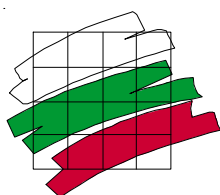


# WORKING PAPER SERIES

## **THE NEED FOR ECONOMIC MODELS IN ECONOMIC POLICY MAKING**

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## **1. Introduction**

Economic models can be extremely useful in the process of economic policy making. At the same time it should be emphasised that economic models should never be seen as a panacea for solving all kinds of economic problems. This paper discusses to what extent economic models could act as a useful tool in order to improve the quality in the process of economic policy making. For this purpose we will use the medium term annual model of the Bulgarian economy that recently has been developed at the Agency of Economic Analysis and Forecasting of the Bulgarian Ministry of Finance viz. the AEAF Model. (see for a detailed description Agency for Economic Analysis and Economic Forecasting (2003a)). The plan of this paper is as follows. In section 2 we shall present a brief overview of the determining factors that have been responsible for the economic upturn in the Western European economies after the Second World War. The main purpose of this section is to show to what extent macroeconomic policy, and hence the use of macroeconomic models, can be helpful in stimulating economic growth and employment. In the next section we will discuss the main characteristics of the AEAF Model. Section 4 presents a brief overview of the benefits and limitations of making forecasts with economic models whereas section 5 shows how the AEAF model can be used for making economic forecasts. In this section discussed not only the advantages but also the limitations of such forecasts. In section 6 we shall deal with the use of the AEAF Model in the process of economic policy making. Shown is how simulations of fiscal policies with the AEAF model can improve our understanding of its effects on the Bulgarian economy. Section 7 contains a discussion of other policies whereas the paper ends in section 8 with some concluding remarks.

## **2. Determining Factors for Western European Growth**

From the perspective of Central Europe there is no doubt that Western Europe is relatively prosperous. Most of this prosperity evolved after the Second World War. Hence it seems useful to discuss briefly which key factors have been responsible for this development. Table 2.1 shows an overview of ten key determining factors of post-war economic growth in Western Europe. They are presented in at random order because it is very difficult, if not impossible, to quantify the relative importance of these ten key factors. In this respect it should be noted that the ten factors are interrelated. For instance, a market economy can only flourish under the conditions of solid macroeconomic and microeconomic policies. In addition, economics insights based on economic theory may differ. Some economists, for instance, will argue that technological progress is to a large extent (up to about fifty per cent!) responsible for the rate of economic growth whereas others will argue that a proper working market economy or solid macroeconomic policies should be seen as the dominating determining factor. And there is also the issue of progress in economic science. In the 1950s and 1960s the factor „solid macroeconomic policies“ had a quite different meaning than in the 1980s and 1990s. In the first mentioned period there

was a general agreement among economists that Keynesian policies directed at a stimulation of demand could prevent economies from stagnation.

**Table 2.1 Ten Key Determining Factors for Economic Growth**

Relevant factors in at random order	Main elements
1) Technological progress	– Embodied in physical and human capital or disembodied as an autonomous growth determinant.
2) Physical capital	– Cumulated investments for which profits are the dominant way of financing. Especially related to the factors 1, 4, 5 and 6.
3) Human capital	– A good educational system providing a well equipped labour force. Related to factors 1 and 4.
4) Market economy	– A proper working price mechanism is the fundamental condition for the market economy resulting in flexible markets for labour, goods and services. Related to the factors 5, 6 and 7.
5) Solid macroeconomic policies	– Consistent monetary and fiscal policies based on the state of the art of economic insights such as supply-side and monetary economics. Especially related to factors 4, 6 and 8.
6) Solid microeconomic policies	– Microeconomic policies directed at improving the working of the market economy i.e. more flexibility in markets for goods, services and labour. Privatisation of state owned enterprises etc. Especially related to factors 4 and 7.
7) Good legislation	– Laws in which property, conditions of labour, relations between enterprises and the government (taxes, environment etc.) are clear with avoiding red tape. Related to factors 4 and 6.
8) European integration	– Free traffic of goods, labour and capital and one single currency. Related to factors 4, 5 and 7.
9) Relative stable social environment	– Cooperation between the government and the social partners (i.e. employer organisations and trade unions) directed at the common goal to improve welfare. Related to factors 4, 5 and 6.
10) Government investments in infrastructure	– These type of investments can provide the conditions for a better working of the entire national or EU economy. Especially related to factors 2, 4 and 8.

However, real events in the 1970s, characterised by stagflation i.e. the combination of low rates of economic growth in combination with high rates of inflation, caused the bankruptcy of Keynesian economics. It became then apparent that increasing government budget deficits and an increasing tax

burden to finance the continuously growing share of public spending as a percentage of GDP did increase the economic problems instead of diminishing it. Hence, in the 1980s and 1990s the insights of supply-side, monetarist and new classical economics became the new fashion in practical economic policy making.

No doubt, the process of European integration did play a major role in the development of Western Europe. Recent examples of its success are the introduction of the euro but also the joining of the European Community of new member states in the mid 1980s (Ireland, Portugal and Spain). The ongoing enlargement of the European Union with Central European States will certainly benefit the new as well the older member states. All in all, the post-war economic performance in Western Europe can be characterised as a success story. It should be emphasised, however, that the ten mentioned key factors that were responsible for this success should be handled with care since they gained their role by trial and error. Macroeconomic policies, and hence macroeconomic models as a tool in the process of economic policy preparation, are important. But their role should not be exaggerated. Other factors are important as well.

**3. The AEAF Medium Term Model**

Table 3.1 contains a summary of the main characteristics of the AEAF model for the Bulgarian economics. As shown, the model contains seven interdependent blocks. The main feature of the model is that it contains not only the traditional (Keynesian) demand side but also the supply side based on the insights of supply-side economics and neoclassical growth theory. In addition, the model contains a monetary block, and as a result also the interactions between the real and monetary sectors of the economy. This makes it possible to analyse for example, the monetary and real consequences of the current account of the balance of payment and foreign direct investments. In a nutshell the seven blocks can be described as follows. The *first block* represents the supply side of the economy. It contains a two-level CES production function. The first level describes the relation between GDP production capacity on the one hand and efficiency units of the total capital stock and labour on the other hand. The second level aggregates private sector and public sector capital stocks to total capital stock. Utilization rates are derived through minimising short-term costs with given production, labour and capital stocks. Planned capacity is related to (expected) sales and to the difference between foreign prices and cost per unit of output of domestic production. This difference can be seen as an indicator of profitability.

