RE-ESTIMATION OF THE MACRO-ECONOMETRIC MODEL OF THE ALBANIAN ECONOMY (MEAM)

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C O N T E N T

ABSTRACT

The MEAM macromodel has been mainly used to analyze various risk scenarios in the Albanian economy, as well as to generate projections about important macroeconomic indicators like inflation, GDP components, labor market, etc. The current MEAM estimation is based on vintage quarterly data during the 1996-2006 period. Because many of the important indicators have been revised in recent years, this article intends to investigate whether such revisions and the extension of the estimated period with post-global crisis data observations have affected the stability of the model. The preliminary results suggest on the need to re-estimate the parameters of the model and opens the discussions about possible changes in certain transmission channels, as in the case of foreign prices or reconsidering the assumptions on the competitiveness channel in external trade equations.

I. INTRODUCTION

The MEAM model represents the macroeconomic process of monetary policy transmission observed in Albania and also describes the functional relationships in the economy. Since 2006, when MEAM was built, the model has been used to generate projections for the main macroeconomic indicators: inflation, gross domestic product and aggregate demand components; labor market etc. Additionally, the model is designed to produce various simulations or risk scenarios in support of the decision-making process at the Bank of Albania.

In line with the general research work, the macroeconomic modeling of an economy represents a continuous process which is further expanded, enriched and improved. The availability of new statistics, revision of existing data and the presence of structural breaks which alter economic relationships require the re-estimation of the model. The original model covering the period 1996-2006 was able to generate acceptable simulations and forecasts (Tanku, Dushku, & Ceca, 2011) in particular regarding economic growth. Nevertheless, the inclusion of new series and the use of different interpolation procedures have diminished the performance of the model reflecting new economic realities.

The re-estimated model presented in this material, adopts quarterly series for the period 1996-2012, whilst the previous model went as far as 2006 (Dushku, Kota, & Binaj, 2006). The availability of new national accounts data (which represent the key series in the model) and the substantial revision of existing series (national accounts and others) require a process of re-testing for the model stability. In this process, we have maintained a similar structure to the original model. However, we have incorporated small changes which aim to tackle the "weaknesses" of the previous model. These changes consist in using better proxies for several indicators, incorporating the methodological changes in the generation of certain series and in including additional transmission channels which were formerly estimated outside the general model.

In more details, the household consumption equation was enriched with an additional explanatory variable: the interest rate which enables the transmission of monetary policy shocks to consumers' behavior. In the real exports equation we have included a different proxy for "relative prices" determined as the ratio between the export deflator and the domestic price deflator instead of foreign prices (the original version)..Such specification is more comparable with the 'relative prices' concept in the imports equation. Also, the model is enriched with an equation for import prices (which was not included in the original version) modeled as a function of exchange rate and euro area producer prices. Another improvement concerns the consumer price index equation where the foreign price variable was substituted with the import deflator. In this manner, the shocks sourcing from import prices and exchange rate first affect exports and imports' prices. Afterwards they are transmitted to consumer prices and net exports. The general database was improvement through means of better interpolation for national account series (Çela, 2014) and enhanced empirical approach in the generation of aggregate supply figures for NAIRU and potential output (Çela & Skufi, 2014).

This material, which includes the work so far, aims to stimulate the discussion on issued related to the "inside" and "outside" consistency of the re-estimated MEAM. The consensus regarding the final structure of the model from both users and builders is extremely important since the output (projections or simulations) are applied in the monetary policy decision making process at the Bank of Albania. Accordingly, it needs to incorporate the viewpoints of all parties regarding the functioning of the Albanian economy. The macro model needs to be theoretically coherent and able to replicate historic figures (empirically coherent). Since it is quite difficult to fulfill both pledges simultaneously, it is necessary to make certain compromises in regard to the final specification.

The material is organized in the following sequence. In the next section we are going to explain the general data framework focusing on the source, the methodology applied for interpolating annual to quarterly data and the procedure followed in the generation of new series. In the following section, we explain the

individual re-estimated equations grouped in the respective blocks and also compare the new parameters with those from the original model. The fourth section features simulation results in the case of five main exogenous shocks: interest rate, exchange rate, foreign prices, foreign demand and fiscal expenditure; which represent the main transmission channels. The last section summarizes the results for the re-estimation process and emphasizes issues requiring future improvement or investigation.

II. DATABASE SUMMARY

In this section, we are going to explain the series we use in the individual equations emphasizing the nature of the series, the source and the necessary transformations applied to obtain an appropriate version to be included in the model. For simplicity purposes, the series have been grouped in four categories according to the affiliation of the variable:

- national account indicators
- prices, interest rates, exchange rate
- fiscal indicators
- labor market indicators

II.1. NATIONAL ACCOUNT INDICATORS

AVAILABLE INDICATORS

The variables included in this category represent the Gross Domestic Product and demand side components:

- Household Consumption
- Public Consumption
- Consumption of non-profit organizations
- Private investment
- Public Investment
- Exports of goods and services
- Imports of goods and services

- Inventory changes and statistical discrepancy

All data is available in million ALL (domestic currency of Albania), in nominal (current prices) and real (2010 prices) format. The sources of annual data are the National Accounting Bulletins from the Institute of Statistics (INSTAT). In the case of exports and imports, data is obtained from Balance of Payments Statistics (Bank of Albania). Quarterly data for public consumption and investment are available from the Fiscal Bulletins (Ministry of Finance).

In the case of Household Consumption and Private Investment, the joint aggregate is estimated as a residual of GDP after the deduction of all known components. Quarterly data for the GDP series itself were obtained according to an accounting method which adds net taxes on products to quarterly Gross Value Added (GVA). Prior to 2008 (quarterly data from INSTAT cover the years 2008-2013), GVA data were extrapolated on a sector base. Respective deflators were applied to obtain real term statistics (for further information consult the material from Bank of Albania Economic Bulletin: Çela (2014)).

The procedure of separation of Household Consumption from Private investment was based on Vika &Abazaj (2014). The application of the respective deflator provides the real term data in regard to Household Consumption. On the other hand, since the investment deflator is not available, Private Investment is estimated as a residual of overall GDP (after the deduction of known components).

GENERATED INDICATORS

Apart from the indicators obtained directly form available statistics or generated through interpolation of existing statistics, the model also includes certain generated series:

- Potential GDP and Output Gap
- Capital Stock
- Disposable Income
- Foreign Demand

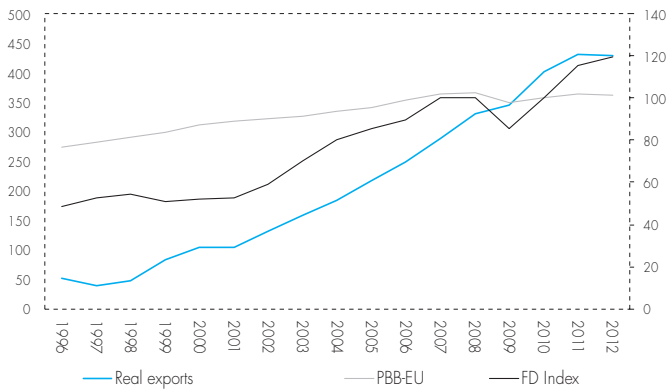
Potential GDP represents the quarterly real GDP series achieved through potential exploitation of production factors: labor, capital and total productivity. Total productivity is determined as a residual from the Cobb-Douglas production faction which we will explain in the following sections. The respective Output Gap is determined as the difference in percentage between actual real GDP and the potential real GDP in the given period.

The Capital Stock series is generated on an assumption for initial stock value (at the beginning of 1996). We further add the new real capital flow (private and public) and allow for 8% annual depreciation. On the other hand, nominal Disposable Income in calculated by adding transfers and deducting taxes from the total GDP figure. Household Consumption deflator index is applied to obtain the real Disposable Income.

The Foreign Demand index is developed based on industrial indices from partner countries (importers of Albanian commodities), which are affiliated with certain categories of Albanian exports, and weighted based on the category contribution to overall exports (Çela, 2014). The respective categories include:

- fuels
- textiles, leather and garments
- construction materials and metals

Chart 1 Real exports (billion ALL; 2010=100) and alternative foreign demand indices



Source: Instat, Eurostat and authors' calculations.

In the original model, Foreign Demand represents a weighted index of economic activity in the EU-27 area. The reformulation of the index is rooted in the need to figure out a more representing series considering the dynamics of Albanian exports (in particular since 2009) which can be observed in Chart 1.

The graph shows Albanian real exports in real billion ALL (measured on the left-hand side vertical axis) and two alternative indices for foreign demand. The index with the red line represents the proxy based on EU real GDP (applied in the original model), whilst the green line index represents the proxy based on industrial sector data (2010=100 in both cases). As we deduct from the graph, the green line follows more closely the pattern of the real exports' dynamic.

