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Market-based Eurobonds Without Cross-Subsidisation

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No. 37

Market-based Eurobonds Without Cross-Subsidisation

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Market-based Eurobonds Without Cross-Subsidisation

Most current Eurobond proposals imply substantial cross-subsidisation since some countries partially pay the risk premia for others, thus creating moral hazard and disincentives for fiscal discipline. We suggest, instead, to use standard technologies of financial intermediation like pooling and collateralizing risks. The proposed Eurobond system decreases the costs for all participating nations which is Pareto improving. Since collateral requirements are calculated on individual risk, we eliminate cross-subsidisation. It is essential for the model that a significant fraction of governmental bonds is still issued individually since the model utilizes the risk perception abilities and disciplinating functions of the private capital market. We also discuss institutional issues of possible implementations.

Keywords: sovereign debt, Eurobond, collateral, pooling, cross-subsidisation

JEL classification: E62, E63, H63

I. Introduction

Some economists and many politicians believe that a major step towards strengthening the Eurozone is through the joint issue of Eurobonds. Although there exist different proposals for such a Eurobond, the common idea is that countries issue a joint debt instrument with joint liability (Delpla and Weizsäcker (2010), Tremonti and Juncker (2010), De Grauwe and Moesen (2009), see also Mayer (2009)). This has sparked huge debates on the issues of cross-subsidisation and moral hazard, making the idea highly expensive and uninteresting for well-to-do economies (Ifo Institute (2011), Berg, Carstensen, and Sinn (2011)). Economists argue that this would act as a disincentive to fiscal discipline, because a part of the risk premium which the countries would have paid otherwise, is then paid by well to-do countries – strong countries would cross-subsidise less disciplined countries. Liability for other country's risk is a form of bail-out which is not allowed in the European legislation, and which invites free-riding on the creditworthiness of strong countries (Kösters (2009), Gross (2011), Issing (2009), see Boonstra (2011), Eijffinger (2011) Wyplosz (2011) for a critical overview). Eurobonds will be accepted by most economists and politicians if and only if there is strong convergence in macroeconomic data and fiscal policies. This requires a strong governance structures like the Stability and Growth Pact (SGP) and perhaps a political union (Eijffinger (2011), Wyplosz (2011)).

Eurobonds aim to enable countries under financial pressure to have access to money at moderate rates. This could be seen either as an advantage because it dampens financial distress including possible spill-over effects to other countries, or as a disadvantage because the pressure for fiscal reforms and fiscal discipline is dampened as well. The aim is to create a large new governmental bond market with a lot of liquidity and jointly lower average costs of borrowing like the USA. This will also help attract outside investors willing to make Euro a reserve currency. From the investor's perspective, the joint liability decreases expected losses which cuts the risk premium. Furthermore, the enhanced liquidity of such an instrument would allow a lower premium.

Another target which is associated with Eurobonds is that it should be less likely to coordinate self-fulfilling rational expectations at an inefficient equilibrium: the expectation of a default induces a higher risk premium which then in fact increase the probability of a default¹. Such coordination is sometimes interpreted as a speculative attack against a weak country. Inefficient equilibrium should be ruled out by an instrument which has a thick and liquid market, making it unlikely for speculative attacks to be successful (see De Grauwe (2011), Obstfeld (1996)).

The commonly discussed proposal by Delpla and Weizsäcker (2010) distinguishes *red bonds* and *blue bonds* – a terminology we have adopted for our framework. They suggest that debt up to the Maastricht rate of 60% of the GDP should be issued as blue bonds (Eurobonds), while every country is responsible for its own debt beyond this threshold and pays risk-adjusted interest rates on the capital market (red bonds). While this model suffers from the criticism mentioned above, Baglioni and Cherubini (2011a) develop a complex model of Eurobonds without cross-subsidisation. In fact, our own approach is closely related to Baglioni and Cherubini (2011a, 2011b). Their model is based on two tranches of debt (red and blue bonds), cross-guarantees for the blue bond tranche, the pooling effect, and on the existence of collaterals for the blue bond. However, they focus on dynamic impact of growth rates on public debt while an explicit calculation of collateral requirements is missing. Although our model is based on simplifying assumptions, it is possible to calculate explicitly those collateral requirements and the cost reduction effect with real data. Moreover, the authors put the focus on debt reduction. However, we believe that a low debt level alone cannot solve the problems caused by financial crises. Countries like Spain, even with low debt levels, are facing problems.

Boonstra (2010) proposes a central financing agency for the EMU ("EMU Fund") which is issuing the blue bonds. The EMU Fund charges risk adjusted markup according to the country's financial situation. The latter is measured by some indicators so that the Eurobond will not rule out the incentive for fiscal discipline. We

¹Such a default can be the result of illiquidity rather than insolvency.

argue, however, that such politically adjusted criteria will make the system vulnerable to political rent-seeking. Nevertheless, it is a step in the correct direction. Our proposal, instead, relies on the perception of the private investors who should buy the Eurobonds.

The paper is organized as follows: Section II starts with an outline of the basic structure of the model, discusses the features of the red bond market and transforms the observed risk premium into individual collaterals which would be necessary if the country would like to pay the (almost) risk-free rate. Then we estimate the pooling effects for the case that 80% of the debt is issued by blue bonds. Again, we calculate the collateral requirement to reduce the rate to a predefined low level. These collaterals are shown to be significantly lower than without pooling. Since the collateral is contributed by the participating countries according to their individual risk, no cross-subsidization will take place. Further suggestions of utilizing financial intermediation are provided. Section III discusses institutional aspects of the agency which issues blue bonds. Since governments will be seeking for opportunities to externalize their costs to the expense of other pool members, the institutional design of the blue bond issuing institution will play an important role. Section IV concludes.

II. Eurobond Model

II.1. Basic Structure and Properties

We start by considering the market for governmental (red) bonds. We assume that investors are risk averse which is seen as an empirically valid assumption especially for holders of governmental bonds. This implies that the red bond rate does not only incorporate the probability of a nation failing and the expected losses, but also the variances of these losses.

Furthermore, there is a market for blue bonds, issued by a common agency which we call European Central Agency (ECA). Governments can borrow from the ECA up to a specified threshold level of the total debt, e.g. 80%. Thus, a red bond market is constantly maintained for every nation irrespective of their level of debt. We will highlight the importance of such a scheme later on. The terms blue bond and Eurobond are used as synonyms. We would like to mention here that the bonds issued by the ECA will have seniority in claim compared to the other liabilities of the government.

