The PBO model of analysis and forecast expenditure for interest

1. Introduction

As part of its activities, focused on analyzing and checking the Government's macroeconomic and public finance forecasts, the Parliamentary Budget Office (PBO) has launched a programme to develop tools for monitoring and forecasting public finances and for assessing the effects of the most important legislative measures. Part of this activity is the development of a model for analyzing and forecasting the expenditure for interest on domestic government securities[1], which enables the impact of changes in interest rates on interest expenditure to be assessed in the short and medium term and the debt management policy to be analysed (historical analysis).

For the single distinct types of government securities[2], the model reproduces the individual issue tranches, the redemption at maturity, early redemptions and the coupon payments on securities issued starting from 1990, reconstructing the outstanding debt stock starting from January 2010 and up to two months prior to the date of the analyses and the respective interest paid. For future years, based on the assumption of the reissue of securities that mature, scenarios on forward interest rates and on the general government borrowing requirement, the model simulates the issue of securities and the related interest expenditure for a forecast four-year period, covering the planning horizon of the official public finance documents.

[1] Debt instruments offered to the market by the Treasury are divided into domestic securities, issued with national documentation, and foreign securities, issued on foreign markets with specific documentation and consistent with international standards. Interest expenditure on domestic government bonds accounts for about 85 per cent of the interest expenditure of the state sector. Other components that contribute to interest expenditure are: foreign government securities; interest-bearing postal bonds attributable to the Ministry of Economy and Finance (MEF); securities issued by Infrastrutture S.p.A.; interest on instruments other than securities (health loans, postal current accounts, loans granted by the Cassa Depositi e Prestiti (CDP), interest-bearing current accounts held by CDP, other interest on government loans).

[2] Ordinary Treasury Bills (BOTs), Zero Coupon Treasury Bonds (CTZs), Treasury Certificates (CCTs, CCTeus), Treasury Bonds (BTPs), Treasury Bonds linked to European inflation (BTP€is), Treasury Bonds linked to Italian inflation (BTPs Italia).

The disaggregated structure of the model permits calculating, both at the final stage and in simulation, the main characteristic debt indicators, such as, for example, average interest rates and average time to maturity (of the stock of securities and of new issues) for each individual component of government bonds, and to perform sensitivity analyses based on varying scenarios. The model does not distinguish by the type of holder of government securities and therefore does not explicitly refer to transactions under the Public Sector Purchase Program (PSPP).

The information base fuelling the model is made available to users of the PBO website by means of interactive display[3] showing details of the main data regarding the evolution of debt in domestic government securities (issues, redemptions and net issues) and the related interest expenditure, as well as the distribution of a number of major indicators[4]:

- composition of issues and stocks by type of security, issue date, interest rate applied;
- overall average interest rates and issuance by year of issue and type of securities;
- average time to maturity by year of issue and type of securities;

The interactivity also makes it possible to refer to the database at individual security level, distinguished by ISIN code[5] and issue tranche. The basic data are available for downloading in a format that can be processed. Display will be updated every quarter.

2. *The model structure*

The model[6] is functionally split into two modules. A first module (final analysis and short-term monitoring) reconstructs the dynamics of the stocks of outstanding securities actually issued in Treasury auctions from 1990 until two months before the processing date, and calculates the related accrued interest expenditure according to ESA 2010[7]. The second module, on the other hand, projects, by simulating an issue policy based on refinancing needs, the stock of securities in the four years following the date of the forecast and estimates the related interest expenditure based on interest rate scenario assumptions. This section analyses the functioning of the two modules separately, highlighting the main methodological choices adopted and illustrating the information bases which fuel the model.

[3] http://en.upbilancio.it/dashboard-titoli-di-stato/
[4] For a better understanding of the terms used in this publication, see the Glossary at the foot of the document.
[5] International Securities Identification Number: identification code of individual security.
[6] Models of this type are used by the MEF and other forecasters to monitor and forecast interest expenditure.
[7] European system of national and regional accounts adopted by Council Regulation (EU) No 549/2011 (published in the Official Journal on 26 June 2013), which came into effect in September 2014.

Final analysis module and short-term monitoring

As already highlighted, the model follows the evolution of the stock of outstanding securities, for individual securities (ISIN), over time, recording the issues of the individual tranches by the Treasury, both in auctions and in exchange and buyback transactions. The historical series of issues is taken from the Bank of Italy's Public Information Base[8], integrated with Treasury source data on exchange and buyback transactions[9]. Such sources provide information on the type of security, the amount issued/reimbursed, the coupon rate (where applicable), the issue price and the maturity (and therefore the effective average time to maturity).

What is more, for floating rate securities (CCTs linked to the 6-month BOT rate, CCTeus linked to the 6-month Euribor rate, BTPs Italia and BTP€is linked to Italian and European inflation respectively) the information published by the Bank of Italy is obtained[10] relating to the coupon rate applied every six months.

