upB ufficio parlamentare di bilancio

Work Plan of the Parliamentary Budget Office

Year 2020

(as required by Law 243 of 24 December 2012, Article 18, paragraph 4)

The objective of the Parliamentary Budget Office (PBO) is to contribute to the sustainability of Italy's public finances, ensuring that the public accounts are transparent at the service of Parliament and the general public. As specified in the law establishing the PBO (Law 243/2012, pursuant to the new Article 81 of the Constitution), the PBO assesses macroeconomic and public finance forecasts; quantifies the macroeconomic effects and the impact on the public finances of the most important legislative measures; analyses public finance trends, including by sub-sector, and verifies the long-term sustainability of the public finances; assesses compliance with fiscal rules and monitors the activation and use of a number of mechanisms envisaged in the framework of European rules (specifically, the corrective mechanism and authorisation in the case of exceptional events). Finally, the PBO prepares analyses and reports, also at the request of the parliamentary committees responsible for public finance matters.

The end of last April marked the end of the six-year term of the first PBO Board, which had been appointed on 30 April 2014 by the Presidents of the Senate and the Chamber of Deputies. This document is therefore being presented at a sensitive moment, with the current Board continuing to operate pending the completion of the procedure for the appointment of a new Board.

Accordingly, it would not be appropriate to present a programme of activities to be carried out in the next twelve months as was done in previous years. Instead, it was decided to take the opportunity envisaged in the law establishing the PBO to conduct a survey at the end of the term of the work performed in the development of models and tools for economic forecasting and analysis, work that represented a significant portion of the PBO's efforts in its first six years of life. The set of these tools, together with the human capital embodied in the personnel of the Office, represents the endowment being left to the next Board in order to ensure the continuity of the PBO's analytical capabilities in the coming years.

FORECASTING AND ECONOMIC ANALYSIS MODELS AND TOOLS DEVELOPED BY THE PBO (2014-2020)

We can distinguish three groups of analytical tools. The first includes macroeconomic forecasting tools (the Istat-PBO forecasting model, short-term forecasting tools, models for estimating potential output and other macroeconomic models). The second group includes tools for assessing the public finances (tools for forecasting and monitoring the public accounts, those for analysing debt sustainability, the framework for assessing compliance with fiscal rules). The third group includes tools for evaluating public policies (the micro-simulation model for corporate taxation, the micro-simulation models of taxes and subsidies for households, the micro-simulation model for forecasting pension expenditure in the medium-long term).

1 Macroeconomic forecasting tools

The PBO's medium-term forecasts are produced using mainly the annual model (MeMo-It). This model represents the framework within which the results of a number of additional tools are integrated to enable an assessment of short-term developments, international dynamics and the growth potential of the economy. A brief description of individual models is provided below.

1.1 The Istat-PBO forecasting model

The Istat model represents the fulcrum of the medium-term macroeconomic forecast, as it is the main quantitative tool both for the endorsement exercises for the MEF macroeconomic forecasts and for the forecast scenarios published twice a year in the PBO's Report on Recent Economic Developments.

MeMo-It was originally provided by Italy's National Institute of Statistics (Istat) under a framework agreement when the Parliamentary Budget Office began its work. During its use, the PBO has modified the original specification, not only in the individual behavioural equations but also in the structure of the links between certain blocks of equations. These changes, performed independently of Istat, are part of a programme - still under way - to adapt the MeMo-It model to the specific requirements of the PBO. On the one hand, the development work has involved the institutional sectors, with the specification of a block for the business sector (financial and non-financial firms). On the other hand, as a further extension, the supply-side block was supplemented with equations and identities that form a short-term block, in addition to the long-term supply segment (potential output) already present in the MeMo-It model. Finally, the changes in the MeMo-It model introduced by the PBO have included the development of a number of simulation programmes to achieve Tinbergen targeting. These algorithms are helpful in both

accelerating the alignment of the main endogenous variables following the updating of the national accounts and in optimising the acquisition of information outside the model on the public finance scenario to be incorporated into the macroeconomic forecast.

The MeMo-It model is constructed using a neo-Keynesian approach. In the short term the economy is driven by demand conditions, while in the long term gross output is determined by the supply side, and the system converges towards an equilibrium output level. In the short term, aggregate demand and aggregate supply are mainly balanced through the model's nominal variables (prices, wages), which move in response to differences between actual and potential output (the output gap).

The theoretical foundations of the MeMo-It model are discussed in Bacchini et al. (2013).[1] The model is constructed as a system of simultaneous equations and, in the specification of the model, the so-called Cowles Commission approach is extended to recent developments in the econometric literature. Consideration is given to the integration and cointegration properties of time series through a dynamic representation of equations with error correction and the assessment of weak exogeneity for sets of variables. In the modified version used by the PBO, the model consists of more than 70 stochastic equations and 120 identities.

1.1.1 Supply

The supply block is essential in determining the features of the model. In the PBO formulation, the model distinguishes between long- and short-term supply functions. In the long term, supply includes a set of equations and identities to estimate a production function for goods and services that is consistent with price stability (potential output). The specification follows the approach delineated by the European Commission,[2] in which potential output is represented through a Cobb-Douglas production function with constant returns to scale with an assumption of technical change independent of the factors of production. In the short term, the total supply of goods and services is modelled as the sum of real value added at factor costs in the market sector and the value added of the public sector. Market sector supply is modelled as a function of labour inputs, the capital stock and total factor productivity. The level of public-sector output is given by the general government account.

The output price formation process (value added deflator at factor costs) is modelled with a specification analogous to a neo-Keynesian Phillips curve. External supply shocks enter

[1] Bacchini et al. (2013), "Building the core of the Istat system of models for forecasting the Italian economy: MeMo-It", Rivista di Statistica Ufficiale, Vol. 15 No. 1.

[2] Havik, K., Mc Morrow, K., Orlandi, F., Planas, C., Raciborski R., Roeger, W., Rossi A., Thum-Thysen, A. and Vandermeulen, V. (2014), "The Production Function Methodology for Calculating Potential Growth Rates & Output Gaps", European Economy. Economic Papers, No. 535.

through import prices, while internal productivity shocks are measured through unit labour costs.