II.2. PRICES, INTEREST RATES AND EXCHANGE RATE

The indices of national accounts, consumer prices and producer prices

The indices applied in the deflation of national account indicators were generated from the interpolation process of annual national account statistics from INSTAT. The procedure exhibits different patterns according to the case in question.

In the case of exports' and imports' prices, the interpolation of deflators was achieved through weighted trade indices calculated on monthly foreign trade data. The individual indices for category of goods are calculated by employing value and quantity export and import data. Since there are no quantity based statistics for service exchanges, the indices calculated on goods' data were applied to interpolate the general (goods and services) deflators.

In regard to Household and Public Consumption, the respective indices were interpolated based on consumer price monthly data. As for the Consumption of Non-Profit Organizations and Statistical

Discrepancy, the quarterly deflators were assumed equal to the annual average.

In the case of capital formation, as we mentioned previously, nominal and real series were calculated as residuals. Therefore, the deflator series was based on these figures without the need to apply a particular interpolation process. The same principle applies to the case of GDP deflator.

Regarding the Consumer Price Index, although data is available in monthly fashion, the base period was shifted from December 2007 to 2010 in order to apply the same standard with the rest of the series. The same principle applies in the case of Domestic Producer Prices.

INTERNATIONAL PRICE INDICES AND EXCHANGE RATE

The international price indices included in the model feature export, import, consumer and producer prices from the euro area (Eurostat Database). In all cases, quarterly data is obtained by simple average of monthly data.

In the case of exchange rate, the series is defined as the ALL-Euro in nominal terms. Again, we take the simple quarterly average of monthly data.

INTEREST RATES

The two series included in the model feature the 12-month Bond Rate and Base Interest Rate. In both cases, data are available in nominal terms from the Bank of Albania. Again, we calculate quarterly averages from monthly data and apply annualized inflation rate to obtain real data.

GENERATED INDICES

In this group are included indices which are not directly available from official statistics but are necessary in the modeling process. The series themselves are generated based on other available data.

The deflator index for the GDP-Exports statistics is determined based on the respective nominal and real data of the two aggregates. This particular aggregate represents the gross domestic product after the deduction of exports and the respective deflator is included in the equation of real exports.

Real exchange rate is calculated from the deflation of nominal ALL-Euro data by the Consumer Price Index. The simple quarterly average is commuted from monthly statistics.

Unit Labor Cost represents an additional index which connects labor data with the national accounts. The formula of calculation includes the product of the number of employers with average nominal wage (also multiplied with three since nominal wage data is on monthly terms) over real GDP.

The Relative Productivity Index represents a proxy for this particular development between Albania and the euro area. The index is based on the respective ratios of producer prices over consumer prices for the two areas.

II.3. LABOR MARKET

The general statistics for the labor market associated with the number of employees, labor supply and unemployment rate were obtained from INSTAT. As for the natural rate of unemployment, the estimation was based on the Non-Accelerating Inflation Rate of Unemployment (NAIRU) concept generated from a state-space model with Kalman Filter. That is a difference from the original model applying the Non-Accelerating Wage Rate of Unemployment (NAWRU) estimated with the Elmeskov technique (Kota, 2007).

II.4. FISCAL INDICATORS

Fiscal indicators were obtained from monthly budget statistics from the Ministry of Finance. They include disaggregated items for

expenditure, income, budget deficit, deficit financing and debt.

II.5. TRANSFERS AND FOREIGN ASSETS

These series were obtained from Bank of Albania statistics. Respectively, workers' transfers (remittances) and other current transfers were retrieved from Current Account data of the Balance of Payment (quarterly frequency). As for Net Foreign Assets, stock data are available from International Investment Position statistics.

III. EQUATIONS

III.1. AGGREGATE DEMAND BLOCK

HOUSEHOLD CONSUMPTION

D(LOG(GDP_CONHH)) = - 0.084(LOG(GDP_CONHH(-1)) - 0.57*LOG(GDP_DI(-1)) - 4.98) - 0.21* D(I_B12(-5) / 100)*

In the long-term, Household Consumption (GDP_CONHH) is modeled on proper lags and real Disposable Income (GDP_DI). Disposable income is calculated by adding private and public transfer to GDP data and deducting direct and indirect taxes. The Household Consumption deflator index is applied for the deflation. In the original version, the Household Consumption equation exhibited the following pattern:

D(LOG(GDP_CONHH)) = - 0.24(LOG(GDP_CONHH(-1)) - 0.89*LOG(GDP_DI(-1)) - 1.06)*

Compared to the re-estimated version, the original equation exhibits a larger adjustment coefficient (0.24 compared with 0.084 in the re-estimated equation). Furthermore, the long-term coefficient for Disposable Income is smaller in the re-estimated version (0.57 as compared to 0.89 in the original model). That would reflect a diminished impact associated with disposable income with inertia

remaining the predominant contributor of Household Consumption.

In the end, in the re-estimated version we have also included the 12-month real T-bills' rate (I_B12) in the short-term relationship, to take into account for their impact on general Household Consumption.

PRIVATE INVESMENT

D(LOG(GDP_GFCFP)) = - 0.27(LOG(GDP_GFCFP(-1)) - 0.55*LOG(GDP(-1)) + 1.61 * I_B12(-1)/100 - 4.19)*

In the long-term, Private Investment (GDP_GFCFP) are modeled on the proper lags, Gross Domestic Product (GDP) and real 12-month T-bills' Rate (I_B12). The specification follows the same line of the original version:

D(LOG(GDP_GFCFP)) = - 0.25(LOG(GDP_GFCFP(-1)) - LOG(GDP(-1)) + I_B12(-1)/100 - 4.19)*

As we can observe from the two specifications, both equations exhibit very similar adjustment coefficients. On the other hand, long-term coefficients associated with the explanatory variables are different. In the case of GDP, the coefficient has shrunk from 1 to 0.55; and the coefficient of the T-bills' rate has jumped to 1.62 (from 1 in the original version). It is import to emphasize that in the original version, both coefficients were calibrated at 1. As a consequence, the shift is due to the different specification and not the optimization process involving different series (extended series).

Real exports of goods and services

D(LOG(GDP_EXP)) = - 0.31(LOG(GDP_EXP(-1)) - 1.79*LOG(FGN_DEM(-1)) - 3.00) + 0.38*DLOG(P_EXP / P_ABSORP)*

In the long-term relationship, real exports (GDP_EXP) are expressed as a function of past values and the Foreign Demand index (FGN_DEM). In the short term, we have included the P_EXP / P_ABSORP as a proxy for relative prices. P_EXP represent the Export Price deflator index, whilst P_ABSORP represents the deflator for the

GDP-EXP aggregate (the domestic output which is not exported). In the original version, the real exports' equation is the following:

D(LOG(GDP_EXP)) = - 0.5(LOG(GDP_EXP(-1)) + log(P_EXP(-1)/P_exp_eur(-1)) - LOG(FGN_DEM(-1)) - 1.09@trend)*

These two equations display several differences. First, the proxy for Foreign Demand is different. In the re-estimated equation, the generation method of the index has altered (as we mentioned previously) and the coefficient has risen from 1 to 1.79. The change in the method was motivated by the sharp growth of exports in the years 2010-2012. The proxy based on EU-GDP was no longer able to appropriately capture the foreign demand during the crisis in Western Europe. This is the reason why we introduced an alternative proxy which is better connected to the structure of Albanian exports. As for the changing coefficient, this is due to a new series being introduced which bears different dynamics compared to the previous one.

In the original version, the Relative Prices' proxy was calculated as a ratio of Albanian Export Price index and the Euro-area Export Price index. From this point of view, relative prices are demand connected and are supposed to have an invert relationship with exports. Applying such proxy would assume a considerable similarity between Albanian and euro area exports. Statistics reveal that is not the case.

The alternative proxy we introduced is modeled based on the supply side. It is the domestic producer (of goods and services) which selects the destination of its output between domestic and foreign market (exports). The choice is also influenced from relative prices. The index for the domestic market is calculated as the deflator for the aggregate of GDP deducting exports to obtain the amount of domestic output that is not exported. According to this approach, the expected sign of the coefficient is positive and the optimization process delivers such result (the coefficient is estimated at 0.38). The variable is included only in the short-term relationship due to the absence of co-integration with the other indicators.

