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Contagion as a Dealmaker?

The effect of financial spillovers on regional lending programs

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Abstract

The recent European sovereign debt crisis highlighted the critical role of regional lending arrangements. For the first time, European mechanisms were called to design financing programmes for member countries in trouble. This paper analyses how the risk of contagion, an essential characteristic of interlinked economies, shapes borrowing conditions. We focus on the role of spillovers as a channel of bargaining power that a country might have when asking for financial support from regional lending institutions. We build and present a new database that records both the dates on which official meetings took place, relevant statements were released and the timing of the announcements regarding loan disbursements. This database allows us to assess the defining role that announcements of future actions have in mitigating spillover costs. In addition, we study the design of lending arrangements within a recursive contract between a lender and a sovereign country. When accounting for spillover costs, arising from the borrower to the creditor, we find that it is in the lender's best interest to back-load consumption by giving more weight to future transfers in order to reduce contagion cost. Subsequently, we test and validate our theoretical predictions by assessing the effect of spillovers on loan disbursements to programme-countries and by juxtaposing lending conditions imposed by the IMF and the European mechanisms.

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1 Introduction

The collaboration between the IMF and the European lending mechanisms during the European debt crisis was generally deemed successful. However, "different views over program strategy emerged because of differential emphasis on potential spillovers within the euro area" (IMF, 2017). The IMF's main priority is to ensure *"the stability of the international monetary and financial system"*, while the European Commission (EC) and the European Central Bank (ECB) - representing all members of the euro area - put heightened emphasis on reducing the risk of contagion within the currency union (Darvas, 2017) (Table 1).[1]

	IMF	**EC-ECB**
Latvia (2008)	Restore stability & promote growth	Help Latvia in a way that sets good precedent for others & helps the stability of neighbours
Greece (2010/11)	Restore stability & promote growth	Ensure stability in the Euro-Area (fear of contagion), address the Greek debt later
Ireland (2010/11)	Restore stability & promote growth	Ensure stability in the Euro-Area (fear of contagion)

Table 1: Priorities of the IMF and the European institutions involved in lending programs (source: Darvas (2017))

At the peak of the sovereign debt crisis, starting in 2011, the ESM provided loans with a longer maturity and at a lower interest rate than the IMF (Corsetti et al., 2017) (Table 2).[2] [3] A potential explanation is that the threat of contagion perceived by the average euro area member, which is internalized by the ESM, is larger than the one of the average IMF member country due to closer financial and trade linkages within the former group.[4] In addition, the IMF has the capacity and ability to pool risks together among different countries globally. This channel

[1] Even though the case of Latvia is included in Table 1, it does not fall within the scope of the European debt crisis. However, it constitutes an illustrative example of the persistent priorities of the IMF and the European mechanisms when providing financial assistance to sovereign countries that continued throughout the European debt crisis.

[2] The European Financial Stability Facility (EFSF) was created as a temporary crisis resolution mechanism by the euro area Member States in June 2010. The European Stability Mechanism (ESM) was set up in 2012 as a successor of the EFSF.

[3] The evolution of the different loan conditions provided from the European mechanisms in comparison to the IMF is insightful and reflects the development in the design of the European loan-contracts. The incentive structure in the beginning reflected institutional shortcomings and political dynamics that overtime changed. Initially, the EFSF shadowed the expertise and contract-design of the IMF. However, after 2011 we observe a change in the conditions offered by the European mechanisms.

[4] For a graphical illustration of financial linkages in the euro area see Appendix A. Germany held Spanish banking debt worth 49% of German GDP and France held Greek banking debt worth

Official Loan Terms		EFSF/ESM		IMF	
Country (in programme)	Date	Maturity	Interest Rate	Maturity	Interest Rate
Greece	May 2010	5 yrs	4.041	5 yrs	3.23
	June 2011	10 yrs	3.78	5 yrs	3.53
	March 2012	20 yrs	2.07	8 yrs	3.13
	December 2012	30 yrs	0.93	8 yrs	3.07
Ireland	December 2010	7.5 yrs	5.25	7 yrs	3.37
	July 2011	15 yrs	2.74	7 yrs	3.53
	June 2013	22 yrs	2.32	7 yrs	3.07
Portugal	May 2011	7.5 yrs	5.47	7 yrs	3.37
	July 2011	15 yrs	3.15	7 yrs	3.53
	June 2013	22 yrs	2.19	7 yrs	3.07
Spain	November 2012	12.5 yrs	0.78	-	-
Cyprus	May 2013	15 yrs	1.03	4 yrs	3.07

Table 2: Official Loan Terms. source: Corsetti et al. (2017) based on IMF, EC, EFSF, ESM and Bloomberg

reinforces the bargaining power of troubled countries within the euro area and with respect to the regional mechanisms. As a result, ESM lending conditions might be more benign compared to those offered by the IMF and the degree of leniency granted by the ESM is increasing in the strength of spillover risk.

A motivating example is the case of Ireland and Cyprus. Both countries faced a banking crisis in 2008 and 2012/13, respectively. Consequently, they entered into a lending agreement with the IMF and the European lending mechanisms. Despite the fact that both countries were affected by the same type of crisis, the remedies applied differed. In both cases, the IMF proposed the bail-in of the banking sector. Instead, European mechanisms strongly opposed a bail-in of Irish banks' creditors, while in the case of Cyprus, they agreed.

In his review of the Irish crisis, Eichengreen mentions a potential reasoning behind the European mechanisms' different approaches:

> "[...] some commentators [...] suggest that Trichet insisted (telephonically) that the Irish authorities should **not** bail in bank bondholders on the grounds that doing so would damage the big French and German banks holding Irish bank paper" (Eichengreen, 2015)

In contrast, shareholders of the Cyprus' banking sector were primarily located in Russia. Hence, spillover effects onto other euro area countries resulting from a Cypriot bail-in were considered low compared to the Irish case. Indeed, Figures 1 and 2 in the Appendix illustrate that Euro-core countries such as Germany, Belgium,

28% of French GDP, when the respective first financial assistance program was agreed upon by the European lending mechanisms.

the Netherlands and France held substantially larger debt-amounts of Irish banks than of Cypriot banks when the respective ESM packages were approved.

We construct a new dataset that records all the dates that official meetings (e.g., Eurogroup meetings) between the different institutions and lending mechanisms (i.e., EC, ESM, IMF etc.) took place or relevant statements were made by officials for a crisis-hit country (Greece, Ireland, Portugal, Spain and Cyprus).[5] We distinguish between announcements made by the IMF and the European mechanisms and assess their impact on a measure of interconnectedness.[6] Lending related announcements – irrespective of being related to future loans or current period disbursements – by the European mechanisms reduced the spillover effect that Ireland, Greece and Portugal had on the rest of the union, but had the opposite effect for Cyprus. In contrast, lending related announcements by the IMF did not significantly affect spillovers of debtor countries. We embrace the view that the European lending mechanisms successfully accomplished their goal of reducing the risk of contagion within the euro-area, which we use as motivating evidence to turn our focus to the design of lending programs by regional mechanisms.[7]

The aim of this paper is to assess how the presence of contagion within a region or currency union, in our context, may impact the design of lending programs offered by regional mechanisms.[8] In other words, we explore whether (and when) the risk of spillovers gives countries in trouble bargaining power that results in more favorable borrowing conditions. To answer this question, within a simple recursive contract framework, we present a dynamic lending contract between a lending mechanism and a borrowing country, in which we introduce spillover costs. We structure the lending mechanism and the borrowing country in the spirit of a principal-agent model. The model frames the financial assistance contract as a bargaining game, where the

[5]In the newly built dataset we also observe all the loan-disbursements with the corresponding maturity and interest rate. Therefore, we have full information on the conditionality of the loan, which is later used to validate the theoretical predictions of our model. Moreover, we are able to track the timing of the announcements regarding a loan disbursement and distinguish between the anticipated date of a disbursement, the realized date, and in some cases the revised date. The timing can help to study promises of loan amounts, interest rates and maturity dates and whether these promises were materialized or revised/updated.

[6]Our measure of interconnectedness is based on an estimated time-varying correlation, derived from a bivariate-GARCH model.

[7]Our underlying assumption is that contagion is an increasing function of spillovers, in that the higher the level of spillovers to other countries, the higher the cost for the other countries, the more contagious the country is. For this reason, most of the times throughout the paper we use the two terms interchangeably.

[8]Our narrative examples and empirical evidence draw from the experience of the European Union. However, our underlying hypothesis and theoretical model has a broader application to all Regional Financing Arrangements (RFA)(RFA members are the European Stability Mechanism, the Arab Monetary Fund, the BRICS Contingent Reserve Arrangement, the Chiang-Mai Initiative Multilateralisation, the Eurasian Fund for Stabilization and Development, the EU Balance of Payments Facility, the European Financial Stabilisation Mechanism, the Latin American Reserve Fund (FLAR), and the North American Financial Agreement).

principal (lending mechanism) offers a contract to the agent (borrowing country), which consists of current and future transfers. We adopt the view that financial assistance programmes worked as a carrot-and-stick.

The contract requires voluntary participation from the side of the borrower, who always has the option to leave and resort to autarky. Therefore, for the contract to be self-enforcing, the loan terms have to be designed in a way that ensure voluntary participation of the borrower. We interpret a binding participation constraint as a credible threat of default, since if the borrower resorts to autarky, he reneges its obligations to the principal. The novelty of the theoretical part comes from the fact that in all states in which the borrower credibly threatens to default, the principal incurs a cost. This cost arises from the interconnectedness between the lending and borrowing economy. It accurately represents spillover costs which emerge when tightly linked economies, participating in a lending agreement, face the contingency of one-sided default. The principal internalizes the spillover costs weighted by the corresponding probability of a binding participation constraint, which allows to account for the fact that the European mechanisms took contagion into serious consideration in the design of the lending programs.

To better understand the theoretical predictions of our model, we compare it to a benchmark model in which spillover costs are absent. The latter case corresponds to a simple one-sided limited commitment dynamic contract. We find that a lending program characterized by high spillovers between the contracting parties will put more weight on future payments compared to the benchmark model. The reason is that the principal takes advantage of lower spillover costs due to higher promised transfers. Therefore, the principal finds it more profitable to equate the binding participation constraint and thus ensure voluntary participation of the borrower through substituting current consumption transfers with future ones. As a result, in the presence of spillover costs, the contract back-loads consumption at a higher degree than the benchmark case.

We test and validate the main prediction of our theoretical model empirically. More precisely, we show empirical evidence that higher interconnectedness between the country in trouble and the rest of the euro-area partners has a negative effect on the country's current consumption. In particular, the borrowing country appears to be worse off in the short term, but better off in the long term under a lending contract which involves high spillovers between the two parties. We proxy current consumption by a measure of current cumulative loan disbursements.

Recent relevant work in the literature (Gourinchas et al., 2018) discusses the size of cross-country transfers in the euro-area during the sovereign debt crisis, showing

that transfers were large and heterogeneous among the different countries. In their two-period model, lenders transfer resources to debtors to avoid default. In our paper, we focus on contagion as a channel for the willingness of the creditors to provide financial assistance. Our theoretical part represents financial assistance programmes between a lending mechanism and a sovereign borrower as a constrained efficient allocation. An extensive strand of the literature adopts the same representation, advocating its advantage to explicitly model the underlying frictions. In particular, Dovis (2019) juxtaposes the aforementioned approach to the quantitative incomplete markets approach on sovereign debt, as initiated by the seminal paper of Eaton and Gersovitz (1981), in order to evince its suitability for policy analysis. Atkeson (1991) is one of the first works representing sovereign borrowing as an constrained optimal contract, followed by Thomas and Worrall (1994), Alvarez and Jermann (2000) and Kehoe and Perri (2002) who either study limited commitment or moral hazard as main frictions. This work also draws on more recent literature such as Abrahám et al. (2018) and Muller et al. (2019). In particular, we borrow from the latter work the interpretation of the arising limited commitment friction in a lending programme as a credible threat of default by the borrower.

We contribute to this strand of the literature by explicitly modelling spillover costs. These costs are directly linked to the underlying limited enforcement friction, which characterises the contract. In our model, the lender incurs certain costs when the borrower credibly threatens to leave the contract. This additional element changes the structure of the loan offered by the lender and the weight she puts on the available means to sustain the contract.

Part of the contribution of this paper relies also on the newly built dataset. This is the first dataset to record all the dates that announcements and statements of EU and IMF officials regarding programme-countries were made. Moreover, we extend and enrich the dataset of Corsetti et al. (2017) on loan conditions (i.e., disbursements, maturities, interest rates) beyond 2011 and in higher frequency. We distinguish between the timing of announcements on the different conditionality measures and record information on announcements related to a payment of a future disburesement, the realization of a disbursement, or its revision.

There is enough empirical evidence in the literature of existence of contagion, with a broad range of definitions for contagion (see e.g., Forbes (2012)). Beirne and Fratzscher (2013) study contagion in the euro area focusing on sovereign credit risk, and show that between 2000 and 2011 sovereign spreads and Credit Default Swaps were on average 31bp and 44bp respectively higher in the euro area due to cross-country spillovers. Constancio (2012) also shows evidence of contagion during the euro-area sovereign-debt crisis. He focuses on comovements in sovereign bond yields

filtering out long-run trend and attributing the remaining correlation to cross-country contagion. His findings indicate that in 2011, 38 percent of the variance of Italian and Spanish government yields was explained by contagion from Greece, Ireland, and Portugal. We add to this existing evidence and follow a widely-used approach in finance (Diebold and Ylmaz, 2009), which is based on VAR variance decompositions, to compute an aggregate spillover index in the subsamples before and after the peak of the crisis. However, in order to explore better the time-dimension and the frequency of our data, we estimate dynamic conditional correlations (Engle, 2002a), which we use a measure to proxy contagion between countries.

The remaining of the paper is organized as follows. In Section 2, we describe the newly built dataset. In Section 3, we provide empirical motivation regarding our theoretical modelling assumptions. Section 4 presents the model and its predictions, which we validate empirically in Section 5. Section 6 concludes.

