

Model of Moldova 01/1 (outline of model)

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GTZ MACROECONOMIC MODEL OF MOLDOVA (Documentation)

The macroeconomic modeling tools have been implemented in the Ministry of Economy and Reform in order to obtain reliable middle-term financial forecasts, enable policy simulations and contribute to well informed policy making. Accordingly, two macroeconomic models have been developed. A model that is based on quarterly figures and provides prediction in the one-year perspective is complemented by annual model that provides predictions in three-year perspective.

Development of macroeconomic modeling at the Moldovan government have been supported by the technical assistance received from the GTZ. Activities in the working group, workshops and seminars allowed to distribute modeling tools to other agencies: National Bank of Moldova, Ministry of Finance and Center for Strategic Studies and Reforms. This provides framework for consistent financial planning.

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1. Overview: modeling economic relationships

The macroeconomic model represents and forecasts the developments of key economic variables in four broadly defined sectors of the economy¹, that is:

- the real sector (real output, prices and nominal aggregates);
- the external relations (current account, capital account, financing of the external imbalances, external debt);
- the budgetary sector (revenues, expenditures, deficit and its financing, government debt);
- the banking sector (balance sheets of NBM and of the consolidated banking sector).

There are two types of links established between economic variables within the model and both are expressed as a system of equations that constitute the core of the model.

¹ The medium term annual model predicts the developments in all four sectors simultaneously providing full consistency and cross-check of the results (general equilibrium model). As in shorter time perspective, such construction would be too restrictive and data-consuming, quarterly model is a partial equilibrium model (only selected economic variables are forecasted).

Identities, that have to hold true and need not to be verified by estimation procedures, e.g. budget deficit has to be financed, what consequently must lead (when privatization and grants are included in the budget revenues) to either:

- relaxation of monetary policy if deficit is covered by direct credit from central bank;
- external capital inflow if deficit is covered by foreign debt;
- exploitation of domestic savings and less credit available to the economy.

Behavioral relations, i.e. economic links that usually take place and the existence of which is confirmed by statistical evidence, e.g.

- the mentioned monetary expansion leads to higher inflation;
- the mentioned capital inflow leads to appreciation of the currency which in turn increases imports and current account deficit;
- the mentioned lower credit to the economy leads to less investments and consequently less economic growth in the future.

This example shows that in the medium term perspective, economic situation (within the model as in the reality) depends heavily on economic policy of the Moldovan authorities. Thus a short list of key determinants of the projected developments includes:

- structural measures, especially privatization;
- quality of fiscal policy;
- restrictedness of monetary policy;
- international market sentiments towards Moldova (FDIs, IMF programs, portfolio investments, current transfers).

All the above variables are under full or partial control of Moldovan authorities. Additional factors that are beyond this control include first of all:

- situation in Russia (which is essential determinant for Moldovan exports to CIS markets);
- weather condition (which is essential for Moldovan agriculture).

Manual

Production of forecasts and running policy simulations requires

- i) understanding of economic relationships,
- ii) basic knowledge of statistics and econometrics,
- iii) e-views (econometric software) literacy.²

Given these skills an expert should not experience any important difficulties in running the model. Section below provides short guide to the basic procedures necessary to effectively use GTZ macroeconomic models.

Files:

The (annual) modeling package consists of four files:

mold_model.wf1 - e-views working file - the core of the model;

forecast.prn – program file that requests e-views to produce the forecast;

mold_scen.xls - excel workbook that provides formatted tables for presenting results to the public;

mold_prep - excel workbook that allows for imputing new data and checking for its consistency

Workfile *mold_jvi_model.wf1*:

All important objects are easily accessible in the e-views workfile. These objects include:

- all series (variables), that constitute the database of the model
<listed under names specified in the appendix of this document>;
- groups (of variables), that offer easy way of updating the workfile and presenting the results
<listed under names specified in the appendix of this documents>;
- all estimated equations, that represent behavioral relations among variables
<listed under names specified in the appendix of this documents, in general behavioral equation explaining the variable XXX will have a name *eq_XXX*>;
- models – there is a model that explains developments in every year of the forecast
<for example *model_2002* gives all predictions for year 2002>

There are some variables, equations and models in the workfile that are not currently used. They are not deleted, because they either document the previous efforts, offer alternative specifications or may be used in the future. The best way to see which equations are used in the forecasting is to check the specification in the model object.

² E-views offers very good introduction, tutoring and on-line assistance under its help function.

Model objects

A model object for a given year (*model_2002* for year 2002 for example) contains all information about economic developments in given year. These information are grouped in four main sections:

- real economy;
- external relations
- budgetary sector;
- banking.

Within each section following three types of specification can be found:

- values of exogenous variables
(for example line $m2e=(1+g) \cdot m2e(-1)$ means that g% growth in money supply is assumed);
- behavioral equations (for example line `:eq_impne$` implies that the model explains imports of non-energy resources by equation that can be viewed in the workfile by clicking `eq_impne$`);
- identities (for example line exp=expcis$+expnoncis$$ implies that total exports should be calculated as a sum of exports to CIS countries and export to non-CIS countries).

In order to produce forecasts e-views solves simultaneously all equations given in the model. Currently there are more than 200 equations in each model object. Model object for each year differ basically only in the respect to assumptions and in some cases in respect to specifications. For example some variables can be treated as exogenous if external predictions for nearest years are imported to the model and treated as endogenous in later years. Because of these differences it is recommended not to solve every model separately (what leaves possibilities for choosing the wrong forecasting period), but rather use the program procedure described below.

Comments, equations and links in lines that are proceeded by ‘ do not influence the solution of the model (for example line `':eq_gdprAgr` implies that the model ignores the equation `:eq_gdprAgr`). They are not deleted, because they either document the previous efforts, offer alternative specifications or assumptions or may be used in the future.

Program *forecast.prg*

There is an additional file *forecast.prg* that request e-views³ to execute the forecasting procedure with *model_2001* giving predictions for year 2001, *model_2002* giving predictions for year 2002 etc. Program *forecast.prg* may also request e-views to show groups presenting output of the forecast.