IMPORTS OF GOODS AND SERVICES

D(LOG(GDP_IMP)) = - 0.11(LOG(GDP_IMP(-1)) - 0.96*LOG(GDP(-1)) + 0.7*LOG(P_IMP(-1) / P_GDP(-1))*

Real Imports (GDP_IMP) are modeled on their past behavior, GDP and a proxy for relative prices. The proxy for relative prices is calculated as the ratio of the Import Price Index (P_IMP) and the GDP Deflator Index (P_GDP). In the original version, the equation exhibits the following pattern:

D(LOG(GDP_IMP)) = - 0.3(LOG(GDP_IMP(-1)) - LOG(GDP(-1)) + 0.49*LOG(CPI_EU_sa(-1) / P_CPI(-1)) -1.53)*

It is important to emphasize the difference in the concept of relative prices. In the original version, the proxy is calculated as the ratio of EU Consumer Price Index (seasonally adjusted) over the Albanian c Consumer Price Index. According to this approach, relative prices are demand oriented with the Albanian consumer choosing between domestic output and imports based on price differentials. However, the Consumer Price Index is structured to capture price movements for a certain category of aggregate demand (Household Consumption) while imports boast a much larger variety. Furthermore, the consumer basket of the EU is not necessarily same or similar to the structure of Albanian imports and/ or Albanian inflation basket.

For these reasons, in the re-estimated equation we have followed the same general approach introducing a relative price proxy that better reflects the realities of imports and domestic output. This proxy is calculated as the ratio of Import Prices (capturing foreign output prices) over the GDP deflator index (capturing domestic output prices). The long-term coefficient for relative prices was calibrated at 0.7 following several trials. The GDP coefficient is estimated at a lower level compared to the original version (although the value in the original model is calibrated), whilst the adjustment coefficient has fallen from 0.3 to 0.1.

DEMAND BLOCK IDENTITIES

Nominal and real Gross Domestic Product (GDP_N and GDP) are determined based on aggregate demand identities. The components which are not modeled through individual equations are included as exogenous:

GDP_N = GDP_CONHH_N + GDP_CONGOV_N + GDP_GFCF_N + GDP_EXP_N - GDP_IMP_N + GDP_NPISH_N + GDP_CHIN_N

GDP = GDP_CONHH + GDP_CONGOV + GDP_GFCF + GDP_EXP - GDP_IMP + GDP_NPISH + GDP_CHIN

Real Public Consumption (GDP_CONGOV) is calculated by deflating the nominal series with the respective deflator index. As for capital formation, Total Investment (GDP_GFCF_N and GDP_GFCF) is included in the GDP equations. Total investment is expressed according to the following identities for nominal and real values respectively:

GDP_GFCF_N = GDP_GFCFP_N + GDP_GFCFG_N

GDP_GFCF = GDP_GFCFP + GDP_GFCFG

GDP_GFCFP_N and GDP_GFCFP stand for Private Nominal Investment and Private Real Investment respectively. On the other hand, GDP_GFCFG_N and GDP_GFCFG represent nominal and real Public Investment. Total nominal Public Investment is further expressed in identity form:

GDP_GFCFG_N = GE_CAE + GDP_GFCFGL_N

GE_CAE stand for Central Government Investment and GDP_GFCGL_N include Local Government Investment. The separation of these two components is necessary for the further measurement of public deficit which includes only capital formation from the central government.

Capital formation deflators are applied separately to obtain real figures for private and public investment. In the case of public investment, the deflator is applied on total investment (the aggregate of central and local government).

In the case of trade, since in the equations we model real exports and imports, the respective deflators are applied on the real figures to obtain nominal series. As for Consumption of Non-Profit Organizations and Statistical Discrepancy, the deflating process is not necessary since both nominal and real values enter directly into the national account identities.

Upon obtaining nominal GDP, we commute the series for nominal Disposable Income (GDP_DI_N) according to the following formula:

GDP_DI_N = GDP_N + CAB_REM + CAB_TRANSFOTH - (GR_TR - GR_NTR - GR_G) + GE_T + (GE_DI - GE_FI)

In the formula, Worker's Remittances (CAB_REM), Other Transfers from the Balance of Payments (CAB_TRANSFOTH), Other Public Transfers (GE_T) and the difference between Domestic Interest Payments (GE_DI) and Foreign Interest Payments (GE_FI) are added to the nominal GDP aggregate. The aggregate specified as (GR_TR - GR_NTR - GR_G) represents the deduction of Non-Tax Revenue (GR_NTR) and Grant Revenue (GR_G) from overall Public Revenue (GR_TR). In this way we are able to deduct from nominal GDP only direct and indirect taxes omitting public revenues originating from alternative sources. In the end, the Household Consumption price index is applied to generate real Disposable Income.

III.2. LABOR MARKET BLOCK

LABOR DEMAND

D(LOG(L_D)) = - 0.29(LOG(L_D(-1)) + 0.22*LOG(P_W(-1)) - 0.53*LOG(GDP(-1)) - 1.32*(GDP(-1) / S_CS(-1)) - 2.37)*

Labor Demand (L_D) is modeled on past behavior, Real Wage (P_W), GDP and the ratio of GDP over the Capital Stock (S_CS) as a proxy for capital productivity. In the original version, the equation is the following:

D(LOG(L_D)) = - 0.26(LOG(L_D(-1)) + LOG(P_W(-1)) - LOG(GDP(-1)) +0.18*dum_ld - 7.30)*

From the two outputs, it can be observed that the coefficients next to Real Wage and GDP are much smaller in the revised version. That is a consequence of their calibration in the original models whilst in the revised version they are a product of the optimization process.

On the other hand, the Capital Productivity proxy is not included in the original version. The variable is included in the revised version to reflect the theoretical concept which states that shifts in Capital Productivity are reflected on Labor Demand. The same literature points out that the relationship could be positive reflecting a degree of complementarity between the two factors. On the other hand, negative relationship reflects a pattern of substitutability between labor and capital. In our case the obtained sign of the coefficient is positive, reflecting patters of complementarity in the Albanian economy. As for the adjustment coefficients, the differences between the two equations are most marginal.

NOMINAL WAGE

D(LOG(P_W_N)) = - 0.28(LOG(P_W_N(-1)) + 0.08*L_UN(-1) - LOG(P_CPI(-1)) - 0.79*LOG(GDP(-1) / L_D(-1)) - 2.46)*

The quarterly average Nominal Wage (P_W_N) is modeled on past behavior, the Unemployment Rate (L_UN), the Consumer Price Index (P_CPI) and the ratio of GDP over Labor Demand (L_D) as a proxy for labor productivity. In the original version, the equation has the following shape:

D(LOG(P_W_N)) = - 0.35(LOG(P_W_N(-1)) + 0.61*L_UN(-1) - LOG(P_CPI(-1)) - 0.69*LOG(GDP(-1) / L_D(-1)) - 8.3)*

It is important to emphasize the smaller coefficient next to the Unemployment Rate in the revised version (0.08 as compared with 0.61 in the original version) reflecting a weaker impact coming from unemployment shifts on nominal wages. This is not surprising considering the very moderate unemployment changes experienced in the years 2007-2012. Furthermore, we observe small differences in the cases of labor productivity and adjustment coefficients.

LABOR MARKET IDENTITIES

In the general model, Nominal Average Wage (P_W_N) is modeled from a behavioral equation whilst Real Wage appears as an explanatory variable. To obtain Real Wage data, we deflate nominal wage by the Consumer Price Index (P_CPI):

P_W = P_W_N / (P_CPI / 100)

Nominal wage is further introduced in the Unit Labor Cost (P_ULC) identity according to the following formula:

*P_ULC = L_D * P_W_N * 3 / GDP*

Labor Demand (L_D) is multiplied with the nominal wage and 3 to obtain e measure of quarterly employees' compensation (P_W_N represents monthly wage average on quarterly basis and that requires multiplication by 3). The product is divided by real GDP. Additionally, the rate of unemployment (L_UN) is expressed as the difference in percentage between labor demand and labor supply:

*L_UN = 100 * (1 - L_D / L_S)*

L_D stands for Labor Demand and L_S for Labor Supply.

III.3. EXCHANGE RATE AND INTEREST RATES BLOCK

REAL EXCHANGE RATE

D(LOG(P_RER)) = - 0.35(LOG(P_RER(-1)) + 0.68*P_PROD(-1) + 0.001*NFA_GDP_N(-1) + 0.011* GB_GDP_N(-1) - 4.86)*

The Real ALL-Euro exchange rate (P_RER) is measured by deflating the nominal exchange rate with the relative price index. The latter is defined as the ratio of Harmonized Euro-Area Consumer Price Index over the Albanian Consumer Price Index ((HICP/P_CPI). Based on the stock-flow approach from Luçi & Vika (2009), the long-term relationship is modeled on past behavior, relative productivity (P_PROD) (defined as relative Albanian vis-à-vis EU ratio of non-tradables' price index (proxied with the Consumer Price Index) over tradables' price index (proxied with the Producer Price Index)); the ratio of Net Foreign Asset Stock over GDP (NFA_GDP_N); and the ratio of Fiscal Deficit over GDP (GB_GDP_N).

