# OPC
## OFICINA DE PRESUPUESTO DEL CONGRESO

GUIDELINES FOR THE PRERATARION OF THE
MACROECONOMIC SCENARIO

Working Paper

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**CONTENTS**

## EXECUTIVE SUMMARY

The purpose of this document is to outline the main methodological aspects and technical tools used for the preparation of the Argentine Congressional Budget Office's (OPC) macroeconomic scenario. From the OPC's point of view, this development is essential because of its role in independent fiscal analysis.

The analysis was carried out at two levels. In the first place, forecasts were evaluated through behavioral equations to explain changes of the main macroeconomic variables, both real and nominal. In the second place, the forecasts derived from these behavioral equations were validated by an adjustment process based on the recent evolution and accounting identities used (from which the projections of the main macroeconomic variables were obtained).

In this regard, the approaches included in this document are not intended to specify a closed macroeconomic model, to investigate the causal processes of the phenomena under study or to provide certainty for future budgetary outcomes. Rather, it seeks to contribute to the analysis of how the Argentine economy and its interaction with the public budget will evolve under a given economic policy.

## 1.    INTRODUCTION

Macroeconomic variables play a fundamental role in the design of budgetary policy, as they are closely linked to the revenue and spending estimates (and financing needs) included in the Budget Bill.

Making short, medium, and long-term projections of significant national macroeconomic variables allows, among other things, producing independent analyses of the impact of these variables on the public sector balance sheet, forecasting their future evolution for multi-year horizons, as well as conducting studies on the intertemporal sustainability of the national public debt.

Therefore, it is necessary to obtain indications on the parameters of macroeconomic behavior that can be used as a reference for the preparation of a platform scenario for the short, medium, and long term, which will allow us to quantify the effects of possible changes in both international variables and economic policy. Likewise, ensuring the consistency of the relations reflected in this platform scenario will guarantee the consistency of the economic projections used in the analyses

The purpose of this document is to describe the main methodological aspects and technical tools for the preparation of the macroeconomic scenario used by the OPC in the report "Revised Estimates - Budget Bill 2020"[1].

These tools are part of the macroeconomic module of the OPC, which purpose is to determine the performance of the economy from a scheme based on the accounting identities of the National Accounts (CCNN)[2], which in turn is complemented with various behavioral equations[3].

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[1] The contribution made by researchers from the Instituto de Economía Política (IIEP), which is part of the *Universidad de Buenos Aires* (UBA) and the *Consejo Nacional de Investigaciones Científicas* (CONICET) was essential.

[2] Although the NNCC system covers the entire economy and guarantees the consistency of the data used as it is an integrated system, it has some limitations in terms of the objectives of a macro consistency scheme, such as, for example, those derived from the omission of information related to the monetary sector. Future developments of this module will try to offer representations that include these aspects.

[3] In this regard, it should be mentioned that extrapolations of statistical regularities observed in certain periods of time, as well as predictions based on theoretical patterns of behavior, have not offered solid guidelines for analysis. This is the result of the significant changes in the configuration of growth trends, the wide cyclical variability and the successive crises followed by radical changes in policies with respect to the previous operating schemes, which characterize Argentina's macroeconomic performance.

3

When considering an economy with a tradition of macroeconomic instability such as Argentina's, there are considerable margins of uncertainty that inevitably have an impact on the preparation of forecasts. Under these conditions, it is worth mentioning that this document is purely methodological in nature and seeks to provide a preliminary version of the general guidelines to be used in the analysis and evaluation of fiscal aggregates in future reports.

Finally, the estimates and projections made by the OPC are under permanent revision. They are prepared under the criteria of flexibility that allow their reformulation and re-estimation according to changes in exogenous variables, as well as in economic policies.

## 2.      MACRO-FISCAL CONSISTENCY SCHEME

A consistency scheme is used to verify compliance with budget constraints for all sectors of an economy. It is not a model per se, but rather a generic verification process on the projections made that can be used as a basis for its preparation[4].