Typical procedures:**Data update:**

Data are typed to the excel workbook *mold_prep*, checked for consistency (sub-sums) and copied to the respective group in the e-views workfile (for example *group_govrev* in the case of government revenues).

Re-estimation of equations:

Selected equation is opened from the workfile and reestimated (all model objects will automatically incorporate changes in estimated coefficients)

Changing specification or assumptions (forecast or policy simulation):

Selected model object is opened and assumptions are directly modified or alternative equation is incorporated to the model object.

Running the forecast

Program file *forecast.prg* is opened and executed. Program might be executed only if workfile *mold_model.wf1* is open in the same program window.

Exporting results

Predictions from selected groups are copied from the group in the workfile *mold_model.wf1* and pasted in the respective table in excel workbook *mold_scen.xls*.

Adding one more year of forecast

A global range of the model needs to be extended. A model object for the last year of current forecast (for example *model_2004*) is copied to the new model object and saved under relevant name (*model_2005*). Changes in assumptions (in *model_2005*) are introduced. In the program file *forecast.prg* two lines are added requesting e-views to run forecast for the additional year (2005) using the new model object (*model_2005*).

³ Program *forecast.prg* might be executed only if workfile *mold_model.wf1* is open in the same program window.

Model Specification

This description is based on actual specification of model_2002 from the e-views workfile mold_model.wf1. Explanatory notes are added.

REAL ECONOMY

The first section of the model describes development of the real economy, including real production dynamics, situation in the labour market, price developments and structure of GDP.

GDP by sectors of production, constant 1999 prices, lei million

GDP in constant 1999 prices (a sum of the value added in various sectors and the net indirect taxes)

$$(1) \text{gdpreal} = \text{gdpr_agr} + \text{gdpr_ind} + \text{gdpr_const} + \text{gdpr_trade} + \text{gdpr_trans} + \text{gdpr_fin} + \text{gdpr_res} + \text{gdpr_adm} + \text{gdpr_edu} + \text{gdpr_soc} + \text{gdpr_oth} + \text{gdpr_tax}$$

Developments in agriculture are basically exogenous

$$(2) \text{gdpr_agr} = \text{gdpr_agr}(-1) * (1 + 0.1 * \text{dlog}(\text{invpr} / \text{def_gdp}))$$

The level of value added in industry

$$(3) \text{gdpr_ind} = \text{gdpr_ind}(-1) * (1 + 0.1 * \text{dlog}(\text{inv} / \text{def_gdp})) * (1 + 0.5 * \text{dlog}(\text{gdpr_agr}))$$

Performance of construction sector (a function of the value added in investment)

$$(4) \text{LOG}(\text{GDPR_CONST}) = a_{4,1} + a_{4,2} \text{LOG}(\text{INV} / \text{DEF_GDP})$$

Value added in trade

$$(5) \text{LOG}(\text{GDPR_TRADE}) - \text{GDPR_TRADE_RES} = a_{5,1} + a_{5,2} \text{LOG}(\text{X\$A})$$

Value added in transport (a function of the total volume of external trade)

$$(6) \text{LOG}(\text{GDPR_TRANS}) = a_{6,1} + a_{6,2} \text{LOG}(\text{IMP\$}) + a_{6,3} \text{LOG}(\text{EXP\$})$$

Value added in financial services (a function of the annual real money balances)

$$(7) \text{LOG}(\text{GDPR_FIN}) = 9.518062676 + 1.52564139 * \text{LOG}(\text{M2A} / \text{CPIA})$$

Value added in real estate, research and other business activities (exogenous)

$$(8) \text{gdpr_res} = \text{gdpr_res}(-1)$$

Value added in public administration (a function of the changes in the real value of public consumption)

$$(9) \text{LOG}(\text{GDPR_ADM}) = a_{9,1} + a_{9,2} \text{LOG}(\text{CONSPUB} / \text{DEF_GDP}) + a_{9,3} \text{D98}$$

Value added in education (a function of the government expenditures on the social sector, deflated with wage growth)

$$(10) \text{LOG}(\text{GDPR_EDU}) = a_{10,1} + a_{10,2} \text{LOG}(\text{GOVEXPCURSOC} / \text{WAGE})$$

Value added in social services (a constant)

$$(11) \text{gdpr_soc} = \text{gdpr_soc}(-1) * 1$$

Value added in other activities (a function of the value added in the financial activity)

$$(12) \text{GDPR_OTH} = a_{12,1} + a_{12,2} \text{GDPR_FIN}$$

Net taxes are dependent (a function of the collections of indirect taxes)

$$(13) \text{LOG}(\text{GDPR_TAX})$$

$$= a_{13,1} + a_{13,2} \text{LOG}((\text{GOVREVTVAT} + \text{GOVREVTEXC} + \text{GOVREVTAR}) / \text{DEF_GDP})$$

Labor market

Employment (a function of the real GDP, productivity growth (exogenous))

$$(14) \text{emp} = \text{emp}(-1) * (1 + (\text{gdpreal} / \text{gdpreal}(-1) - 1) / 2)$$

Wages (a function of productivity dynamics)

$$(15) \text{LOG}(\text{WAGE}) = a_{15,1} + a_{15,2} \text{LOG}(\text{GDP} / \text{EMP}) + a_{15,3} \text{LOG}(\text{GDP}(-1) / \text{EMP}(-1))$$

Price developments

CPI developments (a function of the average money growth and exchange rate movements)

$$(16) \text{LOG}(\text{CPIA}) = a_{16,1} + a_{16,2} \text{LOG}(\text{XSA}) + a_{16,3} \text{LOG}(\text{M2A})$$

Similarly GDP deflator is explained by (average) money growth and exchange rate movements. Estimated weights are however different.

$$(17) \text{LOG}(\text{DEF_GDP}) = a_{17,1} + a_{17,2} \text{LOG}(\text{M2A}) + a_{17,3} \text{LOG}(\text{XSA})$$

Exchange rate is exogenous, but selected in order to ensure the short-term sustainability of balance of payment.

