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MAKMODEL

A MACRO-ECONOMETRIC MODEL FOR THE REPUBLIC OF MACEDONIA

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Abstract

This report describes the macro-econometric model for the Republic of Macedonia MAKMODEL. It documents the main features of this model that was built by research teams of the Macedonian and Dutch central bank during July 1999 - June 2001 as one module of a large scale PHARE-project, funded by the European Commission. Details on the statistical aspects of the Macedonian monthly data collected for the period 1993-1999 are provided, along with the construction and estimation of the econometric model. The last sections present some simulation and forecasting examples. The ultimate aim of MAKMODEL is to use it for macro-economic policy analyses at the Macedonian central bank, by means of keeping the statistical basis up to date, elaborating upon the model, and making forecasts and running simulations in the near future.

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Preface

In 1999 the National Bank of the Republic of Macedonia (NBRM) adopted a two year PHARE project for technical assistance. The assistance was provided by 'De Nederlandsche Bank' (DNB), the central bank of the Netherlands. A wide range of central banking activities was covered, involving several departments within both banks. The present report gives an account of the part of the project covering the econometric modelling in which field the Netherlands' central bank has a long-standing tradition (see e.g. DNB [1985, 2000]). The main goal was to build a macro-econometric model for the Macedonian economy, in the near future to be used for policy analyses and forecasting by the NBRM.

The macro-econometric model that was constructed during the two-year project has been given the name MAKMODEL. It consists of 38 equations and 45 exogenous variables, so one could call it a medium-size model. The main behavioural equations are estimated with available time series covering the period 1993-1999. As during this relatively short period the Macedonian economy has undergone major shocks, the estimated relationships are often unstable. The collected data set for the Republic of Macedonia and the way the data and programmes are set up offer however the opportunity to study developments in the economy efficiently and make it rather easy to elaborate upon the model regularly.

The present version of MAKMODEL, as presented in this report, can be used for analysis of the effects of monetary or fiscal shocks, external shocks and/or labour market shocks. Short- to medium term forecasting can easily be carried out. In this latter case assumptions are to be made concerning all the foreign and domestic exogenous variables. Sensitivity analyses on the exogenous variables can illuminate the sensitivity of the forecasts to external developments, as is also shown in this report.

1. Introduction

In recent years the practice of modelling transition economies has been developing strongly.[1] Common features of transition countries are that the economies are undergoing a period that is often volatile due to major changes, like privatisations, liberalisations, in- and outflows of domestic and foreign capital and so on. In some cases, statistical data are surrounded with a lot of uncertainty or major definition alterations. For those countries that have become independent rather recently, like the Republic of Macedonia in 1991, time series are moreover short. Carrying out econometric analyses is for all of these reasons not straightforward.

In addition to this, the transition period is expected to be temporary. This implies that when a model has been estimated with data covering a transition period, making forecasts (or running simulations) with the model might give misleading results. Often strong trends are present during the transition period. These trends have to be modelled explictly in order to estimate the crucial equations in a suitable way. Extrapolating these trends during the forecast exercise would however mostly not be realistic; after the transition period, a more stable period without these strong trends can be expected. In order to circumvent these difficulties one can adhere to estimating the model 'modestly' in the sense of not relying too much on the data by judging the estimated equations on the test statistics. Instead, economic plausibility should prevail. This latter approach is followed here for the case of the Republic of Macedonia. All behavioural equations have been estimated while keeping in mind simulation and forecasting properties. The consequence is that test statistics may not be always favourable and that, connected with this, many parameters are calibrated.

This report documents the first results of the construction of the macro-econometric model for the Macedonian economy MAKMODEL. The main part of the model covers the real economy as financial markets in the Republic of Macedonia are still developing. A structural modelling approach is taken up along traditional Keynesian expenditure components to model the real side. As the time series available for the Macedonian economy are still very short, especially after excluding the volatile initial transition years 1992-1994, the model was estimated using monthly data covering the period 1995-1999. The characteristic strong dynamics in the monthly time series have been captured by an 'error correction model' (ECM), which distinguishes between a long-term relationship of the economic variables and influences of short-term dynamics.

As emphasised before, much effort has been put into the building of the data block. Annex 2 provides a detailed account of the construction of the data. In case monthly data were not available, either Lisman or Ginsburgh interpolation techniques have been applied to construct monthly time series.[2] So, in order to be able to carry out econometric analyses the intention during this project has been to

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[1] For example: Gavrilenkov, Henry and Nixon (1999), Barrell *et al.* (2001), and Basdevant (1999). Also, see the special issue on modelling economies in transition of *Economic Modelling* 17 (2000).

[2] These interpolation methods are described in Boot *et al.* (1967) and Ginsburgh (1973).

make the data set complete. In this respect the data set is unique; for the Republic of Macedonia it is the first time that a consistent database on the main macro-economic variables was constructed.

The paper is organised as follows. Section 2 gives a description of the behavioural equations. Section 3 presents several policy simulations and model properties. Section 4 discusses future avenues. The annexes contain detailed information on the structure of the model, the collected time series and forecasts for a decade ahead, and the construction of the data.

2. Model description

This section presents the nine 'behavioural' or 'estimated' equations in the model. The other 29 equations in the model are technical equations or identities that are not discussed in detail, but reported in Annex 1. The descriptions of the behavioural equations are presented in the following order: aggregate demand, wages and the labour market, prices, public sector, money demand and interest rate policy.

The econometric equations are all specified in the 'error-correction-model' (ECM) form. In general, the ECM assumes two things. Firstly, there is a stable, long-term equilibrium relationship between an endogenous or dependent variable Y and an explanatory variable X. Secondly, short-term deviations may occur from this equilibrium relationship. This can result from past developments of X, Y and possibly of some other exogenous variable(s), Z, which does not necessarily have a long-term equilibrium relationship with Y. The general form of the ECM-equation is the following:

$$DLOG(Y) = C1*\{LOG(Y(-1)) - C2*LOG(X(-1))\}$$
$$+ C3*DLOG(Y(-1)) + C4*DLOG(X(-1)) + C5*DLOG(Z(-1)) + C6.$$

In this equation LOG and DLOG represent the natural logarithm and the first difference of the natural logarithm, respectively, (-1) denotes a one-period lag, and the C's are coefficients or parameters to be estimated. The term between curled brackets is the long-term equilibrium relationship that can be rewritten as

$$LOG(Y) = C2*LOG(X).$$

This relationship is the core of the equation telling what economic determinant drives the development of the dependent variable Y in the long-term. C2 is what is called the long-term parameter. It indicates the elasticity of variable Y with respect to variable X; in case X would increase 1 percent each period, Y would increase C2 percent in the long term. The DLOG-terms form the short-term dynamics of the ECM. The variables in this part drive the short-term developments of the dependent variable. These developments may lead to deviations from the long-term relationship. Their influence is however only temporary, as the value of the dependent variable will return to the equilibrium value that is determined by the long-term relationship. Coefficient C1 is called the adjustment parameter; it is the speed with which this return towards the long-term equilibrium is being realised. Its value should lie between −1 and 0. A value close to zero means a low speed, a value close to − 1 a high speed. Finally, C6 is an intercept. In the following discussion of the estimation results we will not pay specific attention to the intercept, neither will we mention the seasonal dummy variables which have been included in the estimation to capture seasonal factors. As the estimation has been done with monthly series, eleven dummies have been used. Furthermore, the model refers to the period 1992-1999, but most equations have been estimated over the period January 1995-December 1999 because: (1) data were not available before 1995, (2) inclusion of the volatile early years of the transition, 1991-1994, gives rise to unreliable or implausible parameter estimates.

While discussing the estimated behavioural equations in the following parts of this Section, the above ECM terminology will be taken for granted.

2.1. Aggregate demand

The Macedonian economy has, since its independence, experienced a complex process of economic and political reforms directed towards the creation of a modern democratic society with a market oriented economic system. Like most other transition countries, the early transition years 1991-1993 were characterised by a sharp decline in real GDP (Chart 1). In the period 1991-1995 the accumulated output fall amounted to 25% for real GDP and to 50% for industrial output.

Chart 1 Gross domestic product and industrial output
(Annual change in %)

■ Real GDP   □ Industrial output
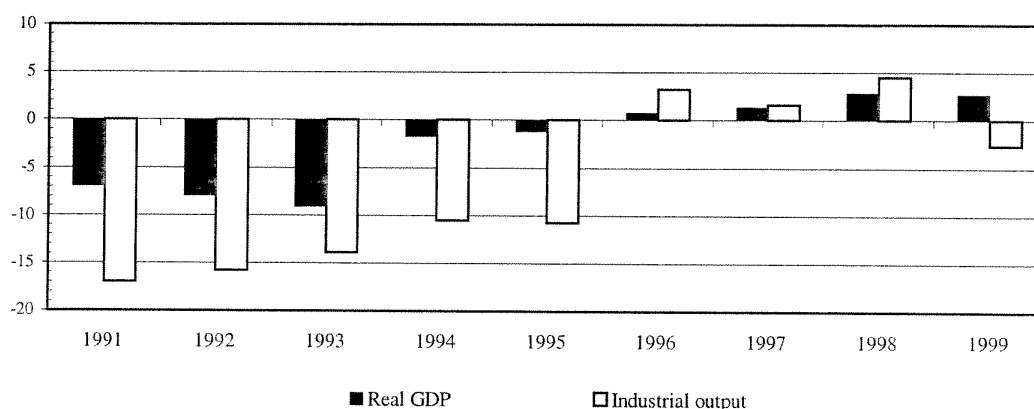
It is clear that it is not feasible to explicitly model the output of an economy that has undergone a drastic restructuring. The short sample period and the highly volatile data for the econometric model make the analysis even more complicated. For this reason, at this stage of the modelling process no effort has been undertaken to explicitly model a production function. Nevertheless, by modelling for instance the labour demand function later on, a production function is implicitly assumed.

From the demand side, actual GDP follows from the *ex post* income identity:

$$Y = CONS + I + G + X - M + MES_Y$$

with Y = GDP, CONS = private consumption, I = investment in fixed assets, G = government expenditures, X = exports of goods and services, M = imports of goods and services, MES_Y = inventories formation plus measurement errors. All variables are in prices of 1995.

