Computing the EU's SURE Interest Savings with an Extended Debt Sustainability Analysis Tool[*]

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Abstract

The EU's SURE programme provided loans to member states to fund public spending on unemployment schemes during the COVID-19 crisis. Funds were raised through securities issued on capital markets and disbursed as bilateral loans. This paper examines the interest savings from loans for Belgium, Spain, Portugal, and Italy using a Debt Sustainability Analysis tool extended to account for different types of debt. Results show significant interest savings under the SURE programme, with potential for even greater savings during periods of market stress.

Keywords: Public debt, Fiscal sustainability, Interest payments, European Union.

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

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 preserving 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 December 2022, 94 bn have been allocated to 19 Member States (see Table 1)[2]. 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 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.[3]

Figure 1
SOVEREIGN 10-YEAR YIELDS: EU COUNTRIES AND SUPRANATIONALS
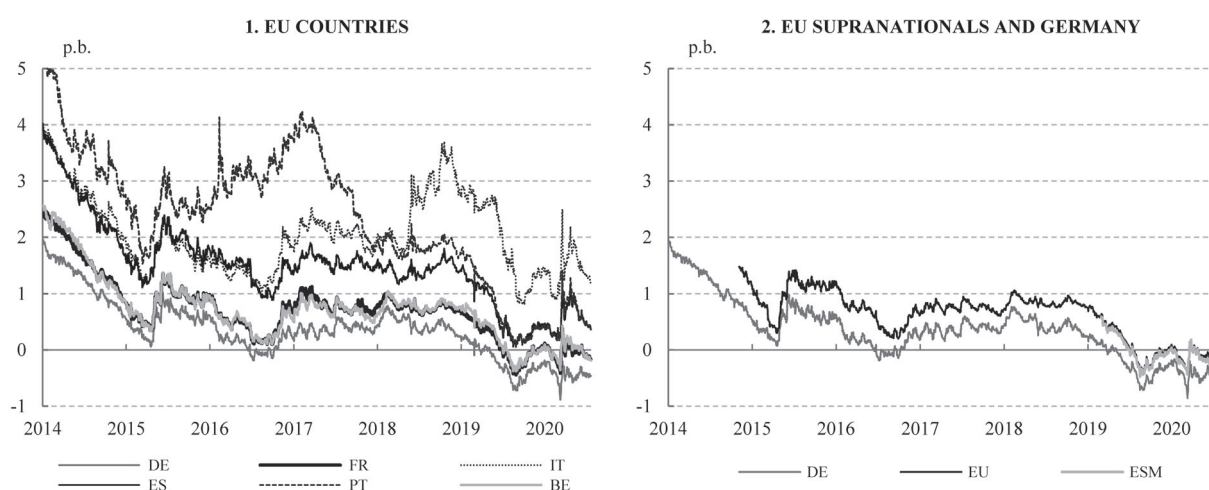
Source: Bloomberg.

A key feature of the programme are the reduced costs borne by receiving countries. As it can be seen in figure 1, 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 or the ESM. 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 respect 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 (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).[4]

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, which usually 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?

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

(a) Until March, 2021.

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

Source: European Commission.

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. 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 Gros, 2018)). Recent methodological references are IMF (2021), EC (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. We take into account different funding sources in terms of maturities and costs.[5]

The paper is also related to the recent debate on debt sustainability against the background of low interest rates. In this sense, the DSA framework has been proposed by some authors (Blanchard *et al*., 2021) as an alternative tool to numerical fiscal rules in the European Union. These authors propose abandoning the formal rules-based systems and adopting

a system of transnational standards, such as the need to prevent "excessive budget deficits", based on country-specific government debt sustainability analyses.

We use our DSA model to conduct simulations for public debt and interest payments in two 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 the favourable market conditions when the SURE loans were disbursed prevail over a prolonged period of time. In a second set of scenarios, in turn, 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.

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) and very similar to those estimated by the European Commission for the four countries (which were, in percentage of the amount disbursed, 14% for Italy, 7% for Portugal and Spain and 2% for Belgium). The savings depend on the 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 much larger.

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

In this section, we describe the model we use for studying debt dynamics. First, we describe the basic debt sustainability equation, which the model follows. Second, we introduce behavioural equations to the dynamics of the main endogenous variables. We use a stylized version of the traditional New Keynesian model, featuring an IS curve and a Phillips curve (Galí, 2015). Finally, we describe how we calculate the country's interest payments, which is the main novelty of the paper. In addition, although we abstract from the central bank's behaviour, we feature a sovereign risk premium channel, similar to Corsetti *et al.* (2013).

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

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

where π_t is net inflation, g_t is net growth of real GDP and def_t 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:

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

Figure 2 presents the determinants of euro area debt-to-GDP ratio following equation 3 (and abstracting from deficit-debt adjustments).

