

18-20 Europe's Search for a Safe Asset

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Banks hold government bonds denominated in local currency for liquidity and risk-management purposes. In sovereign debt crises, this can become a problem, because bank holdings of sovereign debt transmit sovereign distress to the real economy (Bolton and Jeanne 2011, Gennaioli et al. 2014a, b). This problem is exacerbated in a currency union in which sovereigns lack a central bank that could purchase sovereign bonds in a financial panic. During the euro crisis, increases in sovereign risk raised the funding costs of domestic banks, which curtailed lending, exacerbating the recession and exposing sovereigns to additional stress (Altavilla et al. 2017). Sovereign rating downgrades can also lead to sharp increases in the volume of bonds that banks are required to post as collateral to obtain funding from the European Central Bank (ECB), which reduces the liquidity available for lending (Claeys and Gonçalves Raposo 2018). For these reasons, crises in the euro area would be less severe if banks instead held liquid euro-denominated assets not sensitive to sovereign risk.

To address these problems, some authors have proposed the creation of a common euro area low risk (“safe”) asset backed by full or partial guarantees by member states.¹ However, this approach is divisive, as it may imply that more creditworthy issuers would pay for risks created by less creditworthy issuers. An alternative, proposed by Brunnermeier et al. (2011, 2017), could be to create a public intermediary, or a legal framework regulating private intermediaries, that would issue multi-tranche debt securities backed by a diversified pool of euro area sovereign bonds (sovereign bond-backed securities, or SBBS). By making the loss-absorbing subordinated (junior) tranches thick enough, the senior tranche—referred to as European Senior Bonds, or “ESBies”—could in principle be rendered as low-risk as a German government bond, without requiring any member state guarantees.

The SBBS idea has received a mixed reception. While stopping short of a full endorsement, an extensive report by a task force of the European Systemic Risk Board (ESRB 2018) suggests that SBBS might be practically feasible. In reaction, the European Commission has proposed regulation that could facilitate the development of an SBBS market (EC 2018). At the same time, SBBS have been ferociously criticized, mainly on three grounds.² First, in a sovereign debt crisis engulfing several euro area countries, even the most senior SBBS tranche might turn out not to be safe after all. Second, producing SBBS requires simultaneously issuing senior and subordinated tranches, but would anyone want to buy the junior tranches, particularly in a crisis? Third, SBBS might interfere with national sovereign bond markets, raising sovereign borrowing costs.

1. These proposals include ideas to create “Eurobonds” through joint and several liability for all euro area bonds (De Grauwe and Moesen 2009, Bonnefoy 2010) as well as ideas to extend joint and several liability only to a portion of each country’s debt stock (as in Delpla and Weizsäcker’s 2010 “blue bond” proposal or in Hellwig and Philippon’s 2011 “Eurobills” proposal). The most recent proposal in this tradition is the “purple bond” proposal by Bini-Smaghi and Marcussen (2018), discussed below.

2. See Academic Advisory Council to the German Ministry of Finance (2017), Minenna (2017), Standard and Poor’s (2017), Greive et al. (2018), De Grauwe and Ji (2018), Giugliano (2018), Münchau (2018), Gabor and Vestergaard (2018) and Claeys (2018). For a less critical view, see Goldman Sachs (2018).

This Policy Brief surveys and evaluates the recent debate on euro area safe assets by comparing SBBS with a broad set of alternative proposals—some with an extensive history, others very recent. It reaches two main conclusions. First, SBBS mostly do not deserve the criticism that they have attracted. Indeed, they do well compared to most alternatives. At the same time, some of these alternatives could be superior in some respects. These include the widely discussed option to issue common euro area bonds financed by member state contributions or a common tax, in addition to less well-known proposals, such as the idea to create a senior, publicly-owned financial intermediary that would issue a euro area bond backed by a diversified portfolio of sovereign debt purchased at face value (“E-bonds;” see Monti 2010). The combination of diversification, seniority, and a small amount of capital could render E-bonds even safer than ESBies, particularly in an extreme, euro area-wide crisis.

However, none of the alternatives surveyed in this paper dominates SBBS entirely. Common euro area bonds financed by member state contributions, a common tax, or the proceeds of a sovereign wealth fund would require new revenue commitments, new institutions, or both. E-bonds would require some public money and would lead to some, albeit limited, redistribution across member states. They would also have a greater impact on national bond markets. That said, E-bonds are a serious alternative to SBBS that deserve a more thorough evaluation.

This Brief first describes the SBBS approach as well as seven alternatives. It then compares these proposals in five respects: the volume of safe assets that each could generate; the safety of the safe assets produced, particularly in extreme crisis events; their impact on sovereign borrowing costs; the extent to which they might give rise to redistribution (if at all); and their fragility in a crisis. The latter refers not to the risk of default of the safe asset but rather to the possibility that the production of safe assets might be disrupted. A concluding section distills the take-aways.

RECENT PROPOSALS TO CREATE EURO AREA SAFE ASSETS

SBBS/ESBies

Brunnermeier et al. (2011, 2017) proposed the creation of a European Senior Bond (European Safe Bond in their original paper) based on a combination of diversification and tranching. A financial intermediary (or many private intermediaries) would buy a diversified pool of sovereign bonds at market prices, financed by issuing securities whose payoffs would be the joint payoffs of the bonds in its portfolio. The weight of each country’s bonds in the portfolio would be set, by regulation, to correspond roughly to the capital key of the ECB (which in turn reflects the relative size of nominal GDP

and population), except that countries with very small debt stocks would be underweight and the remaining countries slightly overweight. Table 1 contains one such set of portfolio weights.³

According to ESRB (2018), SBBS would be issued in three tranches: senior, mezzanine, and junior (i.e., first-loss equity). All debt service received by the intermediary would first be used to meet the claims of the senior tranche holders, then those of the mezzanine holders, and finally those of the holders of the equity tranche. In the event of sovereign default, the senior tranche (ESBies) would remain safe as long as total losses do not exceed the combined claims of the mezzanine and equity tranche holders. The riskiness of the senior tranche will hence depend on the “thickness” of the subordinated tranches—i.e., the subordination level. The higher the subordination level, the larger the cushion protecting the senior tranche from sovereign default. Using a two-level default simulation model,⁴ Brunnermeier et al. (2017) argue that achieving a five-year expected loss rate as low as that of a German bund (0.5 percent in the most adverse calibration of their model) would require a subordination level of about 30 percent. Similarly, ESRB (2018) assumes that the senior tranche would comprise 70 percent, the mezzanine tranche 20 percent, and the equity tranche 10 percent of face value.