**Table 3.1 Main Characteristics of the AEAF Model**

Blocks of equations	Main characteristics
1) Supply-side	– Determination of production capacity (potential demand in the absence of excess capacity) and

- excess capacity (production capacity minus real GDP). The capital stock (cumulated investments), labour and technological process determine production capacity within a CES production function.
- 2) Domestic demand
    - Equations for private consumption and private investments based on, among others, disposable income of households, profits and monetary factors (interest rates and money).
  - 3) Foreign sector
    - Determination of foreign trade, i.e. exports and imports of goods and services by world trade, competitive position and excess capacity.
  - 4) Wages and prices
    - Determination of wages by the inflation rate, labour productivity, shifting forward of direct taxes and social security contributions and the Phillips curve (unemployment rate). Prices are determined by labour costs, capital costs and indirect taxes.
  - 5) Labour market
    - Equations for the demand for and the supply of labour based on labour costs (real wages), desired capacity and the growth rate of the population. This block is completely consistent with the supply side block which is based on a CES production function.
  - 6) Government block
    - This block describes the relations between taxes, labour income and profits, social security benefits and wages and social premiums paid by employers and employees. As a result the government budget deficit as well as the burden of taxation can be defined.
  - 7) Monetary sector
    - This block is based on a money multiplier model for an open economy in which the money supply is determined by the behaviour of the banking sector, the foreign sector and the monetary authorities and money demand by the behaviour of the private sector. As a result interest rates and money can spill over to domestic demand and vice versa.
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The second block provides a rather conventional determination of effective domestic demand. Consumption expenditure is explained by disposable income of households. In addition a so-called spill-over effect from the monetary sphere is included. This effect represents over- (under-) liquidity of households. Total investment is divided into government investment and private investment. Government investment is assumed exogenous in values and can be treated as a policy variable. Since prices of government investment are determined endogenously within the model government investments in constant prices are treated endogenously. The changes in private investment are dominated by the flexible accelerator mechanism, in which desired capacity and expected capital costs determine the planned capital stock; an additional determinant is the utilization rate. Here as well as in

the case of private consumption excess money supply (demand) represent, in addition to the interest rates that play a role in capital costs, monetary influences. Changes in stocks are related to sales and the lagged stock (flexible accelerator). Also prices of commodity imports (speculation) and the utilization rate (precaution) play a role.

The *third block* describes the trade relations with abroad. World trade (that is total world imports weighted by the relative share of Bulgarian exports to the various world regions), relative prices and home pressure of demand explain exports of goods. Exports of services are determined endogenously as well, and its main determinants are world imports and relative prices. Total imports are divided into two categories: imports of goods and imports of services. Imports of goods are explained by total domestic sales, relative prices (domestic versus import prices) and a variable representing home pressure of demand. The latter reflects that imports tend to increase relatively fast when domestic demand is in excess of domestic supply. Imports of services follow disposable income corrected for different price developments domestically and abroad.

Wages and prices are determined in the *fourth block*. Domestic cost per unit of output, that is the sum of capital- and wage costs, and import costs determine market prices (consumption, investment, etc.). In a few of these price equations such as in the case of private consumption indirect taxes play a role as well. Here it should be mentioned that through prices cost per unit of output play an extremely important role in the model. It is the main determinant of prices and through them of the competitiveness of the Bulgarian economy. The costs per unit of output are determined through cost minimization under the assumption of an exogenous public sector capital stock. As a result the productivity per unit of private owned capital and labour declines if the capital stock of the public sector lags behind. In some policy simulations this effect is quite significant such as in the case of increasing government investments. The GDP deflator is determined on the basis of the definitional relationship.

The private wage rate equation implies full compensation of consumption prices, compensation of labour productivity, a complete shifting of the burden of taxes and premiums for social security to employers and a Phillips-curve effect reflected by the unemployment rate. The government wage rate follows the private wage rate with some time lag.

The *fifth block* contains private labour demand and –supply. Labour demand is related to the desired capacity and labour costs developments in comparison with overall cost developments. Labour supply is based on an endogenous participation rate, on which the differences between real wages and alternative income has a positive and labour market tension has a negative impact. In some versions of the model labour supply is based on population growth only. *Block six* describes the government sector. Social benefits follow wage rate developments. Total premiums follow the social benefits



corrected by government payments. The shares of premiums paid by employers and employees depend on the unemployment rate. Taxes are endogenous. The expenditures in current prices are exogenous as well as government employment.

Money supply and demand are determined in the *seventh block*. The main feature is a money multiplier model, in which the main inputs for money supply are the surplus (deficit) on the current account and the surpluses (deficits) on the financial accounts of the balance of payments. In addition the behaviour of the private banks is explained through shifts in its portfolios has an impact on supply. Money demand follows behaviour of the public regarding its optimum portfolios. The monetary sub-model determines the various interest rates that on their turn have an impact on several domestic demand categories. The major spill-over from the real to the monetary sector is total domestic demand reflecting the transaction motive of the public. The channels through which the monetary variables have an impact on the real sphere are the interest rates and a variable reflecting over- or under-liquidity of the economy.