As regards the demand for the factors of production, investment spending considers three types of capital good in the business sector: machinery and equipment, non-residential buildings (both representing non-ICT assets), and information and communication technologies (ICT), and is specified taking account of the heterogeneity of capital assets. The formulation of the demand for labour is obtained from the optimality conditions in profit maximisation.

Developments in employment are measured in terms of standard labour units. The labour supply is specified through equations of the participation rate differentiated by gender to take account of the divergent behaviour of that variable in the long term (declining for men, rising for women). The unemployment rate is specified as an identity from the estimates for resident employment and the labour force.

1.1.2 Demand

The demand blocks in the MeMo-It model seek to describe the behaviour of economic agents associated with the main aggregates of gross output on the expenditure side: households' consumption decisions, firms' investment decisions, the role of the public sector, and residents' transactions in goods and services with the rest of the world. These behaviours are also the result of decisions concerning other variables that are assessed in the context of the institutional sectors. For each resident institutional sector, we have assessments of value added, compensation of employees, gross operating income, disposable income, gross saving and net lending/borrowing.

The households block includes equations and identities that model private consumption and developments in disposable income and its components, which refer to the household sector account. Aggregate spending decisions for goods and services are taken in accordance with the permanent income hypothesis and are specified as a function of real disposable income, the medium-term interest rate and the stock of households' financial and non-financial wealth.

Firms' decisions are incorporated in the investment functions, whose specifications (together with those of the corresponding deflators and the functions for the user cost of capital) contain variables drawn from the structure of the institutional sector accounts. This structure was further developed by the PBO, for example by representing the gross operating margins of the private sector by taking account of the effective average rate of corporate income tax.

The public sector block reproduces the general government consolidated account, with the main variables on the revenue and expenditure sides, which are mainly defined using

identities consistent with the national accounts definitions and, for a small number of aggregates, using stochastic relationships. The model allows the activation of transmission channels in the form of interactions among the economic policy instruments available to government and the behavioural functions of other economic agents. Fiscal policy instruments, which correspond to exogenous variables in the model, are largely defined on the revenue side in the form of average effective (or implicit) rates, while on the expenditure side the variables are represented by aggregates such as intermediate consumption, gross fixed capital formation and social security benefits.

In its use by the PBO, the public sector block in the MeMo-It model reflects a synthesis of the multiple analyses, checks and statistical assessments at the basis of the estimation of a more disaggregated account than the general government consolidated account, conducted by the Public Finance (PFD) and Sectoral Analysis (SAD) departments of the PBO. These departments produce more detailed forecasts of the individual revenue and expenditure components of the general government consolidated account, basing their analysis on historical trends, in-year monitoring, an initial macroeconomic forecast and the quantification of the effects of budget adjustment measures. These assessments are then incorporated in the model through the calibration of the fiscal policy instruments. This involves revisions of the initial macroeconomic projection, which can lead to subsequent adjustments of the public finance scenario in order to ensure consistency between the macroeconomic scenario and the consolidated account over the forecasting horizon.

The foreign sector block registers transactions between the Italian economy and the rest of the world. Real exports of goods and services are obtained from a behavioural equation that establishes a relationship between world demand and the effective real exchange rate. Imports are divided into non-energy goods, energy goods and services. Each aggregate in volume terms is specified as a function of final demand and the ratio between the corresponding import deflator and the domestic demand deflator. The balance of trade in goods and services contributes to the balance of transactions between the Italian economy and the rest of the world, which also includes the balance of primary incomes (aggregate of the flow of compensation of employees and property income) and the balance of current transfers and the capital account.

1.2 Short-term forecasting tools

The PBO's forecasting process is supplemented by a varied series of econometric models, mainly infra-annual in frequency, which use monthly and quarterly economic data, or even mixed frequency data using the MIDAS method[3], hard data (time series from Istat,

[3] Frale, C., Marcellino, M., Mazzi, G. and T. Proietti (2011), "EUROMIND: a monthly indicator of the euro area economic conditions", Journal of the Royal Statistical Society, Series A, Vol. 174. Frale, C. and Monteforte, L. (2011), "FaMIDAS: A Mixed Frequency Factor Model with MIDAS Structure", Temi di discussione (Economic working papers), Bank of Italy, No. 788 .

Eurostat, etc.) and soft data (qualitative indicators obtained from business and household surveys, electricity consumption, Google trends data, goods traffic). Short-term models are used to complete the information on the economic situation for the current year, so as to bridge the lag with which economic data is published and incorporate the judgemental assessment of the PBO economists.

The PBO uses a variety of short-term forecasting models for GDP and its components (both on the demand side and for the sectors of economic activity), which are constrained on the basis of the national accounts identifies, so that the GDP projection is consistent with that for the individual components, while ensuring the chain-linking of real variables.[4] Five different models are currently used, two for direct estimation of GDP and three indirect estimations obtained by aggregating the components of demand (consumption, investment, imports and exports) or sectors of economic activity (agriculture, industry excluding construction, construction, services). The short-term forecast of GDP is the average of the five forecasts.

The forecasting of short-term developments in GDP uses a model for forecasting industrial production based on a broad set of hard and soft monthly indicators, using the methodology proposed in Bańbura et al. (2016) and Costantini and Pappalardo (2010).[5]

To obtain forecasts based on economic developments over a longer time horizon, a quarterly factorial model is also used, which includes information from a substantial number of real and nominal economic indicators. It produces a forecast for GDP, its components and inflation. The model is based on the work of Luciani and Monteforte (2013).[6]

Targeted short-term indicators have also been developed for certain specific sectors or economic phenomena. In past years, two new tools were introduced: the index of uncertainty among businesses and consumers, which is based on information collected with Istat surveys and the diffusion index of sectoral growth for the manufacturing sector, which makes it possible to identify the intensity of fluctuations in the business cycle. In 2019, as part of a framework agreement between the National Statistical Institute and the PBO, a joint project was launched to produce a credit rationing indicator for the Italian economy based

[4] Five different models are currently used, two for direct estimation of GDP and three indirect estimations obtained by aggregating the components of demand (consumption, investment, imports and exports) or sectors of economic activity (agriculture, industry excluding construction, construction, services). The short-term forecast of GDP is the average of the five forecasts, or the median in the case of unlikely extreme values.

