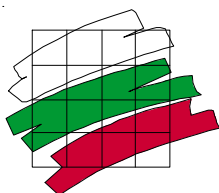


# WORKING PAPER SERIES

## **SIMULATIONS WITH THE AEF MODEL**

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## **1. Introduction**

The main purpose of this paper is to be of assistance in understanding the working of the AEAF model (see AEAF (2003a)). To this end we will explain in section 2 how in the simulations levels and percentages changes are treated as well as the important difference between stocks and flows. Section 3 deals with the consequences of linking the block of the real sector with that of the monetary sector. This is demonstrated with a sensitivity analysis in which we compare a policy simulation made with the complete AEAF model with the one that is obtained from the real block only. Section 4 discusses the major mechanisms that are at work in the model. Their importance for the outcomes of the AEAF model will be demonstrated with two sensitivity analysis viz. on the one hand the exclusion of the Philips curve mechanism and on the other hand the exclusion of the shifting forward of taxation from the wage equation. The paper ends with some concluding remarks in section 6.

## **2. Levels versus Percentage Changes and Stocks versus Flows**

Table 2.1 contains the baseline scenario for the Bulgarian economy for the 2003-2015 period as discussed elsewhere (see Knoester and Van der Windt (2003)). Note that in this table both percentage changes per annum as well as absolute levels per annum appear. The percentage changes are not cumulated which means that every figure represents the percentage change in the distinguished variables for each mentioned year. It should be emphasised that the absolute levels have a completely different dimension in comparison with the percentage changes. The absolute levels represent the cumulated percentage changes of the variables behind the levels. Usually the shown absolute levels are based on a definition in which the cumulated percentage changes over the next period of the relevant variables are added to the one period lagged level. The absolute level of the current account of the balance of payments (as a percentage of GDP) in 2005, for example, is the result of its starting value in 2002 and the cumulated percentage changes per annum of real exports, real imports, export prices, import prices and, for the denominator, real GDP and the GDP price deflator over the 2003-2005 period. Although this seems very obvious, one should always be aware of the big difference in interpretation of percentage changes and absolute levels. This is even more important when in the model percentage changes per annum do fluctuate substantially due to for example the business cycle or to compensating reactions (a plus can be followed by a minus etc.). In that case the cumulated percentage changes and the absolute levels are far more relevant in judging a simulation than simply the (not cumulated) percentage changes per annum.

<b>Table 2.1: Baseline scenario 2003 – 2015</b>					
	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2010</b>	<b>2015</b>
<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

Table 2.2 shows, as an example, a policy simulation for a once-and-for-all 1 per cent of GDP reduction of government consumption (see also Knoester and Van der Windt (2003, page 12). Note that in this table, in contrast with table 2.1, the percentage changes are cumulated. If we look at the outcomes for real GDP we can trace that, as a consequence of the decrease in government consumption, the Keynesian multiplier works perfectly well in 2003 because in that year real GDP decreases with 0.32 per cent. However, already in 2004 the cumulated effect of this policy on real GDP has diminished to -0.06. This means, of course, that in 2004 the percentage change for real GDP is positive (0.26) in reaction on the negative percentage change in real GDP in 2003. An assessment of this change in signs will be given in the next section where the links between the monetary and real sectors of the AEAF model will be discussed. The only point we want to make here is that for a proper judgement of a certain policy we should not look so much at its short run effects on the economy but rather at its medium and long run effects. For this purpose the cumulated percentage changes are far more useful than the annual percentage changes. Note finally, that in principle the cumulated percentage changes have the same dimension as the absolute levels of the variables.

<b>Table 2.2: A once-and-for-all 1 per cent of GDP decrease of government consumption</b>					
	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2010</b>	<b>2015</b>
<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
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

The last issue to be discussed is the important difference between stocks and flows. According to the monetarists stocks and not flows are of decisive importance for the long run performance of the economy. Examples of flows are real GDP, private consumption, private investments, the current account of the balance of payments and the government budget deficit. Flows cause by definition the changes in the stocks. For instance, the current account of the balance of payments (a flow) is by definition the change in international reserves (a stock) whereas the government budget deficit represents the change in the stock of government debt. Likewise, private investments (flows) are the change in the physical capital stock. It should be emphasised that in judging the working of the AEF model one should always keep in mind the important dimensional difference between stocks and flows. As long as, for instance, a balance of payments deficit occurs, there will be every period (a year, quarter or month) a decrease in the international reserves to the same amount. This means also that a balance of payments deficit - as long as it holds - will induce a permanent decrease in base money and hence in money supply. Private investments are very important for the economy because they induce every period an increase in the physical capital stock. Note that the difference between stocks and flows imply an essential difference in judging economic forecasts and policy simulations.