At the macroeconomic level, the main budgetary constraints are those of the real, fiscal, external, and financial sectors. Based on those, a macroeconomic framework is developed with inter-sectoral linkages and a set of forecasts, which will be consistent with each other and with the current policy framework. If there is any inconsistency that the scheme cannot resolve, an *ad-hoc* validation will be used, which requires empirical knowledge of the stylized facts and the recent evolution of the macroeconomic variables involved.

The proposed Macro-Fiscal Consistency Scheme is composed of the macroeconomic module (which includes the real, external, and financial sectors), the fiscal module and the financing module (see Figure 1).

The main macroeconomic variables (growth, inflation, real exchange rate, among others) are obtained from the macroeconomic module using the techniques described in the following section. It includes a series of initial assumptions (in accordance with the "no policy change" criterion) that will govern the entire Macro-Fiscal Consistency Scheme.

The fiscal module studies the historical behavior of fiscal revenues (taxes and Contributions, among others) and primary expenditure (Social benefits, economic services, operating expenses, among others), to identify interactions between these and macroeconomic variables. Projections of the Primary Fiscal Balance are made based on the interaction found[5].

Finally, the financing module includes the financial needs arising from the projected primary fiscal balance and the maturity profile of the outstanding debt. This module considers alternative scenarios and simulates a financing strategy based on an interest rate path consistent with the macroeconomic module, while keeping the scheme coherent.
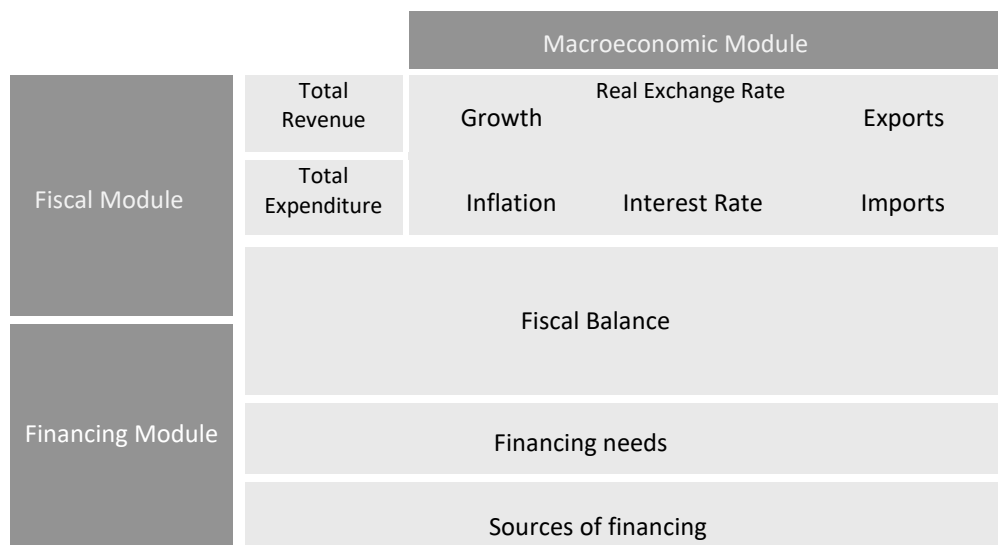
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[4] See Easterly, 1989

[5] The fiscal module follows the methodology for recording the Savings-Investment-Financing Account.

The Macro-Fiscal Consistency Scheme can be thought of as an intermediate approach between a general equilibrium model and a partial econometric model.

**FIGURE 1**

**MACRO-FISCAL CONSISTENCY SCHEME**

| | | Macroeconomic Module | | |
|---|---|---|---|---|
| **Fiscal Module** | Total Revenue | Growth | Real Exchange Rate | Exports |
| | Total Expenditure | Inflation | Interest Rate | Imports |
| | | Fiscal Balance | | |
| **Financing Module** | | Financing needs | | |
| | | Sources of financing | | |

**SOURCE:** OPC

### 3. MACROECONOMIC MODULE

The macroeconomic module, with which the main variables of the real, external, and financial sectors were projected, was developed based on the accounting identities of the National Accounts, together with behavioral equations from which projections were made for part of the components of Aggregate Demand, as well as price dynamics.