[5] Bańbura, M., Giannone, D. and M. Lenza (2015), "Conditional forecasts and scenario analysis with vector autoregressions for large cross-sections", International Journal of Forecasting, Vol. 31 N. 3. Costantini, M. and C. Pappalardo (2010), "A hierarchical procedure for the combination of forecasts", International Journal of Forecasting, Vol. 26 No. 4.

[6] Luciani, M. and L. Monteforte (2013), "Uncertainty and heterogeneity in factor models forecasting", Temi di discussione (Economic working papers) 930, Bank of Italy, Economic Research and International Relations Area.

on business surveys.[7] The development of this experimental statistic will lead to its regular publication by Istat.

1.3 Models for estimating potential output

The PBO also uses various quantitative tools to estimate potential GDP and the output gap, variables necessary for the calculation of structural budget balances. The PBO had initially used the model of the European Commission, based on the methodology agreed between the Member States within the Output Gap Working Group.[8] Subsequently, a long-term project was carried out to give the PBO its own quantitative tool for estimating potential output and the output gap. The analyses involved the implementation of the most widely accredited methods in the literature. The results of these studies ruled out the possibility of finding a single model with general characteristics superior to all the others from a statistical and econometric point of view. Accordingly, our approach has been based on a number of models, adopting different assumptions and specifications. Multiple tools enable economic interpretation in the light of various theories and are also useful in the construction of uncertainty metrics, similar to the macroeconomic scenarios formulated by the PBO panel of forecasters on the occasion of the endorsement exercise for the macroeconomic scenarios produced by the Ministry for the Economy and Finance (MEF). The econometric specifications adopted are parsimonious, and the estimation techniques do not require particular restrictions on the parameters. The proposed models are characterised by the low pro-cyclicality of the estimates, which also explains their stability with respect to preliminary data. The output gap measures obtained are consistent with economic theory, as they allow inflation to be forecast within a limited error range. The estimates and forecasts of the output gap recently performed by other organisations tend to lie within the confidence interval calculated on the basis of the models. The new method was used during the hearings on the MEF's policy documents to evaluate the Government's estimates of the output gap. The project has been documented in a working paper,[9] which has also been presented at a number of international conferences;[10] the English version has been submitted to an international scientific journal for publication.

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[7] The indicator is based on the methodology set out in Girardi A. e M. Ventura, "Measuring Credit Crunch in Italy: Evidence from a Survey-based Indicator", publication pending – available online from 25 April 2019, Annals of Operations Research, doi: 10.1007/s10479-019- 03238-7.

[8] Havik K., Mc Morrow K., Orlandi F., Planas C., Raciborski R., Roeger W., Rossi A., Thum-Thysen A. and V. Vandermeulen (2014), op. cit.

[9] Proietti T, Fioramanti M., Frale C. and Monteforte L. (2020), " Un approccio sistemico per la stima dell'output gap dell'economia italiana", Nota di lavoro UPB no. 1/2020 (in Italian)**.**

[10] *Workshop on Fiscal Policy*, Lisbon, 22 November 2019 and CIRET *Workshop on* "The use of economic tendency surveys to assess potential growth and the position of economies in the business cycle", Boulogne-Billancourt (Paris) 13 14 November 2019.

1.4 Other econometric models

Another tool used by the PBO for forecasting the macroeconomic scenario is an international multi-country model.[11] The model is mainly used to construct the assumptions for the main exogenous international variables (international prices, exchange rates, interest rates, world trade) which are fed into the PBO forecast for Italy using the Istat MeMo-It model. Alternatively, the multi-country model is employed by the PBO to simulate the repercussions of international shocks on the basis of the interrelationships that characterise the model.

The macroeconomic modelling used by the PBO also includes the QUEST III with R&D model. This is the version of the dynamic stochastic general equilibrium model (DSGE) that the European Commission provides upon request to the economic ministries and fiscal councils of the Member States.[12] The QUEST models made available to the Member States are dynamic general equilibrium models with three regions (the economy of a country, the rest of the euro area and the rest of the world). The version of QUEST shared with the Member States has semi-endogenous growth and an extension to model the research and development sector. QUEST was developed in particular in order to analyse the impact of public finance reforms (for example, tax reforms). As for the future uses of the QUEST model, the PBO is pursuing a line of development that should enable a joint use of QUEST with the household microsimulation model used by the PBO. This analytical effort seeks to evaluate the effects of a tax reform or other public finance measures, while also considering the behavioural and general equilibrium effects (dynamic scoring).[13]

[11] For more information on the model, see: www.oxfordeconomics.com.

[12] For more on the QUEST III R&D model provided to the Member States, see the macroeconomic models website of the European Commission (https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/economic-research/macroeconomic-models_en) and the bibliography given there. https://ec.europa.eu/economy_finance/publications/pages/publication_summary16459_en.htm.

[13] For more on the use of QUEST III R&D by the European Commission together with the EUROMOD microsimulation model, see: https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/dynamic-scoring-tax-reforms-european-union.

2 Tools for assessing the public finances

2.1 Tools for forecasting the public accounts

As part of its activities, the PBO formulates public finance forecasts (three-year horizon), both trend and policy (i.e. inclusive of the effects of budget measures). The forecasts are made using an institutional accounting scheme that enables the construction of the consolidated general government revenue and expenditure account, defined in accordance with the accounting rules set out in the European System of Accounts (ESA 2010). These forecasts are used for the public finance block of the PBO's macroeconometric model.

The forecast for general government revenues, and in particular that for tax revenue (including social contributions), is essentially based on developments in the monthly cash and accrual figures and in the proxies for the different tax bases, which can mainly be drawn from the macroeconometric model (see section 2.1.1). For revenues other than tax revenue, extrapolations of the individual items are performed, taking due account of specific institutional information.

The forecast for general government expenditures is structured into a number of categories. More specifically, individual models are used to forecast interest expenditure (see section 2.1.2), compensation of employees (section 2.1.3) and pension expenditure (section 2.1.4).

The forecasts for other expenditure items are based on specific procedures. For intermediate consumption, the forecast involves extrapolation of historical data, taking account of budgetary measures and adopting a sectoral breakdown. A substantial part of this aggregate is made up of purchases in the healthcare sector, characterised by especially rapid expenditure growth. The calculations for health expenditure forecasts are performed using a set of linked spreadsheets (see section 2.1.5). For social benefits other than pensions, the forecast uses historical trends, the appropriations made and developments in relevant variables from the macroeconomic model. For other residual current expenditure, extrapolations are performed for the individual items, taking account of specific institutional information. Looking at capital expenditure, essentially consisting of investments and investment grants, extrapolations are performed on the basis of past trends, evaluating the actual expenditure implementation coefficients with respect to the appropriations indicated in official sources.