Overall, the information base is currently made up of over 400 government securities, of which approximately 1,500 individual tranches of issues are recorded (Table 1).

The estimate of interest expenditure on domestic government bonds is calculated on an accruals basis (ESA 2010). In particular, this calculation is made on the basis of the full accrual method, which reflects a "continuous" approach to the calculation of the debt burden (different from a cash method based on payment maturities).

Table 1 – Securities, issue tranches and early redemption – January 2010 – July 2017

Type	Number of distinct securities (ISIN)	Average number of tranches per security	Average number of early redemptions per issued tranche
BOT	218	1.0	0.0
CTZ	26	4.2	0.1
CCT	13	6.7	2.9
CCTEU	12	7.3	2.3
BTP	122	6.9	0.7
BTPI	16	10.8	0.7
BTPIT	16	1.0	0.1
Total	**423**	**3.6**	**0.7**

[8] https://infostat.bancaditalia.it/inquiry/#eNorLqhMz0ksLgYAD7UDdw%3D%3D. In detail, the following tables are used: TDEE0120: BOTs (Ordinary Treasury Bills); TDEE0121: CTZs (Zero-coupon Treasury Bonds); TDEE0122: CCTs (Variable-rate Treasury Certificates); TDEE0123: BTPs (Treasury Bonds); TDEE0130: BTPs with early redemption; TDEE0135: CCTs early redemption.

[9] http://www.dt.mef.gov.it/en/debito_pubblico/altre_operazioni/operazioni_di_concambio/

[10] https://www.bancaditalia.it/compiti/operazioni-mef/cct-ccteu/index.html?com.dotmarketing.htmlpage.language=1 and ttps://www.bancaditalia.it/compiti/operazioni-mef/btp-indicizzati/index.html?com.dotmarketing.htmlpage.language=1.

According to the definitions of the European regulation, the calculation of interest expenditure for a specific year is broken down by type of security as follows:

- Zero coupon securities (BOTs and CTZs): no coupon payments are made. Interest, based on the difference between the redemption price and the issue price (instruments issued at a discount), must be distributed over the years until the maturity of the bond; for year t, the related interest expenditure is then given by:

$$I_t = Ct \cdot \frac{g_t}{365} \cdot \frac{100 - p_e}{d} \qquad (1)$$

where:

$$Ct = Capital\ in\ circulation\ in\ year\ t,$$
$$g_t = Days\ of\ accrual\ of\ interest\ in\ year\ t,$$
$$p_e = Issue\ price,$$
$$d = residual\ time\ to\ maturity\ of\ security\ (in\ years).$$

- Securities with coupon (BTPs, CCTs/CCTeus, BTP€is and BTPs Italia): interest consists of three elements:

$$I_t = I_t^C + I_t^S + I_t^U \qquad (2)$$

a) coupons paid every six months, for the share referable to the days of accrual in the year *t*:

$$I_t^C = Ct \cdot \frac{g_t}{365} \cdot i_t \qquad (3)$$

where $i_t = average\ yearly\ coupon\ rate\ for\ the\ year\ t$;

b) the amount of interest accrued in each period for securities issued at a discount, attributable to the difference between the redemption price and the issue price, calculated as in the case of zero coupon bonds:

$$I_t^S = Ct \cdot \frac{g_t}{365} \cdot \frac{100 - p_e}{d}, \qquad (4)$$

c) capital uplift, a component concerning only securities linked to inflation (BTP€is and BTPs Italia) for which the amounts of the coupons to be paid and/or of the capital to be reimbursed are related to the evolution of a price index. The change in value of the capital to be reimbursed between the start and the end of a particular accounting period, due to the change in the index of reference, is deemed to be interest accrued in such period.

$$I_t^U = Ct \cdot r_t\,. \qquad (5)$$

where $r_t = capital\ revaluation\ rate\ in\ the\ year\ t$.

Since the amounts involved in the interest calculation may vary between homogeneous securities (same ISIN), but issued in different tranches (issue price, days of accrual, etc.), the interest calculation is carried out separately for each individual issue tranche. Table 2 shows an example of interest calculation for two BTPs issued in multiple tranches[11], which highlights the effect of the different components in calculating the flow of the interest accrued for 2016.

As regards the calculation of interest on variable-coupon linked securities, the model calculates the average annual coupon rate i_t as the average of the coupon rates paid half-yearly with reference to the days of accrual in the year t, an average which is weighted with the related days of coupon interest accrual in the year. As an example, table 3 shows an example of a calculation of the annual average coupon rate for an index-linked security.