2 A New Dataset on Loan Announcements and Disbursements during the Euro Crisis

In order to determine the effect of announcements and disbursements by the European lending mechanisms and the IMF on spillovers between Euro area countries we create a novel database. We use press releases, memos and other official statements of the European Commission (EC), the ESM and the IMF. In Appendix C.1 we present some examples of these statements. For each day, we record the following information:[9]

1. whether a statement relating to a lending program has been issued by the EC/ESM or the IMF (includes mentions of current or future loan disbursements as well as more general announcements related to e.g., the initialization of a lending program, completed review missions or maturity extensions),
2. whether an EC/ESM statement mentions a concrete future or current-period loan disbursement,
3. whether a realized EC/ESM disbursement was anticipated,
4. at which time horizon a future EC/ESM disbursement is anticipated to take place (within the current month or the next 1, 2, 3, 6, 12, 24 or 36 months), and

[9]EC statements contain information on joint (planned) actions by the Troika (EC, ECB and IMF) or explicitly mention financial assistance given by the EFSF, the EFSM or the ESM. While the content of statements issued by the EC tends to overlap with those from the ESM, the latter provides additional information in some cases. Press releases and official statements issued by the aforementioned institutions can be found here: https://www.esm.europa.eu/newsroom/press-releases, https://ec.europa.eu/commission/presscorner/home/en, https://www.imf.org/en/News/

5. the announced or realized loan size, interest rate and maturity of the loan.

We record data for all euro area crisis countries (Ireland, Greece, Spain, Portugal and Cyprus) from April 29, 2009 until September 20, 2018.[10] Information mentioned in points 1.-3. above is recorded in form of dummy variables which equal one if such an information was provided on a given day and zero otherwise.

To the best of our knowledge we are the first to collect such information. Our approach differs from Corsetti et al. (2017) who collect information on changes in maturities and interest rates offered to debtor countries which occurred in 2011 and 2013. In contrast, our database contains higher frequency (daily) data on lending related announcements. Furthermore, while Corsetti et al. (2017) are interested in the effect of loan conditions on sovereigns' bond market access, our aim is to identify the causal effect of financial assistance on spillovers across euro area countries. As will be highlighted below, any disbursement or change in loan conditions made by the Troika is always signalled in advance of the episode. Recording only such an episode would eliminate the surprise effect of the policy actions. To remedy this issue, we focus on announcements by the EC and the IMF rather than the policy changes.

From the descriptive statistics in Table 4, three facts are striking. First, Greece and Ireland were the most common subject of statements and press releases by the EC and the ESM followed by Spain, Portugal and finally Cyprus. Second, the difference between "all" announcements made by the European creditors and the number of concrete references to future or current disbursements is large especially for Spain, reflecting the Spanish government's hesitation to ask for financial support. Third, for Greece, future disbursements were announced three times more often than actual disbursements whereas the ratio was below 1 for Ireland, potentially reflecting the lengthy bargaining process with Greece over austerity measures.

To visualize the dynamics of events, Figure 7 plots the annualized count measure of announcements for each country. The height of the bars reflects the timing of the crises and subsequent lending programs[11]. For example, for Greece announcements by the IMF and the EC jumped up in 2010 and stayed elevated through 2015. Indeed, in April 2010, the Greek authorities requested an initial loan of 45 billion and in May 2010 they announced a number of austerity measures to secure a three-year 110 billion loan. A second bailout loan of 130 billion was approved in February 2012. In 2013, the Greek parliament approved new austerity measures paving the way for a new tranche worth almost 7 billion euros. Finally, in 2015, the Troika approved the third bailout package worth 86 billion euro. As reflected in Figure 7, the Irish debt crisis started

[10] When a statement or press release is issued during the weekend, we record it on the following Monday (when markets open).

[11] For a detailed description of events during the European debt crisis see Corsetti et al. (2017).

simultaneously but ended sooner than in Greece (announcements by the IMF and the EC after 2014 are mostly concerned with post-program surveillance missions to Ireland). Portugal received a 78 billion bailout package but already regained complete access to financial markets in September 2013. Spain became a major concern for the Euro-zone in June 2012 as indicated by the spike in EC announcements[12]. The large number of EC statements on Spain in 2012 potentially reflects the size of the Spanish economy and hence the threat it posed to the rest of the euro area. On 9 June 2012, the Eurogroup decided to grant Spain a financial support package with a maximum value of €100 billion. Although Cyprus already requested financial assistance in 2012, the package worth €10 billion was only approved in March/April 2013 which is mirrored in the chart.

Overall, Figure 7 shows that IMF and EC statements tended to move in parallel but most initial IMF statements occurred earlier. Furthermore, actual disbursement had always been pre-announced (not visible in our annual chart) resulting in a likely anticipation effect that our empirical strategy in section Section 3.3.1 will take into consideration.

3 Empirical Analysis

In this section we assess the risk of contagion empirically. The sovereign debt crisis highlighted the relevance of transmission of shocks and contagion in the euro area due to strong financial and trade interlinkages. At the same time, several Member States had to take up financial support from the IMF and the Regional financial arrangements (RFA) (e.g., Ireland, Cyprus, Greece). For this reason, the EA appears to be the ideal candidate to illustrate our analysis.

As a first step in our empirical analysis, we want to check whether there is evidence of contagion across the financial markets of the different EU countries. To understand how interconnected the different markets are, we first construct an overall measure of contagion – a Spillover Index – based on a Vector Autoregressive (VAR) model (Diebold and Ylmaz, 2009). Then, in order to understand how contagion may have changed over time, we examine a time-varying measure of correlations that we estimate using a Bivariate-GARCH Dynamic Conditional Correlation Model (DCC) (Engle, 2002a).

To study the different spillover channels we use different financial and macroeconomic data. More precisely, for the sovereign channel, we obtain daily and monthly data from Datastream on sovereign CDS of 5-year seniority and 10-year government bond total returns denominated in euro. For the banking channel, we make use of

[12]The interest rate on Spain's 10-year bonds reached 7% and the country had difficulty accessing bond markets

the 5-year senior bank CDS daily data of the biggest banks of each country from Datastream denominated in euro, equity total return indices from MSCI Bloomberg, and consolidated banking data from the BIS. Regarding the bank CDS, we create a weighted aggregate bank CDS index for each country, where the weights depend on the size of assets holdings of each bank.[13] Moreover, we control for common currency financial factors, such as the Eurostoxx 50 index, the 3-month Euribor and EONIA rate. Our final sample covers the period between 2007 to 2018.

3.1 The Spillover Index - Vector Autoregressive Model

Following Diebold and Ylmaz (2009), within a VAR we examine variance decompositions, which allow us to aggregate spillover effects across countries and derive a single measure of contagion. The idea is that for each financial asset i (i.e., the government bond of country i), we focus on the shares of its forecast error variance coming from shocks on asset j (i.e., the government bond of country j). Then we sum up each county's shares which gives us a measure of interconnectedness.

More precisely, if we take a simple covariance stationary VAR

$$y_t = Ay_{t-1} + u_t,$$

where $u_t \sim wn(0, \Sigma_u)$, we can derive the moving average (MA) representation, since our model is covariance stationary. The MA representation reads as

$$y_t = (I - AL)^{-1}u_t = B(L)u_t,$$

where $B(L) = (I - AL)^{-1}$. For the derivation of the variance decompositions, it is easier to write the MA representation in an equivalent form

$$y_t = \Gamma(L)\varepsilon_t,$$

where $\Gamma(L) = B(L)Q_t^{-1}$ and $\varepsilon_t = Q_t u_t$, $E(\varepsilon_t \varepsilon_t') = I$ and Q_t^{-1} is the unique lower-triangular Cholesky factor of the covariance matrix of u_t. The one-step-ahead forecasting at time t is $y_{t+1,t} = Ay_t$ with the corresponding one-step-ahead error vector being

$$e_{t+1,t} = y_{t+1} - y_{t+1,t} = \Gamma_0 \varepsilon_{t+1}$$

with covariance matrix $E(e_{t+1,t}e_{t+1,t}') = \Gamma_0\Gamma_0'$. Using the H-step-ahead forecasts, for a pth order N-variable VAR, the Spillover index is

$$S = \frac{\Sigma\Sigma\gamma_{\mathrm{h,ij}}^2}{\Sigma \mathrm{trace}(\Gamma_{\mathrm{h}}\Gamma_{\mathrm{h}}')}$$

[13] Data on the size of asset holdings is obtained from the S&P Global Market Intelligence platform

In our analysis, we estimate a model of two lags for the endogenous variables (y). The vector of endogenous variables consists of first log-differences of daily CDS for Belgium, Cyprus, France, Germany, Greece, Ireland, Italy, Portugal, and Spain, i.e., $y_t = (y_{BEL,t}, y_{CYPR,t}, y_{FRA,t}, y_{DEU,t}, y_{GRE,t}, y_{IRL,t}, y_{ITA,t}, y_{PRT,t}, y_{ESP,t})$. We analyze daily data on sovereign CDS (2008-2018) (bank CDS etc.)

Our results show evidence of contagion between EA countries, but since contagion is not one-to-one (i.e., the spillover measures are not 100 percent), this is an indication that there is room for risk-sharing [14]. We find evidence of heterogeneous interlinkages among the Member States. Peripheral countries, such as Italy, Spain, Portugal and Ireland are a great source of spillovers among themselves and appear to affect also a number of core countries. Instead, Cyprus does not contribute to the variability of the sovereign and banking markets of the rest of the countries. This result is in line with our motivating narrative evidence.

3.2 Bivariate-GARCH Dynamic Conditional Correlation Model

Exploiting the high frequency of the data, we study time-varying correlations and the extent to which official announcements for programme-countries affect the decisions of other countries investors. For this purpose we use the Bivariate-GARCH Dynamic Conditional Correlation (DCC) model of Engle (2002b). Correlations are a critical input for financial management and DCC is a flexible, parametric model widely used for forecasting, and estimation of time-varying correlations. A Fisher transformation is applied in the resulting correlation to ensure that the correlation are normalized and always lie between -1 and 1, which is the measure that we use for the analysis that follows.

In Figure 8 we plot the estimated DCC for the programme-countries (Greece, Ireland, Portugal, Cyprus), as well as the realized disbursements of the loans that these countries received. An interesting observation coming from the different subplots and the DCC is the existence of two different "contagion-regimes". In the beginning of the sample, in 2009, Greece, Ireland and Portugal were interconnected with the different euro-area markets at a correlation level of 0.6-0.7. Instead during 2012, we observe a regime-switch, investors decide to move away from these markets and diversify their portfolios, moving into a "low-contagion" regime.

Since we are interested in the initial period of the euro-area sovereign debt crisis,

[14] As the variance contribution from one country's (i) Generalized Δ(Sovereign CDS), (ii) 10 yr. government bond total returns, (iii) Equity total returns and (iv) Generalized Δ(Bank CDS) is not 100% (Table 5 - Table 8), this implies that shocks on these measures in one country do not transmit fully across countries of the Eurozone. As a result, since shocks are not perfectly positively correlated, there is room for risk-sharing. In other words, when a country (country A) does not affect highly another country (country B), this means that for example in times that country A is in trouble, country B (which is not highly affected by country A) can take up some of the risk.

we analyze the sub-sample of the "high-contagion" regime. We re-run the VAR model and assess the variance decompositions to derive the spillover index for the period of 2008-2011. As expected, the euro-area markets were highly interconnected in the first part of the eurozone crisis, at a level of 76.63 percent. The spillover for the subsample is higher compared to 54.09 percent of the entire sample, but there is still evidence that there is room for risk-sharing. Looking also at the contributions of each country, there is spillover-heterogeneity across the different countries with Spain contributing the most to the variation of most of the countries, in particular to Italy, Portugal, and Ireland. The contribution of Ireland and Greece to the neighbor countries of the Union, is also pretty high. Instead, Cyprus appears to have the smallest contribution level in the sovereign CDS of the other countries, with it being very low.

3.3 Spillovers and lending during the Euro crisis - A linear regression analysis

3.3.1 The effect of lending programs on spillovers

To verify whether providing financial support to crisis-hit countries mitigated their spillover effects on other members of the Eurozone we rely on our newly constructed database on loan announcement and disbursements. For each country we regress the DCC on a dummy that equals one on days of announcements and zero otherwise. As reported in Table 11, announcements by the European lending mechanisms are negatively related to spillovers for all countries except Cyprus. Hence, the realized effect on spillovers is in line with the European commissions' objective. In contrast lending related announcements by the IMF have no significant effect on spillovers for any of the debtor countries (see Table 12).

Disaggregating European mechanisms' announcements by type and controlling for Eurostoxx50 returns and the Euribor, we find that both announcements of future loan disbursements and of current-period disbursement significantly reduce spillovers for Ireland (Table 13) and Portugal (Table 14) providing evidence against anticipatory effects. Neither of the coefficients is significant for Greece (Table 15) and Cyprus (Table 16).

4 A Recursive Contract Model with Spillover Costs

In the present section, we perform an alteration to an otherwise standard recursive contract model with limited commitment to understand the implications of spillover effects for contractual terms. Building on Muller et al. (2019), we represent the lending agreement between a lender and a sovereign country (borrower) as a recursive dynamic contract inflicted by one sided limited commitment.

In our dynamic principal-agent framework, the principal is the lending mecha-

nism and the agent is the distressed sovereign country requesting financial assistance. Throughout the analysis, the lender is assumed to be fully committed, while the borrower can leave the contract at any time and resort to autarky.[15] As a result, the lender has to design the contractual terms in such a way that the borrower always honors them at every state.[16]

The limited commitment friction is represented through the addition of a participation constraint which has to be satisfied, in order for the contract to be self-enforcing. The critical idea is the interpretation of a binding participation constraint as a *credible threat of default*. Under a binding participation constraint the borrower is indifferent between between honoring the contract and resorting to autarky. Hence, defaulting on lending terms becomes a credible contingency. The principal's optimal response to a binding participation constraint, within a textbook model of one-sided limited commitment, is an increase in consumption and promised utility. This can be interpreted as a renegotiation of the loan terms. As Muller et al. (2019) put it, the lender "sweetens the deal" when the sovereign credibly threatens to default.

Extending the idea of a binding participation constraint as a credible threat of default, we focus on its subsequent effects on lender's profits due to the existence of spillover costs. In our theoretical model, the lender incurs a certain cost whenever the participation constraint binds. This cost is the result of lender's exposure to the borrower and aims to capture the losses incurred by the lender when the contingency of borrower's default arises. In addition, the theoretical model allows to examine the response of the lender when this spillover cost exists and when it is absent. In this way, we are able to study in what way loan terms differ when the lender is vulnerable to spillover costs due to high exposure to the borrower compared to the case of a well protected lender without spillover effects from a borrower's default.

4.1 Model

Every period the agent receives a stochastic endowment stream $\{y_t\}_{t=0}^{\infty}$, where for each $t \geq 0$ y_t is iid according to the discrete probability distribution $Prob(y_t = y_s) = \Pi_s$, where $s \in \{1, 2, ..., S\}$, with $y_s < y_{s+1}$, $\forall s$. In each period, the borrower gives its endowment to the lender, receiving back consumption (c_t) and a stream of future utilities namely promised utility (w_t).

