COMPUTING THE EU'S SURE INTEREST SAVINGS USING AN EXTENDED DEBT SUSTAINABILITY ASSESSMENT TOOL

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Abstract

Loans to Member States under the SURE programme were part of the unprecedented European Union (EU) response to the COVID-19 crisis in 2020-2021. Resources were used to finance countries' public spending on temporary unemployment schemes. The EU raised funds on the capital markets by issuing securities, and channelled them to recipient countries in the form of bilateral loans. The programme was implemented in a period in which countries had full access to capital markets under very favourable financing conditions. Nonetheless, the full envelope of the programme was used up. In this paper we compare government interest payments under the SURE programme with a counterfactual in which governments themselves raised the same amount of funds on the markets. We focus on the cases of Belgium, Spain, Portugal and Italy. We extend a state-of-the-art DSA framework with a rich modelling set-up in which the dynamics of interest payments on loans and securities, maturing debt and new debt issuance, are jointly determined. Two results stand out: (i) under the financial conditions prevailing at the time of the implementation of SURE, interest savings for the four countries analysed are estimated to be significant (between 3% and 12% of the total amount disbursed over the first 10 years), with amounts depending on the current spread between the EU yield curve and the national one and the maturity structure of the national debt; (ii) under counterfactual scenarios of stressed market conditions during the duration of the loans, savings would be even larger. The latter illustrates the key role these instruments may play in episodes of market stress.

Keywords: public debt, fiscal sustainability, interest payments, European Union.

JEL classification: E44, E61, E62, F36, F45, G14, H63, H68.

Resumen

Los préstamos de la Unión Europea (UE) a los Estados miembros en el marco del instrumento europeo de apoyo temporal para atenuar los riesgos de desempleo en una emergencia (instrumento SURE, por sus siglas en inglés) formaron parte de la respuesta de la UE a la crisis del COVID-19 en 2020-2021. Los recursos se destinaron a financiar el gasto público de los países en planes de reducción del tiempo de trabajo y en medidas similares. Para ello, la UE recaudó recursos en los mercados de capitales mediante la emisión de valores y canalizó esos recursos a los países receptores en forma de préstamos bilaterales. El programa se aplicó en un período en el que los países tenían pleno acceso a los mercados de capital y en condiciones de financiación muy favorables. No obstante, la dotación total del programa prácticamente se agotó. En este documento calculamos los pagos de intereses de los Gobiernos en el marco del SURE frente a una situación contrafactual en la que el Gobierno recurriese a la financiación de mercado por los mismos importes. Nos centramos en los casos de Bélgica, España, Portugal e Italia. Con este objetivo, ampliamos un marco de análisis de sostenibilidad de la deuda (DSA, por sus siglas en inglés) de última generación con una modelización en la que la dinámica de los pagos de intereses, el vencimiento de la deuda y la emisión de nueva deuda se determinan conjuntamente. Destacan dos resultados: i) en las condiciones financieras imperantes en el momento de la aplicación del SURE se estima que el ahorro de intereses para los cuatro países analizados es significativo (en acumulado, durante los 10 primeros años, entre el 3 % y el 12 % del importe total nominal desembolsado), y depende del diferencial entre la curva de rendimiento de la UE y la nacional y de la estructura de vencimientos, y ii) en escenarios contrafactuales de condiciones de mercado estresadas durante la duración de los préstamos, el ahorro sería aún mayor. Esto ilustra el papel clave que pueden desempeñar estos instrumentos en episodios de tensiones financieras.

Palabras clave: deuda pública, sostenibilidad fiscal, pago de intereses, Unión Europea.

Códigos JEL: E44, E61, E62, F36, F45, G14, H63, H68.

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1 Introduction

European Union (EU) national authorities reacted swiftly and with a wide array of instruments to the economic crisis created by the global spread of COVID-19.[1] At the supranational level, European Central Bank (ECB) policies have provided ample monetary accommodation, thus creating very favourable financing conditions. In turn, EU fiscal authorities launched a number of programmes, that included direct financial support to Member States, like SURE (Support to mitigate Unemployment Risks in an Emergency) loans, "Next Generation EU" (NGEU) transfers and loans, and the reinforcement of the European Stability Mechanism's (ESM) existing backstop facilities.

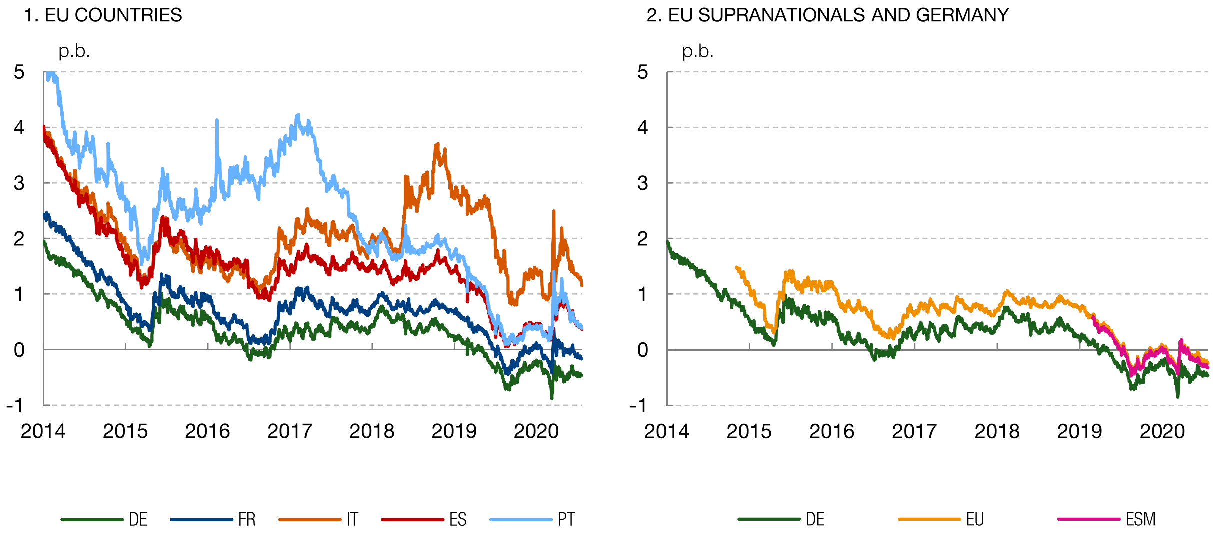
In particular, SURE was a novel mechanism created to cover the sudden increase in public spending devoted to preserve employment through temporary lay-off schemes and other similar mechanisms for self-employed workers. The instrument's total envelope amounted to €100 billion. Up to March 2022, 94 bn have been allocated to 19 Member States. The resources were raised on the capital markets through debt issuance, with the EU acting as an intermediary for the Member States. In turn, to ensure the highest credit quality of the debt issuance and a low cost, Member States provided the EU on a voluntary basis with irrevocable, callable on demand guarantees to cover for potential losses (up to 25% of the total envelope). In order to avoid excessive concentration, a 60% limit on the total exposure to the three Member States representing the largest share of the loans was imposed.[2]