Figure 2
EVOLUTION OF THE DETERMINANTS OF EURO AREA DEBT-TO-GDP RATIO
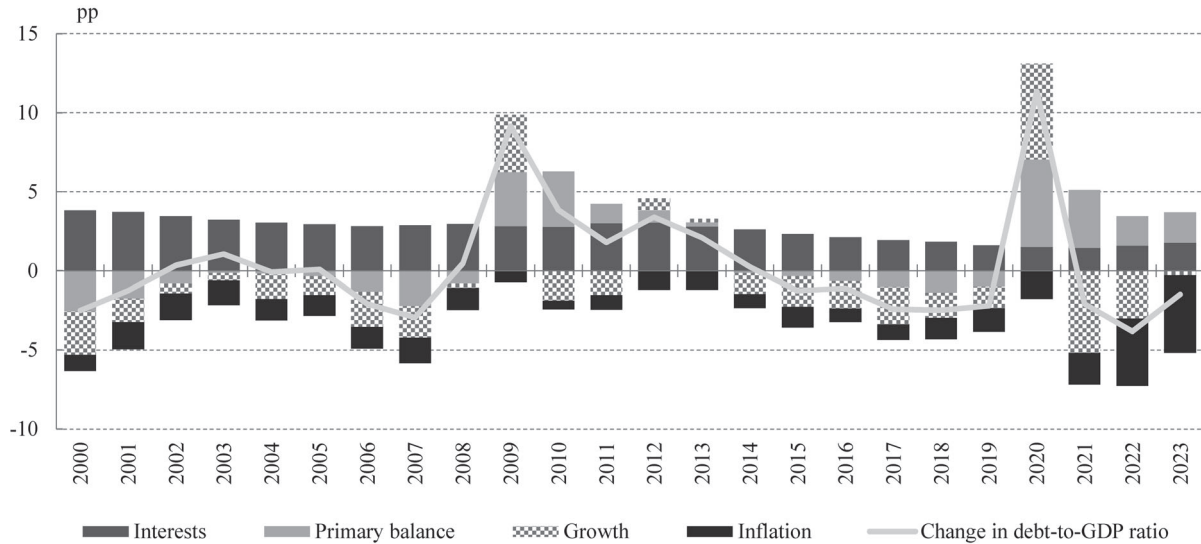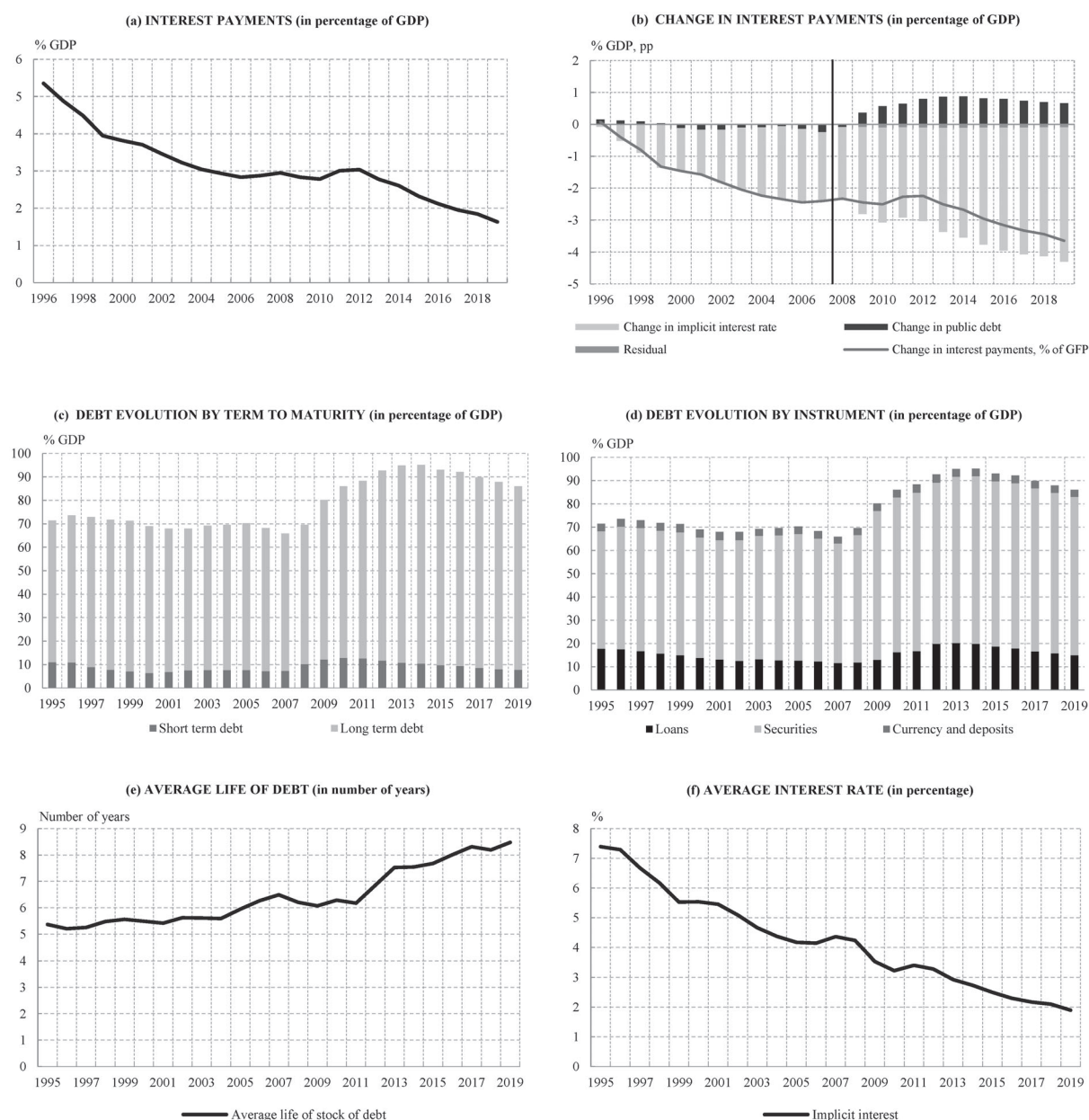

