstrom, Nowman, and Wandasiewicz; Christ; Fair; Adams and Dixon; Kinoshita; Gaburro (1985, 1986)]. Sometimes, the disposable income is replaced by wages [Ros Bosch; Spanikova; Artus and Bismut; van Miltenburg (1997a, b)], gross national product [Furno; Denton and Oksanen] or gross domestic product [Chung; Eu and Semudram; Kinoshita; Fair]. As explanatory variables for private consumption, different components of wealth are used [Klein and Goldberger; Dombrecht; Brunia; Paleologos; Galli, Terlizzese, and Visco; Kawasaki; Chung; Morishima and Saito; de Bondt, van Els, and Stokman; Grimes, Spencer, Dunggan, and Dick; Ekstedt and Westberg; Fair; Campbell; Gaburro (1985, 1986); Artus and Bismut].

The present version of the Romanian macromodel also uses the disposable income in the determination of private consumption. Taking into account the available information, disposable income is approximated by the sum:

$$YD=GDP-(BR-TR)+NOCAE*ERE \quad (I.3.1)$$

where:

YD – disposable income, billion RON,

GDP – gross domestic product, current prices, billion RON,

BR – general consolidated budget revenues, billion RON; these are interpreted as a general consolidated budget, which includes the state budget, the local budgets, the social insurance budget, and other similar funds; all of them exert income redistribution functions regulated by authorities;

TR - government transfers, billion RON, including consolidated budget expenditures for social protection (pensions, unemployment benefits, social assistance) and labour income of public sector workers,

NOCAE - net incomes and current transfers, billion Euro,

ERE – exchange rate, RON per Euro.

3.2. The interest rate is also involved in the estimation of the private consumption [Lahti; Kawasaki; Furno; de Bondt, van Els, and Stokman; Ekstedt and Westberg; Bergstrom, Nowman, and Wandasiewicz; Fair; Adams and Dixon; Kinoshita; Gaburro (1985, 1986); Artus and Bismut]. The effect of interest rate on consumption is however contradictory. "Irving Fisher's model shows that, depending on the consumer's preferences, changes in the real interest rate could either raise or lower consumption" (Mankiw 1994, p.402). The analysis of the Romanian series revealed, nevertheless, a negative correlation between private consumption in real terms, on one hand, and the interest rate, on the other.

3.3. Many macromodels introduce one or several lags [Lord; Klein and Goldberger; Malinvaud; Duesenberry; Neck and Matulka; Fidrmuc and Pichelmann; Dombrecht; de Barganca, Figueiredo, and Rato; van Miltenburg (1997a, b); Lahti; Brunia; Paleologos; Jahnke et al; Kawasaki; Chung; Furno; Elabbassi; Spanikova; Palmer and Palme; Kinoshita; Karbuz; Bergstrom, Nowman, and Wandasiewicz; Fair; Denton and Oksanen; Campbell; Kinoshita; Gaburro (1985, 1986); Artus and Bismut].

The proposed version of Romanian macromodel also includes the previous level of private consumption as an explanatory variable of the current one.

3.4. Depending on the peculiarities of studied economies, some authors specify - among causal factors of private consumption - the exchange rate [Artus and Bismut], the employment effect [Hasselman, Post, and van der Beld; Ekstedt and Westberg], and other indicators. In the Romanian case, such variables seem to be irrelevant, and, consequently, they will not be taken into consideration.

The following relationship has been included:

$$CHc=f(YDc, IR, CHc(-1)) \quad (I.3.2)$$
$$(+)\ (-)\ (+)$$

where:

CHc – consumption of households at constant prices,

YD – disposable income at constant prices,

IR – reference interest rate of the National Bank of Romania (NBR).

4. Modelling researchers relate public consumption to different explanatory variables: gross national product or global output [Serry; Hughes-Halett and Petit; Petit], national income [Arif and Rangarjan], budget expenditures [Neck and Karbuz], budget revenues and deficits [Fukuchi, Imagawa, Oguchi, Ohno, Takenaka, and Tokunaga; Vargas; Sarpong; Pandit], population [Rao and Azhar; Sarpong; Pandit], employment and wages in government sector [Cordina], lagged public consumption [Fukuchi, Imagawa, Oguchi, Ohno, Takenaka, and Tokunaga; Sarpong; Arif and Rangarjan]. We approximate the public consumption in relation with the government budget expenditures.

5. Investments are, often, correlated with the stock of capital [Klein in Pindyck and Rubinfeld; Nemenyi; Scheneider, Hofreither, and Neck; Barten and Dhaene; van Miltenburg (1997a, b); Lahti; Brunia; Hughes-Halett and Petit; Gandolfo and Padoan; Galli, Terlizzese, and Visco; Kawasaki; Chung; Ros Bosch; Valvanis-Vail; Furno; Spanikova; Fair; Assali], the labour income [Olexa, Holuska, Orsagova, Klein and Sasinek; Fidrmuc and Pichelman; Dombrecht; Brunia; Valvanis-Vail], and employment [Cukierman, Pazner, and Razin]. This approach is adequate in a consolidated market economy, in which the capital formation decisions usually take into account the degree of utilisation of existing capacities and the production cost. Such factors would be less conclusive in an economy like Romania's. In transition, the stock of capital is subjected to deep restructuring processes. Consequently, we did not retain it as an explanatory variable for investments.

More adequate under these conditions are indicators that reflect the financial potential of the given economy. Many models employ, in the determination of investments, gross national or domestic product, national net product, global output or aggregate demand, disposable income, wealth of the private sector, profits, private savings, and money stock [Greene; Olexa, Holuska, Orsagova, Klein and Sasinek; Fidrmuc and Pichelman; Pindyck and Rubinfeld; Scheneider, Hofreither, and Neck; Fidrmuc and Pichelmann; Dombrecht; Barten and Dhaene; Salvas-Bronsard, Lacroix, Belanger, Levesque, Montmarquette and Outlas; Fontaine, Garbley and Gilli; Lahti; Rossier; Brunia; Paleologos; Petrochilos; Chou and Lin; Fanning and Bradley; Cukierman, Pazner, and Razin; Hughes-Halett and Petit; Petit; Gandolfo and Padoan; Galli, Terlizzese, and Visco; Naohiro, Akira, Makoto and Mitsuo; Kawasaki; Pyo; Chung; van Miltenburg (1997a, b); Ros Bosch; Valvanis-Vail; Furno; de Bondt, van Els, and Stokman; Spanikova; Tarp and Brixen; Ekstedt and Westberg; Assarson; Mattei; Thomas; Christ; Fair; Campbell; Kinoshita; Krishnamurty, Pandit, and Sharma; Assali; Gaburro (1985, 1986); Neck and Matulka; Neck and Karbuz; Jahnke et al.; Nemenyi; Serry]. For statistical reasons, we use the disposable income defined previously.

The interest rate is also often employed in the determination of investments [Greene; Olexa, Holuska, Orsagova, Klein and Sasinek; Fidrmuc and Pichelman; Pindyck and Rubinfeld; Neck and Matulka; Neck and Karbuz; Fidrmuc and Pichelmann; Salvas-Bronsard, Lacroix, Belanger, Levesque, Montmarquette and Outlas; Fontaine, Garbley and Gilli; Serry; Lahti; Brunia; Paleologos; Petrochilos; Cukierman, Pazner, and Razin; Jahnke et al.; Kawasaki; van Miltenburg (1997a, b); Valvanis-Vail; Furno; de Bondt, van Els, and Stokman; Spanikova; Ekstedt and Westberg; Assarson; Mattei; Thomas; Fair; Campbell; Adams and Dixon; Assali; Gaburro (1985, 1986)]. Similarly to private consumption, the variation of the reference interest rate of NBR (vIR) is included in the estimation of gross fixed capital formation.

Some modelling works include in the econometric specifications lagged investment [Paleologos; Petrochilos; Chou and Lin; Jahnke et al.; Furno; Campbell; Gaburro (1985, 1986)], public investment [Serry; Krishnamurty, Pandit, and Sharma; Assali], orders [Rossier]. In our opinion, such variables are not significant in the case of the Romanian economy. Instead, the inflow of foreign capital cannot be ignored.

As a result, the gross fixed capital formation (GFCF) has been estimated in connection with the disposable income (YD), the reference interest rate of NBR (IR), and the foreign direct and portfolio investment (FDPIE):

$$GFCF=f(YD, IR, FDPIE) \quad (I.5.1)$$
$$(+) \ (-) \ (+)$$

6. The exports refer to all the transactions - either with goods or with services; they are expressed in Euro (XGSE).

6.1. These are explained first of all by the foreign demand (regional or world) as economic growth or dynamics of international changes [Dombrecht; Serry; van Miltenburg (1997a, b); Lahti; Artus, Avouyi-Dovi, and Laffargue; Brunia; Chou and Lin; Cukierman, Pazner, and Razin; Faini and Rossi; Kawasaki; Eu and Semudram; Ros Bosch; Hasselman, Post, and van der Beld; de Bondt, van Els, and Stokman; Grimes, Spencer, Dunggan, and Dick; Spanikova; Ekstedt and Westberg; Palmer and Palme; Limskul and Kalayanee]. With this aim, we shall use the world trade in real terms (WTc).

6.2. Some modelling works make use of specific factors as utilisation rate of productive capacity [van Miltenburg (1997a, b); Lahti; Faini and Rossi; Ros Bosch; Hasselman, Post, and van der Beld; Ekstedt and Westberg], lagged export [Dombrecht; van Miltenburg (1997a, b); Lahti; Brunia; Chou and Lin; Eu and Semudram] or lagged import [Limskul and Kalayanee]. The last of them seems to be adequate for our macromodel, too. This dependence comes from the fact that the Romanian export industries are based, in a substantial measure, on imported raw materials and energy resources.

6.3. An important export determinant is the international competitiveness. Different indicators have been used, for example, level of foreign prices, exchange rate in relation with domestic inflation etc [Dombrecht; Hall and Taylor; Abel and Bernanke; Krugman and Obstfeld; van Miltenburg (1997a, b); Lahti; Artus, Avouyi-Dovi, and Laffargue; Brunia; Chou and Lin; Fanning and Bradley; Cukierman, Pazner, and Razin; Faini and Rossi; Kawasaki; Eu and Semudram; Ros Bosch; Hasselman, Post, and van der Beld; de Bondt, van Els, and Stokman; Grimes, Spencer, Dunggan, and Dick; Spanikova; Ekstedt and Westberg; Palmer and Palme; Liang]. In our case, the competitiveness index (ICOsdr) will be defined as follows:

$$ICOsdr=IERE*WTDsdr/PGDP \quad (I.6.1)$$

$$IERE=ERE/ERE(-1) \quad (I.6.2)$$

where:

ERE – exchange rate, RON per Euro,

WTDsdr – world trade deflator, special drawing rights, and

PGDP – gross domestic product deflator.

Taking into account the structure of Romanian commercial changes, the world trade deflator of special drawing rights has been considered more adequate than other deflators. The influence of international competitiveness on export increases step-by-step, due to the gradual transition from centrally planned to market economy. Consequently, the following expression has been adopted:

$$XGSE=f(WTc, MGSE, ICOsdr) \quad (I.6.3)$$
$$(+) \quad (+) \quad (+)$$

where MGSE represents the import in Euro.

7. The import is also considered in a more general meaning (goods and services together).

7.1. The majority of modellers estimate import by variables linked (directly or implicitly) to the output or internal absorption. Thus, frequently gross domestic product, gross national product or total sales are utilised [Lord; Scheneider, Hofreither, and Neck; Fidrmuc and Pichelmann; Dombrecht; van Miltenburg (1997a, b); Lahti; Rossier; Brunia; Paleologos; Chou and Lin; Fanning and Bradley; Cukierman, Pazner, and Razin; Petit; Kawasaki; Moosa], as well as different indicators of income [van Miltenburg (1997a, b); Ros Bosch; Neu; de Bondt, van Els, and Stokman; Grimes, Spencer, Dunggan, and Dick; Spanikova; Tarp and Brixen; Kinoshita; Limskul and Kalayanee; Karbuz; Fair; Elhuni; Dittus and O'Brien; Campbell; Adams and Dixon; Harper and Lim; Fukuchi, Imagawa, Oguchi, Ohno, Takenaka, and Tokunaga; Gaburro (1985, 1986)]. The domestic demand [Neck and Matulka; Neck and Karbuz; Barten and Dhaene; Artus, Avouyi-Dovi, and Laffargue; Jahnke et al.; Ekstedt and Westberg; Palmer and Palme], total investment expenditure [Dittus and O'Brien; Gaburro (1985, 1986)], financial wealth of the private sector [Dombrecht], liquidity ratio [van Miltenburg (1997a, b); Spanikova] or money supply [Gaburro (1985, 1986)] are also involved.

The dependence of import on domestic absorption is present in the Romanian economy. But its main components – the final consumption (FCc) and the gross fixed capital formation (GFCFc), both at constant prices – do not have identical influences and, consequently, are included separately.

7.2. The econometric specifications of import include also domestic and external relative prices, exchange rate, and other indicators reflecting the international competitiveness [Lord; Scheneider, Hofreither, and Neck; Neck and Matulka; Neck and Karbuz; Fidrmuc and Pichelmann; Dombrecht; van Miltenburg (1997a, b); Lahti; Artus, Avouyi-Dovi, and Laffargue; Brunia; Paleologos; Chou and Lin; Cukierman, Pazner, and Razin; Petit; Jahnke et al.; Kawasaki; Ros Bosch; Neu; de Bondt, van Els, and Stokman; Grimes and Spencer, Dunggan and Dick; Tarp and Brixen; Ekstedt and Westberg; Palmer and Palme; Kinoshita; Limskul and Kalayanee; Karbuz; Fair; Dittus and O'Brien; Campbell; Harper and Lim; Fukuchi, Imagawa, Oguchi, Ohno, Takenaka, and Tokunaga; Kinoshita; Gaburro (1985, 1986)].

Such an influence can be found in the Romanian economy, too. Similarly to export, the effect of competitiveness on import becomes more and more significant.

