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MACROECONOMIC IMPACTS OF THE H.E.P. CEBREN ON MACEDONIA

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First Draft of the Final Report
(not to be cited)

Content

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INTRODUCTION

The work presented in this report evaluates the macroeconomic situation of Macedonia (FRYM) and studies the possible socio-economic impact of building a hydro electricity power plant in Cepren. In particular macroeconomic cost, including the effects of increased public debt, and long-run benefits from this huge investment are compared.

This basic task proved to be a major challenge, not only because of the difficulties of finding and using data on this newly emerged nation state – economically it started to exist as autonomous entity not before 1992 - but also because macroeconomic relationships are still on their way to be established. Moreover this country as closest neighbor to the most dangerous part of the Balcan, the Kosovo, permanently is under heavy exogenous political and military strain, a fact not easily to be incorporated in a macroeconomic model. So it was not surprising that the central statistic office of Macedonia does not have a macroeconomic model of the country. In other words, we had to start from scratch.

In this report we approach this problem by splitting our primary task into a few more difficult aspects that are treated in more or less independent chapters written by renowned experts in the respective field, then, as last chapter, a simulation model is developed theoretically, estimated econometrically and used for a simulation study to answer our basic questions.

The fiscal problem of Macedonia is identified as major obstacle for the project in the first chapter „Fiscal Policy in Macedonia“ written by Helmut Frisch. He applies an interesting theoretical apparatus, developed by Daniel Cohen to show that in principle economic developments in Macedonia seem to be sound enough to support this project without endangering public finance – given a wise policy with respect to imports.

In the same direction the second chapter, written by Vladimir Gligorov, deals with the particular fiscal risks present in Macedonian system, risks that are not immediately visible to standard macroeconomic analysis. His intimate knowledge of the political economy of Macedonia reveals these inherent risks and leads him to a prudent but still positive evaluation of the project.

In chapter 3 Ewald Walterskirchen discusses the most burning economic question of Macedonia's current situation: unemployment. He provides a lot of insight in this question, both, in an empirical as well as in a theoretical respect. Though there is not much to be gained by the project at hand, these results proved to be important for the formulation of the macro-model.

The basic overview of the simulation approach is introduced in chapter 4, written by Gerhard Hanappi. The idea to combine a macro-model with a meso-economic sectoral model to operationalize the project impact leads to the further structure of chapters.
After the theoretical macroeconomic part has been discussed in detail in chapter 4, chapter 5 shows how this theoretical macro-model can be fitted to empirical observations.
Chapter 6 discusses the sectoral meso-economic model. In particular, the last existing input-output table of Macedonia, dating from 1987, is used to inject more recent information to produce (with the RAS method) a highly aggregated input output table with 8 sectors for 1998. Below the brief summary presented in chapter 6, of course, a lot of statistical and methodological work is hiding. This input output formulation then is plugged into the macro-model to study the impact of changing sectoral flows due to the project.
The final chapter 7 then presents the simulation study based on these modeling efforts and discusses the results. It is interesting that many of the findings presented in earlier chapters prove to be justified by simulation results. ***In particular, from a long-run macroeconomic perspective the hydro-electrical power plant Cepren seems to be a valid economic investment***. Chapters 5, 6 and 7 have been written by Gerhard Hanappi too.

A brief „Executive Summary" presents the major findings and concludes this report.

FISCAL POLICY IN MACEDONIA

(A Macroeconomic Assessment)

Prof. Helmut Frisch

University of Technology, Vienna

According to the IMF Report (1998) the Government in Macedonia pursued in 1996, 1997 and 1998 a tight fiscal policy. This policy was reflected in a small overall fiscal deficit and in a primary surplus (i.e the tax revenue exceeded current expenditure).

Table 1

Fiscaldeficit

in % of GDP

	1997	1998	1999
Total Expenditure	39,4	37,9	42,00
Total Revenue	38,9	37,2	34,2
Fiscal Deficit	0,5	0,7	7,8

The overall fiscal deficit (def) can be considered as consisting of two components: pd (primary deficit in % of GDP) and interest payments $i \cdot b$ where i is the interest rate and b is the ratio of government debt to GDP

$$def = pd + i \cdot b$$

Table 2

Fiscaldeficit

in % of GDP

	def.	pd	ib
1997	0.5	-1.9	2.4
1998	0.7	-1.6	2.3
1999	7.8	5.5	2.3

pd negativ is a primary surplus

pd positiv is a primary deficit

These two tables give a clear picture of the restrictive fiscal policy stance of Macedonia. The overall fiscal deficit was very small in 1997 and 1998, the interest payment on government debt 2.4 percent of GDP in 1997 and 2.3 percent (1998) was almost compensated by a surplus of the balance of the primary household. The situation deteriorated dramatically in 1999. The primary surplus of 1.6 % (1998) turned into a primary deficit of 5.5 % (1999): adding interest payment the fiscal deficit rose to 7.8 % of GDP. This deterioration of the fiscal situation has to be seen in the context of the war in the neighbouring Kosovo which has weakened Macedonias economy mainly through the inflow of 250.000 refugees, through the reduced exports (loss of Yugoslavia market) and through a general stagnation.

The real GDP growth was zero 1999 instead of the forecasted 3 %. While a large part of direct costs for the refugees was born by foreign agencies the budget of the host country was affected for instance by increased spending for public order. However the EBRD states at the beginning of the year 2000 that "signs of recovery are now apparent." (p.218)

PUBLIC DEBT

The IMF reports for 1998 a public debt of 60 % of GDP for Macedonia. This is not a bad record, if we remember the 60 % debt to GDP ratio is the critical ratio for EU countries to become members of the European Monetary Union. Most of the public debt is denominated in foreign currency: 34 percent is owned by foreign officials and commercial creditors; 21 percent are domestic liabilities denominated mainly in deutsch mark. These deposits owned by domestic residents are "frozen", i.e. cash withdrawals are only allowed under specific circumstances. Those deposits are not serviced by the government. The remainder of 5 percent are other domestic liabilities.

The EBRD reports a foreign debt to GDP ratio (in percent) of 39.5 for 1998. This ratio implies a debt servicing to export ratio of 8.5 percent for 1998. This means that 8.5 percent of the international currency earnings through exports are devoted to the servicing and repayment of the debt.

CURRENT ACCOUNT

The alarming reference number is the deficit of the current account, i.e the trade balance including services. In percent of GDP the current account deficit rose from 5.2 % (1995) to 9 % in 1998. The dinar was depreciated in July 1977 at 14 percent to improve the competitiveness of the economy and improve the trade balance, but it was not successful to turn around the sign of the current account. (Mainly because of the excessive imports since 1996). Macedonia depends on energy imports (10 percent of the value of imports) and imports will further in-

crease if the economy picks up. The increase of energy imports has to be financed either by an increase of exports or by a reduction of international reserves or by an increase if international indebtedness. The planned construction of two hydro electric power stations in Macedonia, will help to increase the supply of domestic energy and contribute to improve the deficit of the current account through a reduction of the oil bill. In addition it will have a multiplier effect on domestic output and employment. Exports declined 1996 and grew by a mere 2 percent 1997. After the devaluation export growth rebounded to 7 percent. Exports have lost market shares in the former SFRY but have gained ground in the European Union. This suggests a process of trade integration with advanced economies at the expense of traditional partners.

Can we say anything simple about the long-run international financial solvency of Macedonia ? Remember that most of the government debt is denominated in foreign currency. Therefore, we have to compare the ability of the country to earn foreign currency through the export channel with the level of debt in foreign curreny.

Denote exports with x_t; assume that the country repays $b \cdot x_t$ for all periods to come. The present value of these repayments equals the inhereted debt level, D

(1) $$D_0 = \frac{b \cdot x_1}{1+r} + \frac{b \cdot x_2}{(1+r)^2} + \ldots + \frac{b \cdot x_t}{(1+r)^t}$$

Consinder the simple case where exports grow at a constant rate n and the realinterested rate is constant and r. [Daniel Cohen: How to evaluate the solvency of an indebted nation, Economic Policy 1985.]

Two cases are possible:

i) n > r

ii) r > n

If n > r the rate of growth of earnings from exports exceeds the real interest rate. The country's wealth in present value terms is infinite and there is no solvency problem. A small fraction of x can repay any level of the initial debt.

If case ii) holds, that r > n , the interest rate exceeds systematically the rate of growth exports, then we calculate according to D. Cohen (1985) the minimum fraction of debt repayment in foreign currency to avoid insolvency of the country. The value of b that satisfies equation (1) for $t \to \infty$ is:

(2) $$b = \frac{r-n}{1+n} \cdot \frac{D_0}{x_0}$$

$\frac{D_0}{x_0}$ is the given (initial) Debt/export ratio, $\frac{r-n}{1+n}$ is an index of solvency, and b is that fraction of exports that should be devoted to repay the debt, to keep the debt to export ratio constant.1998 the debt net of reserves was 1067 mill US $ and exports mounted to 1322 mill US $; $\frac{D_0}{x_0} = \frac{1067}{1322} = 0.81$.

If we accept Cohens assumption that for developing countries the index $\frac{r-n}{1+n} = 0.05$, i.e the difference between the real interest rate and the rate of growth of exports is 5 % (a very pessimistic view !) we get for Macedonia a solvency index number of:

$$b^* = 0.05 \cdot 0.81 = 0.04$$

The critical value of repayment b* which keeps the initial (i.e. 1998) debt to export ratio constant is 4 percent. Since Macedonia achieved a larger share of percent the debt to export ratio will fall in the long run. It should be noted that all measures aimed at expanding exports will further reduce the cost of repayment. This moderate value b = 4 percent places Macedonia in an international comparison in a good position. For instance Cohen calculated b-values for the small Latin American countries of 6 % < b < 13 %, Israel has a b-value of 7 %, Egypt and Peru 12 percent.

The critical repayment ratio of 4 percent guarantees Macedonias international solvency and shows that the country has still more room to borrow.

The above solvency ***index*** describes the capacity of a borrower country to make future repayments in foreign currency.It does not reflect the actual situation of the current account (trade balance including services). The latter is not in a favorable situation:

Table 3

Trade balance

(mill US $)

	1995	1996	1997	1998
Exports	1204	1147	1237	1311
change %	11	-4.7	7.8	6.0
Imports	1719	1627	1779	1914
change %	16	-5.4	9.4	7.6

Source: WIIW

While exports growth was adequate, import growth was excessiv (16 % in 1995) and picked up again 1997 in response to the liberalization of the trade system. The majority of imports were industrial supply (61 %) and consumergoods (28 %). The largest single item was oil and derivatives for about 10 %.

Trade policy should support measures to increase exports and try to subdue imports to the extent that the necessary share of 4 percent of export earnings can be devoted to the repayment of the foreign debt.

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Fiscal Risks in Macedonia

Vladimir Gligorov

Introduction

There are two types of public obligations. The first are legal obligations. Those determine the level and the character of public expenditures as detailed in the appropriate budgets. The second type consists of a set of obligations that are mainly political. Those have to do with the budgets taking over the obligations of firms, banks or individuals for macroeconomic or other political reasons.

Both types of obligations involve risks that may originate from the same causes, though they will, as a rule, have different transmission mechanisms. The most common causes are internal and external shocks that can affect public as well as private expenditures and revenues and thus have significant influence on the fiscal balance. Fiscal risks of this kind play a significant role in the "second generations theories of exchange rate crisis".[1]

In this note, the fiscal risk emanating from political obligations in Macedonia will be assessed.

Arrears

Probably the key fiscal risk is the one connected with the inter-enterprise arrears. The estimates of these arrears differ. This is probably because just summing up the arrears of individual firms would imply multiple counting. I do not know the estimate of net-arrears and I doubt that it exists. Clearly, it would be this net figure that would be relevant for the assessment of the fiscal risk.[2] To get at some idea of the fiscal risk involved, one could start with the aggregate figure, which has been put at about DEM 1 billion or at about 17% of the Macedonian GDP.[3] Assuming that all these arrears are entered into involuntarily, that would mean that the total of these arrears might not be settled sometime in the future. To these

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[1] In the fist generation theories, the inconsistency of monetary and fiscal policies was taken to be the cause of sharp devaluation. In the second generation theories, it was the inconsistency between the external and the internal equilibria (i.e., between the exchange rate and the rate of unemployment) that was seen as causing the inconsistency between the monetary and fiscal policies with the exchange rate crisis as a result. In this case, high unemployment brings in fiscal risks that get monetised and the external equilibrium becomes unsustainable.

[2] It could be different for monetary policy. Arrears are an expansion of credits. Therefore, the total amount of arrears would have an important influence on the monetary aggregates and thus on the monetary policy. Indirectly, there will be an influence on the fiscal policy too, but this can be disregarded here.