Source: AMECO.

Figure 3 shows the evolution of interest payments, debt and maturity in the euro area aggregate before the Covid-19 crisis. As it can be seen, the fall in the interest payments (panel a) closely follows the fall in the aggregate interest rate (panel b). This effect has been counteracted by the increase in the maturity of debt and the average increase in public debt.

Figure 3
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)

Source: AMECO and own calculations.

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 model is a synthetic, backward-looking version of a New Keynesian model (see Galí, 2015), in which aggregate demand will depend on interest rate and output gap developments, including the effect of the fiscal impulse. Specifically, 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 percent-

age of nominal potential GDP, $P_t \overline{Y}_t$, and of changes in interest rates on real economic growth, g, given by the fiscal multiplier β_1 and the elasticity of GDP growth to interest rates β_3 (see, inter alia, Warmedinger *et al.*, 2015):

$$g_t = \rho g_{t-1} + (1 - \rho)\overline{g} + \beta_1 \Delta def_t^{p,E} + \beta_2 O_t + \beta_3(r_t - r_{t-1}) \qquad (4)$$

where ρ measures the persistence of the growth in real output, which in turn is found anchored to the growth of real potential output, $\overline{g}$. 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, r_t, and GDP growth, g_t. To complete the notation, the output gap is defined as $O_t \equiv \dfrac{Y_t - \overline{Y}_t}{Y_t}$, where $Y_t = (1 + g_t)Y_{t-1}$ denotes the level of real output, and $\overline{Y}_t = (1 + \overline{g}_t)\overline{Y}_{t-1}$ that of potential real output, while the public deficit as a percentage of nominal GDP, is defined as the sum of the structural public deficit, def^{E_t} (or as a % of potential GDP $def_t^{p,E}$), and the cyclical deficit, def_t^C,

$$def_t \equiv def_t^{p,E} \frac{\overline{Y}_t}{Y_t} + def_t^C \qquad (5)$$

where the cyclical deficit is defined as a proportion (elasticity, ϵ) of (the inverse) of the output gap, such that the public deficit increases proportionally during recessions $def_t^C \equiv -\epsilon O_t$.

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,

$$\pi_t = E_t(\pi_{t+1}) + \theta_1 O_t \qquad (6)$$

and

$$E_t(\pi_{t+1}) = \theta_0 \pi^0 + (1 - \theta_0)\frac{1}{4}(\pi_{t-1} + \pi_{t-2} + \pi_{t-3} + \pi_{t-4}) \qquad (7)$$

Finally, to determine the evolution of primary deficit a fiscal rule is needed. We assume that the primary deficit evolves according to the SGP rules until the medium-term objective is reached, while it remains stable from then on, following EC (2015). In general, this means that, if the public deficit is above 3% of GDP, the primary structural deficit is corrected by 0.5% of GDP every year. When it is below, the adjustment of the primary structural deficit will follow a matrix specifying the annual fiscal adjustment towards a "Medium-Term objective", which is country-specific. This adjustment 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), see Table 2.