Because the level of a flow (balance of payments position, private investments) can induce a permanent change in a stock (international reserves/base money and the stock of physical capital) it can have decisive consequences for the medium and long run outcomes of the AEAF model. In this respect the foregoing discussion of annual percentage changes and cumulated percentage changes or absolute levels is highly relevant.

For instance, in every model with a supply-side, and therefore also in the AEAF model, the stock of physical capital determines (together with labour and technological progress) the level of production capacity. Consequently the level of private investments (i.e. the changes in the stock of physical capital) causes in every period a permanent (percentage) change in production capacity. This means that the cumulated percentage changes of private investments (representing the level of private investments) will have a permanent effect on the growth rate of production capacity. This stresses the importance of the inclusion of the supply-side in the AEAF model because in the medium and long run production capacity determines real GDP. The same is true for the inclusion of the monetary sector in the AEAF model since the cumulated percentage changes of the difference between exports and imports (representing the balance of payments position) will have a permanent effect on the growth rate of (base) money.

### **3. Linking the Real and Monetary Blocks**

It has been said before: the linking of the real and monetary blocks has important consequences for our judgement on the forecasts and policy simulations of the AEAF model. As explained elsewhere (see AEAF) 2003a)) we do distinguish two transmission channels from the monetary to the real block viz. the real interest rate on the one hand and the difference between redefined base money and expenditures on the other hand. From the real block there is by means of the inclusion of expenditures in the money demand equations a transmission channel to the monetary block. But by far the most important transmission channel from the real to the monetary block - and vice versa! - is the current account of the balance of payments. As explained in the paper on the AEAF model and in the previous section the level of the current account of the balance of payments (a flow) induces permanent changes in redefined base money (a stock).

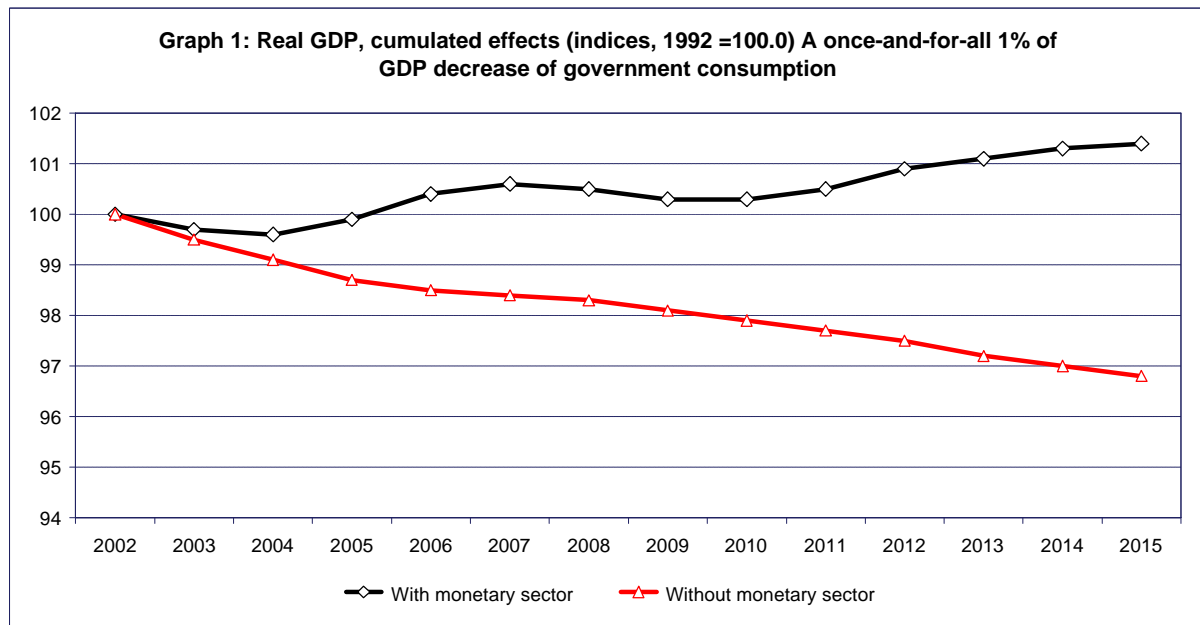
In order to demonstrate the importance of the linking of the monetary and real blocks contains table 3.1 once again the once-and-for-all 1 per cent of GDP decrease of government consumption as already shown in the previous section. However, this time we have included in the table (between brackets) which results would be obtained from this policy in the absence of the interactions between the monetary and real blocks. The outcome with the version of the model excluding the monetary block makes not only perfectly clear the importance of the links between the monetary and real blocks but also the importance of the use of a medium term model in evaluating the effects of economic policy.