7.3. The modelling literature implies other factors as capacity utilization rate [Lahti; Rossier; Ros Bosch; de Bondt, van Els, and Stokman; Spanikova], tariffs [Grimes, Spencer, Dunggan, and Dick; Karbuz], export [Artus, Avouyi-Dovi, and Laffargue; Jahnke et al.; Moosa; Ekstedt and Westberg; Karbuz, Campbell], lagged import [Scheneider, Hofreither, and Neck; Neck and Matulka; Neck and Karbuz; Fidrmuc and Pichelmann; Brunia; Chou and Lin; Kinoshita; Limskul and Kalayanee; Fair; Dittus and Brien; Campbell; Kinoshita; Gaburro (1985, 1986)], population [Fair], interest rate [Fair], net stock of foreign security and reserve holdings [Fair; Fukuchi, Imagawa, Oguchi, Ohno, Takenaka, and Tokunaga]. We did not find such factors relevant for the Romanian economy.

As a result, the following specification has been retained:

$$MGSE=f(FCc, GFCFc, ICOsdr) \quad (I.7.1)$$
$$(+) \quad (+) \quad (-)$$

8. The most frequent explanatory variables of prices are considered:

- labour cost and mark-up assumption [Dornbusch, Fischer, and Sparks; Carlin and Soskice; van Miltenburg (1997a, b); Lahti; Scheneider, Hofreither, and Neck; Rossier; Brunia; Paleologos; Gandolfo and Padoan; Kawasaki; Cordina; Ros Bosch; Hasselman, Post, and van der Beld; de Bondt, van Els, and Stokman; Spanikova; Weyerstrass; Ekstedt and Westberg; Palmer and Palme; Assarson; Karbuz; Bergstrom, Nowman, and Wandasiewicz; Fair; Adams and Dixon; McDonald and Dixon; Harper and Lim; Anderson; Krishnamurty, Pandit, and Sharma; Gaburro (1985, 1986); Fidrmuc and Pichelman],
- international prices and exchange rate [Neck and Karbuz; Wang; Serry; van Miltenburg (1997a, b); Lahti; Rossier; Artus and Bismut; Brunia; Paleologos; Chou and Lin; Gandolfo and Padoan; Aghevli and Rodriguez; Kawasaki; Moosa; Cordina; Ros Bosch; de Bondt, van Els, and Stokman; Spanikova; Palmer and Palme; Assarson; Kinoshita; Karbuz; Fair; Shams; Malcolm, Kerrison, and Menzies; Campbell; Adams and Dixon; McDonald and Dixon; Anderson; Krishnamurty, Pandit, and Sharma; Basu; Gaburro (1985, 1986); Fidrmuc and Pichelman],
- monetary variables [Wang; Serry; Paleologos; Gandolfo and Padoan; Aghevli and Rodriguez; Ito; Moosa; Eu and Semudram; Hasselman, Post, and van der Beld; Spanikova; Shams; Arnaudo; Harper and Lim; Anderson; Arif and Rangarjan; Krishnamurty, Pandit, and Sharma; Gaburro (1985, 1986)],
- taxes and budget policies [Brunia; Papadopoulos; Naohiro, Akira, Makoto, and Mitsuo; Kawasaki; Hasselman, Post, and van der Beld; Palmer and Palme; Assarson; Bergstrom, Nowman, and Wandasiewicz; Malcolm, Kerrison, and Menzies; Adams and Dixon; McDonald and Dixon; Anderson; Gaburro (1985, 1986); Fidrmuc and Pichelman],
- income or domestic absorption [Naohiro, Akira, Makoto, and Mitsuo; Campbell; Arif and Rangarjan; Basu].

The literature centred on demand pressure and output-gap is really huge.

We consider the gross domestic product deflator (PGDP) as a leading price index. It is derived as the ratio between indices of nominal (IGDP) and real (IGDPc) gross domestic product. The derivation of other sectorial price indices from GDP-GNP deflator is not novel [Cukierman, Pazner, and Razin; Harper and Lim]. We also have preferred this solution taking into consideration that IGDP and IGDPc result from the entire system of behavioural and accounting relationships included in macromodel. In such determination, the gross domestic product deflator seems to be the most representative expression of the supply-demand interaction.

The consumer price index (CPI) and the price index of tangible fixed assets (PK) are, therefore, estimated in two phases: first as econometric equations (these determinations are marked with the suffix eq) and, subsequently, as components of the GDP deflator, with which they must be compatible.

8.1. The consumer price index is connected to the broad money (as main monetary variable) and the exchange rate (which incorporates the influence of international markets).

It is interesting to note that the dependence of CPI on broad money was weakened by the monetary distortion, which was significant for the Romanian transition economy (Dobrescu 2000), being present either in money supply, or in demand.

Box: Monetary Distortion

Thus, the money supply was affected by the so-called disturbing form of "dollarization", which refers to:

a) utilisation (explicit or implicit) of the foreign currency deposits in domestic transactions at exchange rates higher than that of the Central Bank, and

b) undertaking domestic transactions using foreign currency that exists (at households and some firms) outside the banking system.

In broad money equivalent, the disturbing form of "dollarization" (Z), can be defined by:

$$Z=(H1*(ER^{*}-ER)+H2*ER^{*})*h \qquad (I.8.1)$$

where:

H1 - foreign currency deposits of residents in the banking system, in reference foreign currency,

ER^{*} - actually used (explicitly or implicitly) exchange rate for domestic transactions,

ER - exchange rate of the Central Bank, by which the foreign currency deposits of residents are evaluated within M2 (it assumes that $ER^{*}>ER$),

H2 - amount of foreign currency held by firms and households outside the banking system and used for carrying out domestic transactions, in reference foreign currency,

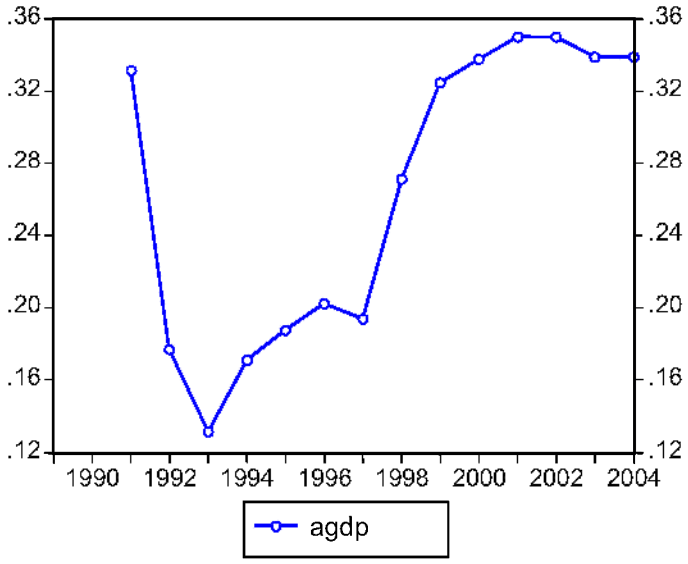
h - scaling coefficient by which the disturbing form of "dollarization" is equalized to broad money.

Therefore, the money supply can be approximated by the sum

$$Ms=M2+Z \qquad (I.8.2)$$

On the other hand, the money demand (Md) has also some peculiarities. Its standard dependencies on real gross domestic product (+), prices' level (+), and interest rate (-) are of course valid, but two other disturbances have interfered. The first regards the non-accounted economy, which obviously increases the money demand. The second refers to the barter operations and, especially, to the arrears (in the largest sense). The evolution of the ratio of arrears to gross domestic product (agdp) is presented in Graph agdp.

Graph agdp



The break in 1992-1993 was determined by the global compensation of inter-enterprise arrears operated at the end of 1991. The volume of arrears (A) can be also transformed in broad money (N); this represents the required extra amount of M2 (therefore a monetary injection), which should be pumped into economy in order to eliminate instantly the arrears and the barter operations. Consequently,

$$N = A*m \qquad (I.8.3)$$

where m is a scaling coefficient. The interpretation of N seems to be ambiguous. It can be considered as a money substitute, in which case it expands the money supply. But N can also be considered on the money demand side, as a diminishing factor. However, the implications on macroeconomic equilibrium are similar.

Summarising, the monetary distortion – represented by Z and N in previous Box – weakens the dependence of prices on broad money controlled by the Central Bank. This connection, nevertheless, cannot be annulled. In the case of the Romanian economy, it becomes more and more perceptible. Due to these considerations, the money supply has been maintained as an explanatory variable of the consumer price index (CPI). The following relationship has been included:

$$CPIeq=f(M2, ERE) \quad (I.8.4)$$
$$(+) \quad (+)$$

8.2. A similar approach was adopted for the price index of tangible fixed assets (PK):

$$PKeq=f(M2, ERE) \quad (I.8.5)$$
$$(+) \quad (+)$$

8.3. As we already mentioned, it is necessary to introduce an explicit connection of the consumer price index and the price index of tangible fixed assets to the gross domestic product deflator. This is why we introduced a corrective coefficient PRC:

$$CPI=CPIeq*PRC \quad (I.8.4a)$$

$$PK=PKeq*PRC \quad (I.8.5a)$$

The coefficient PRC results from the assumed condition, namely:

$$PGDP=shch*CPI+shgfcf*PK \quad (I.8.6)$$

$$shch=CH/(CH+GFCF) \text{ and} \quad (I.8.7)$$

$$shgfcf=GFCF/(CH+GFCF) \quad (I.8.8)$$

where CH – final consumption of households and GFCF - gross fixed capital formation, both at current prices; therefore shch+shgfcf=1.

9. Generally, the exchange rate is modelled by involving as causal variables the monetary indicators [Dornbush; Mishkin; Wang; Fair; Adams and Dixon; Krugman and Obstfeld; de Bondt, van Els, and Stokman; Weyerstrass; Matthews], its previous levels [Wang; Jahnke et al.], the domestic inflation, and the foreign capital inflows [Bergstrom, Nowman, and Wandasiewicz; Anderson; Assali; Neu; Abel and Bernanke].

In the case of Romanian economy - beside the actual sluggishness - two factors are also important: the domestic inflation and the foreign capital inflows (NCINXE). The last is interpreted as follows:

$$NCINXE=NCINE+XGSE \quad (I.9.1)$$

$$NCINE=NOCAE+FDPIE \quad (I.9.2)$$

The dependence of the exchange rate on its previous level is relatively high. This is probably the consequence of a specific transition circumstance: for a long period, the behaviour of households and firms was characterised by strong expectation for depreciation of local currency. The current inflation plays also an important role. At the same time, there is an increasing influence of the international financial markets. Therefore:

$$ERE=f(ERE(-1), PGDP, NCINXE) \quad (I.9.3)$$
$$(+) \quad (+) \quad (-)$$

10. The transition processes have progressively enforced the functional role of the monetary variables. Among them, the interest rate holds a particular place. Unfortunately, we did not have reliable data concerning the commercial banking system, which developed slower and hesitatingly in Romania. Experience from our previous studies indicates the series of the National Bank's reference interest rate as the most reliable information.

10.1. Usually, the interest rate is correlated with inflation [Abel and Bernanke; Mishkin; Scheneider, Hofreither, and Neck; Neck and Karbuz; Ros Bosch; Anderson and Carlson; de Bondt, van Els, and Stokman; Bergstrom, Nowman, and Wandasiewicz; Christ; Green et all.; Fair; Arnaudo; Gaburro (1985, 1986); Pindyck and Rubinfeld] and the real output [Scheneider, Hofreither, and Neck; Neck and Karbuz; de Bondt, van Els, and Stokman; Weyerstrass; Bergstrom, Nowman, and Wandasiewicz; Green et all.; Fair; Arnaudo; Pindyck and Rubinfeld].

Our macromodel also includes these factors, but not separately. Their cumulative expression – nominal gross domestic product - proved more suitable.

10.2. The money supply is often included in the estimation of interest rate [Scheneider, Hofreither, and Neck; Neck and Matulka; Neck and Karbuz; Serry; Gandolfo and Padoan; Anderson and Carlson; Weyerstrass; Bergstrom, Nowman, and Wandasiewicz; Green et all.; Fair; Arnaudo; Campbell; Gaburro (1985, 1986); Pindyck and Rubinfeld]. The connection of the interest rate to money supply can be also observed in the Romanian economy.

10.3. There are specifications that explain the domestic interest rate, at least partially, through the foreign interest rate [Krugman and Obstfeld; Artus and Bismut; Gandolfo and Padoan; Ros Bosch; de Bondt, van Els, and Stokman; Bergstrom, Nowman, and Wandasiewicz; Malcolm, Kerrison, and Menzies] and the exchange rate [Krugman and Obstfeld; Artus and Bismut; Ros Bosch; Malcolm, Kerrison, and Menzies].

The international markets begun to play a more and more important role in the functioning of Romanian economy, too. The short-term interest rate in advanced economies (STIRAE) has been considered relevant for such analysis, taking into account the geographical structure of Romanian foreign trade and financial flows.

10.4. Sometimes, the domestic interest rate is defined in relation to other determinants as, for example, the rate of capital gain [Mishkin; Fontaine, Garbley and Gilli; Bergstrom, Nowman, and Wandasiewicz], public sector debt

[de Bondt, van Els, and Stokman] etc. The lack of information and the disturbing effects of transitional transformations did not allow, at least until now, to identify in the Romanian economy such interdependencies.

As a result, the relationship

$$IR=f(IR(-1), GDP, M2, STIRAE) \quad (I.10.1)$$
$$(+) \quad (+) \quad (-) \quad (+)$$

has been used.

11. The statistical series are relatively short and often fractured, due to the deep transforming processes of transition. As it is known, ADF test of stationarity does not offer conclusive results in the case of limited number of observations; as a rule, the series satisfying it were nevertheless used. The Granger causality test was computed for one, two, and three lags. The simplest methods of estimation were also preferred. The structural breaks in the evolution of some indicators have been handled by the inclusion of dummies. Obviously, all these circumstances weaken the stability of econometric coefficients that must be continuously updated.

Chapter II: Input-Output Coefficients

This block operates with two types of coefficients:

- input coefficients (a_{ij}) implied in determination of output, and
- those defining the final utilization of resources (more precisely its sectorial distribution).