[3] See Narodna banka na Republika Makednonija, *Godisen izvestaj* 1999, p. 21.

arrears, those that have been entered into voluntarily could be added. Let us assume that those amount to another DEM 2 billion. Altogether, this is about 50% of GDP.

Out of the first category of arrears, over half belongs to about 50 companies, which means that these companies own a lot of money. This is slightly less than 10% of GDP. Assuming that at least the interest payments on these debts constitute an implicit obligation of he budget, this gives an implicit obligation of 5% of GDP. Assuming that the risk that this obligation is going to be called upon is high, e.g., 50%, that gives the fiscal risk of about 2.5% of GDP.

As for the other debts, they should carry smaller risks. Assuming that these debts are mostly short-term obligations, it could be argued that the opportunity cost of entering into these types of obligations is equal to the short term interest rate forgone. If the short term real interest rate is around 20%, that means that about 20% of these arrears could be defaulted on. That would be about DEM 400 million, or about 6.5% of GDP. Assuming that the risk of default is not that high, e.g., 25%, that would mean that the fiscal risk arising from these inter-enterprise arrears would be about less than 2% of GDP. If the risk were scaled down to 10%, that would give the fiscal risk of about less than 1% of GDP.

Unemployment

Unemployment is very high in Macedonia, over 30%.[4] During the last decade, the unemployed had very little influence on the economic policy. This was the case because most of the new unemployment came from the first time employment seekers and only the smaller part came from those who lost their jobs. Still, it cannot be expected that this high level of unemployment, if it persists, will have no influence on the government's policies forever. Therefore, there is a fiscal risk that could be associated with the change in the monetary policy and fiscal policy stances that may be necessitated by the political pressure that high unemployment may eventually exert. This fiscal risk is quite difficult to quantify. The costs would depend very significantly on the way the government would want to reduce the level of unemployment. Assuming that it would rely on fiscal stimuli of one kind or another, those would have a negative effect on the public revenues. If the pressure is not altogether high, it could be expected that an initial increase in the budget deficit could be expected (the eventual growth in GDP should bring in more tax revenues). A conservative estimate could put that risk at about 1% of GDP.

[4] This is according to the labour surveys. Registered unemployment is higher.

Banks

There are a number of fiscal risks that are connected with the banking sector.

One is connected with the so-called old foreign currency savings. These are savings in foreign currency that the banking system defaulted on and that was taken over by the government and is now part of the public debt. This part of the public debt is not really serviced, but the existence of the debt does bring in the risk that it will have to be serviced at some point in time. It is, at this point in time, difficult to assess what is the precise risk involved.

The other is connected with the foreign currency savings that were deposited with a number of failed banks. There has been a continuing pressure by the depositors on the government to cover their losses. Those could amount to more than DEM 100 million. Some members of the government have said that the budget will take over this debt, though there is no legal basis for that. This is then a clear instance of the political fiscal risk.

The third source of risk is connected with the bad loans of the banks. It is not altogether clear how high this risk is. For instance, in the case of the privatisation of Stopanska Banka, the government reportedly took over DEM 250 million in bad loans. Other banks are much smaller, so the remaining fiscal risk may not be altogether high.

To sum up, the fiscal risk emanating from the banking system may amount to a few hundreds of millions of German marks. The interest cost on this debt could amount to thirty-forty million German marks per year, or probably around 0.5% of GDP.

Social safety net

Other fiscal risks are connected with the social safety net that may become important in the election campaign or through growing social tensions. It is difficult, at this point, to determine the level of this risk.

Total

Putting the risks together, it could be argued that the total fiscal risk that the Macedonian general budget is facing is probably below 5% of GDP. This is clearly a very rough measure and not much store should be put by it. Still, it does make the existing fiscal balance in Macedonia somewhat more realistic.

The risks of fiscal deterioration

As mentioned in the introduction, the risks of fiscal deterioration depend on the internal and external shocks. Clearly, if growth accelerates because of the opening up of markets or because of the increase of investments or because of higher domestic consumption due to the increase in the transfers or for whatever reason, that would be beneficial to the fiscal balance. The same goes for the fall of the interest rates. Those would boost the banking system and diminish the burden of the inter-enterprise arrears. On the other hand, the continued poor growth performance and the persistent high interest rates will make the fiscal balance unsustainable.

What are the risks, on balance? In the short run, i.e., in a year or so, little positive development can be expected because there is a lot of restructuring to do. In the medium term, the problems with the sustainability of the current account, i.e., of the servicing of the foreign debt will be a problem. Beyond that, an average growth rate of 4-5% should be helpful, but the fiscal risks will still continue to be high.

High Unemployment as a Risk for the Budget in Macedonia

Ewald Walterskirchen

The crisis in neighbouring Kosovo had a severe impact on Macedonia's economy in 1999, mainly through reduced exports and a high number of refugees. Macedonia is still suffering from this economic fallout of the Kosovo crisis.

Trade with Yugoslavia collapsed, causing Macedonia to lose one of its most important trading partners. The transport costs of exports to EU countries doubled, since the main transit route had been closed. As a consequence, some factories had to close down, adding to already high unemployment. The Kosovo crisis came at a time when the region was facing severe structural problems and very high deficits in the current account, but when the general government budget was more or less balanced.

Macedonia had been facing an enormous influx of refugees from Kosovo which put a heavy strain on social and economic infrastructure. Macedonia accommodated up to 250.000 refugees at the peak of the crisis, that is about 13% of the total population. This has been a considerable burden although most of the associated expenses have been reimbursed by the international community.

Equally important have been the consequences for the country's economy and labour market. After the devaluation in 1997, output and employment had picked up substantially in Macedonia. But the Kosovo crisis stopped this favourable developments. With manufacturing output declining by 2,5% in 1999, it is very likely that employment in industry dropped too. The rather unreliable national statistics do not show such a decline in 1999, but there may a considerable time lag in the reaction of employment to output changes.

A poor employment performance has two main consequences for the budget:

- Since wages and salaries are the main basis of government revenues in Macedonia, a poor employment performance gives rise to concern about increasing fiscal deficits. The employment ratio is extremely low in Macedonia - less than 20% of total population - thus eroding the most important tax base.

- Low demand for labour results in very high unemployment rates which put an additional burden on the general government budget.

Unemployment is considered to be one of Macedonia's largest problems. The unemployment rate is about 32%, but only about one quarter of the jobless receives unemployment benefits (according to an IMF-Report). Moreover, the withdrawal of labour due to disability and early retirement does not show off in the unempoyment statistics, but it raises social expenditures. The unemployment statistics, too, are not very reliable: the estimates of unemployment rates vary from 26 percent to 36 percent.

The unemployment rate has risen sharply with the imposition of hard budget constraints on enterprises. Many firms are not replacing workers who change jobs or retire, and rigidities in the labour market are limiting the growth of new employment.

Macedonia is trying various employment programmes for laid-off workers, in particular incentives for enterprises ready to employ the jobless. The government attempts to encourage new jobs by exempting enterprises from paying social taxes on new hires for a limited period.

The vast majority of the unemployed has been without a job for more than 18 months and is therefore not eligible for unemployment benefits. According to a Labour Force Survey of the Statistical Office, 76 percent of the unemployed are out of job for more than 18 months, 44 percent for more than 4 years. This is the reason why only about 20% of the unemployed are receiving benefits. There is a need for a more comprehensive unemployment insurance system to prevent social unrest, but this would put a heavy burden on the budget.

The outlook for Macedonia is much brighter than recent developments. Even the macroeconomic slowdown in 1999 was not as severe as expected by most forecasting institutes. Signs of recovery are now apparent. For the year 2000, the IMF and the EBRD are expecting a GDP growth rate of 3% for Macedonia. This should help to stabilise employment and unemployment.

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A SIMULATION APPROACH TO STUDY MACEDONIA'S ECONOMY

Gerhard HANAPPI

MACROMAZE: The Macroeconomic Model

As Finn Tarp [Tarp F., 1993, p.30] following Easterly [Easterly W., 1989] has pointed out, each policy-oriented, open economy model must consist of at least of four building blocks that describe the following sectors:

- the private, non-financial sector,
- the government sector,
- the domestic monetary system and
- the foreign sector.

Starting with the ***private, non-financial sector***, the first group of equations describes expected total income as the sum of its demand components. Note however, that this is only that part of this sector that describes the ***commodity market***. The other part of this sector, often neglected by models interested in the financial side of the economy, namely the labour market, will follow further down.

$$Y_t^* = C_t + I_t + G_t + X_t - M_t \tag{1.1}$$

$$C_t = C_t(\alpha_t^S, L_t^D, w_t, P_t) \tag{1.2}$$

$$I_t = I_t^D(r_t^D, w_t, Y_t^*, I_t^S) + I_t^F(r_t^F, \pi_t^*, e_t^*) \tag{1.3}$$

$$G_t = G_t^U(\alpha_t^U, U_t) + G_t^D(D_t, r_t^B) + I_t^S + G_t^C(Y_t) \tag{1.4}$$

$$X_t = X_t(Y_t^F, e_t) \tag{1.5}$$

$$M_t = M_t(Y_t, e_t) \tag{1.6}$$

Equation (1.1) is just a reinterpretation of the well-known social product identity, laying emphasis on the role of *expected* income Y_t^*.

The consumption function (1.2) is a Kaldor-type formulation - different saving ratios for wage income ($L_t \cdot w_t$) and profit income (P_t) - augmented by a policy parameter, α_t^S, that can be used to model the transition process towards the possibility of private savings[1]. Since only disposable income can be consumed, the level of taxes, T_t, has to enter this equation too.

[1] In a sense this transition is the emergence of a credible and functioning domestic banking sector.

In equation (1.3) the traditional investment function used in standard models for industrialized countries is modified so to support explicitely two types of investment: domestic investment and foreign investment. The former depends on the usual arguments - the domestic interest rate r_t^D, relative prices represented in the real wage rate w_t and an accelerator described by Y_t^* - plus the investment of state-owned enterprises, I_t^S, again an exogenous variable enabling the description of the transformation process. Foreign investment is thought to depend on the more general notion of expected overall profitability of the economy, described by the ratio of total revenues over total wage cost, π_t^*, on the expected real exchange rate, e_t^*, and on its opportunity cost, the foreign interest rate r_t^F.

Government expenditure, G_t, is described according to its use in equation (1.4). Since unemployment usually is the most burning policy question during transition, government expenditure for the unemployed is described in the first term as depending on the unemployment rate u_t. A policy variable α_t^U can be used to describe institutional changes during transition[2]. Interest payments for public debt, G_t^D, depend on the level of debt, D_t, and the corresponding interest rate, r_t^D. The third term is investment of state-owned firms[3], I_t^S, while the last term captures all other current government expenditure.

Equation (1.5) describes exports, X_t, as depending on real GDP growth of trading partners, Y_t^F, and the real exchange rate, e_t. Note in this respect, that the German convention for exchange rates is used throughout the model: the nominal exchange rate, e_t^N, is the price of one unit of foreign currency in domestic currency, e.g. 31 denars for one DM. The nominal exchange rate becomes the real exchange rate if it is corrected by ratio of price levels:

$$e_t = e_t^N \cdot \frac{p_t}{p_t^F} \tag{1.7}$$

Standard reasoning thus would assume a rise of exports as e_t increases, indicating a devaluation of the denar.

Finally imports, M_t, are described in an analogous way in (1.6). Here domestic income, Y_t, drives imports.

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[2] In Macedonia currently only one fifth of the unemployed receive unemployment payments.

[3] Note that government investment fully enters in (1.4), government expenditure, while its influence might also be felt in domestic investment in (1.3). This modelling strategy substitutes the more indirect link of the 'crowding out' debate, since the latter runs via fully functioning capital markets.

Proceeding to the ***government sector***, the first thing to note is that equation (1.4), already described above, is also part of this building block - blocks are linked. Flows initiated by government activity also directly entered equations (1.1) and (1.3) - not to mention indirect influences, so it has to be kept in mind that this sectoral division mainly is a didactic device. Nevertheless equation (1.4) together with the following four equations usually are considered to build the core of this sector:

$$G_t = T_t + X_t - M_t - \Delta R_t + \Delta D_t + P_t^S \tag{1.8}$$

$$T_t = T_t(L_t^D, w_t, P_t) \tag{1.9}$$

$$D_t = D_{t-1} + \Delta D_t \tag{1.10}$$

$$R_t = R_{t-1} + \Delta R_t \tag{1.11}$$

Government expenditure, described by specific use in equation (1.4), can be financed in different ways. This is the content of equation (1.8). Government expenditure thus has to be financed in one of the following ways:

- Taxes, T_t, that are described in more detail in equation (1.9),
- foreign exchange arising from an excess of exports over imports[4], $X_t - M_t$,
- a decrease of the stock of official reserves, $-\Delta R_t$,
- an increase of the stock variable public debt, ΔD_t, or
- profits of state-owned firms, P_t^S.