A key feature of the programme are the reduced costs borne by receiving countries. The majority of European countries, with the exception of some economies with triple A ratings (such as Germany, Finland, Netherlands, Austria and Luxembourg) pay a higher premium on long-term issues than the premium paid by the EU (see Figure 1). Taking advantage of its flatter yield curve, the EU was able to provide loans at longer maturities, above 14 years, than the average of EU countries for their long-term debt (see Table 1), and at a lower cost. In particular, the average spread of the loans with respective to an equivalent issuance of national debt, was around 100 basis points (bp) for Italy, around 45 bp for Spain and Portugal and 6 bp for Belgium. The European Commission (EC) calculated that savings from the programme amounted for all the participant Member States to more than 8 bn euro

[1]See Cuadro-Sáez et al. (2020); Alonso et al. (2021).

[2]see Article 9 of the SURE regulation in `https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32020R0672`.

Figure 1: Sovereign 10-year yields: EU countries and supranationals



Source: Bloomberg.

Table 1: SURE: main characteristics

	Total (bn)	Maturity of SURE loans (a)	Average spread (b)	Average maturity of current debt
Italy	27.44	14.8	96	9.7
Spain	21.32	14.7	44	9.3
Belgium	8.20	14.7	6	13.8
Portugal	5.93	14.7	47	7.1

Source: European Commission.

(a) Until March, 2021.

(b) Weighted difference between the cost of SURE loans and the cost of similar loans at the date of issuance.

(in current terms) until maturity. This calculation was made by comparing savings bond by bond, and summing them across issue dates and maturities (up to 30 years).[3]

From the perspective of an EU country, interest payment' savings on SURE loans might have been a motivation to request such loans. But just comparing the different costs at issuance of similar bonds by the EU and national governments at a given date only gives a partial view to such calculation. First, additional issues by Member States might have had a higher cost if investors had internalised the relative increase in interest expenditure from that issue. Second, and more importantly, when financing a new stream of expenditures, countries do not necessarily replicate the maturity structure of the EU loans, that usually

[3] See https://ec.europa.eu/info/sites/default/files/economy-finance/sure_one_year_on.pdf.

have a longer maturity date than the average maturity of the country. Those hypothetical new issuances should be rolled over, increasing the exposure to sudden changes in interest rates. Regarding the latter point, an additional motivation for resorting to SURE or similar programmes arises: what would have been the savings in a situation of "market stress" (i.e. with heightened costs) rather than the one of normal access in which SURE was launched?

In this paper, we look at the savings in interest payments governments may have obtained from financing their fiscal needs by resorting to SURE loans versus ordinary market financing, under different, counterfactual financial market conditions. To deal with these we use a simulation model. We take an aggregate perspective, and use a model along the lines of so-called DSA (public Debt Sustainability Analysis model) deterministic approach. DSA is a standard instrument of fiscal surveillance but it is also a tool for making decisions about the provision of financial support by international organizations like the IMF or the European Commission (Alcidi and Gross (2018)). Recent methodological references are IMF (2021), Commission (2021), or Bouabdallah et al. (2017). In particular, we extend a state-of-the-art DSA deterministic framework with a rich modelling setup in which the dynamics of interest payments on loans and securities, maturing debt and new debt issuance, are jointly determined. In particular, we allow for a rich setup to take into account different funding sources in terms of maturities and costs.[4]

We use the model to conduct simulations for public debt and interest payments in two broad scenarios, in which we compare the savings from SURE loans to obtaining the same financing directly from the markets, in terms of costs, maturity structure, and average life of outstanding debt. In one set of scenarios we assume a continuation of normal market access at current financial conditions, i.e. we assume that current market conditions, that are very favourable, prevail over a prolonged period of time [5]. In a second set of scenarios, in turn,

[4]There are two approaches in the literature for the detailed estimation of interest payments in realistic settings. One tries to exploit as much as possible the available granular information, following a security-by-security approach (see among others Girón and Solorza, 2015; Bolder and Deeley, 2011; Argimón Maza and Briones Bouzas, 1991). This approach uses a significant amount of information, but also tends to present some caveats in terms of lack of coverage of public debt in the form of loans or its coverage of the sub-central levels of the government. The second one (see Martínez-Pagés (2018) and the references quoted therein) follows a more aggregated approach, focusing on the main stylised features of the process at hand, while keeping desirable properties like real-time forecasting accuracy, and is the one we choose in this paper.

[5]Under normal circumstances, we do not consider for simplicity that the SURE issuance changes the interest rate that a country faces for its national debt. However, it could be the case that the issuance of this debt increases the interest rate of the country. For example, using a structural model of sovereign yield curves in a heterogeneous monetary union, Costain et al. (2021) analyze how shocks that affect the expected path of net bond supply –such as the announcement of the ECB's pandemic emergency purchase program, PEPP, or the pandemic outbreak itself– transmit to sovereign yield curves in the euro area. An alternative calibration of this scenario yields additional but limited savings. In any case, this channel might be significant for larger EU loan programmes

we simulate stressed market access situations, i.e. we assume that there is an increase in the costs of issuing securities and/or difficulties in financing needs with the desirable mix of public debt instruments. More specifically, we simulate the impact of loans provided by European institutions under the SURE scheme on interest savings under both scenarios for the four largest euro area countries that have participated in SURE: Italy, Spain, Belgium and Portugal.

The rest of the paper is organised as follows: in Section 2 we outline the model, in Section 3 its calibration, and in Section 4 the simulation exercises and the key results. Finally, in Section 5, we sum up our findings and discuss policy implications.