$$(18) \text{xSe} = 18$$

Money growth (exogenous)

$$(19) \text{m2e} = 1.2 * \text{m2e}(-1)$$

Interest rate is calculated as the sum of inflation and real interest rate

$$(20) \text{int} = \text{cpia} / \text{cpia}(-1) * (100 + \text{intreal}) - 100$$

Real interest rate (exogenous)

$$(21) \text{intreal} = 10$$

Money velocity and monetization

$$(22) \text{velm2a} = \text{gdp} / \text{m2a}$$

$$(23) \text{mongdp} = 1 / \text{velm2a}$$

Real exchange rate against western trade partners

$$(24) \text{xSa_rnoncis} = \text{xSa} * \text{cpi_west} / \text{cpia}$$

GDP by expenditures, current prices, lei million

GDP in current prices

$$(25) \text{ gdp} = \text{gdpreal} * \text{def_GDP} / 100$$

Net exports are calculated as a sum of trade and service balance expressed in lei

$$(26) \text{ netexp} = \text{exph} - \text{imph} + \text{servbalh}$$

Value of exports, imports and services in lei

$$(27) \text{ exph} = \text{exp\$} * \text{x\$a}$$

$$(28) \text{ mph} = \text{imp\$} * \text{x\$a}$$

$$(29) \text{ servbalh} = \text{servbal\$} * \text{x\$a}$$

Investments (sum of private and public investments)

$$(30) \text{ inv} = \text{invpub} + \text{invpr}$$

Private investments (in real terms, a function of real economic growth and credit to the economy extended by banking system during the given year, in real terms)

$$(31) \text{ LOG}(\text{INVPR} / \text{DEF_GDP}) = a_{31,1} + a_{31,2} \text{ LOG}(\text{GDPREAL}) + a_{31,3} \text{ LOG}((\text{MSNDCNGOV} - \text{MSNDCNGOV}(-1)) / \text{DEF_GDP})$$

Public investments (approximation by the government capital expenditures)

$$(32) \text{ invpub} = \text{govexpcap}$$

Consumption

$$(33) \text{ cons} = \text{gdp} - \text{inv} - \text{netexp}$$

Public consumption

(a function of the current government expenditures excluding interest payments)

$$(34) \text{ CONSPUB} = a_{34,1} + a_{34,2} (\text{GOVEXPCUR} - \text{GOVEXPCURINT})$$

Gross national disposable income

$$(35) \text{ gndi} = \text{gdp} + \text{nfi} + \text{transfh}$$

Lei values of current transfers and net factor income from abroad

$$(36) \text{ nfi} = \text{nfi\$} * \text{x\$a}$$

$$(37) \text{ transfh} = \text{transf\$} * \text{x\$a}$$

Total savings

$$(38) \text{ sav} = \text{gndi} - \text{cons}$$

Public savings

$$(39) \text{ savpub} = \text{govrev} - \text{govrevntpri} - \text{conspub}$$

Private savings

$$(40) \text{ savpri} = \text{gndi} - \text{cons} - \text{savpub}$$

EXTERNAL RELATIONS (usd millions)

The section covers external relations of Moldova, including current account, capital account, financing of the BOP gap and developments of external debt.

Current account

$$(41) \text{ curac} = \text{trbal\$} + \text{servbal\$} + \text{nfi\$} + \text{transf\$}$$

Current account balance is the sum of trade balance, balance of services, net factor income and (net) current transfers

Trade balance (of goods)

$$(42) \text{ trbal\$} = \text{exp\$} - \text{imp\$}$$

Exports (a sum of exports to CIS and non-CIS countries)

$$(43) \text{ exp\$} = \text{expcis\$} + \text{expnoncis\$}$$

Exports to CIS countries (a function of Russian GDP expressed in US\$)

$$(44) \text{ LOG(EXPCISS)} - \text{EXPCISS_RES} = a_{44,1} + a_{44,2} \text{ LOG(GDP_RUSS)}$$

Exports to non-CIS countries (a function of the real output in industry)

$$(45) \text{ LOG(EXPNONCISS)} - \text{EXPNONCISS_RES} = a_{45,1} + a_{45,2} \text{ LOG(GDPR_IND)} + a_{45,2} D97$$

Imports (a sum of imports of energy and non-energy resources)

$$(46) \text{ imp\$} = \text{impe\$} + \text{impne\$}$$

Imports of energy resources (a function of domestic real activity (needs) and exports to CIS countries (capabilities to finance imports))

$$(47) \text{ LOG(IMPE\$)} = a_{47,1} + a_{47,2} \text{ LOG(EXPCISS)} + a_{47,3} \text{ LOG(GDPREAL)}$$

Imports of non-energy resources (a function of disposable income (GDP, net factor income and transfers) expressed in dollars)

$$(48) \text{ LOG(IMPNE\$)} - \text{IMPNE\$_RES} = a_{48,1} + a_{48,2} \text{ LOG(GDP/X\$A)} + a_{48,2} \text{ LOG(NFIS+TRANSF\$)}$$

Balance of services (exports minus imports of services)

$$(49) \text{ servbal\$} = \text{servexp\$} - \text{servimp\$}$$

Exports of services are linked to exports in goods

$$(50) \text{ servexp\$} = \text{servexp\$}(-1) * \text{exp\$} / \text{exp\$}(-1)$$

Import of services (a sum of those incurred in transports, tourism and other services)

$$(51) \text{ servimp\$} = \text{servimptr\$} + \text{servimptu\$} + \text{servimpoth\$}$$

Imports of services in transport (a function of changes in imports)

$$(52) \text{ servimptr\$} = \text{servimptr\$}(-1) * \text{imp\$} / \text{imp\$}(-1)$$

Imports of services in tourism (a function of the dollar value of consumption)

$$(53) \text{servimptu\$} = \text{servimptu\$}(-1) * (\text{conspr} / \text{x\$a}) / (\text{conspr}(-1) / \text{x\$a}(-1))$$