#### **4. Forecasting the Economy with Economic Models**

The AEF-model provides a proper tool for making medium term forecasts for the Bulgarian economy. Before we will demonstrate this some general remarks must be made. First of all it should be emphasised that nobody can predict the future. Using economic models in making economic forecasts may suggest certain preciseness because it gives a lot of detailed quantified information for the future. Of course, these forecasts should never be interpreted as being the absolute truth. In the Netherlands the Central Planning Bureau (the Netherlands Bureau for Economic Policy Analysis) has a long tradition in making forecasts for the Dutch economy. Recently the Central Planning Bureau has analysed the quality of its annual forecasts for the 1971–1997 period (see Central Planning Bureau (1999)). The conclusions are as follows. It appeared that the annual forecasts made for the Dutch economy have been better than so-called naive forecasts in which for the forecasted figures simply the realised figures of the previous period would be used. Table 4.1 shows the quality of the annual forecasts for the growth rate of Dutch GDP made by the Central Planning Bureau (in September), the European Union (in November) and the OECD (in December). In this table the following three benchmarks are used for the quality of the forecasts viz.:

- 1) the average value of the difference between forecasts and realisation;
- 2) the absolute value of the difference between forecasts and realisation;
- 3) the so called inequality coefficient defined as the root mean square of the forecasts dividend by the root mean square of naive forecasts in which the forecasts are the realised figures for the previous year. This means that the lower this coefficient, the better the quality of the forecast.

When the coefficient is larger than one the quality of the forecasts is worse than the quality of naïve forecasts.

As can be seen there are no big differences in the quality of the forecasts made by the CPB, the EU and the OECD. Also the forecasts are better than naive forecasts because the inequality coefficient is in all three cases lower than one. It should be noted, however, that the quality of the forecasts is only slightly better than the naive forecasts. For this reason the Central Planning Bureau analysed the sources of the forecasting errors in the past (see Central Planning Bureau (2000)). It was found that the main source for errors was caused by forecasting errors in foreign variables such as the growth rate of world trade and oil prices. Table 4.2 makes this perfectly clear. According to the Central Planning Bureau the quality of the forecasts would improve with about 40 per cent (in terms of the average absolute forecast error) if it would be possible to forecast foreign variables perfectly. Table 4.2 also shows that for obvious reasons, the quality of the forecasts improves substantially when the autumn forecasts for the next year is followed by an update in the spring of the forecasted year. All in all this section suggests that making forecasts with economic models makes certainly sense. At the same time these forecasts should in practise be handled with care because perfect forecasts simply do not exist.

**Table 4.1 Quality of autumn forecasts for Dutch GDP growth in the next year**

	average		average		inequality	
	forecast error		absolute forecast error		coefficient	
	1974-1984	1985-1997	1971-1984	1985-1997	1971-1984	1985-1997
CPB (September)	0.3	- 0.5	1.5	1.0	0.7	0.9
EU (November)	--	- 0.7	--	0.9	--	0.9
OECD (December)	- 0.1	- 0.7	1.5	0.9	0.7	0.9

Source: Central Planning Bureau (1999), page 153

**Table 4.2 Quality of autumn and spring forecasts**

	average		average		inequality	
	forecast error		absolute forecast error		coefficient	
	autumn	spring	autumn	spring	autumn	spring
	annual percentage changes					
real GDP and inflation	0.1	0	0.8	0.5	0.8	0.6
world trade	-0.3	-1.0	2.1	1.6	0.7	0.5
foreign prices	2.6	0.4	4.2	2.0	0.7	0.4
exchange rate \$	1.4	-1.0	9.5	6.0	0.8	0.5
oil price	6.1	-1.0	17.5	9.0	1.0	0.7

Source: Central Planning Bureau (2000), page 156

## 5. Forecasting the Bulgarian Economy

Table 5.1 contains a forecast (i.e. a central projection) for the Bulgarian economy made with the AEAF model for the period 2003 up to and including 2010. As shown, the exogenous variables such as the growth rate of world trade and foreign prices (i.e. import prices and prices of foreign competitors) have been given values, which seem plausible at this very moment. We have assumed for the growth rate of world trade, for instance, that it will increase with a modest 2% in 2003 and that it will accelerate to an average growth rate of 4% per annum in the period 2004-2015. For foreign prices we have assumed that they will increase with 4% annum. In addition, we made the assumptions that the exchange rate of the leva vis-à-vis the euro and the exchange rate of the euro vis-à-vis the dollar on average will not change in the forthcoming years. Finally, it is assumed that oil prices will remain constant. On the basis of this quantification of the exogenous variables we have simulated a central projection for the endogenous variables with the AEAF model. As shown in table 5.1 this means that, for instance, real GDP in Bulgaria will increase with 4% in 2003 while it will accelerate to about 5% in the following years. After 2010 it slows down to an average of 2.5% per annum. Table 5.1 also shows that the Bulgarian inflation rate will be on average about 3½% per annum and that the unemployment rate will only slightly decrease. It should be emphasised that the presented central projection is obtained under the condition of a neutral (or constant) policy mix of the Bulgarian government. This means, for instance, that the tax burden as a percentage of GDP will not increase, that the present link between the leva and the euro under the currency board will be preserved and that all other policies will remain unchanged.

**Table 5.1: Baseline scenario 2003 – 2015**

	2003	2004	2005	2010	2015
<i>Percentage changes per annum</i>					
GDP	4.34	5.19	5.34	2.45	1.69
Production capacity	2.77	2.88	2.39	1.82	2.16
Private consumption	4.90	4.72	6.23	2.99	2.73
Disposable income households	8.39	9.78	9.94	7.41	8.04
Exports G&S	5.68	5.85	4.56	3.14	2.14
Investment	2.52	1.18	4.43	-0.53	-1.08
Wage rate	12.95	9.45	10.64	7.23	8.13
Deflator private consumption	2.30	3.25	3.50	4.29	5.37
GDP deflator	3.19	4.09	4.08	4.81	6.13
Employment	0.71	1.36	0.75	-0.15	0.14
<i>Absolute levels</i>					
Unemployment	16.72	15.59	14.95	13.38	12.44
Current account BoP, % GDP	-2.93	-1.15	-0.90	-1.01	-1.19
Government Deficit, % GDP	3.33	2.46	1.54	-0.84	-1.83

As argued in the previous section economic forecasts should be handled with care. Therefore it is perhaps better to interpret the central projection not so much as a forecast for the Bulgarian economy but rather as a plausible scenario for the coming years. It is also obvious that the assumed growth rate for world trade can easily be smaller or bigger. The same is true for foreign prices whereas it seems plausible that the U.S. dollar will depreciate further vis-à-vis the euro. It is possible to construct an additional, so-called cautious scenario for the Bulgarian economy by combining the central projection with some so-called „uncertainty simulations“. At this very moment -mid 2003- there is, given the present stagnation in Western European economies such as Germany, France and the Netherlands, a real possibility that the relevant world trade growth for Bulgaria will be less than has been assumed in the central projection. The same is true for foreign prices because, as said before, a further depreciation of the U.S. dollar vis-à-vis the euro can occur. For this reason this section contains two uncertainty simulations viz. an annual 1 per cent decrease in world trade presented in table 5.2 and an annual 1 per cent decrease in foreign prices (i.e. a further depreciation of the U.S. dollar) presented in table 5.3. The effects of these two uncertainly simulations can be combined with the central projection in table 5.1 in order to obtain a cautious medium term scenario for the Bulgarian economy.