2 The model

2.1 Public debt and its determinants

For analytical purposes, it is worth disaggregating the change in the debt ratio as a percentage of GDP into its fundamental factors (see Figure 2). To do so, we start by defining the level of public debt at a certain date (B_t) in nominal terms as the level of the previous period, plus the nominal interest payments on public debt, R_t^b, plus the primary budget deficit (DEF_t^p) and the so-called deficit-debt adjustment (DDA_t):

$$B_t = B_{t-1} + R_t^b + DEF_t + DDA_t \tag{1}$$

Dividing by nominal GDP (Y_t) one gets the debt-to-GDP ratio as a function of its fundamentals, also called the government budget constraint:

$$\frac{B_t}{Y_t} = \frac{1}{(1+\pi_t)(1+g_t)} \frac{B_{t-1}}{Y_{t-1}} + \frac{R_t^b}{Y_t} + def_t^p + dda_t \tag{2}$$

where π_t is net inflation, g_t is net growth of real GDP and def_t^p is the primary deficit as a percent of GDP. Notice that the nominal interest payments R_t^b and the nominal stock of debt B_t are averages of pertinent objects across terms to maturity. A standard, approximated version, suitable for accounting decomposition of the fundamental determinants of debt, takes the form

$$\frac{B_t}{Y_t} = \frac{B_{t-1}}{Y_{t-1}} + \frac{R_t^b}{Y_t} - (\pi_t + g_t) \frac{B_{t-1}}{Y_{t-1}} + def_t^p + dda_t \tag{3}$$

2.2 Behavioural reactions to changes in debt

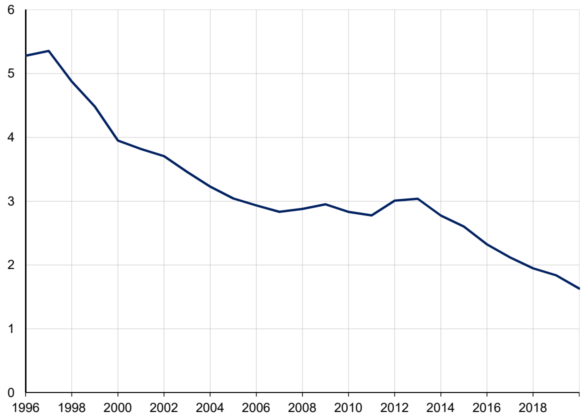
In addition, the framework of analysis includes a set of behavioural relationships (this section follows Hernández de Cos et al. (2018))[6]. The first, equation (4), captures the effect of changes in the fiscal policy stance, measured on the basis of the change in the primary structural deficit, $\Delta def_t^{p,E}$, as a percentage of nominal potential GDP, $P_t\bar{Y}_t$, on real economic growth, g, given by the fiscal multiplier β_1 (see, inter alia, Warmedinger et al., 2015):

$$g_t = \rho g_{t-1} + (1-\rho)\bar{g}_{t-1} + \beta_1 \Delta def_t^{p,E} - \beta_2 O_t - \beta_3 \left(r_t^{10yr} - r_{t-1}^{10yr}\right) \tag{4}$$

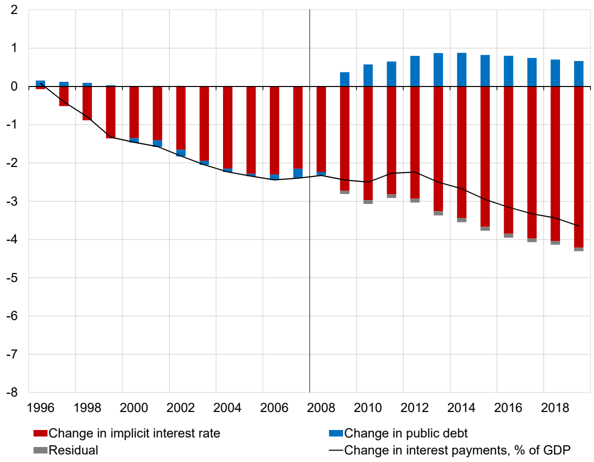
[6] For a general discussion of so-called Debt Sustainability Analysis (DSA) frameworks, see IMF (2021), and the references quoted therein.

Figure 2: General Government interest payments for the euro area aggregate.

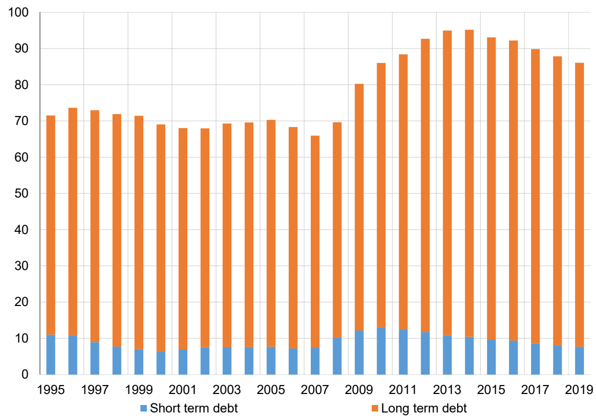
(a) Interest payments (in percentage of GDP)



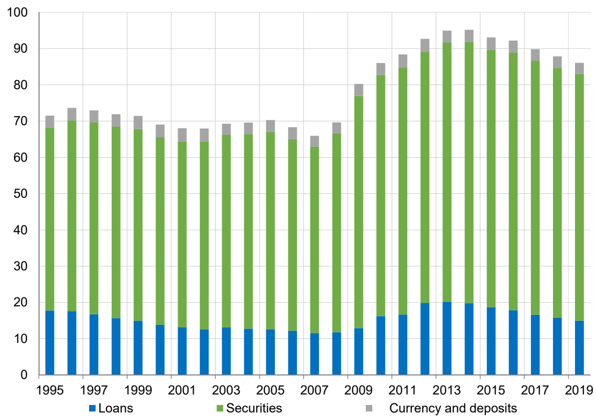
(b) Change in interest payments (in percentage of GDP)



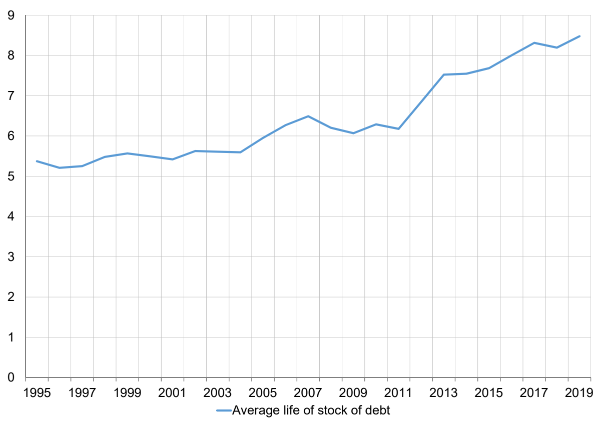
(c) Debt evolution by term to maturity (in percentage of GDP)



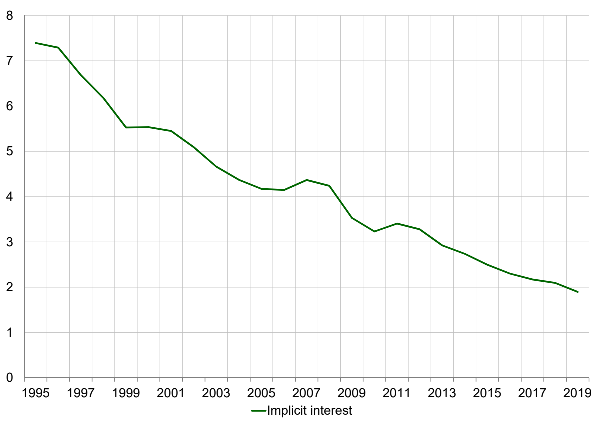
(d) Debt evolution by instrument (in percentage of GDP)