The behavioral equations respond to various analytical and methodological approaches and are the best result of a series of specifications based on the search for statistical regularities. The results obtained are validated and adjusted based on recent performance, and the projections of the main macroeconomic variables are obtained in accordance with the accounting identities used.

This operational method allows us to prepare forecasts that include the necessary complexity to estimate the macroeconomic performance of our country. The exogenous variables of this module are determined considering the prevailing economic policy at any given time, following the "no policy change" criterion.

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"No Policy Change"

The OPC adopts this criterion to determine the exogenous variables of the consistency scheme. They will be in accordance with the economic policies in force at the time the projections are made if they remain unchanged.

Thus, the impact of future changes in current policies can be assessed based on this baseline scenario. This criterion is in line with the practice used by other Congressional Budget Offices in the rest of the world for their medium and long-term projections (i.e., CBO of the United States[6] and ORB of the United Kingdom[7]).

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[6] See Arnold, 2018 "*How CBO Produces Its 10-Year Economic Forecast*"- https://www.cbo.gov/
[7] See Chapter of "*Economic and Fiscal Outlook, 2019*"- https://obr.uk/.

As an example, the interaction between the identity used for the estimation of GDP, the result of the specification used for the estimation of exports and the exogenous variables used is described. The identity equation of Aggregate Demand is used as a starting point:

$$1)\quad PIB_t = C_t + G_t + IBIF_t + X_t - M_t$$

Where

PBI =Gross Domestic Product

G= Government Spending

X = Exports

C = Consumer Spending

IBIF = Gross Domestic Fixed Investment

M = Imports

The projection of the components of Aggregate Demand and GDP is then determined based on econometric exercises (with the specifications detailed in the next section). For exports, the variable to be considered is the one that arises from the econometric estimation, measured in logarithms, which links the exported quantity of goods ($Xt$) with the growth of trading partners ($PIBt$, exogenous variable) and the real exchange rate ($TCRt$), obtained through another behavioral equation.

$$2)\quad lX_t = \alpha_0 + \alpha_1 lPIB^*_t + \alpha_2 lTCR_t + u_t$$

Where:

PBI* = Trading Partners' Gross Domestic Product

TCR = Multilateral Real Exchange Rate

In this line, estimates are made for the other relevant variables based on the behavioral equations that will be specified in the following section.

The main sources of information used are the National Institute of Statistics and Census (INDEC) and statistical data from the Central Bank of Argentina (BCRA). The information has been supplemented with data from the Ministry of Agriculture, the Ministry of Labor, Employment and Social Security and the International Monetary Fund.

## BEHAVIORAL EQUATIONS

To provide explanations for the changes of the main macroeconomic variables, both equations (real and nominal) were used to determine the level of activity, the quantity of exported goods, consumption, investment, inflation, and the real exchange

rate.

This selection of variables follows the basic identity of the National Accounts, both nominal and real.

The equations below take variables changes in logarithms ($l$) and in differences if they are prefixed by $\Delta$ for the definition of growth rates, also stating the number for the respective lags (i.e., $\Delta 4$ refers to the interannual variation when quarterly series is used)

**Level of Activity**

The model for estimating the level of activity studies the evolution of the GDP growth rate (GDP in constant values). A distributed lag model with a quarterly structure is used. The number of optimal lags was determined based on the Akaike information criterion of the conditional model. The explanatory variables are the GDP growth rate ($PIB$), a set of controls including the quantities exported ($X$), the country risk ($EMBI$) and the real exchange rate[8] ($TCR$), a quarterly binary variable ($i=1,2,3,4$) to deal with the seasonality of GDP ($TRIM_{it}$) and a random component ($u_t$). The explained variable is determined in annualized growth rates.

