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A Possible Approach to Simulate Macroeconomic Development of Bulgaria

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SUMMARY. TRANSFORMATION OF CENTRALLY PLANNED ECONOMIES INTO MARKET ONES IS A UNIQUE EVENT AND THERE ARE NO ESTABLISHED RULES. IN INDIVIDUAL COUNTRIES TRANSFORMATION RUNS WITH DIFFERENT INTENSITY AND SUCCESS. THE ECONOMIC THEORY CONTINUES TO PERSISTENTLY SUMMARIZE ACCUMULATED EXPERIENCE AIMING AT ESTABLISHING 'TRANSITION LAWS'. HOWEVER, NO BREAK HAS BEEN MADE IN THIS FIELD YET. CONSEQUENTLY, THIS IMPEDES EMPLOYMENT OF QUANTITATIVE METHODS IN TRANSITION ECONOMIES. THE APPROACH AND MODELS DEVELOPED UNDER A CENTRALLY PLANNED ECONOMY PROVED INAPPLICABLE AND THERE ARE NO NEW MODELS DEVELOPED, ALTHOUGH THE NEED OF AT LEAST A MEDIUM-TERM PERSPECTIVE FOR ECONOMIC DEVELOPMENT STILL EXISTS.

GIVEN THE MACROECONOMIC MODELING EXPERIENCE BASED ON THE MONETARY APPROACH APPLIED TO THE BALANCE OF PAYMENTS AND NEOCLASSICAL GROWTH MODELS, THIS PAPER PRESENTS A MODEL ATTEMPTING TO COMBINE BOTH TRADITIONAL MODELING METHODS AND THE SPECIFICITY OF A PARTICULAR TRANSITION ECONOMY UNDER A CURRENCY BOARD. THE MODEL IS AGGREGATED AND OF STRUCTURAL TYPE WHICH ALLOWS TO STUDY CAUSALITY RELATIONSHIPS IN THE ECONOMY AND MAKES SIMULATION POSSIBLE. BASED ON SOME ASSUMPTIONS FOR MEDIUM-TERM ECONOMIC DEVELOPMENT VARIOUS SCENARIOS HAVE BEEN DESIGNED, WITH THE MODEL BEING APPLIED TO EACH INDIVIDUAL SCENARIO. THE MODEL'S OPEN NATURE ALLOWS FOR FURTHER DEVELOPMENT AND IMPROVEMENT BY INCLUDING NEW VARIABLES AND DERIVING NEW EQUATIONS.

JEL classification: E10, E17, C51, C53, O11

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1. Overview

The macromodel described in this paper does not pretend to be *completely* new. Studies of a number of authors in the field of econometric macromodeling and programming have been used in the paper.[1] Notwithstanding, this model may be called unique at least because there are no developed macromodels dealing with the specific characteristics of the currency board in Bulgaria. To this end, the model provokes interest and is open for additional study and improvement.

In respect of theoretical fundamentals, the model is based mostly on the neoclassical approach to economic growth. However, it would be appropriate to say that the model is not completely based on any particular economic theory or trend. It contains both elements of the Keynesian approach (but taking into account economic agents' expectations) and monetarist concepts. For instance, the balance of payments is considered as a difference between changed money demand and changed net domestic assets which is based on a purely monetarist approach.

Concurrently, this approach complies with the purely Keynesian understanding of elasticity effect in determining the volume of imports. Eclectism of the selected approach may be inappropriate from theoretical point of view, but it allows development of a rational structural model.

The model relies on the monetary approach to the balance of payments with the assumed relationship between monetary aggregates changes and balance of payments changes. In principle, this model may be successfully applied to small and open economies, with the external sector being of critical importance for the economy. Reliability of this approach significantly increases under a currency board since it allows for more precise money supply estimation given the lack of internal sources of reserve money growth.

The model is of structural type and represents a system of equations and identities which are solved with preliminary set assumptions linked with the external environment and the economic policy pursued. Solu-

[1] *Mikkelsen, J.* (1998) A Model for Financial Programming, *IMF Working Paper*, WP/98/80; *Bier, W.* (1992) Macroeconomic Models for the PC, *IMF Working Paper*, WP/92/110; *Barth, B., B. Chadha*. A Simulation Model for Financial Programming, IMF, WP/89/24; *Fisher, S.* (1997) Applied Economics in Action: IMF Programs, *American Economic Association (AEA) Papers and Proceedings*, vol. 87, #2; *Reinchart, C.* (1991) A Model of Adjustment and Growth: An Empirical Analysis, in Macroeconomic Models for Adjustment in Developing Countries, Khan, M., P. Montiel and N. Haque eds, IMF.

tion of behavioral equations requires preliminary computation of the model's parameters (coefficients) which is the most difficult and critical part of the formulation and specification. Reliability of the parameters is a 'litmus paper' for any model. After the publication of Robert Lucas Jr.'s classical article *Econometric Policy Evaluation: A Critique* in 1976, econometrists and politicians demonstrated reservation, even bias against structural models. This, in turn, requires arguments in support of the proposed model.

1.1. Selection of a Structural Model

The major advantage of the structural model is that it gives a rational explanation of the causality relationship between variables included in the model. Although the predictive power of the models based on the statistical analysis of time series is usually stronger, it is hard to give a logical explanation if an individual variable is estimated to be strongly dependent on other variables taken with a lag of two or even five periods. Such results may be obtained if VAR models are used. These models are very useful in establishing impulse response of various variables to external shocks. However, it is also true that these models are dominated by statistics and econometrics, rather than economic rationale. Even taking the risk of a bigger error (*not necessarily*), models establishing immediately implications of any decision is to be preferred under the conditions of a transforming economy with a key role of structural changes and government regulation.[2]

1.2. Monetary Approach to the Balance of Payments

Limited central bank's traditional functions associated with money supply regulation entail a different approach to modeling of credit aggregates. The impact of quasi-monetary policy implemented by the government through the amount of deposits in the Issuing Department balance sheet needs to be formalized,[3] since money supply follows currency board rules but is also strongly impacted by government financial

[2] The article of *Francis Diebold* The Past, Present, and Future of Macroeconomic Forecasting, *NBER, Working Paper #6290* literally reads: "Nonstructural models are unrestricted reduced-form models. As such they are useful for producing unconditional forecasts in a variety of environments ranging from firm-level business forecasting to economy-wide macroeconomic forecasting. Again, however, in macroeconomics we often want to analyze scenarios that differ from the conditions presently prevailing, such as the effects of a change in a policy rule or a tax rate. Such conditional forecasts require structural models."

[3] See *Nenovsky, N., K. Hristov* (1998) Financial Repression and Credit Rationing under Currency Board Arrangement for Bulgaria, BNB, *Discussion papers* #2.

operations. Provision of macroeconomic equilibrium under a currency board requires employment of IMF traditional restrictions in order to avoid the shift of budget account fluctuations into money supply fluctuations.

1.3. Parameters of the Model

The issue of dependence of parameters in structural models on changes in the economic policy could not be disregarded. However, the effects of parameters instability (in terms of quality of forecasting) may be smoothed. The first step is to limit their number, thus ensuring parsimony of the model. Quite intentionally they are limited to the acceptable minimum in the present model which helps reduce errors. The second step allows certain exogenizing and calibration of parameters. Actually, this means that recalculation of parameters is not based only on econometric calculations but also on particular adjustments associated with expected changes (in terms of theory). For example, the parameter characterizing the relationship between growth and investment should be exogenously increased, unless bigger capacity utilization is expected due to particular reasons. Obviously, in this case growth will be higher under unchanged level of investment.[4]

2. Specification of the Model

2.1. General Description

The structure of the model has been chosen in a manner to enable formalization of demand and supply of goods and services (real sector), currency (monetary sector) and forex reserves (external sector). The government sector is also individually studied: its fiscal and quasi functions are clearly delimited. It is assumed that the monetary sector is balanced, that is demand and supply are equal by definition. As regards the real sector, it is assumed that particular fluctuations between short-term demand and long-term supply of goods and services may occur based on the concept of potential (long-term) and short-term growth.

In principle, currency board rules entail employment of a fixed exchange rate against the euro. However, due to purely technical reasons

[4] To this end *G. Minassian* writes: "This approach to economic modeling allows for successful combination of the established scheme of quantitative computation and various (even opposite) understandings for future development dependent on the economist's research potential." See *Minassian G., M. Nenova and V. Yotzov* Currency Board in Bulgaria, p. 208.

indicators in foreign currency are denominated in US dollars.[5] This impacts the model to some extent, so far as changes in the BGN/USD exchange rate are inevitably assumed irrespective of the pegged exchange rate of the lev to the euro. Despite the assumption of this flexibility, exchange rate changes may not be considered as a policy variable, since they reflect only expected changes of the euro against the US dollar and are based on forecast of authoritative international financial institutions, not on government actions. Provided that the balance of payments will soon be compiled in euro (levs), the model may be easily reformulated into the entirely fixed exchange rate and all ensuing adjustments.

The model is dynamic and allows to follow changes in the policy pursued in the medium-term prospect. To this end, short-term changes in fiscal and monetary[6] policies impact supply, while in the long run supply is determined as neoclassical, that is based on a Cobb-Douglas production function. Demand, in its turn, is determined by final consumption, investment and net exports of goods and services. Equations describing relationships between income, household final consumption and import demand are behavioral, that is they are described using elasticity coefficients, while public consumption and exports are considered externally determined (outside the model). Private investment is determined by the production function assuming that *short-term growth is an exogenously determined target*.

Convergence between short-term (dependent on changes in fiscal and monetary policies) and long-term (impacted by factors of production) nominal GDP is effected through changes in the price level. Consequently, under unchanged price level any change in fiscal and/or monetary policies will cause fluctuations of the short-term growth

[5] In spite of the fact that Bulgaria's foreign trade flows have been definitely oriented towards European markets after the introduction of a currency board, a significant amount of incomes and expenses are denominated in US dollars. Bulgaria's foreign debt and foreign debt service are also denominated in US dollars. However, the most important fact is that Bulgaria's balance of payments is also compiled in US dollars which obscures to some extent the theoretical direct link between the balance of payments and money supply, leaving room for valuation adjustments.