[15] We acknowledge that our model is looking into one slice of the real world. For example, in reality a country at a first stage would first aim to seek financing from private investors. Then, if it is cut off from private investors, would seek assistance from the official sector creditor at a second stage. In our model we are zooming into this second dynamic.

[16] In the real world, the official sector creditor judges whether the country is insolvent (i.e., more likely to default and not pay back the official sector) or has liquidity issues before agreeing to give money. Official lending mechanisms tend to avoid giving money to a country that is not solvent. In addition, given the seniority of debt, the official sector creditor debt changes over time and as a result it becomes more difficult for the country to default as the time passes.

In each period, the borrower can either stay within the contract and receive current consumption (c_t) and promised utility (w_t) or renege the contractual agreement and live in autarky - consuming its endowment forever after. Therefore the participation constraint (PC) takes the following form:

$$u(c_t) + \beta w_t \geq u(y_t) + \beta v_{\text{aut}} \quad \forall t \quad \text{[PC]}$$

Where $v_{\text{aut}} = \sum_{t=0}^{\infty} \beta^t \sum_{s=1}^{S} \Pi_s u(y_t)$, is the discounted value of future utility derived from consumption of own endowment. Essentially, the participation constraint ensures that at each period and state, the contract option is at least equal to the outside option, namely autarky.

We assume that the sole friction of the model is limited commitment from the side of the borrower, while the lender is fully committed to the contract. An additional constraint of the model in recursive form is that the lender delivers the past promised utility, namely the promise keeping constraint (PKC).

$$\sum_{s=1}^{S} \Pi_s \Big(u(c_t) + \beta w_t \Big) \geq v \quad \text{[PKC]}$$

Where v is the promised utility with which the contract enters current period and it acts as a state variable. The promise keeping constraint makes sure that what the contract allocates to the borrower is at least equal to what has been promised to the borrower (v).

Moreover, we add another state variable $\hat{s} = s : y_s = \max\{y_0, y_1, ..., y_t\}$ which records the maximum state realised up until the current period. This implies that at any state s, if next period's state s' is higher than $\hat{s}$, then the participation constraint will be binding, while if s' is lower than $\hat{s}$, then the participation constraint will be slack. Due to the iid nature of the endowment's stochastic process the participation constraint at the future state s' will be binding or slack according to the following probability distribution.

$$\text{PC at } s' = \begin{cases} \text{slack}, & \text{with } prob = \sum_{s=1}^{\hat{s}-1} \Pi_j \\ \text{binding}, & \text{with } prob = \sum_{s=\hat{s}}^{S} \Pi_j \end{cases}$$

This is critical for the functioning of the model, since the future contingency of a binding participation constraint gives rise to a credible threat of default from the side of the borrower and the lender is taking this into account when designing the loan terms.

The model departs from the textbook one-sided limited commitment structure

due to the existence of spillover cost. As already mentioned, the spillover cost arises in the case of a binding participation constraint and mirrors the losses incurred by a lender who is exposed to the borrower. Therefore, the profit of the lender is represented by the following value function.

$$P(v,\hat{s}) = \max_{\{c_j,w_j\}} \underbrace{\sum_{j=1}^{S}\Pi_j\{y_j - c_j\}}_{\text{expected current transfer}} + \beta\Bigg(\underbrace{\sum_{j=1}^{\hat{s}-1}\Pi_j P(w_j,\hat{s}')}_{\text{exp.prof. (PC \textbf{slack})}} + \underbrace{\sum_{j=\hat{s}}^{S}\Pi_j[P(w_j,\hat{s}') \quad \underbrace{-\zeta(w_j,\hat{s}')}_{\text{spillovers when PC binds}}]}_{\text{exp.prof. (PC \textbf{binds})}}\Bigg)$$

In each period, the lender is maximizing its profit function over current consumption and promised utility allocated to the borrower. The profit function consists of the current transfer denoted as the difference between the currently realised endowment and the corresponding current consumption allocated to the borrower and the discounted expected profit which is divided in two parts. First, with probability $\sum_{s=1}^{\hat{s}-1}\Pi_j$, the borrower is realised with an endowment lower to the maximum endowment that has been realised up to date and hence the participation constraint is slack. Under this case, no credible threat of default arises. With certainty, the borrower finds it optimal to stay within the contract. Second, with probability $\sum_{s=\hat{s}}^{S}\Pi_j$ the borrower next period is realised with an endowment that is higher than what has been realised so far and hence the participation constraint is binding. Under this case, the outside option of autarky now appears to be more lucrative and the threat of default becomes credible.

Due to the exposure of the lender to the borrower, spillover cost arises. This is denoted by the $\zeta(w_j,\hat{s})$ function with the following properties, strictly decreasing and convex in future promised utility ($\zeta_w < 0$, $\zeta_{ww} > 0$). The spillover cost is decreasing in future promised utility since the more favourable future terms the lender offers to the borrower, the less lucrative the outside option appears to the borrower and thus the contingency of default appears to be more distant.

The problem takes the following form, in which the lender maximizes its objective function with respect to current consumption and future promised utility under

the promise keeping and participation constraint.

$$P(v,\hat{s}) = \max_{\{c_j,w_j\}} \sum_{j=1}^{S} \Pi_j\{y_j - c_j\} + \beta\Big(\sum_{j=1}^{\hat{s}-1} \Pi_j P(w_j,\hat{s}') + \sum_{j=\hat{s}}^{S} \Pi_j[P(w_j,\hat{s}') - \zeta(w_j,\hat{s}')]\Big)$$

$$\text{s.t.} \quad \sum_{j=1}^{S} \Pi_j\{u(c_j) + \beta w_j\} \geq v \quad \text{[PKC]}$$

$$u(c_j) + \beta w_j \geq u(y_j) + \beta v_{\text{aut}} \quad ,\forall j \quad \text{[PC]}$$

$$w_j \in [v_{\text{aut}}, \bar{v}]$$

$$\hat{s}(t) = \{j : y_j = \max\{y_0, y_1, ..., y_t\}\}$$

Proposition 1: *For a given promised utility v, when the participation constraint is non-binding, the constrained efficient allocation prescribes constant consumption and promised utility and equal to $c_s = g_1(v)$ and $w_s = v$. When the participation constraint binds then consumption, promised utility satisfy equations 1 and 2 respectively.*

$$u'(c_j) = -\frac{\Pi_j}{\theta\Pi_j + \lambda_j} \tag{1}$$

$$P'(w_j) - \zeta'(w_j) = -(\theta + \frac{\lambda_j}{\Pi_j}) \tag{2}$$

where λ_j is the state contingent lagrange multiplier assigned to the participation constraint and θ is the lagrange multiplier assigned to the promise keeping constraint.

Proof: See Appendix

4.1.1 Comparative statics with and without spillover effects

We are primarily interested in juxtaposing a lending agreement between a lending mechanism and a sovereign country as the borrower under the following two cases. The first refers to the model described in the previous section, in which the lender incurs spillover costs in the contingency of a default from the side of the sovereign. The second refers to the absence of spillover cost and represents cases in which the lender is not exposed to the borrower's economy.

The former case can be thought as lending agreements between members of the same union, in which contracting economies are highly interlinked. The latter case effectively represents agreements between a sovereign and an external organisation whose exposure level to the borrower's economic condition is low. Under this case, spillover costs are unlikely to arise and most importantly to affect the lending terms and conditions.

In theoretical terms, the latter case of absent spillover cost is represented by

a standard one-sided limited commitment model without the convex cost function ($\zeta(w_j, \hat{s}')$) in the lender's objective function (Ljungqvist and Sargent, 2018). In the present section, we attempt to trace the differences in the choice variables of the two models and infer in what way the existence of spillover cost affects the conditionality of the resulting contract.

We focus on the case of a binding participation constraint and the corresponding first order conditions, because this is the case in which the default threat becomes credible and the two models differ in the subsequent effect on the lender's objective function.

	No Spillover	**Spillover**
foc wrt c_j	$u'(c_j^{\text{no spil}}) = -\frac{1}{P'(w_j^{\text{no spil}})}$	$u'(c_j^{\text{spil}}) = -\frac{1}{P'(w_j^{\text{spil}})-\zeta'(w_j^{\text{spil}})}$
foc wrt w_j	$P'(w_j^{\text{no spil}}) = P'(v) - \frac{\lambda_j^{\text{no spil}}}{\Pi_j}$	$P'(w_j^{\text{spil}}) - \zeta'(w_j^{\text{spil}}) = P'(v) - \frac{\lambda_j^{\text{spil}}}{\Pi_j}$

Table 3: First order conditions under a binding PC in the two relevant cases

The first order condition with respect to current consumption shows that the lender equates its marginal rate of transformation between current consumption and future promised utlity ($-\frac{1}{P'(w_j)}$) to the marginal rate of substitution of the borrower ($u'(c_j)$) in both cases. Additionally the form of the first order condition with respect to future promised utility has taken this form after using the envelope condition (see appendix).

We start our analysis from the future promised utility under the two specifications with the following proposition.

Proposition 2: *For the same past promised utility v, the contract with present spillover cost allocates higher promised utility and lower current consumption compared to the contract with absent spillover cost.*

$$w_j^{\text{spil}} > w_j^{\text{no spil}}$$
$$c_j^{\text{spil}} < c_j^{\text{no spil}}$$

Proof: See Appendix

5 Discussion of Model Predictions

From the preceding analysis, we infer that the presence of spillover costs affects the loan terms differently when we distinguish current consumption from future promised utility. On the one hand, current consumption in the spillover case is lower than what would be prescribed in the absence of inter-linkages between the lender

and the borrower. On the other hand, future promised utility is higher in the presence of spillovers.

As a result, the borrower's bargaining power from the spillover cost incurred by the lender manifests its benefits only in the future. Essentially, the presence of spillovers enhances the main characteristic of the one-sided limited commitment model of "back-loading consumption" in the future. Theoretically, the reason why this result occurs, is due to the anticipation of a credible threat of borrower's default from the lender. The presence of spillover cost in the contingency of a binding participation constraint induces the lender to increase future promised utility in order to render the contract as being more attractive option compared to autarky.[17]

The reason why the lender does so through promised utility - i.e., future consumption and not current consumption is due to lower costs. The lower costs emerge from the spillover cost function ($\zeta(w_j, \hat{s}')$) being decreasing in w_j. As a result, when relaxing the participation constraint through current consumption, leads to a decrease in current profits for the lender, when doing so by increasing promised utility the lender can also enjoy the benefits from lower spillover costs.

This is an interesting outcome of the model which suggests different loan terms in lending agreements within a union with strong links between the borrower and the lender, compared to lending agreements with an external institution not exposed to the borrower. In the former case, the model predicts benefits for the borrower in the long term, while in the latter, the borrower is better off in the short term.

5.1 Empirical Validation of Model Predictions

The European debt crisis constitutes a suitable environment to test the predictions of the model. During the European debt crisis, the IMF and the European mechanisms collaborated closely to address the financing needs of the countries in trouble. Even though the two entities agreed upon the structural reforms to be followed by the borrowing countries, they provided loans of different amounts and different terms. We attribute this difference to the different economic interconnectedness between each borrowing country and the lending mechanism. On the one hand, we assume that the IMF does not incur any spillover cost, since it constitutes an institution funded by a sizeable number of countries whose interests overall are not directly affected by the European crisis. On the other hand, European lending mechanisms are comprised of European economies whose interests are very much aligned and directly linked to each other.

[17] This is also in line with the carrot-and-stick underlying assumption which we adopt, in which the lender imposes some conditionality and requires from the borrower to implement some reforms in order to make disbursements. From these disbursements only a small fraction is typically front-loaded, while the rest is back-loaded.

5.1.1 Spillovers and the disbursement structure of European lending programs

Our aim is to document how the risk of spillovers across euro area countries affects the speed with which loan payments are disbursed. To do so, we construct a daily measure of current consumption for which we calculate the ratio of cumulative disbursements and the total loan amount promised by the European lending mechanisms. This provides us with an indicator of how much is paid out to a certain country in the current period relative to how much a country expects to still receive in the future. The data for both, the numerator and the denominator, is obtained from reading press releases of the ESM and the Euopean Commission and are part of the dataset described in Section 2. Both take into account disbursements and promised loans through the EFSF, the EFSM, the ESM and the Greek Loan facility (GLF). The denominator remains largely unchanged for Cyprus, Ireland and Portugal, i.e., the amounts promised at the start of the lending programs did not change. However, for Greece the denominator changes with each of the three lending programs (GLS, EFSM and ESM). Figure 8 plots our measures of spillovers and current consumption for Greece, Portugal, Ireland and Cyprus over time, revealing that except from Ireland the cumulative amounts disbursed fell short of what was initially promised.[18]

To empirically validate our theoretical prediction that the presence of spillovers costs results to lower current consumption, we run the following panel regression:

$$Current\ Consumtpion_{it} = c + \beta DCC_{it}^{MA} + u_{it} \tag{3}$$

We regress Current Consumption, which is the measure of disbursements that we discuss above, on past moving averages of the DCC over 30 and 90 days before period t. We use this measure to mitigate potential problems with reverse causality and frequently fluctuating DCCs measures. However, we also include the results of the standard measure of DCC. Appendix E displays the results from the panel regression which shows that higher spillovers are negatively related to current consumption. Hence, posing a threat to other countries in the euro area seemed to have influenced the timing of disbursements which were back-loaded, i.e., relatively higher consumption was promised in the future. The regression coefficients remain negative and significant at the 5% and 10% level respectively for all of our DCC measures. Furthermore, our results are robust to linear de-trending.

Overall, we observe that the effect of spillovers on "back-loading" consumption is present under the European financial assistance programme. Table 10 presents the

[18] Note that disbursements started on a different day for each crisis country.

results from regressing the level of spillovers and a measure of current consumption disbursements. Higher spillover costs imply lower current disbursement, a result that is robust under various specifications using the moving average of spillover costs the past 30 and 90 days respectively. By construction this result implies that higher spillover costs imply higher consumption allocated to future transfers.

6 Conclusion

In this paper we assess how the risk of contagion affected the design of lending contracts to crisis-hit countries within the euro-area. We introduce a simple recursive contract model with spillover costs. We find that the presence of contagion reduces current consumption for the country in trouble, and back-loads future consumption.

Moreover, we present a newly built dataset that records all the dates that official meetings of the IMF and the Europeans took place, and official announcements were made. This record includes rich information on the loan conditions that were offered in the different programme-countries and the timing regarding the realization of a loan disbursement.

Overall, our results indicate that accounting for spillover costs in the design of lending contracts is relevant. We support our argument by showing evidence that the European Mechanisms' decision to provide financial support successfully mitigated spillovers.