Various specifications of GDP determinants were studied. The definition of the model considers the external influences on growth, in other words, the country's economic structure is limited by external constraints (the availability of foreign currency from commercial and financial channels), with the equation to be estimated being:

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[8] The BCRA's real exchange rate specification is used, which uses the "chained geometric Laspeyres" index according to the following equation:

$$I_t = I_{t-1} * \prod (e_{j,t}/e_{j,t-1})^{\varpi_{j,m-1}}$$

Where:
$e_{j,t}\ E_{j,t}\ P_{j,t}/P_t$ is the real exchange rate with country "j" on the day "t"
$\varpi_{j,m-1}$ = is the share of country "j" in Argentina's international trade with its main partners (excluding primary products, fuels and energy), in the moving average of the last 12 months of the month prior to that of day "t".
$E_{j,t}$ = is the nominal exchange rate of the peso with respect to the currency of country "j" on day "t". It is expressed in units of national currency per unit of currency, so a rise indicates depreciation.
$P_t$ = is the reference Consumer Price Index (CPI) for Argentina for day "t"
$P_{j,t}$ = is the IPC of country "j" for day "t".

$$\Delta lPIB_t = \alpha_0 + \Sigma_{i=1}^{2} \alpha_i lPIB_{t-i} + \Sigma_{i=1}^{2} \beta_i lX_{t-i} + \Sigma_{i=1}^{3} \delta_i TRIM_{it} + u_t$$

The Model approaches require the formulation of hypotheses for the behavior of explanatory variables. The model is estimated on a quarterly basis data since 2006, whose coefficients are recalibrated according to the publication calendar of official statistics for the variables involved. The exercises carried out have a high level of adjustment and an absence of correlation in the residuals.

### Domestic Expenditure

The consumer spending and gross fixed domestic investment models were developed through the *Autometrics*[9] automatic selection methodology, which allows searching for the main variables of a model from a wide set of information without restrictions, considering the appropriate lag structure, the identification of structural breaks and external values. The procedure emphasizes the importance of avoiding bias by omitting possible determinants controlled by their collinearities, using a "general to particular" approach.

### Consumer Spending

The model below fulfills the effects of projections conditioned to the behavior of the level of activity. The estimates use quarterly data the from 1995 to date. The results of the cointegration analysis by systems show that consumer spending adjusts to the income level, allowing the validation of a uni-equational estimate of this component and the projection of consumer spending based on GDP. The variables considered are Consumer Spending ($CP$), Gross Domestic Product($PIB$), real wage ($SR$)[10], and a random component ($ut$)

$$\Delta 4lCP = \alpha 0 + \alpha 1 lCPt - 4 + \alpha 3 lPIBt - 4 + \alpha 4 \Delta 4 lPIBt + \alpha 5 \Delta lCPt - 1 + \alpha 6 lSRt - 1 + S + ut$$

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**Gross Fixed Domestic Investment**

Following a methodology in line with the consumer spending model, investment is defined as total gross fixed capital formation, the results of which can be seen in the following equation. The variables included are Gross Fixed Capital Formation ($FBKF$), Terms of Trade ($ToT$), deposit interest rate ($Tdep$), real wage ($SR$), real bilateral exchange rate with U.S. dollar and a random component ($ut$).

$$\Delta_4 lFBKF = \alpha_0 + \alpha_1 \Delta_4 lPIB_t + lFBKF_{t-4} + \alpha_3 lToT + \alpha_4 l(1 + \overset{.}{T}_{dep})_{t-1} + \alpha_5 SR_{t-1}$$
$$+ \alpha_6 lPIB_{t-4} + \alpha_7 lTCRB_{t-1} + \alpha_1 \Delta_3 lFBKF_{t-1} + S + u_t$$

The model used data since 1996 with quarterly periodicity, passes the diagnostic tests, with a slight heteroscedasticity that does not change the main results according to the robust ES.

**Foreign Trade**

The estimates of exported quantities ($X$) are composed of the following explanatory variables: Gross Domestic Product ($PIB$), the weighted average GDP of the main export destinations of Argentina ($PIB*$), Real Exchange Rate ($TCR$), production of the main crops ($Cosecha$), and a random component ($ut$).