[6] Under currency board rules no active monetary policy is pursued. The BNB may only change the percentage of minimum required reserves which have a direct effect on money multiplier and supply of broader monetary aggregates. The possibility to increase money supply through refinancing commercial banks is likely to be only theoretical. On the other hand, monetary implications of the fiscal policy (the so-called quasi-monetary policy implemented through changing government deposit) should not be disregarded as they signal a quasi-monetary policy pursued under a currency board, the only difference being that this policy is not implemented by the BNB.

around long-term growth which is considered potential at a particular employment level in the economy.

The monetary sector is formally described through money demand and supply, with supply of broad money aggregates dependent on general money multiplier and reserve money. Reserve money supply is determined by changes in net foreign and domestic assets, while demand is described by behavioral equations, including money multiplier components and changes in government deposit in the balance sheet of the Issue Department. Net capital flows (direct and portfolio investments and external loans) are determined exogenously and the target of forex reserves level is based on the ratio of forex reserves to imports of goods and nonfactor services in months. Treatment of the exchange rate needs to be clarified. Despite the assumed possible exchange rate changes against the US dollar, the exchange rate should not be treated as floating, as in the context of the model this means an automatic equilibrium of the external sector (given the target of forex reserves and assumptions in respect of net capital flows) attained through changes in the BGN/USD exchange rate. In this respect, we may not be sure that exchange rate changes based on forecast will be able to provide external sector equilibrium. It is possible for the expected changes to be quite divergent from those necessary to attain equilibrium. In this context, equilibrium may be achieved by reviewing the target of forex reserves or assuming a possibility of disequilibrum resulting in a balance of payments financial gap which will require additional financial sources. This specification is of critical importance, since employment of the exchange rate as a nominal anchor and related constraints on the monetary policy predetermine the key role of the fiscal policy in providing real sector equilibrium.

After external sector equilibrium is achieved, fiscal and monetary policies may be designed in a manner ensuring equilibrium of both real and monetary sectors at a price level which should not exceed a preliminary set inflation target. Under a set net foreign assets target, net domestic assets (domestic credit) can be determined in accordance with money market equilibrium. Consequently, various combinations of fiscal measures, including both revenue and expenditure sides of the budget may be used to restore real sector equilibrium and to subdue short-term growth fluctuations to its potential values.

2.2. Description of Specific Economic Sectors

2.2.1. Real Sector

Supply in the structural model is described by the following equations:

$$\Delta \ln Q_{lt} = \alpha_1 \Delta \ln K_t + \alpha_2 \Delta \ln L_t + \alpha_3 \quad (1)$$

$$K_t = I_t + (1 - \delta) K_{t-1} \quad (2)$$

$$I_t = \hat{I}_{gt} + I_{pt} \quad (3)$$

$$\Delta \ln Q_{lt} = \ln(1 + \bar{g}_{lt}), \quad (4)$$

where Q_{lt} is real GDP in the long run, K_t and L_t are capital stocks (in real terms) and labor in private and real sectors in the period *t*. I_t are total investments distinguished between private [I_{pt}] and public [I_{gt}] sectors. The link between capital stocks in two consecutive periods is determined through δ, which shows the average percentage of depreciation costs.

In the first equation long-term (potential) GDP growth is determined as a function of production factors: growth depends both on extensive (labor and capital) and autonomous growth factors assumed as a constant. The economic meaning of this constant is to show that growth is still possible under unchanged size of capital stocks and number of employed ($\Delta \ln K_t = \Delta \ln L_t = 0$). This may be a result of various reasons which are beyond the scope of this model, and it is assumed that coefficient α_3 reflects the impact of autonomous growth factors. Since variables referring to capital stocks reflect capital availability and not the degree of capital utilization, in addition the coefficient α_3 reflects changes in capacity utilization. Coefficients α_1 and α_2 reflect factor productivity of capital and labor correspondingly.

From a theoretical point of view, employment of production functions in valuing long-term (potential growth) is based on sound economic grounds. However, some difficulties occur at a higher technical level. First, problems related to determination of capital stocks. Reliability of statistical data provided is insufficient. If we are sure about reliability of information on the size of investment and equation (2) is used, it will be possible to generate a dummy time series of capital stocks, which is admissible in the context of econometrics since not the

absolute figures but dynamics in them is significant in computing coefficients. Consequently, the problem relates mostly to reliability of statistical data on the amount of investment, and particularly depreciation costs. Second, difficulties associated with formulation of the production function occur. Various approaches are known in economic literature, including isolation of technical progress as an autonomous factor. However, treatment of relationships between factor productivity of capital and labor is of greater importance, that is possibilities for substitution between them and the effect on total factor productivity.

In equation (4) long-term GDP growth is formulated in a manner which significantly diverges from that in the first equation and shows the link with short-term growth determined as an exogenous target. It should be noted that unlike standard stabilization programs implemented under the IMF model, the growth variable target in this model is shown in its long-term aspect. Exogenous short-term growth may not be determined separately from exogenous inflation, since inflation has effect both on fiscal and monetary policy, which, as it has already been mentioned, may shift short-term growth from its long-term dynamics. In other words, long-term (potential) growth determined through equation (1) should not be interpreted as a maximum admissible limit but as anticipated growth from the point of view of extensive factor dynamics (amount of capital and number of employed), the intensive component (factor productivity) and autonomous factors. To this end, monetary and fiscal policies should be dosed in a manner to minimize fluctuations of short-term growth around the long-term trend.

Taking into account that the major task of any macroeconomic model is to 'produce' maximum reliable forecasts and allow for simulation of various implemented policies, exogenous determination of target growth ($\overline{g}_{lt}$) should be sustainable and consistent in the longer run. Theoretically, the model may be also realized under unrealistically high growth target. It is possible to undertake particular measures to achieve or even realize this target. However, this would be a mistake since the economy may overheat in a particular future period. We realize that such warnings may sound strange in the context of current economic situation in Bulgaria when all efforts are focused on searching sources of accelerated economic growth. Notwithstanding, the problem is reduced to particular figures: 3%, 5% and 10% growth. Growth rate may be high but sustainable and lower but volatile, and therefore unhealthy. Qualitative assessment of economic growth is not an academic whim and real life examples proved quite convincing.

The above considerations raise the following question: "How to determine sustainable economic growth if its real nominal amount is unhelpful". It is well known from the theory of economic growth that growth sustainability in the long run requires an increasing ratio of GDP to capital stocks, or at least a constant function. Provided the ratio decreases (if capital stocks grow faster than GDP), in the long run all domestic resources should be used for investment, in order to maintain a minimal growth rate. This will inevitably lead to an economic crisis. Undoubtedly, as a result of increased domestic savings (at the expense of reduced consumption) and use of foreign GDP in the form of investment the crisis may be postponed but not avoided. In this context, maximum sustainable growth ($0 < \alpha_1 < 1$) may be attained under a constant ratio between GDP produced and required capital. Maintenance of the above ratio over time requires fulfillment of the following condition in the long run: $\Delta \ln Q_{lt} = \Delta \ln K_t$, that is growth rates of GDP and capital stocks should be equal. If the above condition is substituted in equation (1) and solved in respect of long-term growth target, we will obtain:

$$\bar{g}_{lt} = \frac{\alpha_2 \lambda + \alpha_3}{1 - \alpha_1} \ , \qquad (5)$$

where λ is the increase in the number of employed in the long run.

Statistical and econometric research for Bulgaria estimates the α_3 parameter at 0.0162, with autonomous factors of economic growth approximating 1.6% annually in the long run. Having assumed that total factor productivity ($\alpha_1 + \alpha_2 = 1$) is a constant, equation (5) is written as: $\bar{g}_{lt} = \lambda + \frac{\alpha_3}{\alpha_2}$. This allows for some quantitative assessments of the long-term economic growth stability under various assumptions on employment growth and its marginal productivity.

Let us assume that the government will pursue an investment-oriented (domestic and foreign) policy intended to reduce unemployment to 8% of total labor force in the long-term prospect (ten years). Based on demographic statistics showing a decline in total number of individuals and labor force, an 8% unemployment target means an increase in employment in the 10-year period by approximately 30,000 persons per annum which allows to estimate it at 0.0146 on an average annual basis. Taking into consideration these assumptions, long-term

economic growth can be displayed as a function of marginal labor productivity:

Table 1

LONG-TERM ECONOMIC GROWTH SUSTAINABILITY AT DIFFERENT VALUES OF MARGINAL LABOR PRODUCTIVITY

Growth, %, in period	0.80	0.75	0.70	0.65	α_2 = 0.60	0.55	0.50	0.45	0.40
1	3.70	3.83	3.99	4.16	4.37	4.62	4.91	5.27	5.72
2	3.62	3.75	3.90	4.08	4.29	4.54	4.83	5.19	5.64
3	3.58	3.71	3.86	4.04	4.25	4.50	4.79	5.15	5.60
4	3.54	3.67	3.83	4.00	4.21	4.46	4.75	5.11	5.56
5	3.47	3.61	3.76	3.94	4.15	4.39	4.69	5.05	5.50
6	3.44	3.58	3.73	3.91	4.12	4.36	4.66	5.02	5.47
7	3.41	3.55	3.70	3.88	4.09	4.33	4.63	4.99	5.44
8	3.38	3.52	3.67	3.85	4.06	4.30	4.60	4.96	5.41
9	3.35	3.49	3.64	3.82	4.03	4.27	4.57	4.93	5.38
10	3.33	3.46	3.61	3.79	4.00	4.25	4.54	4.90	5.35

It should be admitted that instability of the production function impedes precise measurement of any of the coefficients. Employment of various techniques in individual periods helped estimate more thoroughly autonomous factors, while frequent shocks on labor supply during the last 15 years[7] hampered valuation of marginal factor productivity. If estimations made between 1950 and 1980[8] are considered relatively stable, it may be assumed that the coefficient indicating marginal labor productivity ranges between $0.6 < \alpha_1 < 0.8$. This means that Bulgaria's long-term sustainable economic growth varies within 3% and 4% on an average annual basis.[9] The rate of long-term economic growth corresponding to the marginal labor productivity will be further used in the model ($\alpha_2 = 0.75$).