**Table 5.2: A permanent decrease in the growth rate of world trade by 1 per cent**

	2003	2004	2005	2010	2015
<i>Cumulated as % of baseline</i>					
GDP	-0.71	-0.81	-0.86	-1.29	-1.77
Production Capacity	-0.26	-0.40	-0.53	-1.07	-1.64
Private Consumption	-0.84	-1.15	-1.41	-2.68	-4.13
Disposable Income Households	-1.56	-2.24	-2.90	-6.36	-10.31
Exports G&S	-1.90	-2.19	-2.43	-3.67	-4.75
Investment	-0.78	-1.07	-1.31	-2.39	-3.58
Wage rate	-1.05	-1.64	-2.23	-5.24	-8.63
Deflator private consumption	-0.64	-1.07	-1.52	-3.77	-6.27
GDP deflator	-0.86	-1.42	-2.00	-4.96	-8.31
Employment	-0.29	-0.43	-0.57	-1.06	-1.59
<i>Absolute difference from baseline</i>					
Unemployment	0.24	0.37	0.49	0.93	1.40
Current account BoP, % GDP	-0.31	-0.31	-0.31	-0.35	-0.29
Government Deficit, % GDP	0.34	0.42	0.48	0.66	0.71

Table 5.2 shows that a slowdown in the growth rate of world trade by 1 per cent per annum has negative consequences for the Bulgarian exports of goods and services. This decrease in external demand will induce a decrease in Bulgarian domestic demand (consumption and investments) and overall GDP growth. The decreasing external and domestic demand will depress wages and prices resulting in an improving Bulgarian competitive position which compensates partly the decrease in exports as a result of the lower growth rate of world trade. This simulation makes perfectly clear that

ultimately less world trade will have negative consequences for the Bulgarian economy such as a decline of real GDP and an increase in the unemployment rate. A permanent decrease in foreign prices by 1 per cent per annum as shown in table 5.3 will harm the Bulgarian export of goods and services as well. As a result real GDP will decline with about 0,35 per cent in the medium run while at the same time the inflation rate will decrease with about 1.75 per cent. It should be noted, however, that in the long run the decrease in foreign prices will only have very small effects on the real sector of the Bulgarian economy whereas the main result will be a lower Bulgarian inflation rate.

**Table 5.3: A permanent decrease in foreign prices by 1 per cent**

	2003	2004	2005	2010	2015
<i>Cumulated as % of baseline</i>					
GDP	-0.12	-0.58	-0.94	-1.12	-1.47
Production Capacity	-0.02	-0.09	-0.23	-0.80	-1.20
Private Consumption	0.03	-0.15	-0.60	-1.79	-3.08
Disposable Income Households	-0.33	-1.42	-2.87	-10.69	-19.54
Exports G&S	-0.35	-1.64	-2.45	-3.68	-4.67
Investment	0.07	-0.05	-0.36	-1.12	-1.70
Wage rate	-0.23	-0.93	-2.17	-9.60	-17.69
Deflator private consumption	-0.42	-1.13	-2.20	-9.14	-16.66
GDP deflator	-0.22	-0.88	-1.95	-9.42	-17.76
Employment	-0.02	-0.11	-0.27	-0.89	-1.36
<i>Absolute difference from baseline</i>					
Unemployment	0.02	0.09	0.23	0.77	1.18
Current account BoP, % GDP	0.02	-0.30	-0.40	-0.47	-0.46
Government Deficit, % GDP	0.09	0.33	0.57	1.14	1.27

## 6. Fiscal Policies

The AEA model is not only a proper tool for making medium term forecasts or scenarios for the Bulgarian economy but also for analysing the effects of economic policy. This quality of the model should not be underestimated. Since the working of the economy is rather complicated a medium term model can provide us a far better understanding of the consequences of economic policy than would be obtained on the basis of relatively simple notions. We will demonstrate this contention by discussing the effects of five simulations of fiscal policy namely lower taxes financed by lower public spending (table 6.1), a decrease of the budget deficit by cutting public spending (table 6.2), a decrease of the budget deficit by increasing direct taxes (table 6.3), a reshuffling of public spending (table 6.4) and an increase in government wages (table 6.5).

As known, Bulgaria intends to decrease its level of taxation. However, this policy should not lead to an increase in the government budget deficit. As a consequence the only way to finance the intended lower taxes is to cut in public spending. Table 6.1 contains a one-and-for-all cut in public spending

and simultaneous decrease in direct taxes and social security contributions by 1 per cent of GDP in 2004. It should be noted that in a growing economy these public spending cuts do not imply a real cut in public spending but only that the real growth rate of public spending should be less than the real rate of economic growth. However that may be, table 6.1 shows the result of this policy mix in the short, medium and long run for the Bulgarian economy. In 2005 real GDP increases by about 1 per cent whereas the unemployment rate would be about 0,40 percentage points lower than in the absence of this policy. Note also that the interest rate and the inflation rate will fall. In addition, the ex post government budget deficit will decrease slightly instead of the initial balanced-budget policy mix. The reason for this is that as a result of the increased rate of economic growth the government revenues will grow faster (among others through the progression in taxation) than the endogenous growth of public spending. It should be emphasized that the found positive effects of this policy mix on the Bulgarian economic performance are completely in line with the principles of the inverted Haavelmo effect (see Knoester (1983, 1993)). Lower direct taxes and social security contributions will depress wage claims, which will result in lower real wage costs (see Knoester and Van der Windt (1987)). These lower real wage costs will have a direct positive effect on employment and also exert a positive effect on the profit position of enterprises. This improved profit position implies a positive effect on the rate of economic growth and hence, in an indirect way, also on employment. Obviously, the said positive effects of lower taxation on the economic performance outweigh the concomitant negative effects of the reduced public spending which is entirely in line with the inverted Haavelmo effect.