<b>Table 3.1: A once-and-for-all 1 per cent of GDP decrease of government consumption</b>					
	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2010</b>	<b>2015</b>
<i>Cumulative as % of baseline</i>					
GDP	-0.32 (-0.46)	-0.06 (-0.49)	0.33 (-0.35)	0.46 (-0.19)	0.10 (-0.25)
Production Capacity	-0.06 (-0.07)	-0.10 (-0.18)	-0.08 (-0.29)	0.07 (-0.28)	0.35 (-0.29)
Private Consumption	-0.19 (-0.35)	-0.21 (-0.79)	0.26 (-0.86)	0.64 (-0.78)	0.78 (-0.89)
Disposable Income Households	-0.68 (-0.81)	-0.79 (-1.23)	-0.55 (-1.51)	-0.12 (-1.61)	0.35 (-1.75)
Exports G&S	0.11 (0.12)	0.33 (0.43)	0.44 (0.83)	0.23 (1.24)	-0.82 (1.29)
Investment	0.39 (-0.24)	1.70 (-0.52)	3.48 (-0.78)	4.69 (-0.36)	2.29 (-0.40)
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 (-0.21)	-0.56 (-0.74)	-0.51 (-1.08)	-0.10 (-1.24)	0.37 (-1.35)
Deflator private consumption	-0.11 (-0.12)	-0.32 (-0.42)	-0.35 (-0.72)	-0.07 (-0.88)	0.60 (-0.93)
GDP deflator	-0.42 (-0.41)	-0.73 (-0.77)	-0.85 (-1.15)	-0.57 (-1.42)	0.28 (-1.51)
Employment	-0.07 (-0.08)	-0.13 (-0.20)	-0.14 (-0.33)	-0.05 (-0.26)	-0.16 (-0.28)
<i>Absolute difference from baseline</i>					
Unemployment	0.06 (-0.07)	0.11 (0.17)	0.12 (0.29)	0.04 (0.23)	0.14 (0.25)
Current account BoP, % GDP	0.35 (-0.43)	0.35 (0.66)	0.17 (0.78)	-0.02 (0.80)	0.02 (0.85)
Government Deficit, % GDP	-0.69 (-0.69)	-0.70 (-0.63)	-0.80 (-0.63)	-0.92 (-0.75)	-0.97 (-0.79)
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 (-)

Figures in parentheses represent the effects with the real block alone; figures without parentheses the effects with the complete AEAF model.

Note, for instance, that in the short run (i.e. in the year 2003 of the simulation) the effects of the decrease in government consumption are more or less the same for the two models. The overall short run effect of this policy has in both models the traditional textbook consequences for the economy viz. a Keynesian decline in real GDP. However, in the medium and long run a complete different picture arises. In the simulation with the real block only the Keynesian outcome of a decline in real GDP will be sustained throughout the whole period. Be aware of the important consequences that such a model might have in the process of economic policy making. Based on this outcome policy advisors can only conclude that a cut in government consumption does harm the economy and for that reason should be avoided.