Imports of other services (exogenous)

$$(54) \text{servimpoth\$} = \text{servimpoth\$}(-1)$$

Net factor income (the sum of workers' remittances, interest payment and others)

$$(55) \text{nfi\$} = \text{nfilab\$} + \text{nfidebt\$} + \text{nfiother\$}$$

Workers remittances (exogenous)

$$(56) \text{nfilab\$} = \text{nfilab\$}(-1)$$

Interest payments

$$(57) \text{nfidebt\$} = -0.036 * \text{debttextnen}(-1)$$

Other incomes (exogenous)

$$(58) \text{nfiother\$} = -2$$

Current transfers (exogenous)

$$(59) \text{transf\$} = 145$$

Capital account

Capital account balance is the sum of (net) capital transfers, (net) foreign direct investments, long-term and short term net capital inflows.

$$(60) \text{capac} = \text{captrans} + \text{fdi} + \text{lloanbal} + \text{sloanbal}$$

Capital transfers (exogenous)

$$(61) \text{captrans} = 0$$

Foreign direct investments (exogenous)

$$(62) \text{fdi} = 120$$

Net long-term capital inflow (exogenous): difference of exogenous disbursements and

$$(63) \text{amortizationslloanbal} = \text{lloanin} - \text{lloanout}$$

$$(64) \text{lloanin} = 31$$

$$(65) \text{lloanout} = 130$$

Net short term capital inflow (including error in conditions; exogenous)

$$(66) \text{sloanbal} = 0$$

Financing of balance of payment deficit

Overall balance of payment (a sum of capital and current account)

$$(67) \text{overbal} = \text{curac} + \text{capac}$$

Change in gross external reserves (exogenous)

$$(68) \text{dgres} = 0$$

(Net) financing from IMF (exogenous)

(69) $imf=0$

Exceptional financing (arrears, debt restructuring and relief)

(70) $excefin=-overbal-imf+dgres$

Reserves and external debt

Reserves are calculated as a sum of end of last year level and change in the current year

(71) $gres=gres(-1)+dgres$

Gross reserves in months of imports

(72) $gresimpm=gres/imp\$*12$

External debt

(73) $debttext=debttext(-1)+lloanbal+sloanbal+imf+excefin$

External debt in months of exports

(74) $debttextexpm=debttext/exp\$*12$

Energy debt i

(75) $debttexten=debttexten(-1)+excefin$

Non-energy external debt

(76) $debttextnen=debttext-debttexten$

BUDGETARY SECTOR, lei millions

Revenues

General government revenues (a sum of tax revenues, non-tax revenues and grants)

(77) $govrev=govrevt+govrevnt+govrevgrant$

Government revenues exclusive of contribution revenues of social fund

(78) $govrevmin=govrev-govrevtpen$

Tax revenues (enterprise and personal income tax, value added and excise tax, tariffs and others...)

(79) $govrevt=govrevtvat+govrevtexc+govrevtcit+govrevtpit+govrevtpen$
 $+govrevttar+govrevtoth$

Personal income (a function of employment and wages)

(80) $LOG(GOVREVTPIT) = a_{80,1} + a_{80,2}LOG(WAGE) + a_{80,3}LOG(EMP) + 0.24011197*D97$

Enterprise income tax (a function of the level of economic activity, especially in industry)

(81) $LOG(GOVREVTCIT) = a_{81,1} + a_{81,2}LOG(GDPR_IND) + a_{81,3}LOG(GDP)>$

VAT (a function of consumption)

$$(82) \text{ govrevtvat} = 1.0 * \text{govrevtvat}(-1) * (\text{cons}) / (\text{cons}(-1))$$

Excise tax (a function of consumption)

$$(83) \text{ govrevtexc} = 1.0 * \text{govrevtexc}(-1) * \text{cons} / \text{cons}(-1)$$

Revenues from tariffs (a function of lei value of imports)

$$(84) \text{ GOVREVTAR} = a_{84,1} + a_{84,2} \text{IMPH LOG}(\text{GOVREVTPEN}) \\ = a_{84,3} + a_{84,4} \text{LOG}(\text{WAGE}) + a_{84,5} \text{LOG}(\text{EMP})$$

Other tax revenues (a function of GDP)

$$(85) \text{ govrevtoth} = 1. * \text{govrevtoth}(-1) * \text{gdp} / \text{gdp}(-1)$$

Personal income tax (a function of employment and wages)

$$(86) \text{ LOG}(\text{GOVREVTPEN}) = a_{86,1} + a_{86,2} \text{LOG}(\text{WAGE}) + a_{86,3} \text{LOG}(\text{EMP}) >$$

Non-tax revenues (a sum of revenues from privatization (until end of 1999), profits from the central bank and other)

$$(87) \text{ govrevnt} = \text{govrevntpri} + \text{govrevntbc} + \text{govrevntoth}$$

Other non-tax revenues (a function of GDP)

$$(88) \text{ govrevntoth} = \text{govrevntoth}(-1) * 1.1 * \text{gdp} / \text{gdp}(-1)$$

Revenues from privatization (exogenous)

$$(89) \text{ govrevntpri} = 0$$

Central bank profit (a function of the size of the net domestic credit)

$$(90) \text{ GOVREVNTBC} = a_{90,1} \text{BNDC} + a_{90,2} \text{D99} + a_{90,3} \text{D00}$$

Grants (exogenous)

$$(91) \text{ govrevgrant} = 0$$

Expenditures

General government expenditures (current and capital expenditures and net lending)

$$(92) \text{ govexp} = \text{govexpcur} + \text{govexpcap} + \text{govexpdircre}$$

Government expenditures exclusive of social fund spendings)

$$(93) \text{ govexpmin} = \text{govexp} - \text{govrevtpen}$$

Current expenditures (national economy, social sphere, interest payments, social fund spendings and other expenditures...)

$$(94) \text{ govexpcur} = \text{govexpcursub} + \text{govexpcursoc} + \text{govexpcurint} + \\ \text{govexpcurpen} + \text{govexpcuroth}$$

Expenditures on national economy (a function of GDP)

$$(95) \text{ govexpcursub} = 1 * \text{govexpcursub}(-1) * \text{gdp} / \text{gdp}(-1)$$