**Table 6.1: A once-and-for-all 1 per cent of GDP decrease in direct taxes and a simultaneous decrease in government Consumption**

	2003	2004	2005	2010	2015
<i>Cumulative as % of baseline</i>					
GDP	0.05	0.69	0.85	0.68	0.36
Production Capacity	0.05	0.21	0.44	0.60	0.44
Private Consumption	0.39	0.91	1.18	1.25	0.77
Disposable Income Households	0.14	0.11	0.54	0.88	0.53
Exports G&S	0.38	1.09	1.34	0.99	0.82
Investment	0.74	1.09	1.01	0.93	-0.33
Base money	-0.03	-0.41	-0.71	-1.42	-2.17
M2	-0.42	-0.48	-0.34	-0.48	-1.09
Currency outside banks	-0.55	-0.48	-0.23	-0.14	-0.58
Deposits	-0.19	-0.47	-0.55	-1.11	-2.01
Wage rate	-1.66	-1.97	-1.50	-0.91	-0.86
Deflator private consumption	-0.48	-0.95	-0.78	-0.42	-0.44
GDP deflator	-1.01	-1.69	-1.52	-1.09	-1.15
Employment	0.06	0.23	0.47	0.65	0.50
<i>Absolute difference from baseline</i>					
Unemployment	-0.05	-0.20	-0.41	-0.57	-0.45
Investment, % GDP	0.14	0.13	0.09	0.07	-0.01
Current account BoP, % GDP	-0.05	-0.10	-0.06	-0.13	-0.01
Government Deficit, % GDP	0.17	0.11	-0.02	-0.09	-0.00
Capital imports, % base money	-0.03	-0.04	0.02	0.10	0.24
Short term Interest rate	-0.06	-0.01	0.04	0.14	0.21

Another policy objective of the Bulgarian government is to decrease the budget deficit by about 1 per cent of GDP. In principle, there are two alternatives to reach this goal namely by cutting public spending or by increasing taxes. Table 6.2 presents the results of a once-and-for-all cut in public spending and table 6.3 a once-and-for-all increase in direct taxes by 1 per cent of GDP. As shown, the best way to reduce the Bulgarian budget deficit is to cut public spending instead of increasing direct taxes. An increase in direct taxes will harm the Bulgarian economic because it induces a shifting forward of higher taxes into higher wage claims. These higher wage claims will result in higher real wage costs. As a consequence the Bulgarian competitive position will deteriorate resulting in a lower rate of economic growth. The higher wage costs will also lead to less employment, which results in a rising unemployment rate. For obvious reasons higher wages also imply lower profits, which induces a decrease in private investments in the short and medium run. Finally, it should be noted that the cumulated increase in direct taxes by 1 per cent of GDP will not result in a reduction of the budget deficit by 1 per cent of GDP but only in a reduction of about 0,8 per cent. This is because of the simulated increase in direct taxes will result in a lower rate of economic growth which implies an endogenous decrease in tax revenues.

A far better policy should be to reduce the budget deficit by a cut in public spending. In practice this policy can be implemented by reducing the real growth rate of public spending beneath the real rate of

economic growth. Table 6.2 shows that in the short run this way of closing the budget gap has more or less the same negative consequences for the Bulgarian economy as an increase in direct taxes. However, in the long run this outcome will change considerably. Whereas in the long run the effects of closing the budget gap through tax increases remain negative for the Bulgarian economy, the results are much more favourable in the case of closing the gap by cuts in public spending. In the medium and long run the last mentioned policy even leads to an increase in real GDP and lower inflation. The reason for this outcome can be found in the link between the monetary and the real sectors of the Bulgarian economy.

**Table 6.2: A once-and-for-all 1 per cent of GDP decrease of government consumption**

	2003	2004	2005	2010	2015
<i>Cumulative as % of baseline</i>					
GDP	-0.32	-0.06	0.33	0.46	0.10
Production Capacity	-0.06	-0.10	-0.08	0.07	0.35
Private Consumption	-0.19	-0.21	0.26	0.64	0.78
Disposable Income Households	-0.68	-0.79	-0.55	-0.12	0.35
Exports G&S	0.11	0.33	0.44	0.23	-0.82
Investment	0.39	1.70	3.48	4.69	2.29
Base money	1.78	4.00	5.35	5.39	7.08
M2	0.15	0.88	1.69	2.11	2.93
Currency outside banks	-0.47	-0.29	0.18	0.58	0.94
Deposits	1.28	3.05	4.52	4.97	6.60
Wage rate	-0.20	-0.56	-0.51	-0.10	0.37
Deflator private consumption	-0.11	-0.32	-0.35	-0.07	0.60
GDP deflator	-0.42	-0.73	-0.85	-0.57	0.28
Employment	-0.07	-0.13	-0.14	-0.05	-0.16
<i>Absolute difference from baseline</i>					
Unemployment	0.06	0.11	0.12	0.04	0.14
Investment, % GDP	0.11	0.23	0.35	0.42	0.18
Current account BoP, % GDP	0.35	0.35	0.17	-0.02	0.02
Government Deficit, % GDP	-0.69	-0.70	-0.80	-0.92	-0.97
Capital imports, % base money	-0.15	-0.42	-0.63	-0.72	-0.95
Short term Interest rate	-0.27	-0.49	-0.64	-0.65	-0.86