Table 1 shows the structure of aggregate demand. Private consumption contributes to around three-quarters of GDP, public consumption one-sixth, investment in fixed assets one sixth. The Macedonian economy is very open. Imports amount to more than half of GDP. Exports cover around 70 to 80%

of imports. The current account deficit reflects the low domestic savings relative to the capital needed for the restructuring of the economy.

Table 1 Components of real GDP (%)

	1991-93	*1994-96*	*1997-99*
Gross Domestic Product	100.0	100.0	100.0
Domestic sector	103.0	110.1	112.7
Final consumption	87.8	91.3	90.6
Private consumption	69.1	72.7	73.3
Government consumption	18.7	18.6	17.3
Gross investments	15.2	18.8	22.1
Investments in fixed assets	17.1	16.4	17.7
Inventories	-1.9	2.3	4.4
External sector	-3.0	-10.1	-12.6
Exports of goods and services	37.1	33.1	41.5
Imports of goods and services	40.1	43.2	54.1

In MAKMODEL government consumption and inventories are treated as exogenous variables. The other GDP components are endogenous variables for which econometric equations are estimated. In Section 2.1.1 the estimated equations for private consumption and investment in fixed assets are presented, in Section 2.1.2 those for exports and imports.

2.1.1. Domestic sector

The estimated equation for real **private consumption** reads as:

$$DLOG(CONS) = -0.02*\{LOG(CONS(-1)) - LOG(YDN(-1)/PRS(-1)\} + 0.89*DLOG(CONS(-1))$$
$$(-) \qquad\qquad (9.40)$$

R^2-adj. = 0.78, SE = 0.002, Sample: 1995:08-1999:12

where YDN = real disposable income, PRS = retail price index, and the other variables are as defined before. The estimation diagnostics are denoted as follows. In the following absolute values of *t*-statistics are presented between parentheses below the coefficients, (-) in this case implies that the parameter was calibrated, R^2-adj. is the R^2 adjusted for degrees of freedom, SE = standard error of the estimate.

Only one explanatory variable, the real disposable income, is included in the long-term equilibrium relationship. Interest rate effects were not found to be of any significance to consumption demand. This irrelevance of interest rates to private consumption can be ascribed to the still underdeveloped consumer credit market in the Republic of Macedonia. For most of the period under consideration, the banks have been very restrictive, credit ceilings were applied in this period. Banks have been offering limited amount of credits to households with high interest rates and strong collateral, although some improvement was made in more recent years. Consequently, consumers made little or no use of bank credits.

The long-term income coefficient is imposed to be 1, considering that changes in consumption and disposable income move closely within line with each other. The adjustment coefficient of –0.02 indicates a very slow adjustment of consumption demand to income changes. Both findings may find a partial explanation in measurement problems with respect to households' disposable income. As a matter of fact, the measurement of disposable incomes of households is incomplete, as it comprises only registered incomes such as wages and salaries. A substantial part of other households' incomes are not included in the official income statistics.

For real **investment in fixed assets** the following equation was estimated:

$$DLOG(I)= -0.88*\{LOG(I(-1)) - LOG(Y(-1)) + 0.002*INF(-1)\} - 0.002*D(IL(-3))$$
$$(5.44) \qquad\qquad\qquad (4.07) \qquad\quad (3.31)$$

R^2-adj. = 0.54, SE = 0.11, Sample: 1994:07-1999:12

where INF = inflation (in percentages), IL = lending rate (in percentages), D( ) denotes first differences, and the other variables are as defined before.

According to the long-term equilibrium part of the equation, there is a strong accelerator mechanism behind investment, as is evident from the long-run elasticity of 1 that was not rejected on the basis of the data. A small negative long-term equilibrium relationship between investment and inflation was found. The interest rate could not be included significantly into the long-term equilibrium part of the equation, but a small but significantly negative effect was found in the short-term dynamics. The representative interest rate for investment in the Republic of Macedonia is the short-term lending rate, as firms mostly use short-term bank credit. Banks usually do not provide long-term loans to firms because the banks' liabilities are mostly short-term. Moreover, long-term loans would generate a risk of mismatch coming on top of the already high business risk on corporate loans.

2.1.2. External sector

The Republic of Macedonia is a small and open economy with the foreign trade (imports plus exports) exceeding 80% of GDP. Consequently, the regional and foreign affairs policies of the Republic of Macedonia and neighbouring countries have a great impact on the performance of the Macedonian economy. Germany, FR Yugoslavia, Greece, the US and Slovenia are among the Republic of Macedonia's ten most important trading partners (see Table 2). In addition, Greece and FR Yugoslavia serve as the main transport corridors for Macedonian exports and imports. The Republic of Macedonia traditionally exports iron and steel products and textile products and is a price-taker on these markets. On the import side, the most imported goods are oil, vehicles and equipment.

In **export** equations in general a measure of the part of the world trade volume which is relevant to the domestic country, as well as competitive world trade prices, are among the most important variables. These series had to be constructed for the Republic of Macedonia. The world trade volume is calculated by summing up the import volumes of the main trading partners, after weighting

them by their respective shares in Macedonian exports. The world export price is a weighted average of world prices of the main categories of goods that are exported by the Republic of Macedonia.

Since the declaration of independence by the Republic of Macedonia in 1991, the development of world trade has undergone several severe shocks. Chart 2 shows the development of world trade, in which the main events are represented by arrows. Box 1 gives an account of the events that affected the foreign trade of the Republic of Macedonia.

Table 2   Structure of foreign trade

	1992			1995			1999		
	Export share	Import share	Import-export coverage ratio	Export share	Import share	Import-export coverage ratio	Export share	Import share	Import-export coverage ratio
Macedonia	100.0	100.0	99.4	100.0	100.0	70.0	100.0	100.0	66.4
out of which:									
Germany	19.9	10.0	139.6	21.3	14.9	100.0	21.4	13.7	103.8
FR Yugoslavia	8.1	9.5	60.1	12.7	16.5	54.1	21.3	10.1	139.8
Greece	5.3	10.1	36.7	9.8	10.4	66.0	7.2	9.1	52.5
USA	7.4	7.1	72.9	7.0	9.4	52.6	11.4	4.0	188.7
Slovenia	6.9	5.7	84.9	6.0	6.8	62.2	2.9	8.7	21.7
Italy	4.5	2.8	114.0	7.2	3.5	144.3	5.9	5.2	76.0
Ukraine	6.0	1.6	259.5	3.2	3.2	69.4	0.3	6.4	3.1
Bulgaria	3.2	2.8	79.1	3.0	3.4	61.5	2.2	5.1	28.6
Croatia	5.8	0.5	791.4	2.7	3.3	57.1	4.1	3.4	79.3
Russia	3.3	2.1	110.3	2.5	2.6	67.5	1.3	5.1	16.5
Total	70.0	52.0	94.5	75.0	74.0	71.5	77.9	70.8	73.1

Chart 2   World trade index (1995=100)
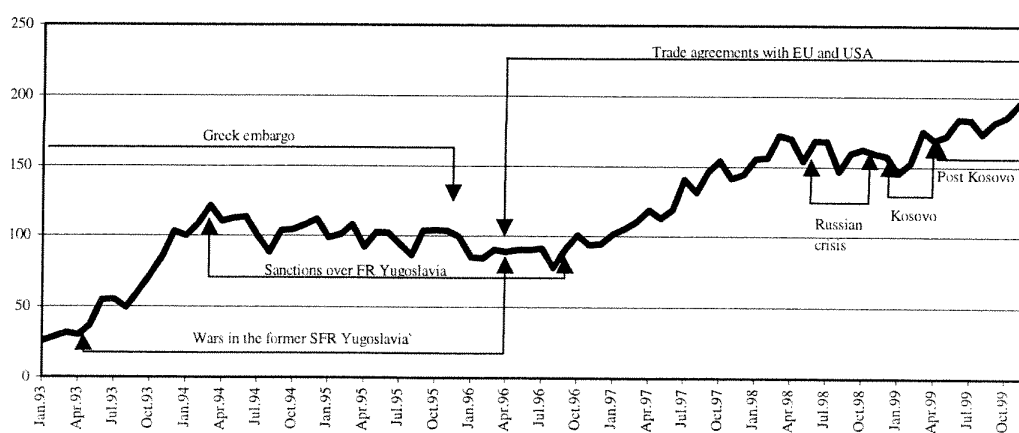
Box 1   Events of great importance to Macedonian exports

Greek embargo: Due to certain political disputes, on June 1992, Greece sealed the border towards the Republic of Macedonia. It was a strong negative shock to the Macedonian economy. Even though Greece was not a major trading partner at the time, Macedonian producers had to find alternative routes for the transport of their imports and exports. The extra transportation cost involved in this re-routing increased the prices of Macedonian imports and exports to less competitive levels. With the signing of the Interim accord between Greece and the Republic of Macedonia in September 1995, the border was re-opened and the flow of goods was normalised. As a result of this, Greece became one of the largest trading partners of the Republic of Macedonia and became the passage for the transport of goods from and to the US.

Yugoslavian wars and UN sanctions: FR Yugoslavia was traditionally a main trading partner of the Republic of Macedonia. However, due to the wars in former Yugoslavia in the 1991-1995 period and the UN sanctions that were imposed over FR Yugoslavia during this period, the demand for Macedonian import goods reduced sharply. In addition, being a member of the UN, the Republic of Macedonian was not allowed to export goods to the Yugoslav market. The sanctions over FR Yugoslavia applied also on the use of the transport corridor through this country resulting in additional costs for the Macedonian producers. The other republics of the former FR Yugoslavia were also important trading partners of the Republic of Macedonia. However, due to the civil war in Bosnia and Herzegovina in the 1992-1995 period the demand for Macedonian products declined. After the end of the civil war, the Macedonian producers were not able to re-take their market share on this market. Exports also declined to Slovenia, especially after the signing of the free-trade agreement between the Republic of Macedonia and Slovenia in 1997. This was a consequence of the non-tariff barriers imposed by the Slovenian administration on Macedonian exports.