The approach differs much in comparison with the original version. In the original equation, it is the nominal exchange rate that is modeled in the following fashion:

*LOG(P_ALL_EUR) = -0.57 + 0.88*LOG(P_ALL_EUR(-1) + (1-0.88)*(CPI_EU/P_CPI) – 1*(r_EU – P_B_12) + 0.88*(r_be(-1) – P_B_12(-1))*

The nominal rate (P_ALL_EUR) is modeled on relative prices (CPI_EU/P_CPI) and real interest rate differentials between EU and Albania (R_EU-P_B_12).

The new specification was selected based on better performance compared to the original version. Furthermore, the inclusion of real term exchange rate is motivated from the long-term nature of the general model. According to the literature, real exchange rate represents a long-term phenomenon and is appropriate for long-term specifications. Considering the shift in approach, the explanatory variables are also required to change in order to accommodate for

these differences.

In a clear difference from the original equation where nominal exchange rate is modeled based on the theory of one price, the ratio of relative prices in the revised equation takes into account the concept of relativism between Albania and the EU in terms of ratio of non-tradable over tradable prices. This is an appropriate specification to capture possible Balasa-Samuelson effects on exchange rate.

On the other hand, the inclusion of un-covered parity condition interest rate proxy generated results that rejected theoretical expectations. The coefficients did not just exhibit opposite signs but were much larger compared with the expectations. Furthermore, the inclusion of interest rates would interfere with the effects coming from relative prices in the revised version. For these reasons, the variable was ultimately dropped from the specification.

In the end, it is important to emphasize that the different approach does not reflect a major change in the structure of the model. In the revised version, the nominal rate is determined by "inflating" the real exchange rate with consumer prices. Since both variables are endogenous in the model, the nominal exchange rate is also determined inside the general framework. Changes in the variable (endogenous) are further transmitted to other nominal variables (in this case export and import deflators and from there to other endogenous variables).

12- MONTH T-BILLS' RATE

D(I_B12_N) = - 0.26 (I_B12_N(-1) - 0.96*I_REPO_N(-1) - 1.93 * LOG(GD_D(-1)) + 22.94)*

The nominal 12-month T-bills' rate (I_B12_N) is modeled on past behavior, Base Interest Rate (I_REPO_N) and the Domestic Debt Stock (GD_D). In the original version, the equation follows this pattern:

D(I_B12_N) = - 0.26 (I_B12_N(-1) - 0.5*I_REPO_N(-1) - LOG(GD_D(-1)) - 4.70)*

Stark differences are observed in the case of the Base Rate coefficient which shifts from 0.5 to 0.96 reflecting a complete transmission toward treasury bills' rates. Additionally, the coefficient next to Domestic Debt Stock jumps from 1 to 1.9 (almost doubled). Once more we have to remind that both coefficients are calibrated in the original equation. As for the adjustment coefficient, that is identically the same across the two specifications.

IDENTITIES

In the previous section we explained that is the nominal bond rate that is modeled through the behavioral equation. On the other hand, it is the real Bond Rate (I_B12) that enters the equations of Household Consumption and Private Investment. The deflation process is the following:

*I_B12 = I_B12_N - (P_CPI / P_CPI(-4) * 100 - 100)*

Based on the formula above, the annualized inflation rate is deducted from the nominal bond rate. The index cannot be applied since the nominal series is expressed in percentage interest rate. The same principle is applied in deflating the nominal Base Interest Rate (I_REPO_N) to obtain the real Base Interest Rate (I_REPO):

*I_REPO = I_REPO_N - (P_CPI / P_CPI(-4) * 100 - 100)*

As for nominal exchange rate (P_ALL_EUR), the process is reversed as we have to "inflate" real exchange rate (P_RER) in the following way:

P_ALL_EUR = P_RER / (P_EZCPI / P_CPI)

P_EZCPI and P_CPI represent consumer price indices for euro area and Albania, respectively.

III.4. PRICE BLOCK

CONSUMER PRICE INDEX

D(LOG(P_CPI)) = - 0.09(LOG(P_CPI(-1)) - 0.32*LOG(P_IMP(-1)) - 0.42*LOG(P_ULC(-1)) - 0.68) + 0.002*S_GAP - 0.076*D(L_UN(-1) / 100)*

The Consumer Price Index (P_CPI) is modeled on past behavior, the Import Price Index (P_IMP) and Unit Labor Cost (P_ULC). The Output Gap (S_GAP) and Unemployment Rate (L_UN) are included only in the short-term relationship. The original version of the equation is the following:

D(LOG(P_CPI)) = - 0.11(LOG(P_CPI(-1)) - 0.71*LOG(PM_EUR(-1)*P_ALL_EUR) - (1-0.71)*LOG(P_ULC(-1)) + 5.70) + 0.1*S_GAP - 0.12*D(L_UN(-1) / 100)*

The revised equation reflects a different specification from the original model. Originally, foreign prices (PM_EUR) and the nominal exchange rate (P_ALL_EUR) were jointly introduced in the long-term relationship. In the revised version, only the Albanian import price index calculated from import data available in local currency is introduced. The coefficient is smaller in the revised version.

Additionally, the short-term coefficients related with Output Gap and Unemployment are smaller in the revised version although in the case of Output Gap that could be associated to the different series of the variable. Lastly, the Unit Labor Cost and adjustment coefficients are slightly different in the revised version.

EXPORT PRICE INDEX

D(LOG(P_EXP)) = - 0.47(LOG(P_EXP(-1)) - 0.73*LOG(P_IMP_EU19(-1)) - 0.54*LOG(P_ALL_EUR(-1)) + 1.44)*

The long-term relationship includes past behavior, the euro area export price index (P_IMP_EU19) and Nominal Exchange Rate (P_ALL_EUR). The original equation is the following:

D(LOG(P_EXP)) = - 0.02(LOG(P_EXP(-1)) - LOG(PX_EUR - 1.24*LOG(1/P_ALL_EUR(-1)) - 6.57)*

In the original version, the Export Price Index calculated on trade statistics available in Euro (PX_EUR) stands for foreign import prices included in the revised version. The coefficient in the re-estimated equation is smaller. Additionally, the sign of the exchange rate coefficient is reversed (from negative to positive in the revised version). As for the adjustment coefficient, the value is much larger in the revised equation (0.47 as compared to 0.02 in the original equation).

The approach shift is reflected in several aspects and occurs for separate reasons. First, it is important to point out that the general interpolation procedure for the endogenous variable was based on estimated accounting indices and not a purely statistical process as in the original model. Secondly, foreign prices and exchange rate appear as separate explanatory variables. In the original equation where they appear as a joint variable, the purpose is to capture the accounting effects generated from each variable. However, purely accounting effects are appropriate in the case of static models. The existence of lags reflects additional effects which require the separation of the two variables from one-another.

Last, it is important to explain the different proxy for foreign prices. In both equations, the endogenous variable reflects border prices for exports in domestic currency (in terms of FOB at the moment of departure from Albania). In the original version, the PX_EUR variable denotes the same prices expressed in a different currency (Euro). Considering that Albania is a small open economy thought to reflect price-taker behavior, it was believed appropriate to include a variable which reflects the prices at which our partners actually buy from the world. In this case, import prices from the main trade partner (EU-19) would make for a better proxy.

IMPORT PRICE INDEX

D(LOG(P_IMP)) = - 0.40(LOG(P_IMP(-1)) - 2.41*LOG(P_EXP_EU19(-1)) - 0.47*LOG(P_ALL_EUR(-1)) + 8.86)*

In the long-term relationship, the endogenous variable is modeled on past behavior, Euro-Area Export Prices (P_EXP_EU19) and Nominal Exchange Rate (P_ALL_EUR). The equation is included only in the revised version of the model and it is motivated on certain reasons.

First, it was contemplated that the impact coming from exchange rate fluctuations should be separated from foreign prices (they appear joint in the original CPI equation) in order to avoid similar problems which characterized the Export Price Index equations. Secondly, it was deemed necessary to include a better proxy for Albanian imports. As in the case of exports, we applied a figure from the euro area (namely the export price index). Thirdly, since import prices are important in modeling the import demand and also domestic consumer prices, we believed that the variable should be entirely endogenous and have a separate equation.