The variables are also monitored during the year, examining monthly or quarterly financial, administrative and statistical data. For monitoring purposes, the PBO has a specific database (see section 2.2) and an automated cataloguing and reconstruction process for the financial effects by individual budget item of legislative measures (section 2.3). Monitoring also extends to developments in the general government borrowing

requirement as reported by the Bank of Italy and in the quarterly general government accounts based on Istat data.

With regard to local government finances, the PBO has a method for analysing the redistributive effects of the equalisation mechanism for funding the municipalities, which replicates the operation of the equalisation fund, based on the difference between fiscal capacity and standard funding requirements, using two databases: 1) the estimated standard funding requirements of the basic functions of the municipalities, which are formulated by SOSE and are available on Opencivitas.it, occasionally supplemented by data specifically provided by SOSE for specific needs; and 2) data on fiscal capacity, provided by the Revenue Agency. This method has been used to illustrate the structure of the equalisation mechanism and its redistributive effects and the effects of methodological and technical innovations introduced over the years.

2.1.1 Forecasting tax revenue

Direct, indirect and capital account tax revenues are forecast by the PBO using a highly detailed scheme that can produce an estimate for about 100 individual taxes (those reported in national accounts published by Istat), using information from various databases linked electronically. In particular, these include: the time series of taxes (annual data from the state budget, from the Department of Finance of the Ministry for the Economy and Finance, and the national accounts produced by Istat); data from interim monitoring (monthly cash and accrual data from the State budget, monthly data on revenue payments indicated in tax form F24 provided by the Department of Finance and quarterly accrual basis data from Istat), the financial effects of the budget measures for the current year and previous years (calculated using the financial annexes to the individual legislative measures) and economic variables drawn from the macroeconometric model. A special procedure has been created for forecasting self-reported tax revenue (IRPEF, IRES and IRAP), which also takes account of the mechanism for the payment of balances and payments on account of the individual taxes.

More specifically, the procedure used for the forecasts links a number of electronic spreadsheets by applying the rates of change in the proxies for the taxable incomes (drawn from the macroeconometric model: real and nominal GDP, value added, inflation, oil prices, household consumption, gross wages for the entire economy, self-employment income, gross operating income of producer households) to the initial data (representing the most recent historical data), taking account of both the historically observed values for tax elasticity and the effects of the (cumulative) budget packages in the individual years.

2.1.2 The model for analysing and forecasting interest expenditure

The PBO model for the analysis and forecasting of interest expenditure on public debt[14] is used to evaluate the short- and medium-term impact of developments in interest rates on expenditure for interest on domestic government securities as well as to perform simulations of debt management policy.

The model is divided into two modules. The first module for analysis of issuance and short-term monitoring reconstructs developments in the stock of outstanding securities issued by the Treasury Department and calculates the related interest expenditure. The second module simulates an issuance policy on the basis of refinancing needs to extrapolate the stock of securities over the time horizon of the Government's policy documents and estimates the related interest expenditure on the basis of the forecast scenario for the yield curve for government securities.

The model also enables the performance of sensitivity analyses as a function of scenario variables, such as, for example, estimating what the past structure of the stock of public debt and interest expenditure would have been under different assumptions concerning the levels and dynamics of their determinants (interest rates, borrowing requirement, maturity of securities).

The information base behind the model is published on the PBO website, with an interactive dashboard[15] providing key information on the evolution of the debt represented by domestic government securities (issues, redemptions and net issues) and the associated interest expenditure, as well as the distributions of selected indicators (average rates, residual maturity).

Future developments of the model concern the definition of alternative issuance policies that jointly take account of objectives for the average time to maturity of the debt and for interest spending. Finally, the model will be supplemented by the estimation of the other components that contribute to government interest expenditure as a whole in addition to that on domestic government securities.

2.1.3 The model for forecasting compensation of employees

Compensation of employees in general government is forecast using an institutional model that estimates the wage bill and social security contributions separately, employing both national accounts data from Istat and the data contained in the annual accounts of the Office of the State Accountant General, as well as a database that reconstructs and

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[14] For a complete description of the model, see *Ufficio parlamentare di bilancio (2017), "Il modello UPB di analisi e previsione della spesa per interessi", Working Paper no. 3/2017, October (summary in English: The PBO analytical and forecasting model for interest expenditure).*

[15] See http://www.upbilancio.it/base-dati-dei-titoli-di-stato/.

organises the regulations governing staff turnover. The wage bill is broken down into per capita salaries and the number of employees. With regard to employment dynamics, cessation rates and current legislation governing turnover are taken into account. To estimate trends in average salaries, contractual renewals are considered (for the four sectors: central administrations, local administrations, education and research sector, and health care sector; if a bargaining agreement has not been renewed, the indemnity for expired agreements is considered) as are the effects of salary creep (a residual item essentially connected with supplementary bargaining, seniority rises and employment career changes). Social security contributions are then calculated and, finally, appropriations for peacekeeping missions and the financial effects of budgetary measures are taken into account.

2.1.4 The model for forecasting pension expenditure

The model uses the sample of active contribution payers disseminated periodically by INPS. Currently, the available sample is at 31 December 2015, purged of those who, between that date and 31 December 2018, retired for reasons that cannot be controlled directly (for example, those connected with subjective conditions not present in the sample, such as poverty, family conditions, burdensome or physically demanding jobs, etc.).[16]

The workers included in the sample are private-sector employees (including those enrolled in special pension funds), public employees (broken down by pension fund to which they belong), para-employees (term-contract workers) and the self-employed (farmers, artisans and retail traders).[17] The initial dataset is organised by cell, each grouping the workers who share the same characteristics as at 31 December: employment status,[18] gender, age (approximated to the nearest whole number), contribution seniority (approximated to the nearest whole number), weeks worked in 2015, pension calculation (defined-benefit, mixed, defined contribution). Average gross income earned in 2015 is associated with each cell.