To get an intuition for the extent to which ESBies would be able to withstand debt crises, assume an average loss-given-default rate of 50 percent (a conservative value; see Cruces and Trebesch 2013). Column 2 of table 1—which lists countries in the order of their credit rating from highest to lowest—implies that under this assumption, all euro area countries with credit ratings up to and including Belgium, plus several of the better-rated smaller countries,

3. See Leandro and Zettelmeyer (2018a), table C.6, columns 5 or 7. These weights differ slightly from those assumed in ESRB (2018) by envisaging a smaller share for countries with small outstanding debt stocks, which allows a higher overall safe asset volume.

4. The first level simulates 2,000 five-year periods, in each of which the economy can be in three states—an expansion, a mild recession, or a severe recession. The three states differ in terms of default probabilities and loss-given-default rates. The second level determines whether one or several countries default, conditional on the state determined in the first level. Two calibrations are used: a benchmark in which probabilities of default and loss-given-default parameters are assumed to be consistent with bond yields and credit default swap (CDS) spreads at end-2015 and historical averages, and an adverse calibration that assumes much higher cross-country correlations in default probabilities. See Brunnermeier et al. (2017) and Leandro and Zettelmeyer (2018a) for details.

Table 1 Alternative portfolio weights and losses given default in seniority-based approaches (percent)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	ECB capital key	SBBS portfolio weights (L&Z 2018a)	Assumed maximal losses given default (lgd1, Brunnermeier et al. 2017)	maximal lgd rate of senior national tranche assuming lgd1 and subordination level of 70 percent	Optimal portfolio weights (L&Z 2018a)	E-bonds	
						Implicit subordination levels	maximal lgd rate assuming lgd1 (column 3)
Germany	25.6	27.55	40.0	0.0	29.2	50.5	0.0
Netherlands	5.7	4.58	40.0	0.0	6.4	50.5	0.0
Luxembourg	0.3	0.08	40.0	0.0	0.1	50.5	0.0
Austria	2.8	3.01	45.0	0.0	3.3	64.2	0.0
Finland	1.8	1.41	45.0	0.0	2.0	50.5	0.0
France	20.1	21.70	60.0	0.0	21.3	69.1	0.0
Belgium	3.5	3.79	62.5	0.0	4.0	71.0	0.0
Estonia	0.3	0.00	67.5	0.0	0.0	50.5	34.3
Slovakia	1.1	0.48	70.0	0.0	0.7	50.5	39.4
Ireland	1.7	1.67	75.0	16.7	2.3	50.5	49.5
Latvia	0.4	0.10	75.0	16.7	0.1	50.5	49.5
Lithuania	0.6	0.17	75.0	16.7	0.2	50.5	49.5
Malta	0.1	0.07	78.0	26.7	0.1	53.5	52.7
Slovenia	0.5	0.36	80.0	33.3	0.4	61.8	47.6
Spain	12.6	13.54	80.0	33.3	10.7	69.5	34.4
Italy	17.5	18.85	80.0	33.3	16.0	77.5	11.0
Portugal	2.5	1.79	85.0	50.0	1.8	65.0	57.2
Cyprus	0.2	0.08	87.5	58.3	0.1	50.5	74.7
Greece	2.9	0.77	95.0	83.3	1.1	50.5	89.9
Total or average	100.0	100.0	60.6	12.8	100.0	62.4	9.3

SBBS = sovereign bond-backed securities; L&Z = Leandro and Zettelmeyer; lgd = loss given default

Notes: Countries are listed in the order of their credit rating from highest to lowest. Columns 1, 2, and 5 show portfolio shares. Column 3 shows the maximal lgd assumptions made by Brunnermeier et al. 2017 (lgd1). Column 4 shows the corresponding loss-given-default rates suffered by the senior tranche in the national tranching approach, assuming a homogenous subordination level of 70 percent and the lgd assumptions of column 3. Column 6 shows the percentage of general government debt securities that would remain in the market, based on end-2016 data, assuming that the E-bond issuer originates loans with a total volume of €2.62 trillion subject to the portfolio shares shown in column 5; these loans are assumed to replace debt securities in equal volume. Column 7 shows, for each country's senior debt, the loss-given-default rates suffered by the senior E-bond intermediary, assuming the subordination levels of column 6 and the lgd assumptions of column 3. The last cells in columns 3, 4, and 7 show losses-given-default rates suffered by holders of the entire portfolio of sovereign bonds (column 3, assuming portfolio weights in column 2), holders of the pool of senior national tranches (column 4, assuming portfolio weights in column 2), or the senior E-bond intermediary (column 7, assuming portfolio weights in column 5).

Sources: Brunnermeier et al. (2017), ESRB (2018), and Leandro and Zettelmeyer (2018a).

could default without inflicting losses on the senior tranche.⁵ ESBies would suffer a loss only if either France or Germany also defaulted, or if losses-given-default were to turn out far above historical precedent. For example, under the more

severe loss-given-default assumptions made by Brunnermeier et al. (2017)—lgd1, shown in column 3 of table 1—ESBies would still offer full protection in a generalized debt crisis in which Italy, Spain, and all smaller countries with credit ratings worse than Ireland defaulted.

A single-tranche SBBS (pure diversification)

Just before Brunnermeier et al.'s (2011) ESBie proposal, Beck et al. (2011) proposed a European security backed by a basket of sovereign bonds based on ECB capital key

5. The sum of portfolio weights of all euro area countries except France and Germany is 51 percent. Assuming a 50 percent loss-given-default rate, this implies that a crisis engulfing all of these countries would inflict losses of 25.5 percent, well below the 30 percent level at which the senior tranche would start suffering losses.

weights—in effect, a single-tranche SBBS. The credit risk of such a security would be a weighted average of sovereign risk in the euro area, and as such clearly less safe than an AAA-rated or AA-rated bond. Furthermore, since the security would not be protected by either seniority or capital, any default in one of the underlying bonds would lead to a loss. However, sovereign exposure would be less concentrated than

A single-tranche security would sidestep some of the criticisms directed at multi-tranche SBBS—in particular, the question of who would buy the junior tranches.

in the portfolios of bonds held by most banks in the euro area today, and the security would be safer than the portfolios held by many banks, particularly in the lower-rated euro area member countries. As pointed out by Gros (2018), a single-tranche SBBS would also share an important benefit of ESBies, namely, that its price would be more stable over time than even the price of any single—even AAA-rated—sovereign bond, as the prices of AAA-rated bonds have typically increased in crises that depressed the prices of lower-rated bonds and fallen again when crisis risks receded, due to flights to safety.