(e) Average life of debt (in number of years)



(f) Average interest rate (in percentage)



where ρ measures the persistence of the growth in real output, which in turn is found anchored to the growth of real potential output, $\bar{g}$. Furthermore, the situation of the output gap, O_t, conditions the rate of expansion of output, meaning that in each period a fraction β_2 of the gap closes. Equation (4), finally, includes an inverse relationship between the changes in the long-term market interest rate (proxied by the 10 year rate on sovereign bonds), r^{10yr}, and GDP growth, g_t. To complete the notation, the output gap is defined as $O_t \equiv \frac{Y_t - \bar{Y}_t}{Y_t}$, where $Y_t = (1 + g_t)Y_{t-1}$ denotes the level of real output, and $\bar{Y}_t = (1 + \bar{g}_t)\bar{Y}_{t-1}$ that of potential real output, while the public deficit as a percentage of nominal GDP, $def_t = \frac{DEF_t}{Y_t}$, is defined as the sum of the structural public deficit, def_t^E (or as a % of potential GDP $def_{p,t}^E$), and the cyclical deficit, def_t^C,

$$def_t \equiv def_{p,t}^E \, \frac{\bar{Y}_t}{Y_t} + def_t^C \tag{5}$$

where the cyclical deficit is defined as a proportion (elasticity, ϵ) of the output gap $def_t^C \equiv \epsilon \; O_t$.

The second behavioral equation is a Phillips curve, which links the course of the inflation rate with the degree of slack in the economy, measured by the output gap, and inflation expectations, which weight the recent past and the ECB's medium-term objective, π^0,

$$\pi_t = \theta_0 \pi^0 + (1 - \theta_0)\frac{1}{4}\left(\pi_{t-1} + \pi_{t-2} + \pi_{t-3} + \pi_{t-4}\right) + \theta_1 O_t \tag{6}$$

Finally, to determine the evolution of primary deficit a fiscal rule is needed. In particular, in the paper we assume that primary deficit evolves according to the SGP rules until the medium term objective is reached, while it remains stable from then on. In general, this means that the primary structural deficit is corrected by 0.5% of GDP every year until the primary structural balance is reached. Nonetheless, the exact path of structural deficit requirements in the model follows the matrix specifying the annual fiscal adjustment towards the Medium-Term objective under the preventive arm of the Pact, which is conditional on several economic variables: the difference between real growth and potential, the level of the output gap and the level of debt (and other rules, as prescribed in the *Vade Mecum* on the Stability and Growth Pact).

2.3 Interest payments and maturing debt

To close the model we need two additional equations, one determining interest spending of public debt, R_t^b, as the sum of the interest payments across a variety of debt instruments, that differ in their maturity (average life), cost and issuer, in cases in which several levels of government co-exist, and another, determining the evolution of public debt's implicit interest rates, r_t. Most models of debt sustainability include an stylised representation of implicit interest rate dynamics, with some persistence (hysteresis) consequence of the assumed term structure of public debt instruments, with two maturities: long-term and short-term.

However, since the objective of this paper is to calculate the impact on debt accumulation of EU loans, it is crucial to consider a richer model to calculate the interest rate burden on debt, which, among other things, distinguishes between different maturities and debt instruments.

From an accounting point of view the implicit interest rate on debt, r_t is defined as the ratio between the average level of outstanding public debt over a given year, $\bar{B}_t$, and interest paid in that very year, R_t^b,

$$r_t \equiv R_t^b / \bar{B}_t \tag{7}$$

which in turn is a composition of a variety of debt instruments, as mentioned above. The existence of different accounting standards (cash-based vs. accrual principle) also complicates the computation of interest payments, depending on the scope of the analysis.

We follow Martínez-Pagés (2018) and assume that total debt, B_t, can be decomposed according to their maturity and characteristics into the following instruments: currency and deposits, B_t^{CD}, short-term debt securities and loans, B_t^{ST}, with maturity up to one year, long-term debt issued by the national authority, B_t^{LT}, and long-term debt issued by the EU, B_t^{EU}:[7]

$$B_t \equiv B_t^{CD} + B_t^{ST} + B_t^{LT} + B_t^{EU} \tag{8}$$

According to ESA2010 accounting standards, an outstanding public debt instrument generates an obligation to pay interest on a time-continuous basis until it matures. Thus, the whole stream of public debt interest payments due can be computed as the product of the average outstanding debt in the future, times its implicit interest rate. In turn, average outstanding debt over a given year t, $\bar{B}_t$, can be decomposed into three elements:

$$\bar{B}_t \equiv \bar{B}_t^{carry} + \bar{B}_t^{mature} + \bar{B}_t^{new} \tag{9}$$

[7] This is a simplifying assumption which can be changed to respond to specific questions, for example distinguishing between the debt of national and regional authorities or between loans and securities.

where $\bar{B}_t^{carry}$ is debt issued in a year $\tau < t$, that does not mature at year t, $\bar{b}_t^{mature}$ refers to debt issued in a year $\tau < t$ that does mature in year t, and $\bar{B}_t^{new}$ stands for new debt issued over year t. The three components are expressed as averages over a given year, given that maturing debt and new issues are distributed within the year at different dates, and thus expressed with a bar symbol, ¯, while the same variable without the bar denotes the year-end value. The total amount of new debt at the end of year t, B_t^{new}, is equal to the rollover of matured debt plus the current deficit (primary and interest payments) and the deficit-debt adjustments in a given year.

$$B_t^{new} \equiv B_t^{mature} + DEF_t^p + R_t^b + DDA_t \tag{10}$$

In turn, each of these elements is calculated as the sum over the different debt instruments mentioned above (eg.: $B_t^{new} = \sum_M B_t^{new,M}$, where $M = CD, ST, LT, EU$) .