But look at the outcomes of the same policy if we use a model that includes not only a real block but also a monetary block. In that case the medium and long run effects are completely different from those that are obtained with the real block only. In the linked model the Keynesian decline of real GDP as a consequence of the cut in government consumption is only temporary. Within three years – namely in 2005 - the ultimate effect of this policy does not show a decline in real GDP but instead an increase. This outcome is completely in line with the monetarist view that increasing government budgets will lead for a „crowding out“ of private investments from the market. As can be seen in table 3.1 and which is also clearly illustrated in Graph 1, this also holds for the linked AEAF model. The opposite of this policy, namely a decrease of government consumption resulting in a smaller government budget deficit, will lead to an increase in private investments. This is mainly caused by the monetary effects of the balance of payments. As a result of the decrease in government consumption (less demand) there arises a surplus on the current account of the balance of payments. This will lead to an increase in redefined base money and to a fall in interest rates, which in turn stimulates private consumption but especially private investments. As a result real GDP shows in the medium and the long run an increase instead of a decrease. The discussion of this specific form of economic policy is only meant to make clear how important it is to use a proper, well- specified medium term model of the economy. The links between the monetary and the real sectors of the economy are only an example of this. In the next section we will present an overview of some other the major mechanisms that are included in the AEAF model.

## 5. Major Mechanisms in the AEAF model

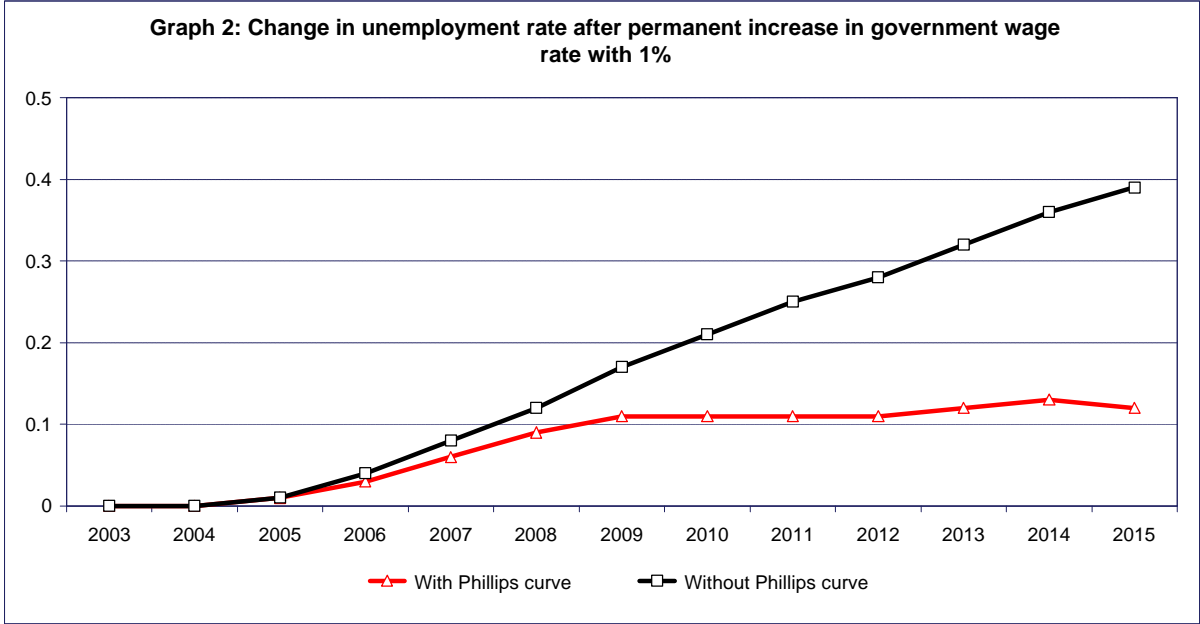
Of course, every equation is important in the AEAF model. Deleting one of them could impose major problems in solving the model for policy simulations or for making baseline scenarios. But there are also important differences in the relative importance of the equations. First of all, the behavioural equations are for obvious reasons much more important than the definition equations. But there is also an important ranking order within the definition and behavioural equations. This has a lot to do with the previous discussion of the difference between stocks and flows but also with the quantification of theoretical insights. In this section we will present an overview of those mechanisms that are of decisive importance for the working of the AEAF model. The mechanisms are summarised in table 4.1 in at random order and should be interpreted as a kind of a road map for a better understanding of the working of the AEAF model. It may also serve as a guideline for further research. Any economic model, and also the AEAF model, should be the subject of an ongoing process for further improvement. The presented mechanisms in table 4.1 offer the places in the model where further research could have a high value added.