**Table 6.3: A once-and-for-all 1 per cent of GDP increase in direct taxes**

	2003	2004	2005	2010	2015
<i>Cumulative as % of baseline</i>					
GDP	-0.37	-0.75	-0.53	-0.24	-0.25
Production Capacity	-0.11	-0.31	-0.51	-0.53	-0.10
Private Consumption	-0.59	-1.12	-0.94	-0.65	-0.02
Disposable Income Households	-0.82	-0.89	-1.09	-1.03	-0.21
Exports G&S	-0.28	-0.77	-0.89	-0.74	-1.58
Investment	-0.35	0.61	2.38	3.60	2.68
Base money	1.81	4.38	6.06	6.88	9.50
M2	0.56	1.32	1.97	2.53	4.02
Currency outside banks	0.07	0.18	0.37	0.66	1.48
Deposits	1.44	3.46	5.03	6.10	8.82
Wage rate	1.47	1.39	0.96	0.77	1.21
Deflator private consumption	0.36	0.63	0.43	0.33	1.02
GDP deflator	0.58	0.95	0.65	0.49	1.38
Employment	-0.12	-0.36	-0.61	-0.69	-0.65
<i>Absolute difference from baseline</i>					
Unemployment	0.11	0.31	0.54	0.61	0.57
Investment, % GDP	-0.03	0.10	0.26	0.33	0.20
Current account BoP, % GDP	0.40	0.45	0.24	0.13	0.03
Government Deficit, % GDP	-0.86	-0.81	-0.78	-0.81	-0.96
Capital imports, % base money	-0.11	-0.37	-0.63	-0.80	-1.15
Short term Interest rate	-0.20	-0.47	-0.66	-0.78	-1.05

As a consequence of a reduction of the public sector deficit by cuts in public spending, the interest rate decreases substantially. This results in an increase in redefined base money and hence also in the broader defined monetary aggregates (M2). This implies an increase in private investments and consumption, which explains the said increase in the rate of economic growth.

Table 6.4 shows the effects of a reshuffle in public spending. In stimulating the economy the Bulgarian government could consider a budgetary neutral policy of a decrease in government consumption in favour of a simultaneous increase in government investments in infrastructure. Of course, such investments should be chosen with care. In the Netherlands, for instance, we can trace very successful (the Rotterdam harbour, Amsterdam airport) but also rather disastrous (new railway to Germany) policies of government investment. In the AEA model we have assumed that government investments are only of the successful type. This means that an increase in government investments will not only have a positive effect on domestic demand but also on the supply-side of the economy (i.e. production capacity will increase as well). Based on these assumptions the suggested reshuffling in public spending will have very favourable effects on the Bulgarian economy. As a result real GDP increases not only in the short run but the more in the longer run. Note also that private investments and the export of goods and services do increase substantially. Hence, such a policy could be very promising, although projects for an increase in government investments should be chosen with care.

In Western European economies there is an ongoing debate how to prevent increasing government budget deficits. A key element in this discussion is, of course, how to handle wages and salaries in the government sector. Table 6.5 shows what could be the result when government wages do increase faster than the inflation rate. As a result the government budget deficit will increase substantially. Also real GDP will decline. This is mainly the result of a decrease in exports and investments. This policy stimulation makes perfectly clear that the wage development in the government sector should be in line with the wage developments in the private sector. If not, the costs in terms of lower real GDP, lower investments and less exports could be substantial.

**Table 6.4: A once-and-for-all 1 per cent of GDP decrease in government consumption and a simultaneous increase in government investments**

	2003	2004	2005	2010	2015
<i>Cumulated as % of baseline</i>					
GDP	0.23	0.38	0.70	1.10	3.08
Production Capacity	0.01	0.19	0.42	0.71	2.99
Private Consumption	-0.06	-0.12	-0.05	0.17	1.62
Disposable Income Households	-0.11	-0.41	-0.58	-0.61	-0.09
Exports G&S	-0.07	0.21	0.85	1.45	4.38
Investment	7.78	8.44	9.63	10.85	11.57
Base money	-0.43	-1.01	-1.28	-1.58	-5.67
M2	-0.18	-0.54	-0.71	-0.79	-2.11
Currency outside banks	-0.08	-0.35	-0.45	-0.44	-0.51
Deposits	-0.36	-0.90	-1.18	-1.44	-4.98
Wage rate	0.03	0.03	-0.06	0.05	2.87
Deflator private consumption	0.01	-0.35	-0.74	-1.09	-2.56
GDP deflator	-0.36	-0.85	-1.38	-1.85	-3.88
Employment	0.01	0.04	0.11	0.25	1.38
<i>Absolute difference from baseline</i>					
Unemployment	-0.01	-0.03	-0.10	-0.22	-1.23
Current account BoP, % GDP	-0.10	-0.12	-0.05	-0.06	-0.09
Government Deficit, % GDP	0.03	0.11	0.15	0.15	0.14
Capital imports, % base money	0.02	0.07	0.10	0.14	0.74
Short term Interest rate	0.04	0.08	0.10	0.14	0.70

**Table 6.5: A permanent increase in the government wage rate by 1 per cent**

	2003	2004	2005	2010	2015
<i>Cumulated as % of baseline</i>					
GDP	-0.02	-0.06	-0.13	-0.25	-0.70
Production Capacity	0.00	0.00	-0.02	-0.05	-0.76
Private Consumption	0.04	0.13	0.20	0.20	-0.07
Disposable Income Households	0.11	0.30	0.49	0.64	1.47
Exports G&S	-0.02	-0.09	-0.19	-0.27	0.34
Investment	-0.08	-0.28	-0.79	-1.67	-7.08
Base money	-0.09	-0.47	-1.20	-2.03	-12.62
M2	0.02	-0.02	-0.18	-0.44	-4.15
Currency outside banks	0.06	0.14	0.18	0.15	-0.75
Deposits	-0.06	-0.33	-0.89	-1.59	-10.57
Wage rate	0.33	0.79	1.32	1.89	6.65
Deflator private consumption	0.02	0.08	0.15	0.19	-0.38
GDP deflator	0.11	0.30	0.53	0.74	1.55
Employment	0.00	0.00	-0.01	-0.04	-0.14
<i>Absolute difference from baseline</i>					
Unemployment	0.00	0.00	0.01	0.03	0.12
Current account BoP, % GDP	-0.02	-0.06	-0.10	-0.11	-0.10
Government Deficit, % GDP	0.12	0.29	0.52	0.80	3.73
Capital imports, % base money	0.01	0.05	0.13	0.23	1.65
Short term Interest rate	0.02	0.07	0.16	0.26	1.58