The ECA is endowed with a collateral, funded by the participating governments. This collateral should be a safe asset like cash deposits or credible guarantees – similar to the ESM. One can also think about gold, but other assets (e.g. real

estate) seem to be less suitable². In the following we consider a “cash collateral” for simplicity. The amount of collaterals is determined in a way that the investors are willing to pay an almost risk free rate for the blue bond. The required collateral for each participating nation is calculated according to their individual default risk, the expected losses and their variance – informations which are obtained from the red bond market perception. This is the reason why we call this proposal *market-based* since we take the expectations and risk attitudes of investors seriously. The exact methodology will be explained later on. With this collateral there is a cross-guarantee, provided by the participating countries.

Collateral contributions of a country work like an insurance premium. But since every country is still financing its debt partially at the red bond market, investors would detect higher risks, therefore charging higher risk premia, which then automatically increases the individual collateral contributions to the ECA. Hence, we expect no moral hazard created by this cross-guarantee. Moreover, the proportionality of the collaterals to the individual risk avoids cross-subsidisation, implying that the largest share of the entire collateral will be provided by the GIPS countries.

It has to be pointed out that paying a collateral which will be used with a certain probability and to a certain extent (depending on the pool risk) implies that the countries do *not* only pay the almost risk free blue bond rate. The *effective* interest rate is composed by the blue bond rate plus the expected loss of the collateral. Therefore, the participating countries will effectively *not* pay the same price as in the blue bond market. They will only benefit due to the *pooling effect* which will be explained and calculated later on.

There are two straightforward ways to demonstrate the cost reducing effects of pooling: The first way is to calculate the collateral requirements which would be necessary in a red bond market in order to make the investor willing to waive for the individual risk premium. We will show that the sum of these individual collateral requirements are drastically larger than the collateral in the pool. The second way is to calculate the effective interest rates (costs per unit of debt) to be paid for participating in the blue bond market, and comparing them to the red bond rates.

The main feature of the proposed instrument is that it is based on very common technologies of insurance and asset transformation, or more generally: *financial intermediation* which is known as a wealth creating institutional arrangement (see Samartín (2011), Seog (2010)). It aims not to circumvent the disciplinary power of capital markets but to utilize it in a more efficient way. The proposal avoids cross-subsidisation with its negative consequences. However, its aim is not to be a mechanism to incentivise fiscal discipline of the participating countries. The lower cost might be seen as a disincentive for strengthening fiscal discipline. But it

²Another suggestion is that guarantees could be backed by the access to central bank money. This, however, would be very close to a financing of budget deficits by the central bank, which is highly questionable.

also makes it more unlikely that a very high risk premium *induces* a default which otherwise would not have happened (interest rate speculation against a country).

We argue that these main features do not crucially depend on the specific simplifying assumption we have to make in the following sections. The basic logic will not change if more realistic assumptions and more sophisticated procedures e.g. to estimate haircut distributions are used. Therefore, also the numerical results should give only an impression about possible scales of cost reduction.

II.2. The Red Bond Market

There are different types of governmental bonds with different maturities. Furthermore there are different concepts to determine the level of governmental debt, and not 100% of the debt are financed by bonds. To keep the analysis as simple as possible, we assume that the entire debt is financed by one bond type with an average nominal interest rate. Each default event, i.e. inability to pay interest rates or paying back mature bonds, is assumed to affect the entire amount of bonds. Investors, financial intermediaries, and market watchers are estimating default probabilities and forming expectations about possible consequences of such a default. From this they calculate the risk premia which are expressed in the red bond rate spreads.

We assume a risk-free rate of 1% (gross rate $R_0 = 1.01$) so that the risk premia RP_i in table 1 are the *additional* rates to be paid in the red bond market. The default probabilities p_i are taken from the Credit Risk Report Q1/2012 by CMA Global Sovereign. Although in the original source they are calculated as cumulative probabilities for a 5 year period, we take them as a default probability per year which makes the subsequent collateral calculations more conservative. Similar probability estimations can be obtained from historical data or from implied default probabilities of ratings by rating agencies (e.g. the J.P. Morgan implied default probability model). More econometric approaches can be found in Schirm (2003), Scholtens and Hameeteman (2007), Hull, Predescu and White (2005).

For a risk-averse investor, the risk premium makes the investor indifferent between a risk-free investment and the bond. Therefore the investor has to build expectations about the case of default. In such a case he will not get back the entire invested capital plus the interest rates but only a certain fraction of it (loss given default, LGD). This fraction (the *recovery rate*) is $(1 - h_i)$ where h_i is the *haircut rate* which is a stochastic variable. We assume that h_i follows a β -distribution as it is a continuous probability distribution defined on the interval of $(0, 1)$. Also, we believe, it is highly unlikely for a haircut of 1 to occur. And since it is the representation of loss, given that it defaults, a haircut of zero is illogical in this case. Hence, β -distribution satisfies all these conditions. Moreover, it is also widely used in practice (see e.g. Riskworx (n.d.)). For econometric approaches to estimate LGD

Country (index i)	Probability of default p_i	Risk Premium RP_i	Debt (trillion €) K_i
Austria	0.1290	0.0128	0.217322
Belgium	0.1870	0.0212	0.36064
Cyprus	0.637	0.06	0.012172
Estonia	0.078	0.01*	0.00096
Finland	0.0570	0.0079	0.092826
France	0.139	0.0161	1.712568
Germany	0.064	0.0042	2.08684
Greece	0.9882	0.253	0.355395
Ireland	0.395	0.072	0.168792
Italy	0.297	0.0505	1.89758
Luxembourg	0.060*	0.0103	0.007644
Malta	0.2100	0.0319	0.00432
Netherlands	0.0980	0.0096	0.392504
Portugal	0.5249	0.0952	0.184338
Slovakia	0.1430	0.038	0.029877
Slovenia	0.2050	0.0428	0.01666
Spain	0.3210	0.0616	0.735005

* Market values not available. Assumed here for calculation purposes.

Sources: Eurostat, CMA Global Sovereign

Table 1: Stylized Red Bond Market – Basic data

functions we refer to Sturzenegger and Ziegelmeyer (2011), Chava, Stefanescu and Turnbull (2011), Cruces and Tresbesch (2011).