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A Financial linkages across the euro area

The following figures 1 - 5 illustrate the size of outstanding bank claims for each of the five crisis in the year in which their respective first financial assistance program was agreed upon by the European lending mechanisms. The data is taken from the BIS Consolidated banking statistics and we express the level of indebtedness of banks in Cyprus, Ireland, Spain, Portugal and Greece as shares of creditors' GDP. In each figure the debtor country is coloured in green and creditor countries take different shades of red, where darker shades reflect higher claims outstanding. No data was available for countries coloured in grey.

What becomes apparent from these graphs is that the main creditors were Germany, France, the Netherlands and Belgium. Overall, the most striking bilateral debt relationships are: Germany that held Spanish banking debt worth 49% of German GDP and France that held Greek banking debt worth 28% of French GDP.

Furthermore, there seem to be some "neighborhood" effects in the sense that Portugal was especially exposed to Spanish banking debt (10.4% of Portuguese GDP) and vice versa (Spain held Portuguese banking debt worth 5.6% of Spanish GDP). Similarly, Greece held Cypriot debt worth 4.8% of Greek GDP. Furthermore, the banking sectors with the largest debt abroad (wrt. other Euro area creditors in our sample) were Ireland (124% of its GDP) and Cyprus (99% of its GDP). However, measured as a share of creditor countries' GDP, Cypriot banks posed the lowest threat to Euro area members compared to the other four crisis countries which is partly driven by the small size of the Cypriot economy.

Figure 1: Outstanding claims on Irish banks as a share of creditor country's GDP in 2010 (Data source: BIS Consolidated banking statistics)

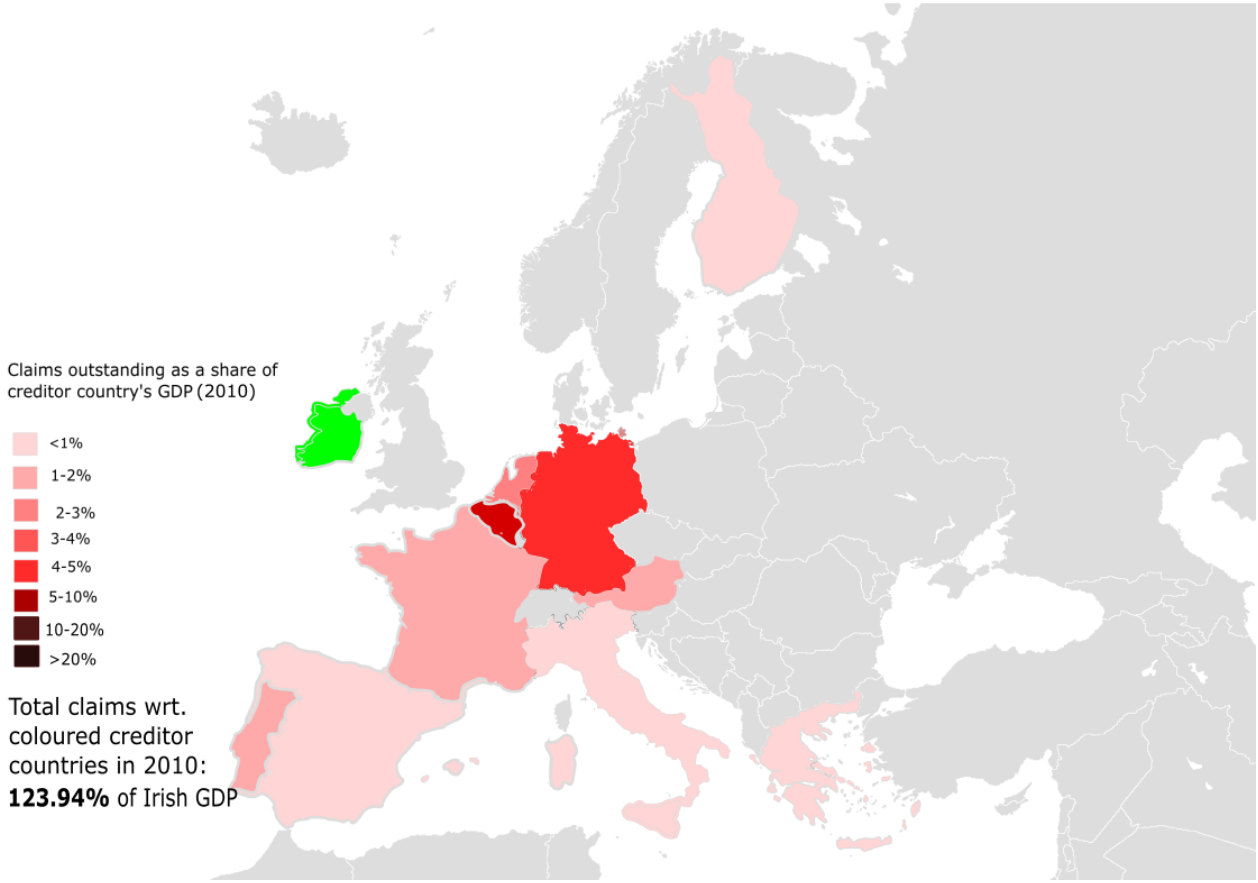


Figure 2: Outstanding claims on Cypriot banks as a share of creditor country's GDP in 2011 (Data source: BIS Consolidated banking statistics)

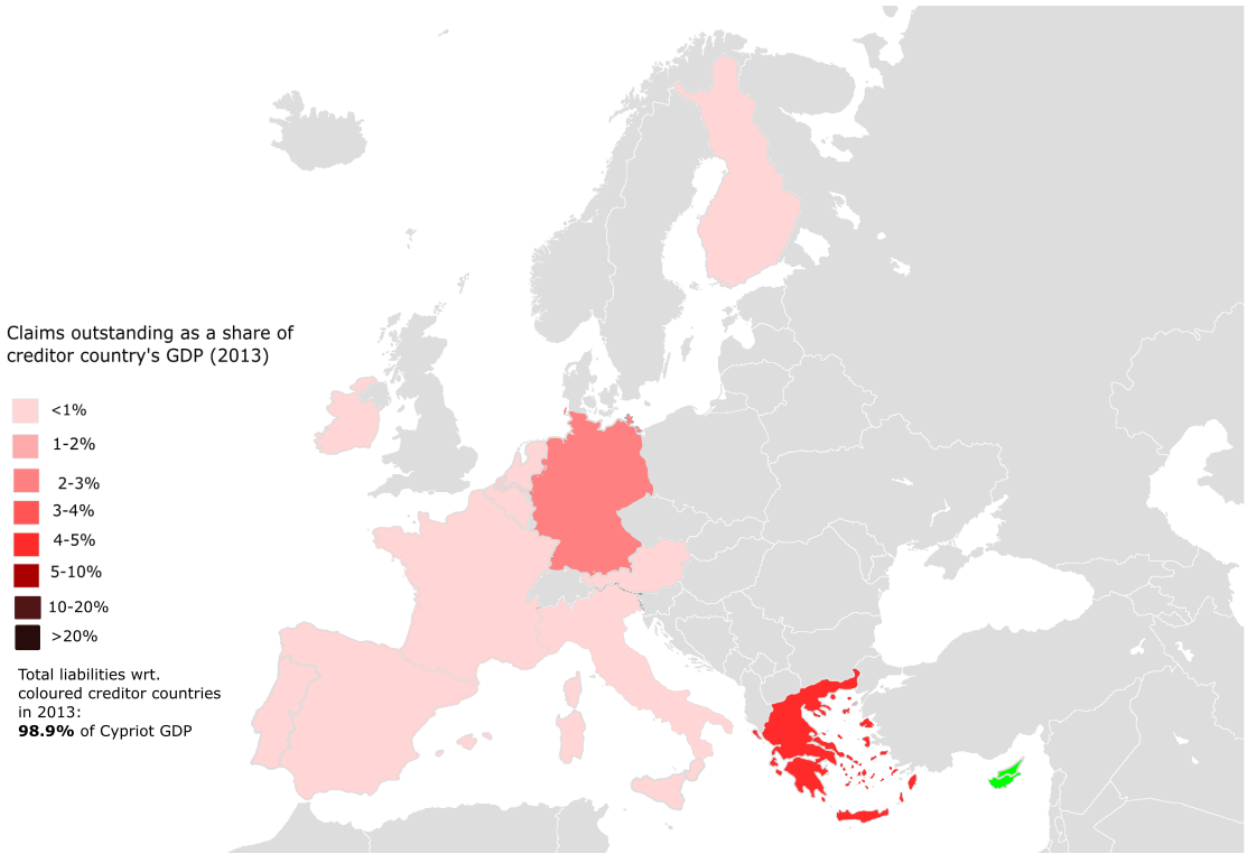


Figure 3: Outstanding claims on Greek banks as a share of creditor country's GDP in 2011 (Data source: BIS Consolidated banking statistics)

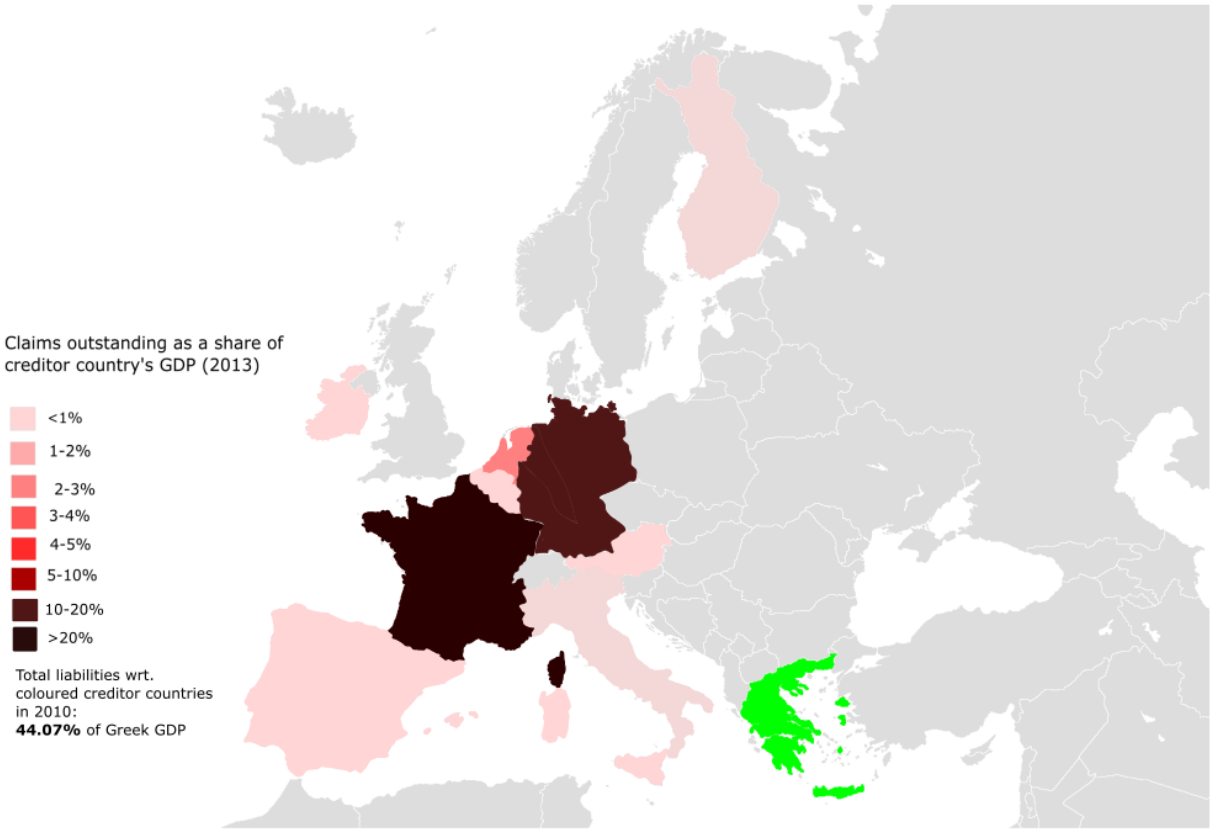


Figure 4: Outstanding claims on Spanish banks as a share of creditor country's GDP in 2011 (Data source: BIS Consolidated banking statistics)

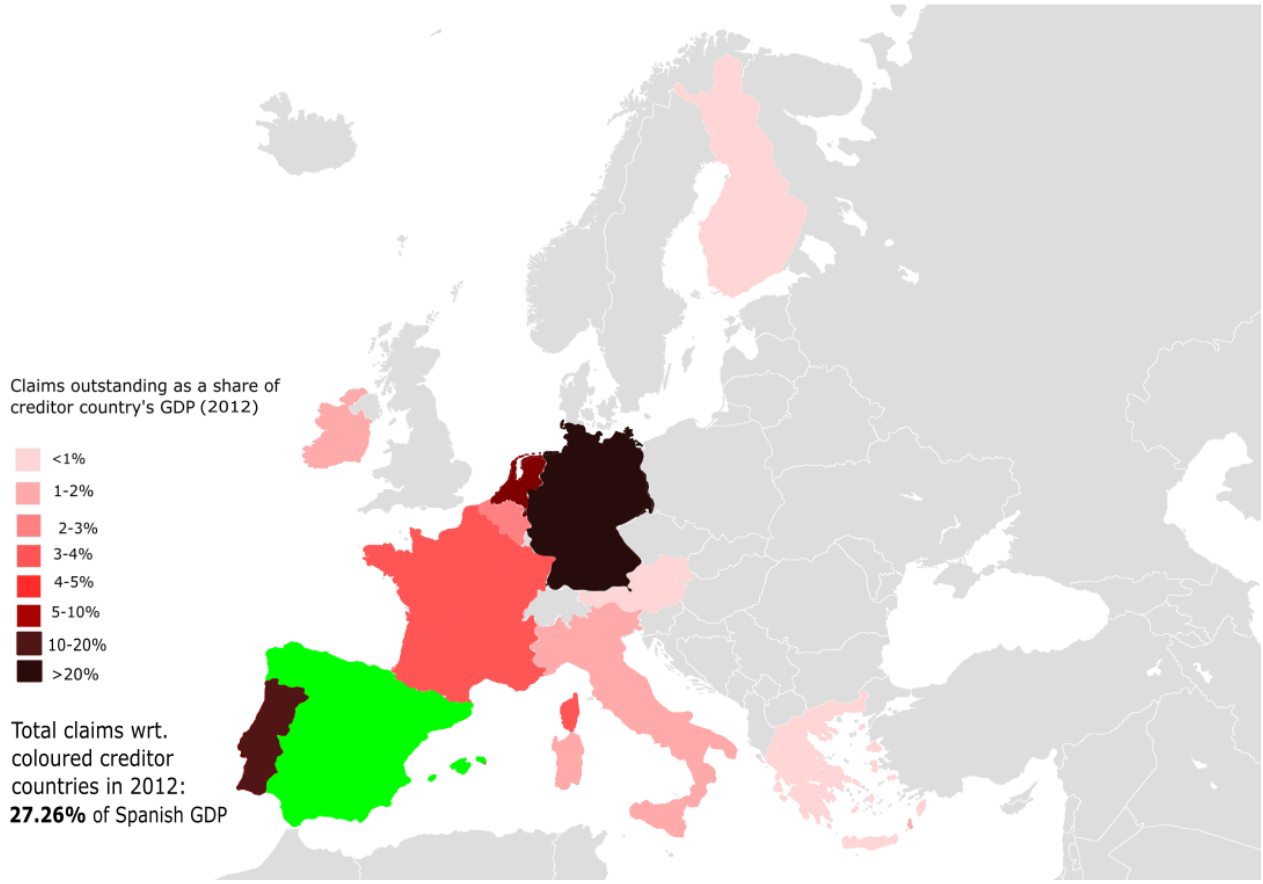


Figure 5: Outstanding claims on Portuguese banks as a share of creditor country's GDP in 2011 (Data source: BIS Consolidated banking statistics)