PRICE IDENTITIES

Previously, we mentioned that there are differences between the Household Consumption prices index (P_CONHH) and the general Consumer Price Index. In order to make the Household Consumption deflator endogenous, we have introduced the following formula that connects this deflator to the CPI:

*P_CONHH = KOEF_P_CONHH * P_CPI*

The KOEF_P_CONHH represents an exogenous index generated from raw statistics and it remains exogenous in the simulation process. On the other hand, CPI is an endogenous variable whose shifts would be further channeled to the Household Consumption deflator. Furthermore, the P_CPI series is applied in generating annual inflation figures:

*P_INF = (P_CPI / P_CPI(-4) * 100 - 100)*

Last, nominal and real GDP series (GDP_N and GDP) which are calculated from the respective identities are applied to generate the GDP deflator:

*P_GDP = GDP_N / GDP * 100*

III.5 SUPPLY BLOCK

The Supply Block includes 4 identities applied in the generation of production function, potential and output gap indicators. As we have mentioned previously, the Capital Stock series is determined on a primary assumption for the initial value in 1996. Then, real private and public investment flows are added to the stock allowing of an annual depreciation rate at 8%. Based on Capital Stock, Labor Demand and GDP data we develop the following production function:

*GDP = S_TFP * L_D0.7 * S_CS0.3*

Total factor productivity is calculated as a residual of the function. Potential Labor Supply (S_L_S) is determined based on Labor Supply (L_S) and the Natural Rate of Unemployment (S_NAIRU):

*S_L_S = (1 - S_NAIRU / 100) * L_S*

Assuming a fully employed Capital Stock and introducing potential labor utilization, we calculated the potential GDP series in the following formula:

*S_GDP = EXP(LN_S_TFP_HP + 0.3 * log(S_CS) + 0.7 * log(S_L_S))*

In the case of Total Factor Productivity, the HP filter is applied on the residual data to obtain a potential series. In the end, the output gap is determined as the percentage change between actual and potential real GDP.

THE FISCAL BLOCK

The Fiscal Block consists entirely of identities applied in the calculation of revenue, expenditure, deficit and debt. In the case of Total Revenue (GR_TR), the identity is the following:

$$GR\_TR = GR\_EXC + GR\_PIT + GR\_CD + GR\_VAT + (GR\_SFR + GR\_G + GR\_NTR + GR\_NTO + GR\_LT + GR\_ST + GR\_PT)$$

The revenue items are the following: Excise duties (GR_EXC), Personal Income Tax (GR_PIT), Custom Duties (GR_CD), Value Added Tax (GR_VAT), revenues from Special Funds (GR_SFR), Grant revenue (GR_G), National tax and other taxes (GR_NTO), Local Tax revenue (GR_LT), Solidarity Tax (GR_ST), Profit Tax (GR_PT) and Non-Tax revenue (GR_NTR).

Total Budget Expenditure (GR_TE) is determined with the following formula:

$$GE\_TE = GE\_CUE + GE\_CAE + GE\_RFC + GE\_OT$$

GE_CUE stands for Current Expenditure, GE_CAE stands for Capital Expenditure of central government; GE_RFC stands for Reserve and Contingency fund; GE_OT stands for Other Public Transfers. A separate identity is included for Current Expenditure:

$$GE\_CUE = GE\_OM + GE\_PE + GE\_LBE + GE\_I + GE\_T$$

The formula includes Operational and Maintenance expenditure (GE_OM), Staff expenditure (GE_PE), Local Government grants (GE_LBE), Interest Payments (GE_I) and Government Transfers (GE_T). Interest payments are further disaggregated into Domestic Interest Payments (GE_DI) and Foreign Interest Payments (GE_FI).The difference between Total Revenue and Total Expenditure determines the Budget Deficit (GB):

$$GB = GR\_TR - GE\_TE$$

The formula for the determination of the central government Budget Stock is the following:

*GD = GD(-1) + GB * (-1) - GD_NDF + GD_NFD*

The new Deficit flow and Debt flows obtained not for financing (GD_NFD) are added to the previous stock (GD-1). Deficit financing that comes not in the form of debt flow (GD_NDF) are deducted from the total. In the final, Domestic Debt is calculated by deducting Foreign Debt from the overall debt stock.

IV. SIMULATION ANALYSIS IN THE REVISED VERSION

In this section we are going to present certain "routine" shocks that are applied to the model namely base interest rate transmission, exchange rate depreciation, fiscal stimulus, shifts in foreign prices and foreign demand differentials. The responses of endogenous variables are presented for a 2-year horizon (Graphs 4.1-4.6)

We have also introduced the response functions from the original model in order to compare the results between the two. In all cases, we have presented the response functions for the variables which are directly affected and also for GDP and inflation.

IV.1 MONETARY POLICY SHOCK

The base interest rate serving as monetary policy instrument is shocked by 100 basis points for 2 consecutive years. The transmission mechanism dictates an increase of interest rates in the economy due to higher 12-month bond rate affecting private investment and household consumption. The general slowdown in economic activity is further reflected in lower inflation.

It is observed that the transmission of base interest rate is completed after 6 quarters which higher impact in the case of private investment compared with household consumption. Additional effects reflect higher response from economic growth and controlled shifts in inflation.

Compared to the original model, the reaction magnitude is augmented. The transmission towards interest rates is complete whilst in the original model is half that high. Higher transmission rates produce greater impacts in terms of household consumption and investment. Additionally, GDP and inflation reactions are stronger.

IV.2 DOMESTIC CURRENCY DEPRECIATION

In this scenario we assume a 10% depreciation of ALL vis-à-vis euro in the 2 year horizon. The initial effects are related to the export and import deflators and additionally towards the trade components. In the end, the effects connect with GDP and inflation. Unlike the original model, in the revised version, exchange rate indirectly impacts inflation via trade deflators and aggregate demand.

It can be observed that export and import prices react by half as much as the depreciation shock. Furthermore, the shock seems to boast economic growth mainly as a result of import fall than export growth. On the other hand, there is moderate impact on inflation. This last result seems in line with the findings of Vika, Hoxholli & Hashorva (2015) which report a reduction of the effect of exchange rate depreciation on inflation by 10-15 % in the period 2009-2015.

Compared to the original version, export prices react in the opposite direction reflecting the opposite sign in the individual equation. As for import prices, it is not possible to compare the two models since the equation is included only in the revised version.

In regard to the response of real exports, the impact is much subdued in the revised version compared to the original one. Import reaction is similar both follows different dynamics (the response is much more volatile in the revised version). As for GDP and inflation reactions, they are both smaller in the revised version.

IV.3 FOREIGN DEMAND AND FOREIGN PRICES

In the revised version, foreign prices affect both export and import deflators and are further transmitted towards aggregate demand and inflation. As better proxies for foreign prices we have included trade deflators from the euro area with the respective EU export (import) deflator serving as explanatory variable in the model import (export) equation. Estimations suggest a higher transmission rate in the case of domestic imports and the comparative inability of domestic exporters to adjust their prices vis-à-vis international changes. However, an increase in foreign prices stimulates the economy - by slowing down import growth and stimulating imports – while their transmission towards inflation is incomplete and controlled.

In the case of imports, the effect sourcing from international price changes is much higher in the case of the revised model suggesting a higher degree of demand reaction to nominal shifts. As a consequence, the impacts on GDP and inflation are larger. In the case of inflation, the stronger impact is mainly related to the stimulated domestic economic activity and less connected to import deflator changes.

As for exports, although the transmission magnitude is higher in the revised version, the impact on exports is much smaller. This produces marginal effects on GDP and inflation (in the case of inflation, the impact is associated entirely with higher economic activity).

Last, the foreign demand index, which is constructed on weighted international industrial indices from fuels, textiles and metals, boasts a considerable influence on Albanian exports. The impact is entirely transmitted within 6 quarters with substantial effect on real economic growth.

IV.4 FISCAL SHOCKS

The fiscal shocks include shifts only in public expenditure without any reference to public revenue. Of course, growth in current and/or capital expenditure has a direct impact on economic growth whilst consumer price reactions are moderate both in the case of public consumption and public investment shocks. Nominal bond rate increases due to higher domestic debt but the real bond rate falls due to higher effects coming from inflation. As a consequence, real interest rate decrease coupled with higher income stimulates the private sector and household to increase their spending.

From the graphs we can observe that the impact on GDP and inflation is higher in the revised version (both in the case of current and capital expenditure shocks). In the case of GDP that could be related to higher values for current and capital expenditure in the last years of the sample adopted in the revised model. On the other hand, inflation is much more affected by real economic activity in the revised framework.

Higher commitments of public expenditure are reflected on larger debt stock deviations. However, the impact of domestic debt on bond rate is smaller in the revised model. This produces more moderate impacts on household consumption and private investment suggesting a smaller indirect impact of the public sector on the economy.