Note that during the transition process the last term might well turn out as a negative value.

The tax function of equation (1.9) allows for different taxation of wage income, $L_t \cdot w_t$, and profit income, P_t. Private profits are defined as the excess of revenues over total cost, consisting of wage cost and capital cost:

$$P_t = Y_t - L_t^D \cdot w_t - K_t \cdot r_t^D \tag{1.12}$$

Clearly the currently prevailing high domestic interest rate in Macedonia discourages domestic firms and gives foreign firms, benefitting from low foreign lending rates, a large advantage. The question how far internal profit transfers of transnational firms reduce taxable profits, P_t, is not adressed.

Equations (1.10) and (1.11) simply show the updating of the stock variables R_t and D_t.

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[4] Note that this amount must be balanced by a change in G_t^C since foreign exchange earning firms only change back. Nevertheless it is necessary to make this process visible if public debt has to be repaid in foreign currency that only can be earned by a trade surplus.

The third building block concerns the ***domestic monetary system***. In a country devoted to an explicit policy of a fixed exchange rate, i.e. a fixed rate versus the Euro, this amounts to a description of that exchange rate policy, since the money supply will always adjust to accomodate this guaranteed rate. In other words, with given exchange rate policy there is no more room for monetary policy via the money supply. Indeed the money supply does not play a significant role in this model at all - though it could, of course, be derived as an epiphenomenon.

Instead, the persistent large difference between domestic and international interest rates that could not be eliminated by free convertibility of the Macedonian denar has to be explained by other reasons. The model proposes two different sources: A higher probability of business failure in Macedonia than in countries with low interest rates and a low credibility of the exchange rate policy. As a consequence the domestic interest rate is determined as an equilibrium rate that takes care of these influences:

$$(1+r_t^D)\cdot b_t = (1+r_t^F)\cdot \frac{e^*_{t+1}}{e_t} \tag{1.13}$$

For any given success probability b_t, which is one minus the probabilty of a business failure[5], and for any expected[6] real exchange rate e^*_{t+1}, a domestic interest rate r_t^D can be computed that leaves investors indifferent between domestic and foreign investments. Equation (1.13) thus can be used to determine the domestic interest rate under the assumption of rational investors who fully take into account institutional vagaries.

The other two important monetary phenomena to be modeled in this sector are the processes determining prices and wages. The price-wage system consists of the following two equations:

$$p_t = p_t(\alpha_t^p, \Delta w_t^n, p_t^F, \frac{\Delta Y_t}{Y_t}) \tag{1.14}$$

$$w_t = w_t(w_{t-1}, u_t) \tag{1.15}$$

For prices three possible impacts are distinguished:

- cost-side impacts via a change in the nominal wage rate Δw_t^n,

[5] Evidently business failure can originate from many diverse sources as bureaucratic hurdles, obsolete infrastructure, political instability and the like. The probability used by investors summarizes all these obstacles.

[6] The time index of expectation variables refers to the point in time for which the variable is forecasted, and not to the time when this forecast is made. The latter is here always omitted since all forecasts are made at the current point of time, i.e. at time t.

- cost-side impacts from the foreign price level p_t^F,
- demand-side impacts from real overall growth $\frac{\Delta Y_t}{Y_t}$, and
- exogenous price policy with parameter α_t^p.

The price level thus is viewed as the aggregate outcome of individual price setting behavior that responds to developments on the cost and demand side as well as to institutional changes[7], compare equation (1.14).

Wages are modeled less ambitious. As equation (1.15) shows, the real wage is thought to exhibit a certain stickiness incorporated in the influence of the lagged term w_{t-1}. The second influence comes from the labour market, where decreasing unemployment rates are expected to exert some upward pressure on real wages[8].

Equations (1.13), (1.14) and (1.15) form the core of the domestic monetary system. Domestic money markets, where ample supply of denar savings of private households meets money demand for transaction and speculation with denar, do not seem to be adequate descriptions of the determination of Macedonia's interest rate.

The key sector for the understanding of future developments of Macedonia clearly is the ***foreign sector***. One main part of this sector, the major link to the Macedonian economy has already been introduced - trade as described by exports (1.5) and imports (1.6) of goods and services. Another link appeared in equation (1.8), where public finance - think of interest payments for foreign currency debt - was shown to depend on a trade surplus. As the relevant stock variables - and buffer - for this process official reserves R_t, and public debt D_t have been introduced in (1.10) and (1.11). Both are typically held in foreign currency and constitute an important part of the foreign sector. A further genuine ingredient of the foreign sector is the determination of the real exchange rate, mentioned in passing in equation (1.7) above. Note that this innocent equation, via p_t, also provides a link from the domestic monetary sector to the foreign sector.

The last remaining element of this building block now is the determination of the nominal exchange rate:

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[7] Again this approach circumvents the direct influence of the money supply, which proponents of the quantity theory of money usually highlight. But with some additional interpretation the money supply as intermediating variable can be brought into the picture again - leaving the equations as they are.

[8] Without going into the details of the wage structure it seems to be reasonable to assume that the wage level already is near its minimum level - current movements therefore are assumed to be asymmetric.

$$e_t^N = e_t^N(\alpha_t^F, \frac{\Delta D_t}{D_t}, \frac{\Delta R_t}{R_t}) \tag{1.16}$$

Equation (1.16) states a certain exchange rate policy. It provides an exchange rate instrument, α_t^e, and the influence of the two growth rates of debt and reserves. In particular these rates might be used as sensitivity borders for forced, sudden adjustment of the nominal exchange rate. It has to be mentioned that the trajectory of the nominal exchange rate partly - and within limits - can be interpreted as an independent policy instrument. As is the case with the announced fixed exchange rate regime of Macedonia. On the other hand, the control over this instrument can be lost if certain limits of important related variables are reached. Furthermore, and partly as a consequence of this limited control, one has to distinguish between announced policy and actually planed policy.

All these arguments amount to the formulation of an independant equation for the nominal exchange rate that the domestic private sector and the foreign sector expect:

$$e_t^* = e_t^*(\alpha_t^e, e_{t-1}, e_{t-1}^*) \tag{1.17}$$

Expectations of nominal exchange rates are assumed to follow something like a simple auto-regressive process, where again some instrumental influence from monetary authorities can be modeled by the use of a parameter α_t^e.

The foreign sector can be seen as reaching into each part of the model, it consists of the equations (1.5), (1.6), (1.7), (1.8), (1.10), (1.11), (1.16) and (1.17). This is particularly important for the case of Macedonia, where the actual dynamics indeed seem to depend to a large degree on a prosperous embedding of its future within its future trade partners.

At this point one must take a step back to consider what the major problem of the Macedonian economy currently really is. And there is no doubt that is problem is the extremely high unemployment rate. Unfortunately most macromodels used by international financial institutions do not incorporate labour market dynamics. They rather tend to follow the counterfactual assumptions of neoclassical growth models, which postulate full employment due to perfect foresight and perfect competition on all markets. Contrary to this strand of models Keynesian macromodels sometimes insist that unemployment might be persistent[9]. Both groups of theorists do not follow the distinctions of the practioneers cited in the beginning of this chapter, but usually distinguish between different four aggregate markets:

[9] Compare Flaschel's interpretation of Domar's growth model as a stable model with a positive unemployment rate [Flaschel P.,].

the commodity market, the labour market, the money market and the bond market. While the latter two are pretty close to the domestic monetary sector and the foreign sector treated above, the government sector is absent in this list. As far as applied modeling is concerned it is a necessary component that should always be fully incorporated in a macromodel - instead of being banned to a specialized sub-discipline like 'public finance'.

On the other hand the ***domestic non-financial sector has to be augmented*** by some more equations that allow for labour market dynamics. This is what follows now and what closes the model.

First, a production function has been specified, and has been used in two directions: Inverting it, solving it for labour demand L_t^D, gives a labour demand function.

$$L_t^D = L_t^D(\alpha_t^L, Y_t^*, K_t, O_t) \tag{1.18}$$

Labour demand depends on capital stock K_t, on expected demand Y_t^*, on the openess of the economy O_t and on a labour market instrument α_t^L. Note first that openess of the economy here is defined as the ratio of total trade in GDP,

$$O_t = \frac{X_t + M_t}{Y_t} \tag{1.19}$$

Since there is no extra term for (domestic) technical progress, it is clear that it is assumed that technical progress enters via O_t - it is the international division of labour that leads to technical progress, and it is measured as trade share in GDP. Note second that expected demand Y_t^* is correctly anticipated - see equation (1.1) - but that actual employment, due to the interfering instrument α_t^L, may be different from the one needed to produce exactly this output. This leads to the second use of the (non-inverted) production function, namely to determine actual output, Y_t, with the labour force actually employed, L_t^D.

With respect to the capital stock the usual updating procedure with a given exogenous rate of depreciation, δ, is used:

$$K_t = K_{t-1} + I_t - \delta \cdot K_{t-1} \tag{1.20}$$

Finally labour demand L_t^D together with an exogenously given labour supply L_t^S determine the unemployment rate u_t

$$u_t = u_t(L_t^D, L_t^S) \tag{1.21}$$

As described above, the unemployment rate enters the wage equation (1.15). But it also should be taken into account that high unemployment rates incur political instability and deter foreign investment. In this model this non-standard behavioral assumption translates into an equation for the determination of the probability of business failure.

$$b_t = b_t(b_{t-1}, u_t) \tag{1.22}$$

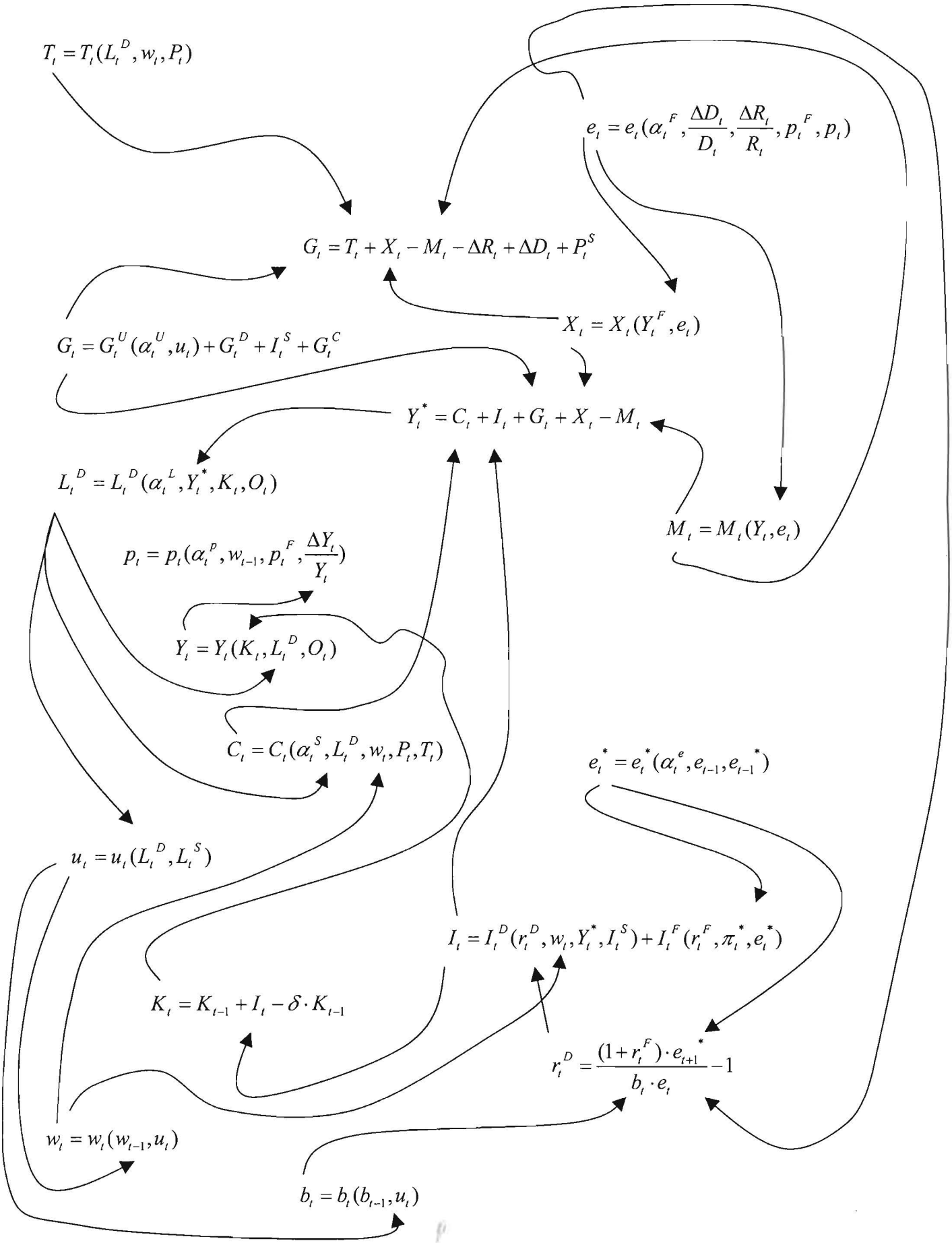
If u_t increases, then b_t goes down. So while there is scope for unemployment if supply of labour and demand for labour drift apart, there are also some countervailing economic forces, though perhaps not strong enough to dominate the first process. The unemployment rate enters the wage equation (1.15) and eventually will lead to lower real wages that in turn could trigger off additional consumption and - if lower domestic investment is compensated by higher foreign investment - leads to higher expected demand. But if the higher unemployment rate does not lower real wages significantly, while it simultaneously increases the risk of business failure, $(1-b_t)$, via equation (1.22), then lower foreign investment will trigger off a process that further depresses the economy.