Constant real value of social spendings is expected
 (96) $\text{govexpcur}_{\text{soc}} = 1 * \text{govexpcur}_{\text{soc}}(-1) * \text{cpia} / \text{cpia}(-1)$

Interest payments include domestic and foreign debt service
 (97) $\text{govexpcur}_{\text{int}} = \text{govexpcur}_{\text{intex}} + \text{govexpcur}_{\text{intdm}}$

Foreign debt service (exogenous)
 (98) $\text{govexpcur}_{\text{intex}} = 44.2 * x\a

Domestic debt service (a function of average stock internal domestic debt and nominal interest rate)
 (99) $\text{govexpcur}_{\text{intdm}} = \text{int} / 100 * (\text{govdebt}_{\text{dom}} + \text{govdebt}_{\text{dom}}(-1)) / 2$

Other current expenditures (a function of GDP)
 (100) $\text{govexpcur}_{\text{roth}} = 1 * \text{govexpcur}_{\text{roth}}(-1) * \text{gdp} / \text{gdp}(-1)$

Constant real value of Social Fund expenditure
 (101) $\text{govexpcur}_{\text{pen}} = 1 * \text{govexpcur}_{\text{pen}}(-1) * \text{cpia} / \text{cpia}(-1)$

Share of capital expenditures in total government revenues (exogenous)
 (102) $\text{govexp}_{\text{cap}} = \text{govexp}_{\text{cap}}(-1) * \text{govrev} / \text{govrev}(-1)$

Net lending (exogenous)
 (103) $\text{govexp}_{\text{dircre}} = \text{govexp}_{\text{dircre}}(-1) / 1.5$

Government balance

(General) government cash balance is the difference between general government revenues and taxes
 (104) $\text{govbal}_{\text{cash}} = \text{govrev} - \text{govexp}$

Calculation of primary government cash balance excludes interest rate payments
 (105) $\text{govbal}_{\text{prim}} = \text{govbal}_{\text{cash}} + \text{govexp}_{\text{curint}}$

(General) government accrual balance is cash balance adjusted for change in arrears
 (106) $\text{govbal}_{\text{acrua}} = \text{govbal}_{\text{cash}} - \text{govar}_{\text{rearch}}$

Calculation of primary government accrual balance excludes interest rate payments
 (107) $\text{govbal}_{\text{prima}} = \text{govbal}_{\text{acrua}} + \text{govexp}_{\text{curint}}$

Change in arrears (exogenous)
 (108) $\text{govar}_{\text{rearch}} = 0$

Deficit financing

Financing (negative of government cash balance)

$$(109) \text{ govfin} = -\text{govbalcash}$$

Financing from privatization (exogenous)

$$(110) \text{ govfinpriv} = 21.6 * x\$a + 120$$

External financing (debt disbursements, amortization and restructuring)

$$(111) \text{ govfinext} = \text{govfinextin} - \text{govfinextout} + \text{govfinextres}$$

$$(112) \text{ govfinextin} = 30 * x\$a$$

$$(113) \text{ govfinextout} = 131.3 * x\$a$$

$$(114) \text{ govfinextres} = 50 * x\$a$$

Domestic debt financing

$$(115) \text{ govfindom} = \text{govfin} - \text{govfinpriv} - \text{govfinext}$$

Non-bank domestic financing (a function of GDP)

$$(116) \text{ govfindomnbank} = \text{govfindomnbank}(-1) * \text{gdp} / \text{gdp}(-1)$$

Domestic bank financing

$$(117) \text{ govfindombank} = \text{govfindom} - \text{govfindomnbank}$$

Financing from commercial banks is predicted to grow in line with net domestic credit extended by commercial banks

$$(118) \text{ govfindombcom} = 1 * \text{govfindombcom}(-1) * (\text{msndc} - \text{bndc}) / (\text{msndc}(-1) - \text{bndc}(-1))$$

Financing from the central bank

$$(119) \text{ govfindombcen} = \text{govfindombank} - \text{govfindombcom}$$

Government debt

Total government debt (a sum of domestic and foreign debt, expressed in lei)

$$(120) \text{ govdebt} = \text{govdebttext} * x\$e + \text{govdebt} \text{ dom}$$

External debt

$$(121) \text{ govdebttext} = \text{govdebttext}(-1) + \text{govfinext} / x\$a$$

Domestic debt

$$(122) \text{ govdebt} \text{ dom} = \text{govdebt} \text{ dom}(-1) + \text{govfindom}$$

Domestic debt excluding credit from national bank

$$(123) \text{ govdebt} \text{ dom} \text{ nbc} = \text{govdebt} \text{ dom} - \text{bndc} \text{ gov}$$

Interest payment (total foreign and domestic) as percentage of government revenues

$$(124) \text{ govexp} \text{ cirev} = \text{govexp} \text{ curint} / \text{govrev} * 100$$

$$(125) \text{ govexp} \text{ cierev} = \text{govexp} \text{ curintex} / \text{govrev} * 100$$

$$(126) \text{ govexp} \text{ curidrev} = \text{govexp} \text{ curintdm} / \text{govrev} * 100$$

External interest payments as percentage of exports

$$(127) \text{ govexp} \text{ cieexp} = \text{govexp} \text{ curintex} / x\$a / (\text{exp}\$ + \text{servexp}\$) * 100$$

BANKING SECTOR

Money multiplier (exogenous)

$$(128) \text{ mm} = 1.01 * \text{mm}(-1)$$

Accounts of National Bank, lei millions

Total assets are equal to reserve money (total liabilities)

$$(129) \text{ ba} = \text{brme}$$

Net foreign assets in lei

$$(130) \text{ bnfa} = (\text{bnfa}(-1) / \text{x}\$e(-1) + \text{dgres-imf}) * \text{x}\$e$$

Net domestic assets (total assets - net foreign assets)

$$(131) \text{ bnda} = \text{ba} - \text{bnfa}$$

Other items

$$(132) \text{ bndoi} = \text{bndoi}(-1) - \text{bnfa}(-1) * (\text{x}\$e - \text{x}\$e(-1)) / \text{x}\$e(-1)$$