Russian crisis: A severe setback for the demand for Macedonian goods was the financial crisis and the deterioration of the economic performances in Russia in 1997 and 1998. A lot of export contracts were terminated in the leather and metal-processing industry.

Trade agreements with EU and US: At the beginning of 1996 the Republic of Macedonia signed an agreement on exports of textile products to the European Union. This was beneficially towards Macedonian textile exporters. In addition, the Republic of Macedonia was granted import quotas for textile and iron and steel products by the US, which resulted in an increase in exports of these products to the US.

Kosovo crisis: The Kosovo crisis during the beginning of 1999 had a very strong negative effect on the Macedonian exports. The Yugoslavian market, a traditionally very important market for Macedonian products, was shut down. In addition, the transport corridor through this country was closed. The resulting increase in transportation costs on Macedonian products lead to a reduction of the demand for Macedonian exports. After the end of the war in FR Yugoslavia the Yugoslavian market reopened for Macedonian goods and the transport corridor to the EU market was re-established.

The equation for the volume of exports reads as

$$DLOG(X) = -0.20*\{LOG(X(-1)) - LOG(YW(-1)) + 0.95*(LOG(PX(-1)/PXW(-1))\}$$
$$(2.73) \phantom{*\{LOG(X(-1)) - LOG(YW(-1)) + }(2.53)$$

$$+ \quad 0.13*DLOG(M(-1))$$
$$(1.33)$$

R^2-adj. = 0.32, SE = 0.16, Sample: 1994:04-1999:12

where YW = volume of world trade, PX = export price, PXW = world export price, M = volume of imports.

As follows from the short term dynamics, exports depend on imports. The reason for this is that the Republic of Macedonia imports quite a lot of intermediate goods that are exported again after processing them domestically. In accordance to the absorption approach to the current account of the balance of payments, the volume of imports is strongly linked to real aggregate domestic demand, as a more or less constant part of domestic spending is imported from abroad. Next, imports depend on the price competitiveness of the Macedonian goods on the domestic market against world prices. Therefore, a weighted world price of imports has been constructed for the Republic of Macedonia. Analogously to the construction of the world price of exports, as mentioned above, the world import price is calculated as a weighted average of world prices of the main categories of goods that are imported by the Republic of Macedonia. Both the aggregate domestic demand variable and the relative price variables are in the equation for Macedonian real **imports**

$$DLOG(M) = -0.49*\{LOG(M(-1)) - LOG(DD(-1)) + 0.4*LOG(PM(-1)/PY(-1))\}$$
$$(3.46) \phantom{*\{LOG(M(-1)) - LOG(DD(-1)) + 0.4*LOG}(-)$$

R^2-adj. = 0.30, SE = 0.20, Sample: 1994:05-1999:12

where PM = price of imports, PY = GDP deflator, DD = real domestic demand, and the other variables are as defined before.

2.2. Wages and labour market

As mentioned before, the production side has not been modelled explicitly, but implicitly. Assuming an underlying constant elasticity of substitution (CES) production function (see also Barrell *et al.*, 2001),

$$Y = \gamma[\delta K^{-\rho} + (1-\delta)LD^{-\rho}]^{-1/\rho}$$

where γ and δ are the production function scale parameters, and the elasticity of substitution σ is given by $1/(1+\rho)$, Y refers to real GDP, LD refers to labour demand and K represents the capital

stock. If $\rho = 0$, production is characterised by a unit elasticity of substitution, and the production function is of the Cobb-Douglas type. We assume there is no labour augmenting technical progress. Then, the first-order condition for profit maximisation is:

$$\beta(W/PY) = \gamma^{-\rho} (1-\delta)Y^{1+\rho} LD^{-(1+\rho)}$$

where β = the profit margin, W = wages per worker, and the other variables are as defined before. This reduces to a log-linear **labour demand** equation of the form:

$$LOG(LD) = -\sigma\ LOG(W/PY) + LOG(Y) + \alpha$$

where α denotes a constant, and the other variables are as defined before. Like Barrell *et al.* (2001), we find a unit elasticity for production. In the estimated long-term relationship labour demand depends positively on the level of activity in the real economy, measured by real GDP, and negatively on real wages:

$$DLOG(LD) = -0.05*\{LOG(LD(-1)) - LOG(Y(-1)) + LOG(W(-1)/PY(-1))\}$$
$$(5.85)$$

$$+ 0.14*DLOG(LD(-1)) + 0.26*DLOG(LD(-2)) - 0.41*DLOG(LD(-3) + 0.32*DLOG(Y)$$
$$(1.00) \qquad\qquad (3.49) \qquad\qquad (3.27) \qquad\qquad (2.71)$$

R^2-adj. = 0.81, SE = 0.002, Sample: 1995:08-1999:12

According to the above profit maximisation condition, wages are set by employers according to

$$W = \lambda\ PY\ (Y/LD)^{1+\rho},$$

where λ is a constant, and the other variables are as defined before. There is no active wage policy restricting wage increases in the private corporate sector, although in the beginning years of the transition wages of state-owned or incompletely privatised companies were set by the government on the basis of the 1993 Law on Wages and Pensions. In the course of the 90s, the corporate sector has evolved into a market sector with no regulation with respect to wage formation, except for a law on the minimum wage level. Consequently, wages in the private corporate sector are to a large extent determined by employers, taking into account inflation and labour productivity developments. Real wage developments in the Republic of Macedonia have during most of the period under consideration been quite moderate, which is to a large extent due to the still high level of unemployment (see Chart 3).

Chart 3 Unemployment rate
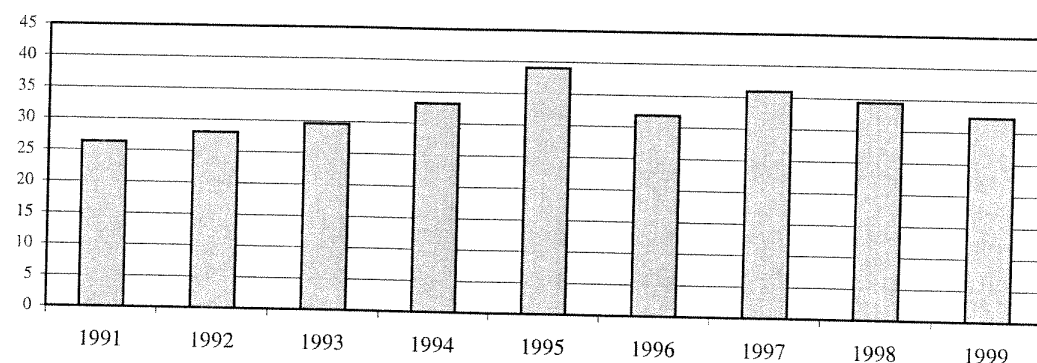
Note: From 1996 according to Labour Force Survey

The development of the nominal **wage bill per worker** is captured by the following equation:

$$DLOG(W) = -0.20*\{LOG(W(-1)) - LOG(LP(-1)) + 0.02*U(-1) - LOG(PRS(-1))\}$$
$$(2.85) \qquad\qquad\qquad (4.08)$$

$$+ 0.7*DLOG(LP) - 0.03*D(U)$$
$$(-) \qquad\qquad (3.37)$$

R^2-adj. = 0.55, SE = 0.01, Sample: 1995:08-1999:12

Here U = unemployment rate, LP = Y/LD is the labour productivity defined as real GDP per employee, and the other variables are as defined before.

According to the long-term relationship in the wage equation, wages largely follow the development in labour productivity and the retail prices. Hence, a 'nominal wage indexation' to the retail price level was found, rather than a strong link between wages and output prices. This indicates that market forces still play a minor role in the labour market. Unemployment has a dampening effect on the bargaining power of the labour unions. Unemployment is per definition the difference between labour supply and labour demand, as a percentage of labour supply, where labour supply in the model is exogenous. Unemployment plays a role in the short-term, as it is significant in the short-term dynamics part of the equation.

2.3. Prices

The Republic of Macedonia, like many other countries under transition, witnessed hyperinflation during the beginning years of the transition period (see Chart 4). A stabilisation policy, implemented from 1992 to 1994, managed to accomplish an impressive and quick decline of the inflation within a few years, after which a low inflation rate was maintained. In view of this development, the **price of retail sales** was modelled only over the period of moderate inflation, i.e. from 1995 onwards. In

the long-term equilibrium relationship for the retail price homogeneity is assumed with respect to the input costs, i.e. the coefficients of the input costs should add up to one. Therefore, the coefficient of import prices is fixed to one minus the value of the estimated coefficient for unit labour cost. Further, a one-to-one impact of indirect taxes on consumer prices is assumed by fixing the coefficient of one plus the tax rate at unity.

DLOG(PRS) = -0.28*{LOG(PRS(-1)/(1+ITAXR(-1)))-0.82*LOG(ULC (-1))-0.18*LOG(PM(-1))}
           (2.63)   (11.93)   (-)

          + 0.06*DLOG(POILW$(-1)) + 0.03*DUM
            (1.32)   (2.20)

R^2-adj. = 0.34, SE = 0.03, Sample: 1995:07-1999:12

where ULC = unit labour cost, ITAXR = indirect tax rate, POILW$ = price of oil in US dollars, DUM = a technical correction in January-February 1997, and the other variables are as defined before.