Table 2
MATRIX OF PRIMARY STRUCTURAL DEFICIT ADJUSTMENTS

		Debt condition	
		Debt ≤ 60% of GDP	**Debt ≥ 60% of GDP**
Growth condition	$g_t \leq 0$ or $O_t \leq$ -4%	No adjustmentment	
	-4 ≤ O_t ≤ -3	0	0.25
	-3 ≤ O_t ≤ -1.5	0 if $g_t \leq \bar{g}_t$, 0.25 if above	0.25 if $g_t \leq \bar{g}_t$, 0.5 if above
	-1.5 ≤ O_t ≤ 1.5	0.5	0.5
	$O_t \geq 1.5$	0.5 if $g_t \leq \bar{g}_t$, 0.75 if above	0.75 if $g_t \leq \bar{g}_t$, 1 if above

Source: European Commission.

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 a 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 interest paid in a given year, R_t^b and the average level of outstanding public debt over that year, $\bar{B}_t$,

$$r_t \equiv R_t^b / \bar{B}_t \tag{8}$$

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 will now proceed to explain how we obtain expressions for each of these variables. First, to obtain the average level of total debt, $\bar{B}_t$, we start by defining total debt B_t and then show how to express it in terms of the average over a given year. Second, we obtain the interest payments as the sum of the interest on each of the components of debt and maturities.

First, we assume total debt, B_t, can be decomposed according to their maturity and characteristics into the following instruments (in line with Martínez-Pagés, 2018): 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]

$$B_t \equiv B_t^{CD} + B_t^{ST} + B_t^{LT} + B_t^{EU} \tag{9}$$

Figure 4
ASSUMPTIONS ON TIMING OF DEBT ISSUANCE AND MATURING IN THE MODEL
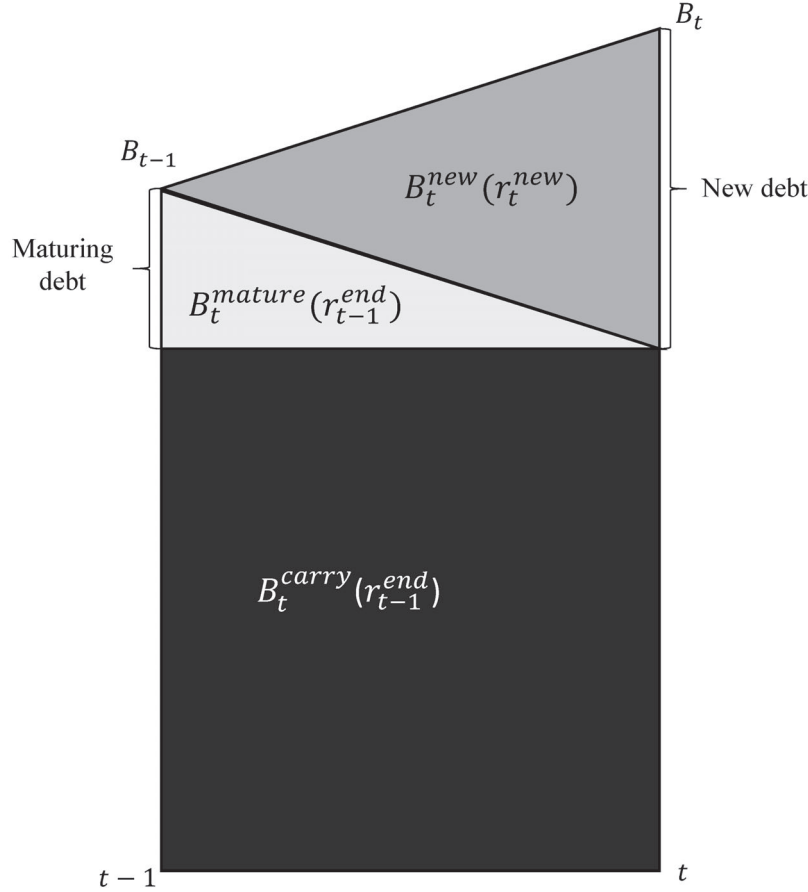
According to ESA2010 accounting standards, an outstanding public debt instrument generates an obligation to pay interest on a time-continuous basis until it matures. Thus, the whole stream of public debt interest payments due can be computed as the product of the average outstanding debt in the future, times its implicit interest rate. In turn, average outstanding debt over a given year t, $\bar{B}_t$, can be decomposed into three elements:

$$\bar{B}_t \equiv \bar{B}_t^{carry} + \bar{B}_t^{mature} + \bar{B}_t^{new} \tag{10}$$

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, $\bar{B}_t^{new}$, 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.

$$B_t^{new} \equiv B_t^{mature} + DEF_t^p + R_t^b + DDA_t \tag{11}$$

In turn, each of these elements is calculated as the sum over the different debt instruments mentioned above (eg.: $B_t^{new} = \Sigma_M B_t^{new,M}$, 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 4, 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:

$$\bar{B}_t^{carry,M} = B_t^{carry,M} = B_{t-1}^M - B_t^{mature,M} \tag{12}$$

$$\bar{B}_t^{mature,M} = \frac{1}{2} B_t^{mature,M} = \frac{B_{t-1}^M}{al_{t-1}^{end,M}} \tag{13}$$

$$\bar{B}_t^{new,M} = \frac{1}{2} B_t^{new,M} \tag{14}$$

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 $B_t^{mature,ST\ or\ CD} = B_{t-1}^{ST\ or\ CD}$ and $B_t^{carry,ST\ or\ CD} = 0$.