The equations are estimated using an autoregressive distributed lag model (ARDL). For imports, the significant variables were Argentina's GDP and the Real Exchange Rate, while for the quantities exported were the GDP of the rest of the world and the Real Exchange Rate. Exports of primary products ($Xpp$) are explained by harvest, exports of Manufactures of Agricultural Origin ($Xmoa$) by harvest and Real Exchange Rate, exports of Manufactures of Industrial Origin ($Xmoi$) by GDP of the rest of the world and the Real Exchange Rate; Fuels and Energy ($Xcye$) by Argentina's GDP and the Real Exchange Rate. The equations are shown below:

$$lX_t = \alpha_0 + \alpha_1 lPIB_t^* + \alpha_2 lTCR_t + u_t$$

$$lXpp_t = \alpha_3 + \alpha_4 lCosecha_t + u_t$$

$$lXmoa_t = \alpha_5 + \alpha_6 lTCR_t + \alpha_7 lCosecha_t + u_t$$

$$lXmoi_t = \alpha_8 + \alpha_9 lPIB^*_t + \alpha_{10} lTCR_t + u_t$$

$$lXcye_t = \alpha_{11} + \alpha_{12} lPIB^*_t + \alpha_{13} lTCR_t + u_t$$

Following the same methodology, the model for estimates of total imported quantities is determined below, as well as the equations for the components according to economic use (capital goods ($Mbsk$), intermediate goods ($Mbsi$), fuels and lubricants ($Mcyl$), parts and accessories for capital goods ($Mpya$), consumer goods ($Mbsc$), and passenger motor vehicles ($Mva$). These variables depend on the Argentine Gross Domestic Product ($PIB$), the Real Exchange Rate and a random component ($ut$), two variables used in the estimate of exported quantities. The equations to be considered are the following:

$$lM_t = \alpha_0 + \alpha_1 lPIB_t + \alpha_2 lTC_t + u_t$$

$$lMbsk_t = \alpha_3 + \alpha_4 lPIB_t + u_t$$

$$lMbsi_t = \alpha_5 + \alpha_6 lPIB_t + \alpha_7 lTC_t + u_t$$

$$lMcyl_t = \alpha_8 + \alpha_9 lPIB_t + \alpha_{10} lTC_t + u_t$$

$$lMpya_t = \alpha_{11} + \alpha_{12} lPIB_t + \alpha_{13} lTC_t + u_t$$

$$lMbsc_t = \alpha_{14} + \alpha_{15} lPIB_t + \alpha_{16} lTC_t + u_t$$

$$lMva_t = \alpha_{17} + \alpha_{18} lPIB_t + \alpha_{19} lTC_t + u_t$$

Estimates for the quantities imported and exported were made with data from 1997 on a quarterly basis. In all equations good adjustment criteria are achieved and the out-of-sample projections are satisfactory.

**Real Exchange Rate**

The projection of the Real Exchange Rate is based on a medium-term relations formulation, where the explanatory variables considered are: an autoregressive term ($TCR_{t-1}$), the net external assets of the private sector ($AENP$) and the government ($AENG$), the performance of the trade balance ($BC$), the foreign exchange intervention of the Central Bank identified through the variation of international reserves ($var\_res$), and a random component. This scheme is based on the theory of international financial flows as determinants of a country's

external constraint[11]. The statistical analyses take quarterly values since 2005.

$$TCR_t = \alpha_0 + \alpha_1 lAENP_{t-1} + \alpha_2 \Delta lAENG_{t-1} + \alpha_3 \Delta TCR_{t-1} + \alpha_4 BC_{t-1} + \alpha_5 var\_res_{t-1} + u_t$$

**Inflation**

The model for determining the variation of the consumer price index depends on a lagged component ($P_{t-1}$,), the nominal exchange rate ($TCN$), regulated prices ($Preg$), the wage index ($lSal$), and a random component ($ut$), through an ordinary least squares estimation method. The exercise equation is as follows:

$$\Delta lP_t = \alpha_0 + \alpha_1 \Delta lP_{t-1} + \alpha_2 \Delta lPreg_t + \alpha_3 \Delta lSal_t + \alpha_4 \Delta lTCN_t + u_t$$

The chosen specification arises from a previous discarding of a specification with purely monetary explanatory variables, since they did not give good results, and from a subsequent estimation with significant variables in price formation, taking those that turned out to be important to represent short-term price variations.

As previously mentioned, the equations take transformations of the variables in logarithms and in differences if they are prefixed by $\Delta$ for the determination of growth rates. The estimates do not represent significant effects in the identification of non-linearities in the interaction between variables.

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[11] See Gourinchas And Rey, 2007

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