Table 2 – Example of calculation of annual average coupon rate for a non-index linked BTP issued in several tranches

ISIN	Tranche	Issue date	Maturity date	Coupon rate	Issue price	Issue discount	Rate	Days 2016	Average stock value 2016	Interest 2016
IT0003256820	1	2002 03 18	2033 02 01	5.75	101.2	-0.04	5.71	366	3,000	171
	2	2002 05 15	2033 02 01	5.75	101.0	-0.03	5.72	366	2,001	114
	3	2002 07 10	2033 02 01	5.75	103.4	-0.11	5.64	366	753	42
	4	2002 09 16	2033 02 01	5.75	109.2	-0.30	5.45	366	1,100	60
	5	2002 11 18	2033 02 01	5.75	108.4	-0.28	5.47	366	751	41
	6	2003 01 15	2033 02 01	5.75	111.0	-0.37	5.38	366	1,100	59
	7	2003 03 17	2033 02 01	5.75	115.6	-0.52	5.23	366	1,250	65
	8	2003 05 16	2033 02 01	5.75	112.9	-0.43	5.32	366	2,750	146
	9	2003 07 15	2033 02 01	5.75	113.5	-0.46	5.29	366	2,750	146
	10	2016 11 08	2033 02 01	5.75	148.5	-2.98	2.77	54	1,500	6
IT0004923998	1	2013 05 22	2044 09 01	4.75	97.2	0.09	4.84	366	6,000	290
	2	2013 07 15	2044 09 01	4.75	94.2	0.19	4.94	366	1,461	72
	3	2013 11 15	2044 09 01	4.75	97.2	0.09	4.84	366	1,693	82
	4	2014 02 17	2044 09 01	4.75	103.5	-0.11	4.64	366	1,725	80
	5	2014 04 15	2044 09 01	4.75	109.0	-0.3	4.45	366	1,412	63
	6	2014 06 16	2044 09 01	4.75	113.0	-0.43	4.32	366	1,150	50
	7	2014 10 15	2044 09 01	4.75	120.3	-0.68	4.07	366	1,438	59
	8	2016 06 15	2044 09 01	4.75	147.4	-1.68	3.07	200	742	12
	9	2017 05 15	2044 09 01	4.75	124.8	-0.91	3.84	0	1,499	0

[11] In particular two of the BTPs are involved of which a last tranche has been re-issued with market conditions significantly different from those in which it had been initially issued and these therefore show an extensive variability as regards the issue prices.

Table 3 – Example of calculation of the weighted annual average coupon rate for an index-linked security

BTPi - ISIN: IT0004216351, maturity 09/15/2012

		Year 2010		Year 2011		Year 2012	
Coupon date	Coupon rate	Days of accrual	Weight	Days of accrual	Weight	Days of accrual	Weight
15/03/2010	0.97	73	20.0	0	0.0	0	0.0
15/09/2010	0.99	184	50.4	0	0.0	0	0.0
15/03/2011	1.00	108	29.6	73	20.0	0	0.0
15/09/2011	1.01	0	0.0	184	50.4	0	0.0
15/03/2012	1.02	0	0.0	108	29.6	74	28.7
15/09/2012	1.04	0	0.0	0	0.0	184	71.3
Average annual interest rate		**0.99**		**1.01**		**1.03**	

In the event of part of the outstanding amount of a security undergoing early redemption, the interest relating to it is calculated by applying the coupon rate i_t to the average *stock* of the individual tranche, weighted with the days of accrual in the year.

$$I_t^C = \bar{C}_t \cdot i_t$$

$$\bar{C}_t = \sum_j C_{j,t} \cdot w_{j,t}$$

$$w_{j,t} = \frac{g_{j,t}}{g_t}$$

Where:

$$g_{j,t} = Days\ of\ accrual\ of\ the\ tranche\ j\ in\ the\ year\ t$$

Table 4 shows a calculation of the average stock for a security subject to early redemption. From the example, we can see the idea adopted in the proportionate distribution model to the stocks of early redemption among the different outstanding tranches; in this case it can also be seen that the last tranche was issued after the first early redemption operation.

Table 4 – Example of calculation of the annual average stock for a security with early redemptions