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]

Second, total interest paid, R_t^b, can be defined as the sum of interest on each one of the components in (10) and the maturities in (9). While the primary deficit is determined by the 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. Thus maturing debt is assumed to be of a similar maturity to the average maturity of the stock and therefore pays a similar rate, which, however, is changing overtime. 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:

$$R_t^b \equiv \sum_M \left[r_{t-1}^{end,M} \left(\bar{B}_t^{carry,M} + \bar{B}_t^{mature,M} \right) + r_t^{new,M} \bar{B}_t^{new,M} \right] \tag{15}$$

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, $r_{t-1}^{end,ST} = r_{t-1}^{new,ST} = r_{t-1}^{1,y}$. 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:

$$r_{t-1}^{end,LT} = r_{t-2}^{end,LT} \frac{B_{t-1}^{carry,LT}}{B_{t-1}^{LT}} + r_{t-1}^{new,LT} \frac{B_{t-1}^{new,LT}}{B_{t-1}^{LT}} \tag{16}$$

$$r_t^{new,LT} = r_t^{1yr} + \left(r_t^{10yr} - r_t^{1yr}\right) \frac{al_{t-1}^{new,LT} - 1}{10 - 1} \tag{17}$$

Finally, we can obtain the expression determining total interest payments and total average debt by substituting these elements into equation (15) and (10), respectively, defining δ^{CD} as the growth rate of cash and deposits and solving (see Appendix):

$$R_t^b = \left\{ \begin{array}{c} \dfrac{r_{t-1}^{1yr} + r_t^{1yr}}{2 - r_t^{new,LT}} B_{t-1}^{ST} + \dfrac{(1 - \delta^{CD})r_t^{new,LT}}{2 - r_t^{new,LT}} B_{t-1}^{CD} + \dfrac{r_t^{new,LT}}{2 - r_t^{new,LT}}(DEF_t + DDA_t) + \\[2ex] + \dfrac{\left(2al_{t-1}^{end,LT} - 1\right)r_{t-1}^{end,LT} + r_t^{new,LT}}{(2 - r_t^{mew.LT})al_{t-1}^{end.LT}} B_{t-1}^{LT} + \\[2ex] + \dfrac{r_t^{new,LT} - r_{t-1}^{end,EU}}{2\left(2 - r_t^{new,LT}\right)} B_t^{mature,EU} + \dfrac{r_{t-1}^{end,EU}}{2 - r_t^{new,LT}} B_{t-1}^{EU} + \dfrac{r_t^{new,EU} - r_t^{new,LT}}{2\left(2 - r_t^{new,LT}\right)} B_t^{EU} \end{array} \right\} \tag{18}$$

$$\bar{B}_t = B_{t-1}^{CD} + B_{t-1}^{ST} + B_{t-1}^{LT} + B_{t-1}^{EU} + \frac{1}{2}(DEF_t + DDA_t + R_t^b) \tag{19}$$

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 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:

$$r_t^{10yr,stress} = r_t^{10yr} + \tau_d\big(d_{t-1} - \bar{d}\big) + \tau_b\big(b_{t-1} - \bar{b}\big) \tag{20}$$

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, which is also widely used as a 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. 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, besides its effect on the fiscal variables. However, it could be the case that the issuance of this debt increases the interest rate of a safe country (or reduces the interest rate of a non-safe 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. Given the limited amounts of SURE, this channel may yield additional but moderate savings. In any case, this channel might be significant for larger EU loan programs.

Summing up, the basic equations of the model are the IS curve (equation 4), the Phillips curve (equation 6), the implicit interest rate (equation 8), which is a function of the evolution of interest payments (equation 18) and of average debt (equation 19), the fiscal rule defined in Table 2 and, in the case of endogenous interest rate, the sovereign risk premium (equation 20). The core parameters of the model are described in the next section.

3. Calibration

The basic calibration of the model's parameters is presented in tables 3 and 4.

We calibrate the link between the deficit and the long-term rate $\tau_d = 0.105$ and the link between the debt and the long-term rate $\tau_b = 0.014$, 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 (20).