## 7. Other Policies

Foreign direct investments can play a major role in the future development of Bulgaria. According to Petranov (2003, page 12) the attraction of foreign capital is even a key concern of the Bulgarian government. The objective is to attract in the 2002-2005 period on average about 1 billion U.S. dollars per annum. Although more research is certainly needed we have assumed in the AEAF model that foreign direct investment will lead to a subsequent increase in domestic investment (see for suggestions for further research Petranov (2003) and Gorter and Parikh (2003)). Table 7.1 shows that a once-and-for-all 1 per cent of GDP increase in direct foreign investment will cause an increase in real GDP with about the same percentage. Note also that private investments will increase substantially in the medium and long run. However, due to the rising inflation rate the Bulgarian competitive position worsens resulting in a decline of exports. Since this outcome is not plausible the conclusion must be that in this respect the AEAF model should be improved. A promising improvement could be to include supply-side factors in the equation for real export growth. The investment ratio (private investments as a percentage of GDP) seems to be an obvious proxy for the quantification of such supply-side effects.

**Table 7.1: A once-and-for-all 1 per cent of GDP increase in foreign direct investment**

	2003	2004	2005	2010	2015
<i>Cumulated as % of baseline</i>					
GDP	0.56	1.08	0.72	-0.29	1.18
Production Capacity	0.07	0.37	0.82	1.12	3.56
Private Consumption	0.14	0.80	0.83	-0.03	1.07
Disposable Income Households	0.56	1.85	3.10	3.60	11.01
Exports G&S	-0.16	-0.90	-2.39	-4.00	-10.70
Investment	7.42	15.60	21.62	23.98	50.26
Base money	1.89	0.72	-2.68	-5.58	-0.03
M2	1.11	1.56	1.06	-0.08	4.42
Currency outside banks	0.79	1.79	2.27	1.96	6.66
Deposits	1.71	1.08	-1.25	-3.84	0.35
Wage rate	0.22	1.23	2.66	3.47	5.47
Deflator private consumption	0.11	0.81	2.09	3.27	8.44
GDP deflator	0.04	0.80	2.34	3.85	11.05
Employment	0.08	0.25	0.39	0.28	-1.73
<i>Absolute difference from baseline</i>					
Unemployment	-0.07	-0.22	-0.35	-0.25	1.54
Investment, % GDP	0.79	1.52	1.92	2.05	3.67
Current account BoP, % GDP	-0.45	-1.08	-1.43	-1.37	-0.48
Government Deficit, % GDP	-0.15	-0.45	-0.68	-0.72	-1.74
Capital imports, % base money	-0.07	0.00	0.36	0.79	1.08
Short term Interest rate	-0.13	0.12	0.53	0.89	0.93

Table 7.2 and table 7.3 contain two simulations of monetary policy viz. an increase in the central bank rate and an increase in the growth rate of redefined base money. These simulations of monetary policy make perfectly clear that it is hardly possible to pursue an effective monetary policy in a small open economy with free moving international capital flows. Note, for instance, that as a result of an increase in the central bank rate the capital imports will increase. The increased capital imports will increase the growth rate of redefined base money thus compensating to a large extent the decreased money supply by the banking sector which was induced by the increase in the central bank rate. If we look at the effects of a permanent increase in the growth rate of redefined base money more or less the same picture emerges. As a result of the exogenous increase in base money the domestic interest rates will fall resulting in increasing capital exports. The latter effect partly compensates the increased growth rate of redefined base money. This process of compensation will be strengthened by the effects of the interactions between the monetary and the real sectors of the economy. As a result of the initial increase in redefined base money, private consumption and private investment will pick up substantially. This increase in real GDP results in more imports of goods and services causing deficits on the current account of the balance of payments. These deficits, combined with the deficits on the capital account compensate for about 80 per cent the simulated exogenous increase in the growth rate of redefined base money. This outcome suggests that for an open economy with fixed exchange rates the balance of payments position seems to be of prime importance for monetary policy. In many respects this view on monetary policy agrees with the early views on monetary policy as propagated

by Mundell (1968) as well as with the so-called ‘‘monetary approach to the balance of payments’’. In this approach the balance of payments position is considered to be a primarily monetary phenomenon (see e.g. Hahn (1977), Myhrman (1976) and Swoboda (1976)).

**Table 7.2: A once-and-for-all increase in the central bank rate with 1 per cent**

	2003	2004	2005	2010	2015
<i>Cumulated as % of baseline</i>					
GDP	-0.01	0.00	0.02	0.01	-0.01
Production Capacity	0.00	0.00	0.00	0.01	0.01
Private Consumption	0.00	0.02	0.08	0.11	0.12
Disposable Income Households	0.01	0.04	0.09	0.13	0.15
Exports G&S	-0.01	-0.04	-0.09	-0.14	-0.23
Investment	-0.04	0.06	0.27	0.32	0.11
Base money	0.20	0.53	0.67	0.65	0.87
M2	-1.03	-0.93	-0.84	-0.80	-0.71
Currency outside banks	-0.29	-0.24	-0.18	-0.15	-0.13
Deposits	-2.42	-2.25	-2.14	-2.08	-1.87
Wage rate	0.00	0.02	0.05	0.09	0.09
Deflator private consumption	0.01	0.04	0.07	0.11	0.14
GDP deflator	0.02	0.04	0.07	0.12	0.17
Employment	0.00	0.00	0.00	0.00	-0.02
<i>Absolute difference from baseline</i>					
Unemployment	0.00	0.00	0.00	0.00	0.02
Investment, % GDP	0.00	0.00	0.02	0.02	0.00
Current account BoP, % GDP	0.00	-0.01	-0.05	-0.07	-0.06
Government Deficit, % GDP	0.00	-0.01	-0.02	-0.03	-0.02
Capital imports, % base money	0.18	0.35	0.33	0.32	0.29
Short term Interest rate	0.32	0.30	0.29	0.29	0.26