Starting from the stock of active workers at the end of the previous year, all those who, during the current year, meet the requirements (including any moving retirement window) for one of the available retirement channels (old age, standard early retirement,

[16] The initial version of the model was not able to take account of those retiring for reasons that cannot be controlled directly.

[17] The initial version of the model did not include public employees and para-employees.

[18] Employment status reports either the type of job performed at 31 December (private- or public-sector payroll employee, para-employee or self-employed) or the status of unemployed or unenrolled worker for less than or more than one year. Unenrolled workers do not pay social contributions and do not receive unemployment benefits.

the "women's option" mechanism, the "Quota 100" mechanism[19]) are identified. Their pensions are calculated in accordance with the applicable rules. Active non-retired workers, adjusted for the probability of death, become the stock used for verification of fulfilment of retirement requirements in the following year. For a period covering no more than 6-8 years,[20] the model generates the retirement flows (broken down by channel, job category, gender, age/seniority, calculation mechanism) and the related expenditure. The basic assumption is that everyone chooses to retire as soon as the minimum requirements are met, but it is also possible to apply take-up rates specific to the retirement channel or category of worker.[21]

The advantages of the model include the simplicity of its structure (which is also important in the construction of alternative scenarios) and the virtually complete coverage of the labour force.[22] Its weaknesses include the way in which salary profiles are estimated. The basic assumption is that each worker has served for a number of years equal to his or her contribution seniority, remaining within the category in which he or she was registered at 31 December 2015 (without changes in category from private to public, from employee to self-employed, etc.). The career dynamics, broken down by job category, are calibrated so as to best approximate the average value of pensions paid in the 2016-2019 period.[23]

2.1.5 Forecasting healthcare expenditure

Healthcare expenditure is forecast using a system of linked Excel spreadsheets, in which information relating to estimated pharmaceutical expenditure flows into the more general forecasting system for current healthcare expenditure, as recorded in the final balance of the consolidated revenue and expenditure account for healthcare prepared by Istat and indicated in economic-financial policy documents, such as the Economic and Financial Document (EFD) and the Update to the EFD.

The main spreadsheet breaks down the different items of health services in kind, including goods and services delivered by market producers (pharmaceutical, general medical, specialist medical and hospital assistance in private nursing homes, rehabilitation, supplementary and prosthetic services and other affiliated service providers) and services

[19] As well as any other channel connected with gender, age, seniority, minimum accrued pension level or job category (the characteristics that can be checked with the dataset).
[20] As it is not a full-blown microsimulation, it is preferable to use the model over short-term horizons.
[21] Take-up rates were used to simulate the "Women's option" and "Quota 100" mechanisms".
[22] Only professionals are missing, although their pensions are not included in pension expenditure charged to general government (that registered in the social protection account).
[23] Matching the sample of active contribution payers and the INPS longitudinal sample (LOSAI) is particularly complex. First, the LOSAI does not cover public-sector employment. Moreover, even if one wishes to construct a correspondence between the individual workers in the LOSAI and the cells of the sample, we must bear in mind that each cell grouping employees/self-employed/para-employees at 31 December 2015 contains career paths that differ considerably from each other in terms of the duration of periods working as payroll employees, self-employed and para-employees (with different contribution rates).

delivered by non-market producers (hospital assistance and other health services, or outlays for compensation of employees, intermediate consumption and other). Also considered are administrative services (again regarding compensation of employees, intermediate consumption and other) and other expenditure (sundry contributions[24] and other spending[25]).

In addition to developments in the main economic variables, as estimated by the PBO's macroeconomic forecasting model (mainly GDP and inflation), a series of other factors more specific to the healthcare sector are taken into account in preparing the forecasts. In particular, these include regulatory factors that contribute to the regulation of the sector and control of expenditure (measures to contain expenditure, reforms in the governance of the health system or parts of it, interventions by the regions); the behaviour of economic agents (for example, companies' appeals against pharmaceutical pay-backs for exceeding spending ceilings, which have delayed and decreased reimbursements from the pharmaceutical industry); the evolution of outlays during the year (for example, the information on monthly flows of pharmaceutical expenditure provided by AIFA). Furthermore, the data of the quarterly accounts of healthcare authorities (published by the Office of the State Accountant General in the general government database, BDAP) are analysed, broken down by expenditure item, taking account of differences between budget and national accounts data, which make complete verification of the consistency of changes in expenditure during the year with respect to forecasts a challenging task.

With regard to market services, with the exception of ordinary pharmacy distribution, which we will return to shortly, the financial effects of agreements signed with general practitioners and specialists are also specifically taken into account. Similarly, the impact of national contracts on personnel expenditure is also assessed. Intermediate consumption is broken down into the purchase of pharmaceuticals (the forecast for which is drawn from the dedicated spreadsheet), medical devices[26] and other.

The reconstruction and detailed estimation of the items that make up direct pharmaceutical spending and ordinary pharmacy distribution, including the share allocated to innovative products, is based on the final data – and related updates during the year – published by AIFA. Amounts paid for co-payments, discounts and other fees and contributions or refunds to be paid by the pharmaceutical industry are considered, in particular the effects of the pay-back mechanism triggered for overshoots of the agreed ceilings on direct and pharmacy distribution of drugs (reconstructed in the spreadsheet), with related corrections and adjustments. We also make use of the Cergas-Bocconi OSFAR

[24] Including interest expense, insurance premiums, taxes and duties.
[25] Includes transfers to government entities, firms, households and private-sector institutions.
[26] In addition to the accounts of healthcare authorities, information on final expenditure for medical devices can be obtained from a specific report published by the Ministry of Health and the report of the Court of Auditors on the coordination of the public finances.

(Medicines Observatory) reports, which contain three-year forecasts for developments in pharmaceutical spending.

2.1.6 Additional tools for public finance analysis and forecasting

Dashboard for monitoring the public finances. The PBO has developed a database for public finance monitoring and forecasting (BDMP). The goal is to provide information to monitor the developments in the general government revenue and expenditure account in the current year and, on this basis, to formulate forecasts for future years.

The current version of the BDMP, available from June 2019, first internalises and then disseminates the main sources of official infra-annual public finance data in an editable format. This gives users integrated and constantly updated information on developments in the key public finance aggregates during the year, covering general government entities to the most complete and timely extent possible.