1. For the adopted classification of economic activities (six sectors), 36 input coefficients have been computed.

1.1. The econometric estimations of these coefficients are based on several hypotheses.

- Despite the effects induced by the transitional transformations (changes in the sectorial structure, in relative prices, technologies, etc), it is assumed that the input coefficients tend towards the long-run stable levels (likely the consolidated functional market systems).
- This tendency is conceived as an autoregressive adaptive process, the differences between actual coefficients and their long-run levels being influenced by the past deviations.
- For uniformity, the same specification is adopted for all coefficients. Such a simplification is useful for computational reasons. It starts with:

$$a_{ij}=a^{*}_{ij}+b^{*}(a^{*}_{ij}-a_{ij}(-1))=a^{*}_{ij}*(1+b)-b^{*}a_{ij}(-1) \quad (II.1.1)$$

where a^{*}_{ij} represent the long-run levels of a_{ij}. It is assumed that $0<|b|<1$, which means that actual a_{ij} tend asymptotically towards a^{*}_{ij}. Correspondingly, the first order difference operator is defined in this way:

$$\Delta a_{ij}=a_{ij}-a_{ij}(-1)=a^{*}_{ij}*(1+b)-b^{*}a_{ij}(-1)-a_{ij}(-1)=$$
$$=a^{*}_{ij}*(1+b)-(1+b)^{*}a_{ij}(-1)=g-h^{*}a_{ij}(-1) \quad (II.1.2)$$

where $g=a^{*}_{ij}*(1+b)$ and $h=(1+b)$; therefore, $a^{*}_{ij}=g/h$.

1.2. The main results are presented in Table no. II.1 (parameters c(1)-c(72) in macromodel).

Table no. II.1
The estimates of g and h for the basic sample

Δa_{ij}	g	h	$g/h=a^{*}_{ij}$
Δa_{11}	c(1)=0.094461	c(2)=0.355968	0.265364
Δa_{12}	c(3)=0.00025	c(4)=0.85982	0.000291
Δa_{13}	c(5)=-0.03503	c(6)=-0.29589	0.118372
Δa_{14}	c(7)=0.000112	c(8)=0.268758	0.000417
Δa_{15}	c(9)=0.000247	c(10)=0.612018	0.000404
Δa_{16}	c(11)=0.003917	c(12)=0.67454	0.005807
Δa_{21}	c(13)=0.016678	c(14)=0.456711	0.036518
Δa_{22}	c(15)=0.283832	c(16)=0.542319	0.523367
Δa_{23}	c(17)=0.05151	c(18)=0.537789	0.095781
Δa_{24}	c(19)=0.037157	c(20)=0.404205	0.091926
Δa_{25}	c(21)=0.050273	c(22)=0.372511	0.134957
Δa_{26}	c(23)=0.043055	c(24)=0.783821	0.05493
Δa_{31}	c(25)=0.051004	c(26)=0.433984	0.117525
Δa_{32}	c(27)=0.04486	c(28)=0.535192	0.08382
Δa_{33}	c(29)=0.172608	c(30)=0.54743	0.315306
Δa_{34}	c(31)=0.09475	c(32)=0.329547	0.287516
Δa_{35}	c(33)=0.089491	c(34)=0.492403	0.181743
Δa_{36}	c(35)=0.137139	c(36)=0.445344	0.307939
Δa_{41}	c(37)=0.000966	c(38)=0.442662	0.002182
Δa_{42}	c(39)=0.004796	c(40)=0.637328	0.007525
Δa_{43}	c(41)=0.001368	c(42)=0.558931	0.002448
Δa_{44}	c(43)=0.025766	c(44)=0.48042	0.053632
Δa_{45}	c(45)=0.007348	c(46)=0.800619	0.009178
Δa_{46}	c(47)=0.007819	c(48)=0.55962	0.013972
Δa_{51}	c(49)=0.018031	c(50)=0.84147	0.021428
Δa_{52}	c(51)=0.058295	c(52)=0.906571	0.064303
Δa_{53}	c(53)=0.021308	c(54)=0.91221	0.023359
Δa_{54}	c(55)=0.027122	c(56)=0.810934	0.033445
Δa_{55}	c(57)=0.019438	c(58)=0.268597	0.072369
Δa_{56}	c(59)=0.043159	c(60)=0.777732	0.055493
Δa_{61}	c(61)=0.007149	c(62)=0.759087	0.009418
Δa_{62}	c(63)=0.003102	c(64)=0.127849	0.024263
Δa_{63}	c(65)=0.004151	c(66)=0.23324	0.017797
Δa_{64}	c(67)=0.022443	c(68)=0.268232	0.08367
Δa_{65}	c(69)=0.010774	c(70)=0.218603	0.049286
Δa_{66}	c(71)=0.067766	c(72)=0.443329	0.152857

The relationship for Δa_{13} is characterised by negative econometric estimates, which may generate some difficulties. Thus, if we shall compute a projection for several consecutive years, the coefficient a_{13} itself could become also negative. Consequently, for the main scenario concerning 2005-2010 years, the following specification has been adopted:

$$a_{13}=c(5a)+c(6a)^{*}(a_{13}(-1)-c(5a))/t \quad \text{(II.1.3)}$$

where c(5a) represents the long run level of this coefficient. The macromodel operates after 2004 year, that is for t>16. Under these conditions, the obtained estimates (c(5a)=0.097031 and c(6a)=3.151792) allow the convergence towards positive a_{13}.

1.3. Coming back to the Table no. II.1, with sufficiently long statistical series, in (II.1.2), $b\rightarrow 0$; consequently $h\rightarrow 1$ and $a^{*}_{ij}\rightarrow g$. Such a property has been illustrated using a sui-generis Monte-Carlo experiment. Thus, statistical data for Romania (1989-2001 years) were randomly mixed to obtain series of 1001 terms; all the horizontal vectors undergone this procedure, in order not to affect the structure of sectorial changes.

Table no.II.2
The estimates of g and h for a random sample

Δa_{ij}	g	h	$g/h=a^{*}_{ij}$
Δa_{11}	0.229793	0.990763	0.231935
Δa_{12}	0.00029	1.007236	0.000288
Δa_{13}	0.10878	0.982724	0.110692
Δa_{14}	0.000497	0.998091	0.000498
Δa_{15}	0.000342	0.970387	0.000352
Δa_{16}	0.006938	0.976665	0.007104
Δa_{21}	0.044493	0.97875	0.045459
Δa_{22}	0.516636	0.972327	0.53134
Δa_{23}	0.094215	1.001973	0.094029
Δa_{24}	0.085985	1.016591	0.084582
Δa_{25}	0.128719	1.032674	0.124646
Δa_{26}	0.05213	0.958231	0.054402
Δa_{31}	0.130841	0.991762	0.131928
Δa_{32}	0.084123	0.976806	0.08612
Δa_{33}	0.333505	0.980314	0.340202
Δa_{34}	0.32524	0.966513	0.336509
Δa_{35}	0.186255	0.984842	0.189122
Δa_{36}	0.304863	0.954527	0.319386
Δa_{41}	0.003925	0.989318	0.003967
Δa_{42}	0.009412	1.002036	0.009393
Δa_{43}	0.002396	0.967799	0.002476
Δa_{44}	0.047016	0.996604	0.047176
Δa_{45}	0.008566	0.997065	0.008591
Δa_{46}	0.01781	0.986821	0.018048
Δa_{51}	0.02103	0.95029	0.02213
Δa_{52}	0.05822	0.999922	0.058225
Δa_{53}	0.022697	0.960781	0.023623
Δa_{54}	0.036114	1.042684	0.034636
Δa_{55}	0.077224	0.975483	0.079165
Δa_{56}	0.052544	0.921843	0.056999
Δa_{61}	0.009318	1.005191	0.00927
Δa_{62}	0.017717	0.998148	0.01775
Δa_{63}	0.019085	0.986551	0.019345
Δa_{64}	0.069353	0.972389	0.071322
Δa_{65}	0.040158	0.980053	0.040975
Δa_{66}	0.142847	1.003853	0.142299

As expected, the levels of a^{*}_{ij} are similar in both applications.
The macromodel uses the estimates of g and h deduced from basic sample.

2. The sectorial structure of imports is defined using the parameters shm_i (share of the sector i in import) from input-output tables. The estimation procedure is the one used in the case of input coefficients. However, the series shm_2 and shm_3 are characterised by significant volatility, which makes less adequate such an approach. That is why, the procedure will be applied on sum shm_{23} ($=shm_2+shm_3$).

The results of regressions will be presented, as before, for the basic sample and for the random one; in the last case, the horizontal vectors have been mixed.

Table no. II.3
The estimates of g and h for basic sample

	g	h	g/h	shm^*_i= g/(h*0.993825)
Δshm_1	c(73)=0.015073	c(74)=0.636407	0.023685	0.023832
Δshm_{23}	c(75)=0.437494	c(76)=0.492019	0.889179	0.894704
Δshm_4	c(77)=0.000778	c(78)=0.528472	0.001473	0.001482
Δshm_5	c(79)=0.006043	c(80)=0.239541	0.025229	0.025385
Δshm_6	c(81)=0.013203	c(82)=0.243334	0.054259	0.054596
Total			0.993825	1

Evidently, the corrective coefficient 0.993825 is imposed by the condition $\Sigma shm_i=1$.

Table no. II.4
The estimates of g and h for random sample

	g	h	$shm^*_i=g/h$
Δshm_1	0.028407	0.981675	0.028937
Δshm_{23}	0.826276	0.931194	0.887329
Δshm_4	0.001557	0.982803	0.001585
Δshm_5	0.026152	1.003523	0.02606
Δshm_6	0.054382	0.969579	0.056089
Total			1

Again the values of shm^*_i in both applications are similar. The estimates obtained from the basic sample are included in the macromodel.

The components of Δshm_{23} are estimated by the additional econometric relationship:

$$\Delta shm_2=c(83)*\Delta shm_3 \qquad (II.2.1)$$

where c(83)=-0.712152. Therefore:

$$\Delta shm_2=-0.712152*\Delta shm_3 \qquad (II.2.2) \text{ and}$$

$$\Delta shm_{23}=\Delta shm_2+\Delta shm_3=0.437494-0.492019*shm_{23}(-1) \qquad (II.2.3)$$

3. The sectorial structure of the final utilisation of resources will be estimated on the basis of the corresponding shares (shu_i) computed from the input-output tables. The estimation procedure presented for the coefficients a_{ij} will be again applied in this case. In order to observe the restriction $\Sigma shu_i=1$, a corrective parameter is also introduced.

Table no. II.5
The estimates of g and h for basic sample

	g	h	g/h	shu^*_i=g/(h*1.021525)
$\Delta shu1$	c(84)=0.068609	c(85)=0.558733	0.122794	0.120206
$\Delta shu2$	c(86)=0.050328	c(87)=0.936383	0.053748	0.052615
$\Delta shu3$	c(88)=0.281478	c(89)=0.609256	0.462003	0.452268
$\Delta shu4$	c(90)=0.051132	c(91)=0.625516	0.081744	0.080021
$\Delta shu5$	c(92)=0.01873	c(93)=0.325093	0.057615	0.056401
$\Delta shu6$	c(94)=0.040338	c(95)=0.165576	0.243622	0.238488
Total			1.021525	1

These estimates are used in model.

Table no. II.6
The estimates of g and h for random sample

	g	h	shu*$_i$=g/h
Δshu1	0.112466	0.95893	0.117283
Δshu2	0.052262	0.978122	0.053431
Δshu3	0.443277	0.94627	0.468447
Δshu4	0.087813	1.007091	0.087195
Δshu5	0.052577	0.99171	0.053016
Δshu6	0.22695	1.028654	0.220629
Total			1.000001

The structure of the final utilisation of resources is characterised, therefore, by the preponderance of the secondary sector (3+4) with 55.56%; the shares of primary (1+2) and tertiary (5+6) sectors represent 17.07% and, respectively, 27.37%. Obviously, these estimates of shu*$_i$ reflect the peculiarities of the Romanian economy in the investigated period.

4. The integration of macroeconomic behavioural relationships with the input-output block raises difficult problems, which results in principle from the impossibility to generate consistent sectorial supply-demand equations. In the macromodel, either the production function or the main components of domestic absorption and foreign trade are estimated as aggregate indicators at the level of the national economy. The sectorial decomposition resorts to the following system:

$$GDP=GVA+NIT \quad (II.4.1)$$

GDP - gross domestic product, current prices, billion RON,
GVA - gross value added, current prices, billion RON,
NIT – net indirect taxes, billion RON.

$$NIT=VATO+CD-SUBP \quad (II.4.2)$$

VATO - value added tax, excises duties and other similar indirect taxes, billion RON,
CD - custom duties, billion RON,
SUBP - budget subsidies on goods, billion RON.
VATO, CD, and SUBP are estimated using exogenous coefficients, based on fiscal policies;

$$UF=GDP+M \quad (II.4.3)$$

UF – final resources, current prices, billion RON,
M - import of goods and services, billion RON.

$$M=MGSE*ERE \quad (II.4.4)$$

MGSE - import of goods and services, billion Euro; econometric estimation,
ERE – exchange rate, RON per Euro; econometric estimation.

$$GVA=\Sigma GVA_i \quad (II.4.5)$$

GVA_i - gross value added in sector i, current prices, billion RON; i=1, 2,..., 6.

$$GVA_i=Q_i*(1-(a_{1i}+a_{2i}+a_{3i}+a_{4i}+a_{5i}+a_{6i})) \quad (II.4.6\text{-}11)$$

Q_i - output in sector i, current prices, billion RON; i=1, 2,..., 6,
a_{ij} – input coefficients, i,j=1, 2,..., 6; econometric estimations.
The input coefficients are expressed in current prices, reflecting, therefore, not only technological changes, but also modifications in relative prices.

$$Q_i=DR_i-(shm_i*M+shnit_i*NIT) \quad (II.4.12\text{-}17)$$

DR_i – total resources of the sector i, current prices, billion RON; i=1,2,...,6,
shm_i – share of the sector i in import, i=1,2,...,6; econometric estimations,
$shnit_i$ – share of the sector i in the net indirect taxes, i=1,2,...,6; exogenous coefficients, based on fiscal policies.

$$DR_i=UF_i+a_{i1}*Q_1+a_{i2}*Q_2+a_{i3}*Q_3+a_{i4}*Q_4+a_{i5}*Q_5+a_{i6}*Q_6 \quad (II.4.18\text{-}23)$$

UF_i - final resources of the sector i, current prices, billion RON; i=1,2,...,6.

$$UF_i=shu_i*UF \quad (II.4.24\text{-}29)$$

shu_i – share of the sector i in final resources, i=1,2,...,6; econometric estimations.

$$DAD=UF-X \quad (II.4.30)$$

DAD - domestic absorption, current prices, billion RON; econometric estimations,
X – export of goods and services, billion RON.

$$X=XGSE*ERE \quad (II.4.31)$$

XGSE - export of goods and services, billion Euro; econometric estimation.