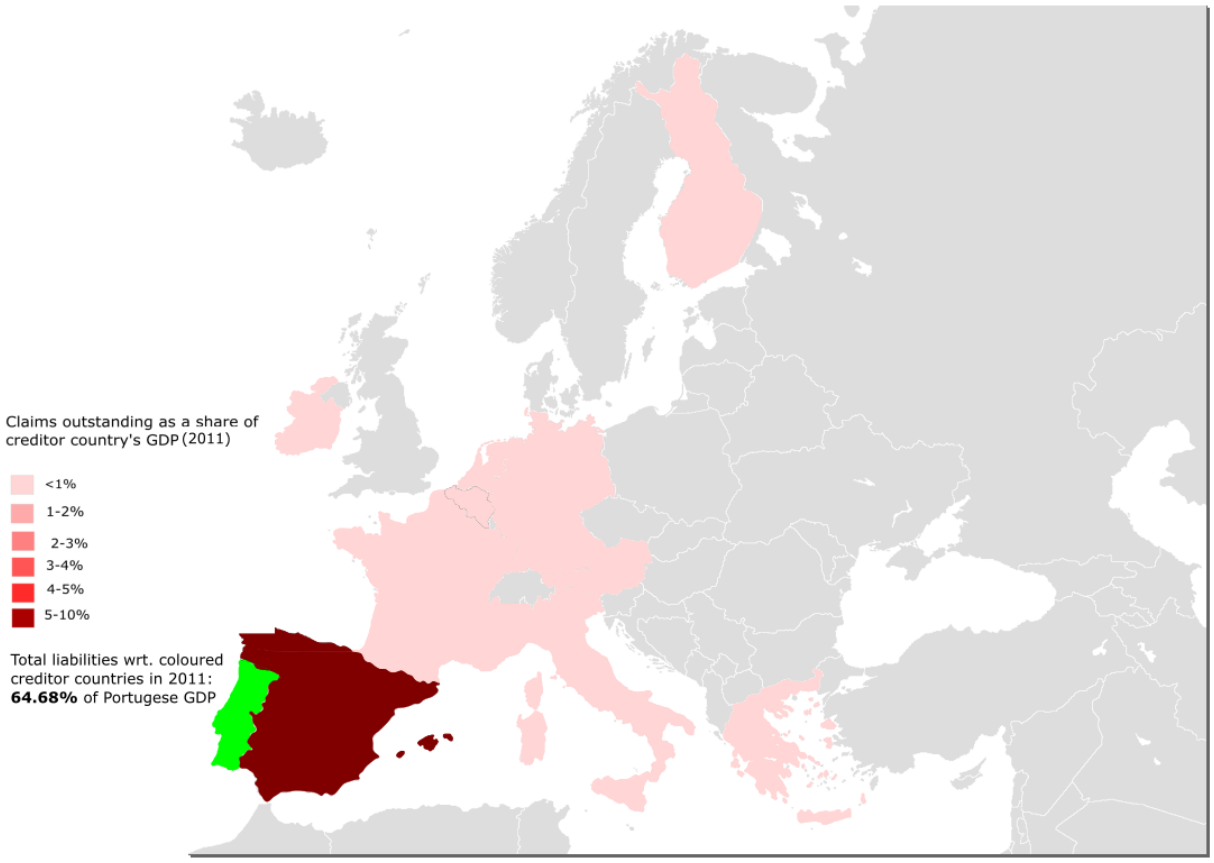
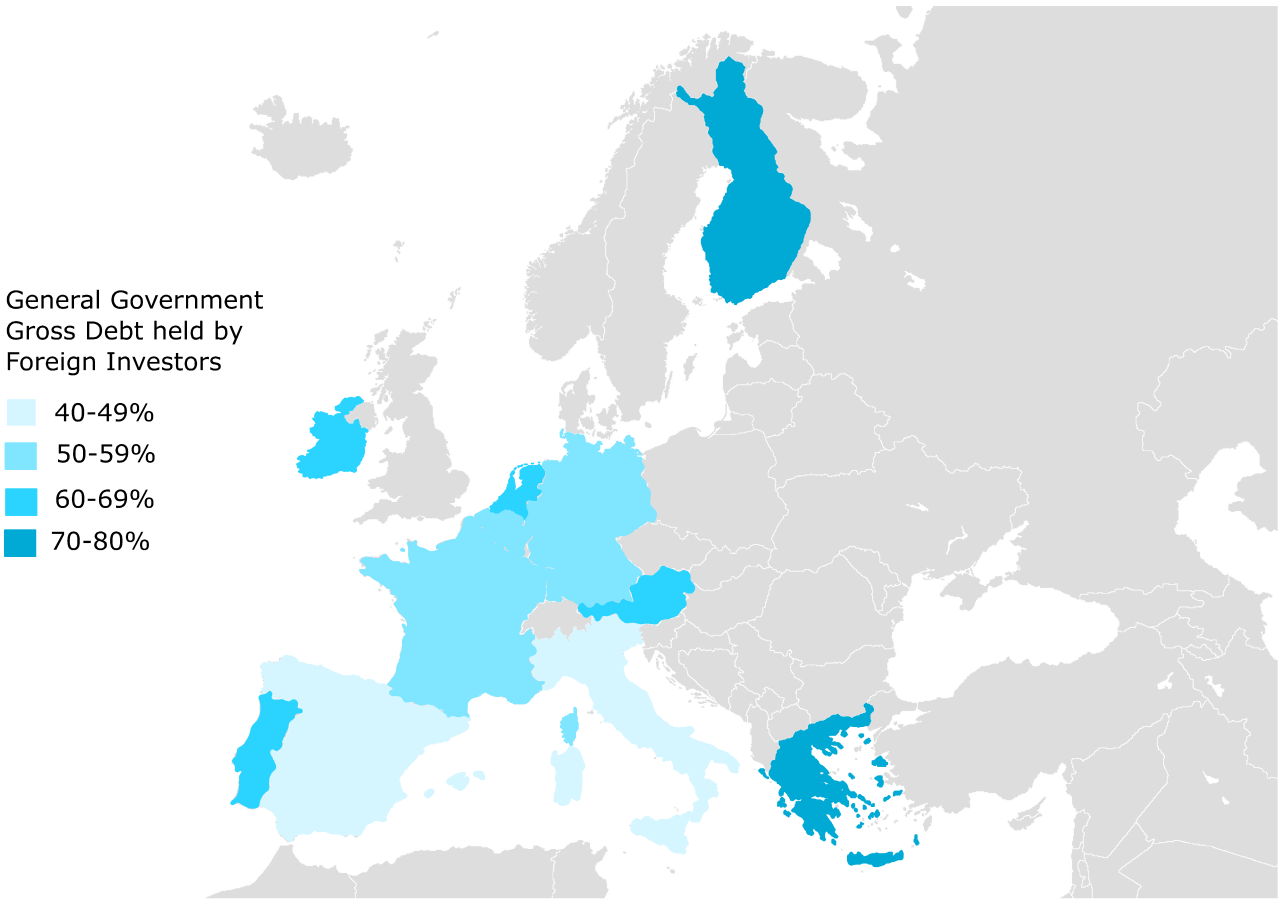


Figure 6: Share of general government gross debt held by foreign investors (Data source: IMF Sovereign Investor Base Dataset for Advanced Economies)



B Theoretical Appendix

Assigning non-state contingent lagrange multiplier θ to the PKC, and a state contingent λ_j to PC, I obtain the Lagrangian:

$$\mathcal{L} = \sum_{j=1}^{S} \Pi_j \Big[\{y_j - c_j\} + \beta P(w_j) \Big] - \beta \sum_{j=\hat{s}}^{S} \Pi_j \zeta(w_j) +$$
$$+ \theta \Big[\sum_{j=1}^{S} \Pi_j [u(c_j) + \beta w_j] - v \Big]$$
$$+ \sum_{j=1}^{S} \lambda_j \Big[u(c_j) + \beta w_j - u(y_j) - \beta v_{\text{aut}} \Big]$$

Note I have to break down the PC term in the Lagrangian from $j = 1 \to \hat{s} - 1$ and $\hat{s} \to S$

$$\mathcal{L} = \sum_{j=1}^{S} \Pi_j \Big[\{y_j - c_j\} + \beta P(w_j) \Big] - \beta \sum_{j=\hat{s}}^{S} \Pi_j \zeta(w_j) + \\ + \theta \Big[\sum_{j=1}^{S} \Pi_j [u(c_j) + \beta w_j] - v \Big] \\ + \sum_{j=1}^{\hat{s}-1} \lambda_j \Big[\underbrace{u(c_j) + \beta w_j - u(y_j) - \beta v_{\text{aut}}}_{>0, \text{ PC slack, } \lambda_j = 0} \Big] \\ + \sum_{j=\hat{s}}^{S} \lambda_j \Big[\underbrace{u(c_j) + \beta w_j - u(y_j) - \beta v_{\text{aut}}}_{=0, \text{ PC binds, } \lambda_j > 0} \Big]$$

Note however, that I know that if in the next period $j \in [1, \max\{s\}_0^t - 1]$, the PC is slack, and $\lambda_j = 0$, while if $j \in [\max\{s\}_0^t, S]$, the PC is binding, and $\lambda_j > 0$, so the Lagrangian can be written as:

$$\mathcal{L} = \sum_{j=1}^{S} \Pi_j \Big[\{y_j - c_j\} + \beta P(w_j) \Big] - \beta \sum_{j=max\{s\}_0^t}^{S} \Pi_j \zeta(w_j) + \\ + \theta \Big[\sum_{j=1}^{S} \Pi_j [u(c_j) + \beta w_j] - v \Big] \\ + \sum_{j=\max\{s\}_0^t}^{S} \lambda_j \Big[\underbrace{u(c_j) + \beta w_j - u(y_j) - \beta v_{\text{aut}}}_{=0, \text{ PC binds, } \lambda_j > 0} \Big]$$

I distinguish two cases with respect to whether the PC binds next period, and I take focs wrt to the relevant variables:

Case 1: Non-binding PC , $\lambda_j = 0$ and $j \in [1, \max\{s\}_0^t - 1]$

$$\frac{\partial \mathcal{L}}{\partial c_j} = 0 \to \Pi_j(-1) + \theta \Pi_j u'(c_j) = 0 \to \boxed{u'(c_j) = -\frac{1}{\theta}}$$

$$\frac{\partial \mathcal{L}}{\partial w_j} = 0 \to \Pi_j \beta P'(w_j) + \theta \Pi_j \beta = 0 \to \boxed{P'(w_j) = -\theta}$$

Case 2: Binding PC , $\lambda_j > 0$ and $j \in [\max\{s\}_0^t, S]$

$$\frac{\partial \mathcal{L}}{\partial c_j} = 0 \to \Pi_j(-1) + \theta \Pi_j u'(c_j) + \lambda_s u'(c_j) = 0 \to u'(c_j)[\theta \Pi_j + \lambda_j] = -\Pi_j \to \boxed{u'(c_j) = -\frac{\Pi_j}{\theta \Pi_j + \lambda_j}}$$

$$\frac{\partial \mathcal{L}}{\partial w_j} = 0 \rightarrow \Pi_j \beta P'(w_j) - \beta \Pi_j \zeta'(w_j) + \theta \Pi_j \beta + \beta \lambda_j = 0 \rightarrow P'(w_j) - \zeta'(w_j) + (\theta + \frac{\lambda_j}{\Pi_j}) = 0 \rightarrow$$

$$\boxed{P'(w_j) - \zeta'(w_j) = -(\theta + \frac{\lambda_j}{\Pi_j})}$$

Envelope Condition

$$\boxed{P'(v) = -\theta}$$

Case 1: Since the PC does not bind, the promised utility that the principal sets remains constant and so does consumption. As a result, in the slack PC case, the contract attains its first best allocation

$$P'(w_j) = -\theta = P'(v) \xrightarrow{P''()<0} \boxed{w_j = v}$$

$$u'(c_j) = -\frac{1}{\theta} \rightarrow u'(c_j) = \frac{1}{P'(w_j)} = \frac{1}{P'(v)} \rightarrow \boxed{c_j = u'^{-1}\Big(\frac{1}{P'(v)}\Big) = \text{constant}}$$

Case 2: Since the PC binds, the allocation receives a wedge represented by the Lagrange multiplier on the PC. On top of this, when the PC binds, the threat of a default becomes credible, and hence spillover costs inflict the allocation.

$$u'(c_j) = -\frac{\Pi_j}{\theta \Pi_j + \lambda_j}$$

and

$$P'(w_j) - \zeta'(w_j) = -\Big(\theta + \frac{\lambda_j}{\Pi_j}\Big) = -\Big(\frac{\theta \Pi_j + \lambda_j}{\Pi_j}\Big)$$

Combining the two I obtain:

$$\boxed{u'(c_j) = \Big[P'(w_j) - \zeta'(w_j)\Big]^{-1}}$$

Note that combining the foc wrt to promised utility with the envelope condition I obtain the following:

$$P'(w_j) - \zeta'(w_j) = -\Big(\theta + \frac{\lambda_j}{\Pi_j}\Big) \xrightarrow{\text{Env:} P'(v) = -\theta)} \boxed{P'(w_j) - \zeta'(w_j) = P'(v) - \frac{\lambda_j}{\Pi_j}}$$

Proposition 2: Given that $\lambda_j^{spil} < \lambda_j^{\text{no spil}}$[19] the comparison focuses on the two

[19]The lagrange multiplier expresses the marginal effect to the objective value function by relaxing the constraint by one unit. Suppose that you relax the constraint by one unit increase in w_j then in the case of no spillovers, the objective function of the principal will change by $P'(w_j)$, it will decrease by that amount. Instead, in the case of present spillovers the objective function will also decrease by $P'(w_j)$ but there is also going to be an opposite effect amounting for $-\zeta'(w_j)$, partially

equations:

$$P'(w_j^{\text{spil}}) - \zeta'(w_j^{\text{spil}}) = P'(v) - \frac{\lambda_j^{\text{spil}}}{\Pi_s} \qquad \text{[Spillovers case]}$$

and

$$P'(w_j^{\text{no spil}}) = P'(v) - \frac{\lambda_j^{\text{no spil}}}{\Pi_s} \qquad \text{[No Spillovers case]}$$

Note that $P'(v)$ is constant and equal to $-\theta$ in both cases (from the envelope condition).