Relevant equations	Main characteristics
1) Demand equations	Quantification of the Keynesian determination of expenditure categories such as consumption and investments.
2) Supply-side equations	Determination of production capacity. Important link between a stock (physical capital stock) and a flow (investments).
3) Monetary equations	Quantification of monetary phenomena such as interest rates and (base) money. Important link between stocks (money) and flows (consumption, investments).
4) Wage equation	Important equation with respect to full compensation of prices in wages, the level of unemployment (Philips curve) and the shifting forward of taxes and social security contributions into higher wages.
5) Price equations	Important relations in combination with the wage equation. Prices are homogenous of the first degree in the variable costs (wage and import costs).
6) Employment equation	This equation contains a mix of Keynesian (demand factors) and supply-side factors (wage costs). As a result this equation can describe cyclical (Keynesian) as well as structural (supply side induced) unemployment.
7) Export equation	Important equation in which the international competitive position is quantified.
8) Investment equation	Important determinant for production capacity and for the linking of a flow (investments) to the stock of physical capital.

A part of the presented major mechanisms have already been discussed in the previous sections or elsewhere (Knoester and Van der Windt (2003)). Here we will discuss only two of them in order to demonstrate their importance in understanding the working of the AEAF model. Both mechanisms are included in the used specification of the wage equation namely the Philips curve on the one hand and the shifting forward of taxation on the other hand. In order to show that additional government expenditure has a significant impact on the private sector activities an additional simulation is presented, namely an increase in government wage rate.

**Phillips curve**

The Philips curve is the relation between the percentage changes in the wage rate and the unemployment rate. Note that this relation links two dimensions viz. percentage changes to a level (i.e. the unemployment rate), and is therefore comparable to the earlier discussed link between stocks and flows. Since we have assumed in the AEAF model for good reasons that there is a full compensation of prices in wages the inclusion of the Philips curve means in fact that we have assumed a relation between percentage changes in the real wage rate and the unemployment rate. Graph 2 shows the results for unemployment of a permanent decrease in the wage rate by 1 per cent, including the Philips curve mechanism as well as excluding this mechanism.