The macroeconomic behavioural relationships and the input-output block are, therefore, integrated into a system of simultaneous equations. This combination enforces the interaction between the sectorial structure of economy and aggregate indicators.

Chapter III: Main Scenario for 2005-2010 years

The macromodel starts from the statistical data of previous years and several exogenous indicators, specific for the current year, which are separately obtained or extracted from other forecasts.

1. Among them, the expected index of disposable income (IY_D^{exp}) plays a leading role.

The experience of Romania showed that, in order to minimise the already produced losses and the future potential losses induced by inflation, the economic agents and trade unions exert a considerable pressure towards obtaining certain increases of nominal income; many of which are beforehand negotiated and agreed. The probability to fulfil such expectations proved significant. The budgetary policy (main public revenues and expenditures) is also in advance defined. There are more and more credible methods to approximate the possible transfers from abroad.

For the present version of macromodel, we consider the estimation of IY_D^{exp} as given. Obviously, in the future, the situation may change substantially. The structure of the macromodel allows switching to other - eventually more relevant – targets.

2. The public budget is estimated using the following exogenous coefficients:

- vato – ratio (to GVA) of the value added tax, excises duties and other similar indirect taxes;
- cd – ratio (to import of goods and services expressed in RON) of the custom duties;
- dtobr – ratio (to GDP) of the direct taxes and other revenues (excluding indirect taxes) of the general consolidated budget;
- $shnit_i$ - share of the sector i in total net indirect taxes, i=1,2,...,6;
- ctr – ratio (to general consolidated budget expenditures) of the government transfers;
- obe – ratio (to GDP) of other expenditures (excluding government transfers) of the general consolidated budget;
- subp – ratio (to general consolidated budget expenditures) of the budget subsidies on goods.

Deliberately, the present version of the macromodel contains a compendious structure of the general consolidated budget. Its future improvements will considerably develop this section.

3. The monetary policy is represented by the broad money (M2), under the control of the Central Bank.

4. The international environment is characterised by the following parameters:

- NOCAE - net incomes and current transfers, billion Euro;
- FDPIE – foreign direct and portfolio investment, billion Euro;
- IWTc – yearly index of world trade, volume;
- WTDsdr – world trade deflator, SDRs;
- STIRAE - short-term interest rate in advanced economies.

These and other similar information may be obtained from the forecasts of the international financial institutions and of specialised research centres. As in the case of public budget indicators, the next versions of the macromodel could significantly extend the range of indicators regarding the international context (regional disaggregation, state of the foreign financial markets etc).

5. The number of population over 15 years (AP) – involved in the determination of labour force – is extracted from the demographic projections. Finally, the rate of tangible fixed assets depreciation (dfa) is set exogenously.

A. Computational Hypothesis

1. The exogenous variables were defined according to the following premises:

a) the inflationary expectations are significantly diminishing in time, so the index of the expected disposable income is decreasing;

b) the re-monetisation of the Romanian economy continues, but the reduction of the money velocity is induced simultaneously with a gradual normalisation of price dynamics;

c) the foreign capital inflows are stationary or are moderately increasing;

d) the public budget coefficients are aligned to the parameters of the last Pre-Accession Economic Programme for the 2005-2008 interval; the corresponding final values are extrapolated for the 2009-2010 years;

e) the rate of tangible fixed assets depreciation represents 0.05, which corresponds to an average period of utilization of 20 years (considered by experts as realistic for the Romanian economy);

f) the external environment is relatively stable, no possible shocks coming from this direction were considered;

g) the projections of the population above 15 years of age are conform to the current demographic projections;

Table III.1 presents the values of the exogenous variables for each year.

Table III.1
The exogenous variables for the main scenario

Variables	Symbol	2005	2006	2007	2008	2009	2010
Expected index of disposable income	IY_D^{exp}	1.135	1.135	1.1325	1.125	1.105	1.085
Population over 15 years, mln. persons	AP	18.12	18.124	18.095	18.066	18.06	18.056
Short term interest rate in advanced economies	STIRAE	0.02	0.02	0.018	0.018	0.018	0.018
Foreign capital inflows, bn. Euro	FDPIE	4.75	4.75	4.75	4.85	5.25	5.5
Net incomes and current transfers, bn. Euro	NOCAE	1.5	1.75	1.75	1.85	2.25	2.5
Broad money, bn. RON	M2	74.28	90	108	130	156	197
World trade deflator	WTDsdr	1.034	1.034	1.034	1.034	1.034	1.034
World trade index, in volume	IWTc	1.045	1.045	1.045	1.045	1.045	1.045
Rate of tangible fixed assets depreciation	dfa	0.05	0.05	0.05	0.05	0.05	0.05
Time	t	17	18	19	20	21	22
Ratio (to GDP) of the direct taxes and other revenues (excluding indirect taxes) of the general consolidated budget;	dtobr	0.207	0.198	0.191	0.186	0.186	0.186
Ratio (to GDP) of other expenditures (excluding government transfers) of the general consolidated budget	obe	0.1837	0.1831	0.1809	0.1826	0.1826	0.1826
Ratio (to GVA) of the value added tax, excises duties and other similar indirect taxes	vato	0.1371	0.1429	0.144	0.1463	0.1463	0.1463
Ratio (to import of goods and services expressed in RON) of the custom duties	cd	0.015	0.015	0.015	0.014	0.014	0.014
Ratio (to general consolidated budget expenditures) of the government transfers	ctr	0.455	0.455	0.455	0.455	0.455	0.455
Ratio (to general consolidated budget expenditures) of the budget subsidies on goods	subp	0.014	0.014	0.013	0.012	0.01	0.008

The sectorial structure of the net indirect taxes which results from input-output tables was kept in large.

2. In the area of labour markets, the series on which the econometric functions were estimated are somewhat different from the ones utilised in the Pre-Accession Economic Programme. The comparability of the data was insured by the introduction of equivalence coefficients in the respective equations.

3. The Romanian economy was affected in the last period by some natural negative factors that have delayed effects of 1-2 years. Such influences on output are introduced into relationship of the total factor productivity, using expert estimations.

4. The preliminary solutions have revealed three inertial evolutions, which require special discussion:

- an accentuated growth in household consumption at the expense of compression of the investments;
- an appreciation, small at the beginning and explosive afterwards, of the RON exchange rate;
- a significant increase, in the first years, of the imports with the severe deterioration of the trade balance;

We do not exclude the possibility that these tendencies result, at least partly, from the function specification and the data series used in regressions. At least as plausible is the explanation that they reflect the real behaviour of the Romanian economy. In the building of the present scenario the second presumption is admitted. From a technical point of view, the equations concerning household consumption, gross fixed capital formation, exchange rate, and import have been completed with corresponding corrective coefficients.

The proposed technique should not be viewed only as a computational exercise. It is motivated by more profound rationale. If the macroeconomic management does not change, the probability of attaining the main scenario is reduced. The probability becomes acceptable only in the case that strong measures for producing the adjustment of the domestic demand, exchange rate and imports are adopted and become effective. In other words, these coefficients should be considered not only as computational ingredients, but also as milestones of macroeconomic policies that must be promoted in this period.

B. Simulation results

1.The obtained indicators (in an economically plausible solution of the system) are presented in Table III.2.

Table III.2
Main scenario for 2005-2010

Indicators	Symbol	2005	2006	2007	2008	2009	2010
Gross domestic product, current prices, bn. RON	GDP	281.3	317.52	358.74	401.73	443.32	481.17
Yearly Index of the gross domestic product, current prices	IGDP	1.178	1.1288	1.1298	1.1198	1.1035	1.0854
Yearly Index of the gross domestic product, constant prices	IGDPc	1.0497	1.0579	1.0634	1.0641	1.0635	1.0533
Yearly Index of the household consumption, constant prices	ICHc	1.0897	1.0781	1.0727	1.0728	1.0681	1.056
Yearly Index of the gross fixed capital formation, constant prices	IGFCFc	1.0994	1.1199	1.1294	1.1331	1.1279	1.1367
Export of goods and services, bn. Euro	XGSE	23.796	26.83	30.303	34.314	38.682	43.438
Import of goods and services, bn. Euro	MGSE	33.713	37.538	42.492	47.985	55.474	63.908
Ratio (to gross domestic product) of the net export	rNX	-0.1271	-0.1198	-0.1197	-0.1186	-0.1281	-0.1384
Labour force, mln. pers.	LF	9.5479	9.4706	9.4532	9.4101	9.3975	9.38
Employment, mln. pers.	E	8.7929	8.7458	8.7522	8.733	8.7404	8.7389
Unemployment rate	ru	0.0791	0.0765	0.0742	0.0719	0.0699	0.0683
GDP deflator	PGDP	1.1222	1.067	1.0625	1.0524	1.0376	1.0305
Consumer price index	CPI	1.1374	1.0688	1.0682	1.0588	1.0436	1.0404
Exchange rate, RON per Euro	ERE	3.6057	3.5518	3.5236	3.484	3.3822	3.2541
Ratio (to gross domestic product) of the general consolidated budget revenues	br	0.3338	0.3291	0.3229	0.3192	0.3192	0.3192
Ratio (to gross domestic product) of the general consolidated budget expenditures	be	0.337	0.336	0.332	0.335	0.335	0.335
Ratio (to gross domestic product) of the general consolidated budget balance	cbb	-0.0032	-0.0069	-0.0091	-0.0158	-0.0158	-0.0158
Money velocity	v	3.787	3.528	3.3216	3.0902	2.8418	2.4425

Therefore, the reduction in the inflationary expectation induces compression in the nominal GDP whose index decreases from 1.178 in 2005 to 1.0854 in 2010. The growth rate of the real output (IGDPc) is increasing with a tendency to stabilize towards the end of the interval. During entire period, the real GDP is increasing by over 40%. It is worth mentioning that the main resources of growth are the total factor productivity and the expansion of the fixed capital. As expected, this evolution is accompanied by a strong dis-inflation.

With respect to domestic demand, conform to the hypothesis adopted; the dynamics of the gross fixed capital formation stays high, while the annual rate of household consumption tends towards 5-6%. In spite of all corrections (mentioned above) introduced in import, and exchange rate equations, the trade balance deficit remains troublesome (11-13% of GDP). This means that the issue of actively stimulating exports and maintaining import expansions within reasonable limits should be a major preoccupation for Government institutions and the National Bank of Romania.

Given the assumptions of the current simulation, the consolidated budget revenue and expenditure is according to the limits described in the Pre-Acession Economic Programme. So is the public deficit rate as a percentage of GDP.

2. Table III.3 presents the indicators derived from the macro-model in comparison to the values from the Pre-Accession Economic Programme for 2005-2008 (PEP).

Table III.3
The model estimations in comparison to the PEP's

	Symbol		2005	2006	2007	2008
Gross domestic product, current prices, bn. RON	GDP	PEP	281.43	322.78	364.38	406.31
		Model	281.3	317.52	358.74	401.73
Yearly Index of the gross domestic product, current prices	IGDP	PEP	1.1786	1.1469	1.1289	1.1151
		Model	1.178	1.1288	1.1298	1.1198
Yearly Index of the gross domestic product, constant prices	IGDPc	PEP	1.057	1.06	1.063	1.065
		Model	1.0497	1.0579	1.0634	1.0641
Yearly Index of the household consumption, constant prices	ICHc	PEP	1.102	1.063	1.057	1.058
		Model	1.0897	1.0781	1.0727	1.0728
Yearly Index of the gross fixed capital formation, constant prices	IGFCFc	PEP	1.098	1.12	1.125	1.127
		Model	1.0994	1.1199	1.1294	1.1331
Export of goods and services, bn. Euro	XGSE	PEP	25.1	28.75	32.5	36.55
		Model	23.796	26.83	30.303	34.314
Import of goods and services, bn. Euro	MGSE	PEP	33.22	37.95	42.65	47.6
		Model	33.713	37.538	42.492	47.985
Ratio (to gross domestic product) of the net export	rNXGS	PEP	-0.1042	-0.1018	-0.0983	-0.0955
		Model	-0.1271	-0.1198	-0.1197	-0.1186
Labour force, mln. pers.	LF	PEP	9.495	9.4942	9.4933	9.4923
		Model	9.5479	9.4706	9.4532	9.4101
Employment, mln. pers	E	PEP	8.7354	8.7346	8.7338	8.7329
		Model	8.7929	8.7458	8.7522	8.733
Unemployment rate	ru	PEP	0.079	0.078	0.076	0.074
		Model	0.0791	0.0765	0.0742	0.0719
GDP deflator	PGDP	PEP	1.115	1.082	1.062	1.047
		Model	1.1222	1.067	1.0625	1.0524
Consumer price index	CPI	PEP	1.09	1.07	1.05	1.036
		Model	1.1374	1.0688	1.0682	1.0588
Exchange rate, RON per Euro	ERE	PEP	3.61	3.57	3.53	3.51
		Model	3.6057	3.5518	3.5236	3.484
Ratio (to gross domestic product) of the general consolidated budget revenues	br	PEP	0.334	0.329	0.322	0.319
		Model	0.3338	0.3291	0.3229	0.3192
Ratio (to gross domestic product) of the general consolidated budget expenditures	be	PEP	0.337	0.336	0.332	0.335
		Model	0.337	0.336	0.332	0.335
Ratio (to gross domestic product) of the general consolidated budget balance	cbb	PEP	-0.003	-0.007	-0.01	-0.016
		Model	-0.0032	-0.0069	-0.0091	-0.0158

Chapter IV: Responses to Changes of Exogenous Indicators

The simulations included in this section use the exogenous indicators at the level of the year 2005. One or several of these indicators are arbitrarily modified, all the others being maintained constant at their initial levels. We consider most interesting to study the implications of changes on:

- expected index of disposable income (IY_D^{exp});
- inflow of foreign resources (FDPIE and NOCAE);
- general consolidated budget parameters;
- world trade deflator and volume of world trade;
- money supply.