We use a common approximation of a expected utility function for monetary flows x , $E[u(x)] \approx E[x] - \frac{1}{2}\theta V[x]$, with θ as a risk aversion parameter. It is a widely accepted assumption³ that investors in governmental bonds are risk-averse, i.e. that there is not only a risk premium for expected losses but also for the variance (Carr and Wu (2009), and Kriz (2004) especially for governmental bonds, see also Elton et al. (2001), Longstaff et al. (2005), Hull et al. (2005) on variance premia for financial assets). Though it is possible to show that the model works well even in the risk-neutrality case ($\theta = 0$), we will assume positive values for θ as the more appropriate case. Thus, the investor's equilibrium condition reads⁴

$$R_0 K_i = (1 - p_i)(R_0 + RP_i)K_i + p_i(1 - E[h_i])(R_0 + RP_i)K_i - \frac{1}{2}\theta V_i \quad (1)$$

The first term on the r.h.s. is the gross return in case of non-default, the second

³All models based on the CAPM imply risk-aversion.

⁴Symbols are explained in table 1.

term is the expected gross return in case of default with $E[h_i]$ as the expected haircut rate. The third term represents the variance of the returns with $V_i = V[h_i]p_i^2(R_0 + RP_i)^2K_i^2$. To keep analysis simple, we make a slight approximation by dropping the (small) term RP_i in the variance expression, so that we obtain from (1) a simple form for the risk premium:

$$RP_i = \frac{R_0 p_i (E[h_i] + \theta V[h_i] K_i R_0 p_i)}{1 - p_i E[h_i]} \quad (2)$$

Since we have assumed a β -distribution for the haircut rate, the expected value and variance are given by

$$E[h_i] = \frac{\alpha}{\alpha + \beta}, \quad V[h_i] = \frac{\alpha\beta}{(1 + \alpha + \beta)(\alpha + \beta)^2}$$

Hence, we shall represent both, the expected haircut and variance, in terms of α and β . Using this in equation (2), we have two unknowns, α and β , that will decide the shape of the distribution. We determine the various combinations of α_i and β_i which are consistent with p_i, RP_i, K_i . Since there is a continuum of solutions, we take two sets of values at the two extremes. Some examples of estimated β -distributions can be found in the appendix.

The idea of our research is to enable every nation to borrow at the lowest risk premium possible. For this, it is necessary to convince the investor that lending money to a nation is nearly risk free. An investor requires to be paid a risk premium to compensate for the risk he is taking in purchasing the bond. If he does not believe a nation is completely risk free, the risk premium factor cannot be reduced to the desired low rate. We propose to compensate the risk by providing a (cash) collateral that will ensure that the investor is indifferent between the risk premium demanded and the collateral. Such a collateral (or parts of it) are paid in case of default. We have calculated the collateral demanded by an investor to enable a nation to borrow at the predefined low rate of 1.5% (risk premium of 0.5%). This rate is of course only an example. It should be close to the red bond rate of the best-performing countries in the EMU so that the latter have an incentive to join the Eurobond system.

If we now assume that a country provides a collateral, the equilibrium condition is more complex. The investor has to consider two cases: if the haircut rate in case of default is low enough, he will be completely compensated by the collateral (zero loss). If the haircut rate is large, however, he will receive the entire collateral but which is not enough for a full compensation of the loss. Therefore, it is necessary to calculate the *conditional* expected value and variance of the haircut for the case that it exceeds the collateralization rate. Let $f(h_i)$ be the β -pdf, and c_i be the fraction of debt to be collateralized. Thus, c_i is a kind of “anti-haircut rate”. Let

q be the probability that the realized haircut is $h_i < c_i$, i.e. $q = \int_0^{c_i} f(h_i)dh_i$. In these cases the haircut is fully compensated by (a fraction of) the collateral (see figure 1). If $h_i > c_i$, then the investor receives the entire collateral but faces some losses. Let $E[\bar{h}_i] = E[h_i|h_i > c_i]$ be the expected haircut, given the latter case, and $V[\bar{h}_i] = V[h_i|h_i > c_i]$, respectively. Note, that with a given estimation of α and β , these values can easily be calculated.

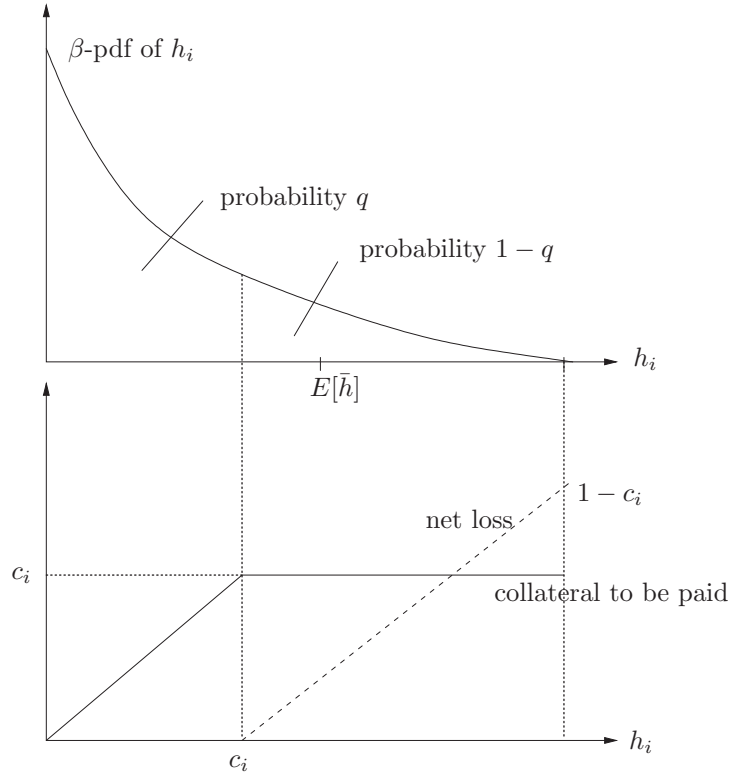


Figure 1: β -distribution and compensation of losses

Then the equilibrium condition for the investor is given by

$$\begin{aligned}
 R_0 K_i = & (1 - p_i)(R_0 + rp_i)K_i + \\
 & p_i[q(R_0 + rp_i) + (1 - q)(1 - E[\bar{h}_i] + c_i)(R_0 + rp_i)]K_i - \frac{1}{2}\theta V_i \quad (3)
 \end{aligned}$$

with rp_i as the (eventually) remaining risk premium (with $rp_i = RP_i$ in case of $c_i = 0$), and $V_i \approx V[\bar{h}_i](1 - q)^2 p_i^2 R_0^2 K_i^2$. Again, we have neglected the small term rp_i in the variance term to obtain significantly simpler expression, see above. Then we can solve expression (3) to rp_i or to c_i :

$$rp_i = \frac{p_i(\theta V[\bar{h}_i] K_i R_0 (1 - q) p_i + E[\bar{h}_i] - c_i) R_0 (1 - q)}{1 - (E[\bar{h}_i] - c_i)(1 - q) p_i} \quad (4)$$

$$c_i = \frac{R_0^2 \theta K_i V[\bar{h}_i] (1 - q)^2 p_i^2 + E[\bar{h}_i] (R_0 + rp_i) (1 - q) p_i - rp_i}{(R_0 + rp_i) (1 - q) p_i} \quad (5)$$