BTP – ISIN: IT0004273493

Cons. Tranche	Cons. Early redemption	Issue / redemption date	Maturity / redemption date	Stock	Redeemed amount	Days 2010	Days 2011	Days 2012	Days 2013	Days 2014	Days 2015	Days 2016	Days 2017
1	1	2007 09 03	2016 03 08	4,000	59	365	365	366	365	365	365	67	
1	2	2016 03 08	2016 06 21	3,941	118							105	
1	3	2016 06 21	2016 09 09	3,823	118							80	
1	4	2016 09 09	2016 11 08	3,705	62							60	
1	5	2016 11 08	2017 03 21	3,643	116							54	79
1	6	2017 03 21	2018 02 01	3,527	0								286
					Average Stock	**4,000**	**4,000**	**4,000**	**4,000**	**4,000**	**4,000**	**3,854**	**3,552**
2	1	2007 10 01	2016 03 08	3,300	48	365	365	366	365	365	365	67	
2	2	2016 03 08	2016 06 21	3,252	97							105	
2	3	2016 06 21	2016 09 09	3,154	98							80	
2	4	2016 09 09	2016 11 08	3,057	51							60	
2	5	2016 11 08	2017 03 21	3,005	96							54	79
2	6	2017 03 21	2018 02 01	2,910	0								286
					Average Stock	**3,300**	**3,300**	**3,300**	**3,300**	**3,300**	**3,300**	**3,180**	**2,931**
3	1	2007 11 01	2016 03 08	2,500	37	365	365	366	365	365	365	67	
3	2	2016 03 08	2016 06 21	2,463	74							105	
3	3	2016 06 21	2016 09 09	2,390	74							80	
3	4	2016 09 09	2016 11 08	2,316	39							60	
3	5	2016 11 08	2017 03 21	2,277	72							54	79
3	6	2017 03 21	2018 02 01	2,204	0								286
					Average Stock	**2,500**	**2,500**	**2,500**	**2,500**	**2,500**	**2,500**	**2,409**	**2,220**
4	1	2008 01 02	2016 03 08	3,300	48	365	365	366	365	365	365	67	
4	2	2016 03 08	2016 06 21	3,252	97							105	
4	3	2016 06 21	2016 09 09	3,154	98							80	
4	4	2016 09 09	2016 11 08	3,057	51							60	
4	5	2016 11 08	2017 03 21	3,005	96							54	79
4	6	2017 03 21	2018 02 01	2,910	0								286
					Average Stock	**3,300**	**3,300**	**3,300**	**3,300**	**3,300**	**3,300**	**3,180**	**2,931**
5	1	2008 02 01	2016 03 08	2,750	40	365	365	366	365	365	365	67	
5	2	2016 03 08	2016 06 21	2,710	81							105	
5	3	2016 06 21	2016 09 09	2,629	81							80	
5	4	2016 09 09	2016 11 08	2,547	43							60	
5	5	2016 11 08	2017 03 21	2,504	80							54	79
5	6	2017 03 21	2018 02 01	2,425	0								286
					Average Stock	**2,750**	**2,750**	**2,750**	**2,750**	**2,750**	**2,750**	**2,650**	**2,442**
6	1	2008 03 03	2016 03 08	2,750	40	365	365	366	365	365	365	67	
6	2	2016 03 08	2016 06 21	2,710	81							105	
6	3	2016 06 21	2016 09 09	2,629	81							80	
6	4	2016 09 09	2016 11 08	2,547	43							60	
6	5	2016 11 08	2017 03 21	2,504	80							54	79
6	6	2017 03 21	2018 02 01	2,425	0								286
					Average Stock	**2,750**	**2,750**	**2,750**	**2,750**	**2,750**	**2,750**	**2,650**	**2,442**
7	1	2008 04 01	2016 03 08	3,025	44	365	365	366	365	365	365	67	
7	2	2016 03 08	2016 06 21	2,981	89							105	
7	3	2016 06 21	2016 09 09	2,891	90							80	
7	4	2016 09 09	2016 11 08	2,802	47							60	
7	5	2016 11 08	2017 03 21	2,755	88							54	79
7	6	2017 03 21	2018 02 01	2,667	0								286
					Average Stock	**3,025**	**3,025**	**3,025**	**3,025**	**3,025**	**3,025**	**2,915**	**2,686**
8	1	2009 07 16	2016 03 08	1,011	15	365	365	366	365	365	365	67	
8	2	2016 03 08	2016 06 21	996	30							105	
8	3	2016 06 21	2016 09 09	966	30							80	
8	4	2016 09 09	2016 11 08	936	16							60	
8	5	2016 11 08	2017 03 21	921	29							54	79
8	6	2017 03 21	2018 02 01	891	0								286
					Average Stock	**1,011**	**1,011**	**1,011**	**1,011**	**1,011**	**1,011**	**974**	**897**
9	1	2011 02 11	2016 03 08	2,170	32		324	366	365	365	365	67	
9	2	2016 03 08	2016 06 21	2,138	64							105	
9	3	2016 06 21	2016 09 09	2,074	64							80	
9	4	2016 09 09	2016 11 08	2,010	34							60	
9	5	2016 11 08	2017 03 21	1,976	63							54	79
9	6	2017 03 21	2018 02 01	1,913	0								286
					Average Stock		**2,170**	**2,170**	**2,170**	**2,170**	**2,170**	**2,091**	**1,927**

The projection module

From the month after that of the last update, in order to be able to forecast interest expenditure, it is necessary to deal with different types of problems separately for the various types of securities considered:

1) outstanding securities issued at fixed rate, which will not be reimbursed before 31/12/2020 (to date last day of the projection horizon);

2) outstanding floating-rate securities, which will not be reimbursed before 31/12/2020;

3) outstanding securities with fixed and floating rates that mature before 31/12/2020, the corresponding amount of which must be refinanced, within the projection horizon;

4) securities to be issued within the projection horizon, necessary to finance the general government borrowing requirements.