Chart 4   Inflation rate

■ ■ 1991-95 (left scale) ━━━1995-99 (right scale)
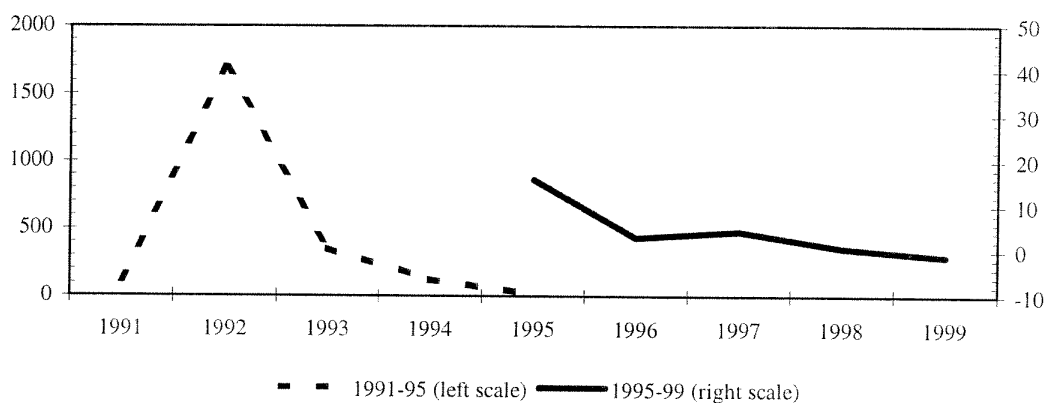
Macedonian exporters are price takers on the world market. The export price in the long run is therefore related to both the price of GDP and the world price of exports. Homogeneity in this long-term relationship is thereby assumed, as in the short-term relationship, so that a 1% increase in both the GDP price and the world export price results in a 1% increase in the export price. The adjustment towards the equilibrium relationship is realised relatively quickly, which reflects price-taking behaviour. A dummy variable is added to correct for a revision of the export price registration for textiles in 1996.

DLOG(PX)= -0.64*{LOG(PX(-1)) - 0.64*LOG(PY(-1)) - 0.36*LOG(PXW(-1))}
          (5.84)   (7.20)   (-)

        + 0.64*DLOG(PY(-1)) - 0.36*DLOG(PXW(-1)) + 0.33*DUMPX
          (7.20)   (-)   (5.50)

R^2-adj. = 0.47, SE = 0.07, Sample: 1994:01-1999:12

where PX = export price, DUMPX = dummy for a statistical break in January 1996, and the other variables are as defined before.

2.4. Public sector

The government budget has been on balance during the second half of the 90s (see Table 3). The main income consists of indirect taxes, which are about two-and-a-half times the direct taxes.

Table 3 Government budget (millions of denars)

| Year | Revenues | | Expenditures | | | Government balance |
	Direct taxes	Indirect taxes	Government expenditure	Interest payments on government debt	Other financial items	
1995	11,595	27,479	37,900	1,841	666	-1
1996	11,191	26,524	37,053	1,794	1,133	1
1997	10,050	25,391	36,044	1,984	2,591	4
1998	10,929	25,851	36,883	1,935	2,071	33
1999	12,792	28,934	38,688	2,485	163	716

Although interest payments on debt comprise only a small part of the total budget, its link with the interest rate on the financial market makes a distinction between interest payments and non-interest payments interesting. In the Macedonian case, the bulk (around 90%) of the government debt is domestic, and the interest rate that is paid on it is linked to interest rates which are substantially lower and much more stable than most of the interest rates in the international financial market. For the domestic debt the discount rate of NBRM is the representative interest rate, being the rate paid on the largest domestic debt component, namely a government bond loan that was issued in 1995 for the rehabilitation of Stopanska banka, the largest bank in the Republic of Macedonia. For the foreign debt a weighted average of the six-month US Dollar and Deutsche mark LIBOR rates have been taken as the representative interest rate on the international market. Through this channel international market developments directly affect the budgetary position of the Macedonian government.

2.5. Money demand

The money stock, measured by the denar component of M2 (M2D), consists mainly of demand deposits, on which no or low interest is being paid (see Chart 5). The share of quasi deposits, which earn the deposit interest rate, moved from 40% in 1993 to around one-fifth to one quarter of total money supply in the second half of the 90s. The interest rate on deposits is included in the money demand equation. The response of the stock of M2D to changes in the deposit interest rate is expected to be positive, as quasi deposits are a component of M2D.

Chart 5 Composition of M2 (denar component)
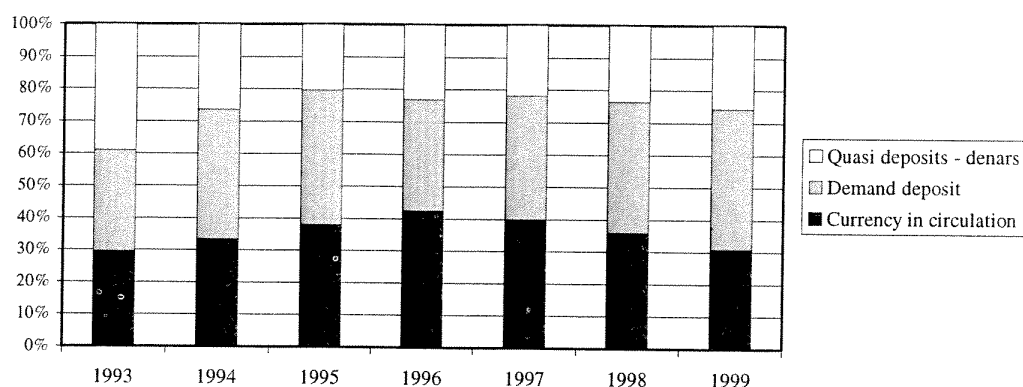
The equation estimated for real money demand is

DLOG(M2D/PRS) = -0.08*{LOG(M2D(-1)/PRS(-1))-LOG(Y(-1))- 0.004*ID(-1)
　　　　　　　　(-)　　　　　　　　　　　　　　　　　　(4.12)

+ 0.003 INF(-1)} + 0.29*DLOG(M2D(-2)/PRS(-2))+ 0.0002*D(ID(-3))
　(2.46)　　　　　　(4.01)　　　　　　　　　　　(1.89)

- 0.12*DUM1 - 0.09*DUM2 - 0.09*DUM3
　(3.57)　　　　(6.15)　　　(4.75)

R^2-adj. = 0.71, SE = 0.03, Sample: 1993:05-1999:12

where M2D = money supply (M2 denar), ID = deposit interest rate, DUM1, DUM2, DUM3 = dummy variables, and the other variables are as defined before.

The long-term income elasticity is fixed at unity, so that an income rise by 1% in the long run leads to an increase in M2D by 1% as well. Free estimation gave implausible high income-elasticity, possibly because the official GDP figure is a bad proxy for the volume of transactions in the Macedonian economy. The adjustment coefficient was calibrated, and shows a slow adjustment speed. According to the small but significant coefficients for the interest and inflation rates in the long-term equilibrium relationship, M2D increases slightly when the real rate on deposits rises. This is what was expected. In the short run dynamics this positive deposit interest rate effect is found as well. However, although statistically significant, these interest coefficients are very small. This may partly reflect the sticky characteristic of the deposit interest rate, and all bank interest rates in the Republic of Macedonia for that matter. In Box 2 more background information on the rigidity of bank interest rate policy is found.[3]

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[3] See also Stavreski (1998).

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A long-term interest rate could not be included in the equation, as long-term government bonds were not available as an alternative financial asset for the public, at least during most of the period under consideration. An alternative interest rate on for example long-term savings deposits, which are not included in M2D, could neither be used in the money demand equation, as there are practically none of those series available.

Box 2 **The rigidity of interest rates set by banks**

Banks' interest rates on lending and deposits in the Republic of Macedonia are relatively rigid. Banks keep these interest rates unchanged, regardless of the monetary policy stance and the economic developments. Therefore, the transmission channel of the monetary policy through interest rates in the Republic of Macedonia is not functioning. For example, during the Kosovo crisis in the first half of 1999, banks' liquidity decreased, yet they kept interest rates mainly unchanged, while the interest rates on deposit auctions and in the money market surged. The rigidity of deposit and lending rates can be ascribed to the following factors:

a) The savings rate of households is relatively low in the Republic of Macedonia, while the need for capital is big. This is keeping the general interest rate on a high level;

b) Savings deposits are relatively small in the Republic of Macedonia, due to a lack of confidence in the banking sector, because of some bad experience in the past. In such a situation, even raising deposit rates is not sufficient to attract more deposits;

c) A high demand of firms for loans, as enterprises practically have no other alternative sources of external finance than bank loans (the stock exchange is still underdeveloped). This high demand for bank loans drains the banks' deposit funding potential, and therefore keeps the level of lending interest rates high;

d) A large share of bad loans in the banks' portfolios, reflecting the unfavourable situation in the real sector and the inefficient credit portfolio management by banks, results in losses which are discounted in high interest rates;

e) Inefficient legal procedures hampering a quick collection of collateral in case of default, also result in the additional default risk premiums in the interest rates in the general interest rate level;

f) Inefficient and costly operation of the banks, reflecting a low degree of competition in the banking sector, leads to higher interest rate margins.
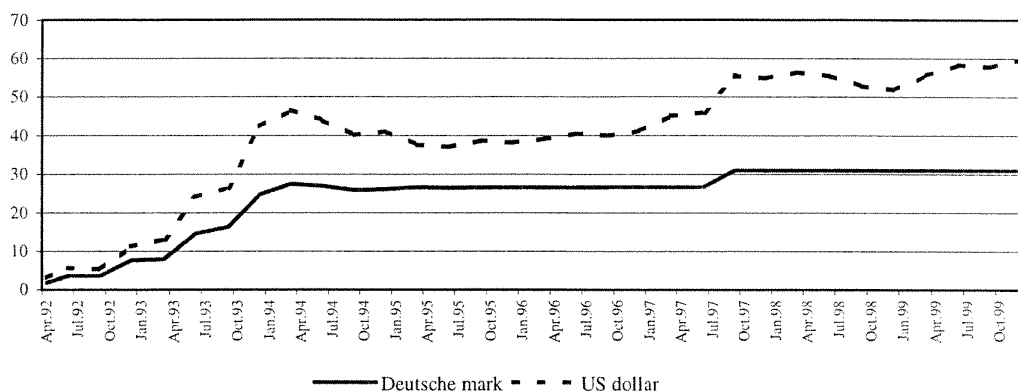

2.6. Monetary policy

Since its (monetary) independence until today, the NBRM had two subsequent monetary policy strategies. During the period September 1992-October 1995 the NBRM followed a strategy of monetary targeting. Thereafter, in the last quarter of 1995, it changed its strategy into one of exchange rate targeting to the Deutsche mark.[4] Only at one point in time, July 1997, the denar was devaluated by 16% against the Deutsche mark, due to a deterioration of the balance of payments. Since then, the exchange rate has been constant, as Chart 6 shows.