Using cash-basis data drawn from a variety of sources, the BDMP performs various functions:

1. collects and integrates data from the various sources in a single database;
2. reclassifies, as far as possible, the data in a manner consistent with ESA 2010 (general government account);
3. displays the (reclassified) data through a dashboard that can be organised, managed and customised by users;
4. stores the various data releases and past dashboards.

Data currently flows to the database from two sources:

- RGS - OpenBDAP data (open-data portal of the general government database) on payments of the State budget by economic category/level II economic classification, published on a monthly basis;
- SIOPE data (General Government Payments Information System) on payments made by all entities that use the system (currently about 15,000 entities, grouped into 19 sectors).

The possibility of using SIOPE revenue data for monitoring - in particular for the local government subsector - is being studied. This would supplement the monitoring that the PBO already performs for cash- and commitment-basis developments in tax revenues on the State budget (see section 2.1.1). In addition, the possibility of asking a breakdown of

payments between accruals and carryovers to the MEF (as regards OpenBDAP data) and the Bank of Italy (for SIOPE data) is being assessed.

Database on the financial impact of legislation on the public accounts. In the formulation of public finance forecasts, analysing the main measures with a financial impact plays an important role. The PBO has equipped itself with a tool that automates all the reporting necessary to conduct this analysis and that enables the storage of public finance data relating to each provision in a uniform format.

The starting point for this analysis is the summary table ("Annex 3") of the financial effects associated with each legislative measure. This table shows the impact on the public accounts of the individual measures adopted compared with existing legislation, as well as in terms of the net balance to be financed from the State budget, the State sector borrowing requirements and the general government net borrowing, consistent with the accounting criteria used for the construction of the general government account.

For forecasting purposes, it is essential to reclassify the budget measures into the individual items of the account. Knowing the composition of the budget package with an adequate level of detail is key to formulating more accurate forecasts of developments in the various public finance aggregates and, consequently, estimating the impact at a macroeconomic level more accurately. This reclassification also enables the quantification of the macroeconomic effects of the individual measures.

2.2 Tools for analysing the sustainability of the public debt in the short to medium term

The PBO has developed a number of tools for assessing debt sustainability, divided into three modules:[27] 1) a deterministic analysis with the formulation of a baseline scenario, in which the policy path of the debt-to-GDP ratio presented by the Government is extended over a time horizon of up to ten years after the last outturn data with ad hoc assumptions (concerning real growth, the output gap, inflation, interest rates, structural primary balance and the stock-flow adjustment); 2) a sensitivity analysis of the baseline scenario to simulate alternative scenarios for budget policy, interest rate dynamics, the real growth rate and inflation rate developments; 3) a stochastic analysis, in which the variables that influence the dynamics of the debt/GDP ratio experience random shocks, taking as a benchmark the macroeconomic forecasts prepared by the PBO, in order to obtain a large number of scenarios of the ratio over the decade to construct a probability cone for the Government's policy forecast.

[27] For a more detailed description of the methodological approach adopted, see Ufficio parlamentare di bilancio (2016), "2017 Budgetary Policy Report", Appendix 3.3. See also "Debt Sustainability Analysis at the UPB", a 20 September 2019 presentation at the 31st annual SIEP conference.

The deterministic analysis module systematically undergoes methodological updates and refinements, incorporating developments in the literature in this field.[28] The stochastic analysis is also being developed to take account not only of contemporaneous relationships between the variables but also lagged relationships through the use of vector autoregressive models. Finally, a collaborative effort is under way with the University of Palermo on the development of a model to optimise the government securities issuance policy integrated within the debt sustainability analysis.

2.3 Template for assessing compliance with fiscal rules

The PBO has developed a template to assess compliance with the fiscal rules governing structural adjustment, growth in net expenditure and debt reduction in relation to GDP.

The template includes all the input data for verification, broken down by source (Ministry for the Economy and Finance, European Commission, Istat and PBO). Part of the template performs the calculations for the structural adjustment and the growth in net spending, applying and adapting the recommendations in the European Commission's Vade Mecum[29] to the Italian context. Once objectives consistent with the rules have been determined, the template makes it possible to establish whether there have been deviations from these objectives and whether or not they are significant.

Another part of the template allows verification of compliance with the rule on the reduction of debt as a proportion of GDP, also indicating the gap between the debt/GDP ratio and the debt rule benchmark in its various formulations.

In addition - and also for the purposes of the two annual comparative publications of the budgetary policies of EU or euro-area countries - the PBO has arranged a database collecting the main data published by the European Commission for analysis and assessment of the Stability and Convergence Programmes and the Draft Budgetary Plans, in particular the nominal budget balance, the structural budget balance, gross public debt and the net expenditure aggregate. This database is used for the infographic published twice a year (in Italian: http://www.upbilancio.it/confronto-tra-i-dpb-2020/, and in English: http://en.upbilancio.it/comparison-between-the-2020-draft-budgetary-plans/).

[28] For a description of a number of recent modifications, see Ufficio parlamentare di bilancio (2019), "2020 Budgetary Policy Report", section 2.2.

[29] European Commission (2019), "*Vade Mecum on the Stability and Growth Pact - 2019 Edition*", European Economy Institutional Paper 101, April, Brussels, https://ec.europa.eu/info/sites/info/files/economy-finance/ip101_en.pdf.

3 Tools for assessing public policies

Over the years, the PBO has developed a number of tools to analyse and evaluate the financial and redistributive effects of specific measures and/or reforms of particular relevance to the public finances. These include microsimulation models of corporate taxation (see section 2.1) and household tax-benefits (see section 2.2). These models assist the PBO in analytical work for both internal and external documents (parliamentary hearings, reports, focus papers, flash notices, etc.). A dynamic microsimulation model for forecasting pension expenditure in the medium-long term is also being developed (see section 2.3).

3.1 The microsimulation model for corporate taxation (MEDITA)

The PBO has constructed MEDITA, a microsimulation model of corporate income taxes (IRES and consolidated taxation) and IRAP (regional business tax). At present, the model is a static microsimulation model, although it does incorporate the dynamic aspects of the main multi-period economic/financial and tax variables, such as interest expenditure, loss carry-forward, the allowance for corporate equity (ACE), increased depreciation allowances and other tax relief measures.