At the same time, a single-tranche security would sidestep some of the criticisms directed at multi-tranche SBBS—in particular, the question of who would buy the junior tranches. Even though it would not be fully safe, a single-tranche SBBS may hence be worth considering as an alternative to SBBS.

National tranching followed by pooling

In a further alternative to the SBBS approach, the order of diversification (pooling) and tranching could be reversed. In a first step, euro area sovereign issuers would agree to issue national bonds in two or more tranches: one senior and the rest subordinated (Wendorff and Mahle 2015). In a debt restructuring, a given loss would first be absorbed by the junior tranche before the senior tranche takes a hit. For example, if the loss-given-default is 40 percent and the subordination level (the size of the junior tranche) is 50 percent, the junior tranche would lose $40/50=80$ percent of its value, while the senior tranche would be repaid in full (holders of any remaining non-tranched bonds would be neither subordinated nor enjoy seniority, and so would lose 40 percent). In a second step, any risk remaining in the senior tranches would be diversified by pooling, which could be induced by diversification requirements embedded in regulation or engineered

by a financial intermediary. The latter case differs from SBBS in that this intermediary would purchase only *senior* national tranches and issue a plain (single-tranche) bond that banks would be incentivized to hold through regulation.

As in the case of ESBies, the safety of the resulting security (or portfolio) will depend on the subordination level. Assuming a uniform subordination level for all countries and similar portfolio weights and risk modeling as in the SBBS approach, a subordination level of about 70 percent would be required to make the diversified portfolio of senior tranches as safe as a German bund.⁶ This means that the holders of senior national tranches would enjoy complete protection from losses of up to 70 percent of any individual country's debt—historically, an unusually high level (Cruces and Trebesch 2013). Under Brunnermeier et al.'s lgd1 assumptions, these investors would suffer losses only in the event of a default by countries rated like Ireland or below (see table 1, column 5). Assuming the portfolio weights shown in column 2 of table 1, the maximum loss-given-default of senior tranche holders—assuming *all* euro area countries default—would be just 12.8 percent.

Purple bonds

Closely related to the national tranching followed by pooling approach is the purple bonds approach suggested by Bini Smaghi and Marcussen (2018) based on the blue bond proposal by Delpla and von Weizsäcker (2010). According to the latter, sovereign bonds would be issued in two tranches, as in the national tranching proposal: junior (called “red bonds”) and senior (“blue bonds”). There are two differences to national tranching, however. First, the size of the senior tranche would be determined by a uniform share of GDP—Delpla and von Weizsäcker (2010) suggest 60 percent, in line with the Maastricht framework. Second, the safety of the blue bonds would be established not only through seniority but also through a joint and several guarantee by all euro area members. Blue bonds should hence be almost entirely safe from the perspective of the final holder (except in crises so broad and deep as to engulf most of the euro area), while euro area members are somewhat protected from having to make good on their guarantee by the fact that only senior securities are guaranteed.

A potential problem of the blue bond proposal is that it would force all countries with debt in excess of 60 percent of GDP to issue new debt as subordinated red bonds. This

6. This is much higher than in the SBBS approach, where the subordination level was only about 30 percent, reflecting the changed order of diversification and tranching: Lowering the expected loss rate of a portfolio that is already diversified requires a comparatively lower subordination level.

implies that countries with debt much higher than 60 percent of GDP would likely find new bond issuance very expensive or even lose market access.⁷ Bini Smaghi and Marcussen (2018) propose a solution to this problem, which consists of a 20-year transition period during which countries would be asked to lower their debt stocks in line with the European Union's debt rule, namely, by 1/20th of the difference between their debt-to-GDP ratio and 60 percent of GDP. Any debt issued above the permitted ceiling would be declared "red," while debt below the ceiling (both existing and newly issued) would be declared "purple"—that is, safer than red, but not quite blue. The difference between blue and purple bonds is that the latter would be neither legally senior nor jointly and severally guaranteed but instead enjoy a more limited guarantee against restructuring *in the context of a European Stabilization Mechanism (ESM) program*. Specifically, the ESM would issue a commitment that any euro area country experiencing a debt crisis would receive assistance, enabling purple bonds to be serviced even in a debt crisis, provided countries agree to the conditionality required by the ESM. If the ESM deems a (limited) debt restructuring necessary, only red bonds would be restructured. Once a country reaches a debt-to-GDP ratio of 60 percent, its purple bonds would turn blue, that is, the joint and several guarantees would become effective as envisaged by Delpla and Weizsäcker (2010).

Bonds issued by a capitalized public intermediary

Some critics of SBBS and related proposals dislike tranching in part because it reminds them of the collateralized debt obligations (CDOs) that were at the root of the great financial crisis (Münchau 2018). A straightforward alternative to SBBS that avoids tranching while replicating the safety properties of ESBies would be to replace the subordinated tranche with risk-absorbing capital. As in the SBBS approach, an intermediary would purchase a diversified portfolio of euro area government bonds at market prices. However, it would issue only a single-tranche security—a plain vanilla bond. Unlike the pure diversification approach described earlier, however, the intermediary would be capitalized. Any default losses would be absorbed—except in catastrophic crises—by the intermediary's capital cushion.

7. The national tranching proposal discussed previously would not suffer from this problem as junior and senior bonds would be issued jointly, in a fixed 70:30 proportion, at any level of debt. Hence, every country that has access to the debt market today should continue to have access under the national tranching proposal, since holding both tranches is equivalent to holding a single-tranche bond.