1. The expected index of disposable income changes from 1.1 to 1.4 (in 2005 this was 1.135).

An increase of disposable income (all the other forecasting assumptions remaining constant) translates into the expansion of the nominal demand, which is associated to an accelerating inflation and growing interest rate.

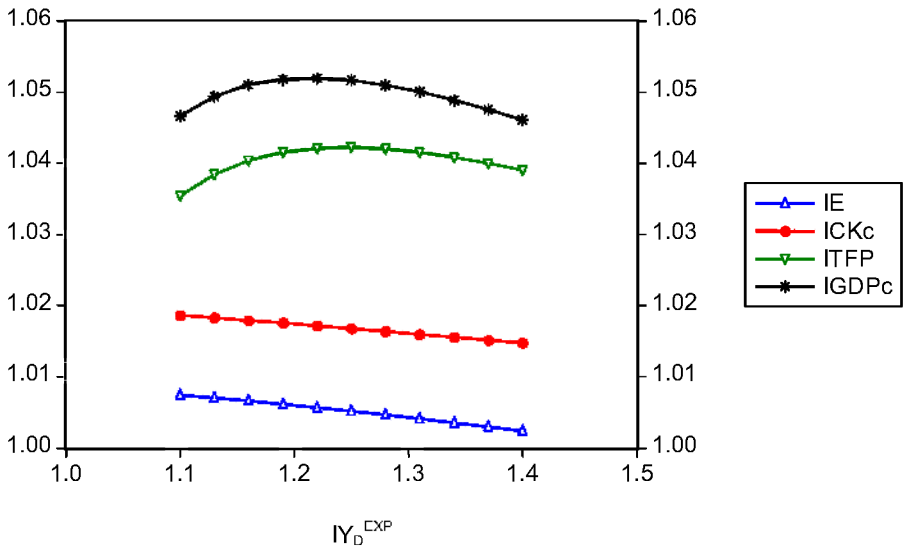
1.1. How does the output react?

The employment registers small changes, its index (IE) reducing from 1.00742 (when IY_D^{exp} is 1.1) to 1.002422 (for IY_D^{exp}=1.4). On the contrary, the contraction of alpha is more accentuated: from 0.695631 to, respectively, 0.643541. This may be considered as an indication that the macromodel correctly reflects the evolution of the Romanian economy, where inflation eroded faster the nominal revenues of households than the gross operating surplus. As a result, the expression (alpha-alpha^4.58235724) exerts an important effect on the index of total factor productivity.

Due to the increasing interest rate, growing YD generates a reduction of the real gross capital formation, which influences not only the tangible fixed assets (their index at constant prices varies from 1.018571 to 1.014705), but especially the index of total factor productivity.

Graph IYDS1 displays the interaction of these consequences, including their repercussions on index of gross domestic product at constant prices (IGDPc).

Graph IYDS1

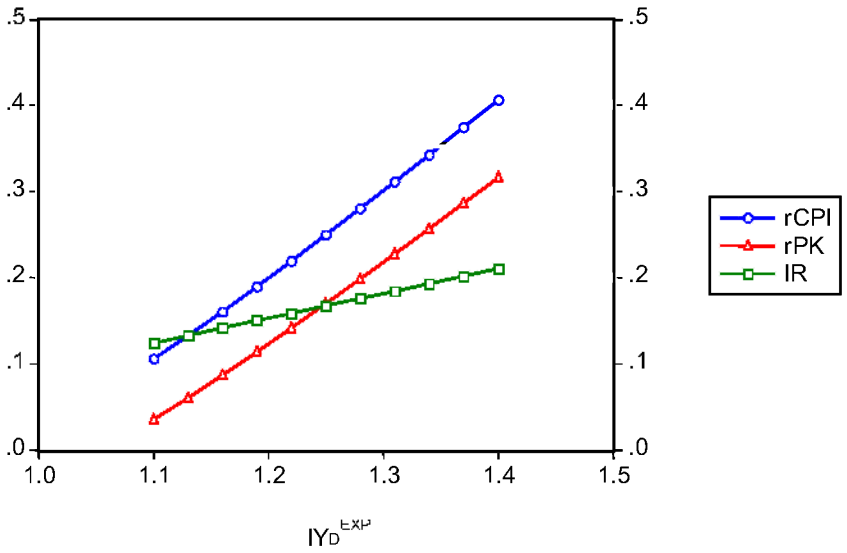


The output curves mimic the behaviour of the index of total factor productivity (ITFP).

1.2. Since the variation of output is limited enough, the growing nominal disposable income inherently translates into inflation, which entails an increasing interest rates (Graph IYDS2). The inflation is measured by the corresponding rates of consumer price index (rCPI=CPI-1) and of price index of tangible fixed assets (rPK=PK-1).

The discrepancy between inflation and interest rate (IR) comes from the determination of the second one. According to the econometric relationship, IR depends – besides the dynamics of prices - on its previous level (inertia has in this case a great coefficient), and on broad money and foreign interest, that remain constant in simulation.

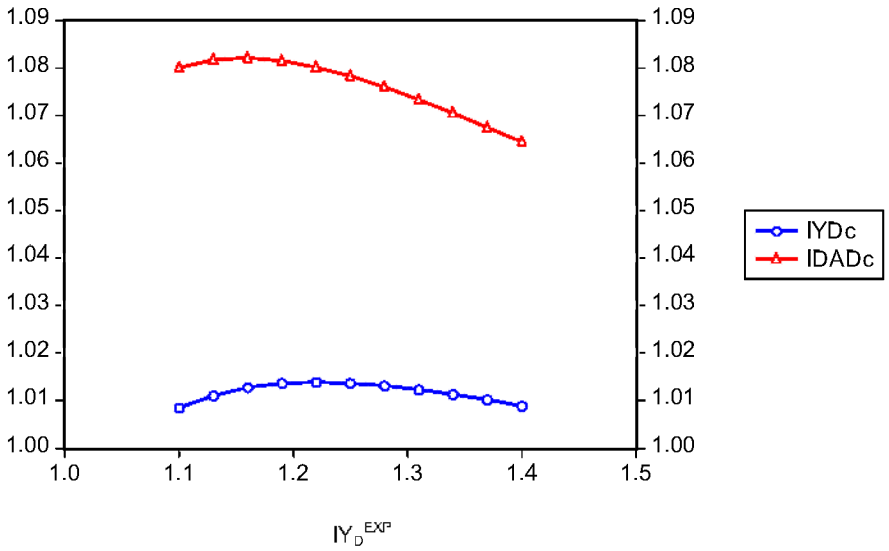
Graph IYDS2



How is then possible for inflation to coexist with stable money supply? The numerical explanation lies in the accommodation of the money velocity. The operational reason consists in the presence of the so-called monetary distortion (especially of extended arrears), which allowed the development of a huge part of transactions without actual money. This way, the ratio GDP/M2 becomes more flexible.

1.3. Because of inflation, the disposable income exerts a noticeably smaller influence on real demand. The Graph IYDS3 presents the indices of disposable income (IYDc) and of domestic absorption (IDADc) deflated by PGDP.

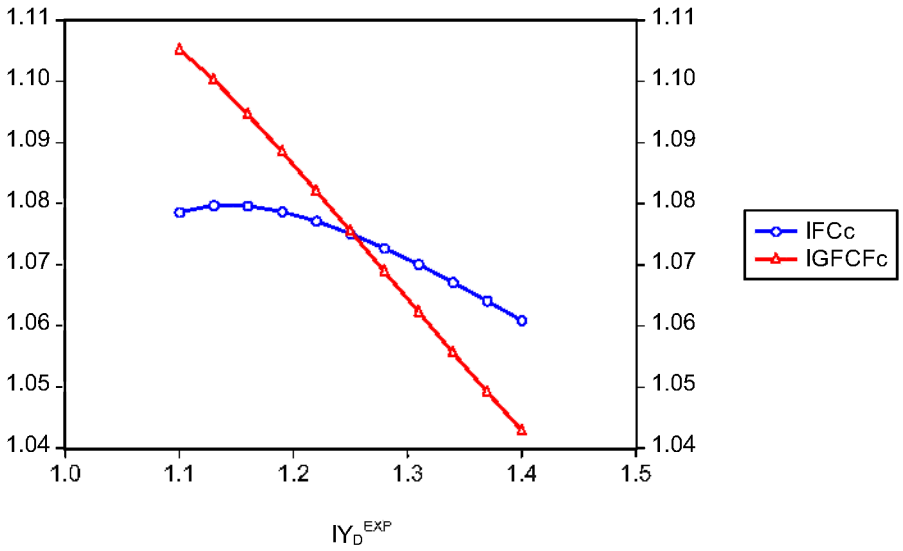
Graph IYDS3



Because of the constancy of NOCAE, the real disposable income follows the trajectory of the real GDP.

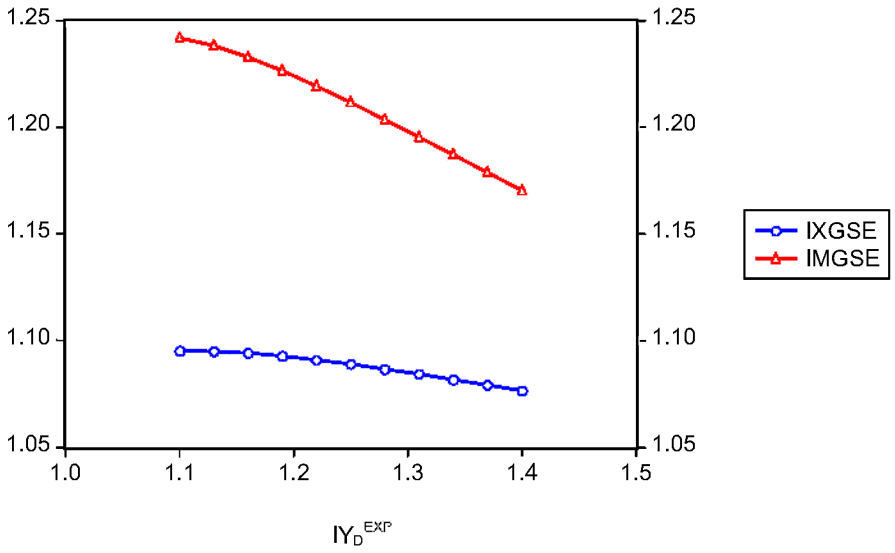
1.4. Again as a consequence of inflation, the nominal exchange rate increases, slightly improving the competitiveness: so the index ICOsdr changes from 0.816858 (when IY_D^{exp} is 1.1) to 0.845645 (for IY_D^{exp}=1.4). This especially affects the imports. In addition, the indices - in real terms - of the final consumption (IFCc) and gross fixed capital formation (IGFCFc) also negatively influence the imports (Graph IYDS4).

Graph IYDS4



The decrease of import indices (IMGSE) entails a similar tendency for exports (IXGSE) (Graph IYDS5).

Graph IYDS5



The combined result of these influences is a modification of the ratio of net export to GDP from -0.128496 (when IY_D^{exp} is 1.1) to -0.112741 (for IY_D^{exp}=1.4).

1.5. In the simulated interval the ratio of budget expenditures to GDP is constant. The direct taxes ratio does not change, as well. Only rNIT registers a very small reduction (from 0.139132 to 0.138957); consequently, the public budget deficit changes from –0.003143 to –0.003278.

2. The second simulation takes into account the following modifications of the inflow of foreign resources (noted further CIn=FDPIE+NOCAE):

Table no. IV.1

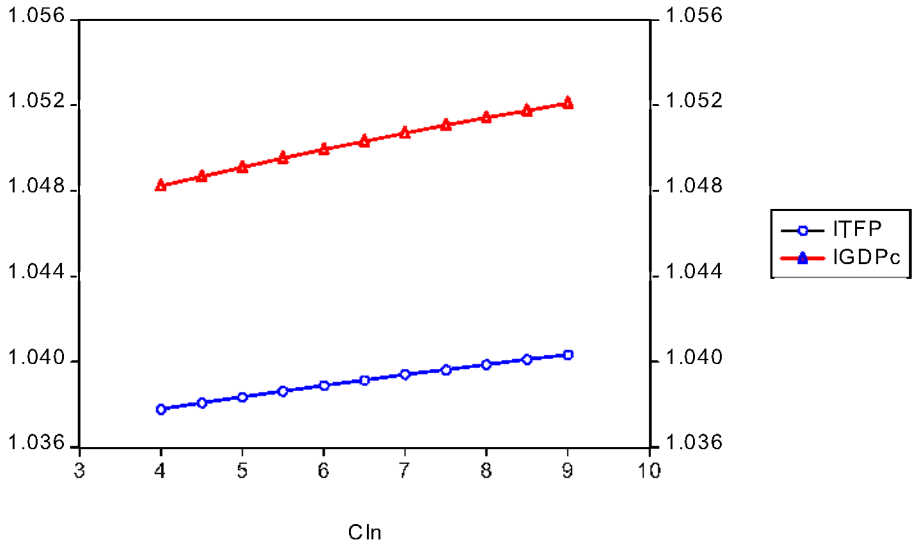
Variant	CIn, bn.Euro	FDPIE, bn.Euro	NOCAE, bn.Euro
1	4	3	1
2	4.5	3.3	1.2
3	5	3.6	1.4
4	5.5	3.9	1.6
5	6	4.2	1.8
6	6.5	4.5	2
7	7	4.8	2.2
8	7.5	5.1	2.4
9	8	5.4	2.6
10	8.5	5.7	2.8
11	9	6	3

Recall that all the other forecasting assumptions remain unchanged. This condition is common for all simulations presented in this chapter.

The inflow of foreign resources influences directly the disposable income, the gross fixed capital formation and the exchange rate, but it has also other implications, which will be discussed in the same succession as in the previous point.