Exogenous growth determination helps unambiguously identify the amount of required private investment by expressing it as a function of GDP growth, employment increase and the level of capital stocks dur-

[7] The emigrant wave to Turkey in 1989 followed by another emigrant wave to Europe and the USA between 1991 and 1993, structural changes and liquidation of a number of industries between 1998 and 1999 impacted significantly labor supply.

[8] See Econometric Macromodels on National Economy Development, Sofia, 1984, *BAS Publishers*, pp. 23 – 35.

[9] These valuations closely approach the valuations published in an IMF study where Bulgaria's long-term economic growth (valued according to various methods) ranges between 3.93% and 5.31%. See *Fisher, S., R. Sahay and C. Vegh* (1998) From Transition to Market: Evidence and Growth Prospects, *IMF Working Paper*, WP/98/52.

ing the previous period and exogenously determined investment in the public sector.

$$I_{pt} = \frac{[\bar{g}_{lt} - \alpha_2(\Delta L_t / L_{t-1}) + \alpha_1\delta - \alpha_3]}{\alpha_1} K_{t-1} - I_{gt} \qquad (6)$$

From the point of view of demand, real GDP is determined by the following identity:

$$Q_t = C_{pt} + \hat{C}_{gt} + I_{pt} + \hat{I}_{gt} + \hat{X}_t - M_t \ , \qquad (7)$$

where C_{pt} and C_{gt} denote final consumption in private and public sectors (in real terms) respectively, and X_t and M_t denote the volume of exports and imports of goods and nonfactor services (in real terms). Consumption and public sector investment are considered exogenous as they are controlled by the government. Strictly speaking, volumes of exports are also exogenous but only in the context of this model. In practice export volumes are dependent both on internal (real sector performance, inflationary expectations and structural changes) and external factors (international market situation, state of trade partners, the effect of changes in the real exchange rate).

Private sector consumption [C_{pt}] is derived as a function of disposable income in the private sector [Y_{dpt}] by the equation:

$$\ln C_{pt} = \beta_0 + \beta_1 \ln Y_{dpt} \qquad (8)$$

The assessment of this equation reveals a strong dependence between consumption and income: the coefficient of determination approaches 1, and strong first order autoregression occurs (DW = 0.79). To avoid the effect of autoregression, the equation may be formulated in another way:

$$\Delta \ln C_{pt} = \beta_0 + \beta_1 \Delta \ln Y_{dpt} + \beta_2 \ln C_{pt-1} + \beta_3 \ln Y_{dpt-1}$$

The use of this specification requires preliminary stationarity test showing that income and consumption are integrated in I (1). This means that their first differences are stationary.

The results of econometric estimations of above equation are summarized in the table below which shows the disposable income elasticity of consumption.

Table 2

DISPOSABLE INCOME ELASTICITY OF CONSUMPTION

Dependent variable: DLOG(CONSP)
Method: Least squares
Sample (adjusted): 1994:2 1999:4
Included observations: 23 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.116939	0.053181	-2.198880	0.0405
DLOG(YDP)	0.873376	0.024426	35.75610	0.0000
LOG(CONSP(-1))	-0.359748	0.108586	-3.313013	0.0037
LOG(YDP(-1))	0.365828	0.110179	3.320307	0.0036
R-squared	0.986205	Mean dependent var.		0.195687
Adjusted R-squared	0.984027	S.D. dependent var.		0.267828
S.E. of regression	0.033850	Akaike info criterion		-3.776998
Sum squared resid.	0.021770	Schwartz criterion		-3.579521
Log likelihood	47.43548	F-statistic		452.7621
Durbin-Watson stat.	1.778090	Prob. (F-statistic)		0.000000

Volumes of imports of goods and nonfactor services are also determined by a behavioral equation:

$$\ln M_t = \gamma_0 + \gamma_1 \ln(RER) + \gamma_2 \ln(C_t) + \gamma_3 \ln(I_t), \qquad (9)$$

where RER is the real exchange rate obtained as a ratio of domestic (P_t^d) and external[10] (P_t^w) price levels and the nominal change in the exchange rate E_t determined as the amount of national currency required for the purchase of a unit of foreign currency, $RER = \frac{P_t^w}{P_t^d} E_t$.

Theoretically, the expected value of the coefficient indicating the impact of the real effective exchange rate on import volumes is: $\gamma_1 < 0$. In other words, the real depreciation of the national currency (when the nominal increase in the exchange rate exceeds the differences in inflation rates) increases the cost of imports and represses them. However, the effect of this factor in Bulgaria is quite contradictory due to the relatively big share of imported energy inputs which have low price elasticity. As imports of consumer goods are concerned, the impact of

[10] Usually indices of the real effective exchange rate changes are computed. This is much more convenient, since there is no need of dealing with price levels but directly with inflation rate. The effective nature of the real exchange rate means that a particular basket of currencies determined through foreign trade weights of major trading partners is used.

the depreciation is very strong. This was clearly pronounced during the crisis at the end of 1996 and early 1997. Under a fixed exchange rate, real effective exchange rate indices depend only on differences in inflation. To this end, it should be reminded again that exogenously determined changes in the nominal exchange rate of the lev against the US dollar may not be treated as a way to reduce imports and improve balance of payments current account. As to the other two coefficients, they should have (and they have) positive values but with lower impact.

The results[11] of the assessment of the effect of the real effective exchange rate, consumption and investment on import volumes are displayed in the table below:

Table 3

REAL EFFECTIVE EXCHANGE RATE, CONSUMPTION AND INVESTMENT ELASTICITY OF IMPORTS

Dependent variable: DLOG(M)
Method: Least squares
Sample (adjusted): 1994:2 1999:4
Included observations: 23 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.013856	1.228584	3.267059	0.0056
DLOG(RER)	-0.708952	0.184284	-3.847067	0.0018
DLOG(CONS)	0.414514	0.191984	2.159100	0.0487
DLOG(I)	0.119040	0.080792	1.473420	0.1628
LOG(M(-1))	-0.236249	0.153320	-1.540889	0.1456
LOG(RER(-1))	-0.426585	0.218340	-1.953762	0.0710
LOG(CONS(-1))	0.327478	0.180311	1.816190	0.0908
LOG(I(-1))	-0.084872	0.121032	-0.701231	0.4947
DUMMY	1.092181	0.150829	7.241171	0.0000
R-squared	0.944098	Mean dependent var.		0.184170
Adjusted R-squared	0.912154	S.D. dependent var.		0.304011
S.E. of regression	0.090105	Akaike info criterion		-1.689503
Sum squared resid.	0.113666	Schwartz criterion		-1.245179
Log likelihood	28.42929	F-statistic		29.55485
Durbin-Watson stat.	2.080900	Prob. (F-statistic)		0.000000

To complete the formal description of the real sector, it is necessary to determine the disposable income of the entire economy (Y_{dt}) as well as of the private sector (Y_{dpt}).

[11] Due to nonstationarity of variable levels, the equation (similar to equation 8) is valued by using first differences of variables which are stationary. A dummy variable reporting forex crises in the spring of 1994 and early 1997 is used in computations.

$$Y_{dt} = \frac{P_{qt}Q_t + F\hat{S}_t + \hat{G}_t}{P_{qt}} \tag{10}$$

$$Y_{dpt} = Y_{dt} - \frac{R_t}{P_{qt}}\,, \tag{11}$$

where $F\hat{S}_t$ is the net nominal amount of external factor services, $\hat{G}_t$ is the net nominal amount of transfers, R_t is the net nominal amount of public sector revenue, and P_{qt} is the GDP deflator. It is of note, that the nominal amount of the private sector disposable income is not deflated by consumer price index but by the implicit GDP deflator. Other conditions being equal, this makes the private sector disposable income less sensitive to exogenously determined changes in terms of trade.

As it has been already mentioned above, the relationship between short-term demand (impacted by fiscal and monetary policies) and long-term supply (dependent on factors of production and their marginal productivity) is effected through changes in the price level.

$$\pi_t = \pi_t^* + \kappa\left(\frac{Q_t}{Q_{lt}} - 1\right), \tag{12}$$

where $\pi_t = \dfrac{\Delta P_t^d}{P_{t-1}^d}$ is the rate of domestic inflation in period t, and π_t^* the rate of expected inflation in the same period. Q_t and Q_{lt} are the real amounts of short-term and long-term GDP defined in equations (4) and (7). According to theory, the parameter $k > 0$, that is when short-term demand exceeds long-term supply, inflationary pressure occurs. On the other hand, expected inflation can be defined as $\pi_t^* = \omega\pi_{t-1} + (1-\omega)\bar{\pi}_t$ indicating that economic agents' expectations are expressed as an average weight of previous period inflation and the inflation target in the current period. It is obvious that parameter ω, showing economic agents' confidence in government's ability to achieve the inflation target, ranges within $0 \le \omega \le 1$. Lack of confidence ($\omega = 1$) results in purely adaptive expectations in which economic agents extrapolate their inflationary expectations only on a past basis. A typical example of this kind of expectations is when the government has undertaken commitment in advance to compensate sala-

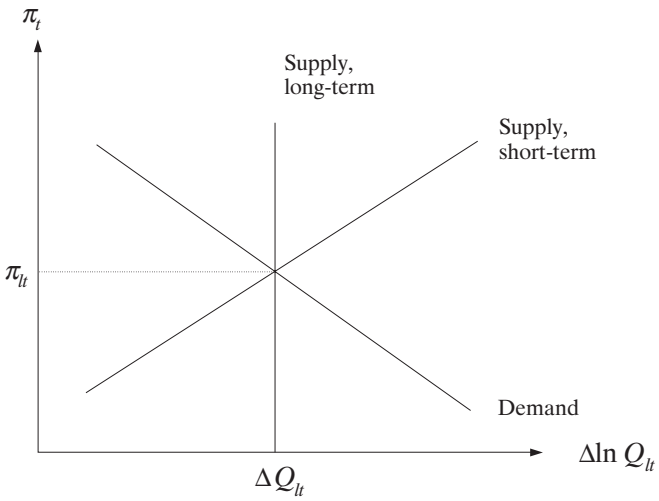
ries with the amount of inflation in the previous period. The opposite case ($\omega = 0$) means that economic agents' inflationary expectations entirely coincide with the inflationary target.