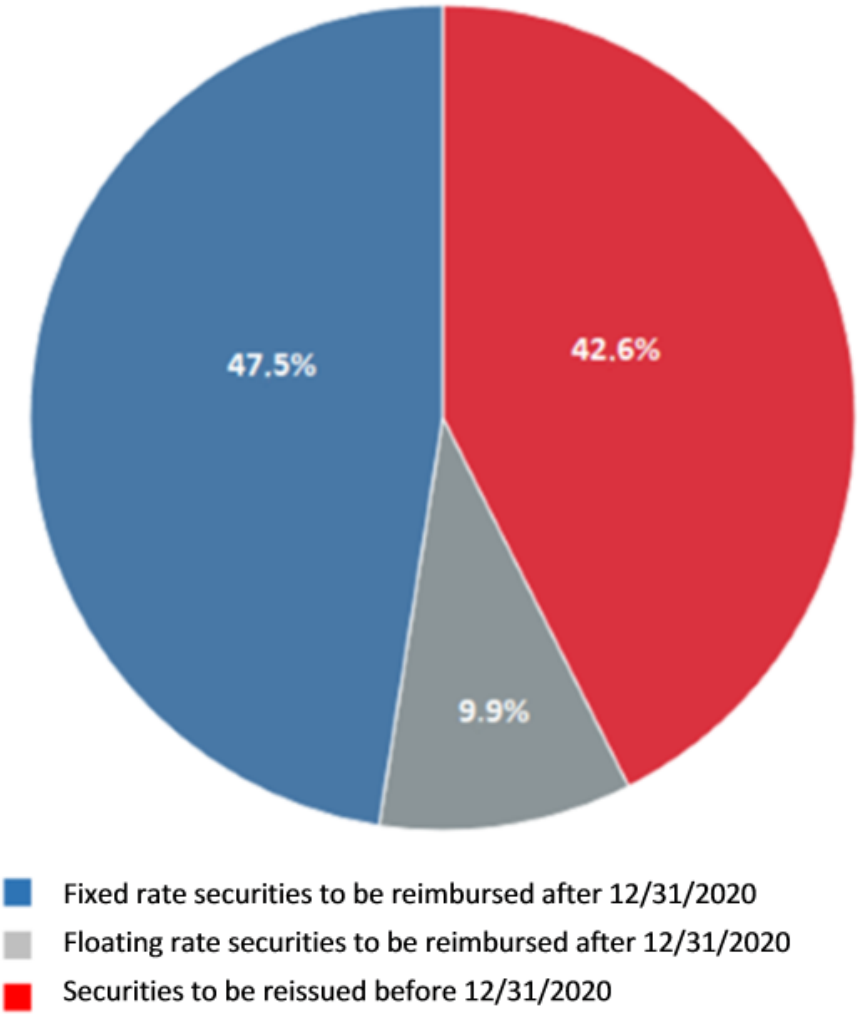
At 31 July 2017, the date of the last update of the model at the time of this publication, approximately 47.5 per cent of the outstanding securities were of the first type, approximately 10 per cent of the second type and the remaining 42.6 per cent are set to mature and to be renewed before 31/12/2020 (Figure 1).

For the first type of securities (fixed rate securities maturing after 2020), all the information necessary for the calculation of the related future interest expenditure is available. This is calculated as described in the previous section on the basis of the average value of the stock, the coupon rate and the issue price. For this segment, therefore, the expenditure forecast is essentially deterministic as it does not depend on the scenario assumptions made in the forecast. The only uncertainty factor that could affect this segment is the possibility that some securities will be reimbursed early, a circumstance which is, for the sake of simplicity, excluded in the model.

For the second type of securities (floating rate securities maturing after 2020), for which interest expenditure depends on future determinations of the indexation parameters, assumptions must be made on the following indices:

- harmonised consumer price inflation index (excluding tobacco) for the euro area (HICP), for the indexation of BTPs linked to European inflation (BTP€is);
- consumer price inflation index for workers' and office workers' households (excluding tobacco) (FOI), for indexation of BTPs linked to Italian inflation (BTPs Italia);
- 6-month Euribor rate, for indexing the yield of CCTeus.

Figure 1 – Composition of outstanding securities as of 31 July 2017



For the third type of securities (securities maturing by 2020, to be refinanced) and for the fourth (securities to finance new general government borrowing requirement), the forecast is influenced by a greater degree of uncertainty as it depends on:

- the issuance policy (which securities will be issued by the Treasury);
- coupon rates of new issues;
- the auction issued price;
- the amount of additional debt.