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[4] See also Bishev (1997).

Chart 6 Nominal exchange rate of the denar
Denars per unit of foreign currency

—— Deutsche mark ▪ ▪ ▪ US dollar

Two alternative monetary policy rules could be hypothesised for the short-term interest rate, the first representing monetary targeting to a monetary target $M2D^T$

$$ID = ID(-1) + \omega(100\Delta_{12}LOG(M2D) - M2D^T),$$

and the second representing exchange rate targeting towards the target $EDEM^T$

$$ID = ID(-1) + \tau(EDEM - EDEM^T).$$

Under exchange rate targeting, the current monetary strategy, the money supply is subordinated to the exchange rate. This implies that an intervention by the central bank on the foreign exchange market by selling or buying foreign currency (in order to maintain the targeted level of the exchange rate) the domestic money supply will decrease or increase. Money market interest rates will follow these movements of liquidity in the banking sector.[5]

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[5] As the interest rate channel hardly plays a role in MAKMODEL up to now, we have not experimented with this channel.

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3. Policy simulations and model properties

MAKMODEL can be used for analysing the effects of a variety of shocks, being policy shocks or external shocks. Most shocks will feed into the economy through multiple channels, carrying over secondary effects. The main linkages between the various model blocks of MAKMODEL are shown in Chart 7.

Chart 7   Model linkages
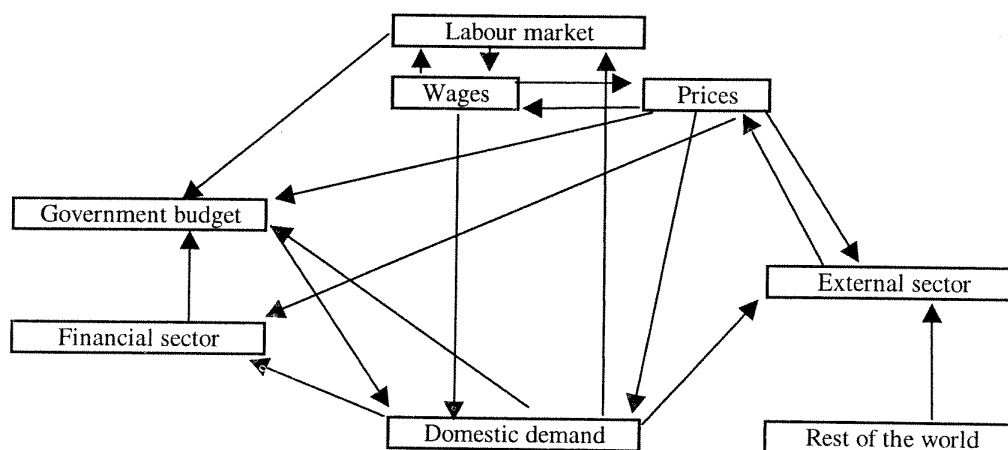
3.1. Forecasting

The model was estimated up to and including 1999. For the years thereafter, to be precise for the period 2000:1-2010:12, a forecast base was constructed. In order to do this, assumptions had to be made concerning all the 45 exogenous variables. The assumptions made are that the exchange and interest rates, and the oil price remain constant during the full period. Important variables like the world trade, government expenditures etcetera were assumed to grow at a constant rate calculated as the average growth rate during the last year 1999. Then, judgement could be included by manipulating the residuals of the behavioural or some technical equations. This is however not done here, so the forecast base made is rather 'technical', i.e. only relying on the model and the assumptions of the exogenous variables. The forecast base is shown, for the main variables for the full period of 10 years, in Annex 3.

This relatively long forecast base serves two purposes. First, sensitivity analyses can be carried out that illustrate the sensitivity of the model to assumptions on external variables and domestic exogenous variables. This is shown in this subsection below. In practice, though, we would advise to make only short to medium-term forecasts for e.g. 1 to 2 years ahead. The model as such relies heavily on the exogenous variables and forecasts for more than 2 years ahead are surrounded with much uncertainty. Second, the base can be used to run simulations over a long period in order to investigate

the long-term properties of the model. This is shown in the next subsection where two simulation examples are presented.

Chart 8 Sensitivity analyses of GDP-forecast to assumed world trade growth
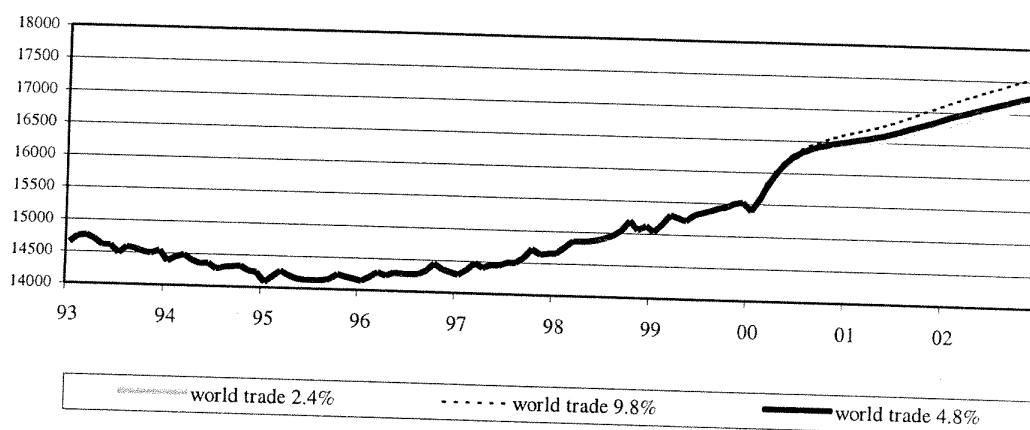Millions of denars

Chart 8 shows the realisations and the 'central forecast' of GDP for the years 2000-2002 (see the black solid line). As follows the GDP increases from 15.5 billion denars in 1999:12 to about 17.3 billion denars in 2002:12 (all in prices of 1995). In this forecast an annual world trade growth of 4.8% is assumed.

The main advantage of using a model such as MAKMODEL for forecasting is that it takes into account all linkages in the economy. Therefore, it gives a consistent framework of preparing policy and experimenting with assumptions. Whenever a forecast is being made, it is insightful to make clear the sensitivity of the assumptions for the forecast. This 'sensitivity analysis' is a powerful means to communicate the crucial assumptions regarding exogenous variables on which the forecast is being based and to what extent the forecast is sensitive to developments which deviate from the assumptions in the central projection.

As a sensitivity analysis Chart 8 also shows the effect on the forecasted growth path of two alternative 'scenarios', i.e. a more optimistic world trade scenario in which world trade is assumed to grow by 9.8% and a pessimistic scenario in which world trade is growing by 2.4%. It follows that in case of the more optimistic scenario of an annual world trade growth of 9.8% during the two years, GDP rises up to 17.6 billion denars in 2002. The more pessimistic scenario of an annual world trade growth of 2.4% shows that GDP will be 17.2 billion denars.

3.2. Simulation examples

Fiscal shock

As a first simulation example, we perform a fiscal shock of 10% in the level of government expenditure during the one-year period January-December 2000. Chart 9i represents the shock. A 10% rise of

the level of government expenditure immediately affects Macedonian GDP, which instantly increases by about 2% to 1% during the period of the shock (also shown in Chart 9i). After the period of the shock, GDP returns to a level slightly below base.

**Chart 9i   10% Government expenditures in 2000**
(% changes from base)
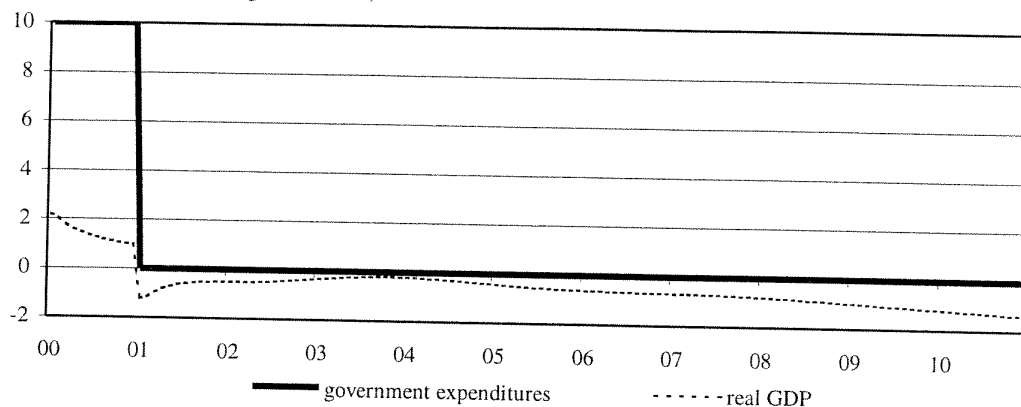
The rise of GDP results in a higher labour demand, which results in an increase of employment of around 1% (Chart 9ii). Consequently, unemployment drops by 0.7 percentage points of the labour force. Labour market effects are prolonged after the shock.

Chart 9ii   Effects on labour demand and unemployment
(% changes resp. %-point changes from base)

Wages rise by 2.3% during the period of the shock, in response of an increase in labour productivity (Chart 9iii). After the shock wage growth returns to a level slightly above base. Inflation during the shock gradually increases to a maximum level of 1.5 percentage points, and after the shock has disappeared it returns in the long run in the direction of the base.