The relationship between short-term demand and long-term supply will be more clearly pronounced if equation (12) is rewritten in a manner showing short-term demand in the right side and long-term supply in the left side of the equation, assuming that the desired inflation target in period t coincides with real inflation ($\pi_t = \overline{\pi}_t$):

$$Q_t = [\frac{(\pi_t - \pi_{t-1})\omega}{k} + 1]Q_{lt} \qquad (13)$$

Chart 1

PRICE LEVEL AND AGGREGATE DEMAND AND SUPPLY



The economic meaning of the above equation reflects the necessity of converging short-term demand into long-term supply in order to preserve control over inflation.

Chart 1 shows the theoretical assumption that in the long run supply is absolutely rigid to changes in the price level which meets condition $k \to \infty$. Economic agents' credibility in governing authorities' ability to

observe the price target ($\omega = 0, \pi_t = \pi_t^*$) also suggests a vertical line of long-term aggregate demand. Long-term equilibrium is achieved at the point where short- and long-term supply intersect demand, being defined both from the targeted price level and the GDP growth rate. In the short run, however, changes in demand caused by various governing authorities' decisions will result in different combinations of growth and inflation, which balance by way of movements on the short-term supply line. At the same time, given exogenous long-term economic growth, short-term fluctuations in the long run balance through the movement of the demand line. The values used in the model are based on expert estimates: $\omega = 0.5$ and $\kappa = 4$.

The price level (within the economy) in the model at the end of each period is set as a target variable and the average annual price level through the linear interpolation of end-of-period values. Hence the domestic rate of inflation will differ from GDP deflator to the extent to which the rate of change in domestic prices will differ from those of exported goods.

The price levels of consume (P_{ct}) and investment (P_{it}) goods are determined in the same way: as an average weight resulting from a change in the general price level (P_t) and the exogenously set price level of imported goods and nonfactor services (P_{mt}).

$$P_{ct} = \xi_1 P_t + (1 - \xi_1) P_{mt} E_t \tag{14}$$

$$P_{it} = \xi_2 P_t + (1 - \xi_2) P_{mt} E_t \tag{15}$$

The values for ξ_1 and ξ_2 used in the model are 0.2 and 0.4 respectively.

2.2.2. Monetary Sector

The model could be specified for a different degree of monetary aggregate aggregation. Based on the standard approach of establishing the relationship between monetary aggregates and inflation, it would be appropriate to include the monetary aggregate with the strongest impact on inflation dynamics. This involves specific econometric tests to be run as illustrated below:

Table 4

MONETARY AGGREGATES IMPACT ON INFLATION PRIOR TO CURRENCY BOARD INTRODUCTION (DECEMBER 1991 – JUNE 1997)[12]

Monetary aggregates	Short-term relationship		Long-term relationship		R^2	DW	S.E.	F-stat.
	Coefficient	*t*-stat.	Coefficient	*t*-stat.				
Reserve money	1.86	5.88	1.38	1.89	0.73	1.76	0.22	9.97
M2	1.97	8.99	1.38	2.00	0.90	1.96	0.13	35.67
M3	1.90	8.92	1.37	2.02	0.91	1.99	0.13	36.12

Table 5

MONETARY AGGREGATES IMPACT ON INFLATION AFTER CURRENCY BOARD INTRODUCTION (JULY 1997 – DECEMBER 1999)

Monetary aggregates	Short-term relationship		Long-term relationship		R^2	DW	S.E.	F-stat.
	Coefficient	*t*-stat.	Coefficient	*t*-stat.				
Reserve money	-0.017	-0.551	0.090	1.52	0.58	1.81	0.01	8.77
M2	0.026	0.589	0.167	1.79	0.56	1.75	0.01	7.85
M3	-0.015	-0.261	0.262	1.59	0.64	1.79	0.01	11.01

Econometric tests show definitively that there is no relationship between money supply and inflation after currency board introduction. This result is only logical, as the major function of the currency board is to reverse inflationary expectations associated with unjustifiable growth in monetary aggregates. The choice of a monetary aggregate therefore cannot be determined in view of its relationship with inflation as there is no such relationship under a currency board arrangement.

The broadest monetary aggregate M3 is chosen in the model because it allows greater freedom in forecasting credit aggregates, in particular credit to the real sector.

Under a currency board arrangement money is an endogenous variable while money supply is restricted by changes in the official forex reserves. This makes it possible to define broad money supply as:

[12] Econometric checks are based on the following equation:

$$\Delta \ln(CPI) = \alpha_1 + \alpha_2 \Delta \ln(MA) + \alpha_3 \ln(CPI_{-1}) + \alpha_4 \ln(MA_{-1}) + \varepsilon_t$$

where CPI is the consumer price index and MA is the monetary aggregate under review. The parameter α_2 reflects the short-term relationship and $\frac{\alpha_4}{-\alpha_3}$ the long-term one.

$$M3^s_t = \mu RM^s_t , \quad (16)$$

where RM^s_t is the reserve money supply and μ is the money multiplier that is partly controlled by the central bank. On the other hand, reserve money is shown as the sum of currency outside banks (COB) and commercial bank reserves (CBR) comprising minimum required reserves, excess reserves and cash balances at commercial bank vaults, i. e. $RM_t = COB_t + CBR_t$. The money multiplier is defined as: $\mu = \frac{1+c}{c+r}$, where c is the ratio of currency outside banks to deposits and r is the ratio of commercial bank reserves to deposits.[13]

According to the methodology of monetary statistics the sources of reserve money growth (i.e. its supply) are changes in net foreign assets (a result of BOP dynamics) and changes in net domestic assets. Under a currency board arrangement the impact of domestic assets is reduced to a minimum. Strictly speaking, these should be excluded as a source of monetary base growth. However, the model leaves room for changes in domestic assets reflecting the fact that not all changes in reserve money can be *strictly* ascribed to changes in net foreign assets driven by changes in official foreign exchange reserves. For example, the government is capable of decreasing or increasing money supply by issuing government securities. In practice this policy is implemented by means of the issuance calendar which depends on the current execution of the state budget. In the cases of budgetary revenue and expenditure gaps the government can reduce the amount of its deposit without causing a change in foreign assets and thus increase money supply[14]. The opposite case is also possible with unexpected inflows into the budget (i. e.

[13] The money multiplier is derived as follows: by definition broad money is the sum of currency outside banks and deposits (quasi-money), i. e. $M3 = COB + D$. Therefore

$$\mu = \frac{M3}{RM} = \frac{COB + D}{COB + CBR} = \frac{\frac{COB}{D} + \frac{D}{D}}{\frac{COB}{D} + \frac{CBR}{D}} = \frac{c+1}{c+r} .$$

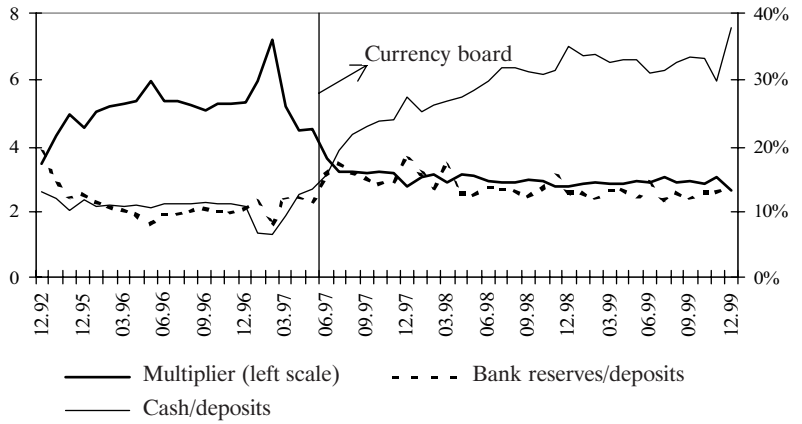
[14] In view of Bulgaria's commitments to implementing the IMF extended program some clarification should be made. The fiscal reserve is set as a trough below which it cannot fall. This trough is 'flexible' and generally depends on IMF tranches and government payments on the foreign debt service. Thus the government's possibilities of raising funds by way of decreasing deposits are severely restricted. The model refers to the more general case that does not necessarily require an agreement with the IMF and subsequent observance of such restriction.

higher tax collection) causing an increase in the government deposit which, without being linked to foreign assets, results in withdrawal of liquidity from the banking system. In the context of this model this means that both sources of reserve money growth can become endogenous since changes in forex variables are endogenous variables in the external sector and the needs of bank financing can be determined as a resultant value in the public sector.

As already pointed out, the model requires equilibrium between demand for and supply of money. As broad money supply depends both on changes in reserve money supply and changes in the money multiplier, there are two possible approaches in determining the multiplier: by formalizing it in a specific equation or by its exogenous setting. The second approach is preferable not only because it is simplified, but also in view of multiplier stabilization and predictability after currency board introduction.

Chart 2

MONEY MULTIPLIER AND ITS COMPONENTS



As shown in Chart 2, the multiplier is sufficiently stable after currency board introduction, which allows for its exogenous setting.

The money demand function is key for any model based on monetary approach to balance of payments. The economic literature dedicated to this issue is abundant. In the model under review a simplified version of money demand as a function of incomes is presented. In the context of the broadest monetary aggregate M3 no distinction is made between money demand from households and that from economic agents. The theory suggests that money demand be *negatively* related to

the interest rate. However, econometric tests for Bulgaria do not show a statistically significant relationship between interest rates (irrespective of their choice) and money demand. This proves definitely that the interest rate has not turned into *price of money*.

Results from econometric tests for real money demand can be summarized in the tables below:

Table 6

DEMAND FOR MONEY (INCOME ELASTICITIES)[15]

Period	Long-term relationship		Short-term relationship		R^2	DW	S.E.	F-stat.
	Coefficient	*t*-stat.	Coefficient	*t*-stat.				
XII'92 – XII'99	1.94	2.91	0.59	12.01	0.91	1.90	0.06	33.5
XII'92 – VI'97	1.30	1.74	0.62	7.64	0.93	2.18	0.07	22.4
VII'97 – XII'99	0.17	2.74	0.33	2.08	0.98	2.44	0.01	78.7

* OLS estimates.