To compute annual average values, we apply the simplifying assumption that debt matures and is issued linearly over the year. Therefore, as shown in Figure 3, the annual average values are equal to one half the end-of-year values, except in the case of non-maturing debt, where both definitions are equivalent:

$$\bar{B}_t^{carry,M} = B_t^{carry,M} = B_{t-1}^{M} - B_t^{mature,M} \tag{11}$$

$$\bar{B}_t^{mature,M} = \frac{1}{2}\ B_t^{mature,M} = \frac{B_{t-1}^{M}}{al_{t-1}^{end,M}} \tag{12}$$

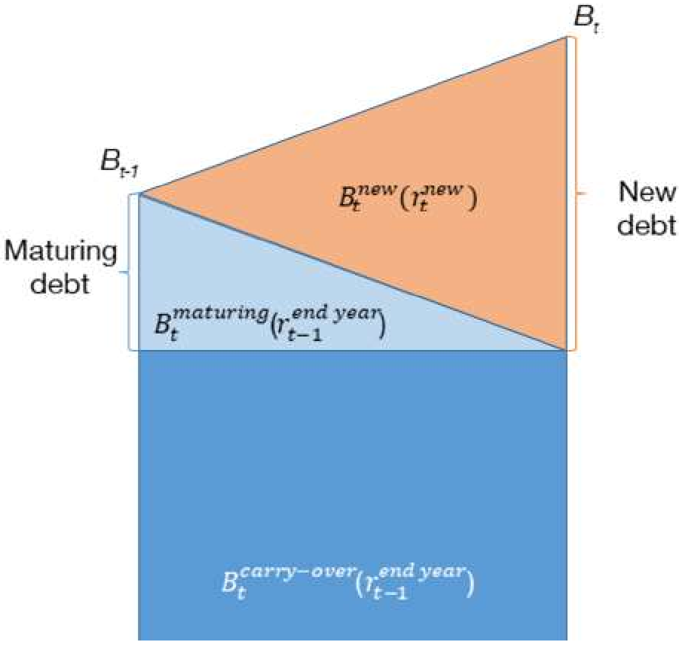
$$\bar{B}_t^{new,M} = \frac{1}{2}\ B_t^{new,M} \tag{13}$$

where M refers to the maturity (cash and deposits, short-term or long-term debt and EU debt) and $al_{t-1}^{end,M}$ is the average life of debt of maturity M outstanding at the end of year $t-1$ (see how is determined in the appendix). Notice that short-term debt and cash and deposits all mature after one year or less, so that $B_t^{mature,STorCD} = B_{t-1}^{STorCD}$ and $B_t^{carry,STorCD} = 0$. Moreover, we assume that over the forecast horizon new issues of short-term debt are similar to what was registered in previous periods, while cash and deposits grow at a constant rate.[8]

In turn, total interest paid, R_t^b, can be defined as the sum of interest on each one of the components in (9) and the maturities in (8). While the primary deficit is determined by the

[8]Alternatively, we could assume that the issues maintain the previous maturity structure or even study the impact of different maturity strategies over the forecast horizon.

Figure 3: Assumptions on timing of debt issuance and maturing in the model.



fiscal rule (see discussion above), interest payments are not. In order to calculate interest payments, first let us define $r_{t-1}^{end,M}$ to be the average interest rate on outstanding debt of maturity M at the end of year $t-1$. Second, let us also assume, for simplicity, that the average cost of maturing and outstanding liabilities is the same, which is reasonable in a situation of fixed interest rates on a given debt instrument over its life. Finally, let us define $r_t^{new,M}$ to be the average interest rate applied to new issues of maturity M over year t. Then, interest payments are determined by the following expression:

$$R_t^b \equiv \sum_M \left[r_{t-1}^{end,M} \ \left(\bar{B}_t^{carry,M} + \bar{B}_t^{mature,M} \right) + r_t^{new,M} \ \bar{B}_t^{new,M} \right] \tag{14}$$

The calculation of interest rates $r_{t-1}^{end,M}$ and $r_t^{new,M}$ can be done in the following way. First, we assume that currencies and deposits do not pay an interest ($r_{t-1}^{end,CD} = r_t^{new,CD} = 0$). Second, the average interest rate on the rest of short-term debt is observable and equal to the average interest rate of one-year Treasury bills over the period, $r_{t-1}^{end,ST} = r_{t-1}^{new,ST} = r_{t-1}^{1y}$. Third, the interest paid by new EU debt for 2020 is equal to the payments registered in the first issues of the SURE program and extended over the forecast horizon with the yield of the German Bund plus the spread observed in 2020. Finally, the end-of-year interest rate on long-term debt over the projection horizon is obtained as the weighted average of the end of period rate on old long-term debt and on new long-term debt[9], while the yield on new long-term issuances is an average of one-year and ten-year Treasury bills:

$$r_{t-1}^{end,LT} = r_{t-2}^{end,LT}\frac{B_{t-1}^{carry,LT}}{B_{t-1}^{LT}} + r_{t-1}^{new,LT}\frac{B_{t-1}^{new,LT}}{B_{t-1}^{LT}} \tag{15}$$

$$r_t^{new,LT} = r_t^{1yr} + \left(r_t^{10yr} - r_t^{1yr}\right)\frac{al_{t-1}^{new,LT} - 1}{10-1} \tag{16}$$

Finally, we can obtain the expression determining total interest payments and total average debt by substituting these elements into equation (14) and (9), respectively, and solving:

$$R_t^b = \left\{\begin{array}{r} \dfrac{r_{t-1}^{1yr} + r_t^{1yr}}{2 - r_t^{new,LT}}B_{t-1}^{ST} + \dfrac{(1-g^{CD})r_t^{new,LT}}{2 - r_t^{new,LT}}B_{t-1}^{CD} + \dfrac{r_t^{new,LT}}{2 - r_t^{new,LT}}(DEF_t^P + DDA_t) \\ \dfrac{(2al_{t-1}^{end,LT} - 1)r_{t-1}^{end,LT} + r_t^{new,LT}}{(2 - r_t^{new,LT})al_{t-1}^{end,LT}}B_{t-1}^{LT} \\ \dfrac{r_t^{new,LT} - r_{t-1}^{end,EU}}{2(2 - r_t^{new,LT})}B_t^{mature,EU} + \dfrac{r_{t-1}^{end,EU}}{2 - r_t^{new,LT}}B_{t-1}^{EU} + \dfrac{r_t^{new,EU} - r_t^{new,LT}}{2(2 - r_t^{new,LT})}B_t^{EU} \end{array}\right\} \tag{17}$$

$$\bar{B}_t = B_{t-1}^{CD} + B_{t-1}^{ST} + B_{t-1}^{LT} + B_{t-1}^{EU} + \frac{1}{2}\left(DEF_t^P + DDA_t + R_t^b\right) \tag{18}$$

as a function of exogenous variables (like the EU debt issuance or maturing or the DDAs) or variables determined the previous period and the current primary deficit. Therefore, this equation closes the model.