Net domestic credit (net domestic assets - other items)

$$(133) \text{ bndc} = \text{bnda} - \text{bndoi}$$

Net credit to the government

$$(134) \text{ bndcgov} = \text{bndcgov}(-1) + \text{govfindombcen}$$

Other domestic credit (exogenous)

$$(135) \text{ bndcoth} = 0$$

Net credit to commercial banks

$$(136) \text{ bndcbank} = \text{bndc} - \text{bndcgov} - \text{bndcoth}$$

Base money (a ratio of the broad money aggregate and money multiplier)

$$(137) \text{ brme} = \text{m2e} / \text{mm}$$

Reserves of commercial banks at National Bank of Moldova (a function of the level of deposits)

$$(138) \text{ BCBRES} = a_{86,1} + a_{86,2}(\text{MSDEP\$} + \text{MSDEPH})$$

Cash in circulation

$$(139) \text{ bcash} = \text{brme} - \text{bcbres}$$

Deposits at National Bank are assumed zero (exogenous)

$$(140) \text{ bdepe} = 0$$

Consolidated banking system

Total asset (total liabilities)

$$(141) \text{ msa} = \text{m2e}$$

Net foreign assets in lei

$$(142) \text{msnfa} = (\text{msnfa}(-1) / x\$e(-1) + \text{dgres-imf}) * x\$e$$

Net domestic assets (total assets - net foreign assets)

$$(143) \text{msnda} = \text{msa} - \text{msnfa}$$

Other items

$$(144) \text{msndoi} = \text{msndoi}(-1) - \text{msnfa}(-1) * (x\$e - x\$e(-1)) / x\$e(-1)$$

Net domestic credit (net domestic assets - other items)

$$(145) \text{msndc} = \text{msnda} - \text{msndoi}$$

Net credit to the government (a sum of end of the previous year level and domestic bank financing to the government in the current year)

$$(146) \text{msndcgov} = \text{govfindombank} + \text{msndcgov}(-1)$$

Net domestic credit to the economy

$$(147) \text{msndcngov} = \text{msndc} - \text{msndcgov}$$

Broad money excluding foreign currency deposits (a constant share of broad money)

$$(148) \text{m2he} = \text{m2he}(-1) * \text{m2e} / \text{m2e}(-1)$$

Lei deposits (broad money excluding foreign currency deposits - cash in the circulation)

$$(149) \text{msdeph} = \text{m2he} - \text{mscash}$$

Share of time deposits in lei deposits

$$(150) \text{msdepht} = \text{msdepht}(-1) * \text{msdeph} / \text{msdeph}(-1) * 1.05$$

Demand deposits

$$(151) \text{msdephd} = \text{msdeph} - \text{msdepht}$$

Dollar deposits (broad money - broad money excluding foreign currency deposits)

$$(152) \text{msdep\$} = \text{m2e} - \text{m2he}$$

Share of net credit to the government of the central bank and of consolidated banking system in the reserve money and broad money, respectively

$$(153) \text{msndcgovm2e} = \text{msndcgov} / \text{m2e} * 100$$

$$(154) \text{bndcgovrme} = \text{bndcgov} / \text{brme} * 100$$

ADDITIONAL INDICATORS

Percentages of GDP (Shares in GDP (%)):

$$(155) \quad \text{cons}gdp \quad = \text{cons} / gdp * 100$$

$$(156) \quad \text{cons}prgdp \quad = (\text{conspr}) / gdp * 100$$

$$(157) \quad \text{cons}pubgdp \quad = (\text{cons}pub) / gdp * 100$$

$$(158) \quad \text{inv}gdp \quad = \text{inv} / gdp * 100$$

$$(159) \quad \text{inv}pubgdp \quad = (\text{inv}pub) / gdp * 100$$

$$(160) \quad \text{inv}prgdp \quad = (\text{inv}pr) / gdp * 100$$

(161)	netexpgdp	=netexp/gdp*100
(162)	expgdp	=exph/gdp*100
(163)	impgdp	=imph/gdp*100
(164)	servbgdp	=servbalh/gdp*100
(165)	savgndi	=(gndi-cons)/gndi*100
(166)	savgdp	=(gndi-cons)/gdp*100
(167)	savpubgdp	=(savpub)/gdp*100
(168)	savprigdp	=(savpri)/gdp*100
(169)	gndigdp	=gndi/gdp*100
(170)	bsigdp	=savgdp-invdp
(171)	bsipubgdp	=savpubgdp-invpubgdp
(172)	bsiprigdp	=bsigdp-bsipubgdp
(173)	curacgdp	=curac*x\$a/gdp*100

GOVERNMENT REVENUES (% of GDP)

(174)	govrevmgdp	=govrevmin/gdp*100
(175)	govrevgdp	=govrev/gdp*100
(176)	govrevtgdp	=govrevt/gdp*100
(177)	govrevtvagdp	=govrevtvat/gdp*100
(178)	govrevtexgdp	=govrevtexc/gdp*100
(179)	govrevtcigdp	=govrevtcit/gdp*100
(180)	govrevtpigdp	=govrevtpit/gdp*100
(181)	govrevtpegdp	=govrevtpen/gdp*100
(182)	govrevttagdp	=govrevttar/gdp*100
(183)	govrevtotgdp	=govrevtoth/gdp*100
(184)	govrevntgdp	=govrevnt/gdp*100
(185)	govrevntbcgdp	=govrevntbc/gdp*100
(186)	govrevntprigdp	=govrevntpri/gdp*100
(187)	govrevntothgdp	=govrevntoth/gdp*100
(188)	govrevgrgdp	=govrevgrant/gdp*100

GOVERNMENT EXPENDITURES (% of GDP)