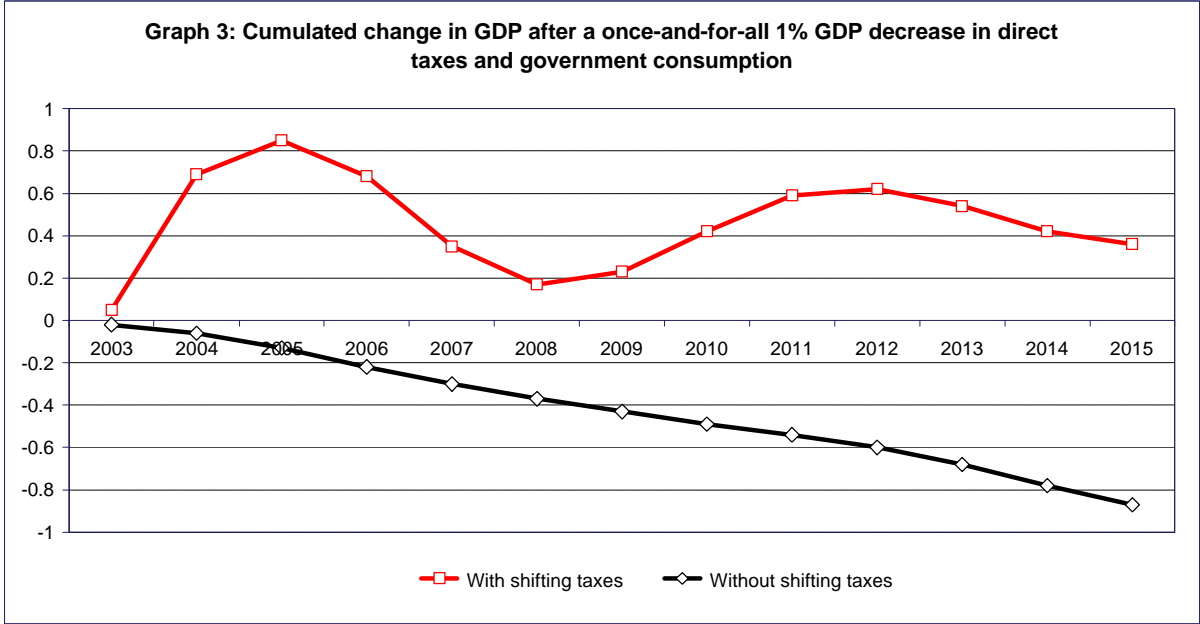


This sensitivity analysis with the AEAF model makes the importance of the working of the Philips curve mechanism perfectly clear. It appears that it acts within the AEAF model as an important equilibrating mechanism for the labour market and hence also for the whole economy. In the absence of the Philips curve mechanism the effects on the unemployment rate are far more substantial. The simulation in this version of the AEAF model has now the tendency to explode. From a theoretical point of view this outcome is quite understandable. In the AEAF model with the inclusion of the

Philips curve every decrease in the unemployment rate (as the result of the simulated decrease in the wage rate) will be followed by a permanent increase in the wage rate. This secondary effect thus compensates to a large extent the initial decrease in wages. As a result the unemployment rate always tends to some kind of an equilibrium rate. Many economists call this equilibrium unemployment rate the natural rate of unemployment. This natural rate of unemployment should not be diminished by macroeconomic policies but by microeconomic policies (more labour market flexibility etc.).

***Shifting forward of direct taxes and social security contributions***

Taxes and The inclusion of the shifting forward of direct taxes and social security contributions is another important element in the wage equation. As discussed in Knoester and Van der Windt (2003) this has important consequences for our view on the effects of a balanced-budget. Table 4.2 contains a once-and-for-all 1 per cent of GDP decrease in direct taxes and a simultaneous decrease in government consumption (figures without parentheses) and the same policy with a version of the AEAF model excluding the shifting forward of taxation in the wage equation (figures in parentheses). Note that in the absence of the shifting forward mechanism the suggested policy mix is much less attractive for policy makers. This demonstrates, of course, the importance of this mechanism as well as the need for further research on this topic.



<b>Table 4.2: A once-and-for-all 1 per cent of GDP decrease in direct taxes and a simultaneous decrease in government Consumption</b>					
	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2010</b>	<b>2015</b>
<i>Cumulative as % of baseline</i>					
GDP	0.05 (-0.20)	0.69 (0.12)	0.85 (0.08)	0.68 (0.04)	0.36 (-0.04)
Production Capacity	0.05 (-0.03)	0.21 (-0.02)	0.44 (-0.02)	0.60 (-0.08)	0.44 (-0.09)
Private Consumption	0.39 (0.45)	0.91 (0.94)	1.18 (0.96)	1.25 (0.69)	0.77 (0.53)
Disposable Income Households	0.14 (0.66)	0.11 (0.82)	0.54 (0.85)	0.88 (0.57)	0.53 (0.42)
Exports G&S	0.38 (0.08)	1.09 (0.14)	1.34 (0.11)	0.99 (0.26)	0.82 (0.30)
Investment	0.74 (0.39)	1.09 (0.37)	1.01 (-0.17)	0.93 (-0.38)	-0.33 (-0.53)
Base money	-0.03 (0.20)	-0.41 (-0.28)	-0.71 (-0.71)	-1.42 (-1.21)	-2.17 (-1.59)
M2	-0.42 (-0.11)	-0.48 (-0.23)	-0.34 (-0.33)	-0.48 (-0.72)	-1.09 (-0.96)
Currency outside banks	-0.55 (-0.21)	-0.48 (-0.23)	-0.23 (-0.33)	-0.14 (-0.71)	-0.58 (-0.96)
Deposits	-0.19 (0.06)	-0.47 (-0.26)	-0.55 (-0.51)	-1.11 (-1.12)	-2.01 (-1.50)
Wage rate	-1.66 (-0.14)	-1.97 (-0.16)	-1.50 (-0.03)	-0.91 (-0.24)	-0.86 (-0.31)
Deflator private consumption	-0.48 (-0.09)	-0.95 (-0.16)	-0.78 (-0.08)	-0.42 (-0.22)	-0.44 (-0.26)
GDP deflator	-1.01 (-0.44)	-1.69 (-0.56)	-1.52 (-0.50)	-1.09 (-0.74)	-1.15 (-0.83)
Employment	0.06 (-0.09)	0.23 (-0.04)	0.47 (-0.04)	0.65 (-0.05)	0.50 (-0.03)
<i>Absolute difference from baseline</i>					
Unemployment	-0.05 (0.02)	-0.20 (0.03)	-0.41 (0.03)	-0.57 (0.04)	-0.45 (0.03)
Current account BoP, % GDP	-0.05 (0.08)	-0.10 (-0.09)	-0.06 (-0.08)	-0.13 (-0.03)	-0.01 (-0.02)
Government Deficit, % GDP	0.17 (0.02)	0.11 (0.07)	-0.02 (0.04)	-0.09 (0.06)	-0.00 (0.05)
Capital imports, % base money	-0.03 (-0.04)	-0.04 (-0.03)	0.02 (0.03)	0.10 (0.10)	0.24 (0.15)
Short term Interest rate	-0.06 (-0.06)	-0.01 (0.01)	0.04 (0.04)	0.14 (0.10)	0.21 (0.13)