**Table 7.3: A permanent increase in the growth rate of redefined base money by 5 per cent**

	2003	2004	2005	2010	2015
<i>Cumulated as % of baseline</i>					
GDP	0.01	0.65	0.86	0.43	0.12
Production Capacity	0.00	0.08	0.29	0.50	0.48
Private Consumption	0.00	0.85	1.59	1.67	1.60
Disposable Income Households	-0.01	0.59	1.41	1.90	1.87
Exports G&S	0.02	-0.12	-0.66	-1.50	-2.33
Investment	0.06	3.97	6.16	5.78	2.18
Base money	4.82	7.62	7.92	6.78	10.23
M2	1.67	3.07	3.91	3.83	4.84
Currency outside banks	0.45	1.36	2.12	2.28	2.37
Deposits	3.87	6.28	7.32	6.81	9.51
Wage rate	-0.01	0.24	1.11	1.93	1.58
Deflator private consumption	-0.02	0.06	0.57	1.26	1.47
GDP deflator	-0.03	-0.03	0.54	1.37	1.82
Employment	0.00	0.09	0.24	0.35	-0.10
<i>Absolute difference from baseline</i>					
Unemployment	0.00	-0.08	-0.21	-0.31	0.09
Investment, % GDP	0.01	0.36	0.49	0.43	0.10
Current account BoP, % GDP	-0.01	-0.49	-0.89	-1.04	-0.76
Government Deficit, % GDP	0.00	-0.15	-0.33	-0.40	-0.28
Capital imports, % base money	-0.28	-0.66	-0.78	-0.74	-1.06
Short term Interest rate	-0.50	-0.69	-0.72	-0.62	-0.99

**Table 7.4: A permanent decrease in the wage rate by 1 per cent**

	2003	2004	2005	2010	2015
<i>Cumulative as % of baseline</i>					
GDP	0.17	0.57	1.09	1.55	4.04
Production Capacity	0.05	0.22	0.54	0.97	4.12
Private Consumption	-0.03	-0.03	0.14	0.45	2.21
Disposable Income Households	-0.36	-0.84	-1.03	-0.94	-0.62
Exports G&S	0.22	0.92	1.78	2.37	5.10
Investment	0.33	0.91	1.83	2.96	5.29
Base money	-0.12	-0.10	0.19	0.21	1.31
M2	-0.15	-0.28	-0.17	0.00	0.95
Currency outside banks	-0.15	-0.34	-0.29	-0.09	0.79
Deposits	-0.14	-0.18	0.06	0.16	1.26
Wage rate	-1.14	-2.38	-3.36	-3.94	-8.04
Deflator private consumption	-0.29	-0.86	-1.31	-1.54	-2.77
GDP deflator	-0.43	-1.20	-1.84	-2.18	-4.05
Employment	0.06	0.25	0.61	1.08	4.21
<i>Absolute difference from baseline</i>					
Unemployment	-0.05	-0.22	-0.54	-0.94	-3.73
Investment, % GDP	0.04	0.10	0.16	0.23	0.30
Current account BoP, % GDP	-0.04	-0.02	0.03	-0.01	0.00
Government Deficit, % GDP	0.06	0.10	0.06	-0.06	-0.63
Capital imports, % base money	0.00	-0.02	-0.05	-0.05	-0.08
Short term Interest rate	0.00	-0.03	-0.05	-0.04	-0.07

## 8. Concluding remarks

In this paper it is argued that economic models can be extremely useful in the process of economic policy making. We have demonstrated this contention with a medium term annual model of the Bulgarian economy that recently has been developed at the Agency of Economic Analysis and Forecasting. Our conclusions can be summarised as follows.

- For the prosperous post-war economic development of Western Europe have been many factors responsible. No doubt, however, that solid macroeconomic policy has contributed substantially to this development.
- In forecasting the economy and analysing the effects of macroeconomic policies a medium term model is essential. Such a model should not only include the demand side of the economy but also the supply side as well as the interactions between the monetary and the real sectors.
- The Netherlands Central Planning Bureau has more than fifty years of experience in making economic forecasts with economic models. It appears from a recent analysis on the quality of these forecasts that they have been better than so-called naive forecasts in which the forecasted figures would be simply the realised figures of the previous period.
- The main reasons for making forecast errors are the forecast errors in foreign variables such as the growth rate of world trade and the development of foreign prices. According to the Netherlands Central Planning Bureau the quality of the annual forecasts would improve with about 40 per cent if foreign variables could be forecasted perfectly.
- Since a perfect forecast of the future is impossible, every economy forecast should be handled with care. In order to prevent exaggerated expectations it would be better to interpret a central projection for the future not so much as a forecast but rather as a plausible scenario for the coming period.
- In principle, every forecast or scenario should be accompanied by so-called uncertainty simulations in which possible set-backs are quantified. By combining these uncertainty simulations with the central projection also a cautious scenario should be presented to policy makers as a possible future scenario.
- Simulations with the AEAF model suggest that the best way to finance a decrease in the level of taxation would be a simultaneous cut in public spending. Then the result would be an increase in real GDP accompanied by a decrease in the unemployment rate.

- The best way to reduce the Bulgarian government budget deficit seems to be a cut in public spending. A policy of closing the budget deficit by increasing taxes will have considerable negative consequences for the rate of economic growth and for the unemployment rate.
- A reshuffle in public spending from government consumption towards government investment in infrastructure can have very favourable effects on the Bulgarian economic performance. At the same time a policy of an increase in the government wage rate that exceeds the inflation rate should be avoided because of its negative consequences for the rate of economic growth and the budget deficit.
- In a small open economy such as Bulgaria the effects of monetary policy are very limited because of compensating reactions through the capital and current account of the balance of payments. As a consequence monetary policy should not be directed at a stimulation of domestic demand but rather at maintaining external equilibrium i.e. the position of international reserves.
- Specific policies such as a policy directed at wage moderation or a policy of stimulating foreign direct investment can be very profitable for the Bulgarian economy. However, for the time being the simulations with an increase in foreign direct investment should be handled with care. For this reason, more research in this field is recommended.



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