The aim of the numerical calculations is to determine the (fictitious) collateral which is required to reduce the empirical red bond rate to a predefined low risk premium of $rp_i = 0.005$ which means a gross return rate of 1.5% for every nation. We assume a risk aversion parameter of $\theta = 2$. The results are not very sensitive to this parameter. With given or estimated variables, we calculate c_i according to eq. (5). As we argued above, we use two (extreme) parameter sets of (α, β) -values. The numerical results can be found in the tables 2 and 3. Since Germany's red bond risk premium is already slightly below the benchmark of 0.5%, the required collateral is obviously zero⁵.

Country	α	β	Collateral as fraction of debt	Collateral for 80% of debt (trillion €)
Austria	0.15	1.408	0.225	0.0397
Belgium	0.15	1.241	0.369	0.1081
Cyprus	0.15	1.557	0.522	0.0052
Estonia	0.15	1.043	0.201	0.0002
Finland	0.2	1.271	0.117	0.0088
France	0.15	1.272	0.285	0.3963
Germany	0.15	2.237	0	0
Greece	0.2	0.874	0.819	0.2363
Ireland	0.2	1.009	0.66	0.0905
Italy	0.15	0.952	0.583	0.8983
Luxembourg	0.2	0.988	0.224	0.0014
Malta	0.15	0.879	0.541	0.0019
Netherlands	0.15	1.428	0.15	0.0478
Portugal	0.2	1.051	0.689	0.1031
Slovakia	0.2	0.589	0.662	0.0161
Slovenia	0.2	0.809	0.624	0.0084
Spain	0.2	0.992	0.632	0.3772
Σ				2.3396

Table 2: Required collaterals in red bond market – parameter set 1

⁵Even if the blue bond rate is slightly above its red bond rate, Germany will benefit indirectly from positive spillover effects (not considered in this paper): the contribution to the pool reduces financial distress of other member countries.

Country	α	β	Collateral as fraction of debt	Collateral for 80% of debt (trillion €)
Austria	0.4	3.739	0.13	0.0229
Belgium	0.45	3.6811	0.209	0.0612
Cyprus	0.35	3.6302	0.338	0.0033
Estonia	0.5	3.478	0.108	0.0001
Finland	0.6	3.809	0.07	0.0053
France	0.45	3.667	0.167	0.2322
Germany	0.35	3.693	0	0
Greece	0.9	3.684	0.534	0.1541
Ireland	0.8	3.983	0.387	0.0530
Italy	0.7	3.95	0.331	0.5100
Luxembourg	0.8	3.955	0.122	0.0008
Malta	0.65	3.8087	0.282	0.0010
Netherlands	0.4	3.785	0.087	0.0277
Portugal	0.6	3.102	0.46	0.0689
Slovakia	1.2	3.534	0.373	0.0090
Slovenia	0.9	3.64	0.356	0.0048
Spain	0.8	3.785	0.379	0.2262
Σ				1.3806

Table 3: Required collaterals in red bond market – parameter set 2

To make the results comparable to the Eurobond system where (up to) 80% of the bonds are issued as blue bonds, the last column shows the individual collaterals which would be necessary to make the investor willing to charge a risk premium of only 0.5% for 80% of the debt. The sum of these individual collaterals would add up to extremely large values between 1.38 and 2.34 trillion Euro. The collateralization rates c_i are also high, and especially the GIPS countries would by far not be able to keep them. As we argue in the next section, the situation will be significantly better when pooling the individual default risks which requires some form of financial intermediation.

II.3. The Blue Bond Market

We propose a Eurobond system where a financial intermediate, the European Central Agency (ECA), issues blue bonds to the market, and uses these funds to finance 80% of the country's debt. We assume that the countries should pay only a pre-defined low blue bond rate (1.5%) to the investors via the ECA. The investors, however, in order to be willing to accept this low rate, have to be compensated by a collateral for the blue bond. We assume that the risks are pooled in the sense that there is a *joint liability* for the debt: In case of any constellation of defaults

(with certain haircuts), the *entire* collateral is used to compensate the investor, not only the collateral of the failing country. If e.g. the haircut of the pool is 5%, and the collateralization rate of the pool is 10%, then the half of the entire collateral (and therefore the half of *every* individually provided collateral) is used to compensate the loss. Thus, we incorporate the basic idea from insurance theory in this framework. The individual collaterals are calculated on the basis of individual risk contribution to the pool, and can be interpreted as a kind of risk insurance premium. This does not reduce the risk of an individual failure, but it significantly reduces the individual risk of not being able to compensate the investor.

Unlike the red bond market for each nation, we don't have a pool in the market from where we can estimate the investor's expectation of losses and the risk premium. Also, the pool is a combination of multiple nations, each having a β -distribution of losses. Although we assume independency of each country's default probability for simplicity, the sum of β -distributed variables does generally not follow a β -distribution. Therefore, we determine the pool losses by completely randomizing the nations that will fail and the haircuts experienced in case they fail. For each nation we have the p_i values to simulate a stochastic default event, and the (α_i, β_i) values in order to generate a stochastic haircut. By running 100,000 numerical simulations we obtain a *quasi-empirical distribution for the pool losses* (in 1% haircut gaps). This large number of iterations ensures that the results average out to the truly expected values. Since we have two parameter sets for (α, β) -values, we also obtain two slightly different loss distributions for the pool (see figure 2). It turns out that pool haircut rates beyond 25% (30%) can be neglected since the entire probability of such an event is almost zero.