The capitalization needed to achieve expected losses as low as those of an ESBie depends on how the capital is invested. If it is kept in a euro area bond portfolio with the same portfolio weights as the rest of the intermediary's bond portfolio, the required capitalization would be the same, as a percentage of assets, as the subordination level of an SBBS intermediary—about 30 percent. In contrast, if the capital is invested in an entirely risk-free asset, the cushion could be slightly smaller—about 27 percent. Either way, making single-tranche SBBS safe would require a very large volume of capital. For example, if the objective is to produce safe assets amounting to 20 percent of euro area GDP, the required capital cushion would be at least $20 \times 0.27 = 5.4$ percent of GDP. With euro area GDP at €11.2 trillion in 2017, this is over €600 billion, almost eight times the ESM's paid-in capital of €80 billion.

A leveraged euro area sovereign wealth fund

One way of lowering the cost of capitalizing a public intermediary designed to issue safe, single-tranche bonds would be to broaden the class of assets in which the intermediary can invest—in effect, allowing it to operate like a sovereign wealth fund. Compared to a fund that can invest only in euro area sovereign debt, this would significantly raise the expected return for any given level of risk, allowing the sovereign wealth fund to gradually capitalize itself out of retained earnings. Some public seed capital would be needed, which could be leveraged through borrowing (subject to maintaining a minimum capital ratio). Once the fund reaches its target size, it would begin to disburse its earnings to its shareholders in the proportion of its capital key, gradually repaying its seed capital, and eventually paying a dividend.

How long this process would take depends on the initial capital, the assumed return, and the permitted leverage. For example, if the fund is initially endowed with capital amounting to 2 percent of euro area GDP, maintains capital at 30 percent of its assets, and earns a rate of return of 3 percent per annum above its funding costs, it would take about 15 years for the "safe" debt issuance of the fund to reach 20 percent of euro area GDP.

E-bonds

An alternative to ESBies that would require neither tranching nor necessarily public capital is the E-bond approach (Monti 2010, Leandro and Zettelmeyer 2018a, b). As in the SBBS approach, an intermediary would hold a portfolio of government debt and issue securities—E-bonds—backed by this portfolio. Unlike SBBS, however, E-bonds would be issued in a single tranche. Like ESBies, they would be made safe through a combination of diversification and seniority, but in this case, seniority applies at the level of the intermediary

issuing the E-bonds, which would be a preferred creditor. To give this a legal foundation, future euro area sovereign bond contracts could stipulate that the bond is subordinated to debt claims held by the intermediary. Alternatively, legal subordination of future sovereign bonds issued in the euro area to claims held by the E-bond issuer could be established through an EU regulation or an amendment of the ESM treaty.

The riskiness of E-bonds depends on the share of each sovereign's debt that the intermediary holds.

In principle, the intermediary could purchase sovereign debt at market prices or at face value directly from national issuers. In the first case, it would purchase bonds in the primary or secondary markets (as in the SBBS approach); in the latter, it would originate loans. Because of the intermediary's preferred creditor status, purchases at market prices would lead to large profits over time. If redistributed to sovereigns in proportion to their borrowing (or alternatively, a capital key), this would imply large net transfers from countries with high borrowing spreads to countries with low spreads, since the market prices of high-spread countries reflect far higher risk than is borne by the senior E-bond intermediary (Leandro and Zettelmeyer 2018a). Hence, this Policy Brief focuses on the second possibility, in which the E-bond intermediary would extend loans at face value and charge its borrowers a uniform interest rate that covers its funding and operating costs. The ESM currently operates along similar lines, making this a more realistic option—although one that also has redistributive implications, as shown below.

The riskiness of E-bonds depends on the share of each sovereign's debt that the intermediary holds. If the share is low, this implies a high share of subordinated bonds, and a correspondingly high level of protection for the E-bond holders, since the E-bond issuer can lose money only after all other holders of a country's debt have lost everything. Leandro and Zettelmeyer (2018a, b) assume purchases of each country's debt of either about 25 percent of its GDP, or about half of its debt stock, whichever is smaller.⁸ For coun-

tries with large debt stocks relative to GDP, such as Italy, the GDP constraint would be binding, implying that the share of debt bought would be quite small (only 22.5 percent in the case of Italy). For countries with a low debt-to-GDP ratio, such as Germany, the debt constraint would be binding, so 50 percent of a country's sovereign debt would be purchased.

The portfolio weights implied by this approach are listed in column 5 of table 1; they are close to, but not quite the same, as the portfolio weights that were assumed for SBBS. Column 6 shows the subordination levels implied by these portfolio weights, based on end-2016 debt stocks, on the assumption that the maximum level of about €2.6 trillion worth of E-bonds (about 24 percent of euro area GDP) is issued. That is, column 6 indicates the percentage of each country's end-2016 general government debt securities that would continue to be held by the market after the remainder has been replaced by loans from the E-bond issuer. Column 7 indicates the loss-given-default rate that the E-bond issuer would face for each set of sovereign loans that it extends, on the assumption that maximum losses-given-default follow the assumptions of column 3 (Brunnermeier et al.'s *ldg1*). For example, for Ireland, *ldg1* is assumed to be 75 percent, whereas the subordination level—the share of (market) debt subordinated to loans by the E-bond issuer—is 50.5 percent. Hence, the maximum loss rate on loans originated by the E-bond issuer is $(75-50.5)/(100-50.5) = 24.5/49.5 = 49.5$ percent.

The E-bond approach could also be combined with (small) levels of public capital, for reasons that will be discussed in the following section.

Debt issued by a euro area budget

Finally, safe assets could be created as supranational bonds issued by a euro area budget (Ubidé 2015, Zettelmeyer 2017). Debt service could be financed either by assigning tax income to the budget or fund (e.g., a small European value-added tax or a corporate tax) or through contributions from member states. In addition to the diversification benefit of revenues drawn from across the euro area, safety could be achieved by a commitment that the budget would have first pick at these revenues (for example, member states would need to pay into the euro area budget before they can service their national debts), and of course by maintaining the volume of the debt at prudently low levels.