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Chart 9iii Effects on wage rate and inflation

(% changes resp. %-point deviations from base)

——— wages   - - - - - - inflation
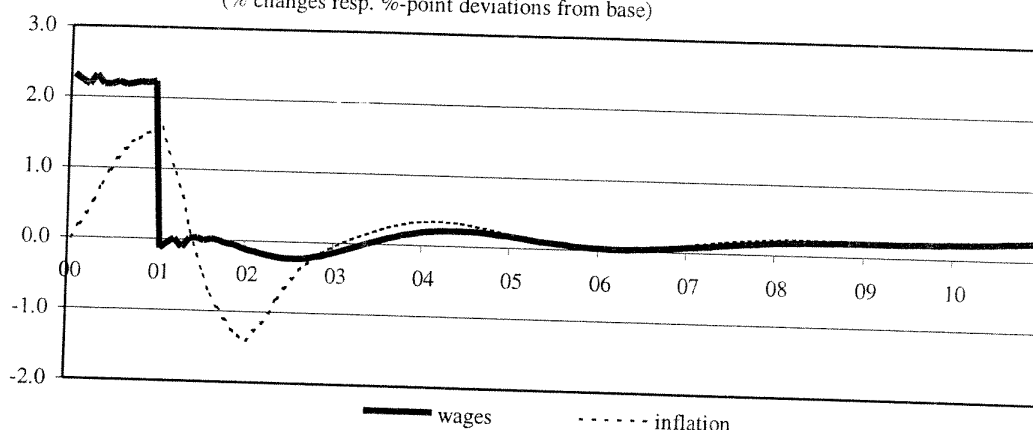
World trade shock

We simulate a shock of -10% in the level of world trade during the one-year period January-December 2000. This shock is temporarily given, as after these 12 months the world trade returns to its previous level again. Chart 10i shows this shock in deviations from base.

Chart 10i -10% World trade shock in 2000

(% changes from base)

——— world trade real GDP   - - - - - real GDP   exports
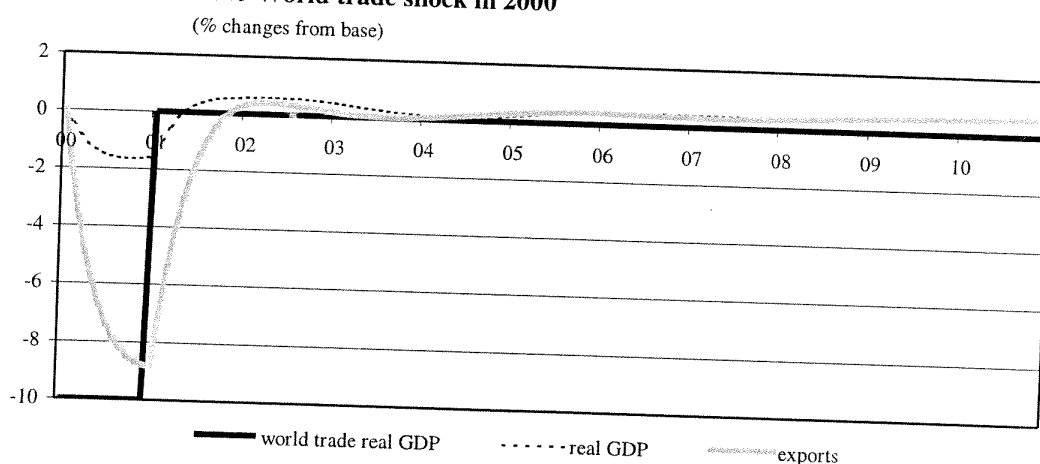
In MAKMODEL a 10% fall in the level of world trade immediately affects Macedonian exports, which decrease by 9% during the period of the shock (also shown in Chart 10i). As a consequence of the fall in exports, GDP decreases by around 1%. After the period of the shock, exports and GDP return to levels slightly above base. This is because export prices have fallen in response to the drop in world trade demand, while world export prices have been assumed constant, so that this shock results in an improvement of the export price competitiveness which holds on even after the shock.

Chart 10ii Effects on labour demand and unemployment
(% changes resp. %-point changes from base)
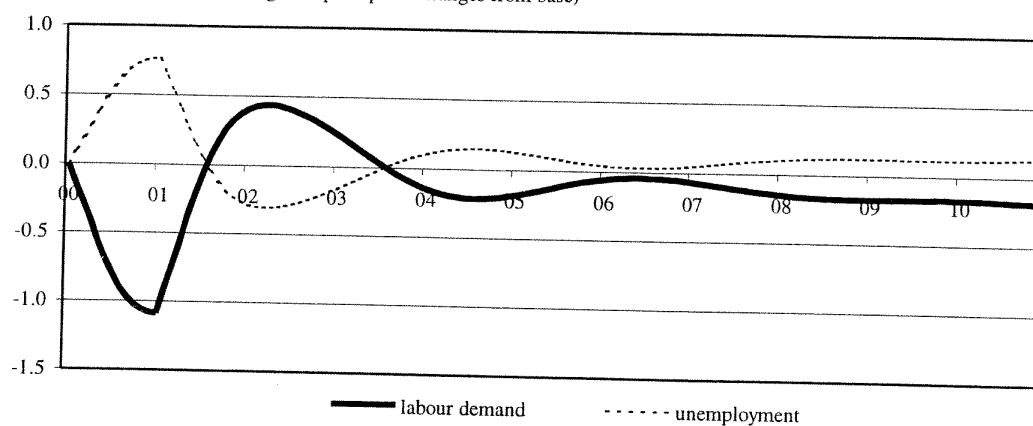
The drop in GDP results in a lower labour demand, which results in a drop in employment of around 1 to 1.2% (Chart 10ii). Consequently, unemployment rises by 0.7 percentage points of the labour force. Labour market conditions recover around mid 2001.

Chart 10iii Effects on wage rate and inflation
(% changes resp. %-point deviations from base)
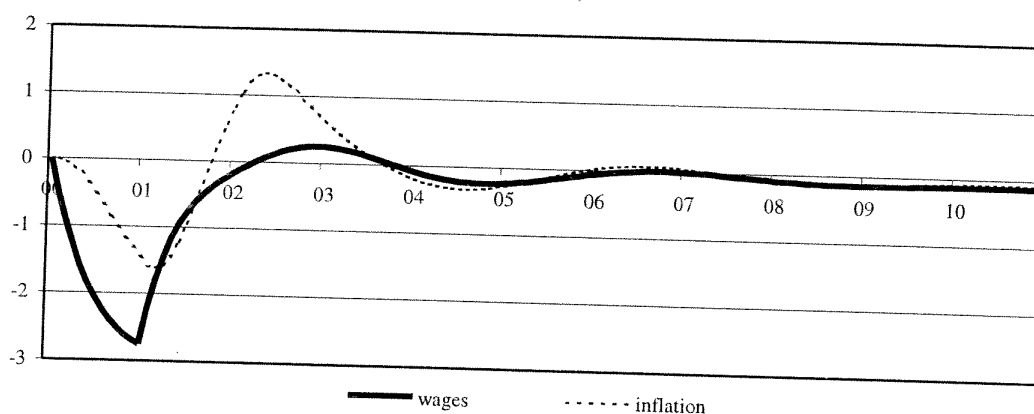
Inflation falls by 1.5%-point following the negative demand shock (Chart 10iii). Labour productivity falls, triggering a fall in wages of even up to 2.5% in deviation from base.

4. Future avenues

The present macro-model for Macedonia is one of the first models in the region. As shown in this report, it is now in the stage that it can be used for simulation purposes as well as for forecasting.

Evidently, one needs to remain aware of the fact that the data used and estimations carried out concern a period where many external and internal shocks affected the Macedonian economy. In this respect MAKMODEL is a modest first step. The modelling work should be continued in the future. It is advisable to keep the data base of the model up to date, re-estimate equations from time to time and use MAKMODEL on a regular basis for simulation exercises and forecasting in order to find out the major modelling shortcomings for describing the Macedonian economy.

In case better time series would become available they could be included in the data base. Until now for instance, consumer prices and private consumption were not available. The price of retail sales and retail sales, respectively, were used instead. Inflation, defined in MAKMODEL as the growth rate of the price of retail sales, has therefore also a limited significance. Also, GDP only exists on an annual basis. In order to model the real economy properly it would be desirable to have reliable GDP-figures at least on a quarterly basis. More data remarks could be made in this vein.

Also, for monetary policy analyses it would be interesting to investigate the credit market further and, along with this, the interest rate channel. In order to do this, more information should become available from the balance sheets of the banking sector or the demand for consumer and corporate credits. Studies in these fields could illuminate how changes in interest rates would affect the demand for credits, and via this channel the real economy.

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Annex 1   Model specification

Aggregate demand at constant prices

1. Y $=$ CONS + I + <u>G</u> + X - M + <u>MES</u>$_Y$
2. DLOG(CONS) $=$ -0.02*{LOG(CONS(-1)) - LOG(YDN(-1)/PRS(-1)}+ 0.89*DLOG(CONS(-1))
3. DLOG(I) $=$ -0.88*{LOG(I(-1)) - LOG(Y(-1)) + 0.002*INF(-1)} - 0.002*D(IL(-3))
4. DLOG(X) $=$ --0.20*{LOG(X(-1)) - LOG(YW(-1))+0.95*(LOG(PX(-1)/PXW(-1))}
              + 0.13*DLOG(M(-1))
5. DLOG(M) $=$ -0.49*{LOG(M(-1)) - LOG(DD(-1)) + 0.4*LOG(PM(-1)/PY(-1))}
6. DD $=$ Y + M
7. CAB $=$ XN – MN + <u>PRI</u>*<u>EUSD</u> + <u>TRB</u>*<u>EUSD</u>

Wages and labour market

8. DLOG(W) $=$ -0.20*{LOG(W(-1)) - LOG(LP(-1)) + 0.02*U(-1) - LOG(PRS(-1))}
              + 0.7*DLOG(LP) - 0.03*D(U)
9. LP $=$ Y/LD
10. YDN $=$ 1 / (1 + DTAXR) * (W * LD + <u>PROF</u> + <u>NII</u> + <u>SSB</u> + <u>NCT</u> + <u>MES</u>$_{YDN}$)
11. U $=$ 100 * (<u>LS</u>-LD)/<u>LS</u>
12. DLOG(LD) $=$ -0.05*{LOG(LD(-1)) – LOG(Y(-1)) + LOG(W(-1)/PY(-1))}
              + 0.14*DLOG(LD(-1)) +0.26*DLOG(LD(-2)) - 0.41*DLOG(LD(-3)+0.32*DLOG(Y)
13. GAP $=$ 100 * <u>YPOT</u> / Y