This simple argument should be convincing enough to see that the causal structure of a model with 22 interwoven equations cannot be grasped so easily. Therefore the most important links are presented in an arrow diagram on the following page. While this helps a little to understand what is going on in principle, causalities describing net effects of instruments on endogenous variables can only be derived from a fully specified and numerically estimated set of model equations.

This is the topic of the next chapter.

MACROMAZE: A small open macroeconomic model for Macedonia

Structural overview



MACROMAZE - Estimations and Assumptions

Gerhard Hanappi

In this part the model specified above is adapted and estimated to enable a long-run forecast of the Macedonian economy. For this purpose a rather extensive search for relevant data has been undertaken, which then had to be completed by an effort to reconcile the findings. In that respect the reader should keep in mind that Macedonia only started to report GDP and other related series in a way comparable to OECD countries in 1996. Though the Official Statistics Unit of Macedonia did its best - actually with impressing success - to catch up with state-of-the-art reporting, we still are left with time series of a few years only. It is therefore rather daring to speak of an econometric model at all, preferably it should be considered as an equation system that only tries to reflect some empirical findings. Of course, this does not reduce its importance for the study of the interaction of the macroeconomic system.

A first decision was to start with 1998 as a base year. There was data for 1999, and it will be used in the forecast, but the year of the war in neighbouring Kosovo was such a shock for the Macedonian economy - think only of the 250.000 refugees adding to a total Macedonian population of only 2 million persons - that it seemed to be wise to consider this year as not typical. The overall macroeconomic picture from 1996 to 1998 was not bad:

Table 2.1. *Macroeconomic Aggregates (mil. den.)*

	1996	1997	1998
GDP	178289	185023	193153
Private consumption	128546	137657	145637
Public consumption	32270	32379	33802
Gross investments	35836	41445	44039
Fixed Assets	27503	28333	29592
Foreign mil $		16	118
mil denar		797	6431
domestic	35836	40648	37608
Exports of goods and services	51983	66238	79000
Imports of goods and services	70812	92697	109325

National sources: Annual Reports

As can easily be seen, this is the empirical base for equation (1.1), since the difference between expected and actual outcome on the left side of (1.1) should show up as an ex post difference between intended and unitended investment on the right side - and large inventories

surely were not the problem in these years. So the last column in table 2.1 is a save starting point for prediction.

Equation (1.2), the consumption function, turned out to be rather simple to determine too. As national data on wages shows, workers can be assumed to spend all their income on consumption, while entrepreneurs in these years clearly experienced an upward trend of their propensity to consume. The latter went from 80,6% (1996) via 82,8% (1997) to 83,91% in 1998. There is good reason to consider this development as a reaction on unattractive conditions of high domestic interest rates, slowing down investment, paralleled by an adjustment to more satisfactory consumption levels after the crisis years just gone through[1]. Summing these ideas up, a level of 85 % propensity to consume out of profits is assumed:

$$C_t = \alpha_t^S \cdot (w_t \cdot L_t^D - \alpha_t^T \cdot T_t) + 0{,}85 \cdot (P_t - (1-\alpha_t^T) \cdot T_t) \qquad (2.1)$$

The policy parameter α_t^S initially can be assumed to be unity, but can be varied in later years if employees start to reach wage levels, where they might be induced to save part of their income. Remark also that the policy parameter $\alpha_t^T, 0 \le \alpha_t^T \le 1$, measures the distribution of the tax burden between workers and entrepreneurs and is needed to transform income into *disposable* income. It has been initialized with a value of 0,9 and can be used in simulations to see the effects of different tax policies.

The investment function is a little bit more tricky to derive. While foreign direct investment started to boost, since labour cost were low and the exchange rate risk was reduced by the credible announcement of fixed rates towards the deutschmark, domestic investment demand stagnated. Indeed this evolution supports the ideas put forward in equation (1.3): In the first term relative factor cost were against increases of the capital stock as long as capital was expensive relative to labour, and growth of income was to weak to overcome this effect. As a deeper look into the data shows, it has been investment of state owned firms that accounted for the steady level of domestic investment. The second term describes FDI and shows that foreign firms look at overall profitability, which developed rather exciting in 1998, and at expected exchange rates.

$$I_t \cdot p_t = 81275 \cdot \left(\frac{p_t \cdot w_t}{r_t^D}\right)^{0{,}25} + I_t^S + 0.306 \cdot I_{t-1}^F \cdot p_{t-1} \cdot \frac{r_t^F}{r_{t-1}^F} + 892898 \cdot \pi_t^* \cdot \frac{e_t}{e_{t+1}^*} \qquad (2.2)$$

[1] The IMF [IMF, 1998, p.94] describes this recovery as an increase of the percentage of net profit (before tax) in GDP as follows: -9% (1994), -5.3% (1995), 2.8% (1996) and 4.8%(1997).

More precisely, what (2.2) states is that the accelerator currently does not play a significant role in domestic investment demand, that relative factor prices could contribute a little and exogenous investment by state-owned firms, I_t^S, surely does. For FDI there is a clear connection to less favourable credit conditions in foreign countries interest rates and a positive link to expected profitability in Macedonia - just like economic plausibility would have suggested. For exchange rate expectations nothing could be observed empirically, because the exchange rate remained constant in this time period, so an elasticity of one was assumed.

The next equation is (1.4) that shows government expenditure according to its use. For the first term the dependency of expenditures for unemployment clearly depends on the number of unemployed persons. Policy instrument α_t^U was set to unity in 1998, but might vary in the future. The second part, expenditures for public debt, depends on the amount of debt and the overall interest rate (including payback of the principal) applied to it. Finally the rest of government expenditure is assumed to be linearly related to GDP.

$$G_t = \alpha_t^U \cdot 0,01438 \cdot U_t + D_t \cdot r_t^B + 0,138 \cdot Y_t \tag{2.3}$$

Turn now to the export and import functions. For MACROMAZE standard assumption for the functional forms of these equations proved to fit quite well, though the few observations available certainly render any econometric evaluation of significance obsolete. The export function estimated is

$$X_t = \left(\frac{Y_t^F}{p_t^F}\right)^{0,772} \cdot (e_t^G)^{0,763} \tag{2.4}$$

In this equation the first term characterizes real GDP of trade partners, while the second term is the real exchange rate's influence. For Y_t^F and p_t^F the GDP and GDP-deflator of total OECD have been used, and e_t^G is the real exchange rate vis-a-vis the deutschmark. The sign of both parameters is positive and therefore economically plausible[2]. Note also, that according to latest news (*The Economist*, April 1-7, 2000), Greece is thought to join EMU next year so that indeed the exchange rate versus the deutschmark is a good proxy for Macedonias future terms of trade.

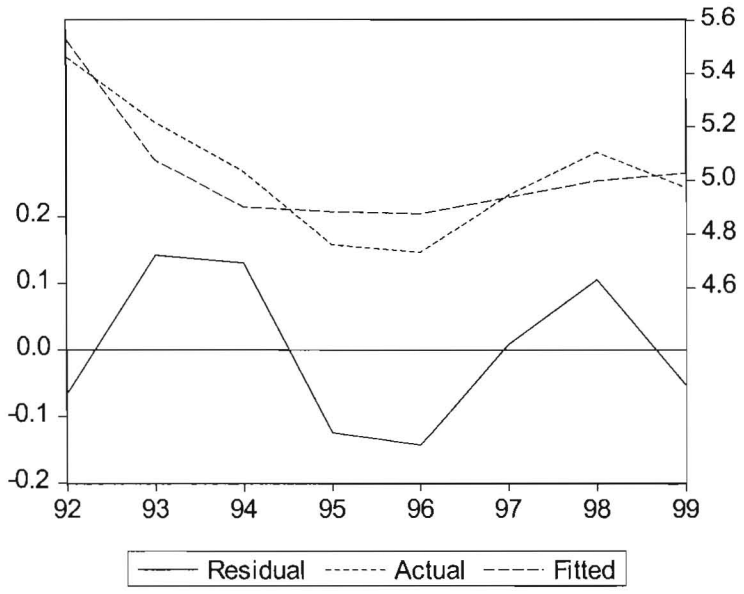
[2] Remember that the German notation of exchange rates is used: an increase in e is a devaluation of the Macedonian denar.

The import function has a similar form, now domestic GDP substituting foreign GDP and economic plausibility suggesting a negative sign of the parameter in front of the real exchange rate. With the given data and the same assumptions as for exports the following estimate proved to be the most convincing.

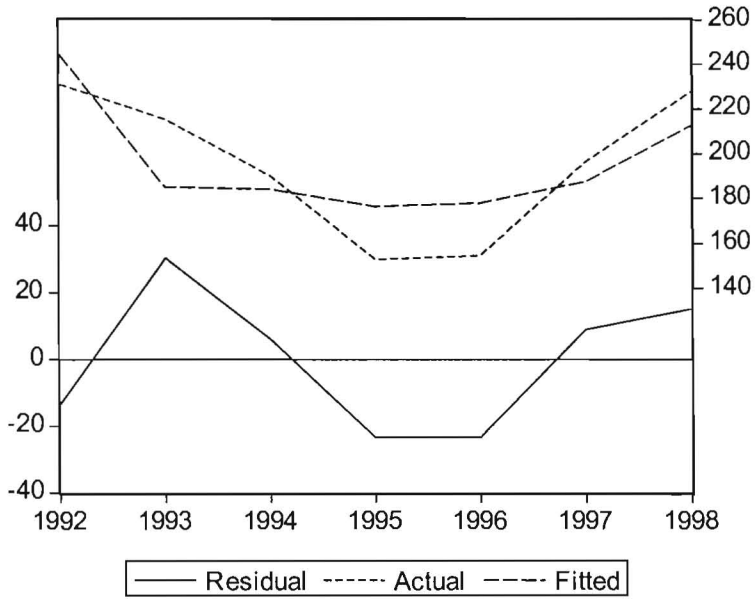
$$M_t = 2{,}973 \cdot Y_t - 917{,}5 \cdot e_t^G - 888{,}2 \qquad (2.5)$$

To provide a visual impression of the quality of these estimates one could take a look at the following two graphs comparing actual and estimated developments of trade flows from 1992 to 1998.

Graph 1: Estimation of exports (in logarithms, residual left scale)



Graph 2: Estimation of imports (residual left scale)



Government expenditure according to source of finance, given in (1.8), is just a flow identity that needs no estimation of a behavioral function - though it has been not easy to find correct data for 1998. On the contrary tax function (1.9) is a behavioral equation again:

$$T_t = 0,2001 \cdot Y_t \tag{2.6}$$

This simple relation emerged out of the fact that it seems to be remarkably stable[3], and that it seemed to be rather difficult and only marginally rewarding to go into deeper details of the taxation procedures. The idea of distinguishing between wage taxes and profit taxes put forward in the last section therefore proved to be not feasable at the current stage of research. But there surely is room for further investigation in a later stage.

At this point it is also important to underline that budget figures of the national statistics (used here) always refer to central government and not to general government. Also the large social funds (pension fund, health fund and employment fund) are not included. The additional fiscal risk that is hidden by these omissions, and how it can be operationalized, will be the topic of a special section further below.

If the different exogenously given components of the finance side of government budget are determined and the tax function is evaluated, then budget revenues, as given by (1.8), can be compared with government expenditures, as given by (1.4), to find the budget deficit. This deficit then increases the stock of public debt. Remember that an important side constraint is that interest on debt in (1.4) can only be paid in foreign currency that has been either acquired by an export excess in (1.8) or has to be financed by a decrease of the stock of public foreign exchange reserve. Remember also that any imbalance of the current account in (1.8) must be equaled by the same amount with opposite sign in (1.4) hidden in current expenditure - the state only functions as exchange agent for exporting and importing firms[4].