V. CONCLUDING REMARKS

This material reflect the re-estimation process concerning the MEAM macro model regarding individual equations and the overall model solution. The general structure has not undergone substantial changes. The re-estimation process features the inclusion of updated series, marginal changes in specifications and inclusion of more precise proxies. In these examples, we can mention the inclusion of interest rates in the household consumption equation and the import deflator index within the CPI equation.

The external block went through the most of changes in the revised model. The export equation features a more appropriate proxies for foreign demand (constructed on industrial indices from Albania's export partners) and relative prices. At the same time, a better proxy for relative prices has been included in the real imports' equation. The respective deflators' equation boast more appropriate variables concerning foreign prices. In regard the exchange rate, the revised version includes the Real Effective Exchange Rate variable as better fitted to the overall long-term pattern of the model. In regard to the other blocks, we can mention the inclusion of improved series for the natural rate of unemployment and potential output. On the other hand, re-estimations in the labor market block demonstrated for weaker reactions as a results of differences in other parts of the model.

The analysis of standard shocks and comparison with the previous version, emphasizes the differences concerning the transmission mechanism. In the case of policy rate shocks, we can mention the full pass-through towards the 12-month bond rate and therefore, enhances impacts on domestic output and inflation rate. On the other hand, foreign price and nominal exchange rate shocks provide for diminished impact on the economy (domestic output and inflation) in spite of the more pronounced pass through towards export and import deflator. This stands for weaker impact on real variables (exports and imports) coming from international price movements. On the other hand, foreign demand shocks provide enhanced impacts on domestic output and inflation. In the end, differences in impacts associated with fiscal shocks are more visible in the second round as a result of different transmission towards interest rates and additionally on household consumption and private investment.

Despite the changes mentioned so far, it is important to emphasize that further improvements could be achieve in the future. First, the external block could incorporate better proxies for relative prices able to capture international competitiveness impacts. At the same time, the import equation could be re-specified to provide different impacts related to shock on aggregate demand components (different impacts associated with household consumption, investment and fiscal variables instead of a common impact from

overall real GDP). The labor market block could be improved by including proxies able to capture substitutability patterns between factors (labor and capital). On the other hand, a series for profits would further enhances the quality of the price related equations (CPI and aggregate demand deflators).

Apart from further modifications in the existing structure, the model could be enriched by including additional blocks, most importantly the financial block. At the same time, we can mention the inclusion of fiscal and monetary rules in order to improve the overall reaction pattern of the model. On the other hand, future optimizations might also feature characteristics related to non-linarites and asymmetries.

Chart 4.1 Monetary policy shock analysis: base interest rate shock +1 pp

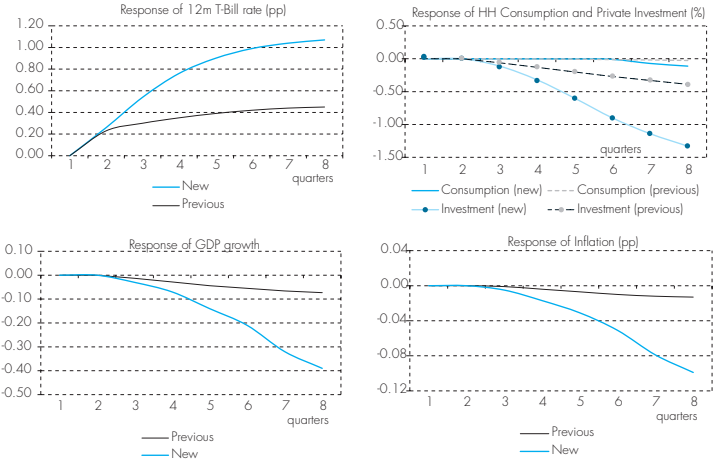


Chart 4.2 Exchange rate shock: domestic currency depreciation by 10%

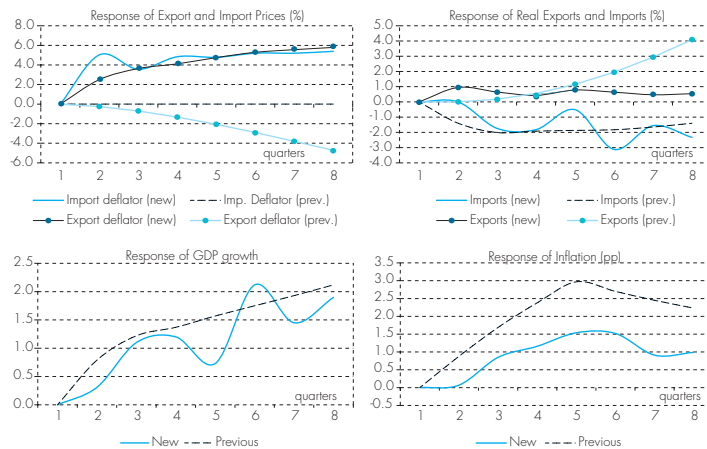


Chart 4.3a Foreign prices: EA export deflator +10%

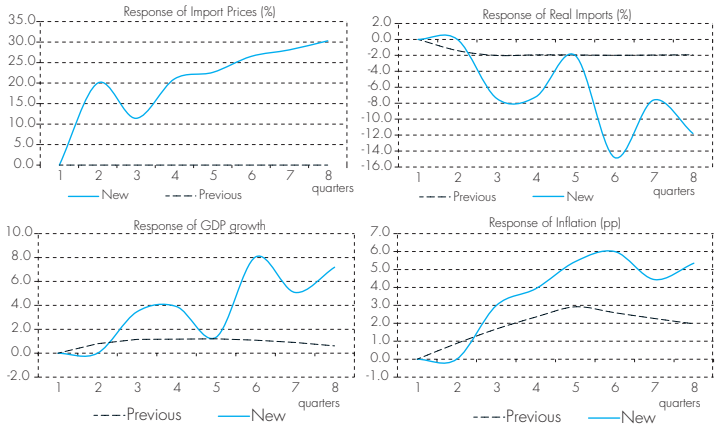


Chart 4.3b Foreign prices: EA import deflator +10%

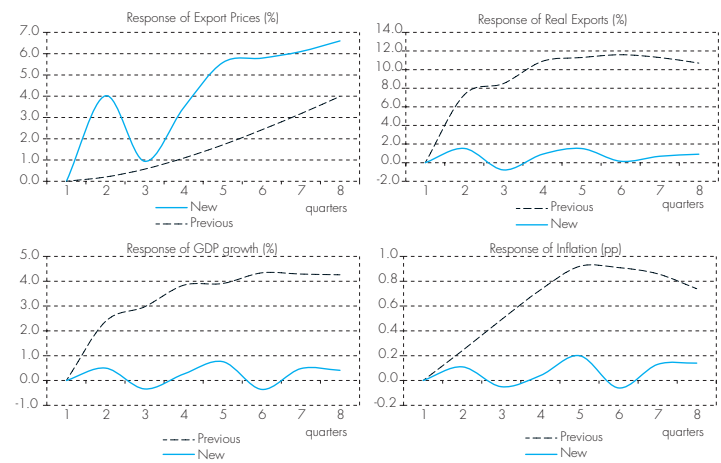
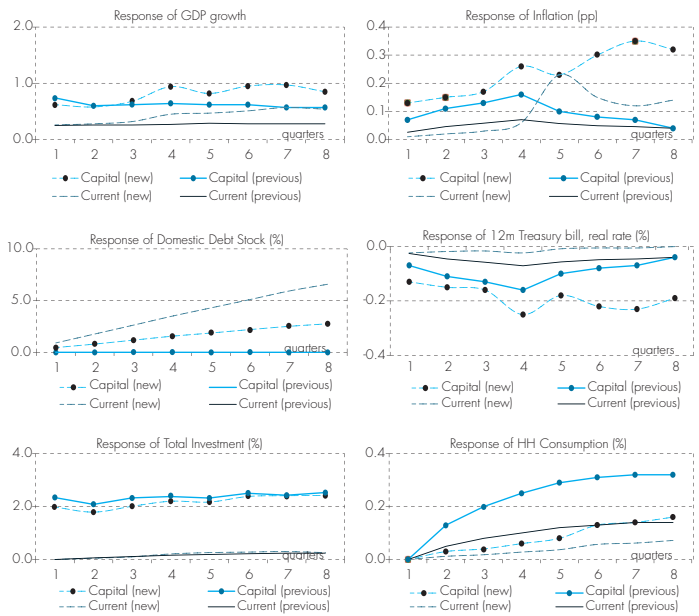