Figures in parentheses represent the effects excluding shifting forward of taxation in wages; figures without parentheses with inclusion of taxation in wages

### ***Government wage rate***

Table 4.3. contains a permanent increase in the government wage rate by 1 per cent. Note that this simulation should be interpreted as the case in which government wages do exceed the increase in the wage rate in the private sector by 1 per cent each year. The simulation shows that this policy has negative consequences for real GDP and private investments. The main reason for this outcome is that the simulated expansionary budgetary policy (i.e. the budget deficit increases!) leads to a deficit on the current account of the balance of payments. As a result base money decreases. In addition, the interest rate will fall in the medium and long run. This monetary tightness results in a crowding of private investments causing a decline of real GDP.

<b>Table 4.3: A permanent increase in the government wage rate by 1 per cent</b>					
	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2010</b>	<b>2015</b>
<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

## 6. Concluding Remarks

Understanding the working of the AEAF model is a rather complicated matter because this model contains a state of the art modelling of the economy. This paper is meant to provide some handles for a better understanding and may at the same time act as a road map with suggestions for further research. Our main conclusions can be summarised as follows.

- In judging baseline scenarios and policy simulations one should make a clear distinction between absolute levels and percentage changes. Only cumulated percentage changes have the same dimension as the absolute levels of the shown variables. For a proper judgement of the medium and long run effects of the AEAF model one should only look at those two mutually comparable dimensions.
- Stocks and not flows are of decisive importance for the long run performance of the economy. Important stocks in the AEAF model are the stock of physical capital and the stock of (base)

money. For the changes in these stocks are the flows of private investments and the current account of the balance of payments of major importance.

- The monetary effects of the balance of payments are of decisive importance for our view on economic policy. A sensitivity analysis with the AEAF model shows that in the absence of those effects the model will change from a monetarist character towards a Keynesian character.
- For the working of the AEAF model are some major mechanisms essential. A sensitivity analysis with two of those mechanisms (namely exclusion of the Philips curve and exclusion of the shifting forward of taxation into wages) shows that they are essential for our view on the working of the economy.
- Any economic model, and hence also the AEAF model, should be the subject of an ongoing process for further improvement. The presented major mechanisms in this paper may well act as a road map for further research in order to improve the model.

## References

Agency for Economic Analysis and Economic Forecasting (2003a), *The AEAFF Model: A Medium Term Model for the Bulgarian Economy*, AEAFF Working Paper Series, Sofia, 2003

Knoester, A and Windt, N. van der (1987), Real Wages and Taxation in Ten OECD Countries, *Oxford Bulletin of Economics and Statistics*, vol. 49, no.1, pp. 151-169

Knoester, A. (1983), Stagnation and the Inverted Haavelmo Effect: Some International Evidence, *The Economist*, vol. 131, no.4, pp. 548-584

Knoester, A. (1993), The Inverted Haavelmo Effect and the Effects of fiscal Policies in the United States, the United Kingdom, Germany and the Netherlands, in: A. Knoester (ed.), *Taxation in the United States and Europe: Theory and Practise*, Macmillan / St. Martin's Press, London / New York

Knoester, A. and Windt, N van der (2003), *The Need for Economic Models in Economic Policy Making*, AEAFF Discussion Paper 0303, Sofia



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