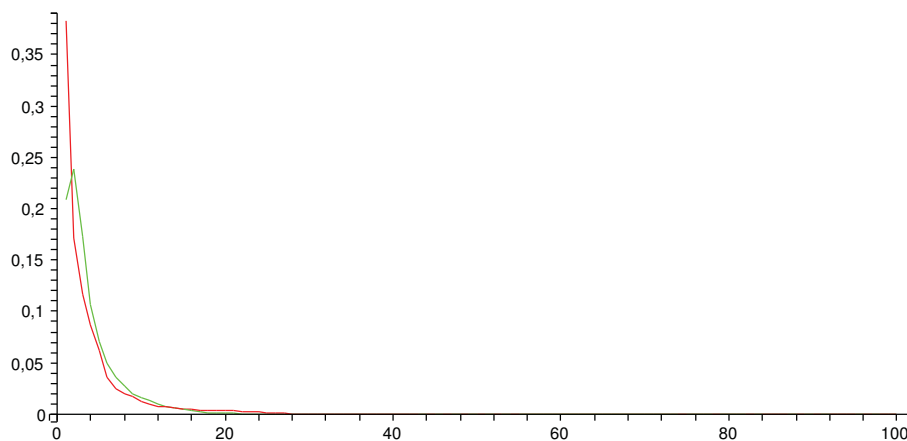


Figure 2: Haircut distribution in the pool

Once, we have the quasi-empirical loss distributions for the pool, we proceed with calculations similar to the single country scenario. For each collateralization rate c

we calculate the expected haircut given that the haircut is larger than the collateral, and variance of losses. We hence calculate the risk premium given the level of collateral. Thus, we can determine the collateralization rate (and henceforth the entire collateral) which is necessary for a predefined risk premium of 0.5%. For the parameter set 1 (low (α_i, β_i) -values, red line in figure 2) the required collateralization rate is about 9%. The probability q that $h < c$ (the investor is fully compensated) is then 91.8%, the expected haircut rate given $h > c$ is 15%. For the parameter set 2 (high (α_i, β_i) -values, green line in figure 2), the required collateralization rate is between 6-7%. The probability q is 84-88%, and the expected haircut for $h > c$ is 9.5-10%.

Although it is now almost sure that *some* default situation will happen in the pool which requires the use of the collateral, it is much more easy to compensate the investor since large haircuts (compared to the entire collateral), induced by the *simultaneous* failure of multiple countries where all are experiencing large haircut rates, is now a very unlikely event. In the following we calculate a mixed scenario with a required collateralization rate of 8%. Given that in the blue bond market the entire debt is 6.62 trillion Euro, the pool collateral requirement to establish a blue bond rate of 1.5% is 530 billion Euro which is significantly less than the requirements in the red bond market as calculated previously. It is clear that these calculations are based on the idea that rational investors are valuating the blue bond according to the assumptions we have made for their valuation of the underlying red bonds. If they are considering non-zero co-variances, endogeneous default probabilities, or the increased liquidity of blue bonds, however, the risk premium for the blue bond might differ. Hence, our calculations are only a starting point.

Since our aim is to provide a Eurobond model without cross-subsidisation, it is essential that the individual collateral contributions to the pool do not exceed those (fictitious) collaterals to be provided in the red bond market, as calculated in the previous section. We argue that the collateral must be divided based on the risk profile of every nation. By ensuring every nation pays a collateral proportionally to its risk and debt size, we prevent free riding by weak nations to the expense of strong countries. Also, well-to-do economies benefit as they are able to obtain a lower rate than their red bond market at very low collaterals. We provide following rules to determine the share s_i each country has to contribute:

1. *Rule 1:* The collateral each nation would pay in the *red* bond market, by the sum of collaterals (collateralization rate times debt) of all nations paid individually, could determine the proportion of collateral:

$$s_i = \frac{c_i \cdot K_i}{\sum_i c_i \cdot K_i}$$

This method, however, depends on the estimated parameters α_i, β_i .

2. *Rule 2*: The excess risk premium of every nation ($ERP_i = RP_i - 0.05$) multiplied by its debt by the sum, is another idea for dividing the collateral:

$$s_i = \frac{ERP_i \cdot K_i}{\sum_i ERP_i \cdot K_i}$$

This method depends only on market values, not on α_i, β_k estimations.

The numerical results for the shares as well as for the total collateral payments for each country can be seen in table 4. Although the sharing rules come to different results, almost no country is worse off compared to the red bond market case⁶. This implies that no country is carrying the burden of other country's risk.

Country	Rule 1				Rule 2	
	param. set 1		param. set 2			
	coll. share c_i	coll. sum col_i	coll. share c_i	coll. sum col_i	coll share c_i	coll. sum col_i
Austria	0.0170	0,0090	0.0166	0.0088	0,0062	0,0033
Belgium	0.0462	0,0245	0.0443	0.0235	0,0214	0,0113
Cyprus	0.0022	0,0012	0.0024	0.0013	0,0024	0,0013
Estonia	0.0001	0,0000	0.0001	0.0000	0,0000	0,0000
Finland	0.0038	0,0020	0.0038	0.0020	0,0010	0,0005
France	0.1694	0,0898	0.1682	0.0891	0,0695	0,0368
Germany	0.0000	0,0000	0.0000	0.0000	0,0000	0,0000
Greece	0.1010	0,0535	0.1116	0.0592	0,3224	0,1709
Ireland	0.0387	0,0205	0.0384	0.0204	0,0414	0,0219
Italy	0.3840	0,2035	0.3694	0.1958	0,3158	0,1674
Luxembourg	0.0006	0,0003	0.0005	0.0003	0,0001	0,0001
Malta	0.0008	0,0004	0.0007	0.0004	0,0004	0,0002
Netherlands	0.0204	0,0108	0.0201	0.0106	0,0066	0,0035
Portugal	0.0441	0,0234	0.0499	0.0264	0,0608	0,0322
Slovakia	0.0069	0,0036	0.0066	0.0035	0,0036	0,0019
Slovenia	0.0036	0,0019	0.0035	0.0018	0,0023	0,0012
Spain	0.1612	0,0855	0.1638	0.0868	0,1522	0,0806

Table 4: Collateral payments in the pool

Because the Eurobond system implies joint liability for the debt and therefore the use of the entire collateral for any event of failure, each country is able to calculate the *expected cost* from participating in the blue bond market. These costs (or in other words: the *effective* interest rate in the blue bond market) have two components: the payment of the blue bond rate of 1.5% and the expected losses from

⁶Greece is an exception when applying rule 2 because it has an extraordinary large risk premium.

giving (parts of) the collateral in case of any failure. The latter component is determined by two possible events: either the pool haircut is lower than the pool collateral. Then the average loss is determined by the conditionally expected haircut $\tilde{h} = E[h|h < c]$. This event happens with probability q . If the pool haircut exceeds the pool collateral, then the countries will lose their entire collateral which happens with probability $(1 - q)$. Thus we have an effective blue bond interest rate of

$$r_i^{eff} = 0.015 + (q\tilde{h} + (1 - q)) \frac{col_i}{K_i}$$

which makes clear that also in this Eurobond proposal risky countries have effectively to pay more than well-to-do countries. Here, col_i are the total collateral payments as reported in table 4, and K_i is the amount of debt financed by blue bonds (80% of the entire debt in our example).