Table 7

DEMAND FOR MONEY (INCOME ELASTICITIES)

Period	Long-term relationship		Short-term relationship		R^2	S.E.	F-stat.	Log likeli-hood
	Coefficient	*t*-stat.	Coefficient	*t*-stat.				
XII'92 – XII'99	1.81	3.31	0.54	3.11	0.41	0.16	3.91	13.76
XII'92 – VI'97	1.20	0.28	0.59	2.15	0.59	0.17	4.31	8.74
VII'97 – XII'99	0.23	10.4	0.35	4.67	0.98	0.01	84.5	35.6

* Cointegration techniques estimation.

Results from econometric tests, despite their rather simplified form, are reassuring. The theoretical concept of a strong statistical relationship between money demand and real income is confirmed. In the context of the model, and given money multiplier stability this is extremely favorable, enabling us to formulate the following relationship between money demand and supply:

[15] The money demand function is specified in a way that allows measurement of the short- and long-term relationship similarly to the consumption function.

$$\Delta \ln\left(\frac{M3}{CPI}\right) = \varphi_1 + \varphi_2 \Delta \ln\left(\frac{GDP}{CPI}\right) + \varphi_3 \ln\left(\frac{M3_{-1}}{CPI_{-1}}\right) + \varphi_4 \ln\left(\frac{GDP_{-1}}{CPI_{-1}}\right) + @\,seas(4) + @\,trend + AR(1)$$

OLS (ordinary least squares) means the method of least squares. The dummy variable *seas* is introduced due to seasonal increases in monetary aggregates at each year's end, relating to closing of budgetary accounts.

$$M3^s = \mu RM^s = \mu(NF\hat{A}_{cb} + ND\hat{A}_{cb}) = M3^d, \quad (17)$$

where NFA_{cb} and NDA_{cb} are the central bank's net foreign assets and net domestic assets respectively, which are endogenous variables and money demand is defined by the above behavioral equation.

Thus money demand represents the reciprocal value of the velocity of circulation (the ratio between nominal GDP values and money supply), i. e. elasticity coefficients obtained from econometric tests can be used directly in the macroeconomic model. In this respect it is interesting to consider both the behavior of the money multiplier and the velocity of circulation.

2.2.3. External Sector

Under a currency board arrangement the external sector plays a key role in the formation of monetary and credit aggregates and the overall model. The underlying and structurally determining identity helps define the current account presented below:

$$CAB_t = \hat{X}_t - M_t + F\hat{S}_t + \hat{G}_t \ , \quad (18)$$

where $\hat{X}$ is the exogenously set volume of exports of goods and nonfactor services. The other variables have the same values as in equations (9) and (10). It is obvious that transfers and factor services are fully exogenous factors and there is no economically rational way of their endogenizing. Moreover, their relatively low levels do not affect significantly the current account. However, the issue of exogenous setting of exports is quite different as the balance on the current account is almost completely determined by the trade balance. From a purely theoretical point of view export volumes can be presented as a function of the variables in the model. In the literature on macroeconomic modeling there are such models. In this model, however, we have discarded this approach because of identification problems. This entails in-debt examination of major principles and approaches in forecasting exports in the suggested model.

It should be noted that exogenous setting of exports (not as an instrumental variable through which pre-set targets can be achieved) does not mean that exports are set independently of the other parameters. It is natural to opt for a certain tradeoff between changes in the real effective exchange rate and exports. Long-term economic growth

rates also impose certain restrictions on potential export growth. It is obvious that rapid export growth is not possible in a decapitalizing economic environment with a sustained downward trend in economically active labor force. On the other hand, Bulgaria's competitive strengths in traditional exports of goods and services in which Bulgaria specialized when the Comecon was active should be taken into account. For example, existing capacities in the chemical industry and metallurgy, though outdated, continue to produce about 40% of exports. At the same time, loss of markets in former USSR countries affected seriously exports of the light and food industries. The general trends in Bulgarian export dynamics in recent years show that the issue of setting exports exogenously should not be approached by using statistical and econometric techniques but rather be based on analysis of trends and their projection in the future. Ultimately this approach requires that *real volumes* be distinguished from *physical volumes*.

Although volumes in the balance of payments are presented in terms of value, from the point of view of modeling and forecasting real volumes are of greater importance. As a first step it is necessary to make an in-dept analysis of exports based on their commodity and geographic structure while eliminating the price factor. In terms of commodity structure, the deeper the segregation, the better the possibilities of identifying problems in the specific industry or production. This is the most reliable approach but it is hardly applicable to macroeconomic models. Rather these models focus on a greater degree of aggregation and the same approach is applied in this model. Analysis of export commodity structure dynamics both in absolute and relative values shows a strong relationship between the progress of economic reform (particularly privatization) in specific industries and productions and their export volumes. Definitely, this fact can be used to outline the future path. The cross commodity and geographic structure is very helpful as it allows for distinguishing between internal and external factors. For example, if the fall in exports of a specific product (e.g. cigarettes) is concentrated in a particular country then it is evident that the problem is not in the manufacturing and supply of this product but rather in the importing country. Based on the cross commodity and geographic structure sufficiently credible assumptions on short- and medium-term export developments can be made.

The next step involves collecting and processing of information about current changes in the international commodity markets. Forecasts and expected prices of major commodity items in Bulgaria's ex-

port list can be derived from this type of information. This, in turn, allows for a shift from real export volumes to export volumes in terms of value. Based on this information, expectations of changes in the terms of trade are constructed which subsequently have an impact on defining the GDP deflator and distinguishing it from the consumer price dynamics.

After resolving the problems with exogenous setting of exports by way of using the basic balance of payments identity the so-called financial gap can be defined, typical of the fixed exchange rate regime. We would like to remind that there is no financial gap under a floating exchange rate regime inasmuch as changes in the nominal exchange rate affect the trade balance and hence forex reserves.

$$GAP_t = \Delta NF\bar{A}_{cbt} - CAB_t - \Delta F\hat{C}_{gt} - \Delta F\hat{C}_{pt}\,, \qquad (19)$$

where ΔNFA_{cbt} is the change in central bank net foreign assets and ΔFC_{gt} and ΔFC_{pt} are changes in net capital flows (loans) in the public and private sectors respectively. In turn, central bank net foreign assets are treated as a target variable inasmuch as these are the difference between foreign liabilities (preliminary known) and assets (official forex reserves), namely the latter are set as a target variable in the form of forex reserves in months of imports of goods and nonfactor services.

2.2.4. Public Sector

Formalizing public sector budget constraints ultimately specifies the model.

$$C_{gt} + I_{gt} + INT_{gt} + NL_t - R_t = \Delta FC_{gt} + \Delta DCCB_{gt} + \Delta DCB_{gt} + \Delta B_t + GAP_t, \qquad (20)$$

where the left side of the identity is overall public sector balance defined as a sum of consumption, investment, interest payments (on internal and external obligations) and net lending[16] less total earnings. The right side stands for financing where ΔFC_{gt} are net foreign credits drawn by the government, $\Delta DCCB_{gt}$ are changes in the fiscal position of the government in the central bank's balance sheet, ΔDCB_{gt} is domestic credit drawn by commercial banks and ΔB_t is the financing of

[16] Net lending is defined as the difference between loans made by the government and their repayment, relating to a specific policy implementation, not to liquidity management (direct or indirect). The most typical example is subsidies and aids granted. From this point of view, they are classified in the group of expenses although it contains elements of financing.

the nonbank (private) sector. Foreign financing and banking sector financing (central bank and commercial banks) are exogenously determined, and the model assumes that government sector financial gap is equal to that of the external sector as defined in equation (17). The only variable not explicitly determined is private sector nonbank financing, usually in the form of government securities issue.

With the exception of total revenue all variables on the left side of the identity are exogenously set. This suggests that the above identity can be satisfied for any combination of revenue and nonbank financing, i.e. lower expenditure is automatically offset by higher nonbank financing and *vice versa*. Taking into account equation (7), however, which includes exogenously set government expenditure and investment, in practice there is only one combination of total income and nonbank financing that provides for equilibrium in the real sector under a preliminary determined level of admissible change in the price level. The balancing mechanism is effected in the following way: The impact of changes in total government revenue (at a given level of total expenditure) is evidenced through the consumer function of the private sector described in equation (11). An increase in government revenue comes through taxes, which cause, other conditions being equal, a decline in the disposable income of the private sector and hence reduce its possibility of public sector financing.

Based on these calculations total public sector revenue represents an endogenous variable inasmuch as it results from its relationships with the other variables in the model. Any other estimation of the results obtained after solving the model needs further analysis which is reduced to answering the question: Which level of deficit in the public sector balance can be assumed as admissible and sustainable in the context of the possibilities of financing?[17] When the fiscal deficit proves higher than the possibilities of sustainable financing (i.e. not leading to lower growth or higher inflation), then general measures taken are usually related to cutting expenditure and/or increasing revenue but this takes time as it requires amending the tax legislation. To this end preliminary research in terms of tax revenue elasticity to the tax base is very helpful as a safeguard against gross errors in the course of drawing up and implementing the consolidated fiscal program. Usually GDP is used as proxy of the tax base and long-term ($\frac{\alpha_3}{-\alpha_2}$) and

[17] See *Horne J*. (1991) Indicators of Fiscal Sustainability, *IMF Working Paper*, WP/91/5; *Blanchard O*. (1990) Suggestions for New Set of Fiscal Indicators, *OECD Working Paper*.

short-term elasticity of total revenue to the tax base is estimated using the following function:

$$\Delta \ln(REV_t) = \alpha_0 + \alpha_1 \Delta \ln(GDP_t) + \alpha_2 \ln(REV_{t-1}) + \alpha_3 \ln(GDP_{-1}) .$$

The results of the analysis for Bulgaria for the period 1990 – 1999 can be summarized in the table below:

Table 8

GDP ELASTICITY OF STATE REVENUE

Long-term relationship		Short-term relationship		R^2	DW	F-stat.	S.E.
Coefficient	*t*-stat.	Coefficient	*t*-stat.				
0.99	1.56	0.91	12.3	0.99	1.98	130.1	0.09

The analysis should be extended further to distinguish changes in revenue due to higher tax collection from those due to changes in tax rates. Only then we can assume that the value solved by the model is realistic.