Table 3
CALIBRATION OF THE DSA AGGREGATED MODEL PARAMETERS

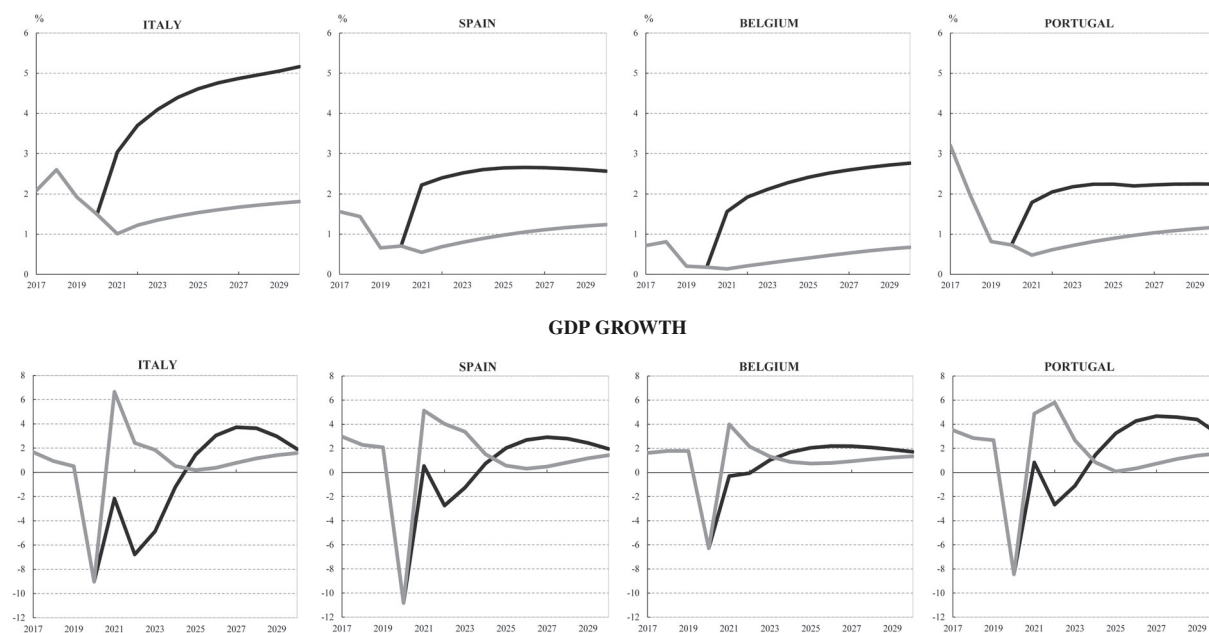| Parameter	Value	Explanation	Source
ρ	0.5	Persistence of GDP growth rate	Bouabdallah *et al.* (2017)
β_1	0.55	Average fiscal multiplier	Bouabdallah *et al.* (2017)
β_2	0.20	Closing of the output gap	Warmedinger *et al.* (2015)
β_3	0.1	Elasticity of GDP growth to interest rates	Warmedinger *et al.* (2015)
ϵ	0.45	Elasticity of public balance to GDP	Price *et al.* (2014)
θ_0	0.3	Anchor of inflation objective	Alvarez and Urtasun (2013)
θ_1	0.1	Inflation response to cyclical slack	Ball and Mazumder (2011)

Source: European Commission and National Treasuries.

Table 4
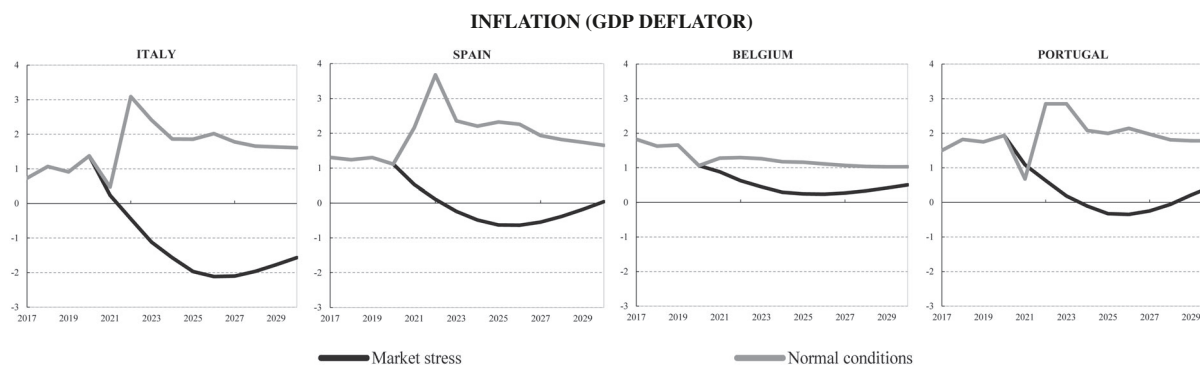**CALIBRATION OF THE DSA COUNTRY-SPECIFIC MODEL PARAMETERS**

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 5
EVOLUTION OF YIELDS, GDP AND INFLATION UNDER DIFFERENT SCENARIOS
YIELD CURVE FUTURES

GDP GROWTH

(Continued)

INFLATION (GDP DEFLATOR)

| ITALY | SPAIN | BELGIUM | PORTUGAL |

━━━ Market stress   ━━━ Normal conditions

Source: Own calculations.