2.1. The index of employment (IE) changes from 1.006778 (when CIn is 4 billion Euro) to 1.007418 (for CIn=9 billion Euro). The index of tangible fixed assets at constant prices (ICKc) also grows, from 1.017292 to, respectively, 1.020064. The expression (alpha-alpha^4.58235724) insignificantly reduces (from 0.508196 to 0.507309) under rapidly enforcing investment intensity (the index of the gross fixed capital formation at constant prices increases from 1.084555 to 1.129229). As a consequence, the total factor productivity registers higher rates (ITFP), which - together with IE and ICKc – determine a similar trend of output (Graph CInS1).

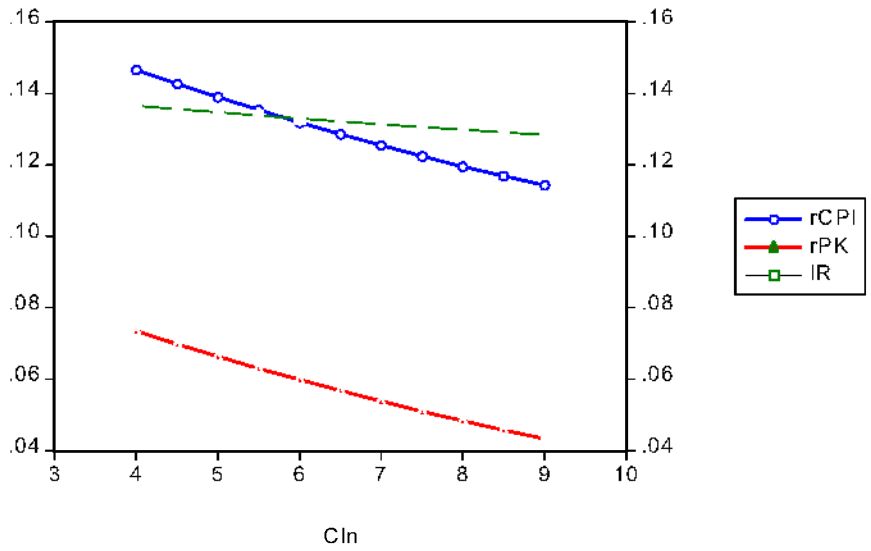
Graph CInS1



Such behaviour of the macromodel can be also considered suitable. The Romanian economy needs a deep technological restructuring, which would be unfeasible in the absence of substantial foreign capital inflows.

2.2. Under the constancy of nominal disposable income, a clear disinflation (rCPI and rPK) and, correspondingly, diminishing interest rates (IR) accompany the growing output (Graph CInS2).

Graph CInS2



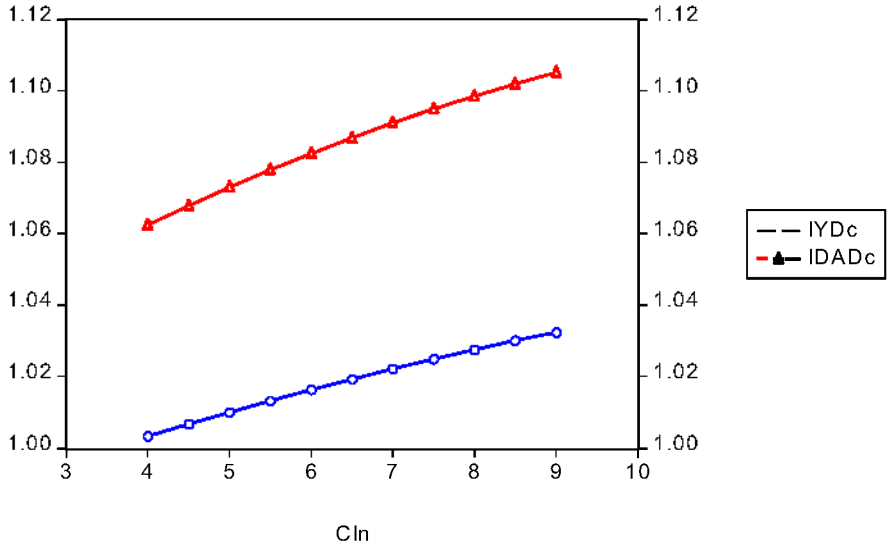
The extremely limited reduction of the interest rate comes from the influence of inertia [econometric coefficient for IR(-1) is relatively high], and also from the constancy of both STIRAE and, especially, broad money.

This last circumstance does not seem realistic. We must not forget that a large number of Romanian firms were and continue to be undercapitalised. Consequently, it would be difficult to expect a significant economic growth without a rise in the money supply.

Such weaknesses are unavoidable in simulations based on individual changes in one or several exogenous indicators, the other being maintained fixed. Nevertheless, the direction of change in interest rate in connection with prices dynamics is correctly determined.

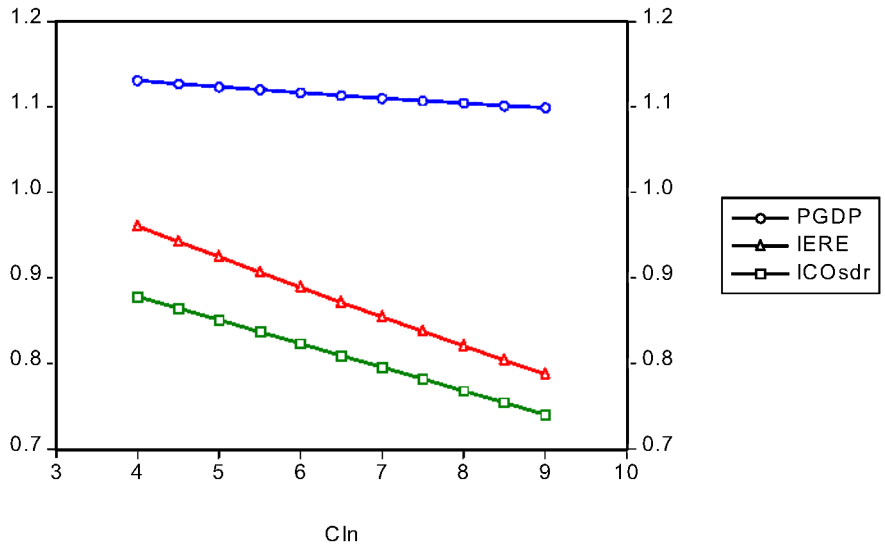
2.3. Because of increasing foreign capital inflows, the index of real disposable income lags behind the index of domestic absorption at constant prices)IYDc and IDADc) (Graph CInS3).

Graph CInS3



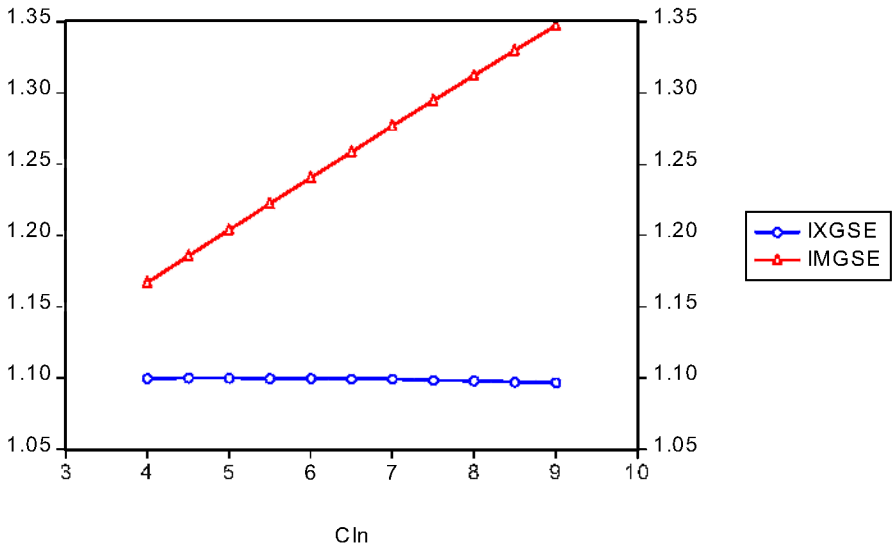
2.4. The same circumstance (growing capital inflows) determines a sensible real appreciation of RON with the corresponding fall of the competitiveness (Graph CInS4).

Graph CInS4



The import index (IMGSE) increases, while the export (IXGSE) stagnates (Graph CInS5).

Graph CInS5



Consequently, the ratio of net export to GDP changes from –0.108367 (when CIn represents 4 billion Euro) to -0.148642 (for CIn=9 billion Euro).

2.5. The ratio of net indirect taxes to gross value added (rNIT) slightly decreases, with corresponding accentuation of the rate of public budget deficit.

3. Regarding the general consolidated budget, two sets of simulations were performed: one for fiscality, another for budget expenditures.

3a. The ratio (to GVA) of the value added tax, excises duties and other similar indirect taxes (vato) and the ratio (to GDP) of the direct taxes and other revenues (excluding indirect taxes) (dtobr) change as follows:

Table no. IV.2

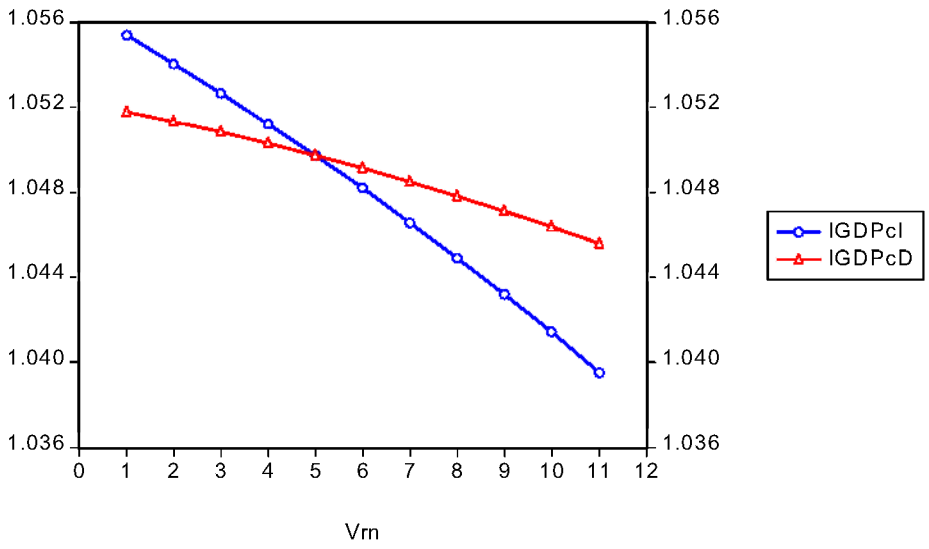
Variant	vato	dtobr
1	0.1234	0.1863
2	0.1268	0.1915
3	0.1302	0.1967
4	0.1337	0.2018
5	0.1371	0.207
6	0.1405	0.2122
7	0.1440	0.2174
8	0.1474	0.2225
9	0.1508	0.2277
10	0.1542	0.2329
11	0.1577	0.2381

The system has been successively solved for each variant included in table, the budget expenditures being constant. This simulation was conducted exclusively as a redistribution of available resources between public and private sectors. Consequently, the expected index of total disposable income does not change. The resulted indicators were computed separately for indirect fiscality (vato) and direct taxes (dtobr). In the first case, these have the suffix I and, in the second, the suffix D.

Four categories of consequences seem interesting and have to be discussed in such a simulation: real output (IGDPc), inflation (PGDP), external disequilibrium (rNX) and public budget balance (cbb).

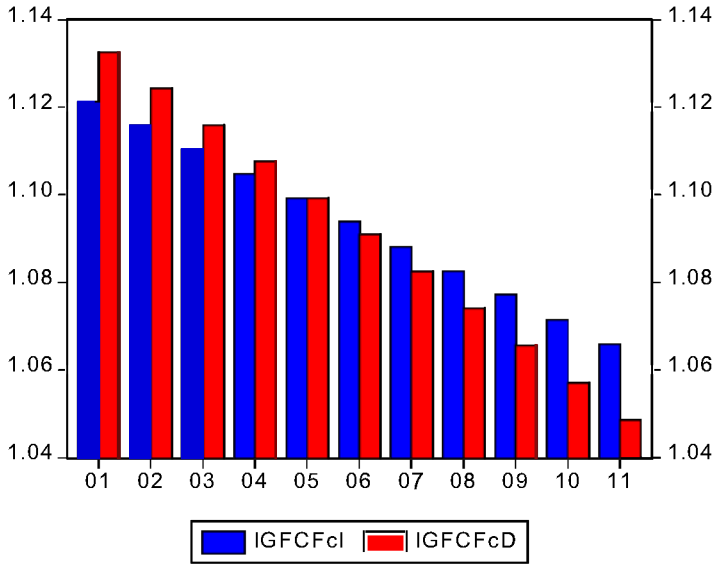
3a.1. The behaviour of the real output is plotted on Graph IGDPcR.

Graph IGDPcR



Therefore, if the fiscality is increased, the real output tends to decrease, the decline being steeper for indirect taxation than for the direct one. The main common factor of such influence is the compression of investment (Graph IGFCFcR).

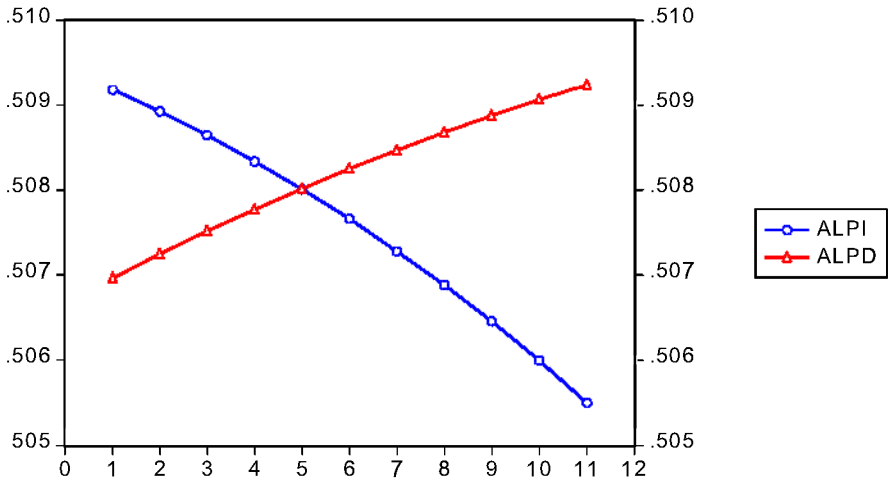
Graph IGFCFcR



The reduction of gross fixed capital formation at constant prices, induced by the higher and higher taxation, generates a corresponding contraction of the production factors. It also negatively affects the index of total factor productivity.