Functions for monetary variables like the exchange rate usually are the most difficult part of econometric work, even in environments with rich and well-documented data sets. As a first step the business failure probability, as specified in equation (1.13), has been estimated using observed values of all but one of the other variables in that equation. This then leads to the following interest rate equation:

$$r_t^D = ((1 + r_t^F) \cdot \frac{e_{t+1}^*}{e_t}) / b_t - 1 \tag{2.7}$$

[3] The IMF reports the following development of this tax rate: 21,2% (1996), 20,8% (1997), 20,6% (1998).

[4] Only under special circumstances and for a limited time it will be able to freeze foreign currency earned by exporters, see the special topic section below.

The obvious difficulty of the one variable which is not observed in this equation evidently refers to the formation of expectations of future real exchange rates, e^*_{t+1}. The only past observation on this point concerned the devaluation of the denar in the years 1997 and 1998. From this observation the following process has been derived: The public recognizes government policy as a fixed exchange rate policy with sudden, not announced devaluation episodes induced by an increase of the public debt that hits a certain sensitivity border[5]. In detail: if the increase in public debt is larger than 20% (it was 40% in 1997), then devaluation occurs with an overall elasticity of 0,5 (the change of the exchange rate in this episode was 17%, roughly half of the change of the current account).

Having computed past values of b_t finally enables to estimate its relation to the unemployment rate according to (1.22) giving

$$b_t = b_{t-1} - 0,25 \cdot (u_t - u_{t-1}) \tag{2.8}$$

As expected the probability of business success falls as the unemployment rate rises. Note that the range of possible values of this probability, of course has to be constraint to the interval [0,1]. In a simulation run prevailing labour market conditions, i.e. the difference between exogenous labour supply and labour demand of private and state sector, produce a 'business climate' characterized by equation (2.8), which in turn drives the domestic profitability expectations expressed in the domestic interest rate. In this monetary process possible choice between domestic and international investment plays an important role, which is represented by the interference of the real exchange rate and expectations about its future. But to derive the real exchange rate from the nominal exchange rate, price level developments have to be taken into account. For the foreign price level the model simply assumes that it is exogenously given. The domestic price level, on the contrary, is determined endogenously.

$$p_t = p_{t-1} \cdot (1 + 0,97 \cdot \frac{\Delta w^n_t}{w^n_{t-1}}) \tag{2.9}$$

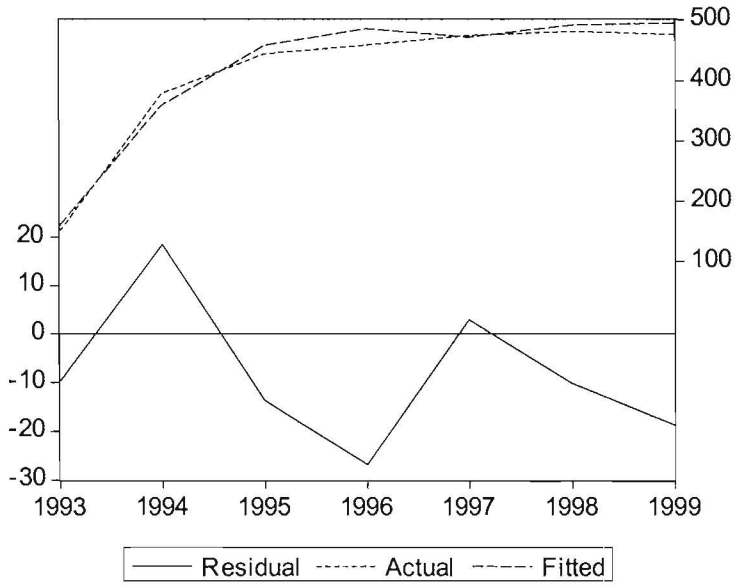
As this equation shows, the theoretical suggestions made in equation (1.14) could not all be discovered in actual price level dynamics of the Macedonian economy. Price setting seems to follow a simple mark-up rule[6] over nominal wages, 97 percent of wage changes are passed

[5] The inrease in public debt brings about rising pressure on the monetary authorities to devaluate the denar, since interest on this debt can only be paid with foreign currency to be earned by more net exports. And these are thought to be stimulated by devaluation.

[6] Contrary to theoretical assumptions in general equilibrium models, mark-up pricing seems to be the relevant mechanism for applied economics. Today most practioneers accept it and use it as a comparative study of European mark-up rates of the OECD proves [Martins J.O. & Scarpetta S., 1999].

over to prices. To appreciate the quality of this estimate graph 3 compares actual and estimated developments. Note as a side issue that it was found that price setting behavior indeed experienced a break in 1992. In the old system (1977-1992) a Phillips-curve behavior can explain the exploding price development much better: $p_t = p_{t-1}^{1,2} \cdot u_t^{-1,41}$.

Graph 3: Estimation of prices (residual left scale)



Note also that in contrast to the theoretical price equation (1.14), the estimated equation (2.9) does not include a policy instrument α_t^p, since no explicit transformation policy for price setting needed to be found.

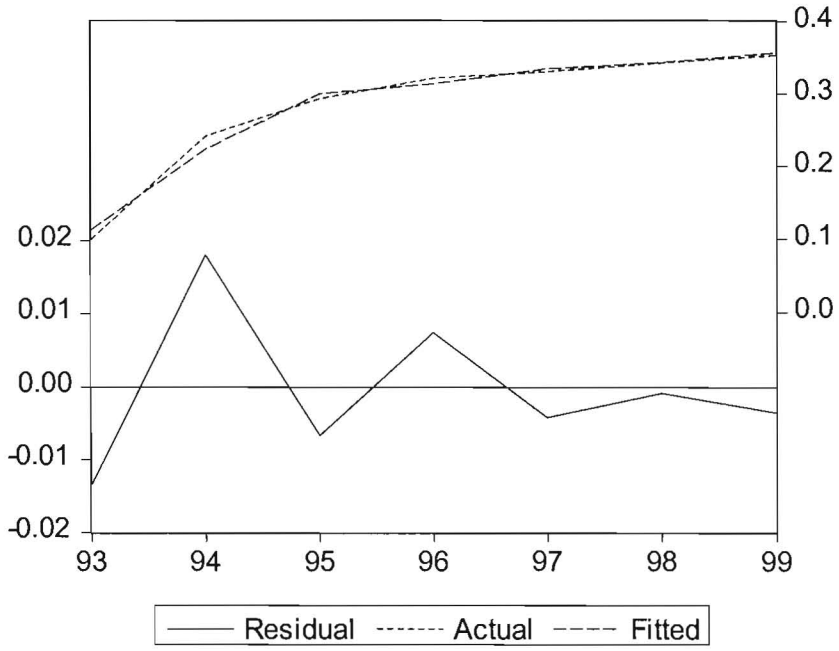
Wage formation was found to follow the equation

$$w_t^n = 0{,}364 \cdot (w_{t-1}^n)^{0{,}398} \cdot (u_t)^{-0{,}359} \qquad (2.10)$$

High unemployment as a determinant of nominal wages thus keeps them rather low and with slowing down inflation rates - remember the mark-up process in (2.9) - the real wage might even increase. Graph 4 shows the estimation.

Wage-price spirals therefore seem to be rather unlikely in Macedonia: If prices increase due to higher wages, the resulting improvement in net exports via a decrease in the real exchange rate should boost GDP and lower unemployment which, in turn, will take away the pressure of a further increase of nominal wages.

Graph 4: Estimation of wages (in logarithms, residual left scale)



Coming to the foreign sector, an important element, the formulation of exchange rate expectations, has already be specified above. Let me restate it more formally again:

$$\left\{ \begin{array}{l} \dfrac{D_t - D_{t-1}}{D_{t-1}} \leq 1,2 \Rightarrow e^*_{t+1} = e_t \\ \dfrac{D_t - D_{t-1}}{D_{t-1}} > 1,2 \Rightarrow e^*_{t+1} = e_t \cdot 0,5 \cdot (1 + \dfrac{D_t - D_{t-1}}{D_{t-1}}) \end{array} \right\} \qquad (2.11)$$

From a technical perspective the introduction of a sensitive border is a discontinuity that most likely produces simulation results following a sequence of stages separated by disruptions.

While (2.11) describes the behavior of all those who need to observe the development of public debt to form expectations about future exchange rates, the monetary authority setting this rate has been described by equation (1.16) in the previous chapter. So at this point there is the possibility to enter the discussion if expectations are formed consistently, and how the audience might learn to adjust their expectation formation process if they are not. For the purpose at hand and given the little empirical evidence these problems will not be dealt with

here. Instead it will be assumed that the audience indeed has correct expectations about the monetary authorities[7]:

$$\left\{\begin{array}{l} \dfrac{D_t - D_{t-1}}{D_{t-1}} \le 1,2 \Rightarrow e_t = e_{t-1} \\ \dfrac{D_t - D_{t-1}}{D_{t-1}} > 1,2 \Rightarrow e_t = e_{t-1} \cdot 0,5 \cdot (1 + \dfrac{D_t - D_{t-1}}{D_{t-1}}) \end{array}\right\} \qquad (2.12)$$

Little can be said about reactions on a strongly decreasing real current account since there is no empirical experience - left alone the eruptive breakdown of trade in 1993, but that cannot serve as typical data. So what is assumed for simulation is that the same sensitivity border, i.e. 20% decrease, will lead to a change with half the effect again. The emerging devaluation has to be seen as forced reaction meant primarily to curbe the international purchasing power of importers. Summing up, exchange rates remain unchanged as long as public debt and current account deficit grow with less than 20%.

Returning to the real sector of the economy, an aggregate production function, compare (1.18), had to be estimated. Unfortunately with such little data a systematic relation between openness of the economy and technical progress could not be found. Probably there were also too many severe other influences to lay bare something rather subtle - like technical advance. Therefore a simple Cobb-Douglas production function for Macedonia was estimated.

$$Y_t = 0,007343 \cdot (L_t^D)^{0,7513} \cdot (K_t)^{0,2487} \qquad (2.13)$$

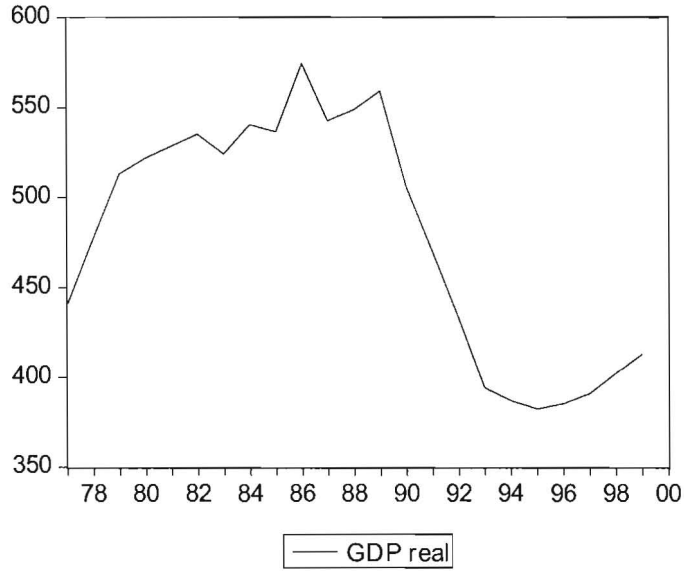
Capital stock K_t had been assumed to possess a capital-output ratio of 3 in 1992, a figure often found in countries at a similar stage of development as Macedonia. From 1992 onwards gross investment figures were used to update capital stock, assuming a rate of depreciation of 2 percent, compare (1.20). As several experiments with slightly different assumptions showed, the output elasticities shown in (2.13) were rather insensitive to theses variations.
Again the production function clearly experienced a profund break in the early 90-ties. An estimation for the old system (1977-1989) gave the function

$$Y_t = 0,8322 \cdot (L_t^D)^{0,495}$$

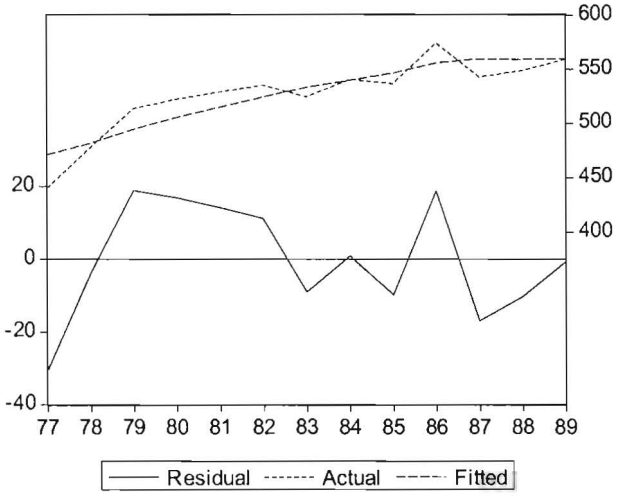
[7] This is not the same thing as to assume rational expectations, where agents know not only a single behavioral

The following graphs illustrate that point.