The model simulates the individual steps for determining the tax payable by each firm: starting from the financial statement variables (positive and negative components for IRAP and profit and loss for the year for IRES), the variations envisaged under tax legislation for the definition of the tax base, the tax liability for the firm and total tax revenue.

The model combines two different sources of data, one for financial statement data and one for administrative tax data. The CERVED (for the period 2010-2015) and AIDA Bureau Van Dijk (2016-2018) databases are used for the corporate financial data, which cover the universe of corporations in all Ateco sectors, with the exception of financial and insurance companies.[30] These databases also include the main demographic characteristics of the companies, certain structural variables and information on their ownership structure. Administrative tax data is drawn from that included in corporate tax returns (IRES, consolidated taxation and IRAP) for the period 2011-2017 provided by the Revenue Agency. The databases are integrated and validated every year in conjunction with the completion of financial statement filings and the filing of company tax returns. The acquisition of administrative data for 2018 is currently under way.

With these data, MEDITA can be used to reconstruct overall corporate tax revenue and evaluate the financial effects of new tax measures for corporations. For the period 2011-2017 (increased each year following the periodic updating of the data), tax legislation in

[30] Other companies operating in financial sectors are included, however.

force in each year is applied to the actual financial statement and tax data. In subsequent years, the tax legislation for the year is applied using the constant population in the last available year (2018). Each financial year is linked to the previous one by the multi-year variables – loss carry-forward, ACE, interest expense in excess of deduction limits, depreciation and other deductions.

As regards the structure of the model, in addition to one module that reclassifies the financial statement and tax data for the simulation of taxes and for the construction of indicators, MEDITA is organised into 5 operational modules for each year of simulation (currently: 2011-2022): IRAP for the non-financial sector; IRES for the non-financial sector; the consolidated taxation for the non-financial sector; IRES and consolidated taxation for the financial sector (2015-2022); economic-financial indicators (including indicators of corporate riskiness) and tax indicators (average rates, cost of capital and average and marginal effective rates). However, it should be borne in mind that the module for the financial sector, implemented in 2019, operates mainly as a mere calculator of taxable income and taxes, having been constructed on the basis of administrative data only. In this case, the set of analyses is more restricted than that used for non-financial companies: with the projection of tax legislation to the years after 2018, it is only possible to simulate tax policy measures for which specific economic/financial information not available in the tax data is not necessary.

With regard to the model's potential, MEDITA makes it possible to study, both ex post and ex ante, economic and distributive effects in respect of the different characteristics of firms (for example sector, size and location) and the financial effects (in terms of the impact on the public accounts) of individual measures or broader tax policies on companies.[31]

As concerns ex ante analyses, the model enables the evaluation of the short-term impact of tax policy measures, without considering the reactions of firms, which, even if regarding just one particular aspect (for example the hiring of a new worker or the purchase of a new machine), would inevitably impact the whole. In this case, the changes in tax variables – definition of taxable income and tax rates are simulated using a constant population assumption (with respect to the last year of available financial data) both in terms of demographic composition and with respect to economic choices (e.g., investment and employment) and financial decisions (capital structure and sources of financing).

In 2019, an initial multi-year evaluation was conducted of a number of tax measures adopted with the 2020 Budget Act (reintroduction of the ACE and super-depreciation).

[31] Examples of analyses conducted with the MEDITA model are contained in: Gastaldi, F., Pazienza. M.G. and Pollastri, C. (2016), "Gli incentivi agli investimenti nella legge di stabilità per il 2016", Working Paper no. 1 (summary available in English: Investment incentives in the 2016 Stability Act); Ufficio parlamentare di bilancio (2019), "La tassazione del reddito di impresa dopo il Decreto Crescita", Focus Paper no. 4 (summary available in English: Taxation of business income in the wake of the Growth Decree); and in the PBO Budgetary Policy Reports for 2016, 2017, 2018, 2019 and 2020.

Alternative techniques are being evaluated, providing for the projection of the main economic-financial variables while preserving the overall consistency of firms' financial statements.

The module for the financial sector will soon be improved. An extension of the model is also envisaged in order to incorporate behavioural effects with regard to investment policies and employment policies.

It should be borne in mind that the current model is the product of a complex evolutionary path. The first version (which dates back to December 2015) was based on a limited number of financial statements from AIDA Bureau Van Dijk: approximately 164,000 firms with revenues of more than €2 million for the years 2010-2014. The database was then completed with CERVED data for the period 2010-2015 and with those from AIDA Bureau Van Dijk, starting from 2016, for the entire universe of companies (about 1 million).

Until 2018, MEDITA was constructed on the basis of financial statement data only. However, tax legislation contains complex rules for determining taxable income and tax liabilities, and a great deal of detailed information is not available in corporate financial statements. Some key variables for reconstructing taxable income were therefore validated with average data by sector and size class drawn from tax returns filed by corporations, provided by the Ministry for the Economy and Finance for the 2012-2013 tax years. These data were also used to validate frequencies and coverage in terms of the main financial statement and tax items.

In that period, in the absence of administrative data, it was also necessary to follow a complex procedure for identifying groups for tax purposes, beginning with the ownership structure reconstructed from the financial statements (propensity score method).

The administrative microdata for the 2015-2016 period were only acquired in 2018, while those for 2017 became available in 2019. The model was therefore completely revised and updated.

This step was essential for both validating the estimation of the model's endogenous variables, such as those relating to increases and decreases in accounting profit and loss for tax purposes, and for reconstructing the universe of companies and groups relevant for tax purposes.

3.2 Household microsimulation models

With regard to modelling used to assess tax, social security and welfare policies, the PBO has developed a simulation platform for the main direct and indirect taxes on households and the main cash transfers. The simulation platform consists of a number of models with different functions, drawing on different information bases:

1) *DTB – Model for direct taxes and transfers (a dynamic version is under development).*

The model is based on the Istat survey on income and living conditions (IT-SILC) supplemented with administrative data from personal income tax returns, data from contribution statements and INPS pension benefits and ISEE (equivalent economic status indicator) declarations. It contains a high level of detail on the different types of taxable income and social security positions thanks to the use of administrative data. It also estimates exempt income and that subject to separate taxation.

Taxable incomes are drawn from administrative data (net of tax evasion in order to reproduce effective tax revenue), while the data registered in IT-SILC are used to estimate non-taxable income and, in general, to reconstruct the actual financial condition of taxpayers (gross of tax evasion).