2.4 Endogenous long-term interest rate under market stress

In order to simulate the model one needs to make assumptions about the future values of long-term interest rates on new issues. One usual alternative is to calibrate them with market futures of the rates on 10-year government bonds, thus being independent of the evolution of public finances over the simulated period. This assumption is adequate under normal market conditions, but if for any reason there were doubts about the sustainability of a country's public finances, the government may suffer difficulties to obtain funds in the market and the interest rates on its government bonds may increase rapidly. Therefore, we

[9] Over the observed past this variable is estimated by extrapolating the trend of implicit rates $r_{t-1}^{end,LT} = r_{t-1}^{LT} + \frac{1}{2}(r_{t-1}^{LT} - r_{t-2}^{LT})$

assume that in situations of market stress the long-term interest rate on government bonds reacts to the situation of public finances, according to the following equation:

$$r_t^{10yr,stress} = r_t^{10yr} + \tau_d \left(d_{t-1} - \bar{d}\right) + \tau_b \left(b_{t-1} - \bar{b}\right) \tag{19}$$

where the long-term rate is affected by the situation of the country's public finances, measured by the distance between the public balance and debt with respect to their respective medium-term references. This is a standard fiscal reaction equation along the lines of those used in the DSA literature quoted before, that is also widely used as closure rule in macroeconomic models with detailed fiscal sectors used for policy analysis and forecasting (see, among other Dieppe et al. (2012), Smets et al. (2010), Coenen et al. (2013)). In the case of the euro area, these medium-term references are set by the Stability and Growth Pact at 3% and 60% of GDP, respectively.

3 Calibration

The basic calibration of the model's parameters is presented in tables 2 and 3, and is taken from Hernández de Cos et al. (2018); Warmedinger et al. (2015); Alvarez and Urtasun (2013); Baldacci and Kumar (2010); Laubach (2009); Boussard et al. (2013); Bouabdallah et al. (2017) and own calculations based on the data when applicable.

We calibrate the link between the deficit and the long-term rate τ_d=0.105 and the link between the debt and the long-term rate τ_b=0.014, so that the long-term rate converges at the end of the sample to the level implicit in the yield curve at that horizon. However, given the great uncertainty surrounding these parameters we also run the simulations under alternative parameterizations. In particular, we double (halve) the excessive deficit and debt coefficients in equation (19).

Finally, in the first two years, we include the expected GDP growth and fiscal deficit from the 2021 Spring Forecast of the European Commission. Moreover, we use the latest 10-year-yield future curve, obtained from JP Morgan (see blue line in Figure 4), as the input

Table 2: Calibration of the DSA aggregated model parameters

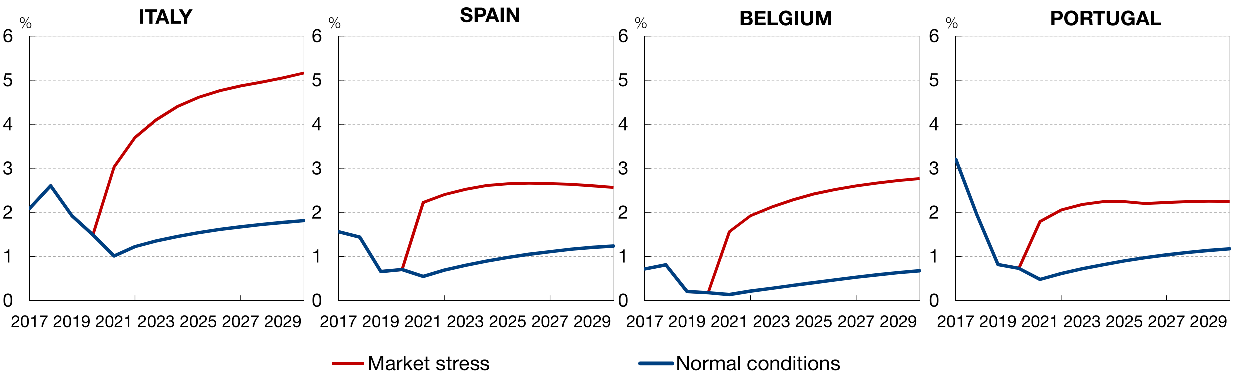
Parameter	Value	Explanation
ρ	0.5	persistence of output
β_1	0.55	average fiscal multiplier
β_2	0.20	closing of the output gap
β_3	0.5	elasticity of interest rate to GDP
$\bar{g}_t$	1.5%	potential growth
ϵ	0.45	elasticity of public balance to GDP
φ_0	0.3	anchor of inflation objective
φ_1	0.1	inflation response to cyclical slack
φ_r	0.8	persistence of implicit rate

Table 3: Calibration of the DSA country-specific model parameters

Variable	Spain	Italy	Belgium	Portugal
Potential growth	1.0	0.3	1.1	1.5
Average maturity of long-term debt	8.7	9.3	13.8	7.1

Source: European Commission and National Treasuries.

Figure 4: Yield curve futures assumption under different scenarios.



for the long run interest rate. The yields for Spain and Portugal are broadly comparable, while they are slightly lower for Belgium and significantly higher for Italy.

4 Simulation exercises

4.1 Baseline conditions

As indicated in the Introduction, we simulate the impact of loans provided by European institutions under the SURE programme for the four largest EMU countries participating: Italy, Spain, Belgium and Portugal. We run the simulations first under normal market conditions, as represented by the 10-year-yield future curve, and then under stressed market conditions, as determined by equation (19) above.[10] The results are presented in nominal terms, aggregating interest savings over the decade lasting from 2021 to 2030 and as a percentage of the total loans granted.[11]

In the case of SURE, we simulate the impact of the amounts received as loans by each country, at the end of 2021 (see Table 1 above), replicating the details of the SURE bonds in terms of cost and maturities.[12] In particular, we assume that all the new debt is issued in 2021 at the average rate of -0.201 and repayments follow the general maturity structure at which the SURE bonds are issued by the EU.[13]

The calculations are based on the counterfactual that, absent the programme, the country issues the same amounts, but according to the average yearly issuance profile of the country, that is, with the same maturity and interest rate than the rest of the country's debt. Therefore, three forces separate the savings under the programme with respect to an alternative calculation that assumes that, in the absence of loans from SURE, Member States would have issued bonds with the same characteristics as the SURE bonds.[14] First, the average interest rate at issuance during the year can differ from the one prevalent at the dates of issuance of the EU bonds. Second, the country can choose to issue debt at shorter horizons, with lower interest rates, thus reducing the savings. Third, it will have to roll-over this debt earlier making the country more fragile to future increases in rates. This final channel will be more important in the simulations in which we assume a stressed market scenario.

[10] If instead we keep the interest rates constant across the simulated horizon, savings will be lower, since the gains are higher the greater the long-term rates.

[11] Alternatively, this can be interpreted as total savings per 1 bn loans.

[12] The conditions of the loans and the financing of the EU can be found at `https://ec.europa.eu/info/files/sure-taking-stock-after-six-months_en`.

[13] Actually, SURE bonds are granted as back-to-back financing, meaning that the loans to countries have the same cost and maturity structure than the bond issued by the EU. We make the simplifying assumption that the total amount of loans is granted at the average cost, and is partially redeemed at the same dates that the EU bonds are redeemed.