The coupon rates of issue are derived from an estimate of the yield curve, which is constructed on the basis of the distribution of forward rates, and therefore depend on the year in which the new security is issued and its average time to maturity. As for the auction, the issued price for coupon securities is assumed to be at par, while for zero-coupon securities the issued price, which is obviously different from the par, is determined on the basis of the assumed yield curve. The size of the additional debt is

derived from assumptions about the development of general government borrowing requirement over the forecast horizon.

The simulation of the future emission policy is more complex. In this version, the model adopts a "continuity" base assumption whereby the portfolio of new simulated issues is made up of:

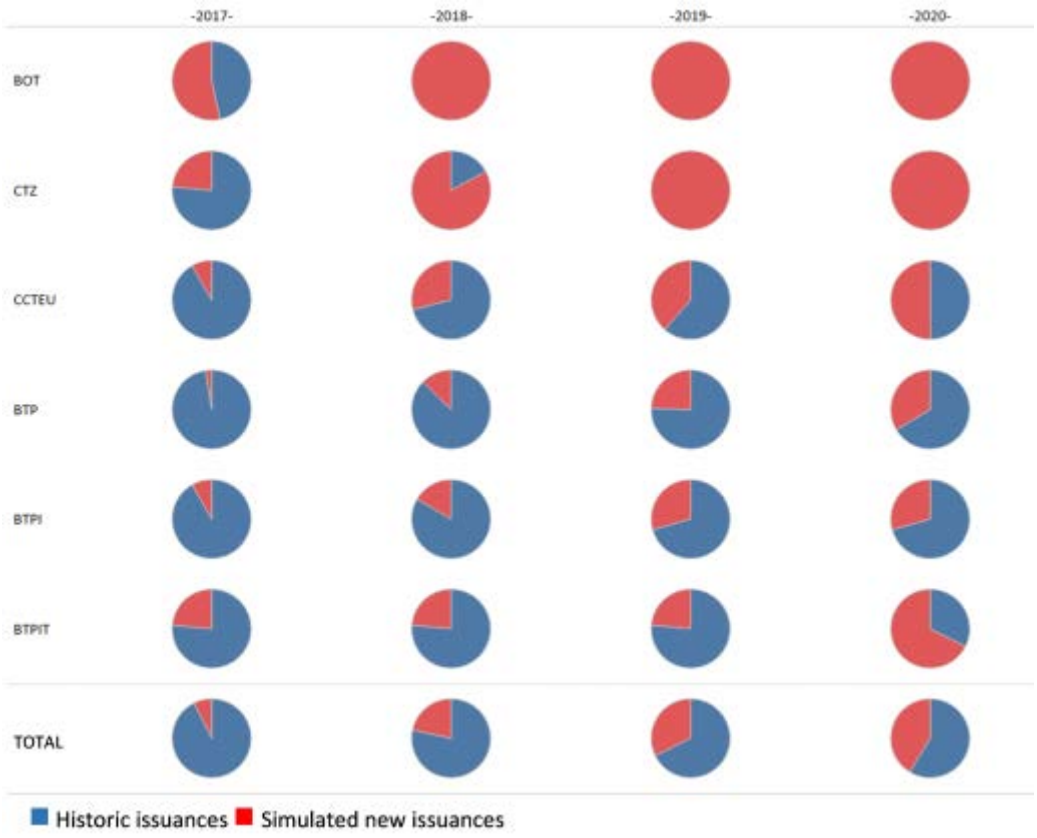
- reissue of securities maturing by 2020 (same type and average time to maturity, but not necessarily same amount);
- issues of tranches of "on the run" securities issued no more than one year after the update date.

The total amount of new issues depends on the amount of maturing securities and the new general government borrowing requirements to be met, and is distributed over the various types of securities issued in simulation, as described above, in accordance with the provisions of the “Framework Decree” and in such a way as to ensure convergence with a predefined objective of average residual maturity of the debt. For 2017, the decree provides that the share of fixed-rate securities with medium/long maturity (BTPs) should be between 60 and 75 per cent; the share of variable-rate securities with medium/long maturity (CCTs and CCTeus) should be between 5 and 10 per cent; the portion of medium/long maturity index-linked securities (BTP€is and BTPs Italia) must not be higher than 15 per cent; the portion of zero coupon securities (CTZs) must not be higher than 4 per cent and finally that the portion of short-term securities (BOTs) must be between 3 and 8 per cent.

Figure 2 shows the progressive “renewal” of the stock of shares in simulation. As expected, the stock of short-term securities is renewed with securities simulated by the model very quickly: already at the end of 2017, BOTs are simulated for about 53 per cent, while from 2018 they are entirely issued in simulation. The stock of CTZs is renewed 24 per cent in 2017, 83 per cent in 2018 and fully issued at the rates assumed in simulation starting from 2019. The progression of simulation issuance of longer-term securities is slower: the share of CCTeus issued in simulation is 8 per cent in 2017, 29 per cent in 2018, 39 per cent in 2019 and 50 per cent in 2020.