Chart 4.4 Foreign demand shock +5%

Chart 4.5 Fiscal shocks: capital expenditure +10%; current expenditure +5%



ANNEX: VARIABLE SUMMARY

Denomination	Type	Description	Source/calculation formula	Notes
NFA	Exogenous	Net foreign asset stock	Bank of Albania; annual terms since 2003; authors' calculations	Nominal (mln ALL); quarterly interpolation and extrapolation prior to 2003 based on flow statistics from Balance of Payments (except for the financial account) and exchange rate changes.
NFA_GDP_N	Endogenous	Net foreign asset stock to GDP ratio	CAB_NFA/GDP_N	Ratio
CAB_REM	Exogenous	Workers' remittances	Bank of Albania	Nominal (mln ALL)
CAB_TRANSFOTH	Exogenous	Other transfers	Bank of Albania	Nominal (mln ALL)
FGN_DEM	Exogenous	Foreign demand index	Authors' calculations	Weighted index from individual indices associated with partners demand for fuel, textiles-garment and basic metals; weights based on the respective shares on total commodity exports
GB	Endogenous	Budget deficit	Ministry of Finance	Nominal (mln ALL)
GB_GDP_N	Endogenous	Budget deficit to GDP ratio	GB/GDP_N	Ratio
GD	Endogenous	Total debt stock	Ministry of Finance	Nominal (mln ALL)
GD_D	Endogenous	Domestic debt stock	Ministry of Finance	Nominal (mln ALL)
GD_F	Exogenous	Foreign debt stock	Ministry of Finance	Nominal (mln ALL)
GD_GDP_N	Endogenous	Debt to GDP ratio	GD/GDP_N	Ratio
GD_LB	Exogenous	Local government debt stock	Ministry of Finance	Nominal (mln ALL)
GD_NDF	Exogenous	Non-debt deficit financing	Ministry of Finance	Nominal (mln ALL); includes privatization revenues + VAT arrears + others + cash stock changes
GD_NFD	Exogenous	Non-financing debt flow	Ministry of Finance	Nominal (mln ALL)
GDP	Endogenous	Real GDP	INSTAT	Quarterly interpolation; indirect seasonal adjustment from components
GDP_CHIN	Exogenous	Real changes in inventories and statistical discrepancy	INSTAT	Real (mln ALL); quarterly interpolation
GDP_CHIN_N	Exogenous	Nominal changes in inventories and statistical discrepancy	INSTAT	Nominal (mln ALL); quarterly interpolation

GDP_CONGOV	Endogenous	Real public consumption	INSTAT	Real (mln ALL); quarterly interpolation
GDP_CONGOV	Exogenous	Nominal public consumption	INSTAT	Nominal (mln ALL); quarterly interpolation
GDP_CONHH	Endogenous	Real household Consumption	INSTAT	Real (mln ALL quarterly interpolation
GDP_CONHH_N	Endogenous	Nominal household consumption	INSTAT	Nominal (mln ALL); quarterly interpolation
GDP_DI	Endogenous	Real disposable income	GDP_DI = GDP_DI_N / (P_CONHH / 100)	Real (mln ALL); calculated from deflation of nominal disposable income with household consumption deflator index
GDP_DI_N	Endogenous	Nominal disposable income	GDP_N + CAB_REM + CAB_TRANSFOTH - (GR_ TR - GR_NTR - GR_G) + GE_T + (GE_DI - GE_FI)	Nominal (mln ALL); calculated by adding public and private transfers and deducting direct and indirect taxes from nominal GDP
GDP_EXP	Endogenous	Real exports of goods and services	INSTAT	Real (mln ALL); quarterly interpolation
GDP_EXP_N	Endogenous	Nominal exports of goods and services	INSTAT	Nominal (mln ALL); quarterly interpolation
GDP_GFCF	Endogenous	Real total investment	GDP_GFCFP+GDP_GFCFG	Nominal (mln ALL); aggregate of real public and private investment
GDP_GFCF_N	Endogenous	Nominal total investment	GDP_GFCFP_N+GDP_GFCFG_N	Nominal (mln ALL); aggregate of nominal public and private investment
GDP_GFCFG	Endogenous	Real public investment	GDP_GFCFG_N/ (P_GFCFG/100)	Nominal (mln ALL); calculated from deflation of nominal public investment with the respective deflator index
GDP_GFCFG_N	Endogenous	Nominal public investment	Ministry of Finance	Nominal (mln ALL); seasonally adjusted
GDP_GFCFGL_N	Exogenous	Local government investment	Ministry of Finance	Nominal (mln ALL); seasonally adjusted
GDP_GFCFP	Endogenous	Real private investment	INSTAT	Real (mln ALL); quarterly interpolation; seasonally adjusted
GDP_GFCFP_N	Endogenous	Nominal private investment	INSTAT	Nominal (mln ALL); quarterly interpolation; seasonally adjusted
GDP_IMP	Endogenous	Real imports of goods and services	INSTAT	Real (mln ALL);); quarterly interpolation; seasonally adjusted
GDP_IMP_N	Endogenous	Nominal imports of goods and services	INSTAT	Nominal (mln ALL);); quarterly interpolation; seasonally adjusted
GDP_N	Endogenous	Nominal GDP	INSTAT	Nominal (mln ALL); quarterly interpolation; indirect seasonal adjustment from components

GDP_NPISH	Exogenous	Real consumption of Non-profit organizations	INSTAT	Real (mln ALL); quarterly interpolation
GDP_NPISH_N	Exogenous	Nominal consumption of Non-profit organizations	INSTAT	Nominal (mln ALL); quarterly interpolation
GE_CAE	Exogenous	Central government capital expenditure	Ministry of Finance	Nominal (mln ALL); aggregate of monthly statistics
GE_CUE	Endogenous	Central government current expenditure	Ministry of Finance	Nominal (mln ALL); aggregate of monthly statistics
GE_DI	Exogenous	Domestic interest payments	Ministry of Finance	Nominal (mln ALL); aggregate of monthly statistics
GE_FI	Exogenous	Foreign interest payments	Ministry of Finance	Nominal (mln ALL); aggregate of monthly statistics
GE_I	Endogenous	Total interest payments	Ministry of Finance	Nominal (mln ALL); aggregate of monthly statistics
GE_LBE	Exogenous	Local government grant	Ministry of Finance	Nominal (mln ALL); aggregate of monthly statistics
GE_OM	Exogenous	Operational and maintenance expenditure	Ministry of Finance	Nominal (mln ALL); aggregate of monthly statistics
GE_OT	Exogenous	Other transfers	Ministry of Finance	Nominal (mln ALL); aggregate of monthly statistics
GE_PE	Exogenous	Staff expenditure	Ministry of Finance	Nominal (mln ALL); aggregate of monthly statistics
GE_RFC	Exogenous	Reserve fund and contingency	Ministry of Finance	Nominal (mln ALL); aggregate of monthly statistics
GE_T	Exogenous	Public transfers	Ministry of Finance	Nominal (mln ALL); include welfare assistance + unemployment payments + social insurance + health insurance + subsidies + compensation for former estate owners + compensation for former politically persecuted + compensation for families in need aggregate of monthly statistics
GE_TE	Endogenous	Total public expenditure	Ministry of Finance	Nominal (mln ALL); aggregate of monthly statistics
GR_CD	Exogenous	Custom duties	Ministry of Finance	Nominal (mln ALL); aggregate of monthly statistics
GR_EXC	Exogenous	Excise duties	Ministry of Finance	Nominal (mln ALL); aggregate of monthly statistics
GR_G	Exogenous	Grants	Ministry of Finance	Nominal (mln ALL); aggregate of monthly statistics
GR_LT	Exogenous	Local tax revenue	Ministry of Finance	Nominal (mln ALL); aggregate of monthly statistics
GR_NTO	Exogenous	National taxes and others	Ministry of Finance	Nominal (mln ALL); aggregate of monthly statistics
GR_NTR	Exogenous	Non-tax revenue	Ministry of Finance	Nominal (mln ALL); aggregate of monthly statistics
GR_PIT	Exogenous	Personal income tax	Ministry of Finance	Nominal (mln ALL); aggregate of monthly statistics