[14] See Box 1 in the Report on the European instrument for Temporary Support to mitigate Unemployment Risks in an Emergency (SURE) following the COVID-19 outbreak pursuant to Article 14 of Council Regulation (EU) 2020/672 SURE: Taking Stock After Six Months

The total savings from the deployment of the SURE programme, aggreggated in current euros over the first 10 years of the programme can be seen in the top part of Table 4. The largest savings are found in Italy, where the savings during the first 10 years represent almost 12% of the loans received, while Spain saves around 5%, and Portugal and Belgium have savings under 4%. This is approximately in line with the differences in the respective yield curves of the countries, for Italy and Spain. In Portugal, savings are smaller, as the maturity structure of its debt is shorter than the other countries, and subsequently the SURE loans substitute debt at the shorter end of the yield curve.[15] In the case of Belgium, although the initial level of long term rates is lower than in the rest, the slope is slightly steeper and the maturity of national debt longer.

4.2 Under stressed market conditions

The main advantage of our model is the ability to produce counterfactual interest payments depending on the future path of interest rates. In particular, we calculate the savings under a stressed scenario in which the long-term interest rate of new issues reacts endogenously to the situation of the country's public finances, measured by the distance between the public balance and debt with respect to their respective medium-term references as modelled in equation (19). As shown in the red line of Figure 4, the long-term rates in each country under this assumption initially increase significantly more than the yield curve because both the deficit and the debt are well above their references in all countries, going above 4.5% in Italy and around 2.5% in the other countries considered. Afterwards, an initial moderation in rates (more significant for Italy), thanks to the short-term improvement in public finances as the economy recovers from the COVID-19 crisis, is followed by a stabilization at high

Table 4: Savings from EU's SURE loan scheme.

	millions €				**Savings as % of loans**			
	IT	**ES**	**BE**	**PT**	**IT**	**ES**	**BE**	**PT**
Total loans	**27440**	**21320**	**8197**	**5930**				
Normal times	3243	1133	250	227	11.8	5.3	3.1	3.8
Market stress	6619	2325	753	409	24.1	10.9	9.2	6.9

[15]They are also similar to the numbers reported by the European Commission, taking into account that those numbers account for the whole programme, and ours, for the first 10 years. See https://ec.europa.eu/info/sites/default/files/economy-finance/sure$_one_year_on.pdf$.

Table 5: Total savings under stressed market conditions (as % of total loans)

	Coefficient of excessive deficit in long-term rate				**Coefficient of excessive debt in long term rate**			
SURE	**IT**	**ES**	**BE**	**PT**	**IT**	**ES**	**BE**	**PT**
Market stress	24	11	9	7	24	11	9	7
with high coefficient	40	16	18	9	37	17	18	13
with low coefficient	20	9	7	7	19	9	7	6

rates for most of the decade. In the case of Belgium, rates continue to increase for the whole horizon, since growth rates are expected to remain subdued.

As a consequence of the higher long-term rates, savings from EU programs are much larger, reaching in the case of SURE 24% of the loans extended for Italy, 11% for Spain and 9% for Belgium (see third row of Table 4).

Finally, in Table 5 we show how these results change under different assumptions about the coefficients in the endogenous interest rate equation (19). In particular, the higher the debt of the country, the higher the potential savings from EU loans when the coefficient that governs the behaviour of interest rates depending on the level of debt increases, as they cushion the destabilizing effect on interest rates.

5 Conclusions

We analyse the role of SURE loans for national public finances, both as a cost-saving tool and as a backstop for hypothetical scenarios in which market conditions were less favourable than current ones (but assuming that market access prevails for EU countries and the EC). We show that under a scenario of favourable financing conditions, savings depend largely on the distance to the EU funding rate. At the same time, nonetheless, we show that in counterfactual simulations in which stressed market scenarios are considered, interest payment savings can be substantial. We read these results as supporting the view that the main contribution of EU-wide loan tools is to provide an insurance mechanism against market stress through the conversion of risky, shorter-term national debt in safe, long-term common debt. This contribution would be reinforced in the case of more extreme risks involving compromised market access.

As a result, the SURE programme has been able to improve both current and future public finances, with a limited cost on the side of the EU, which should help draw a lesson for the design of a future permanent unemployment reinsurance scheme.

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A Appendix: Derivation of the implicit interest rate and interest payments

To compute annual average values for each maturity, we apply the simplifying assumptions described in section 2 of the main text and the expressions defined in equations 11 - 13 to get the following in the case of cash and deposits and short-term debt:

$$
\begin{aligned}
\bar{B}_t^{carry,CD} &= \bar{B}_t^{carry,ST} = 0 \\
\bar{B}_t^{mature,CD} &= \frac{1}{2}\ B_{t-1}^{CD} \\
\bar{B}_t^{mature,ST} &= \frac{1}{2}\ B_{t-1}^{ST} \\
\bar{B}_t^{new,ST} &= \frac{1}{2} B_t^{new,ST} = \frac{1}{2} B_{t-1}^{ST} \\
\bar{B}_t^{new,CD} &= \frac{1}{2} B_t^{new,CD} = \frac{1}{2} g^{CD} B_{t-1}^{CD}
\end{aligned}
\tag{A20}
$$

while in the case of long-term debt:

$$
\begin{aligned}
\bar{B}_t^{mature,LT} &= \frac{1}{2} B_t^{mature} = \frac{B_{t-1}^{LT}}{2al_{t-1}^{end,LT}} \\
\bar{B}_t^{mature,EU} &= \text{set by EC} \\
\bar{B}_t^{carry,LT} &= B_{t-1}^{LT} - B_t^{mature,LT} = \frac{al_{t-1}^{end,LT} - 1}{al_{t-1}^{end,LT}} B_{t-1}^{LT} \\
\bar{B}_t^{carry,EU} &= B_{t-1}^{EU} - B_t^{mature,EU} \\
\bar{B}_t^{new,LT} &= \frac{1}{2} B_t^{new,LT} = \frac{1}{2}\left(B_t^{new} - B_t^{new,ST} - B_t^{new,CD} - B_t^{new,EU}\right) \\
\bar{B}_t^{new,EU} &= \text{set by EC}
\end{aligned}
\tag{A21}
$$