For the two quasi-empirical haircut distributions for the pool we have for parameter set 1 with $c = 9\%$ and $q = 91.8\%$ a conditional haircut rate $\tilde{h} = 2.69\%$. For the parameter set 2 with $c = 7\%$ and $q = 88\%$ we have $\tilde{h} = 1.91\%$. The pooling of risks makes it very likely that every country will lose some parts of their collateral, but also that the expected haircut rates are extremely low. Therefore the effective blue bond rates are also significantly lower than in the red bond market as it can be seen in table 5 (exception: Germany is slightly worse off).

Country	Rule 1		Rule 2	
	param. set 1	param. set 2	param. set 1	param. set 2
Austria	0,0205	0,0219	0,0170	0,0176
Belgium	0,0241	0,0261	0,0192	0,0204
Cyprus	0,0278	0,0330	0,0292	0,0332
Estonia	0,0199	0,0208	0,0163	0,0167
Finland	0,0179	0,0187	0,0157	0,0160
France	0,0220	0,0239	0,0179	0,0187
Germany	0,0150	0,0150	0,0150	0,0150
Greece	0,0351	0,0435	0,0791	0,0972
Ireland	0,0312	0,0356	0,0323	0,0372
Italy	0,0293	0,0326	0,0268	0,0301
Luxembourg	0,0205	0,0215	0,0164	0,0168
Malta	0,0283	0,0300	0,0220	0,0239
Netherlands	0,0187	0,0196	0,0162	0,0165
Portugal	0,0319	0,0395	0,0383	0,0449
Slovakia	0,0312	0,0349	0,0235	0,0259
Slovenia	0,0303	0,0340	0,0248	0,0275
Spain	0,0305	0,0352	0,0296	0,0338

Table 5: Effective blue bond rates

II.4. Merits and Demerits of the Model

The use of financial intermediation by pooling heterogeneous debt contracts, combining them with a collateral, and transforming into another asset (the blue bond) can be seen as a cost reducing and therefore wealth creating financial technology. Countries in financial distress as well as well-performing countries can benefit from participating in this model as we move towards a more Pareto efficient state. We avoid cross-subsidisation and therefore moral hazard or free-riding problems.

Due to the cost reduction it is less likely that countries under financial distress can be triggered in an inefficient default state by speculation. As discussed in chapter III about the institutional setup, this would disburden the ECB from doing this job by buying massively governmental bonds as it was the case in recent times and heavily criticized by many economists.

The model takes the perception of capital markets seriously. While in most other Eurobond proposals, the conditions of participating in this market depend on political criteria, and are therefore prone to political rent-seeking and attempts to extort well-to-do countries, the conditions of our proposal are determined by the red bond market. The ECA has to satisfy private investors by holding a sufficiently large collateral, and the rules of contributing to this collateral are determined by market-based parameters. Therefore it is still possible that investors “bet against a country” since a higher risk premium in the red bond market will automatically increase the collateral contributions. But the impact on the effective cost situation of the target country is significantly dampened, making it more unlikely that a speculative attack is successful. Furthermore, the effects of such an attack could be reduced further by increasing the blue bond share by allowing temporarily to exceed the 80% in an emergency case.

A further argument highlights the capital market influence: The collateral requirement is calculated on the basis of current market data. This means that collaterals have to be adapted according to changes in the market perceptions even at a time-point when the country does not need additional funds by issuing bonds. If, for example, Spanish bonds are perceived as more risky than before (e.g. because of the publication of rating agencies), the market price of blue bonds would also be affected. Therefore, the ECA has to charge additional collaterals in order to keep the rate at 1.5%. Thus, the proposed Eurobond system should not be seen as weakening but strengthening of market discipline. However, the ECA need not to respond to *daily* fluctuations on the capital market. Since it issues blue bonds in a certain frequency (e.g. quarterly or monthly), it is necessary to adapt the collaterals in a similar frequency.

Is it possible to speculate against the ECA? Consider that investors throw blue bonds on the market so that the blue bond rate increases. The ECA would then

need more collateral which makes blue bonds more expensive for the member countries – but still less than financing via red bonds. If member countries are not able or willing to provide more collateral, and if the ECA is organized like a Special Purpose Vehicle (see next section), then it could respond to this attack by selling the debt (proportionally) to the red bond market which restructures the ECA's asset side. The effect would be the same as if investors would have thrown (proportionally) red bonds on the market. Since such an attack is then not coordinated on one target country, it will be much less effective.

The primary aim of the proposal is *not* to establish a mechanism to enforce fiscal discipline. In fact, lower costs of lending might have a discouraging effect on fiscal discipline. But there are no incentives for strategic defaulting since we do not have any bailout. An increased probability of default will immediately rise the red bond rate as well as the collateral requirements and therefore the effective blue bond rate.

Beside the missing encouraging effect for fiscal discipline, the most important demerit of the model is the necessity of a large initial collateral. As we have seen, the largest part of the collateral has to be paid by those countries which are facing financial problems. This makes it likely that in the starting phase of the ECA we will have cross-subsidisation again when large countries like Germany and France provide large parts of the initial collateral. However, this proposal works to a large extent as a substitute for the ESM. Thus, the financial funds already pledged for the ESM can be reallocated to the ECA without *additional* contributions.

There are a lot of critical assumptions and simplifications which can be seen as demerits of the model. However, this model should be seen only as a starting point. With more realistic assumptions and more elaborated estimation techniques the numerical results will be more reliable. But we argue that the basic logic of the model will not be affected. Here are some important effects we have *not* considered:

- *Correlated default:* The simplifying assumption that the defaults of countries are statistically independent is questionable. Due to spillover effects one might expect some positive correlations. However, there are also negative correlations: Increasing risk in country A might lead to a re-allocation of funds towards a safe country B which then benefits from lower interest rates⁷.
- *Endogenous default probabilities:* The probabilities of default depend endogenously on the interest rate. On the one hand this makes it possible to speculate against a country: If agents expect a default with higher probability, the interest rates will increase so that in fact the probability increases that the country will not be able to serve the debt. On the other hand, a blue bond market with lower effective interest rates would have a dampening effect on

⁷E.g. Germany is paying zero (or even negative) interest rates for recently issued short run bonds.

the default probability, especially on the GIPS countries. In this respect our calculations are conservative since we do not account for this effect.