GR_PT	Exogenous	Profit tax	Ministry of Finance	Nominal (mln ALL); aggregate of monthly statistics
GR_SFR	Exogenous	Special funds' revenue	Ministry of Finance	Nominal (mln ALL); aggregate of monthly statistics
GR_ST	Exogenous	Solidarity tax revenue	Ministry of Finance	Nominal (mln ALL); aggregate of monthly statistics
GR_TR	Endogenous	Total public revenue	Ministry of Finance	Nominal (mln ALL); aggregate of monthly statistics
GR_VAT	Exogenous	Value added tax	Ministry of Finance	Nominal (mln ALL); aggregate of monthly statistics
I_B12	Endogenous	Real 12-month treasury bond rate	I_B12 = I_B12_N - (P_CPI / P_CPI(-4) * 100 - 100)	Real; calculated by deflating the nominal rate with annual inflation rate
I_B12	Exogenous	Nominal 12-month treasury bond rate	Bank of Albania	Nominal (%)
I_REPO	Endogenous	Real base interest rate	I_REPO = I_REPO_N - (P_CPI / P_CPI(-4) * 100 - 100)	Real; calculated by deflating the nominal rate with annual inflation rate
I_REPO_N	Exogenous	Nominal base interest rate	Bank of Albania	Nominal (%)
KOEF_P_CONHH	Exogenous	Adjustment coefficient for household consumption price index	P_CONHH/P_CPI	Applied to capture deviations of the respective index from CPI
L_D	Endogenous	Labor demand; number of employed persons	INSTAT and Bank of Albania	Thousand people
L_S	Exogenous	Labor supply	INSTAT and Bank of Albania	Thousand people
L_UN	Exogenous	Unemployment rate	INSTAT and Bank of Albania	%
LN_S_TFP_HP	Exogenous	Potential total factor productivity	Authors' calculations	HP filter applied on total factor productivity series obtained as residual from production function
P_ABSORP	Exogenous	GDP-EXP aggregate deflator	((GDP_N-EXP_N)/GDP-GDP_EXP)-1)*100	Price index for the domestic output that is not exported
P_ALL_EUR	Endogenous	Nominal ALL-Euro exchange rate	Bank of Albania	Simple average of monthly statistics
P_CONGOV	Exogenous	Public consumption deflator	INSTAT	Index; quarterly interpolation from annual data according to CPI distribution
P_CONHH	Endogenous	Household consumption deflator	INSTAT	Index; quarterly interpolation from annual data according to CPI distribution
P_CPI	Endogenous	Consumer price index	INSTAT	Index; seasonally adjusted
P_EXP	Endogenous	Export price index	INSTAT	Index; quarterly interpolation from annual data
P_EXP_EU19	Exogenous	Euro-area export price index	EUROSTAT	Index

P_EZCPI	Exogenous	Euro-are consumer price index	EUROSTAT	Index
P_EZPPI	Exogenous	Euro-are producer price index	EUROSTAT	Index
P_GDP	Endogenous	GDP deflator index	INSTAT	Index; quarterly data calculated from respective nominal and real data
P_GFCFG	Exogenous	Public investment deflator	Authors' calculation	Index; quarterly data calculated from respective nominal and real data
P_GFCFG	Exogenous	Private investment deflator	Authors' calculation	Index; quarterly data calculated from respective nominal and real data
P_IMP	Endogenous	Import price index	INSTAT	Index; quarterly interpolation from annual data
P_IMP_EU19	Exogenous	Euro-area import price index	EUROSTAT	Index
P_INF	Endogenous	Annualized inflation	INSTAT	%, based on CPI data
P_PPI	Exogenous	Producer price index	INSTAT	Index; extrapolation applied for data prior to 2005
P_PROD	Endogenous	Relative productivity	Authors' calculation	Index; based on relative producer and consumer prices for Euro-area and Albania
P_RER	Endogenous	Real ALL-Euro exchange rate	P_ALL_EUR / (EZCPI/CPI/)	Real; commuted by deflating the nominal data with the relative consumption price index for Euro-area and Albania
P_ULC	Endogenous	Unit labor cost	(L_D * P_W_N * 3) / GDP	Calculated as ratio of employers' compensation over real GDP
P_W	Endogenous	Real average wage	P_W_N / (CPI/100)	ALL; commuted by deflating nominal wage with CPI
P_W_N	Endogenous	Nominal average wage	INSTAT and Bank of Albania	ALL
S_CS	Endogenous	Real capital stock	S_CS = S_CS(-1) * (1 - 0.02) + GDP_GFCF	Determined from an assumption of initial value; adding real investment and allowing for 8% annual depreciation
S_GAP	Endogenous	Output gap	S_GAP = 100 * (GDP / S_GDP - 1)	%; difference between actual and potential real GDP
S_GDP	Endogenous	Potential GDP	EXP(LN_S_TFP_HP + 0.3 * log(S_CS) + 0.7 * log(S_L_S))	Real (mln ALL); output of the production function with optimal factor utilization
S_L_S	Endogenous	Potential labor supply	S_L_S = (1 - S_NAIRU / 100) * L_S	Thousand people; determined by the utilization of labor at the natural rate of unemployment
S_NAIRU	Exogenous	Natural rate of unemployment	Authors' calculation	%, state-space model with Kalman Filter approach

SOME DIFFERENCES IN BEHAVIOR EQUATIONS AND SPECIFIC VARIABLES (IN RED COLOR)

Equations/Variables	MEAM-06	Revised Version
Real household consumption eq.	Real disposable income	Real disposable income; real T-bill 12m rate
Real private investment eq.	Real GDP; real T-bill rate	Real GDP; real T-bill rate
Real exports eq.	Foreign demand (real GDP in European Union); Relative prices= export price index / EU export price	Foreign demand (weighted partners industrial indices associated with Albanian exports) Relative prices = export price / GDP deflator (excl. Export price)
Real imports eq.	Real GDP Relative prices = (EU CPI * ALL/EUR) / AL CPI	Real GDP Relative prices = import price / GDP deflator
Labor Demand eq.	Real GDP; real wage; labor demand dummy	Real GDP; real wage; labor demand dummy; capital productivity
Nominal average wage eq.	Real GDP; CPI; unemployment rate; labor productivity	Real GDP; CPI; unemployment rate; labor productivity
Nominal T-bill rate, 12m eq.	Base interest rate; Central government domestic debt stock	Base interest rate; Central government domestic debt stock
Export deflator eq.	Export prices in foreign currency; ALL/EUR exchange rate	Euro Area import price index; ALL/EUR exchange rate
Import deflator eq.	–	Euro Area export price index; ALL/Euro exchange rate
Real Exchange rate eq.	EU CPI / AL CPI; Int. rate differential	Productivity (relative trad/nontrade prices, domestic vs external); NFA stock / GDP; Gov. balance / GDP.
CPI eq.	Foreign prices * exch. rate; Unit labor cost; Output gap (according to NAWRU); Unempl. rate	Import deflator; Unit labor cost; Output gap (according to NAIRU); Unempl. rate
Nominal GDP	Real GDP inflated by CPI	Individual deflators applied separately on the components; the aggregate calculated from the identity
Capital Stock	Nominal stock deflated with CPI	Direct calculation of real capital stock
Natural rate of unemployment	NAWRU according to Elmeskov (Kota, 2007)	NAIRU from state-space model
Unit labor cost	Nominal compensation over nominal GDP	Nominal compensation over real GDP
Public consumption	Percentage of current expenditure	Determined directly from fiscal statistics

BIBLIOGRAPHY

Çela, E. (2014). Në lidhje me metodologjinë e llogaritjes së indekseve të "Kërkesës së huaj". Banka e Shqipërisë, Departamenti i Kërkimeve.

Çela, E. (2014). PBB-ja, komponentët e shpenzimeve dhe deflatorët: Seritë e reja, thyerja strukturore dhe interpolimi 3-mujor 1996-2012. Buletini i Bankës së Shqipërisë 6 mujori i parë 2014, 148-164.

Çela, E., & Skufi, L. (2014). Natural rate ofe Unemployment - reduced form approach. 8th South-Eastern European Economic Research Workshop. Tirana, Albania.

Dushku, E., Kota, V., & Binaj, G. (2006). Modeli Makroekonometrik i Shqipërisë. Material Diskutimi. Banka e Shqipërisë.

Kota, V. (2007). Metoda alternative të matjes së Produktit Potencial në Shqipëri. Material diskutimi. Banka e Shqipërisë.

Luçi, E., & Vika, I. (19-21 November 2009). The equilibrium real exchange rate of ALL vis-a-vis euro: is it much misaligned? 3rd Annual SEE Economic Research Workshop. Athens, Greece: Bank of Greece and Bank of Albania.

Tanku, A., Dushku, E., & Ceca, K. (2011). Hulumtimi empirik i pasigurisë së parashikimit me simulimin Monte Carlo. Material Diskutimi. Banka e Shqipërisë.

Vika, I., & Abazaj, E. (2014). Vlerësime të konsumit dhe investimeve private në Shqipëri: Si kanë ecur ato? Buletini i Bankës së Shqipërisë 6 mujori i dytë 2013, 147-159.

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