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 country-specific 10-year-yield future curve, calculated by the ECB based on market expectations as of June 2021 (see grey line in Figure 5), as the input 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 (20) 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 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.

Table 5
SAVINGS FROM EU'S SURE LOAN SCHEME

	Millions €				Saving 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

The total savings from the deployment of the SURE programme, aggregated in current euros over the first 10 years of the programme can be seen in the top part of Table 5. 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. 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.[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 (20). As shown in the red line of Figure 5 (top panel), 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, 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 rates for most of the decade. In the case of Italy and Belgium, rates continue to increase for the whole horizon, since growth rates are expected to remain subdued. The higher rates generate a recession and

price moderation in the short run, with a recovery afterwards (middle and bottom panels of Figure 5).

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 5).

Finally, in Table 6 we show how these results change under different assumptions about the coefficients in the endogenous interest rate equation (20). As stated before, on the lefthand side we change the coefficient governing the link between the deficit and the long-term rate τ_d, while on the right-hand side we double the coefficient governing the link between the debt and the long-term rate τ_b. In particular, in the second row the coefficient is doubled and in the third row, it is halved. As can be seen, 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.

Table 6
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			
	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

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.

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 12-14 to get the following in the case of cash and deposits and short-term debt:

$$\bar{B}_t^{carry,CD} = \bar{B}_t^{carry,ST} = 0$$

$$\bar{B}_t^{mature,CD} = \frac{1}{2} B_{t-1}^{CD}$$

$$\bar{B}_t^{mature,ST} = \frac{1}{2} B_{t-1}^{ST} \tag{A21}$$

$$\bar{B}_t^{new,ST} = \frac{1}{2} B_t^{new,ST} = \frac{1}{2} B_{t-1}^{ST}$$

$$\bar{B}_t^{new,CD} = \frac{1}{2} B_t^{new,CD} = \frac{1}{2} \delta^{CD} B_{t-1}^{CD}$$

while in the case of long-term debt:

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

$$\bar{B}_t^{mature,EU} = \text{set by EC}$$

$$\bar{B}_t^{carry,LT} = B_{t-1}^{LT} - B_t^{mature,LT} = \frac{al_{t-1}^{end,LT} - 1}{al_{t-1}^{end,LT}} B_{t-1}^{LT} \tag{A22}$$

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

$$\bar{B}_t^{new,LT} = \frac{1}{2} B_t^{new,LT} = \frac{1}{2} \left(B_t^{new} - B_t^{new,ST} - B_t^{new,CD} - B_t^{new,EU} \right)$$

$$\bar{B}_t^{new,EU} = \text{set by EC}$$

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, $al_t^{new,LT}$:

$$al_t^{end,LT} = \left(al_{t-1}^{carry,LT} - 1 \right) \frac{B_t^{carry,LT}}{B_t^{LT}} + \left(al_t^{new,LT} - \frac{1}{2} \right) \frac{B_t^{new,LT}}{B_t^{LT}} \tag{A23}$$

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:

$$al_{t-1}^{end,LT} = al_{t-1}^{carry,LT} \frac{B_t^{carry,LT}}{B_{t-1}^{LT}} + \frac{1}{2} \frac{B_t^{maturing,LT}}{B_{t-1}^{LT}} \qquad (A24)$$

Now, substituting equations A21 and A27 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

$$\bar{B}_t^{CD} = (1 + \delta^{CD})B_{t-1}^{CD}$$

$$\bar{B}_t^{ST} = B_{t-1}^{ST}$$

$$\bar{B}_t^{LT} = \frac{2al_{t-1}^{end,LT} - 1}{2al_{t-1}^{end,LT}} B_{t-1}^{LT} + \frac{1}{2}\left(B_t^{new} - B_t^{new,ST} - CD_t^{new} - B_t^{new,EU}\right)$$

$$\bar{B}_t^{EU} = B_{t-1}^{EU} + \frac{1}{2}\left(B_t^{new,EU} - B_t^{mature,EU}\right)$$

$$(A25)$$

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

$$B_t^{new} = B_t^{mature} + DEF_t^p + R_t^b + DDA_t = \sum_M B_t^{mature,M} + DEF_t^p + R_t^b + DDA_t$$

$$= B_{t-1}^{CD} + B_{t-1}^{ST} + \frac{B_{t-1}^{LT}}{al_{t-1}^{end,LT}} + B_t^{mature,EU} + DEF_t^p + R_t^b + DDA_t$$