- *Liquidity effects:* The liquidity of blue bonds is much higher than each single red bond, making blue bonds more attractive. This will have an additional reduction effect on the interest rate which is not considered in our calculations.

II.5. Further Aspects of Financial Intermediation

The ECA transforms different debt contracts and a collateral into blue bond assets. Up to now, we have only focused on pooling and insurance effects of such an asset transformation. A look at the ECA's balance sheet (figure 3) suggests that there are more wealth creating intermediation activities.

ECA	
Debt country 1	Blue Bonds
Debt country 2	
⋮	
Debt country n	
cash, liquid assets	collateral

Figure 3: Balance sheet of the ECA

Maturity transformation – Our argumentation was based on the simplifying assumption that there is only one type of red bonds. In fact there exists different maturities. It is not necessary that red bonds with a certain maturity are matched with blue bonds of the same maturity. It is possible for the ECA to transform maturities, e.g. by issuing more short run blue bonds and financing more long run debt. The impact on the required collateral has to be investigated.

Investing the collateral – Up to now we assumed that the collateral is held as a cash asset. Alternatively it can be assumed that the ECA invests it in safe and liquid assets, e.g. money market fund shares. If the ECA has a status of a bank, also holding reserves at the ECB would be a safe investment. Investing the collateral requires that it is provided as a liquid asset, not as a guarantee (suretyship).

Hedging – The ECA holds governmental debt as a risky asset. The collateral has a similar function as the equity capital requirements for commercial banks. For managing the sovereign risk, a part of the collateral could be invested in derivatives on governmental bonds, i.e. CDS. In this context, CDS are clearly *not* used as a speculative instrument, but as a hedging strategy. The higher investors assess a country's risk, the higher is the default probability and the necessity to use the collateral. But on the other hand, as the worth of the CDS increases, the worth of collateral increases as well. Henceforth, such a hedging investment works counter-cyclical.

All instruments of financial intermediation can be used to further reduce the cost of borrowing. But they have to be implemented under the maxime that it must be ensured that private investors are willing to buy blue bonds at the predefined low rate. The next section discusses some institutional aspects of the ECA in order to reach these targets.

III. Institutional Issues

Institutional issues are very important because an agency like the ECA could be prone to political rent-seeking and attempts to free-ride on the effort of other countries. Countries in financial distress would try to influence the rules in a way that allows them a better access to cheap money, and to mitigate the pressure towards financial reforms. Therefore, we argue that it is important that the ECA should be an *independent* institution with a clear mandate and clear rules. Such an institution should be able to build up credibility like the ECB. Moreover, the ECB would be completely relieved from engaging in sovereign debt management which is seen very critically by most economists. We suggest two different setups for the ECA.

III.1. *The ECA as a Finance Company*

Looking at the balance sheet in figure 3, the ECA operates in a similar way as a finance company: it holds debts as risky assets and some securities, and finances them by issuing commercial papers which are called "Eurobonds" in this case. Thus, it is engaged in asset transformation as described in this paper. Such an agency has to be equipped with a clear statute which guarantees (*de jure*) independency from government, and the obligation to maintain a blue bond rate of a certain level (e.g. 1,5%). Since it is attractive for countries to finance fiscal policy by blue bonds, they will be tempted to exceed the fraction of 80% at least in case of emergency. This, however, makes the red bond market more and more illiquid, probably more volatile, and the price signals will be less reliable.

It is not sufficient to negotiate a self-committment of countries not to exceed the 80% rule. As we have seen in case of the Maastricht criteria, such rules are weak

and not enforcing. It would be better to have an independent ECA which is *not allowed* by statute to issue blue bonds in order to finance more than 80% of the debt. It has to be debated whether such an arrangement could be credible. Note, that all other Eurobond proposals have similar restrictions, and presume that it is somehow ensured that countries will not exceed the allowed fraction. The danger is that once, when such a joint debt instrument is created, and the issuing institution is weak, the limitations for countries' access to this instrument will be a victim of political opportunism.

As mentioned above, the dependency on the risk perception of the capital market requires a permanent adaption of the collateral contributions according to the signals in the red bond market if the investors are not willing any more to accept the blue bond rate. What happens if a country is not able or willing to deliver additional collaterals in such a case? Should the ECA be able to sell a part of the country's debt (which is then equivalent to a red bond)? Or should it charge a penalty markup on the blue bond rate for this country? Would this help to bring down the blue bond rate to the desired low level again? Questions like these have to be resolved when designing the institutional rules for an ECA which operates like a finance company with illiquid debt assets. The present paper does not provide answers, instead, we point into another direction, namely to construct the ECA as a kind of Special Purpose Vehicle.

III.2. The ECA as a Special Purpose Vehicle

Consider the current case where (nearly) 100% of the governmental debt is financed by red bonds. The ECA, as an independent institution, could then buy red bonds on the primary or secondary market, and contracting with the government that, irrespective of the coupon rate, it will charge only the low blue bond rate. In return for this, the government is obliged to deliver the collateral as it is calculated by fixed rules, determined by the ECA. By doing so, the ECA pools risky assets, backs them with a secure cash collateral, and sells this structured asset to the market in form of a blue bond – similar to Asset Backed Securities. Thus, the ECA operates in a similar way as a Special Purpose Vehicle in the non-bank financial sector. The difference is that it *owns* the red bonds, and is therefore not only a “vehicle” as it is the case for banks which want to get rid of some risky and illiquid debts.

The basic logic is the same as in case of a finance company. The main difference is, that here blue bonds exist *additionally* to the still existing red bonds, while in the former case blue bonds are partially *substituting* red bonds as a financial source. This makes the ECA more independent from potential pressure of local governments: if a country is not willing to provide more collateral, then the ECA can easily bring down the blue bond rate by selling the corresponding red bonds on the secondary market until the required collateralization rate is achieved again. If the

ECA holds a debt contract, however, which is hardly marketable, the bargaining position towards local governments is much weaker, and the ECA is more vulnerable to political pressure.