(189)	govexpmgdp	=govexpmin/gdp*100
(190)	govexpgdp	=govexp/gdp*100
(191)	govexpcurgdp	=govexpcur/gdp*100
(192)	govexpcsugdp	=govexpcursub/gdp*100
(193)	govexpcsogdp	=govexpcursoc/gdp*100
(194)	govexpcigdp	=govexpcurint/gdp*100
(195)	govexpciegdp	=govexpcurintex/gdp*100
(196)	govexpcidgdp	=govexpcurintdm/gdp*100
(197)	govexpcogdp	=govexpcuroth/gdp*100
(198)	govexpcpgdp	=govexpcurpen/gdp*100
(199)	govexpcapgdp	=govexpcap/gdp*100
(200)	govexpdirgdp	=govexpdircre/gdp*100

GOVERNMENT BALANCE (% of GDP)

(201)	govbalmingdp	=govbalmin/gdp*100
(202)	govbalmcashgdp	=govbalmcash/gdp*100

(203)	govbalprimgdp	=govbalprim/gdp*100
(204)	govbalprimagdp	=govbalprima/gdp*100
(205)	govbalacgdp	=govbalacrua/gdp*100
(206)	govarrearchgdp	=govarrearch/gdp*100
(207)	govrevntprigdp	=govrevntpri/gdp*100

GOVERNMENT FINANCING (% of GDP)

(208)	govfingdp	=govfin/gdp*100
(209)	govfinprivgdp	=govfinpriv/gdp*100
(210)	govfinextgdp	=govfinext/gdp*100
(211)	govfinexigdp	=govfinextin/gdp*100
(212)	govfinexogdp	=govfinextout/gdp*100
(213)	govfinexresgdp	=govfinextres/gdp*100
(214)	govfindomgdp	=govfindom/gdp*100
(215)	govfindnbgdp	=govfindomnbank/gdp*100
(216)	govfindbgdp	=govfindombank/gdp*100
(217)	govfindbcengdp	=govfindombcen/gdp*100
(218)	govfindbcomgdp	=govfindombcom/gdp*100
(219)	govdebtgdp	=govdebt/gdp*100
(220)	govdebtomgdp	=govdebtom/gdp*100
(221)	govdebttextgdp	=govdebttext*x\$/gdp*100

Appendix 1. Annual Model: List of groups and variables

group_gdpr - GDP (in constant 1999 prices)

Name*	Type**	Variable	Unit of measurement
GDPR_AGR	exo/end	value added: agriculture	millions of 1999 lei
GDPR_IND	end	value added: industry	millions of 1999 lei
GDPR_CONST	end	value added: construction	millions of 1999 lei
GDPR_TRADE	end	value added: trade	millions of 1999 lei
GDPR_TRANS	end	value added: transport, storage, communication	millions of 1999 lei
GDPR_FIN	end	value added: financial intermediation	millions of 1999 lei
GDPR_RES	end	value added: real estate	millions of 1999 lei
GDPR_ADM	end	value added: public administration	millions of 1999 lei
GDPR_EDU	end	value added: education	millions of 1999 lei
GDPR_SOC	end	value added: health and social work	millions of 1999 lei
GDPR_OTH	end	value added: other activities	millions of 1999 lei
GDPR_TAX	end	net taxes on products	millions of 1999 lei
GDPREAL	def	Gross Domestic Product (GDP)	millions of 1999 lei

group_prices - prices, monetary aggregates and exchange rate

Name*	Type**	Variable	Unit of measurement
CPIE	end	consumer price index, end of period	index
CPIA	end	consumer price index, average	index
DEF_GDP	end	deflator PIB	index
GDPREAL		GDP in prices 1999	14270
VELM2A	end/def	velocity of M3, average	number
M2A	end	M3, average	millions of lei
M2E	exo/def	M3, end of period	millions of lei
BRMA	def	reserve money, average	millions of lei
BRME	exo/def	reserve money, end of the year	millions of lei
XSA	end	exchange rate lei/usd, annual average	lei per USD
XSE	exo	exchange rate lei/usd, end of period	lei per USD
XSA_RNONCIS	def	real exchange rate against non-CIS countries	index

group_gdp - GDP by expenditure, current prices, lei mln.

Name*	Type**	Variable	Unit of measurement
CONS	def	final consumption	millions of lei
CONSPR	def	households	millions of lei
CONSPUB	end	government and non-profit institutions	millions of lei
INV	def	gross capital formation	millions of lei
INVPR	end	private	millions of lei
INVPUB	def	public	millions of lei
NETEXP	def	net export	millions of lei
EXPH	def	export in lei	millions of lei
IMPH	def	import in lei	millions of lei
SERVBALH	def	balance of services in lei	millions of lei
GDP	def	GDP	millions of lei
GNDI	def	gross national disposable income	millions of lei
TRANSFH	def	current transfers in lei	millions of lei
NFIH		net factor income in lei	millions of lei

group_bop - balance of payments, usd mln

Name*	Type**	Variable	Unit of measurement
CURAC	def	current account	millions of usd
TRBAL\$	def	trade balance	millions of usd
EXP\$	def	exports	millions of usd
EXPCIS\$	end	exports to CIS countries	millions of usd
EXPNONCIS\$	end	exports to non-CIS countries	millions of usd
IMPS	def	imports	millions of usd
IMPE\$	end	imports of energy resources	millions of usd
IMPNE\$	end	imports of non energy resources	millions of usd
SERVBAL\$	def	balance of services	millions of usd
SERVEXP\$	end	exports of services	millions of usd
SERVIMPS\$	end	imports of services	millions of usd
NFIIS	end	net factor income	millions of usd
TRANSF\$	exo/end	current transfers	millions of usd
CAPAC	def	capital account	millions of usd
CAPTRANS\$	exo	capital transfers	millions of usd
FDI	exo/end	direct investments	millions of usd
LLOANBAL	def	medium- and long-term loans	millions of usd
LLOANIN	exo	inflows	millions of usd
LLOANOUT	exo	outflows	millions of usd
SLOANBAL	exo	short term loans	millions of usd
OVERBAL	def	overall balance	millions of usd
DGRES	exo/end	reserves adjustments	millions of usd
IMF	exo	IMF credit	millions of usd
EXCEFIN	exo/end	exceptional financing	millions of usd
GRES	def	gross official reserves	millions of usd
GRESIMPM	def	gross official reserves in months of imports	number
DEBTEXT	def	external debt	millions of usd
DEBTEXTPM	def	external debt in months of exports	number