The average life of long-term debt outstanding at the end of the previous year in the previous expression, $al_t^{end,LT}$, can be estimated as a weighted average of the average life of debt carried-over to that period, $al_{t-1}^{carry,LT}$, and the average life of new debt, $al_t^{new,LT}$:

$$
al_t^{end,LT} = \left(al_{t-1}^{carry,LT} - 1\right) \frac{B_t^{carry,LT}}{B_t^{LT}} + \left(al_t^{new,LT} - \frac{1}{2}\right) \frac{B_t^{new,LT}}{B_t^{LT}} \tag{A22}
$$

where a 1 is subtracted from $al_{t-1}^{carry,LT}$ because at the end of year t non-maturing $t-1$ debt's average life will be one full year lower at the end of year t, while, given the assumption of linear new issues over the year, the average life of remaining $B_t^{new,LT}$ at the end of the year is equal to that at the moment of issue less half a year, on average. In addition, $al_{t-1}^{carry,LT}$ can be estimated assuming that debt maturing at year t had at the end of year $t-1$ an average life of 1 year (this follows from the linear issue assumption), which gives the following equation:

$$al_{t-1}^{end,LT} = al_{t-1}^{carry,LT}\frac{B_t^{carry,LT}}{B_{t-1}^{LT}} + \frac{1}{2}\frac{B_t^{maturing,LT}}{B_{t-1}^{LT}} \tag{A23}$$

Now, substituting equations A20 and A26 into the annual average values of debt for each maturity using the expression $\bar{B}_t^M = \bar{B}_t^{carry,M} + \bar{B}_t^{mature,M} + \bar{B}_t^{new,M}$ we get

$$\begin{aligned}
\bar{B}_t^{CD} &= (1+g^{CD})B_{t-1}^{CD}\\
\bar{B}_t^{ST} &= B_{t-1}^{ST}\\
\bar{B}_t^{LT} &= \frac{2al_{t-1}^{end,LT}-1}{2al_{t-1}^{end,LT}}B_{t-1}^{LT} + \frac{1}{2}\left(B_t^{new} - B_t^{new,ST} - CD_t^{new} - B_t^{new,EU}\right)\\
\bar{B}_t^{EU} &= B_{t-1}^{EU} + \frac{1}{2}\left(B_t^{new,EU} - B_t^{mature,EU}\right)
\end{aligned} \tag{A24}$$

Then substituting from above we get the expressions for new total issuances and long-term issuances

$$\begin{aligned}
B_t^{new} &= B_t^{mature} + DEF_t^p + R_t^b + DDA_t = \sum_M B_t^{mature,M} + DEF_t^p + R_t^b + DDA_t\\
&= B_{t-1}^{CD} + B_{t-1}^{ST} + \frac{B_{t-1}^{LT}}{al_{t-1}^{end,LT}} + B_t^{mature,EU} + DEF_t^p + R_t^b + DDA_t
\end{aligned} \tag{A25}$$

$$\begin{aligned}
B_t^{new,LT} &= \left(B_t^{new} - B_t^{new,ST} - B_t^{new,CD} - B_t^{new,EU}\right)\\
&= (1-g^{CD})B_{t-1}^{CD} + \frac{B_{t-1}^{LT}}{al_{t-1}^{end,LT}} + \left(B_t^{mature,EU} - B_t^{new,EU}\right) + DEF_t^p + R_t^b + DDA_t
\end{aligned} \tag{A26}$$

To compute the yield paid by the different types of debt for each maturity, we apply the simplifying assumptions described in section 2 of the text and the expression defined in equation 15 to get

$$
\begin{aligned}
r_{t-1}^{end,CD} &= r_t^{new,CD} = 0 \\
r_{t-1}^{end,ST} &= r_{t-1}^{new,ST} = r_{t-1}^{1yr} \\
r_{t-1}^{end,LT} &= r_{t-2}^{end,LT} \frac{B_{t-1}^{carry,LT}}{B_{t-1}^{LT}} + r_{t-1}^{new,LT} \frac{B_{t-1}^{new,LT}}{B_{t-1}^{LT}} \\
r_t^{new,LT} &= r_t^{1yr} + \left(r_t^{10yr} - r_t^{1yr} \right) \\
r_{t-1}^{end,EU} &= r_{t-2}^{end,EU} \frac{B_{t-1}^{EU} - B_t^{mature,EU}}{B_t^{EU}} + r_t^{new,EU} \frac{B_t^{new,EU}}{B_t^{EU}} \\
r_t^{new,EU} &= \text{set by EC}
\end{aligned} \tag{A27}
$$

Finally, substituting equations A24 and A27 into the interest payment equation for each maturity ($R_t^{b,M} = r_{t-1}^{end,M}(\bar{B}_t^{carry,M} + \bar{B}_t^{mature,M}) + r_t^{new,M} \bar{B}_t^{new,M}$) we get

$$
\begin{aligned}
R_t^{b,CD} &= 0 \\
R_t^{b,ST} &= \left(r_{t-1}^{1yr} + r_t^{1yr} \right) \frac{B_{t-1}^{ST}}{2} \\
R_t^{b,LT} &= r_{t-1}^{end,LT} \frac{2al_{t-1}^{end,LT} - 1}{2al_{t-1}^{end,LT}} B_{t-1}^{LT} + r_t^{new,LT} \frac{B_t^{new} - B_{t-1}^{ST} - g^{CD} B_{t-1}^{CD}}{2} \\
R_t^{b,EU} &= r_{t-1}^{end,EU} \left(B_{t-1}^{EU} - \frac{B_t^{mature,EU}}{2} \right) + r_t^{new,EU} \bar{B}_t^{new,EU} 2
\end{aligned} \tag{A28}
$$

To get equation 17 in the main text, we substitute equations in A28 and A26 into the expression for interest payments ($R_t^b = \sum_M R_t^{b,M}$) to get

$$
R_t^b = \left\{ \begin{array}{r}
\left(r_{t-1}^{1yr} + r_t^{1yr} \right) B_{t-1}^{ST} + (1 - g^{CD}) r_t^{new,LT} B_{t-1}^{CD} \\
+ r_t^{new,LT} \left(DEF_t^P + DDA_t + R_t^b \right) + \dfrac{(2al_{t-1}^{end,LT} - 1) r_{t-1}^{end,LT} + r_t^{new,LT}}{al_{t-1}^{end,LT}} B_{t-1}^{LT} \\
\dfrac{r_t^{new,LT} - r_{t-1}^{end,EU}}{2} B_t^{mature,EU} + r_{t-1}^{end,EU} B_{t-1}^{EU} + \dfrac{r_t^{new,EU} - r_t^{new,LT}}{2} B_t^{EU}
\end{array} \right\} \tag{A29}
$$

and solve for total interest payments R_t^b.

To get equation 18 in the main text, we substitute equations in A24 and A26 into the expression for average debt by maturity ($\bar{B}_t = \sum_M \bar{B}_t^M$) to get

$$
\bar{B}_t = B_{t-1}^{CD} + B_{t-1}^{ST} + B_{t-1}^{LT} + B_{t-1}^{EU} + \frac{1}{2} \left(DEF_t^P + DDA_t + R_t^b \right) \tag{A30}
$$

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