PROPERTIES

Volume

The volume of safe assets that could be generated by securities backed by diversified portfolios of national debt is constrained by the volume of euro area sovereign bonds that is available for purchase and the subordination level, since the

8. These caps are chosen to maximize the volume of E-bonds issued by the intermediary subject to remaining at or below the five-year expected loss rates equal to that of the German bund—0.5 percent, using the simulation model of Brunnermeier et al. (2017). If the purchase cap of 50 percent is interpreted to apply to each country's outstanding stock of general government debt securities, the maximum volume of E-bonds that can be produced using this approach is about €2.6 trillion. If applied to each country's total debt stock, the maximum would exceed €3 trillion.

latter determines the size of the senior tranche. Assuming a uniform 70 percent subordination level, national tranching and pooling would have the lowest yield in terms of volume, capable of generating senior asset pools (diversified baskets of senior national debt tranches) of about 15 to 17 percent of euro area GDP. This is roughly in line with the volume of euro area general government debt securities currently held by euro area banks. At the other extreme, the pure diversification approach—implying a subordination level of zero—could potentially produce the highest volume of securities of any of the proposals studied in this paper (though these would of course be less safe, as shown below).

The remaining proposals fall somewhere between these extremes. Leandro and Zettelmeyer (2018a) show that SBBS could create a safe asset volume of up to 35 percent of euro area GDP, but this would require buying up to 80 percent of the German and French debt markets. If the intermediaries are not allowed to buy more than 50 percent of each country's debt market, the most efficient way of generating European safe assets would be via either SBBS or the E-bond approach, both of which could yield up to about 25 percent of euro area GDP in terms of safe assets generated. Because the capitalization approach is identical to SBBS, except that the junior tranches are replaced by a capital cushion, it could deliver the same volume as SBBS.⁹

By construction, purple bonds could deliver up to 60 percent of GDP in euro area safe assets by the end of the transition period. The amount of debt that a euro area budget could sustain would depend on the revenues that are dedicated to it. For example, under a range of assumptions about growth and real interest rates in the euro area, a primary surplus of 0.5 percent could sustain debt of at least 25 percent of GDP, while a primary surplus of 1 percent could sustain 50 percent or more.

Safety

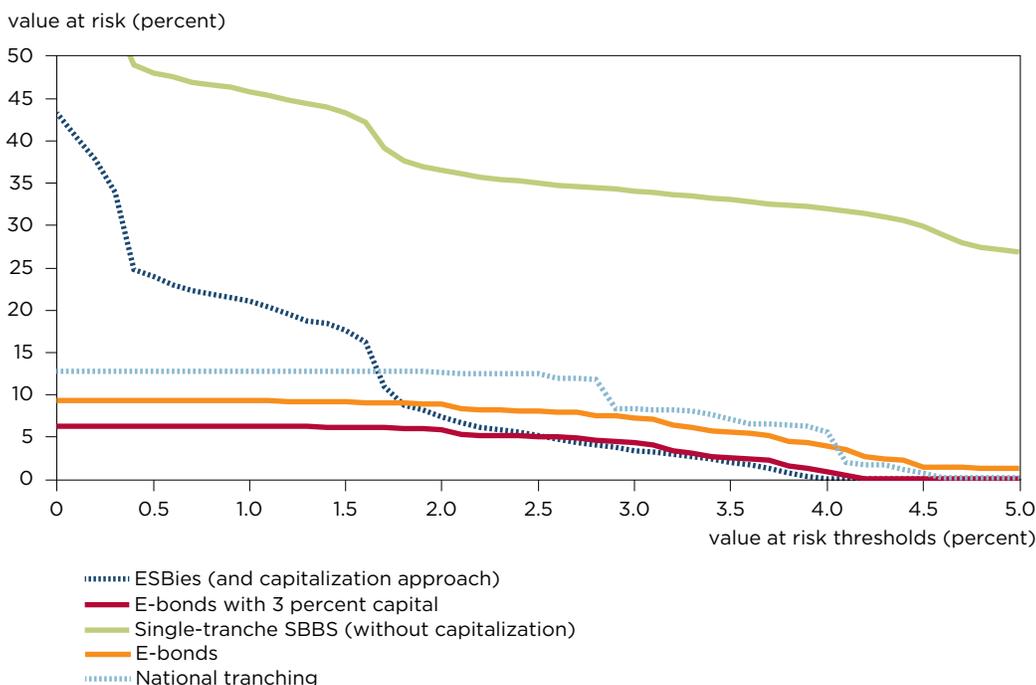
The safety of purple bonds, bonds issued by a euro area sovereign wealth fund, and bonds issued by a euro area budget is impossible to quantify, as the safety of the first would depend on the credibility of the ESM or member state guarantees protecting bondholders, and the other two on the precise institutional arrangements.

9. These results are based on the assumptions of the Brunnermeier et al. (2017) simulation model, which include pessimistic and somewhat arbitrary loss-given-default assumptions (see below and Leandro and Zettelmeyer 2018a for details). If these are substituted for historical averages observed in emerging-market crises, the subordination levels required in the national tranching, E-bond, and SBBS approaches would be reduced, and the maximum volume of safe assets would increase in each approach. However, their ranking should not be affected.

The safety of the remaining approaches—which are all based on diversified pools of national debt—can be compared using a default simulation model such as the Brunnermeier et al. (2017) model described earlier. According to this model, the five-year expected loss rate of a single-tranche SBBS would imply a five-year expected loss rate somewhere between that of a Belgian and an Irish sovereign bond, whereas the remaining proposals are all calibrated to target the expected loss rate of a German bond. The reason for this higher expected loss rate is that a single-tranche SBBS relies only on diversification to reduce risk, without the benefit of either seniority or capital.

To see whether and how the safety properties of the remaining approaches differ, one needs to compare the distribution of potential losses under each approach, particularly in the risk tail. A standard measure to describe this distribution is the value at risk (VaR) at threshold probability p , defined as the maximum loss occurring with at least probability p . Since small losses are more likely than large losses, the VaR declines as the threshold probability increases. Figure 1 shows VaRs for threshold probabilities between 0 and 5 percent for ESBies (or single-tranche SBBS with equivalent capitalization), single-tranche SBBS without capitalization, national tranching, and E-bonds (in two versions, including a capitalized version). The figure suggests that ESBies would fully protect their holders against risks occurring with a probability of about 4 percent or higher. They are also more effective than E-bonds or national tranching in protecting their holders against tail risks between about 2 and 4 percent. However, they are more vulnerable to extreme tail risks. This is because ESBies are fully protected against individual or multiple defaults by euro area member states as long as *aggregate* losses do not exceed the size of the subordinated SBBS tranches. Once this cushion is depleted, however, holders of ESBies bear the full cost of any further defaults. In contrast, E-bonds and the pool of senior tranches envisaged by the national tranching approach bear losses any time the losses-given-default of a *single* country exceed the portion of its debt held by subordinated debt holders. However, they continue to offer partial or even complete protection (depending on the loss-given-default) in the highly unlikely event that countries such as France, Germany, or the Netherlands were to default in addition to lower-rated countries. For this reason, as the probability threshold goes to zero, the maximum VaRs of national tranching and pooling and E-bonds converge to lower levels—12.8 percent and 9.3 percent, respectively, for the portfolio and lgd assumptions of table 1—than the VaR of ESBies.¹⁰