III.3. ECA, ECB, and the ESM

As mentioned above, the ECB is recently engaged in “extra-ordinary measures” and “balance-sheet policies” which in fact means that it is managing governmental debt, e.g. by massively buying bonds from suffering countries in order to decrease their interest rates. Although arguments like the prevention of interest rate speculation against countries (which might bring the entire Eurozone in danger in case of default), or the stabilization of the interest rate channel, might be reasonable justifications, this policy is seen very critically by many economists. Three arguments should be mentioned here: (a) the massive intervention in the bonds market boosts the monetary base and might foster inflationary tendencies in the future, (b) the ECB buys very risky assets which have to be written off with a high probability. In case of very high losses it might become necessary to recapitalize the ECB, (c) the policy endangers the independence and credibility of monetary policy by giving up the clear policy assignment.

We argue that these interventions in the red bond market wouldn't be necessary in case of the Eurobond proposal. Following, for example, the idea of the ECA as a Special Purpose Vehicle, the “interventions” by buying red bonds, backing them by secure assets, and refinancing this by issuing blue bonds, the ECB could concentrate again only on monetary policy according to their goals. The goal of managing the risks and assisting governments in financing their budgets to moderate but market-conform rates, is now assigned clearly to the ECA. The ECA is equipped with the policy tools to do this, while the ECB is relieved from this job.

In order to stabilize the Eurozone, European governments created the EFSF which should be replaced by the ESM. This institution is not designed as a market-oriented financial intermediate but as a “firewall” to prevent countries to fail. Politicians and economists see the necessity because they fear that a default of a single country has negative spillover effects to banks who have to write off a significant part of their risky assets, but also to other countries. The EFSF resp. ESM, however, is primarily based on the economic power of well-to-do countries which partially fund it or give guarantees which should attract private investors. Therefore, it could be seen as an implicit bailout mechanism based on cross-subsidisation. We doubt whether such an institution like EFSF/ESM makes sense any longer when the proposed Eurobond system is established. The financial endowment of EFSF/ESM in order to build a working “firewall” is significantly larger than in our proposal because it does not make any use from standard technologies of financial intermediation like pooling. Thus, it does not only suffer from disincentives by bailout and moral hazard, it is also more expensive than the proposed system.

IV. Conclusion

We propose a Eurobond system which is based on the idea of pooling risks and collateralizing debt. We interpret this not as a politically motivated system which should circumvent the disciplinary power of the capital market, but contrary, as a method of financial intermediation which is completely based on market information. We have shown that this could help to reduce the cost of borrowing significantly. Since there is no cross-subsidization, all participating countries will be better off while the investors will not be harmed (Pareto improvement). Therefore, problems of bailout and moral hazard are avoided. The proposal enables a clear assignment of sovereign debt management to the ECA, and price stability to the ECB, given that the ECA is an independent institution.

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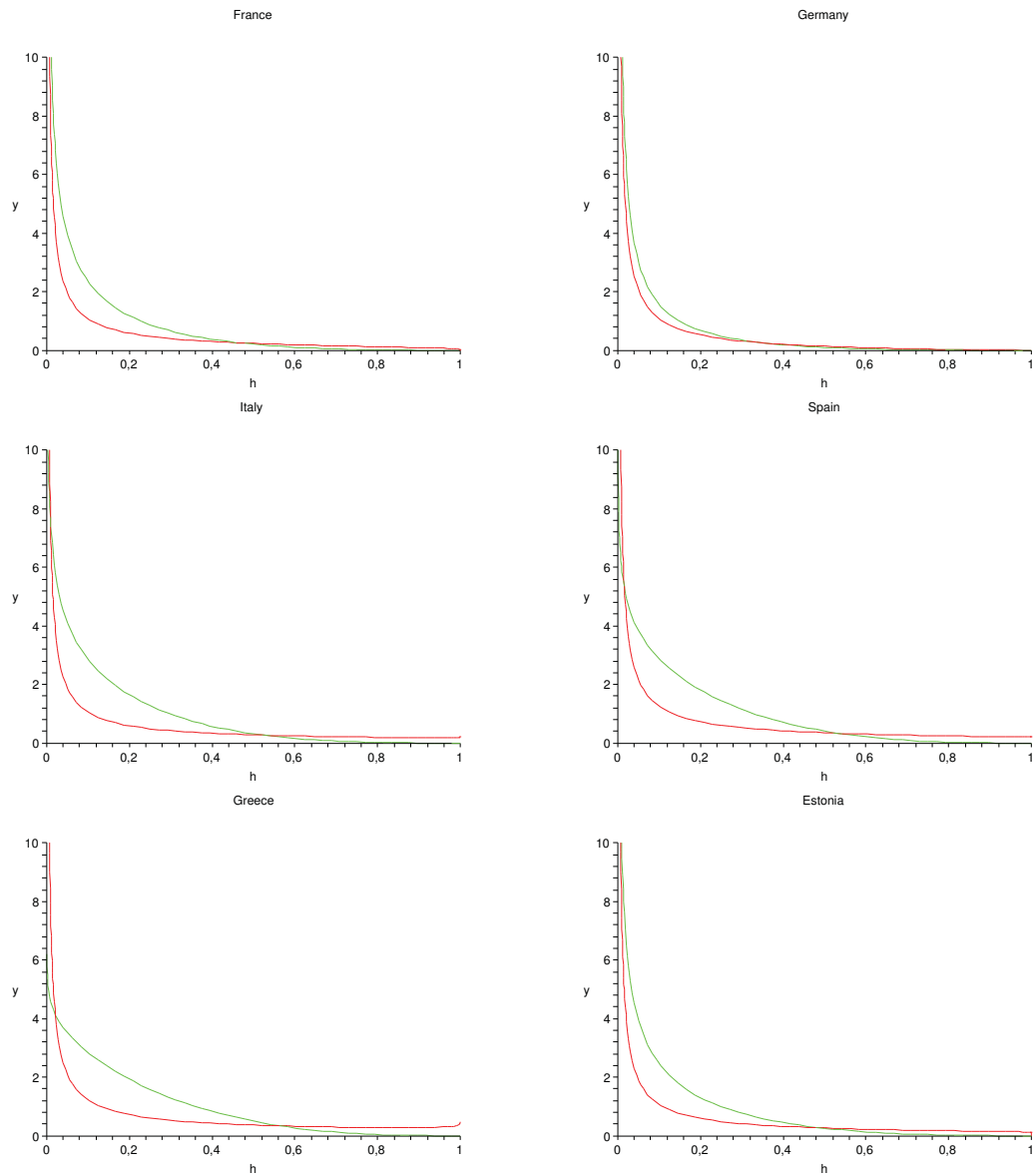
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Appendix

Beta distributions of haircuts for some selected countries (red: α, β values from table 2, green: α, β values from table 3).



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