The difference (between the effect of indirect and direct enforcing fiscality on output) comes mainly from the expression (alpha-alpha^4.58235724). Its value - noted ALPI and ALPD - changes as follows (Graph ALPR):

Graph ALPR

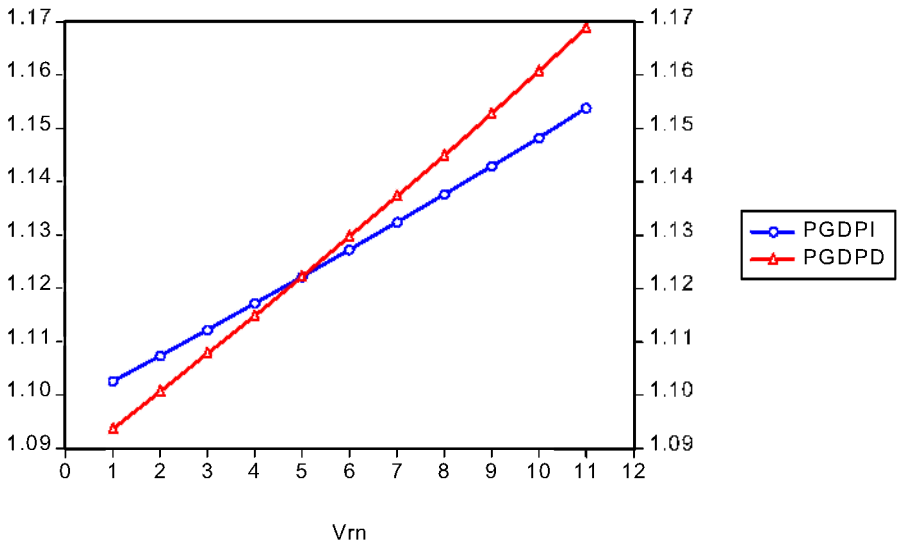


What happens? The increasing of indirect fiscality is accompanied by a growing alpha (from 0.680079 in variant 1 to 0.697903 in variant 11), whilst a higher direct taxation slightly reduces it (correspondingly, from 0.691925 to 0.679724). The Romanian economy has been characterised by a relatively frequent indexation of wages in correlation with the CPI. There are reasons to believe that the indirect fiscality encouraged such behaviour in a greater measure than the direct one.

An increasing indirect taxation has in general – and almost unanimously accepted - inflationary effects. As a rule, these are instantaneously anticipated by trade unions, which request a subsequent correction of nominal wages. In the case of enforcing direct taxation, these effects are less visible and the firms have more possibilities to keep the labour income in a certain connection with the labour productivity. In other words, the macromodel seems to correctly reflect the reality.

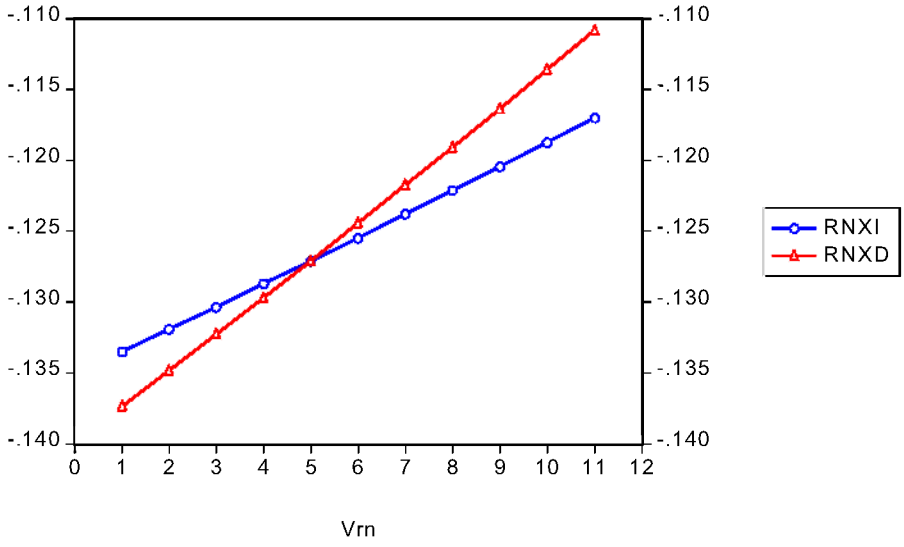
3a.2. The inflation is presented in Graph PGDPR:

Graph PGDPR



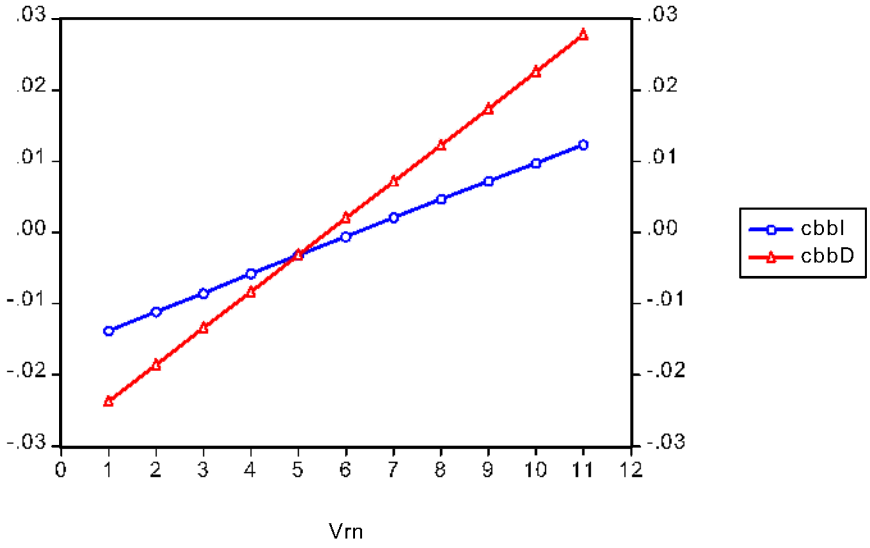
3a.3. The enforcing fiscality is accompanied by an improvement of the net export ratio to GDP (rNX) (Graph rNXR):

Graph rNXR



3a.4. Recall that the coefficients of budget expenditures (ctr and obe) do not change. Under such circumstances, normally, an increasing fiscality ameliorates also the public budget balance (cbb), which passes in both cases (higher direct or indirect taxation) from deficits to surpluses (Graph cbbR):

Graph cbbR



3b. Another series of simulations refers to the budget expenditures, the taxation coefficients remaining constant (vato, cd, dtobr). Again for 11 variants, the following levels of the ratio (to general consolidated budget expenditures) of the government transfers (ctr) and the ratio (to GDP) of the other budget expenditures (obe) have been imposed:

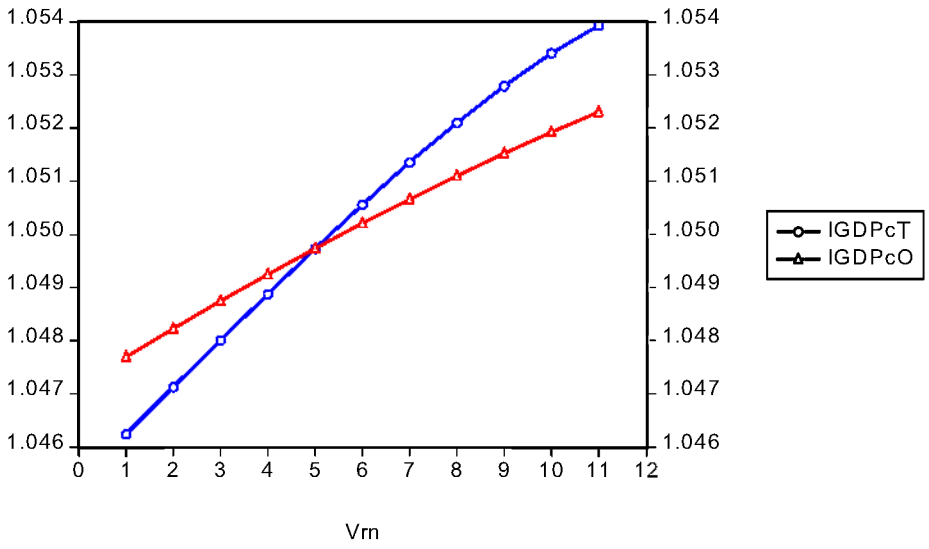
Table no. IV.3

Variant	ctr	obe
1	0.4095	0.1653
2	0.4209	0.1699
3	0.4323	0.1745
4	0.4436	0.1791
5	0.455	0.1837
6	0.4664	0.1883
7	0.4778	0.1928
8	0.4891	0.1975
9	0.5005	0.2021
10	0.5119	0.2067
11	0.5233	0.2113

The resulted indicators are mentioned with the suffix T for the changing ctr and, respectively, O for obe.

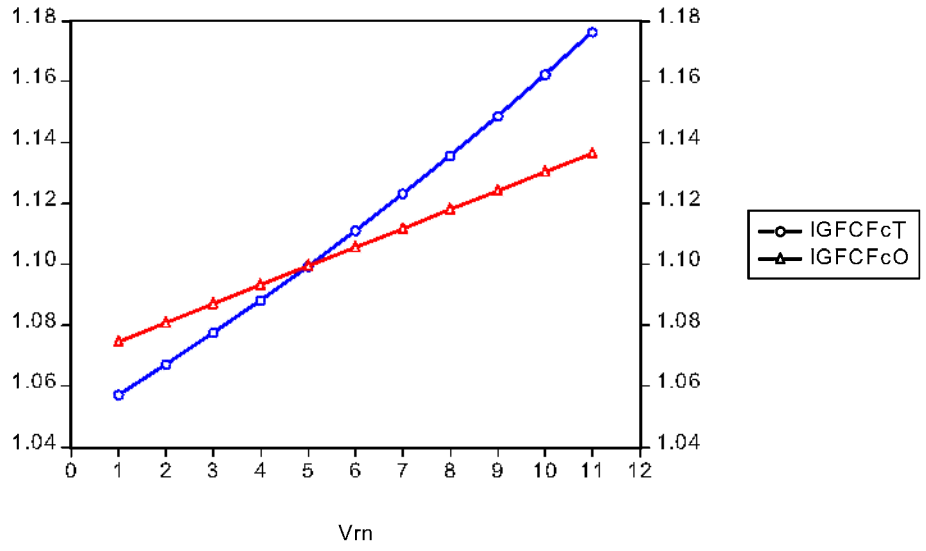
3b.1. Both series of simulations show that increasing budget expenditures stimulates economic growth (Graph IGDPcE):

Graph IGDPcE



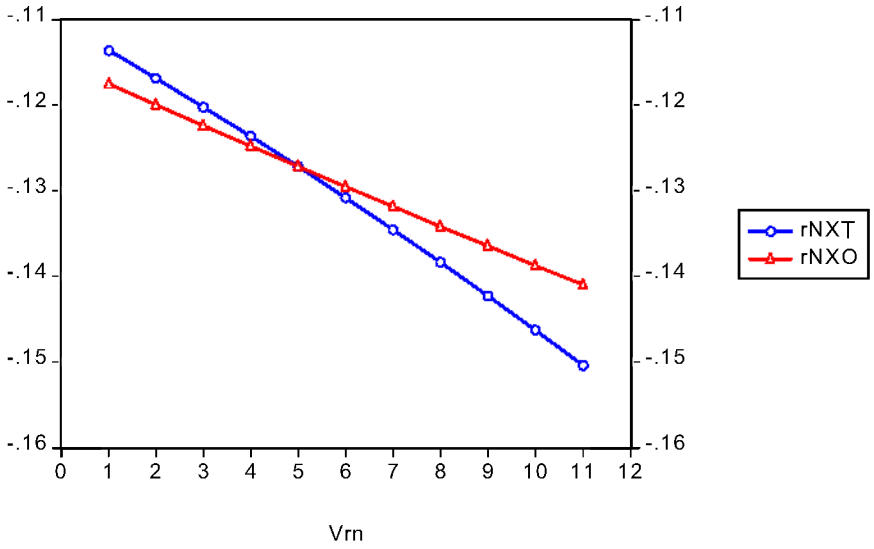
This results especially from the extension of tangible fixed assets and improvement of total factor productivity, both as an effect of increasing indices of fixed capital formation at constant prices (IGFCFc) (Graph IGFCFcE):

Graph IGFCFcE



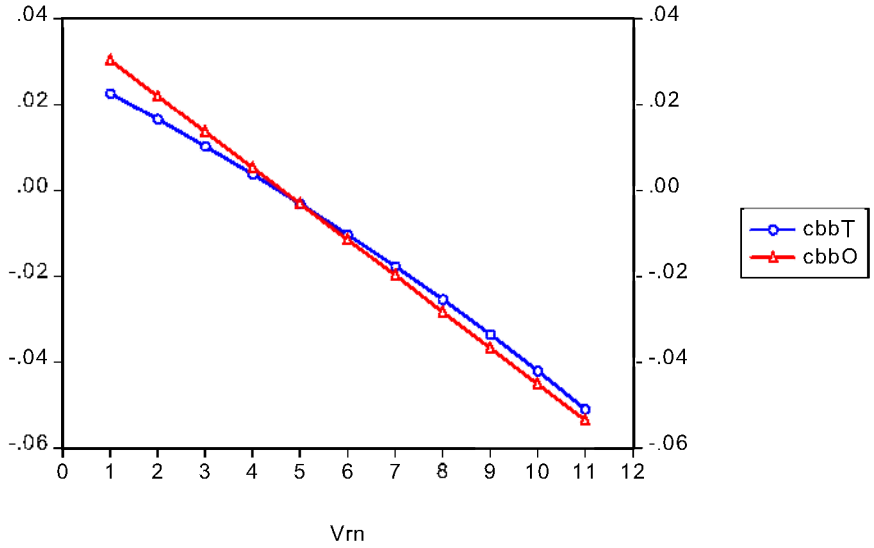
3b.2. The expansion of domestic absorption induced by increasing budget expenditures involves a deterioration of the foreign trade balance (rNX); this effect is stronger in the case of growing government transfers (Graph rNXE):

Graph rNXE



3b.3. The public budget deficit (expressed by cbb) also accentuates (Graph cbbE):

Graph cbbE



3b.4. However, increasing budget expenditures are accompanied by a dis-inflation. Such a result becomes from the assumptions adopted in present exercise. We must not forget that the simulation maintains at a constant level the expected disposable income. This hypothesis can hardly be considered probable. It seems plausible to assume that beneficiaries of the public resources, sensing the eventual changes in the government budget policy, adjust their expectations concerning the disposable income. Normally, if the basic disposable income is amended, the results of simulations significantly change.