10. These levels are sensitive to loss-given-default assumptions. For example, if the maximal loss-given-default is

Figure 1 Value at risk of alternative safe assets, at different probability thresholds

ESBies = European senior bonds; SBBS = sovereign bond-backed securities

Note: This figure shows the values at risk (VaRs) of five assets, at different thresholds ranging from 0 to 5 percent, using portfolio weights shown in table 1 (column 1 for single-tranche SBBS, column 2 for ESBies and national tranching, and column 5 for E-bonds). The maximum loss, as the probability threshold goes to zero, is 60.6 percent for a single-tranche SBBS (this is the assumed loss given default if the entire euro area defaults; see last cell in column 3 of table 1), 43.3 percent for ESBies (the maximum loss of 60.6 percent, minus the 30.5 percent losses absorbed by the subordinated tranches, divided by 69.5 percent, the size of the senior tranche), 12.8 percent for national tranching (table 1, last cell in column 4), 9.3 percent for E-bonds without capitalization (last cell in column 7), and 6.3 percent for E-bonds with 3 percent capitalization.

Sources: Authors' calculations based on the adverse scenario of the simulation model by Brunnermeier et al. (2017).

To offer even better protection against severe defaults by smaller countries or combinations of smaller countries, the E-bond intermediary could be capitalized. Figure 1 shows that under the lgd and portfolio share assumptions of table 1, a 3 percent capitalization (just one tenth of what was required in the pure capitalization approach) would offer the same degree of protection as ESBies for moderate tail risks, along with much better protection against extreme risks. Even if all euro area sovereigns defaulted, holders of capitalized E-bonds would only suffer losses on the order of 6 percent of face value.

The figure also confirms that the pure diversification approach (single-tranche SBBS without capitalization) would offer much less protection than any of the alternatives that use seniority or capital. That said, a comparison of figure 1 with the results of Alogoskoufis and Langfield (2018) indicates that replacing the existing sovereign portfolios of banks by a single-tranche SBBS would increase the safety of most euro area banks with respect to sovereign debt crises, with a large improvement among the 25 percent of euro area banks that are currently most exposed to sovereign risk.¹¹

assumed to be capped at 70 percent—which still exceeds Greece's actual loss-given-default in 2012 (Zettelmeyer et al. 2013)—then senior national tranches would be completely safe, since no loss-given-default would exceed the 70 percent subordination level. The maximum loss (0 percent VaR) of E-bonds would be just 1.9 percent, while the maximum VaR of ESBies would also fall but remain high (37.81 percent rather than 43.3 as in figure 1).

11. Using 2017 European Banking Authority data and the Brunnermeier et al. (2017) sovereign default simulation model that also underlies figure 1, Alogoskoufis and Langfield (2018) find that the five-year expected loss rate of the sovereign debt portfolio of the median euro area bank is currently 5.2 percent, compared to 4.4 percent for a single-tranche SBBS, while the 1-percent VaR is 65 percent, compared to 46 percent for the single-tranche SBBS (see their table 6). For a bank at the 75th percentile of the exposure distribution, they find a five-year expected loss of 6.9 percent (about in line with that of a Spanish bond) and a 1-percent VaR of 80 percent.

Borrowing costs

With a safe asset, the reduction of crisis risks associated with the sovereign exposure of banks should, all else being equal, reduce borrowing costs. That said, not all might be equal—in particular, debt restructuring may become a more viable means for resolving debt crises. If so, the impact on borrowing costs might depend on a country's fiscal position and growth prospects, raising borrowing costs for countries whose debts may not be sustainable, and lowering borrowing costs for other countries.

The purple bond and E-bond proposals have additional disciplining effects:

- In the case of the purple bond proposal, any new debt issuance above the prescribed declining debt path (the red bonds) would not enjoy any protection from debt restructuring and would need to absorb the full brunt of any restructuring deemed necessary by the ESM (since the remainder of the debt stock—the purple stock—would be ESM guaranteed). Since the volume of red bonds would initially be very small relative to the purple debt, high debt countries could find themselves in a situation in which they cannot place any debt above the debt limits dictated by the fiscal compact. Within these debt limits, however, countries would never lose market access, so long as the ESM guarantee backing the purple bonds is credible, and crisis-hit countries are prepared to agree to any conditionality required by the ESM.
- In the E-bond proposal, any bonds issued to the market would be subordinated to claims held by the E-bond intermediary. Since this implies that investors would bear higher losses-given-default, the marginal cost of debt issuance for countries that have reached their debt issuance limit to the E-bond intermediary would go up. However, since the volume of senior debt owed to the E-bond intermediary can never be more than half the volume of total debt, this effect is less stringent than in the purple bond case. Furthermore, the rise in marginal costs of borrowing from the market does not necessarily translate into a rise in overall borrowing costs. The reason is that a share of the debt is now being borrowed from the E-bond intermediary at the much lower German cost of borrowing (assuming that the E-bond was designed to exactly match the expected loss rate of the German bund), and the E-bond issuer passes its low funding costs on to its borrowers. Leandro and Zettelmeyer (2018a) show that the net effect is to slightly raise average borrowing costs for the highest rated borrowers and to slightly lower average borrowing costs for the lowest rated borrowers.

In contrast to E-bonds, ESBies would not subordinate national debt (only the non-senior tranches of SBBS) and hence would not raise borrowing costs through this channel. That said, they may interfere with national debt markets to the extent that they reduce liquidity, as debt purchased by the intermediary would be held to maturity and hence would no longer be available for trading. Nevertheless, the SBBS proposal can be implemented in a way that would maintain large volumes of tradable national debt to preserve its liquidity (see Leandro and Zettelmeyer 2018a). Furthermore, the presence of a large liquid market in euro area safe assets could reduce the costs of hedging euro area risks, which would in turn reduce the cost of dealer inventories of sovereign bonds and raise liquidity in national markets (ESRB 2018, Dunne 2018).