3. Simulation Possibilities

A significant advantage of structural modeling is the possibility of performing simulations of the type what will happen if instrumental variables controlled by the government change in one or in the other direction ('what – if analysis'). The specification of the proposed model allows for the use of this approach. Since the model is macroeconomic and the number of endogenous variables and relevant equations is limited, the possibilities of simulation analysis are reduced to the most significant macroeconomic variables.

Based on specific statistical data about Bulgaria for the period 1990 – 1999 the parameters of the model are calculated using standard econometric techniques. Where this is not possible, or the results are not satisfactory, parameters are determined on the basis of cross-country studies or by examining short-term relationships in the preceding years. In this regard we should note once again that the proposed model is the first attempt at constructing a comprehensive econometric macromodel. Undoubtedly there are other possibilities of improving the quality of estimates, including that of parameters.

Since the model is described by a simultaneous system of equations it is not enough to solve all equations separately. This entails the use of

an iterative process in calculations. The model is based on the popular software product *Microsoft Excel*, and iteration is effected through the standard function of the *MS Excel – Solver Add-In Utility* electronic table. At this stage of research it is neither possible, nor reasonable to construct the entire model on a purely econometric software product such as the Eviews, although it provides enhanced possibilities. However, this specialized econometric program is widely used for estimating parameters in specific equations.

In practice the model is constructed on different sheets of the electronic table and the main sheet – the simulation block – is constructed by using the software options of *Visual Basic Editor*, a standard application of the software package *MS Office*.

Input statistical data necessary for the model and future values of exogenously set variables are described in the applications. The first three columns in the table give the explanation of the specific variable, its name and status, i.e. whether it is treated as endogenous (marked *END*) or exogenous (*EXOG*).

(*NM*) designates variables beyond the scope of the model. In the general case they perform auxiliary functions and their projections in the future (if necessary to outline a full macroeconomic picture) are usually set as proportionate values to adequately chosen endogenous variables. The rows in the tables shown against light gray background indicate that exogenous (manual) setting is required to start the simulation process.

A basic scenario of behavior of exogenous variables covering the period 2000 – 2004 is presented in the applications.

• Long-term exogenous GDP economic growth is relatively stable over time and meets the requirements for sustainability formulated in Table 1.

• Growth rates of real export volumes are higher in the first years of the simulation period and slow down over time. This hypothesis of behavior reflects recovery of export volumes caused by the Kosovo conflict and blocked transportation of contracted export goods.

• Given ongoing social security and health care restructuring, public sector expenditure will increase at the beginning of the projected period both in nominal terms and as a share of GDP. Likewise, the government's investment program is expected to intensify in regard with construction and maintenance of important infrastructure projects. This in turn will cause a certain decrease in government fiscal reserves and reflect on monetary and credit aggregates.

• Official forex reserves will sustain their high level and will not fall below six months in terms of months of imports of goods and nonfactor services throughout the period. This will be possible thanks to a decrease in the current account deficit in combination with expected privatization revenue.

• Expected inflation has no fiscal sources, given a low budget deficit and its non-inflationary funding. However, monetary sources of inflation may emerge if there is an unexpectedly high private investment inflow that could not be sterilized by the government. This scenario is not examined as a basic one. In general, pushing ahead with the price liberalization process will foster inflation in the first two years. The other major factor will be price level convergence with other European countries, but given the low level of incomes this will be a long process and its effect is to be felt even after the end of the simulation period.

• In the first year of the projected period a decrease in commercial banks' minimum required reserves maintained with the central bank is expected: from 11% to 8%. Consequently a higher money multiplier is embedded resulting in, other conditions being equal, higher money supply. At the end of the simulation period yet another decrease of required reserves is envisaged: up to 5% of funds attracted by commercial banks.

Based on the above-mentioned economic preconditions the results from the simulations performed are given in the tables in the appendix.

4. General Assessment of the Model

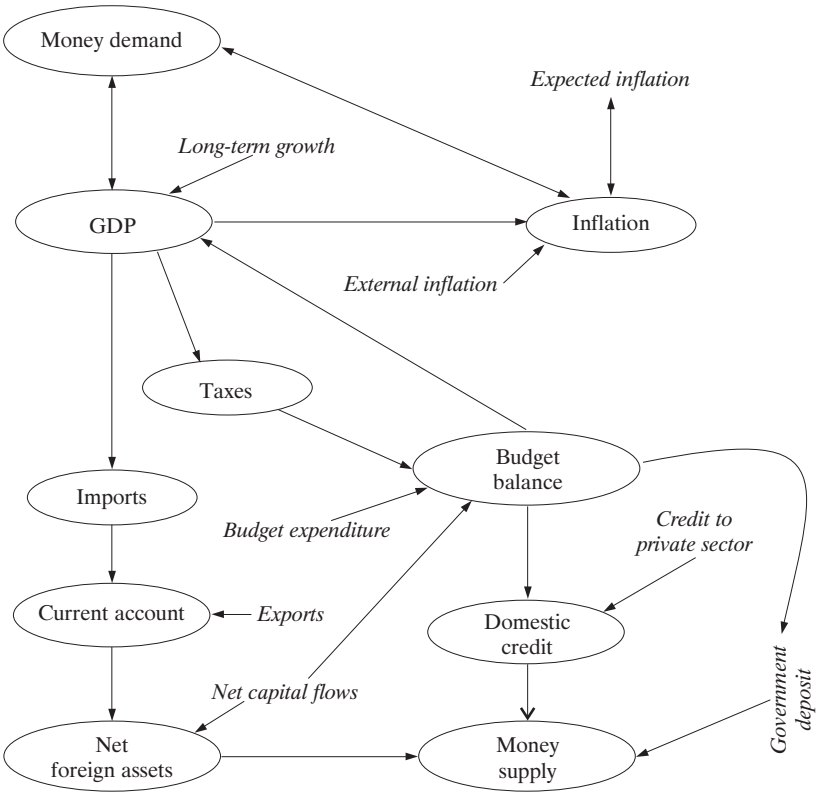
The presented model can be viewed as a starting point in formulating a more detailed estimated program for economic action. Its basic merits are its relative simplicity, the limited scope of necessary statistical data and the clear relationship between the targets set by each economic projection with the possible ways of its practical implementation. The structure of the model is based on the theoretical concepts of medium-term macromodels, including economic growth as a target variable. In this respect the model is a step forward in comparison with IMF stabilization models.

The logic of the model can be summarized as follows: In a small and open economy functioning under currency board arrangement (fixed exchange rate) changes in domestic credit are offset by changes

in forex reserves in the long run. This in turn leads to a change in money supply and its adjustment to real demand is almost automatic. Providing equilibrium between money supply and demand is critical inasmuch as short-term monetary impulses may divert the long-term trend of economic growth in one or other direction. Given the peculiarities of the Bulgarian version of a currency board, the model assumes existence of a strong relationship and interdependence between fiscal and monetary policy, or what is left of it. The structure of the model is described in the chart below in the context of its economic logic.

Chart 3

STRUCTURE OF THE MODEL



Definitely, it should be noted that Bulgaria enters a period when purely stabilization programs intended to solve deep structural disequilibria need be abandoned. Macroeconomic stabilization achieved after currency board introduction puts to the fore the issue of recovering sustainable economic growth rates. The invitation extended to Bulgaria to start negotiations for full accession to EU economic and political structures is a key factor in this direction. From this point of view, formulating and implementing models that ensure only the achievement of macroeconomic stabilization can be regarded as a past stage because such models are based mostly on restricted spending and consumption and limit the possibilities of economic prosperity. Changes in Bulgaria's economic setting in the last two years demand a new approach to economic processes modeling focusing on growth rates.

As an attempt at formulating the problems of macroeconomic modeling in the conditions of a restructuring economy in the light of economic growth the proposed model has a number of unsolved issues and shortcomings. Should input information be improved the separate blocks of the model can (and should) undergo changes:

• Endogenizing long-term economic growth instead of representing it in equation (4) as a preliminary set target. This, in turn, will allow reformulation of equation (6) describing investment in the private sector.

• As private sector consumption has a key impact on aggregate demand and through it on fiscal and monetary policy measures, equation (8) describing the private sector consumer function can be extended to include additional variables. In the ideal case these could be variables reflecting economic agents' expectations (rational or adaptable) and changes in preferences, if possible.

• Exogenous setting of exports can be reconsidered and improved as possible large deviations in its setting may affect seriously projected and simulated possibilities of the model. Complete endogenizing of exports is hardly possible at this stage because exports are affected by various external factors that cannot be included in the model. Nevertheless, it is possible to include that part of export volumes into endogenous variables, which is defined by purely internal supply-related factors.

• Financial sector presentation may be extended to include the stock exchange market and nonbank financial institutions. The dynamics of the broadest monetary aggregate used, M3, does not reflect fully the relationships in the field of financial mediation. So far the lack of

sufficient statistical data (i.e. financial statement) does not allow development of the model in this direction.

• Possibilities of including interest rates in the model should be sought. Their absence is partly related to the former problem. Yet a more serious reason is that all attempts at including interest rates in the function of money demand either in the consumer or the investment function of the private sector show either insignificant statistical dependence or results which contradict economic logic.

• It would be reasonable (following the models of the World Bank) to separate a special block treating the issues of foreign debt and the impact of its service on the balance of payments. Specific difficulties of purely technical nature may arise, as this requires unrestricted access to the record of external obligations.

• In the conditions of the Bulgarian version of currency board government deposits exert strong influence on money supply. From this point of view the model would gain much if appropriate ways of their endogenous inclusion in the model were found. This entails more extensive presentation of the public sector.