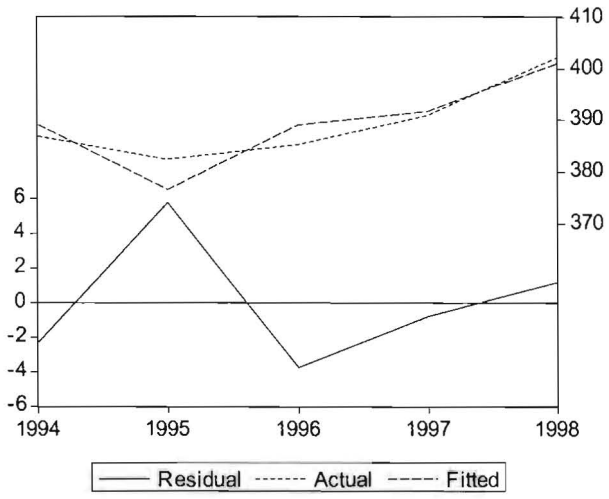
Graph 5: GDP of Macedonia (real, billion 1990 denar)



Graph 6: Estimation GDP 1977-1989



Graph 7: Estimation GDP 1994-1998



These diagrams show convincingly how deep the break in the economic structure of Macedonia in the early 90-ties has been - and which problems a macroeconomic reconstruction of this break has to face.

Equation (2.13) can easily be inverted to derive a labour demand function. Again the high unemployment rates - even in the old system - show that there has been no visible employment policy, so parameter α_t^L in equation (1.18) could safely be ignored.

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function of one specified other agent, but every agent knows the whole model.

The missing influence from stronger integration into world markets, the openness of the economy, in the production function therefore must be thought to enter via foreign direct investment, a demand component. Of course, this is a somewhat different influence, so a future update of this model should try to use additional data to investigate the question again.

Having compiled all base year data and having assumed and estimated all parameters in equations (2.1) - (2.13), simulations of the future macroeconomic development of Macedonia can be carried out. But before these are made, an additional element, the mesoeconomic input-output model MESOMAZE, will be plugged into the mechanisms of MACROMAZE.

MESOMAZE - The Sectoral Model

Gerhard Hanappi

The sectoral model has been built on the basis of the last available input-output table of the Macedonian economy, the one from 1987[1]. Using new available data from the Macedonian Statistical Office on sectoral composition of final demand and value added in the last years up to 1998, it was possible to to use the well-known RAS method to compute an approximation to input-output flows in 1998. To keep problems manageable the original size of the 1987 table had to be reduced to a table with eight sectors. The tables given in the appendix to this chapter show this statistical procedure that finally produced an IO-framework for 1998.

As a consequence the projected investment project Cepren, as specified by the expert civil engineers in VERBUNDPLAN GmbH, could be formulated according to the needs and possibilities of this IO-framework. In principle there is a much broader degree of freedom to specify an investment project than is currently used. This broader possibilities had to be taken care of to enable an interactive software package - to be developed in the second stage of this project - to use the same sectoral model in an interactive way.

In particular, future modules will allow for a flexible specification of finance and repayment schedules. But they also can take care of a more differentiated treatment of the distribution of the benefits of the investment project, i.e. specify time, sector and wages or profits these benefits should flow to. The same richer specification is applicable to domestic finance by taxes per sector and kind of income. To summarize, the specification chosen in MESOMAZE is designed to support a software monitoring tool for large scale investment projects.

In its current form it has been used as a sub-program call in the yearly equilibrating process of the macromodel MACROMAZE. It thus detects and feeds back sectoral incompatibilities in the generation of endogenous macro-variables. In particular some preset sectoral values (e.g. the investment figures of the project) can be introduced in the macrodynamics. The next chapter shows what results this procedure was able to produce.

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[1] I am indebted to Vladimir Gligorov for providing this information.

Appendix to Chapter 6

Original table from 1987:

Macedonia: IO-Table 1987

	1 Mining	2 Agriculture	3 Forestry	4 Water	5 Construction	6 Transportation	7 Trade	8 Services	9 Crafts
1 Mining	180969645	12750140	186402	139287	13150605	4969298	4476746	3566693	3042582
2 Agriculture	16467687	18687382	9627	0	0	6630	739095	354692	114872
3 Forestry	957856	75088	218338	1996	161154	10718	56691	4752	19329
4 Water	312346	255561	5604	86864	111530	31910	13869	27890	22535
5 Construction	1921326	128788	22560	77548	9037398	227655	635742	89300	89325
6 Transportation	7240631	537783	35707	26528	1442319	1892502	903242	155978	84664
7 Trade	7195576	1353473	19471	13637	2094419	969423	430742	649037	572897
8 Services	0	0	0	0	0	0	0	0	0
9 Crafts	3703153	576420	25232	16555	425413	614305	307341	83429	207296
10 Utilities	2420159	61867	4051	15032	177219	97611	240687	96262	64252
11 Other services	1999792	112384	3525	4940	142948	607994	675473	43240	24479
90 Waste	914357	2406	551	166	29524	10184	12579	545	3752
Intermed. Input	224102528	34541292	531068	382553	26772529	9438230	8492207	5071818	4245983
14 Depreciation	19014300	3373000	305600	359900	1414100	3109800	1447600	483400	301100
15 Net pers.income	36615800	20729300	748400	419400	10051600	5645200	10678000	2217900	3145300
16 Operating surplus	75896200	9709100	748400	366100	8706700	4193000	24546300	1718300	2374400
Distributed	131526300	33811400	1802400	1145400	20172400	12948000	36671900	4419600	5820800
18 Inventories	122168	0	0	0	0	0	0	0	0
19	60955167	4025333	23095	0	0	855183	0	878893	4081
20 Imports	129276549	8628140	415217	19586	2364700	11636264	10561397	2604895	2914000
	190353884	12653473	438312	19586	2364700	12491447	10561397	3483788	2918081
Value Added	321880184	46464873	2240712	1164986	22537100	25439447	47233297	7903388	8738881
GOP	545982712	81006165	2771780	1547539	49309629	34877677	55725504	12975206	12984864

Previous table continued

10 Utilities	11 Other services	90 Waste	Interm.Outp.	14 Inventories	15 Investment	16 Cons. pr.	17 Gov. cons.	18 Exports	19 Exp.Yug.	Final Demand	GOP
1269897	1806194	0	226327489	50519753	14220537	54804001	11089559	43025364	145996009	319655223	545982712
417	6	0	36380408	9689436	1080763	22416333	862501	1702601	8874123	44625757	81006165
1054	870	0	1507846	282583	52206	577496	96311	131734	123604	1263934	2771780
16994	26787	0	911890	0	0	0	459961	0	175688	635649	1547539
121955	295939	0	12647536	337000	23758112	469023	2616008	378774	9103176	36662093	49309629
96064	472891	0	12888309	1471625	203373	7177359	799542	4189745	8147724	21989368	34877677
102102	147558	0	13548335	2516895	1499302	30827589	785291	1248816	5299276	42177169	55725504
0	0	0	0	0	0	11160937	97769	723200	993300	12975206	12975206
46186	142838	0	6148168	113205	0	4753548	492033	32610	1445300	6836696	12984864
62173	193366	0	3432679	0	0	908980	520698	5031	11000	1445709	4878388
61513	700838	0	4377126	721403	1146091	1145319	899769	748834	3797928	8459344	12836470
233	643	0	974940	261305	0	0	67469	305949	216287	851010	1825950
1778588	3787930	0	319144726	65913205	41960384	134240585	18786911	52492658	184183415	497577158	816721884
433300	416200	36800	30695100								
967200	2737100	290600	94245800								
1672600	1330000	447600	131708700								
3073100	4483300	775000	256649600								
0	0	0	122168								
0	602468	612079	67956299								
26700	3962772	438871	172849091								
26700	4565240	1050950	240927558								
3099800	9048540	1825950	497577158								
4878388	12836470	1825950	816721884								

Reduced table from 1987:

REDUCED TABLE

	1.Industry	2.Agriculture	3.Water	4.Construct.	5. Transport	6. Trade	7. Utilities	8. Services	***Intermediate***
1. Industry and mining (1)	180969645	12936542	139287	13150605	4969298	4476746	1269897	8415469	22632748
2. Agriculture and forestry (2+3)	17425543	18990435	1996	161154	17348	795786	1471	494521	3788825
3. Water management (4)	312346	261165	86864	111530	31910	13869	16994	77212	91189
4. Construction (5)	1921326	151348	77548	9037398	227655	635742	121955	474564	1264753
5. Transport and communications (6)	7240631	573490	26528	1442319	1892502	903242	96064	713533	1288830
6. Trade (7)	7195576	1372944	13637	2094419	969423	430742	102102	1369492	1354833
7. Utilities, public services (10)	2420159	65918	15032	177219	97611	240687	62173	353880	343267
8. Services (Residual)	6617302	720518	21661	597885	1232483	995393	107932	1207060	1150023
Intermediate Input	224102528	35072360	382553	26772529	9438230	8492207	1778588	13105731	31914472
Wages	36615800	21477700	419400	10051600	5645200	10678000	967200	8390900	9424580
Profits	285264384	27227885	745586	12485500	19794247	36555297	2132600	19125859	40333135
Value Added	321880184	48705585	1164986	22537100	25439447	47233297	3099800	27516759	49757715
GOP	545982712	83777945	1547539	49309629	34877677	55725504	4878388	40622490	81672188

Previous table continued

Inventories	Investment	Cons. pr.	Gov. cons.	Exports	Exp.Yug.	***Final Demand***	***GOP***
50519753	14220537	54804001	11089559	43025364	145996009	319655223	319655223
9972019	1132969	22993829	958812	1834335	8997727	45889691	83777945
0	0	0	459961	0	175688	635649	635649
337000	23758112	469023	2616008	378774	9103176	36662093	36662093
1471625	203373	7177359	799542	4189745	8147724	21989368	21989368
2516895	1499302	30827589	785291	1248816	5299276	42177169	42177169
0	0	908980	520698	5031	11000	1445709	4878388
1095913	1146091	17059804	1557040	1810593	6452815	29122256	306946049
65913205	41960384	134240585	18786911	52492658	184183415	497577158	816721884

Reduced table for 1998:

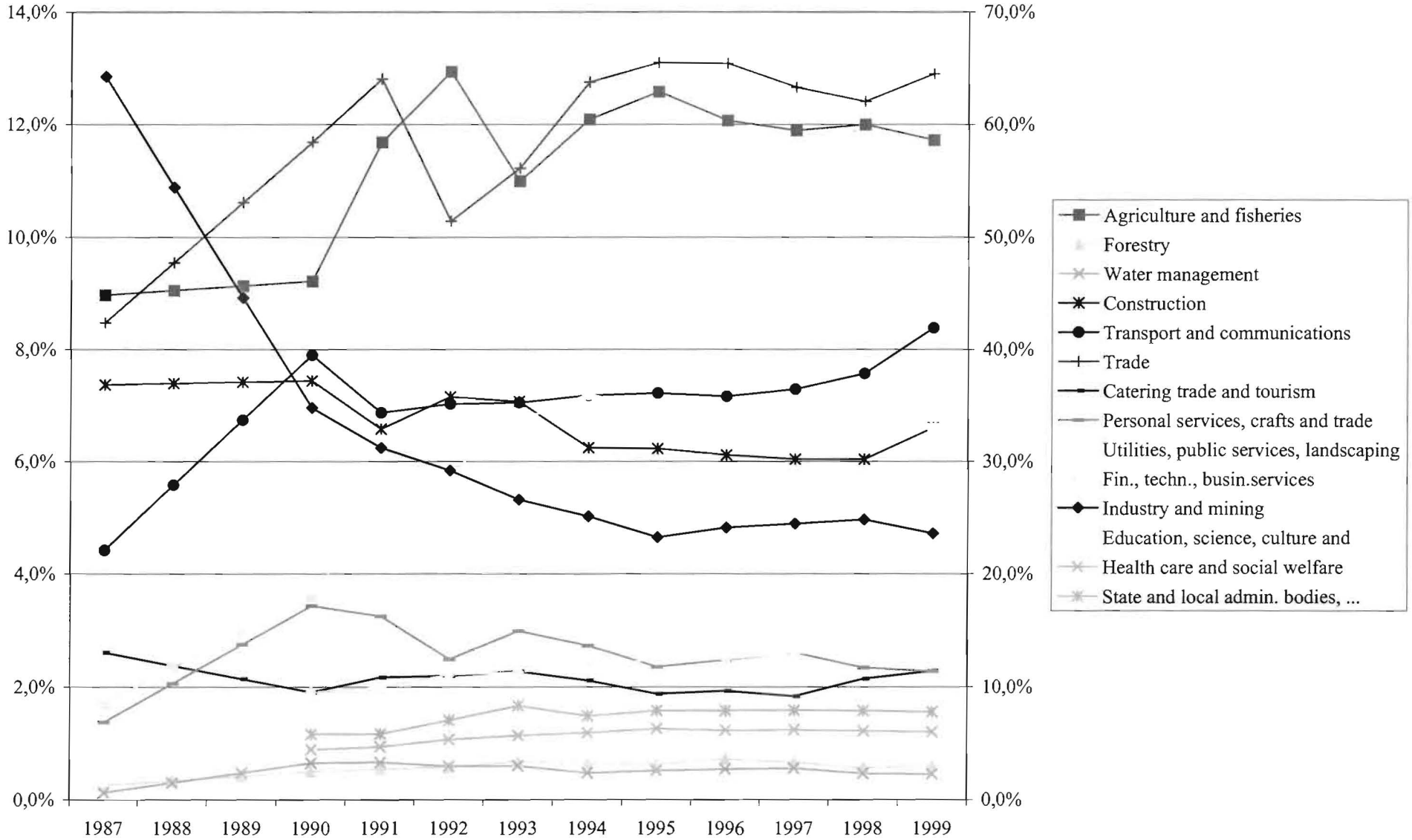
REDUCED TABLE

		1.Industry	2.Agriculture	3.Water	4.Construct.	5. Transport	6. Trade	7. Utilities	8. Services	***Intermedi Output***
1. Industry and mining (1)		54170	5926	89	3748	2574	1670	1497	12818	
2. Agriculture and forestry (2+3)		11611	19366	3	102	20	661	4	1677	
3. Water management (4)		93	119	55	32	16	5	20	117	
4. Construction (5)		3238	390	280	14498	664	1335	809	4069	
5. Transport and communications (6)		5173	627	41	981	2340	804	270	2594	
6. Trade (7)		5252	1534	21	1455	1225	392	293	5087	
7. Utilities, public services (10)		1500	63	20	105	105	186	152	1116	
8. Services (Residual)		14458	2409	101	1244	4661	2709	929	13420	
	Intermediate Input	72191	23007	462	16755	8773	5867	3004	30917	2
	Adjusted Intermediate Input	95495	30434	611	22164	11605	7761	3974	40898	2
	Wages	38071	6589	778	6930	7264	6875	2930	36479	1
	Profits	-3142	20689	-34	7849	8582	24589	1275	27428	
	Value Added	34928	27278	744	14779	15846	31464	4206	104805	2
	GOP	130424	57712	1356	36944	27451	39225	8180	104805	4

Previous table continued

Final Demand	*GOP*
47931	130424
24267	57712
898	1356
11660	36944
14621	27451
23966	39225
4934	8180
64875	104805
193153	406095

Value Added in 1996 (million current denars)	*GOP*	*Int. Input*	*Taxes*	*Wage Sum*	*Gross Profits*	*Depreciation*	*Net Profits*
1. Industry and mining (1)	99645	65255	0	34413	-23	8424	-8447
2. Agriculture and forestry (2+3)	44072	24273	0	6952	12846	2029	10817
3. Water management (4)	1183	442	0	744	-4	338	-342
4. Construction (5)	28081	19008	1	7862	1210	598	612
5. Transport and communications (6)	19479	9054	10	7497	2918	1894	1024
6. Trade (7)	31025	11250	10	13183	6583	1037	5546
7. Utilities, public services (10)	5987	2157	0	2104	1726	649	1077
8. Services (Residual)	78907	30872	19	36426	11588	2482	9106



Development of Final Demand, only "Industry and Mining" on right scale, all others left scale.

Results of the Macro-Meso-Simulation

Gerhard Hanappi

In this final chapter the model developed and estimated in the previous chapters has finally been used for simulation runs. The simulation strategy was as follows:

First a reference run was performed, where there was no special initiative to build hydro-electricity power plants. For this base run rather prosperous assumptions for the world economic development have been assumed. Moreover the growth path of the Macedonian economy was assumed to be rather continuous and stable - though not on an unrealistically high level. Over the 22 years period considered an average well below 5% was thought to be plausible. As it turned out, the absolute growth level of this reference path was not very important with respect to what we really were interested in: The impact of building the power plant[1].

To study this, we introduced the activities related to the HEP initiative and made a second simulation run - with everything else left as it was. This way we could find out what effects the assumed initiative would produce on Macedonia's macroeconomic performance. More precisely, we could subtract the base run values of the relevant variables from the series observed in the HEP-run to get an idea about shapes and quantitative extent of the impact.

Before we turn to these figures it is useful to restate how the building of the power plants entered the model. There were three general routes:

- First there is investment demand occuring in different sectors at different times in the economy. This structure was prepared and introduced. Note that direct effects on final demand as well as indirect first round effects on interindustry flows and corresponding sectoral wages and taxes were considered.
- Second the finance of this investment was introduced. In this case a simple structure of a constant overall interest payment, with no repayment of the principal, was taken as a starting point. Credit has to be paid back in EURO, so exchange rate effects were considered too.

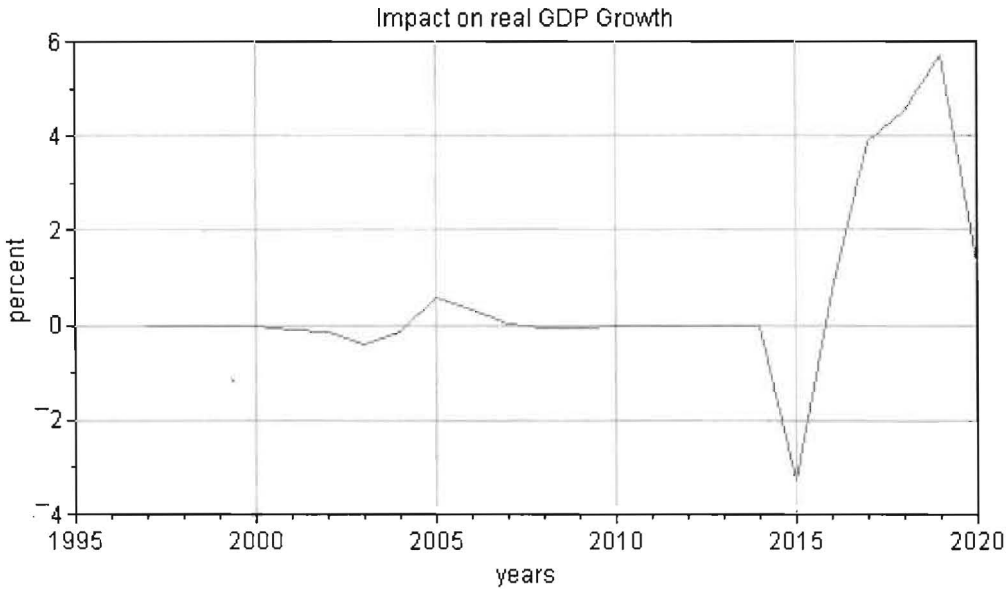
[1] Nevertheless it is remarkable that our reference run produced some slight growth cycles - a property reminding on Joseph Schumpeters approach to growth.

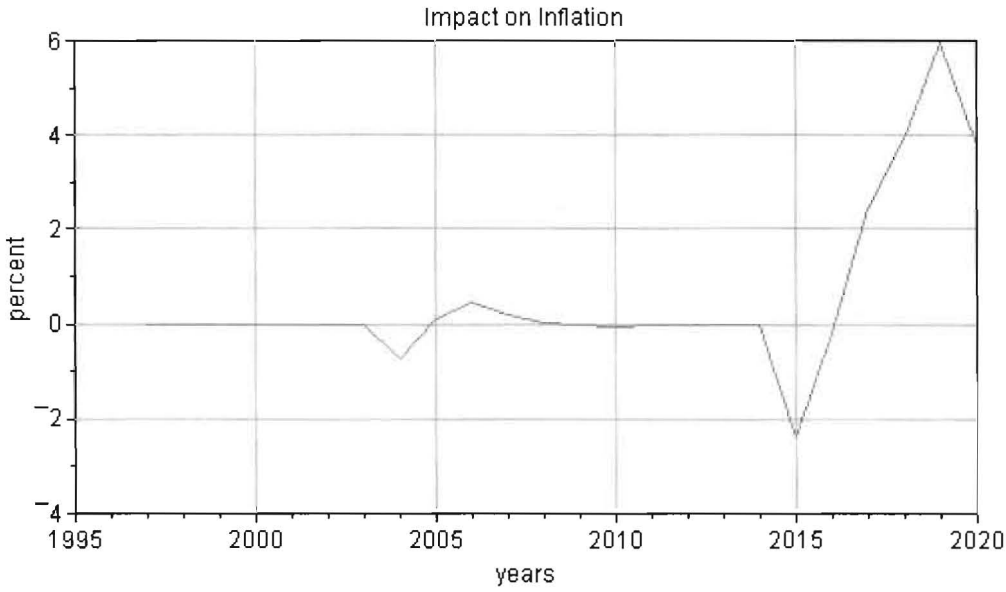
- Third, the power plant once built generates revenues. Again, for simplicity, it has been assumed that these revenues simply are added to government revenues to ease the burden of public debt.

As a matter of fact, the simulation in many respects justifies what conventional wisdom in macroeconomic theory would expect. There are short-run effects that are less favourable but from a macroeconomic point of view, they are by far outweighed by the long-run benefits that derive from building the power plant.

There is, of course, the necessary caveat that we did assume a friendly investment and trade climate in the next 22 years, with no serious political or economic desasters disturbing this troubled region of Europe - an assumption certainly doubted by some observers. Nevertheless, without any valid model of why, how and when such breaks will occur, we are left with our more sanguine suggestions. Perhaps even more encouraging is the fact that our results are quantitatively positive enough to digest some slight drawbacks in future developments.

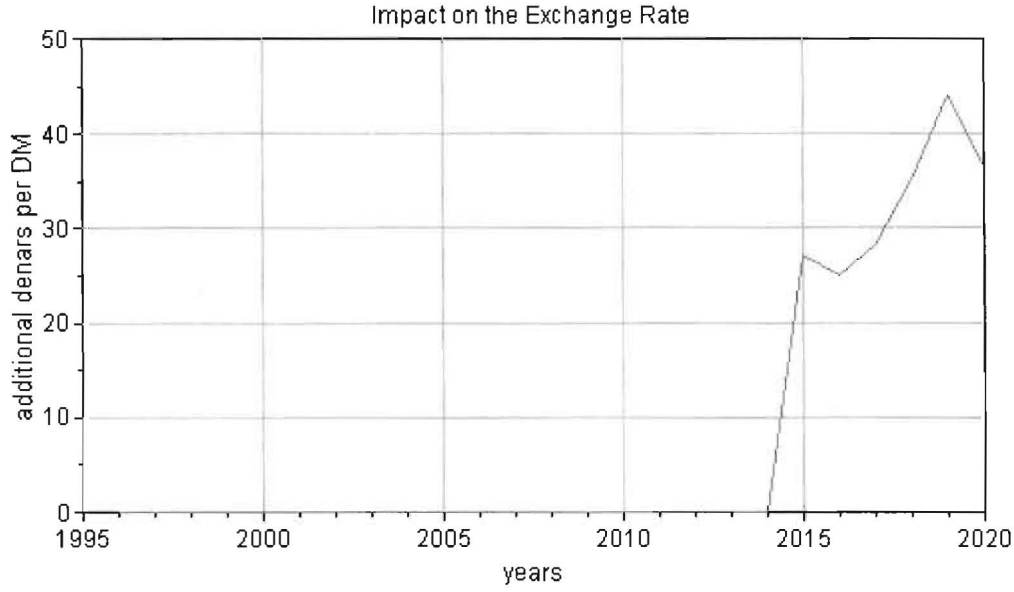
The first and most important macroeconomic impact always concerns the effect on the real GDP growth rate. As the following graph shows, this impact on real GDP growth should not be neglected. While it will not be particularly sensed till the year 2014, the slightly more expansionary course followed will have an interesting and sizeable long-run effect.