Redistribution across euro area members

Assuming they work as intended, the SBBS, capitalization, and national tranching approaches all rule out redistribution by design, as bond purchases would occur at market prices. Assuming that bond prices reflect sovereign risk, there would hence be no systematic profits or losses to be redistributed. A euro area sovereign wealth fund would make significant profits in expectation but still avoid redistribution, since members would share these profits in line with their capital shares. Finally, a euro area budget could lead to redistribution, but only if the expenditure side is designed to do so.

The only proposals in which redistribution would occur systematically (in expectation) are purple bonds and E-bonds. In the case of purple bonds, redistribution arises because purple bonds would be guaranteed by the ESM during the 20-year transition phase, after which they become blue bonds that are guaranteed by euro area members directly and unconditionally. Any losses would be borne by each country according to its capital share in the ESM, without any adjustment for its propensity to cause losses (i.e., its creditworthiness). In the E-bond case, redistribution arises through a similar mechanism: The funding costs of the intermediary are distributed to its debtors according to their portfolio weights, regardless of how much risk each debtor contributes.

Table 2 quantifies these redistributive effects. For the purple bond proposal, the effects are quantified only for the very beginning of the transition phase, when the ESM would declare the currently outstanding euro area debt stock purple, since this enables us to use the Brunnermeier et al. (2017) default simulation model, which is calibrated to current debt stocks. The main results are as follows:

- The expected redistributive effect of the E-bond proposal would be small, on the order of €10 billion over five

Table 2 Redistributive effects of the E-bond and purple bond proposals (billions of euros, unless otherwise stated)

	E-bonds						Purple bonds (beginning transition phase)					
	Debt volume held by E-bond intermediary (1)	Subordination level (percent) (2)	Expected loss rate, senior intermediary (percent) (3)	Expected losses caused (4)	Expected losses absorbed (5)	Expected transfer (>0 means recipient) (6)	Purple bonds (1)	Subordination level (percent) (2)	Expected loss rate, ESM (percent) (3)	Expected losses caused (4)	Expected losses absorbed (5)	Expected transfer (>0 means recipient) (6)
Germany	768.4	50.5	0.00	0.00	3.02	-3.02	2,145.5	0.0	0.50	10.73	102.29	-91.56
Netherlands	168.6	50.5	0.00	0.00	0.66	-0.66	434.2	0.0	0.69	3.00	20.70	-17.71
Luxembourg	3.1	50.5	0.00	0.00	0.01	-0.01	11.0	0.0	0.69	0.08	0.53	-0.45
Austria	87.9	64.2	0.00	0.00	0.35	-0.35	295.2	0.0	0.96	2.83	14.07	-11.24
Finland	51.8	50.5	0.00	0.00	0.20	-0.20	136.0	0.0	0.96	1.31	6.49	-5.18
France	560.9	69.1	0.00	0.00	2.20	-2.20	2,152.5	0.0	1.94	41.76	102.62	-60.86
Belgium	106.1	71.0	0.00	0.00	0.42	-0.42	448.2	0.0	2.64	11.83	21.37	-9.54
Estonia	0.1	50.5	0.62	0.00	0.00	0.00	2.0	0.0	3.10	0.06	0.09	-0.03
Slovakia	17.8	50.5	0.78	0.14	0.07	0.07	42.1	0.0	5.58	2.35	2.00	0.34
Ireland	61.4	50.5	1.19	0.73	0.24	0.49	200.7	0.0	6.05	12.14	9.57	2.57
Latvia	3.6	50.5	1.62	0.06	0.01	0.04	10.1	0.0	6.81	0.69	0.48	0.21
Lithuania	6.1	50.5	1.61	0.10	0.02	0.07	15.5	0.0	6.80	1.05	0.74	0.32
Malta	2.5	53.5	1.93	0.05	0.01	0.04	5.7	0.0	7.32	0.42	0.27	0.15
Slovenia	10.2	61.8	1.51	0.15	0.04	0.11	31.8	0.0	8.17	2.59	1.51	1.08
Spain	280.3	69.5	0.91	2.55	1.10	1.45	1,107.2	0.0	6.80	75.29	52.79	22.50
Italy	420.9	77.5	0.27	1.13	1.65	-0.52	2,219.5	0.0	7.22	160.25	105.82	54.43
Portugal	46.5	65.0	2.52	1.17	0.18	0.99	240.9	0.0	11.80	28.42	11.48	16.94
Cyprus	3.1	50.5	6.75	0.21	0.01	0.20	19.4	0.0	16.07	3.12	0.93	2.19
Greece	28.3	50.5	14.26	4.03	0.11	3.92	315.0	0.0	35.19	110.85	15.02	95.83
Total or average	2,627.6		0.39	10.33	10.33	0.00	9,832.5	0.0	4.77	468.77	468.77	0.00

ESM = European Stabilization Mechanism

Notes: Countries are listed in the order of their credit rating from highest to lowest. The table shows the redistributive implications, based on the benchmark calibration of the Brunnermeier et al. (2017) default simulation model and end-2016 euro area sovereign debt levels of E-bonds (assuming maximum issuance); purple bonds at the beginning of the transition phase, with all euro area debt declared "purple"; and purple bonds at the end of the transition phase, assuming that total debt continues at end-2016 levels but only up to 60 percent of GDP worth of debt is declared purple for each country. For the case of E-bonds, the debt concept applied is general government debt securities; for purple bonds, it is all general government debt (including loans). Expected loss rates, expected losses, and expected transfers all refer to a five-year horizon. For each case, column 1 shows the debt volume bought (E-bonds) or guaranteed (purple bonds). Column 2 shows the subordination level, i.e., the percentage of subordinated debt securities (for E-bonds, this is the debt held by the market; for purple bonds, this is the percentage of "red bonds"; see text). Column 3 shows five-year expected loss rates from the perspective of either the E-bond intermediary or the ESM (for purple bonds), assuming the subordination levels shown in column 2. Column 4 multiplies these expected loss rates with the values in column 1. Column 5 shows the losses that each participating country (i.e., shareholder of the E-bond intermediary or ESM) would be expected to cover, assuming that total losses are distributed in proportion with the shares of debt held or guaranteed as shown in column 1. Column 6 shows the difference between columns 4 and 5. It represents the expected transfer from or to any given country. Positive numbers mean that the country is a net transfer recipient.