Information on the social security funds in which taxpayers are enrolled, taxable income for social security purposes and, in the case of payroll employment, the relevant economic sector, and the qualification and the type of contract are taken from social security account statements. The availability of social security account statements also enables the reconstruction of the career and salary history of the individuals in the sample. This information can be used to perform distributive analyses from a multi-period perspective. Furthermore, by reconstructing contribution histories on the basis of information on careers, it will be possible looking forward to integrate the tax-benefit model with the PBO model for forecasting pension expenditure.

The weights used were calibrated in order to replicate the main aggregate marginal distributions, so as to estimate effective revenue with greater precision.

The model is currently used to estimate the impact of the main provisions regarding taxes and contributions paid by individuals and cash transfers, including those under social safety net programmes. In particular, it was employed to assess the provisions of the 2019 and 2020 budget Acts concerning the taxation of self-employed workers,[32] the bill granting enabling authority for the reorganisation of dependent child measures,[33] measures to reduce the tax burden on payroll employees,[34] and the Cure Italy and Revival Decrees implemented in response to the COVID-19 emergency.[35]

2) *PIT – IRPEF simulation model*

Based on a very large sample of personal income tax returns, selected on the basis of taxpayers' date of birth, the model reconstructs the tax formation mechanism starting from the declared taxable incomes, as drawn from the returns. Compared with the DTB

[32] Hearings of 12 November 2018 and 12 November 2019.
[33] Hearing of 16 October 2019.
[34] Hearing of 19 February 2020.
[35] Hearings of 26 March 2020 and 27 May 2020.

model, which uses IT-SILC sample data, this tool offers greater precision due to its larger size and the greater detail of the variables used. It is currently used to validate the results obtained with the DTB model and to evaluate measures concerning smaller groups of taxpayers, such as certain types of tax expenditure measures.

3) *DITB – Model for the joint simulation of indirect taxes (VAT and excise taxes) and direct taxes*

This model is based on the Istat survey of household spending supplemented with data from personal income tax returns, contribution statements, pension benefits and ISEE declarations. The model estimates the VAT and excise duties paid by households on the basis of the consumption registered in the Istat survey, making use of extensive detail on VAT rates (COICOP classification of elementary expenditure items). Direct income taxes are estimated on the basis of data from personal income tax returns. Some limitations affect the simulation of other direct taxes (wealth taxes). Certain forms of income are econometrically estimated in order to obtain a general picture of the financial condition of households. Information on income earned in the past enables analysis of the results from a life-cycle perspective.

4) *MIB – Model for the simulation of measures/policies based on the ISEE.*

The model is based on a sample of 2 per cent of the ISEE declarations submitted from between 2015 and 2018 (about 2 million individuals) and is currently used to assess measures that envisage the use of the ISEE to determine eligibility for benefits. More specifically, it was used to assess the impact of measures concerning the Citizenship Income[36] and Emergency Income programmes.[37] In early 2020, the model was updated using a new sample of ISEE declarations made available by INPS.

3.3 Dynamic microsimulation model for forecasting pension expenditure in the medium to long term

The dynamic microsimulation model for the medium to long-term forecasting of pension expenditure is still under construction. So far, a number of preliminary activities for its construction have been completed.

The source code of the CAPP_DYN[38] model was examined and revised. It constitutes the starting point for the development of a more advanced PBO model, which exploits the possibility of integration between sample data and administrative data using administrative identification numbers. The operating principles of the code that generates the population of the base year of CAPP_DYN on the basis of IT-SILC and the code that

[36] Hearings of 5 February 2019, 6 March 2019 and 16 July 2019.
[37] Hearing of 27 May 2020.
[38] CAPP-DYN is a dynamic microsimulation model developed by the Public Policy Analysis Centre of the Department of Political Economy of the Università di Modena e Reggio Emilia. For more information, see Mazzaferro, C. and Morciano, M. (2012), "CAPP_DYN: A Dynamic Microsimulation Model for the Italian Social Security System", CAPPaper no. 48, available at https://ideas.repec.org/p/mod/cappmo/0048.html.

determines the evolution of socio-demographic characteristics and economic effects of this population in the long run were analysed. A preliminary simulation of the evolution of the base year population in the long term was performed and developments in the simulated demographic, social and economic variables and the historical data for the years in which the latter are available were compared. Subsequently, the population of the base year was reconstructed using the most recent IT-SILC surveys, while the latter were supplemented with data from INPS administrative sources (account statements and pension records). The consistency between the new population of the base year and the information from INPS sources for the reference universe was then assessed, in particular with respect to labour market variables, such as the composition of the labour force and the wage bill, and current pensions. Of key importance in this case was the choice of the sample weights to be used in the simulation to reconcile the results of the model with the aggregated data. The use of administrative data will be of great importance in enhancing the reliability of the distributive and financial results produced by the model. In dynamic probabilistic models, even small errors in the composition of the population of the base year can generate significant deviations from the assumed values in the medium-long term. Finally, discrepancies between the variables generated by the responses to the IT-SILC survey and those from administrative sources were analysed.

The next step involved a comparison of different econometric estimates of the probabilities of transition between labour market states. These estimates play a central role in the model, as they contribute to determining careers and therefore the future amount of pension benefits. In an initial phase, the functional forms of CAPP_DYN were used to compare estimates that use information on states in two consecutive years obtained, on the one hand, from Istat data from the Labour Force Survey (LFS) – 12-month longitudinal data - and, on the other, from IT-SILC surveys for two consecutive years linked via administrative identification number and supplemented with administrative account statements. In a subsequent phase, new and more accurate estimates were performed by working with original functional forms that include variables relating to the entire work history of individuals, which can only be inferred from the administrative information supplemented with IT-SILC. After considered analysis, it was decided to use the INPS-SILC database in place of the LFS.

The following activities have yet to be completed to render the dynamic microsimulation model operational for the medium/long-term forecasting of pension expenditure. A comparison will be made between different specifications and econometric estimates of the life-cycle profile of employment income: the functional forms of CAPP_DYN will initially be used, while later original functional forms that include variables connected with the complete work history of individuals, which can only be obtained from administrative information, will be employed. Finally, the model mechanisms that determine retirement will be updated and refined on the basis of the modelling of the most recent legislation.