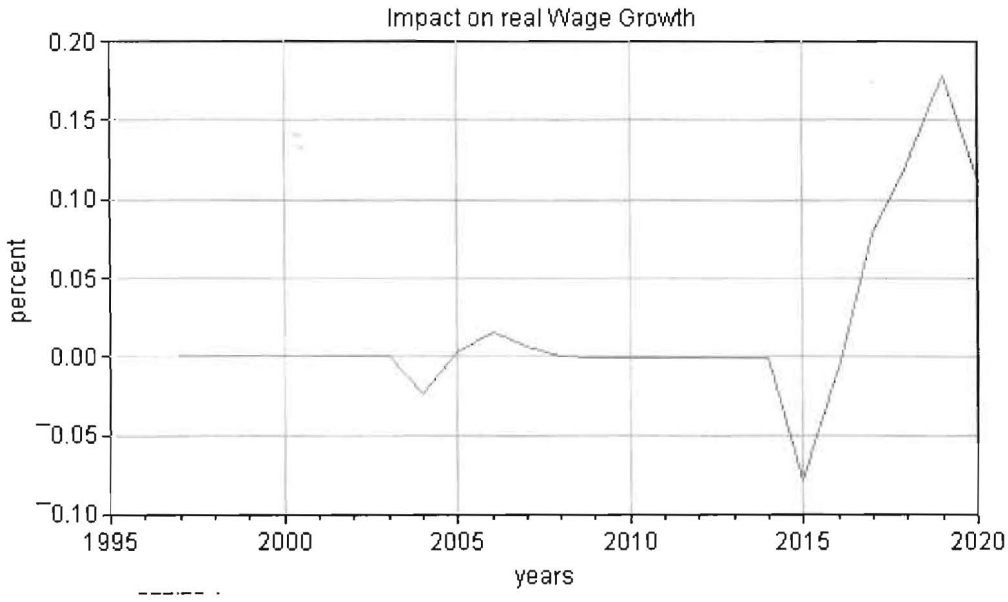
As the graph shows, one drawback, though a mild one, is that the higher growth and lower unemployment rates imply a somewhat higher inflation rate in the long-run. This confirms conventional macroeconomic wisdom. But a look at the absolute levels shows that these inflation rates are well below dangerous developments.

One of the process most difficult to model has been exchange rate development. We have used special treatments in the previous chapters to get a more realistic picture of what goes on in this area - and what will be going on in the future. Now, in the simulation, these efforts pay back.



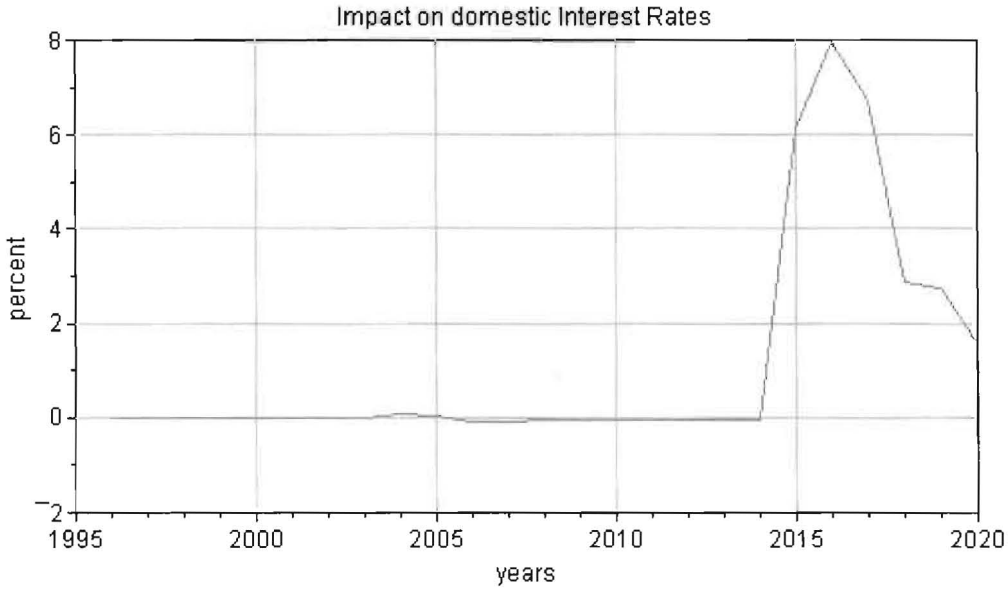
As the graph shows, an interesting and revealing effect occurs: With some given rigidity in the exchange rate regime more expansionary policies seem to force devaluation to occur earlier and stronger than non-expansionary policies. There is a high probability that it is exactly the exchange rate mechanisms that translates the slow and continous long-run growth into a sudden breakthrough at a certain point in time. This is what our simulation mimics. Again we have to warn that in real life exchange rate mechanisms are subject to many external influences not covered in this model.

Taking a look at real wage growth, see next graph, provides some additional insight too.



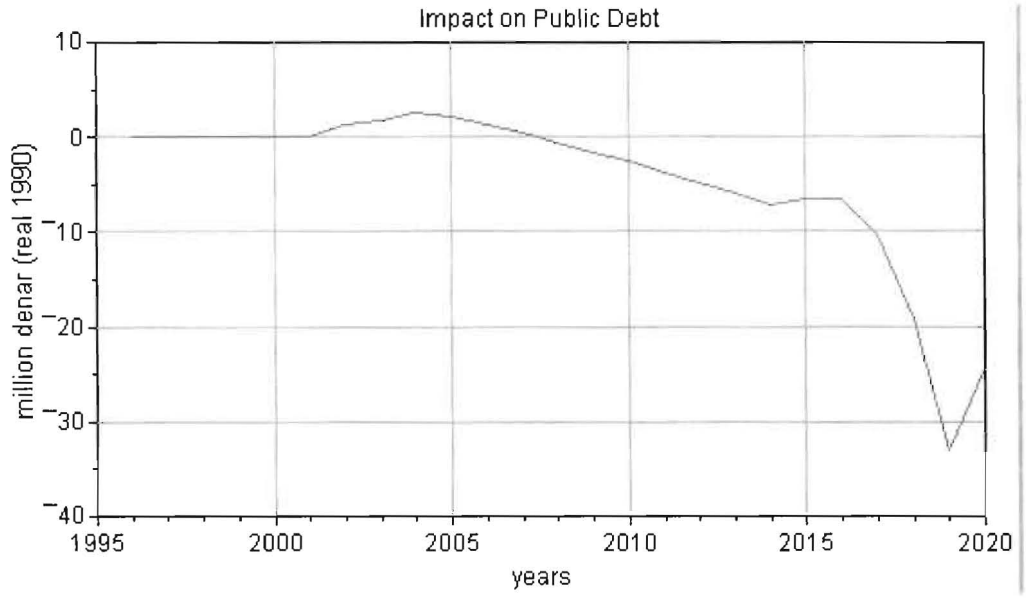
There is a weak positive long-run effect on real wage growth but it is extremely small. Again it seems to be owed to devaluation. In the short-run real wage growth rather suffers.

Turning now to monetary developments, it is interesting to see what happens with the notoriously high domestic interest rate. The next graph presents the effect.



Interest rates react almost exclusively on the devaluation shock. Thus there is no in-built dynamics to solve the crisis of the monetary systems. Domestic interest rates will continue to strangle domestic investment - the building of Cepren cannot change this process. The good news is that interest rates seem to return after the devaluation shock rather fast to their reference path.

Consider now public debt.



The surprisingly good development of public debt reflects the extraordinary advantageous credit conditions assumed in this case. Only interest rate payments of 4 percent on total debt were assumed. Indeed it shows, that there should be some room to pay back the principal from 2010 onwards. Clearly with given well-specified repayment schemes more insight can be gained.

From a sectoral point of view, remember there is an in-built sectoral model running too, it is interesting to observe that the strongest single increase of an input-output flow occurs at the inter-industry activities. It is by three times as large as the next item, inter-service activities. In general industry and services and their interactions tend to grow fastest. This justifies our view that industry was hurt most when the former Republic of Yugoslawia broke down - and that it will be industry again (in interaction with services) that provides a modest upturn of the Macedonian economy.

To summarize: As our simulations show, ***there is an overall positive macroeconomic impact of the building of the Cepren power plant.***

Appendix to chapter 7

Some selected financial impacts of the Cebren project

The following results of the simulation study should provide a quantitative answer concerning the influence of the project on the GDP and budget deficit. Since, in last consequence, it is the Macedonian state who owns the power plant these figures basically present the analogon to usual cost-benefit considerations of private firms. Taking GDP surely means to considers state activity from a broader perspective, while budget deficit refers to a more narrow view.

The following table shows the impact of the project on GDP and on budget saldo in million denar at current prices. Though these are simulation results it is not the absolute value of these numbers that interests most, but their general development. It falls into three different periods:

As long as thepower plant is in its building phase there is a modest negative impact on GDP, i.e. the occuring capital cost do not generate domestic income but increase debt and this effect is stronger than the GDP stimulus from construction activities. Contrary to that, on the budget side tax seems to be responsive enough to lead to a small positive contribution to the budget saldo.

In phase 2, when the plant is finished, debt has accumulated enough to reverse the sign of the budget saldo impact. On the other hand positive influences of the output of the new plant lead to additional GDP of about the same size. Only towards the end of this phase the GDP turns slightly negative again. Nevertheless all these effects remain rather small.

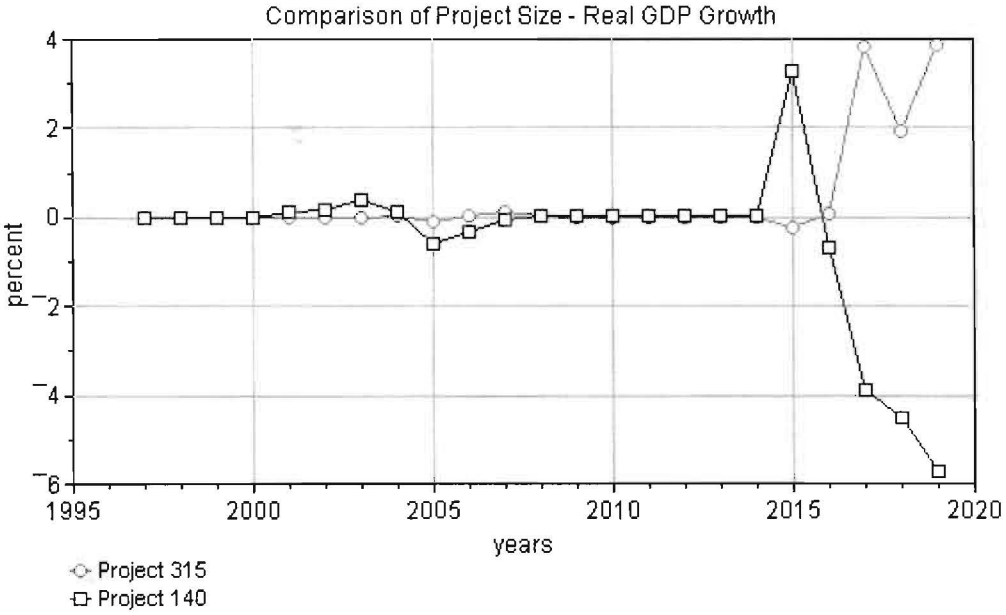
The big impact only arrives as soon as an exchange rate effect is induced in year 2014. This definitely has a positive GDP impact that dominates all oscillations oberserved up to this point. This demand induced boom, of course has the side-effect to increase interest payments on public debt - leading to a mid-run increase in budget deficit.

Table 1: Financial Impact

Year	Change in GDP (mil. Den.)	Change in Budget (mil. Den.)
2001	- 431	58
2002	- 1056	754
2003	- 2637	303
2004	- 6135	586
2005	- 3186	- 163
2006	- 335	- 434
2007	509	- 532
2008	440	- 549
2009	173	- 548
2010	- 59	- 550
2011	- 239	- 556
2012	- 394	- 564
2013	- 540	- 573
2014	- 685	- 582
2015	- 17495	440
2016	- 15431	176
2017	2399	- 1737
2018	25657	- 4156
2019	60557	- 6840
2020	78696	- 9351

Sensitivity to project size

The expected impacts were also tested with respect to project size. Two alternative sizes, namely one with 140 million EURO and one with 315 million EURO, were simulated. As the following graph shows the gain in real GDP growth (measured in additional percentage points relative to a project size of 230 million EURO) of the larger project seems to be insignificant until the exchange rate shock occurs. Since the increased risk of a higher credit is only compensated by an uncertain effect in distant future this size seems to be inferior to the original size.



An even clearer answer can be given with respect to the smaller project. Here some slight advantage in the short run leads to rather disappointing results from there onwards. In this case - if the original stimulus is to weak - there is the danger to miss all beneficial long-run effects.

EXECUTIVE SUMMARY

- From a fiscal perspective the project Cebren is feasible. Some attention should be devoted to future developments of imports.

- There are some severe fiscal risks, which currently are not completely under control. Additional efforts to cope with these risks will be needed.

- Unemployment as major problem of economic policy in Macedonia will remain high. The project will not be able to add much employment.

- Short-run effects on real growth will be small (less than 0.5 percentage points), consisting first of a slowdown and then a weak increase of growth.

- Macroeconomic success in the long-run could be a contribution of the project to real GDP growth in the size of 1 percentage point.

- Development of foreign debt depends on credit conditions. If they are favourable, it could be possible to repay the principal from 2015 onwards.

- A major role will be played by exchange rate policy. It could be wise to devaluate the denar somewhat to promote long-run growth.

- Many of these issues are to be considered with care as long as the political stability of the region is as fragile as it currently is. Nevertheless they constitute something like the most probable case for stable conditions.