Sources: Authors' calculations based on European Central Bank data and (for purple bonds) Bini Smaghi and Marcussen (2018).

years, as the E-bond intermediary would be protected by thick cushions of junior debt (see table 2, E-bond case, column 2). Redistribution would occur mostly at the expense of Germany and France (−€3 and −€2.2 billion, respectively; see column 6) and to the benefit of Greece (€4 billion), Spain (€1.4 billion), and Portugal (€1 billion). Redistribution could be reduced further by excluding exceptionally risky borrowers such as Greece from the portfolio, or by capitalizing the intermediary in a way that reflects each member state's contribution to the risks borne by the intermediary.

- Expected redistribution associated with the purple bond proposal could be much larger, at least at the beginning of the transition phase, when it could amount to almost €470 billion over five years. That said, if the proposal succeeds in creating strong incentives to reduce the debt stock in line with the path envisaged by EU rules, sovereign risk faced by the ESM, and hence the redistributive effects of the proposal, might decline rapidly. Furthermore, it is possible that the Brunnermeier et al. (2017) simulation model exaggerates the risk that the ESM would bear by guaranteeing the purple debt stock.¹²

For both reasons, the expected transfers shown in table 2 for the purple bond proposal should be interpreted as an *upper bound* for the potential redistributive effects of the proposal. That said, the message of the table—that by conditionally guaranteeing the purple bonds, the ESM would be incurring very large risks, particularly at the beginning of the transition phase when the purple bond stock approximately equals the entire outstanding debt stock of the euro area—is likely to be robust.

Fragility

All proposals are potentially prone to accidents that might prompt intervention by the ESM and/or the ECB, and hence carry mutualization risk. However, appropriate design could keep the risk of such accidents low. In the case of the euro area budget or sovereign wealth fund, this means choosing appropriate revenue or contribution streams and limiting how they

can be spent or invested. In the case of SBBS, bonds issued by a capitalized intermediary, and E-bonds, counterparty risks associated with the intermediary or intermediaries should be minimized, and sovereign debt restructuring rules should ensure that intermediaries are not discriminated against (in the case of SBBS) or that their seniority is respected (in the case of E-bonds). In the case of national tranching, the main worry is the greater volatility and potentially lower liquidity of junior debt issues, which might trigger faster loss of market access. To counter this risk requires an ESM that is both large enough to prevent debt runs and capable of differentiating between debt runs and solvency problems.

A frequent criticism of SBBS is that the junior tranches might not find any buyers in future debt crises or perhaps even in normal times. However, this fear is likely unwarranted, as SBBS would mostly reduce rather than increase the net supply of lower-rated sovereign and sovereign-based securities (since they require purchasing bonds in the same rating categories that would correspond to the junior tranches; see Leandro and Zettelmeyer 2018b). Whether junior SBBS can lose market access in a crisis depends on how SBBS are designed. If (1) any country losing market access is excluded from the portfolio bought by SBBS issuers, and (2) sovereigns cannot discriminate against SBBS issuers in a default situation, then it is logically impossible for SBBS to lose market access. Furthermore, even if SBBS were to lose market access, the consequences would be fairly benign, as countries could simply continue to issue sovereign debt directly to the markets.

CONCLUSION

This paper compares proposals to create a safe asset for the euro area: the well-known idea to create multi-tranche sovereign bond-backed securities (SBBS) with the most senior tranche (European Senior Bonds, or ESBies) playing the role of a safe asset, and seven alternatives. Compared to SBBS, each alternative has at least one advantage. Several would avoid the need to issue securities in several tranches. Instead, they would create safety by assigning seniority to a large supranational issuer (E-bonds, euro area budget), injecting it with public capital (capitalization approach, euro area sovereign wealth fund), or through conditional guarantees (purple bonds). Three approaches—national tranching and pooling, purple bonds, and pure diversification (single-tranche SBBS)—have the advantage of not requiring any new institutions or financial intermediaries. E-bonds and purple bonds would strengthen incentives for fiscal consolidation, without necessarily raising average borrowing costs.

On the whole, however, the results of the comparison are favorable to SBBS:

12. If the sovereign CDS spreads at end-2015 used to calibrate the Brunnermeier et al. (2017) model reflected a market expectation that the ESM would either be treated as a senior creditor in future crises or require a debt restructuring as a condition for future programs, then the model might exaggerate the sovereign risk assumed by the ESM in guaranteeing the purple bond stock. While such a market expectation seems unlikely at a time when the ESM had just rescued a highly indebted country (Greece) without insisting on a prior debt restructuring, it cannot be ruled out.

First, most criticisms directed at SBBS/ESBies appear to be unwarranted or exaggerated. Indeed, SBBS have a number of desirable properties. They would protect their holders against a wide range of risks, including correlated defaults; could deliver a relatively large volume of safe assets while maintaining liquid national bond markets; would not affect the borrowing costs of sovereigns; would require neither public capital nor member state (or ESM) guarantees; and would not lead to redistribution across countries.

Second, most of the alternatives to SBBS have at least one major drawback that could outweigh their advantages:

- The maximum volume of safe assets that could be produced using national tranching and pooling is modest (16 to 18 percent of euro area GDP).
- Relying on public capital rather than tranching as a source of safety would be prohibitively expensive.
- A euro area budget—and to a lesser extent a euro area SWF—would require sophisticated new institutions and a suitable accountability structure.
- The purple bond proposal would require the ESM to conditionally guarantee the purple bond stocks of all

euro area countries, even when there are doubts about their sustainability. As a result, this proposal could lead to significant redistribution. Similarly, E-bonds would have redistributive consequences, albeit to a modest degree.

- The pure diversification (single-tranche SBBS) approach would only modestly raise the level of protection of the median euro area bank against sovereign risk.

That said, depending on how each pro and con is weighed, some proposals could be superior to SBBS. The most attractive alternative could be a capitalized version of the E-bond approach. This would require relatively little capital (less than the ESM today) and offer higher protection than ESBies against extreme risks while offering the same protection against moderate tail risks.

There are many feasible approaches to creating a euro area safe asset. While none are free of drawbacks, some ideas—particularly the E-bond proposal—deserve a more thorough examination than they have received so far.

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