Subtracting the two expression we obtain the following:

$$\begin{aligned} P'(w_j^{\text{spil}}) - \zeta'(w_j^{\text{spil}}) - P'(w_j^{\text{no spil}}) = P'(v) - \frac{\lambda_j^{\text{spil}}}{\Pi_s} - P'(v) + \frac{\lambda_j^{\text{no spil}}}{\Pi_s} \rightarrow \\ P'(w_j^{\text{spil}}) - \zeta'(w_j^{\text{spil}}) - P'(w_j^{\text{no spil}}) = \frac{\lambda_j^{\text{no spil}} - \lambda_j^{\text{spil}}}{\Pi_s} \xrightarrow{\lambda_j^{\text{spil}} < \lambda_j^{\text{no spil}}} \\ P'(w_j^{\text{spil}}) - \underbrace{\zeta'(w_j^{\text{spil}})}_{<0,\ \forall w_j} - P'(w_j^{\text{no spil}}) > 0 \rightarrow \\ P'(w_j^{\text{spil}}) - \underbrace{\zeta'(w_j^{\text{spil}})}_{<0,\ \forall w_j} > P'(w_j^{\text{no spil}}) \end{aligned}$$

We know that $P'(w_j^{\text{spil}}) - \zeta'(w_j^{\text{spil}}) < 0$, so the last expression becomes:

$$\begin{aligned} P'(w_j^{\text{no spil}}) < P'(w_j^{\text{spil}}) - \zeta'(w_j^{\text{spil}}) < 0 \rightarrow \\ \zeta'(w_j^{\text{spil}}) < P'(w_j^{\text{spil}}) - P'(w_j^{\text{no spil}}) < 0 \end{aligned}$$

Focusing on the second inequality:

$$\begin{aligned} P'(w_j^{\text{spil}}) - P'(w_j^{\text{no spil}}) < 0 \rightarrow \\ P'(w_j^{\text{spil}}) < P'(w_j^{\text{no spil}}) \xrightarrow{P''()<0} \\ w_j^{\text{spil}} > w_j^{\text{no spil}} \end{aligned}$$

Hence, the presence of spillover cost, is leading to an increased promised utility. Following from above,

offsetting the decrease in profits. Hence in total, relaxing the PC by one unit, causes a larger change in the case of no spillovers, compared to the case of spillovers.

$$
\begin{aligned}
P'(w_j^{\text{no spil}}) &< P(w_j^{\text{spil}} - \zeta'(w_j^{\text{spil}})) \rightarrow \\
\frac{1}{P'(w_j^{\text{no spil}})} &> \frac{1}{P(w_j^{\text{spil}} - \zeta'(w_j^{\text{spil}}))} \rightarrow \\
-\frac{1}{P'(w_j^{\text{no spil}})} &< -\frac{1}{P(w_j^{\text{spil}} - \zeta'(w_j^{\text{spil}}))} \rightarrow \\
u'(c_j^{\text{no spil}}) &< u'(c_j^{\text{spil}}) \xrightarrow{u''()<0} \\
c_j^{\text{no spil}} &> c_j^{\text{spil}} \qquad \blacksquare
\end{aligned}
$$

C Descriptive statistics from database on loan announcements and disbursements

C.1 Example statements

03/05/2010: Euro area and IMF agreement on financial support programme for Greece

"To support the Greek government's efforts to get its economy back on track, euro area Member States on 2 May pledged a three-year programme total of 80 billion in bilateral loans. Under the conditions set out in the Eurogroup statement of 11 April, up to €30 billion out of this programme will be made available for 2010. Its first disbursement will be made by 19 May. In addition, IMF reached an agreement with the Greek authorities to support this program with a stand-by arrangement of about €30 billion, bringing the joint commitment to a total financing of €110 billion." (available here: https://ec.europa.eu/economy_finance/articles/eu_economic_situation/2010-05-03-statement-commissioner-rehn-imf-on-greece_en.htm)

14/09/2011: Commission proposes better financial terms for EU loans to Ireland and Portugal

"Two proposals were adopted by the European Commission today, suggesting reduced interest rate margins and extended maturities for loans granted by the European Union (EU) to Ireland and Portugal. The loans are provided by the EU under the European Financial Stabilisation Mechanism (EFSM) as part of financial assistance packages to the two countries. (...) similar conditions are expected to be adopted for the lending that the European Financial Stability Facility (EFSF) is providing to Ireland and Portugal. (...) Both countries should pay lending rates equal to the funding costs of the EFSM, i.e., reducing the current margins of 292.5 bps for Ireland and of 215 bps for Portugal to zero. The reduction in margin will apply to all instalments, i.e., both to future and to already disbursed tranches. Furthermore, the maturity of individual future tranches to these countries will be extended from the

current maximum of 15 years to up to 30 years. As a result the average maturity of the loans to these countries from EFSM would go up from the current 7.5 years to up to 12.5 years. In addition to the substantial cash savings for Ireland and Portugal, the new financial terms will bring benefits such as enhanced sustainability and improved liquidity outlooks. Moreover, indirect confidence effects through the enhanced credibility of programme implementation should result in improved borrowing conditions for the sovereign as well as the private sector. (...)" (available here: *https://ec.europa.eu/commission/presscorner/detail/en/MEMO_11_602*)

03/06/2013: Statement by the EC and the ECB following the conclusion of the third review of the financial assistance programme for Spain

"A delegation from the European Commission, in liaison with the European Central Bank, the European Stability Mechanism and the European Banking Authority, carried out the third review of the financial sector assistance programme for Spain from 21 May to 31 May 2013. The International Monetary Fund also participated in the review, fulfilling its role as an independent monitor. On the basis of the review, it can be concluded that the programme remains on track. Spanish financial markets have further stabilised since the last review, with sovereign and corporate bond yields dropping amidst lower volatility. In parallel, the liquidity situation of the Spanish banking sector has further improved. This allowed Spanish banks to further regain access to funding markets and to reduce reliance on central bank financing. (...) Progress has also continued with respect to horizontal financial-sector conditionality. Thereby, compliance with the requirements in the Memorandum of Understanding is nearly complete and achievements toward strengthening the governance, regulatory and supervisory framework of the Spanish banking sector have been made. (...) The next review is foreseen to take place in September 2013." (available here: *https://ec.europa.eu/commission/presscorner/detail/en/MEMO_13_489*)

C.2 Descriptive statistics

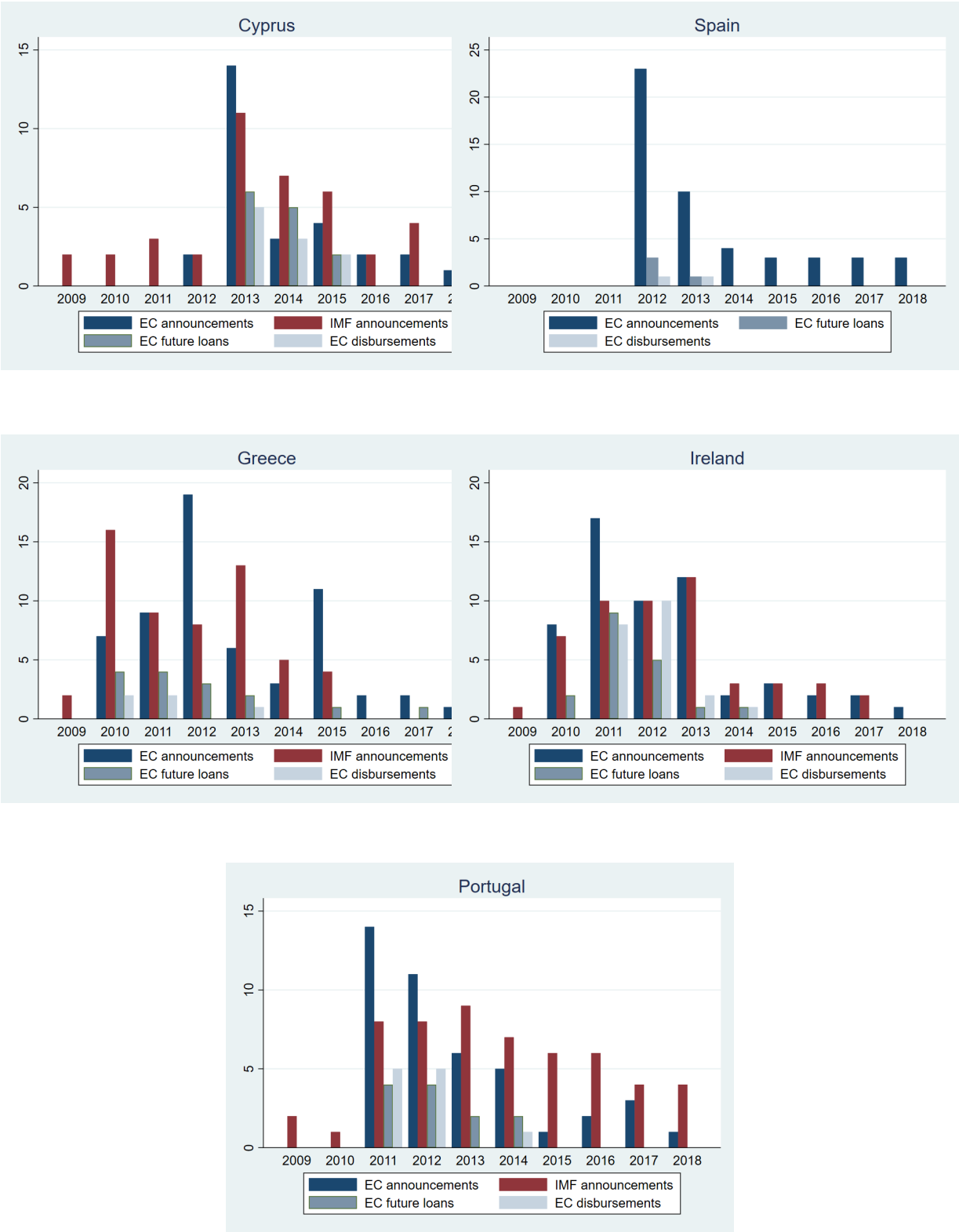
	EC announcem.			IMF announcem.
	All	Future loan	Disbursem.	All
CYP	28	13	10	41
ESP	49	4	2	n.A.
GRE	60	15	5	57
IRL	57	18	21	51
PRT	46	12	10	55

Notes: The first four columns contain a count of the number of days on which a statement was issued by the European lending mechanisms (via the EC and/or ESM website) and the IMF between April 29, 2009 and September 20, 2018. For the former creditor, statements are further dis-aggregated into a general count of "all" announcements, statements announcing future loan payments as well as those referring to disbursements made in the current period. Note that announcements of future and current loan disbursements may occur on the same day.
Regarding the number of announcements issued by the IMF and the European institutions, we find that the Europeans in terms of frequency were more laconic compared to the IMF. In particular, the compiled dataset of the IMF announcements comprises of (i) press releases, (ii) public information notices and (iii) mission statements that although related to the countries under examination - were not always referring to disbursements and corresponding loan terms. For example, there were announcements regarding visits of the managing director to the referred country, welcoming notes of the decisions taken by the European mechanisms etc. In conclusion, we believe that the higher number of IMF announcements was due to issues of transparency and communication strategy adopted by the Fund.

Table 4: Descriptive statistics of loan announcements and disbursements

C.3 Dynamics of announcements

Figure 7: Frequency of announcements by country



Notes: "EC announcements" and "IMF announcements" stand for statements issued by the EC (which may be on behalf of the ESM, EFSF or EFSM) and the IMF, respectively. For the former creditor group, statements are further dis-aggregated into statements announcing future loan payments as well as those referring to disbursements made in the current period.