$$(A26)$$

$$B_t^{new,LT} = \left(B_t^{new} - B_t^{new,ST} - B_t^{new,CD} - B_t^{new,EU}\right)$$

$$= (1 - \delta^{CD})B_{t-1}^{CD} + \frac{B_{t-1}^{LT}}{al_{t-1}^{end,LT}} + \left(B_t^{mature,EU} - B_t^{new,EU}\right) + DEF_t^p + R_t^b + DDA_t$$

$$(A27)$$

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 16 to get

$$r_{t-1}^{end,CD} = r_t^{new,CD} = 0$$

$$r_{t-1}^{end,ST} = r_{t-1}^{new,ST} = r_{t-1}^{1yr}$$

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

$$r_t^{new,LT} = r_t^{1yr} + \left(r_t^{10yr} - r_t^{1yr}\right)$$

$$(A28)$$

(Continued)

$$r_{t-1}^{end,EU} = r_{t-2}^{end,EU} \frac{B_{t-1}^{EU} - B_t^{mature,EU}}{B_t^{EU}} + r_t^{new,EU} \frac{B_t^{new,EU}}{B_t^{EU}}$$ (A28)

$$r_t^{new,EU} = \text{set by EC}$$

Finally, substituting equations A25 and A28 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

$$R_t^{b,CD} = 0$$

$$R_t^{b,ST} = (r_{t-1}^{1yr} + r_t^{1yr})\frac{B_{t-1}^{ST}}{2}$$

$$R_t^{b,LT} = r_{t-1}^{end,LT} \frac{2al_{t-1}^{end,LT} - 1}{2al_{t-1}^{end,LT}} B_{t-1}^{LT} + r_t^{new,LT} \frac{B_t^{new} - B_{t-1}^{ST} - \delta^{CD}B_{t-1}^{CD}}{2}$$ (A29)

$$R_t^{b,EU} = r_{t-1}^{end,EU} \left(B_{t-1}^{EU} - \frac{B_t^{mature,EU}}{2} \right) + r_t^{new,EU} \bar{B}_t^{new,EU}$$

To get equation 18 in the main text, we substitute equations in A29 and A27 into the expression for interest payments $(R_t^b = \sum_M R_t^{b,M})$ to get

$$R_t^b = \left\{ \begin{array}{c} (r_{t-1}^{1yr} + r_t^{1yr})B_{t-1}^{ST} + (1 - \delta^{CD})r_t^{new,LT}B_{t-1}^{CD} \\ +r_t^{new,LT}(DEF_t^P + DDA_t + R_t^b) + \dfrac{(2al_{t-1}^{end,LT} - 1)r_{t-1}^{end,LT} + r_t^{new.LT}}{al_{t-1}^{end,LT}}B_{t-1}^{LT} \\ +\dfrac{r_t^{new,LT} - r_{t-1}^{end,EU}}{2}B_t^{mature,EU} + r_{t-1}^{end,EU}B_{t-1}^{EU} + \dfrac{r_t^{new,EU} - r_t^{new,LT}}{2}B_t^{EU} \end{array} \right\}$$ (A30)

and solve for total interest payments R_t^b.

To get equation 19 in the main text, we substitute equations in A25 and A27 into the expression for average debt by maturity $(\bar{B}_t = \Sigma_M \bar{B}_t^M)$ to get

$$\bar{B}_t = B_{t-1}^{CD} + B_{t-1}^{ST} + B_{t-1}^{LT} + B_{t-1}^{EU} + \frac{1}{2}(DEF_t^P + DDA_t + R_t^b)$$ (A31)

Notes

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

2. In addition to the four countries included in the Table, Poland (11 bn) and Greece (6 bn) also received more than 5 bn each.

3. See Article 9 of the SURE regulation in https://eur-lex.europa.eu/legal-content/EN/TXT/?uri= CELEX:32020R0672.

4. See https://ec.europa.eu/info/sites/default/files/economy-finance/sure one year on.pdf.

5. 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 the 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.

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

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.

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.

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

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 on 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.

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

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Resumen

El programa SURE de la UE concedió préstamos a los Estados miembros para financiar el gasto público en planes de desempleo durante la crisis de COVID-19. Los fondos se obtuvieron mediante valores emitidos en los mercados de capitales y se desembolsaron en forma de préstamos bilaterales. En este papel se examina el ahorro en los pagos de intereses de los préstamos para Bélgica, España, Portugal e Italia utilizando una herramienta de Análisis de la Sostenibilidad de la Deuda ampliada para tener en cuenta diferentes tipos de deuda. Los resultados muestran un importante ahorro de intereses en el marco del programa SURE, con un potencial de ahorro aún mayor en periodos de tensión en los mercados.

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

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