4. The international environment is defined by world trade deflator (WTDsdr) and the index of world trade, volume (IWTc). The macromodel has been successively solved in the following variants:

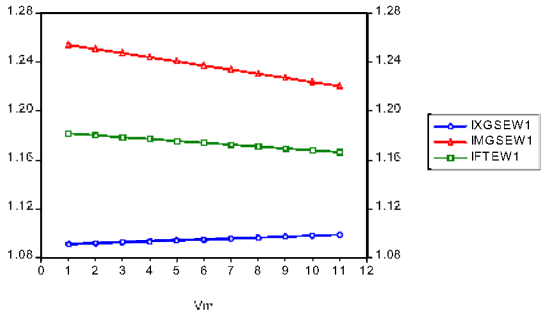
Table no. IV.4

Variant	WTDsdr	IWTc
1	1.009	1.059
2	1.014	1.067
3	1.019	1.075
4	1.024	1.083
5	1.029	1.091
6	1.034	1.099
7	1.039	1.107
8	1.044	1.115
9	1.049	1.123
10	1.054	1.131
11	1.059	1.139

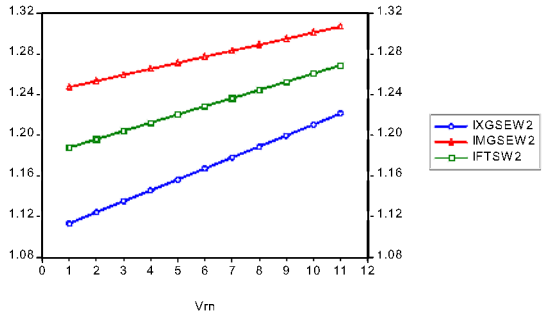
As in previous simulations, the other exogenous indicators do not change. The indicators resulted from WTDsdr series are marked by suffix W1 and those corresponding to variation of IWTc by suffix W2.

4.1. The foreign trade takes over the most significant influences. These are reflected by indices of export (IXGSE), of import (IMGSE), and of total foreign trade (IFTE). Graphs IFTEW1 and IFTEW2 present them:

Graph IFTEW1

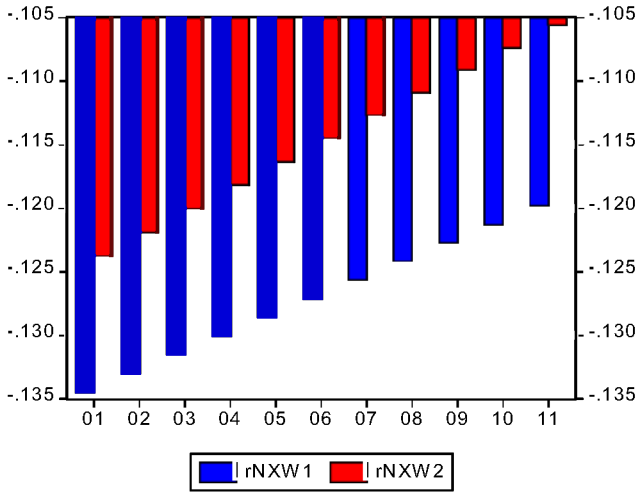


Graph IFTEW2



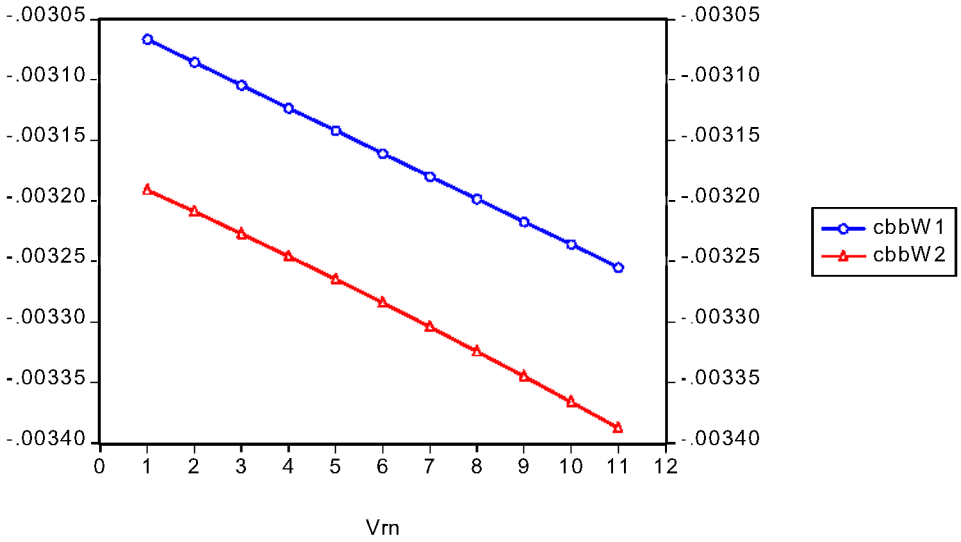
The foreign trade balance (rNX) also improves (Graph rNXW).

Graph rNXW



4.2. Instead, the deficits of the general consolidated budget (negative cbb) accentuate (Graph cbbW).

Graph cbbW



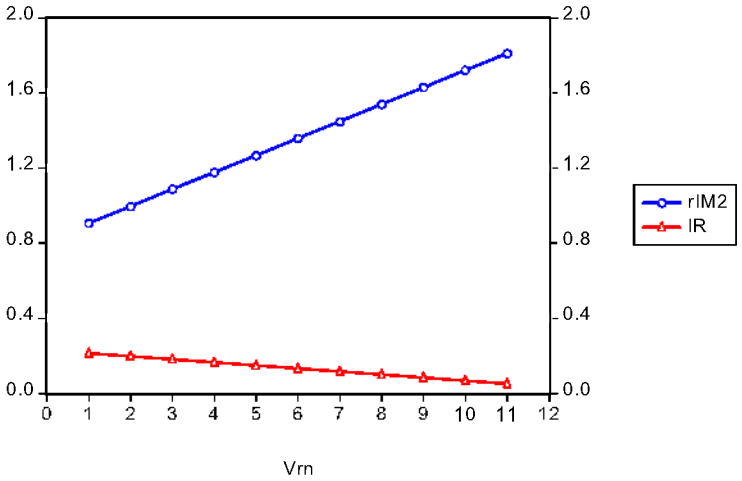
5. The next simulation refers to the money supply (M2S), which is modified as follows:

Table no. IV.5

VRN	M2S, bn.RON
1	50
2	55
3	60
4	65
5	70
6	75
7	80
8	85
9	90
10	95
11	100

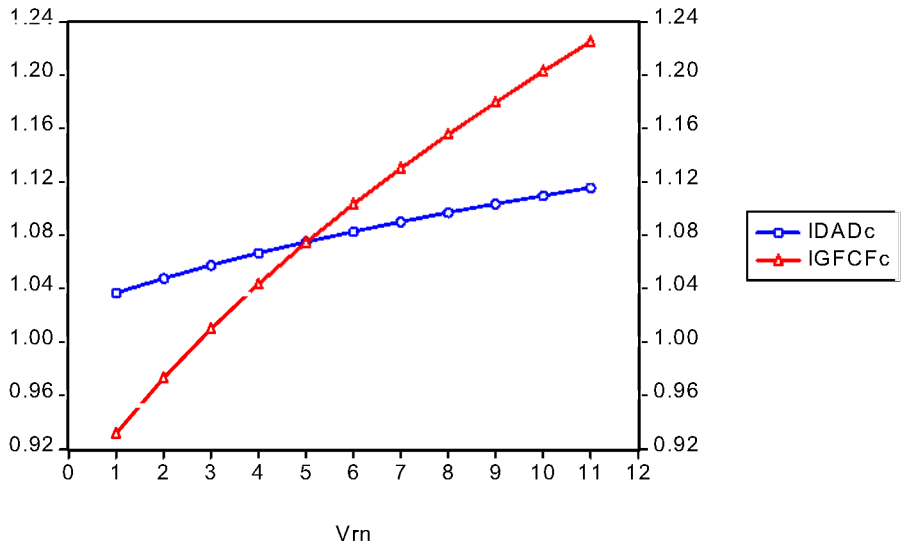
5.1. The disposable income being fixed, the nominal GDP changes a little. Under these conditions, growing M2S means, in fact, a re-monetisation of economy, which attracts, normally, a reduction of the interest rate. The Graph IRM compares variation of the rate of broad money (rIM2=M2/M2(-1)-1) and of the interest rate (IR).

Graph IRM



5.2. The relaxation of interest rate stimulates, in real terms, domestic absorption (IDADc), especially the fixed capital formation (IGFCFc), as it is shown in Graph DADM.

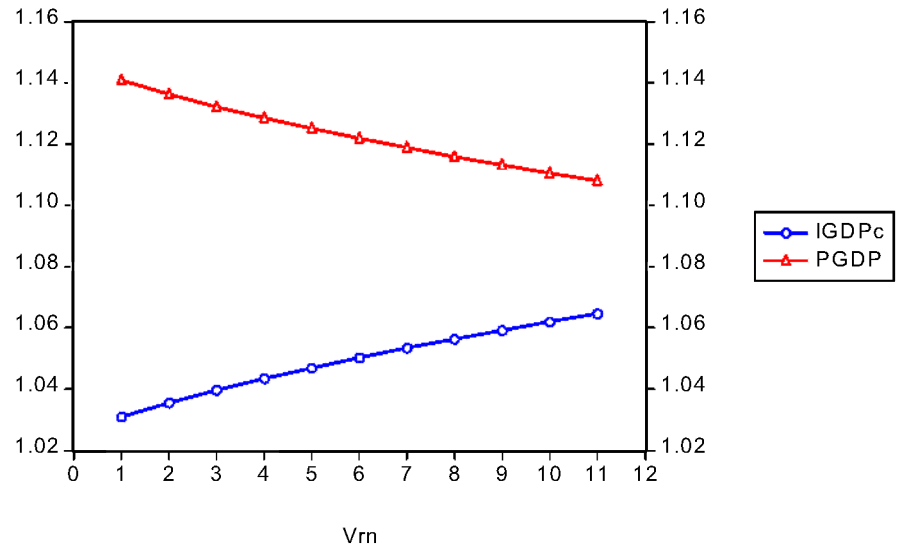
Graph DADM



Expanding investments favourably influence not only the quantity of employed production factors, but also their total productivity.

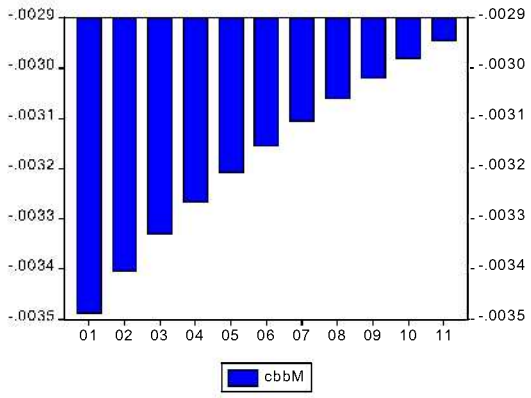
5.3. The economic growth (IGDPc) and disinflation (PGDP) are sustained either by the demand-side circumstances or the supply-side ones (Graph EGM).

Graph EGM

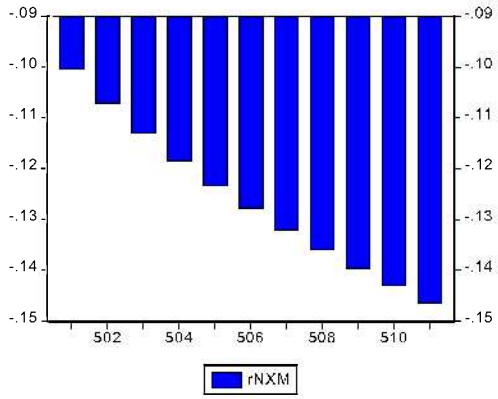


5.4. The small change of public budget deficit (cbb) is associated in this simulation by a deterioration of the external dis-equilibrium (rNX) (Graphs cbbM and rNXM).

Graph cbbM



Graph rNXM



6. The previous type of simulations reveals some of the most important behavioural features of the macromodel. They are, obviously, simply illustrative. Other discretionary interventions in the macromodel are also possible, two of them being really interesting.

6.1. Every econometric specification – even in the most fortunate cases - cannot detect all significant factors involved in the determination of the given indicator. Some expert estimates of such hardly visible causes could be useful. For instance, all the people accept that the Central Bank can influence the interest rate or the exchange rate by more subtle tools than those that are already known and officially practiced (as open market operations, change of the reserve requirements ratio, etc). The exports and imports can also be affected by the specific commercial policies, unreductible to computed competitiveness or other variables included in regressions. The intensity of restructuring processes can influence the evolution of unemployment rate.

In such cases, we must not exclude the possibility to attach to the corresponding econometric relationships some exogenous parameters reflecting the effect of supplementary factors (not taken into account in regressions). An advice from well documented specialists in the respective problems maybe extremely useful. The main scenario for 2005-2010 resorted to such a solution.

6.2. The modeller is frequently questioned about the necessary modifications of economic policies in order to achieve a certain desirable result. The current account or public budget balance, the employment, inflation and other indicators can play such a target-role. In these situations, the system of equations is completed with the intended constraint, adding corrective coefficients to the involved relationships. With the same goal, some carefully chosen objective-functions may also be introduced in the macromodel.

We finish these comments, warning of the risk implied by such operations, namely to transform the rational framework of modelling simulations into gratuitous manipulation. That is why, we must be cautious in accessing them.

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