Generalized Δ(Sovereign CDS)	**BEL**	**CYP**	**FRA**	**DEU**	**GRE**	**IRL**	**ITA**	**PRT**	**ESP**	**Contribution From Others**
BEL	91.40	0.98	18.02	4.85	2.72	16.58	24.23	16.92	20.15	**104.45**
CYP	2.50	96.13	2.90	0.65	0.42	2.28	3.42	2.97	2.60	**17.75**
FRA	18.77	1.22	91.42	10.50	4.27	17.59	25.14	18.49	20.79	**116.77**
DEU	5.56	0.41	9.47	94.60	2.67	7.50	9.27	6.99	8.00	**49.87**
GRE	3.02	0.14	4.90	2.94	98.72	4.50	5.45	5.82	5.40	**32.16**
IRL	17.62	1.73	17.54	6.95	4.72	95.05	34.36	31.37	32.73	**147.03**
ITA	23.73	1.92	23.47	9.08	5.80	34.03	98.04	46.23	58.64	**202.20**
PRT	17.49	1.01	16.96	6.72	5.46	32.15	45.86	98.24	40.10	**168.43**
ESP	18.38	0.91	17.66	6.90	4.52	28.88	54.29	42.78	94.01	**171.63**
Contribution To Others	**107.07**	**8.31**	**110.93**	**48.59**	**29.87**	**143.52**	**202.02**	**168.89**	**191.07**	**Spillover Index 54.09%**

Table 5: Generalized Δ(Sovereign CDS)

D Empirical Analysis

D.1 Evidence of Contagion - VAR Analysis and Spillover Index

10 yr Gov Bonds Total Returns	**AUT**	**BEL**	**FIN**	**FRA**	**DEU**	**GRE**	**IRL**	**ITA**	**NLD**	**ESP**	**Contribution From Others**
AUT	84.23	66.18	15.59	79.82	74.68	4.00	17.34	27.88	79.51	32.70	**397.79**
BEL	64.83	84.24	16.30	64.39	58.64	1.41	18.32	33.51	61.10	38.83	**352.24**
FIN	10.19	9.94	87.16	10.75	6.71	4.14	10.70	15.62	9.69	13.72	**91.47**
FRA	72.13	64.67	16.68	83.94	74.68	2.30	14.92	27.48	78.29	30.67	**389.15**
DEU	72.13	58.05	12.95	72.34	81.70	2.47	11.00	15.82	77.31	23.17	**340.25**
GRE	4.09	3.74	2.56	3.06	3.04	74.45	6.63	8.22	2.74	5.68	**39.75**
IRL	18.79	19.36	15.54	16.81	13.60	4.99	82.83	21.53	15.37	31.74	**157.73**
ITA	30.22	36.38	18.31	30.00	18.73	7.77	21.56	86.45	23.32	60.74	**247.04**
NLD	76.52	60.32	15.21	75.76	77.03	2.52	12.03	20.51	81.23	26.57	**366.48**
ESP	30.48	38.25	17.87	28.96	23.19	5.79	33.10	61.52	25.91	81.91	**265.07**
Contribution To Others	**386.62**	**351.98**	**131.02**	**381.10**	**345.31**	**35.39**	**145.60**	**232.09**	**373.25**	**263.83**	**Spillover Index 76.17%**

Table 6: 10 yr Government Bonds Total Returns

Equity Total Returns	**AUT**	**BEL**	**FIN**	**FRA**	**DEU**	**GRE**	**IRL**	**ITA**	**NLD**	**ESP**	**Contribution From Others**
AUT	92.15	47.66	16.54	45.71	39.65	30.06	30.97	40.28	42.18	39.56	**332.61**
BEL	46.88	93.12	20.32	51.61	46.45	18.19	39.71	33.97	62.03	35.54	**354.68**
FIN	13.29	16.68	90.71	42.67	35.57	10.39	15.62	28.06	30.79	21.26	**214.34**
FRA	43.07	49.74	48.88	89.33	74.49	29.10	33.14	64.48	72.26	59.04	**474.19**
DEU	35.67	42.21	41.08	70.48	82.98	23.52	29.94	50.52	60.51	48.47	**402.39**
GRE	34.43	18.13	11.33	30.31	25.10	89.96	12.23	30.52	24.05	34.88	**220.97**
IRL	29.62	36.94	19.28	34.24	32.62	10.94	90.49	22.39	37.67	22.44	**246.11**
ITA	39.62	34.11	32.08	65.06	54.53	29.59	22.93	88.10	51.65	60.85	**390.45**
NLD	41.26	59.38	36.33	72.21	64.15	23.69	37.86	51.22	87.46	47.88	**433.99**
ESP	37.87	35.07	24.55	60.44	52.40	34.13	21.85	61.95	48.85	90.97	**377.11**
Contribution To Others	**321.71**	**339.92**	**250.39**	**472.72**	**424.95**	**209.61**	**244.24**	**383.39**	**430.01**	**369.92**	**Spillover Index 79.38%**

Table 7: Equity Total Returns

Generalized Δ(BankCDS)	**DEU**	**FRA**	**GRE**	**BEL**	**ITA**	**PRT**	**IRL**	**NLD**	**Contribution From Others**
DEU	97.32	64.64	2.87	16.48	48.39	27.93	7.47	52.95	**220.73**
FRA	64.24	98.57	1.80	15.07	46.93	29.08	7.78	56.50	**221.41**
GRE	3.64	2.74	98.38	2.69	2.43	1.97	0.82	2.92	**17.21**
BEL	15.73	14.07	2.68	94.89	12.57	8.95	3.45	16.67	**74.13**
ITA	47.06	46.85	1.86	12.56	97.66	26.17	6.83	40.20	**181.53**
PRT	30.63	31.29	2.07	10.32	30.21	95.71	7.24	29.90	**141.66**
IRL	7.79	7.79	0.88	3.76	7.87	7.46	98.46	7.73	**43.28**
NLD	54.49	57.96	2.14	16.35	41.77	28.11	7.27	96.43	**208.11**
Contribution To Others	**223.58**	**225.34**	**14.31**	**77.24**	**190.18**	**129.69**	**40.85**	**206.87**	**Spillover Index 58.77%**

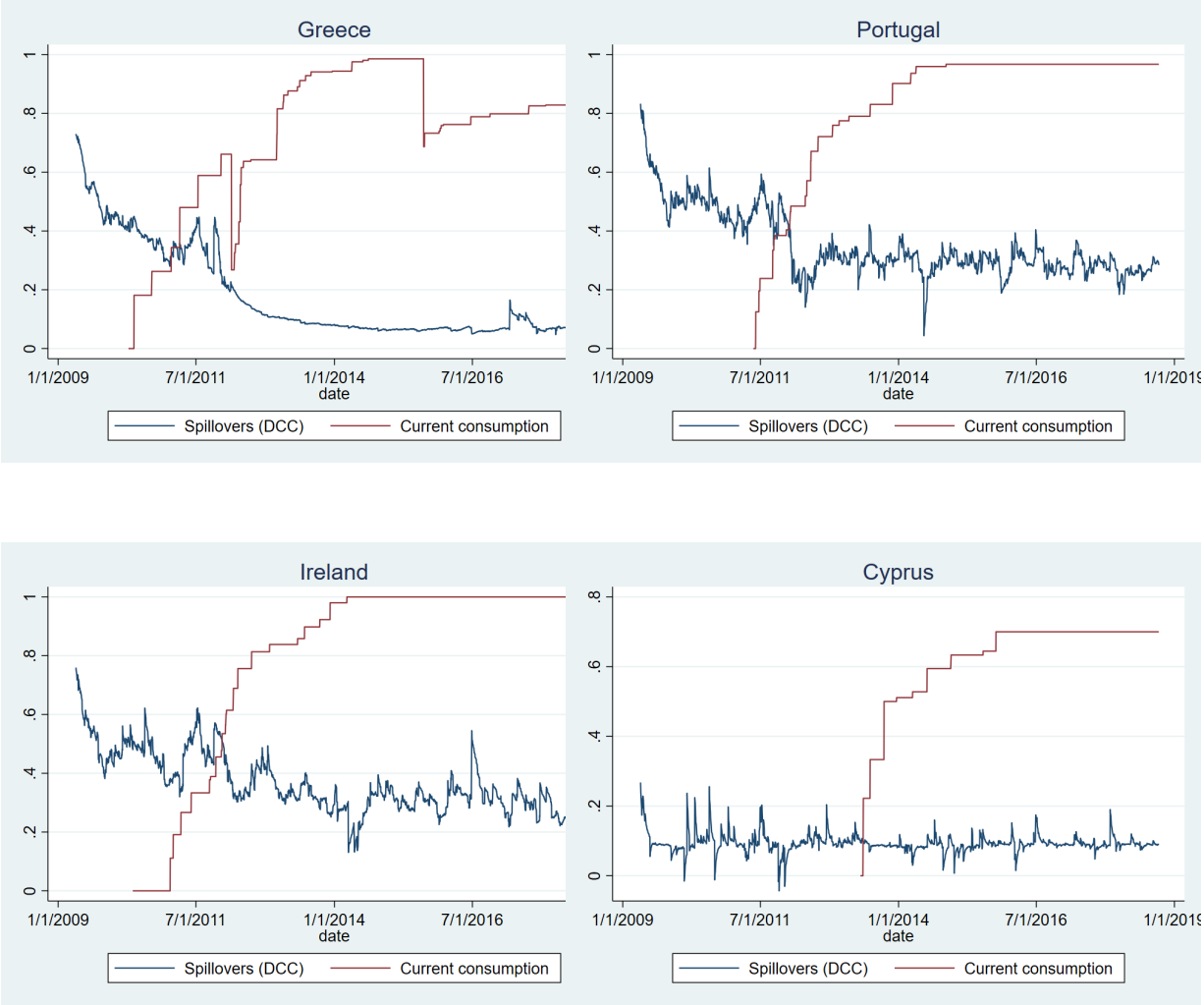
Table 8: Generalized Δ(Bank CDS)

Generalized Δ(Sovereign CDS)	**BEL**	**CYP**	**FRA**	**DEU**	**GRE**	**IRL**	**ITA**	**PRT**	**ESP**	**Contribution From Others**
BEL	95.60	4.018	43.04	35.27	31.54	37.2	53.58	45.28	53.86	**304**
CYP	8.13	92.07	6.76	4.87	4.19	3.18	7.4	5.4	5.94	**46**
FRA	45.02	3.25	91.78	41.20	29.17	30.25	38.66	41.38	42.71	**272**
DEU	37.03	1.91	41.58	89.44	22.31	26.97	34.54	34.35	36.31	**235**
GRE	31.30	2.42	27.13	20.17	94.94	37.54	38.11	45.47	39.89	**242**
IRL	38.44	1.98	30.6	23.98	39.95	94.49	44.34	47.87	48.18	**275**
ITA	51.71	4.28	37.30	33.69	38.33	42.67	93.90	53.4	65.29	**327**
PRT	44.39	1.38	39.13	30.02	44.62	47.69	52.73	95.53	64.89	**325**
ESP	51.84	2.29	38.31	32.15	38.68	45.3	62.82	63.31	97.4	**335**
Contribution To Others	**308**	**22**	**264**	**221**	**249**	**271**	**332**	**336**	**357**	**Spillover Index 73.63%**

Table 9: Subsample (2008-2011) Generalized Δ(Sovereign CDS)

E Spillovers and loan conditions

Figure 8: Spillover measures and current consumption by country



Notes: The current consumption ratio is calculated as the ratio of cumulative loan amounts disbursed over the total amounts promised by the European lending mechanisms.

Table 10: Results from regressing a measure of current consumption on spillovers (DCC).

	(1)	(2)	(3)
	Cum.loans/Overall	Cum.loans/Overall	Cum.loans/Overall
DCC	-2.049**		
	(-7.61)		
MA DCC[-30]		-2.136**	
		(-6.36)	
MA DCC[-90]			-2.242*
			(-5.06)
Constant	1.227***	1.249***	1.278**
	(19.89)	(16.16)	(12.41)
Observations	7716	7716	7716

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: "DCC" is the current dynamic conditional correlation (DCC) of sovereign CDS spreads whereas "MA DCC[-30]" and "MA DCC[-90]" denote the moving average over the last 30 days and 90 days, respectively. Countries included in the panel: Greece, Ireland, Portugal, Cyprus. We include fixed effects and cluster standard errors at the country level.

F The effect of announcements on spillovers - Summary tables

Table 11: Results from regressing the DCC on EFSM/EFSF/ESM (EC) announcements

	(1) IRL_DCC	(2) GRE_DCC	(3) PRT_DCC	(4) CYP_DCC
EC announcements	-0.0338***	-0.0381**	-0.0430***	0.00697
	(-3.49)	(-2.99)	(-3.48)	(1.40)
Constant	0.321***	0.109***	0.308***	0.0922***
	(193.28)	(48.19)	(166.38)	(151.52)
Observations	2452	2452	2452	2452

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Controls: Euribor, Eurostoxx50 return

Table 12: Results from regressing the DCC on IMF announcements

	(1) IRL_DCC	(2) GRE_DCC	(3) PRT_DCC	(4) CYP_DCC
IMF announcements	-0.0151	-0.0000469	-0.0185	-0.00451
	(-1.47)	(-0.00)	(-1.70)	(-1.09)
Constant	0.321***	0.108***	0.308***	0.0923***
	(192.52)	(47.85)	(165.04)	(151.64)
Observations	2452	2452	2452	2452

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Controls: Euribor, Eurostoxx50 return

G The effect of announcements on spillovers - Country details

Table 13: Results from regressing the DCC for Ireland on EFSM/EFSF/ESM and IMF lending announcements referring to Ireland

	(1) IRL_DCC	(2) IRL_DCC	(3) IRL_DCC	(4) IRL_DCC
All EFSM/EFSF/ESM announcem.	-0.0338***			
	(-3.49)			
EFSM/EFSF/ESM loan announcem.		-0.0392*		
		(-2.28)		
EFSM/EFSF/ESM loan disbursem.			-0.0441**	
			(-2.78)	
IMF announcements				-0.0151
				(-1.47)
Eurostoxx50 return	0.00142	0.00145	0.00171	0.00142
	(1.25)	(1.27)	(1.50)	(1.25)
Euribor	0.131***	0.131***	0.131***	0.130***
	(51.67)	(51.47)	(51.58)	(51.50)
Constant	0.321***	0.321***	0.321***	0.321***
	(193.28)	(193.39)	(193.47)	(192.42)
Observations	2452	2452	2452	2452

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 14: Portugal

	(1) PRT_DCC	(2) PRT_DCC	(3) PRT_DCC	(4) PRT_DCC
All EFSM/EFSF/ESM announcem.	-0.0430***			
	(-3.48)			
EFSM/EFSF/ESM loan announcem.		-0.0503*		
		(-2.17)		
EFSM/EFSF/ESM loan disbursem.			-0.0622*	
			(-2.56)	
IMF announcements				-0.0185
				(-1.70)
Eurostoxx50 return	0.00137	0.00133	0.00114	0.00131
	(1.08)	(1.05)	(0.90)	(1.03)
Euribor	0.135***	0.135***	0.135***	0.135***
	(48.11)	(47.96)	(47.99)	(47.90)
Constant	0.308***	0.307***	0.307***	0.308***
	(166.38)	(166.38)	(166.49)	(165.04)
Observations	2452	2452	2452	2451

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 15: Greece

	(1) GRE_DCC	(2) GRE_DCC	(3) GRE_DCC	(4) GRE_DCC
All EFSM/EFSF/ESM announcem.	-0.0381**			
	(-2.99)			
EFSM/EFSF/ESM loan announcem.		-0.00708		
		(-0.28)		
EFSM/EFSF/ESM loan disbursem.			0.0377	
			(0.86)	
IMF announcements				-0.0000469
				(-0.00)
Eurostoxx50 return	0.000473	0.000494	0.000495	0.000499
	(0.31)	(0.32)	(0.32)	(0.32)
Euribor	0.218***	0.217***	0.217***	0.217***
	(63.73)	(63.48)	(63.48)	(63.35)
Constant	0.109***	0.108***	0.108***	0.108***
	(48.19)	(48.05)	(48.06)	(47.85)
Observations	2452	2452	2452	2452

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 16: Cyprus

	(1) CYP_DCC	(2) CYP_DCC	(3) CYP_DCC	(4) CYP_DCC
All EFSM/EFSF/ESM announcem.	0.00697			
	(1.40)			
EFSM/EFSF/ESM loan announcem.		-0.00641		
		(-0.88)		
EFSM/EFSF/ESM loan disbursem.			-0.00159	
			(-0.19)	
IMF announcements				-0.00451
				(-1.09)
Eurostoxx50 return	0.0000396	0.0000338	0.0000307	0.0000385
	(0.10)	(0.08)	(0.07)	(0.09)
Euribor	0.00345***	0.00338***	0.00339***	0.00338***
	(3.74)	(3.68)	(3.69)	(3.68)
Constant	0.0922***	0.0923***	0.0923***	0.0923***
	(151.52)	(152.28)	(152.28)	(151.64)
Observations	2452	2452	2452	2452

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

G.1 Notes on the Portuguese lending programme

Portugal received financial assistance during 2011-2014. The programme was supported by loans from the European Union amounting to 52 bn €and a 26 bn €frin the Extended Fund Facility with the IMF.