Prices

14. DLOG(PRS) $=$ -0.28*{LOG(PRS(-1)/(1+ITAXR(-1)))-0.82*LOG(ULC(-1))-0.18*LOG(PM(-1))}
               + 0.06*DLOG(POILW$(-1)) + 0.03*DUM
15. INF $=$ 100 * (PRS-PRS(-12))/PRS(-12)
16. ULC $=$ (W * LD) / Y
17. ΔLOG(PY) $=$ [(DD-X+M)/DD] ΔLOG(PRS) + [X/DD] ΔLOG(PX) - [M/DD] ΔLOG(PM) + <u>MES</u>$_{PY}$
18. ΔLOG(PG) $=$ ΔLOG(PY) + <u>MES</u>$_{PG}$
19. DLOG(PX) $=$ -0.64*{LOG(PX(-1)) - 0.64*LOG(PY(-1)) - 0.36*LOG(PXW(-1))}
              + 0.64*DLOG(PY(-1)) + 0.36*DLOG(PXW(-1)) + 0.33*DUMPX
20. ΔLOG(PM) $=$ 0.48 ΔLOG(<u>PMWEX$</u>*<u>EUSD</u>/EUSD95) + 0.52 ΔLOG(<u>POILW$</u>*<u>EUSD</u>/EUSD95)
              +<u>MES</u>$_{PM}$

Aggregate demand at current prices

21. YN $=$ 0.01 * PY * Y
22. CN $=$ 0.01 * PRS * CONS
23. GN $=$ 0.01 * PG * G
24. MN $=$ 0.01 * PM * M
25. XN $=$ 0.01 * PX * X

Government budget

26.	DDOM	$= DB - \underline{DFOR}$
27.	DB	$= DB_{-1} - GB + \underline{MES}_{DB}$
28.	GB	$= REV - GN - GINT + \underline{OFIN}$
29.	REV	$= DTAX + ITAX$
30.	DTAX	$= \underline{DTAXR} * YDN + \underline{MES}_{DTAX}$
31.	ITAX	$= \underline{ITAXR} * CN$
32.	GINT	$= \underline{IG} / (100*12) * DDOM_{-1} * \underline{DDCOR} + \underline{IFOR} / (100*12) * \underline{DFOR}_{-1}) + \underline{MES}_{GINT}$

$$33. \quad DY \quad = 100 * DB / \sum_{i=0}^{-11} YN_i$$

$$34. \quad GBY \quad = 100 * \sum_{i=0}^{-11} GB_i / \sum_{i=0}^{-11} YN_i$$

Financial part

35. DLOG(M2D/PRS) = -0.08*{LOG(M2D(-1)/PRS(-1))-LOG(Y(-1))- 0.004*ID(-1) + 0.003 INF(-1)}
    + 0.29*DLOG(M2D(-2)/PRS(-2))+ 0.0002*D(ID(-3))
    - 0.12*DUM1 - 0.09*DUM2 - 0.09*DUM3

36. ID $\quad = ID(-1) + \omega(100\Delta_{12}LOG(M2D) - M2D^T)$ or ID $= ID(-1) + \tau(EDEM - EDEM^T)$

37. ΔIL $\quad = \Delta ID + \underline{MES}_{IL}$

38. ER $\quad = 0.299 \, \underline{EDEM}/\underline{EDEM95} + 0.064 \, \underline{EUSD}/\underline{EUSD95} + 0.052 \, \underline{EATS}/\underline{EATS95}$
    $+ 0.03 \, \underline{EGRD}/\underline{EGRD95} + 0.05 \, \underline{ENLG}/\underline{ENLG95} + 0.028 \, \underline{EGBP}/\underline{EGBP95}$
    $+ 0.204 \, \underline{EITL}/\underline{EITL95} + 0.064 \, ETRL/ETRL95$
    $+ 0.041 \, \underline{EFRF}/\underline{EFRF95} + 0.130 \, \underline{ESIT}/\underline{ESIT95} + 0.038 \, \underline{ECHF}/\underline{ECHF95}$

On notation:

- Underlined variables are exogenous
- Δ means first differences, e.g. $\Delta IL = IL - IL(-1)$
- EUSD95 is the average value for EUSD in 1995, etc.

Annex 2   Model variables

Endogenous:

1.	CONS	=	Private consumption, in constant prices
2.	CAB	=	Current account balance, in current prices
3.	CN	=	Private consumption, in current prices
4.	DB	=	Government debt, in current prices
5.	DD	=	Domestic demand, in constant prices
6.	DDOM	=	Domestic government debt, in current prices
7.	DTAX	=	Direct taxes, in current prices
8.	DY	=	Government debt as percentage of GDP
9.	ER	=	Nominal effective exchange rate, 1995=100
10.	GAP	=	Output gap, in percentages
11.	GB	=	Government balance, in current prices
12.	GBY	=	Government deficit as percentage of GDP
13.	GINT	=	Total government interest payments, in current prices
14.	GN	=	Government expenditures, in current prices
15.	I	=	Gross fixed capital formation, in constant prices
16.	ID	=	Interest rate on deposits, in percentages
17.	IL	=	Lending interest rate, in percentages
18.	INF	=	Inflation, in percentages
19.	ITAX	=	Indirect taxes, in current prices
20.	LD	=	Labour demand, in persons
21.	LP	=	Labour productivity
22.	M	=	Imports, in constant prices
23.	MN	=	Imports, in current prices
24.	M2D	=	Money demand M2 denar component, in current prices
25.	PG	=	Price government expenditures, 1995=100
26.	PM	=	Price of imports, 1995=100
27.	PRS	=	Price retail sales, 1995=100
28.	PX	=	Price of exports, 1995=100
29.	PY	=	Price of GDP, 1995=100
30.	REV	=	Government revenues, in current prices
31.	U	=	Unemployment, in percentages
32.	ULC	=	Unit labour cost
33.	X	=	Exports, in constant prices
34.	XN	=	Exports, in current prices
35.	W	=	Wage rate, gross wage bill per worker, in million Denars
36.	Y	=	GDP, in constant prices
37.	YDN	=	Disposable income, in current prices
38.	YN	=	GDP, in current prices

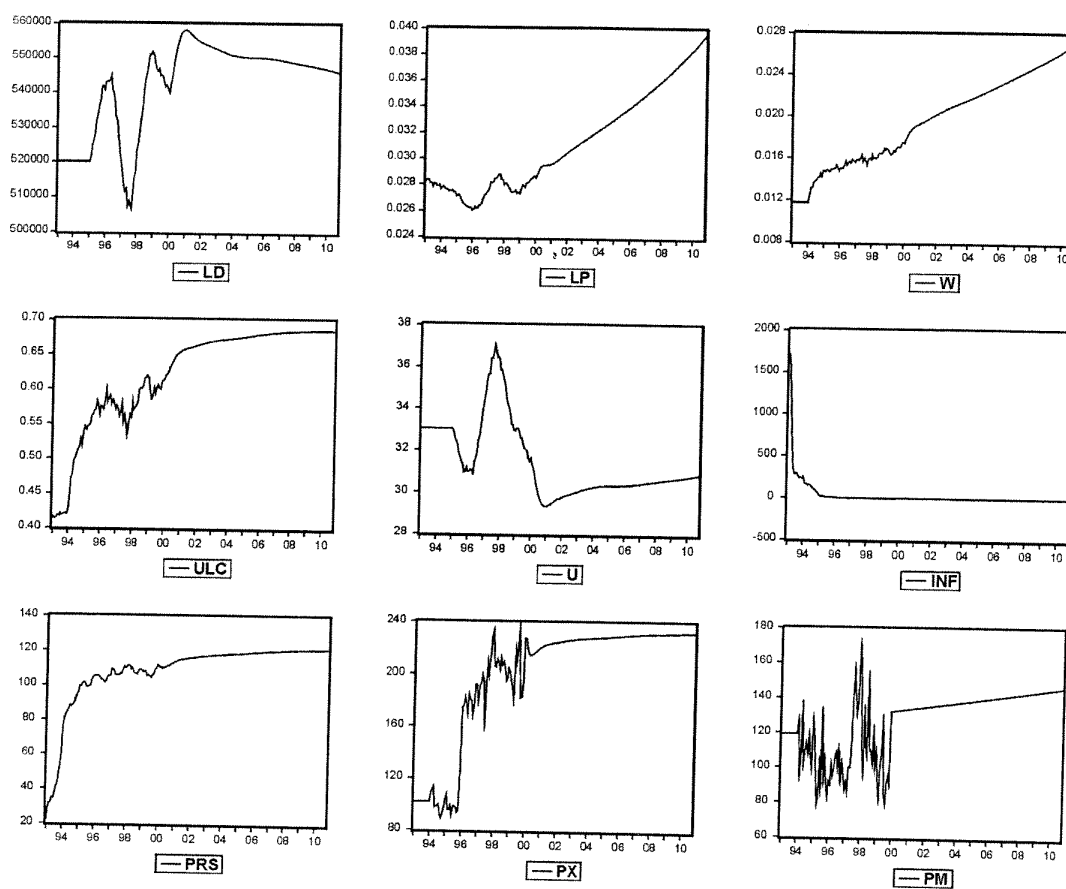*Exogenous:*

1.	DDCOR	=	Domestic debt, correction factor (interest paying share of the total domestic debt)
2.	DFCOR	=	Foreign debt, correction factor (share of public debt in total foreign debt)