group_govrev - government revenues, current prices

Name*	Type**	Variable	Unit of measurement
GOVREVMIN	def	revenues, excluding social fund	millions of lei
GOVREV	def	revenues	millions of lei
GOVREVT	def	tax revenues	millions of lei
GOVREVTPIT	end	income tax from individuals	millions of lei
GOVREVTCIT	end	profit tax	millions of lei
GOVREVTVAT	end	VAT	millions of lei
GOVREVTEXC	end	excise taxes	millions of lei
GOVREVTTAR	end	taxes on international trade	millions of lei
GOVREVTOTH	end	other taxes	millions of lei
GOVREVTPEN	end	social fund contributions	millions of lei
GOVREVNT	def	non-tax revenues	millions of lei
GOVREVNTPRI	exo	privatization revenues	millions of lei
GOVREVNTBC	end	Central Bank profits	millions of lei
GOVREVNTOTH	end	other	millions of lei
GOVREVGRANT	exo	grants	millions of lei

group_govexp - government expenditures, current prices

Name*	Type**	Variable	Unit of measurement
GOVEXPMIN	def	expenditures, excluding social fund	millions of lei
GOVEXP	def	expenditures	millions of lei
GOVEXPCUR	def	current expenditures	millions of lei
GOVEXPCURSUB	exo/end	national economy	millions of lei
GOVEXPCURSOC	exo/end	social sphere	millions of lei
GOVEXPCURINT	def	debt service	millions of lei
GOVEXPCURINTEX	end	internal debt	millions of lei
GOVEXPCURINTDM	end	external debt	millions of lei
GOVEXPCUROTH	end	other	millions of lei
GOVEXPCURPEN	end	pensions	millions of lei
GOVEXPCAP	exo/end	capital expenditure	millions of lei
GOVEXPDICRE	exo/end	net lending	millions of lei

group_govdef - government balance, current prices

Name*	Type**	Variable	Unit of measurement
GOVBALMIN	def	balance as in the budget bill	millions of lei
GOVBALCASH	def	cash balance	millions of lei
GOVBALACRUAL	def	accrual balance	millions of lei
GOVARREARCH	exo/end	change in arrears	millions of lei
GOVBALPRIM	def	cash balance excluding debt service (primary cash balance)	millions of lei
GOVBALPRIMA	def	accrual balance excluding debt service (primary accrual balance)	millions of lei

group_govfin - government deficit financing, current prices

Name*	Type**	Variable	Unit of measurement
GOVFIN	def	financing	millions of lei
GOVFINPRI	exo	privatization	millions of lei
GOVFINEXT	def	net foreign	millions of lei
GOVFINEXTIN	exo	drawings	millions of lei
GOVFINEXTOUT	exo	amortization	millions of lei
GOVFINEXTRES	exo	debt rescheduling	millions of lei
GOVFINDOM	def	net domestic	millions of lei
GOVFINDOMBANK	def	net banks	millions of lei
GOVFINDOMBCEN	def	net Central Bank	millions of lei
GOVFINDOMBCOM	end	commercial banks securities	millions of lei
GOVFINDOMNBANK	end	net non-bank	millions of lei

group_govdebt - government debt

Name*	Type**	Variable	Unit of measurement
GOVDEBT	def	government debt	millions of lei
GOVDEBTEXT	def	external government debt	millions of dollars
GOVDEBTDOM	def	domestic government debt	millions of lei
GOVDEBTDOMNBC	def	to NBM	millions of lei
BNDCGOV	def	other	millions of lei
GOVEXPCIREV	def	debt service as % of government revenues	percentage
GOVEXPCIEREV	def	external debt service as % of government revenues	percentage
GOVEXPCIEEXP	def	external debt service as % of exports	percentage
GOVEXPCURIDREV	def	domestic debt service as % of government revenues	percentage

group_bank - accounts of National Bank of Moldova, current prices

Name*	Type**	Variable	Unit of measurement
BA	def	total assets	millions of lei
BNFA	end	net foreign assets	millions of lei
BNDA	def	net domestic assets	millions of lei
BNDC	def	net domestic credit	millions of lei
BNDCGOV	def	net domestic credit to government	millions of lei
BNDCBANK	def	net domestic credit to commercial banks	millions of lei
BNDCOTH	exo	net other credit	millions of lei
BNDOI	end	other items	millions of lei
BRME	exo/def	reserve money	millions of lei
BCASH	end/def	currency in circulation	millions of lei
BCBRES	end/def	commercial bank reserves in National Banks	millions of lei
BNDCGOVRME	def	CB credits to government, as % of reserves	percentage

group_ms - monetary survey, current prices

Name*	Type**	Variable	Unit of measurement
MSA	def	total assets	millions of lei
MSNFA	end	net foreign assets	millions of lei
MSNBNFA	def	net foreign assets of Banks system	millions of lei
MSNDA	def	net domestic assets	millions of lei
MSNDC	def	net domestic credit	millions of lei
MSNDCGOV	def	net domestic credit to government	millions of lei
MSNDCNGOV	def	net domestic credit to economy	millions of lei
MSNDOI	end	other items	millions of lei
M2E	exo/def	broad money (M3)	millions of lei
M2HE	end	broad money excluding foreign currency deposits (M3)	millions of lei
MSCASH	def	currency in circulation	millions of lei
MSDEPH	def	deposits in lei	millions of lei
MSDEPHT	def/end	time deposits in lei	millions of lei
MSDEPHD	def/end	current deposits in lei	millions of lei
MSDEP\$	def	foreign currency deposits	millions of lei
MSNDCGOVM2E	def	domestic credit to government as % of M3	percentage
MM	exo/end	money multiplier	percentage

* Variable names:

XXX – variable or group

XXXGDP – expressed as percentage of GDP

** Variable types:

exo - exogenous (assumption or policy variable)

def – defined by identity

end – modelled by the behavioral equation

Some variables might change the type under alternative specifications. For example exo/end indicates that the value of the variable may be either assumed or obtained without fundamental changes to the model.