As regards BTPs, approximately 2 per cent of the securities are issued in simulation in 2017, 13 per cent in 2018, 24 per cent in 2019 and 34 per cent in 2020; a similar profile is also observed for BTP€is. For BTPs Italia, on the other hand, in the second half of 2017, 24 per cent of the BTPs were re-issued, while in the following two years, when no securities mature, no new ones are issued in simulation. In 2020, as a result of the maturity of four securities for approximately 28 billion, 67 per cent of them are renewed. Overall, issued in simulation (and therefore with simulated rates) are: in the first year 7 per cent of the total stock, in the second year 22 per cent, in 2019 32 per cent and finally in 2020 41 per cent.

Figure 2 – Composition of stock by type of issue (effective/simulated)



The gradual progression of the debt stock renewal for longer maturities implies that for the shorter term forecasts a substantial share of expenditure is already known, as it does not depend on the assumptions about rates that only affect the reissued securities.

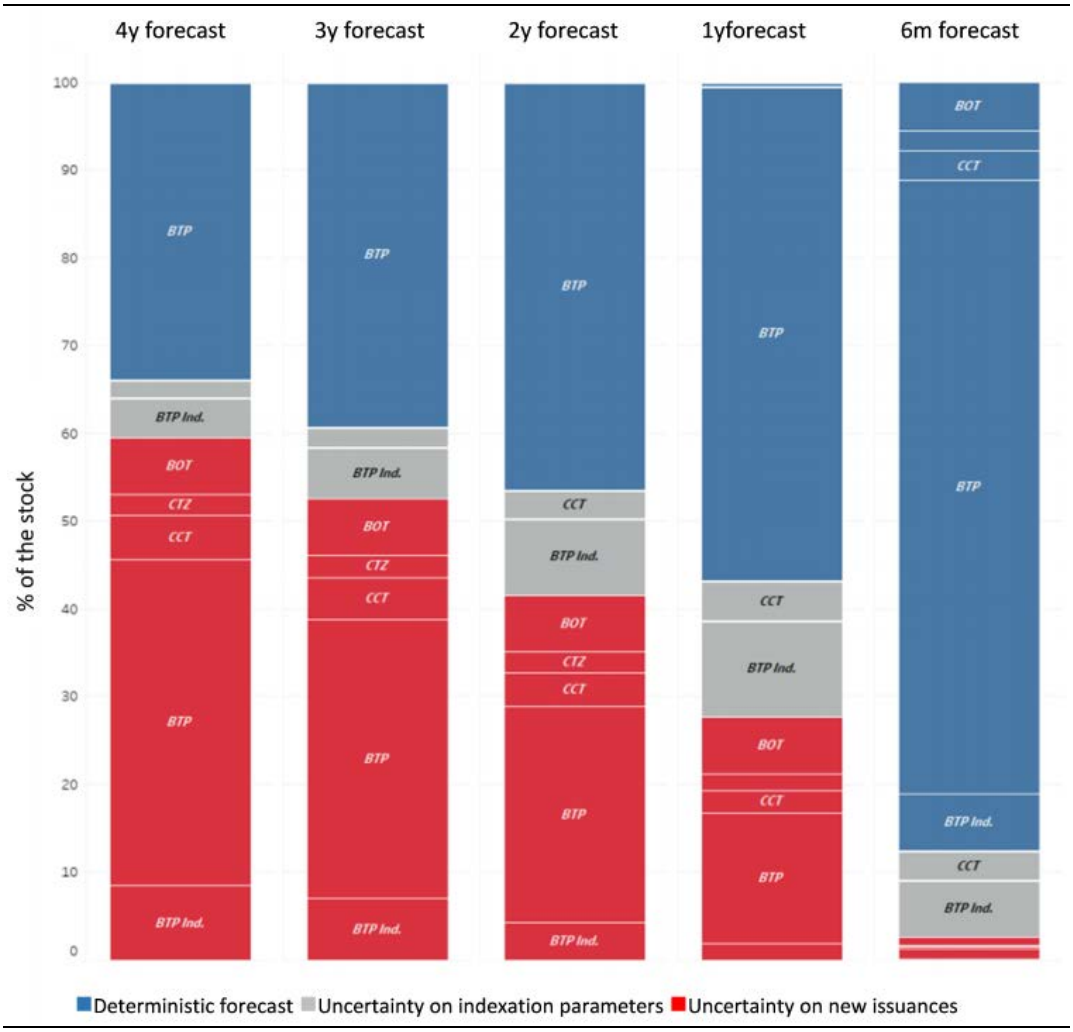
As mentioned, the identification of the different types of securities illustrated in Figure 1 makes it possible to identify a measure of the degree of uncertainty of the forecasts in relation to the length of the forecast horizon. The lower the proportion of fixed-interest securities to be reimbursed over the forecast period, in fact, the higher the precision, since the related interest expenditure can be accurately determined in advance. For the variable-rate securities component that do not need to be reimbursed, the risk is associated only with the indexing component, while for the securities component that will be reimbursed within the forecast horizon, uncertainty will also affect the new issue rates affected by potential market shocks on the Italian yield curve.