3.	DFOR	=	Foreign public debt, in USD million
4.	DFORT	=	Total foreign debt, in USD million
5.	DTAXR	=	Direct tax rate, in current prices
6.	EDEM	=	Exchange rate, denars per DM
7.	EUSD	=	Exchange rate, denars per USD
8.	EATS	=	Exchange rate, denars per ATS
9.	EGRD	=	Exchange rate, denars per GRD
10.	ENLG	=	Exchange rate, denars per NLG
11.	EGBP	=	Exchange rate, denars per GBP
12.	EITL	=	Exchange rate, denars per ITL
13.	ETRL	=	Exchange rate, denars per TRL
14.	EFRF	=	Exchange rate, denars per FRF
15.	ESIT	=	Exchange rate, denars per SIT
16.	ECHF	=	Exchange rate, denars per CHF
17.	G	=	Government expenditures, in constant prices
18.	IFOR	=	Foreign interest rate, in percentages
19.	IG	=	Interest rate on domestic government debt, in percentages
20.	ITAXR	=	Indirect tax rate, in current prices
21.	LS	=	Labour supply, in persons
22.	MES_{DB}	=	Measurement error government debt
23.	MES_{DTAX}	=	Measurement error direct taxes
24.	MES_{GINT}	=	Measurement error total government interest payments
25.	MES_{IL}	=	Measurement error lending interest rate
26.	MES_{PM}	=	Measurement error import prices
27.	MES_{PY}	=	Measurement error GDP price
28.	MES_{Y}	=	Measurement error real GDP
29.	MES_{YDN}	=	Measurement error disposable income
30.	NCT	=	Net current transfers, in current prices
31.	NII	=	Net interest income, in current prices
32.	OFIN	=	Other fiscal items, net, in current prices
33.	PMW	=	World import price, in denars 1995=100
34.	PMWEX$	=	World import price excluding oil, in USD 1995=100
35.	POIL	=	Domestic oil price, in denars 1995=100
36.	POILW$	=	World petroleum price, in USD 1995=100
37.	PRI	=	Primary income, in current prices in USD million
38.	PROF	=	Profits, in current prices
39.	PXW	=	World export price, 1995=100
40.	SSB	=	Social security benefits, in current prices
41.	TDTAX	=	Total direct taxes, in current prices in Denar million
42.	TRB	=	Transfers from abroad, in current prices in USD million
43.	TWI	=	Total wage income, in current prices in USD million
44.	YPOT	=	Potential GDP, in constant prices
45.	YW	=	World trade, 1995=100, in constant price

Annex 3 Graphs main variables
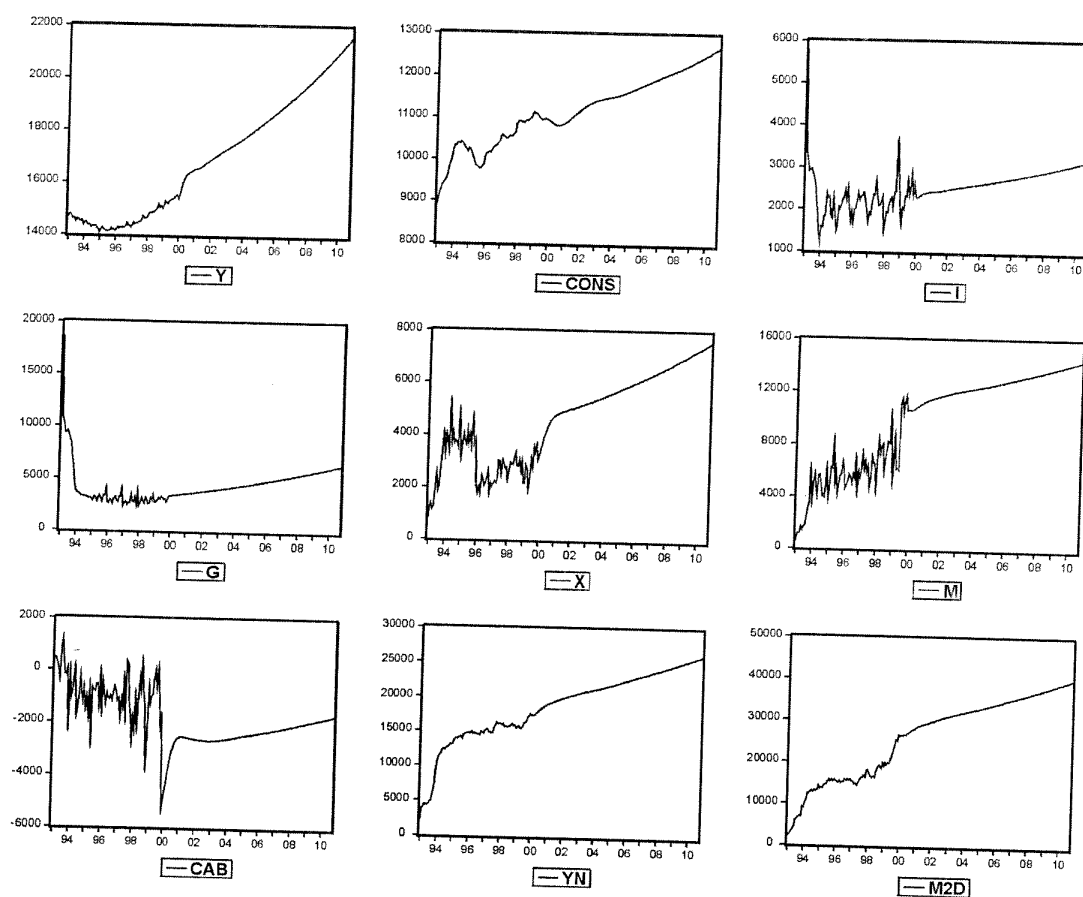
Annex 4   Data constructions and sources

Note: All variables are in millions of denars, in percentages or in number of persons, unless stated otherwise. Variables at constant prices have as a base year 1995.

Endogenous:

1. CONS   =   Annual from Bureau of Statistics, Ginsburgh interpolation with retail sales
2. CAB   =   XN − MN + PRI * EUSD + TRB * EUSD
3. CN   =   0.01 * CONS * PRS
4. DB   =   DDOM + DFOR
5. DD   =   Y + M
6. DDOM   =   Ministry of Finance
7. DTAX   =   DTAXR * YDN + MES$_{DTAX}$

8. DY   = $100 * DB / \sum_{i=0}^{-11} YN_i$

9. ER   =   100 (0.299 EDEM/EDEM95 + 0.064 EUSD/EUSD95 + 0.052 EATS/EATS95 + 0.03 EGRD / EGRD95 + 0.05 ENLG/ENLG95 + 0.028 EGBP/EGBP95 + .204 EITL/EITL95 + 0.064 ETRL/ETRL95 + 0.041 EFRF/EFRF95 + 0.130 ESIT/ESIT95 + 0.038 ECHF/ECHF95)

10. GAP   =   100 * YPOT / Y
11. GB   =   REV − GN − GINT + OFIN

12. GBY   = $100 * \sum_{i=0}^{-11} GB_i / \sum_{i=0}^{-11} YN_i$

13. GINT   =   Monthly from Ministry of Finance
14. GN   =   0.01 * PG * G
15. I   =   100 * IN / PY
16. ID   =   From NBRM
17. IL   =   From NBRM
18. INF   =   100 * (PRS − PRS(-12))/PRS(-12)
19. ITAX   =   ITAXR * CN
20. LD   =   Annual from Bureau of Statistics, Ginsburgh interpolation with wages
21. LP   =   Y / LD
22. M   =   100 * MN / PM
23. MN   =   MD * EUSD
24. M2D   =   From NBRM
25. PG   =   PY
26. PM   =   Constructed at NBRM
27. PRS   =   From Bureau of Statistics
28. PX   =   Constructed at NBRM
29. PY   =   Annual from Bureau of Statistics, Ginsburgh interpolation with producer prices
30. REV   =   DTAX + ITAX

31. U   =   100 * ((LS – LD) / LS)

32. ULC =   (W * LD) / Y

33. X   =   100 * XN / PX

34. XN   =   XD * EUSD

35. W   =   Constructed at NBRM

36. Y   =   CONS + I + G + X - M + MES_Y

37. YDN =   1 / (1 + DTAXR) * (W * LD + PROF + NII + SSB + NCT + MES_{YDN})

38. YN   =   0.01 * Y * PY

Exogenous:

1. DDCOR =   Correction factor

2. DFCOR =   Correction factor

3. DFORT =   NBRM, Lisman interpolation

4. DFOR =   DFCOR * DFORT * EUSD

5. DTAXR =   TDTAX / YDN

6. EDEM =   From IFS

7. EUSD =   From IFS

8. EATS =   From IFS

9. EGRD =   From IFS

10. ENLG =   From IFS

11. EGBP =   From IFS

12. EITL   =   From IFS

13. ETRL =   From IFS

14. EFRF =   From IFS

15. ESIT   =   From IFS

16. ECHF =   From IFS

17. G   =   From Ministry of Finance, deflated by PY

18. IFOR   =   (IFDM + IFUS) / 2

19. IG   =   From NBRM

20. ITAXR =   ITAX / CN

21. LS   =   Annual from Bureau of Statistics, Lisman interpolation

22. MES_{DB} =   DB – DB(-1) + GB

23. MES_{DTAX} =   DTAX - DTAXR * YDN

24. MES_{GINT} =   GINT – (IG / (100*12) * DDOM(-1) * DDCOR + IFOR / (100*12) * DFOR(-1))

25. MES_{IL} = ΔIL - ΔID

26. MES_{PM} = ΔLOG(PM) – [0.48*ΔLOG(PMWEX\$*EUSD/EUSD95)
              +0.52*ΔLOG(POILW\$*EUSD/EUSD95)]

27. MES_{PY} = ΔLOG(PY) –
              {[(DD-X+M)/DD] * ΔLOG(PRS) + [X/DD] * ΔLOG(PX) - [M/DD]* ΔLOG(PM)}

28. MES_Y =   Y - (CONS + I + G + X - M)

29. MES_{YDN} =   YDN – (W * LD + PROF + NII + SSB + NCT – DTAX)

30. NCT   =   From NBRM

31. NII   = From NBRM
32. OFIN   = From Ministry of Finance
33. PMW   = Constructed at NBRM from IFS
34. PMWEX$ = Constructed at NBRM from IFS
35. POIL   = From Bureau of Statistics
36. POILW$ = Constructed from IFS
37. PRI   = From NBRM
38. PROF   = Annual from Payments Operations Bureau, Ginsburgh interpolation with gross wages
39. PXW   = Constructed from IFS
40. SSB   = Ministry of finance
41. TDTAX = Constructed from Payments Operations Bureau
42. TRB   = From NBRM
43. TWI   = Annual from Bureau of Statistics, Ginsburgh interpolation with gross wages
44. YPOT   = Hodrick-Prescott filter of Y
45. YW   = Constructed at NBRM from IFS