Appendix

Table 9

BULGARIA: INPUT SIMULATION DATA

(million levs unless stated otherwise)

	1998	1999	2000	2001	2002	2003	2004
Real sector							
Resources		34595					
Gross domestic product		22776					
Import of goods and nonfactor services		11818					
Expenditure		34595					
Individual consumption		18288					
Collective consumption		1914					
Private investment		2557					
Public investment		1076					
Change in inventories		707	0	0	0	0	0
Export of goods and nonfactor services		10054					
Memorandum items:							
National disposable income		23275					
Private sector disposable income		19274					
Real export growth of goods and nonfactor services (%)		-2.6	7.0	6.0	5.0	5.0	5.0
Short-term real GDP growth (%)		2.5					
Long-term (potential) GDP growth (%)		3.5	4.5	5.0	5.0	5.0	5.0
Total factor productivity growth (%)		1.6	1.6	1.6	1.6	1.6	1.6
Maximum possible GDP sustainable growth (%)		5.0	5.0	5.0	5.0	5.0	5.0
External sector							
Current account		-1266					
Export of goods and nonfactor services		10054					

(continued)

(continued) (million levs unless stated otherwise)

	1998	1999	2000	2001	2002	2003	2004
Import of goods and nonfactor services		-11818					
Factor services		296	184	152	204	98	24
External support and transfers		203	346	438	477	514	514
Capital account		2182	1526	1987	1824	1966	1996
Public sector loans (net)		669	346	587	524	616	616
BNB loans (net)		565	380	600	500	550	580
Private and other loans (net)		948	800	800	800	800	800
Growth in forex reserves		916					
Nonfinancial public sector							
Total revenue and aids (current transfers excluded)		4001					
Including aids		203	250	300	300	300	300
Total expenditure (current transfers excluded)		4152					
Current consumption		1914					
Investment		1076					
Interest payments on domestic debt		208	220	238	254	267	280
Interest payments on foreign debt		690	605	657	686	873	959
Loans (net)		264	200	200	200	150	150
Balance on other items from nonfinancial public sector		-62	-65	-68	-72	-75	-79
Overall balance (external aids excluded)		-415					
Overall balance (external aids included)		-212					
Financing		212					
Foreign financing, net		669	346	587	524	616	616
Net domestic financing from BNB		-208	-260	-100	-50	-60	-65
Net domestic financing from commercial banks		-145	-100	0	0	0	0
Other financing		-103					

(continued)

(continued) (million levs unless stated otherwise)

	1998	1999	2000	2001	2002	2003	2004
Memorandum items:							
Current consumption as a share of GDP (%)		8.4	8.4	8.4	8.4	8.4	8.4
Investment as a share of GDP (%)		4.7	4.7	4.8	5.0	5.0	5.0
Banking sector							
I. Monetary survey							
Assets	6597	7351					
Net foreign assets	5499	6151					
Net domestic assets	1098	1201					
Liabilities	6597	7351					
Narrow money (M1)	2756	2997					
Currency circulation	1742	1957					
Demand deposits	1014	1039					
Quasi-money	3842	4354					
Time and savings deposits	3425	3917					
Import and restricted deposits	417	437					
II. BNB							
Assets	2387	2722					
Net foreign assets	3645	3996					
Net domestic assets	-1258	-1274					
Claims on government, net	-282	-490	-750	-850	-900	-960	-1025
Claims on private sector	230	230					
Other assets, net	-1205	-1014					

(continued)

(continued) (million levs unless stated otherwise)

	1998	1999	2000	2001	2002	2003	2004
Liabilities	2387	2722					
Reserve money	2387	2722					
Currency circulation	1742	1957					
Commercial bank vaults	103	122					
Bank reserves	542	642					
Memorandum items:							
Gross forex reserves in months of imports	#N/A	6.4	6.3	6.1	6.0	6.0	6.0
Bank reserves/demand and time deposits (%)	14.5	15.4					
Bank reserves and commercial bank vaults/demand deposits + savings and time deposits (%)	14.5	15.4	12.4	12.4	9.4	9.4	9.4
Currency circulation/demand deposits (%)	171.9	188.3	188.3	188.3	188.3	188.3	188.3
Time deposits/demand deposits (%)	337.9	376.9	376.9	376.9	376.9	376.9	376.9
Money multiplier	1.15	1.10	1.16	1.16	1.24	1.24	1.24
Price indices and exchange rate							
Prices of domestic goods (end of period)	0.97	1.03	1.123	1.196	1.260	1.311	1.350
Prices of domestic goods (end of period, recalculated)	0.94	1.00	1.090	1.161	1.224	1.272	1.311
Prices of domestic goods (annual average)	1.13	1.00	1.046	1.159	1.228	1.29	1.33
GDP deflator	0.98	1.00					
Consumer goods prices	0.98	1.00					
Investment goods prices	1.05	1.00					
Imported goods prices	0.99	1.00	1.020	1.040	1.072	1.104	1.137
Exported goods prices	1.08	1.00	1.014	1.035	1.057	1.079	1.101
Exchange rate (BGN/USD)	0.95	1.00					
Nominal exchange rate (BGN/USD)	1.76	1.85					

Table 10

BULGARIA: MATRIX OF COEFFICIENTS

	Real capital stocks k(t)	Real output ln ql(t) -ln ql(t-1)	Employment ln l(t) -ln l(t-1)	Real individual consumption ln cp(t) -ln cp(t-1)	Real imports ln (m(t) -mp(t))	Real money demand ln M(t) -ln P(t)	Consumer prices PC(t)	Investment prices PI(t)	Supply-side inflation P(t)/P(t-1)-1
Constant		0.016	0.015	-0.02		-0.20			
i(t)	1.00								
k(t-1)	0.85								
ln k(t)-ln k(t-1)		0.55							
ln l(t)-ln l(t-1)		0.45							
ZQT(t)		1.00							
ln cp(t-1)-ln cp(t-2)				0.08					
ln ydp(t)-ln ydp(t-1)				0.83					
ln yd(t)-ln yd(t-1)						0.59			
ln(PM(t)*E(t)/P(t))					-0.464				
ln P(t)-2 ln P(t-1)+ln P(t+2)						-0.20			
P(t)							0.20	0.40	
PM(t)							0.80	0.60	
CP(t)+CG(t)					0.55				
IT(t)					0.20				
P(t-1)/P(t-2)-1									0.50
q(t)/ql(t)-1									4.00

cp	real individual consumption
cg	real collective consumption
E	exchange rate (BGN/USD)
M1	money supply

i	real investment
k	real capital stocks
m	real imports of goods and nonfactor services
P	price level of domestic output supplied in Bulgaria
PC	price level of consumer goods
PI	price level of investment goods
PM	price level of imported goods and nonfactor services
q	real output (GDP)
ql	long-term real output (GDP)
yd	real national disposable income
ydp	real private disposable income
ZQT	total factor productivity growth

Table 11

BULGARIA: TARGET AND INSTRUMENTAL VARIABLES

(% unless stated otherwise)

	Reporting 1999	Estimate 2000	Forecast 2001	Forecast 2002	Forecast 2003	Forecast 2004
Target variables						
Short-term real GDP growth	2.5	5.3	3.7	5.3	4.9	5.1
Long-term real GDP growth	3.5	4.5	5.0	5.0	5.0	5.0
Inflation (end of period)	6.2	9.0	6.5	5.4	4.0	3.0
Gross forex reserves in months of imports	6.4	6.3	6.1	6.0	6.0	6.0
Instrumental variables						
Minimum required reserves	15.4	12.4	12.4	9.4	9.4	9.4
BNB net domestic assets, million levs	-1274	-1849	-2631	-3368	-4109	-4906
BNB net foreign assets, million levs	3996	4726	5782	6615	7603	8639
Internal financing of nonfinancial public sector, million levs	-457	48	-228	-442	-780	-1086
Internal financing of nonfinancial public sector as a share of GDP						
Overall balance (including aids)	-0.9	-1.6	-1.4	-0.5	0.2	0.9
Total revenue	17.6	15.9	16.1	17.0	17.9	18.6
Total expenditure	18.2	17.2	17.3	17.3	17.5	17.5
Other major variables			**Share of GDP**			
BOP current account	-5.6	-4.9	-5.9	-5.3	-5.1	-4.8
BOP capital account	9.6	6.3	7.6	6.5	6.6	6.2
Investment	15.9	16.9	18.0	17.9	18.0	17.9
Private investment	11.2	12.2	13.2	12.9	13.0	12.9
Government investment	4.7	4.7	4.8	5.0	5.0	5.0
Consumption	88.7	90.1	90.2	89.8	89.2	88.5
Individual consumption	80.3	81.7	81.8	81.4	80.8	80.1
Collective consumption	8.4	8.4	8.4	8.4	8.4	8.4
			Growth			
Reserve money	14.0	5.7	9.5	3.0	7.6	6.8
Money demand (M1)	8.7	11.8	9.5	9.4	7.6	6.8
Real individual consumption	2.5	6.7	4.2	4.3	3.5	3.7
Real private investment	-6.5	15.4	10.6	3.2	5.0	4.9
Real capital stocks	2.3	4.0	4.9	4.9	4.9	4.9
Total factor productivity	1.6	1.6	1.6	1.6	1.6	1.6
GDP deflator	1.6	8.0	4.7	7.2	5.7	4.9
Consumer prices (annual average)	1.8	8.5	4.3	7.8	6.2	5.5

Table 12

BULGARIA: MODEL SIMULATION RESULTS

(million levs at current prices unless stated otherwise)

	Reporting 1999	Estimate 2000	Forecast 2001	Forecast 2002	Forecast 2003	Forecast 2004
Real sector						
Resources	34595	39465	43214	48633	53722	58981
Gross domestic product	22776	25920	28154	31783	35247	38868
Imports of goods and nonfactor services	11818	13545	15060	16849	18476	20113
Expenditure	34595	39465	43214	48633	53722	58981
Individual consumption	18288	21182	23017	25879	28470	31143
Collective consumption	1914	2177	2365	2670	2961	3265
Private investment	2557	3173	3715	4114	4572	5033
Public (government) investment	1076	1218	1351	1589	1762	1943
Change in stocks	707	0	0	0	0	0
Exports of goods and nonfactor services	10054	11714	12766	14381	15957	17597
Memorandum items:						
National disposable income	23275	25656	29507	32966	36063	39080
Private sector disposable income	19274	22484	24283	27309	29998	32828
External sector						
Current account	-1266	-1262	-1656	-1695	-1799	-1866
Exports of goods and nonfactor services	10054	11714	12766	14381	15957	17597
Imports of goods and nonfactor services	11818	13545	15060	16849	18476	20113
Factor services	296	197	164	232	115	29
External support and transfers	203	371	474	542	605	622