Figure 3 shows the results of a financial year in which the components of the stock of securities issued are simulated according to the degree of uncertainty of the forecast as the length of the forecast horizon changes (4, 3, 2, 1 year, six months). The graph identifies the weight of the three components as the length of the forecast horizon changes. In a four-year forecast, around 60 per cent of the stock of securities will have to be renewed and the forecast will therefore be significantly influenced by the rates at

issuance, while for around one third of the stock the related interest expenditure is already predetermined. The remaining 6 per cent is influenced exclusively by the indexation parameters.

The percentage of the stock of securities with predetermined expenditure rises to 40 per cent in a three-year forecast, to 45 per cent in two years and exceeds 55 per cent in a one-year forecast. If we consider a six-month forecast, for more than 85 per cent of the stock the forecast of expenditure is perfectly deterministic; this guarantees highly reliable expenditure monitoring during the year.

Figure 3 – Components of the stock of outstanding securities according to the degree of indeterminacy of the forecast – Simulation year 2016



Glossary

Issued at a discount: interest is equal to the difference between the par value of a bond and its issue price.

Issue tranche: security issue share/series. The Treasury reopens the same bond several times by auction in various successive tranches, so as to provide the market with an outstanding amount big enough to ensure market trading liquidity.

Early redemption: the reimbursement of a security before its maturity date.

Average time to maturity: this is calculated as average of difference (in fractions of a year) between the maturity date and the reference date, weighted with the average stock.

Indexation coefficients: ratio between the daily inflation index number at the date of reference and the daily inflation index number at the issue date for the BTP€I; ratio between the daily inflation index number at the date of reference and the daily inflation index number at the date of payment of the previous coupon for BTP Italia.

Exchange transactions: extraordinary debt management transactions consisting in the issuing of a bond against the contemporaneous repurchase of one or more bonds.

Rate of return: discount rate making the current value of future bond payments and the relative price the same.

Coupon rate: indicates the interest associated with a bond and paid periodically to the holder.

Capital uplift: revaluation of the nominal capital of a bond associated with the variation of an inflation index in a given period.

Synoptic table: characteristics of government bonds

			BOTs	CTZs	CCTs/CCTeus	BTPs	BTP€is	BTPs Italia
Return			Issued at a discount (difference between the redemption value and the issue price)	Issued at a discount (difference between the redemption value and the issue price)	Variable six-monthly coupons linked to 6-month Treasury Bill auction rate or 6-month Euribor, possible issue discount	Six-monthly fixed coupon, possible issue discount	Six-monthly coupons linked to European inflation (HICP index net of tobacco products), possible issue discount and capital revaluation on maturity	Six-monthly coupons linked to Italian inflation (FOI index net of tobacco products), six monthly capital revaluation and loyalty bonus on maturity
Accrued interest	**Zero coupon**		The interest based on the difference between the redemption price and issue price must be spread over the years up to the bond maturity date		-			
	Coupons		-		Six-monthly payment coupons, for the share referable to the accued days in the year t			
	Issued at discount		-		Amount of interest accrued in every period, attributable to the difference between the redemption value and the issue price, calculated as in the zero coupon bonds			-
	Component deriving fro indexation	**Capital uplift**	-				The change in the value of capital to be repaid between the start and the end of the accounting period due to a change in the indexation coefficient is considered as interest accrued in such period	
		Indexation coefficients	-				Coefficient calculated as ratio between HICP index at the date of payment of the coupon and that at the date of issue of the bond (2)	Coefficient calculated as ratio between FOI index at the date of payment of the coupon and that at the date of previous payment(1)
Issuance frequency			Monthly for 6 and 12-month Treasury Bonds and according to cash requirements for 3-month and flexible bonds	Monthly	Monthly (since 2011, CCTs are no longer regularly issued)	Monthly and according to market conditions for 15-, 20-, 30- and 50-year maturities	Monthly and with choice of individual securities according to market conditions	Once/twice a year

(1) Cfr. http://www.dt.mef.gov.it/export/sites/sitodt/modules/documenti_en/debito_pubblico/titoli_di_stato/BTP_Italia.pdf . –
(2) http://www.dt.mef.gov.it/export/sites/sitodt/modules/documenti_en/debito_pubblico/titoli_di_stato/Index_Linked_BTPEi.pdf.