European mechanisms' support was equally divided to the EFSM and the EFSF each responsible for disbursing 26 bn €. On table 12 all realised disbursements are presented. It should be noted that EFSM did not disburse the total amount as this was scheduled in the beginning of the programme but 1.7 bn € less.

The outline of the programme was published in June 2011 under the title "The Economic Adjustment for Portugal" almost a month after Portuguese government's request for financial assistance.

Monitoring the implementation of the programme, was realised through 11 reviews of the progress. In each of those reviews - a statement was released which outlined the scheduled disbursements and their specific timeline.

Below we record what was outlined in each of those reviews regading future payments and compare them to the realised disbursements from table 12. No particular reference to which institution EFSF or EFSM was responsible for disbursing the tranches, however this can be inferred by taking into account the total amount to be disbursed and the timing of the sceduled payments.

1. **19 May 2011**: EU and EFSF funding plans to provide financial assistance for Portugal and Ireland

   "Various borrowing operations by EFSM and EFSF will take place between 23 May and 15 July to cover first disbursements to Portugal and Ireland for a total of 15.3 billions".

   - In the aforementioned period 6 disbursements took place [(1)-(6)], Four of which from the EFSM and the remaining two from the EFSF. (1)-(4) amount for 6.5 bn (EFSM) and (5)-(6) from EFSF amounting for 5.9 bn.

2. **12 August 2011**: Statement by the EC, ECB, and IMF on the First Review Mission to Portugal

   "Approval of the conclusion of this review will allow the disbursement of 11.5 billion (7.6 billion by the EU, and 3.9 billion by the IMF). This disbursement can take place in September".

   - In the aforementioned period the only disbursements were done by the EFSF and correspond exactly to the amount of money announced (7.6 bn) these are the disbursements (7)-(9). The EFSF did not do any payments for this

period.

3. **16 November 2011**: Statement by the EC, ECB, and IMF on the Second Review Mission to Portugal

   "Approval of the conclusion of this review will allow the disbursement of 8 billion (5.3 billion by the EU, and 2.7 billion by the IMF). These disbursements could take place in December and January.".

   - In the aforementioned period, EFSM made one payment (12) while EFSF made three payments (10)-(11) and (13). All those together amount for 5.2 billions (0.1 billion less than announced).

4. **28 February 2012**: Statement by the EC, ECB, and IMF on the Third Review Mission to Portugal

   "Approval of the conclusion of this review will allow the disbursement of 14.9 billion (9.7 billion by the EU, and 5.2 billion by the IMF). These disbursements could take place in April subject to the approval of the IMF Executive Board and ECOFIN and EUROGROUP".

   - In the aforementioned period, EFSM made 2 disbursements (14)-(15) amounting for 4.5 billions, and EFSF made another two (16)-(17) amounting for 5.2 billions. In total 9.7 billions as announced.

5. **04 June 2012**: Statement by the EC, ECB, and IMF on the Fourth Review Mission to Portugal

   "Approval of the conclusion of this review will allow the disbursement of 4.1 billion (2.7 billion by the EU, and 1.4 billion by the IMF). These disbursements could take place in July".

   - In the aforementioned period, only the EFSF made two disbursements, amounting for 2.6 billions (0.1 bn less than announced). (18)-(19) disbursements.

6. **11 September 2012**: Statement by the EC, ECB, and IMF on the Fifth Review Mission to Portugal

   "Approval of the conclusion of this review will allow the disbursement of 4.3 billion (2.8 billion by the EU, and 1.5 billion by the IMF). These disbursements could take place in October subject to the approval of the IMF Executive Board and ECOFIN and EUROGROUP.".

   - In the aforementioned period, two disbursements were made. One from the EFSM (20) of 2 billions, and one from EFSF (21) of 0.6 billions amounting

in total of the announced amount.

7. **19 November 2012**: Statement by the EC, ECB, and IMF on the Sixth Review Mission to Portugal

   "Approval of the conclusion of this review will allow the disbursement of 2.5 billion (1.6 billion by the EU, and 0.9 billion by the IMF). These disbursements could take place in January 2013".

   - In the aforementioned period, January 2013 no disbursement was made by either of EFSM, EFSF. The only disbursement close to this period was 0.6 bn by EFSF in February 2013 (22) in the table. (This is 0.8 bn less than what was promised).

8. **15 March 2013**: Statement by the EC, ECB and IMF on the Seventh Review Mission to Portugal

   "The conclusion of this review could take place in May, subject to the approval of ECOFIN and EUROGROUP and of the IMF Executive Board, and will allow the disbursement of 2.0 billion (1.3 billion by the EU, and about 0.7 billion by the IMF)".

   - In the aforementioned period only EFSF made two disbursements (23) and (24) amounting to 2.1 bn euros (Note here that this amount is more than the announced. HOWEVER, from previous reviews we have 0.1 bn not disbursed from what was promised in the 2nd Review, 0.1 bn not disbursed from the 4th review and 0.8 bn not disbursed from the 5th review. Adding those disbursements to the 1.3 promised bn sums up to the 2.1 bn disbursed in the aforementioned period).

9. **3 October 2013**: Statement by the European Commission, ECB and IMF on the eighth and ninth review mission to Portugal

   "The conclusion of the 8th and 9th reviews could take place in November, subject to the approval of ECOFIN and Eurogroup and of the IMF Executive Board. This would allow for the disbursement of 5.6 billion (3.7 billion by the EU, and about 1.9 billion by the IMF) following the approval of the current reviews."

   - In the aforementioned period the only payment was done by EFSF and amounts to 3.7 bn (25)

10. **16 December 2013** Statement by the EC, ECB and IMF on the Tenth Review mission to Portugal

    "Approval of the conclusions of this review will allow the disbursement

of EUR 2.7 billion (EUR 1.8 billion by the EU and EUR 0.9 billion by the IMF), bringing the total amount disbursed to Portugal to EUR 74 billion representing roughly 94 percent of total available financial assistance".

- Only EFSM made one disbursement (26) of exactly 1.8 bn as announced.

11. **28 February 2014** Statement by the EC, ECB and IMF on the Eleventh Review Mission to Portugal

    "The conclusion of the 11th review could take place in April 2014, subject to the approval of ECOFIN and Eurogroup and of the IMF Executive Board. This would allow for the disbursement of 2.5 billion (1.6 billion by the EU, and about 0.9 billion by the IMF) following the approval of the current review."

    - In the aforementioned period, EFSF made a disbursement (27) amounting to 1.2 bn euros (0.4 bn less than promised).

12. **2 May 2014**: Statement by the European Commission, ECB, and IMF on the Twelfth Review Mission to Portugal

    "The conclusion of the 12th review could take place in June, subject to the approval of the ECOFIN Council and of the IMF Executive Board. This would allow for the disbursement of 2.6 billion (1.7 billion by the EU, and about 0.9 billion by the IMF) following the approval of the current review."

    - Note that at this point EFSM and EFSF owes to Portugal 0.4 bn euros from the 11th review plus another 1.7 bn euros promised by the 12th review. However, the last payment disbursed takes place on 12 November 2014 by the EFSM and amounts to 0.4 bn euros (probably what was owed by the 11th review. The 1.7 bn euros from the 12th review were never disbursed)

    - This can be confirmed by the fact that in total the EFSM had agreed to disburse in total 26 bn euros throughout the programme, however, it only did disburse 24.3 bn (less than agreed by the missing 1.7bn disbursement)

G.2 Notes on the Greek lending programme

Greece was under a financial assistance programme for almost a decade. Financial assistance provided by European mechanisms to Greece can be divided into three distinctive programmes plus an enhanced surveillance framework, which in total disbursed a history high of 283.7 bn. In particular, the **first programme**, namely the Greek Loan Facility (GLF) began in May 2010 and ended in June 2013. It disbursed

Loans to Portugal	**EFSM**		**EFSF**		
Date	**Disbursement (bn euros)**	**Cumulative**	**Disbursement (bn euros)**	**Cumulative**	**Total Cumulative**
(01) 31/05/2011	**1.75**	1.75		0.00	1.75
(02) 01/06/2011	**1.50**	3.25		0.00	3.25
(03) 01/06/2011	**2.25**	5.50		0.00	5.50
(04) 01/06/2011	**1.00**	6.50		0.00	6.50
(05) 22/06/2011		6.50	**3.70**	3.70	10.20
(06) 29/06/2011		6.50	**2.20**	5.90	12.40
(07) 21/09/2011	**5.00**	11.50		5.90	17.40
(08) 29/09/2011	**2.00**	13.50		5.90	19.40
(09) 06/10/2011	**0.60**	14.10		5.90	20.00
(10) 20/12/2011		14.10	**1.00**	6.90	21.00
(11) 12/01/2012		14.10	**1.70**	8.60	22.70
(12) 16/01/2012	**1.50**	15.60		8.60	24.20
(13) 19/01/2012		15.60	**1.00**	9.60	25.20
(14) 24/04/2012	**1.80**	17.40		9.60	27.00
(15) 04/05/2012	**2.70**	20.10		9.60	29.70
(16) 30/05/2012		20.10	**3.50**	13.10	33.20
(17) 30/05/2012		20.10	**1.70**	14.80	34.90
(18) 17/07/2012		20.10	**1.50**	16.30	36.40
(19) 17/07/2012		20.10	**1.10**	17.40	37.5
(20) 30/10/2012	**2.00**	22.10		17.40	39.5
(21) 03/12/2012		22.10	**0.80**	18.20	40.30
(22) 07/02/2013		22.10	**0.80**	19.00	41.10
(23) 27/06/2013		22.10	**1.05**	20.05	42.15
(24) 27/06/2013		22.10	**1.05**	21.10	43.20
(25) 22/11/2013		22.10	**3.70**	24.80	46.90
(26) 25/03/2014	**1.80**	23.90		24.80	48.70
(27) 28/04/2014		23.90	**1.20**	26.00	49.90
(28) 12/11/2014	**0.40**	24.30		26.00	**50.30**

Table 17: Loans disbursed to Portugal under the lending programme, by EFSM and EFSF

80 billions € [20] in total and consisted of billateral loans pooled by the European Commission. This programme was also part of a joint package, assisted by the IMF which disbursed in total 30 billion € through a Stand By Arrangement (SBA).

The second programme in contrast to the first one, provided financial assistance to Greece through the EFSF, which was fully operational since August 2010. The second programme started in March 2012 and ended in June 2015. In total it disbursed 141.8 billion € with loan repayments scheduled from 2023 to 2070 and a weighted average maturity of 42.45 years. It committed all unreleased payments remaining from the GLF (11.8 bn €) plus 130 billion €.

The third programme, namely the ESM stability support programme lasted for three years, from August 2015 to August 2018. It disbursed a total amount of 61.9 bn € with loan maturities ranging from 2034 to 2060 (32.5 years average loan maturity). This last programme was completely under ESM's responsibility.

G.2.1 1st Programme for Greece - Greek Loan Facility

Loans to Greece 1st Programme	**GLF**	
Date	**Disbursement (bn euros)**	**Cumulative**
(1) 18 May 2010	**14.50**	14.50
(2) 13 September 2010	**6.50**	21.00
(3) 19 January 2011	**6.50**	27.50
(4) 16 March 2011	**10.90**	38.40
(5) 15 July 2011	**8.70**	47.10
(6) 14 December 2011	**5.80**	52.90

Table 18: Loans under the 1st programme (Greek Loan Facility - GLF)

[20] The amount was subsequently reduced by 2.7 billion € since Slovakia refused to participate and Portugal and Ireland were expempted after entering a lending programme themselves.

Loans to Greece 2nd Programme	**EFSF**		
Date	**Sub-Tranches**	**Disbursement (bn euros)**	**Cumulative**
(1) March/June 2012 (74 bn)	12 March/10April/25April 2012	**29.7**	29.7
	12 March/10April/25April 2012	**4.9**	34.6
	19 March 2012	**5.9**	40.5
	10 April 2012	**3.3**	43.8
	19 April 2012	**25.0**	68.8
	10 May 2012	**4.2**	73
	28 June 2012	**1.0**	74
(2) December 2012/May 2013 (49.1 bn)	17/19 December 2013	**34.3**	108.3
	28/31 January 2013	**9.2**	117.5
	28 February 2013	**2.8**	120.3
	3 May 2013	**2.8**	123.1
(3) May/June 2013 (7.5 bn)	17 May 2013	**4.2**	127.3
	25 June 2013	**3.3**	130.6
(4) July/December 2013 (3 bn)	31 July 2013	**2.5**	133.1
	18 December 2013	**0.5**	133.6
(5) April/August 2014 (8.3 bn)	28 April 2014	**6.3**	139.9
	9 July 2014	**1.0**	140.9
	14 August 2014	**1.0**	141.9

Table 19: Loans received by Greece under the 2nd programme (EFSF)

Loans to Greece 3rd Programme	**ESM**		
Date	**Sub-tranches**	**Disbursement**	**Cumulative**
(1) August/December 2015 (18.7 bn)	20 August 2015	**13.00**	13.00
	24 November 2015	**2.00**	15.00
	01 December 2015	**2.70**	17.70
	08 December 2015	**2.70**	20.40
	23 December 2015	**1.00**	21.40
(2) June/October 2016 (10.3 bn)	21 June 2016	**7.50**	28.90
	26 October 2016	**2.80**	31.70
(3) July/October 2017 (8.5 bn)	10 July 2017	**7.70**	39.40
	30 October 2017	**0.80**	40.20
(4) March/June 2018 (6.7 bn)	28 March 2018	**5.70**	45.90
	15 June 2018	**1.00**	46.90
(5) March/June 2018 (6.7 bn)	06 August 2018	**15.00**	61.90

Table 20: Loans received by Greece under the 3rd programme (ESM)

PUBLICATIONS

Contagion as a Dealmaker? The effect of financial spillovers on regional lending programs

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