(continued)

(continued) (million levs at current prices unless stated otherwise)

	Reporting 1999	Estimate 2000	Forecast 2001	Forecast 2002	Forecast 2003	Forecast 2004
Capital account	2182	1638	2149	2074	2314	2417
Public sector loans (net)	669	371	635	596	725	746
BNB loans (net)	565	408	649	568	647	702
Private and other loans (net)	948	859	865	909	942	969
Change in forex reserves	916	376	493	379	515	552
Nonfinancial public sector						
Total revenue (current transfers excluded)	4001	4111	4526	5411	6298	7219
Including aids	203	268	324	341	353	363
Total expenditure (current transfers excluded)	4152	4465	4865	5493	6168	6800
Current consumption	1914	2177	2365	2670	2961	3265
Investment	1076	1218	1351	1589	1762	1943
Interest payments on domestic debt	208	220	238	254	267	280
Interest payments on foreign debt	690	650	711	780	1028	1161
Loans (net)	264	200	200	200	150	150
Balance on other items from nonfinancial public sector	-62	-65	-68	-72	-75	-79
Overall balance (external aids excluded)	-415	-687	-731	-495	-299	-24
Overall balance (external aids included)	-212	-419	-407	-154	55	340
Financing	212	419	407	154	-55	-340
Foreign financing (net)	669	371	635	596	725	746
Net domestic financing from BNB	-208	-260	-100	-50	-60	-65
Net domestic financing from commercial banks	-145	-100	0	0	0	0
Other financing	-103	407	-128	-392	-720	-1021

(continued)

(continued) (million levs at current prices unless stated otherwise)

	Reporting 1999	Estimate 2000	Forecast 2001	Forecast 2002	Forecast 2003	Forecast 2004
BNB						
Assets	2722	2877	3151	3247	3495	3733
Net foreign assets	3996	5075	6254	7520	8948	10461
Gross official reserves	6272	7111	7655	8425	9238	10056
Net domestic assets	-1274	-2198	-3103	-4273	-5454	-6728
Claims on government (net)	-490	-750	-850	-900	-960	-1025
Other assets (net)	-1014	-1014	-1014	-1014	-1014	-1014
Liabilities (reserve money)	2722	2877	3151	3247	3495	3733
Memorandum items:						
Money demand (M1)	2997	3351	3670	4014	4320	4614
Money multiplier	1.10	1.16	1.16	1.24	1.24	1.24
Gross forex reserves in months of imports	6.4	6.3	6.1	6.0	6.0	6.0

Table 13

BULGARIA: MODEL SIMULATION RESULTS

(share of GDP, %)

	Reporting 1999	2000	2001	2002	2003	2004
Real sector						
Resources	151.9	152.3	153.5	153.0	152.4	151.7
Gross domestic product	100.0	100.0	100.0	100.0	100.0	100.0
Imports of goods and nonfactor services	51.9	52.3	53.5	53.0	52.4	51.7
Expenditure	151.9	152.3	153.5	153.0	152.4	151.7
Individual consumption	80.3	81.7	81.8	81.4	80.8	80.1
Collective consumption	8.4	8.4	8.4	8.4	8.4	8.4
Private investment	11.2	12.2	13.2	12.9	13.0	12.9
Public (government) investment	4.7	4.7	4.8	5.0	5.0	5.0
Change in stocks	3.1	0.0	0.0	0.0	0.0	0.0
Exports of goods and nonfactor services	44.1	45.2	45.3	45.2	45.3	45.3
Memorandum items:						
National disposable income	102.2	99.0	104.8	103.7	102.3	100.5
Private sector disposable income	84.6	86.7	86.3	85.9	85.1	84.5
External sector						
Current account	-5.6	-4.9	-5.9	-5.3	-5.1	-4.8
Exports of goods and nonfactor services	44.1	45.2	45.3	45.2	45.3	45.3
Imports of goods and nonfactor services	51.9	52.3	53.5	53.0	52.4	51.7
Factor services	1.3	0.8	0.6	0.7	0.3	0.1
External support and transfers	0.9	1.4	1.7	1.7	1.7	1.6
Capital account	9.6	6.3	7.6	6.5	6.6	6.2
Public sector loans (net)	2.9	1.4	2.3	1.9	2.1	1.9
BNB loans (net)	2.5	1.6	2.3	1.8	1.8	1.8
Private and other loans (net)	4.2	3.3	3.1	2.9	2.7	2.5

(continued)

(continued) (share of GDP, %)

	Reporting 1999	2000	2001	2002	2003	2004
Change in forex reserves	4.0	1.5	1.8	1.2	1.5	1.4
Nonfinancial public sector						
Total revenue (current transfers excluded)	17.6	15.9	16.1	17.0	17.9	18.6
Including aids	0.9	1.0	1.2	1.1	1.0	0.9
Total expenditure (current transfers excluded)	18.2	17.2	17.3	17.3	17.5	17.5
Current consumption	8.4	8.4	8.4	8.4	8.4	8.4
Investment	4.7	4.7	4.8	5.0	5.0	5.0
Interest payments on domestic debt	0.9	0.8	0.8	0.8	0.8	0.7
Interest payments on foreign debt	3.0	2.5	2.5	2.5	2.9	3.0
Loans (net)	1.2	0.8	0.7	0.6	0.4	0.4
Balance on other items from nonfinancial public sector	-0.3	-0.3	-0.2	-0.2	-0.2	-0.2
Overall balance (external aids excluded)	-1.8	-2.7	-2.6	-1.6	-0.8	-0.1
Overall balance (external aids included)	-0.9	-1.6	-1.4	-0.5	0.2	0.9
Financing	0.9	1.6	1.4	0.5	-0.2	-0.9
Foreign financing (net)	2.9	1.4	2.3	1.9	2.1	1.9
Net domestic financing from BNB	-0.9	-1.0	-0.4	-0.2	-0.2	-0.2
Net domestic financing from commercial banks	-0.6	-0.4	0.0	0.0	0.0	0.0
Other financing	-0.5	1.6	-0.5	-1.2	-2.0	-2.6
BNB						
Assets	11.9	11.1	11.2	10.2	9.9	9.6
Net foreign assets	17.5	19.6	22.2	23.7	25.4	26.9
Net domestic assets	-5.6	-8.5	-11.0	-13.4	-15.5	-17.3
Claims on government (net)	-2.2	-2.9	-3.0	-2.8	-2.7	-2.6
Other assets (net)	-4.5	-3.9	-3.6	-3.2	-2.9	-2.6
Liabilities (reserve money)	11.9	11.1	11.2	10.2	9.9	9.6

Table 14

BULGARIA: MODEL SIMULATION RESULTS

(million levs at 1999 prices unless stated otherwise)

	Reporting 1999	2000	2001	2002	2003	2004
Real sector						
Resources	34595	36360	38273	40039	41715	43502
Gross domestic product	22776	23993	24889	26207	27492	28891
Imports of goods and nonfactor services	11818	12367	13384	13832	14223	14611
Expenditure	34595	36360	38273	40039	41715	43502
Individual consumption	18288	19514	20332	21210	21963	22776
Collective consumption	1914	2006	2089	2188	2284	2388
Private investment	2557	2950	3262	3367	3534	3706
Public (government) investment	1076	1133	1187	1300	1362	1431
Change in stocks	707	0	0	0	0	0
Exports of goods and nonfactor services	10054	10758	11403	11973	12572	13201
Memorandum items:						
National disposable income	23275	24519	25453	26844	28053	29374
Private sector disposable income	19274	20714	21451	22383	23141	24009
Short-term real GDP growth	2.5%	5.3%	3.7%	5.3%	4.9%	5.1%
Long-term (potential) GDP growth	3.5%	4.5%	5.0%	5.0%	5.0%	5.0%
Exports of goods and nonfactor services growth	-2.6%	7.0%	6.0%	5.0%	5.0%	5.0%
Imports of goods and nonfactor services growth	-6.4%	4.6%	8.2%	3.3%	2.8%	2.7%

(continued)

(continued) (million levs at 1999 prices unless stated otherwise)

	Reporting 1999	2000	2001	2002	2003	2004
Changes in prices and exchange rate						
Prices of domestic goods (end of period)	6.2%	9.0%	6.5%	5.4%	4.0%	3.0%
GDP deflator	1.6%	8.0%	4.7%	7.2%	5.7%	4.9%
Consumer goods prices	1.8%	8.5%	4.3%	7.8%	6.2%	5.5%
Investment goods prices	-4.6%	7.6%	5.9%	7.3%	5.9%	5.0%
Imported goods prices	0.7%	2.0%	2.0%	3.0%	3.0%	3.0%
Exported goods prices	-7.7%	1.4%	2.1%	2.1%	2.1%	2.1%
Exchange rate (BGN/USD)	5.1%	7.4%	0.7%	5.1%	3.5%	2.9%

Table 15

BULGARIA: MODEL SIMULATION RESULTS CONCERNING EXTERNAL SECTOR

(million USD)

	Reporting 1999	Estimate 2000	Forecast 2001	Forecast 2002	Forecast 2003	Forecast 2004
External sector						
Current account	-685	-635	-828	-806	-827	-833
Exports of goods and nonfactor services	5437	5899	6383	6841	7332	7858
Imports of goods and nonfactor services	6391	6821	7530	8015	8489	8982
Factor services	160	99	82	110	53	13
External support and transfers	110	187	237	258	278	278
Capital account	1180	825	1075	986	1063	1080
Public sector loans (net)	362	187	318	284	333	333
BNB loans (net)	306	205	324	270	297	314
Private and other loans (net)	513	433	433	433	433	433
Change in forex reserves	496	189	247	180	237	246

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