A COMPREHENSIVE APPROACH TO THE EURO-AREA DEBT CRISIS: BACKGROUND CALCULATIONS

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Highlights

- This background paper describes in detail the assumptions and calculations behind the results presented in Zsolt Darvas, Jean Pisani-Ferry and André Sapir 'A comprehensive approach to the euro-area debt crisis', Bruegel *Policy Brief* No 2011/02, February 2011. An assessment of the results and policy conclusions can be found in the Policy Brief.
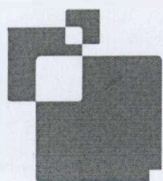
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The first part of this working paper describes our sustainability analysis. The second part discusses our euro-area exposure calculations.

1. Fiscal sustainability assessment

Fiscal sustainability depends on several medium- and long-term factors. In this paper we leave to one side the longer-term issues[1] and concentrate on the medium term (up to 2020), as this is the relevant horizon in the current debates about the euro-area sovereign-debt crisis. Apart from the initial level of debt, fiscal sustainability depends on:

a. borrowing costs,
b. GDP growth,
c. 'non-standard' revenues and expenditures (such as bank bail-outs or privatisation revenues),
d. primary balance apart from 'non-standard' operations.

After outlining our two scenarios in section 1.1, we discuss these four aspects in sections 1.2 to 1.5; section 1.5 also includes our baseline simulation results. Section 1.6 details the calculations behind the assessment of the three types of measures that are currently under consideration (lowering the interest rate on EU loans; extending the maturity of official loans; debt buy-back from the ECB). Section 1.7 describes the calculation behind the haircut needed to restore fiscal sustainability in Greece. Section 1.8 provides a sensitivity analysis to the underlying assumptions.

1.1 Overview of scenarios

Since official programme assumptions about growth and interest rates are widely viewed with scepticism, we use market information whenever available. We describe two scenarios: 'optimistic' and 'cautious', which differ only in terms of interest rate and growth assumptions. The first scenario is optimistic in the sense that it assumes a significant fall in the market interest rates for Greece, Ireland, Portugal and Spain compared to current and expected future market interest rates.

Borrowing cost:
We take official lending rates as given and adopt assumptions concerning future market interest rates, as follows:
Optimistic scenario: Interest rate spreads against German Bunds are optimistically assumed to fall from the current high levels to 350 bps in Greece, 200 bps in Ireland, 150 bps in Portugal and 100 bps in Spain by 2013/14 and are assumed to stay at these levels;
Cautious scenario: Expected future interest rates are calculated using the expectation hypothesis of the term structure of interest rates (which leads to considerably higher expected future interest rates than in the optimistic scenario).

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[1] Every third year, the European Commission performs a sustainability assessment with a 50-year horizon, placing special emphasis on the consequences of ageing. See the latest assessment in European Commission (2009).

GDP growth:

Optimistic scenario: Consensus Economics (2010);

Cautious scenario: Lower GDP growth is assumed than in the optimistic scenario, because, especially in the case of Greece, Portugal and Spain, where the business climate is weak and where we see serious competitiveness problems, efforts to regain competitiveness are assumed to impact growth and inflation negatively compared to the previous scenario.

The two scenarios are identical in all other aspects.

Potential additional bank recapitalisation by governments: estimates from Barclays Capital.

Primary balance in 2011-14:

Greece and Ireland: we use the EU-IMF programme assumptions, as indicated in the IMF country reports published in December 2010 (see IMF 2010a and IMF 2010b).

Portugal and Spain: November 2010 forecast of the European Commission up to 2012, and 1.5 percentage points of GDP additional improvement in both 2013 and 2014.

With the above assumptions, we calculate the persistent primary balance needed from 2015 onwards in order to (a) stabilise the debt/GDP ratio at its 2015 level, (b) reduce the debt/GDP ratio from its simulated 2014 level to a level in 2020 that is consistent with a further fall to 60 percent of GDP (the Maastricht criterion) by 2034. For simplicity, we refer to the second case as the case in which the debt ratio is reduced to 60 percent by 2034.

1.2 Borrowing costs

1.2.1 Official lending rates

Table 1 on the next page shows the composition of financial assistance to Greece and Ireland, which needs to be considered for the overview of official lending rates.

Table 1: Composition of financial assistance programmes (€ billion, unless otherwise indicated)

Contributor	Greece	Ireland
IMF	30	22.5
Euro-area bilateral lenders *	80	-
Non-euro-area bilateral lenders	-	4.8
• *UK*		*3.8*
• *Sweden*		*0.6*
• *Denmark*		*0.4*
European Financial Stability Facility (EFSF)	-	17.7
European Financial Stability Mechanism (EFSM)	-	22.5
Irish government	-	17.5
Total	**110**	**85.0**
Percent of 2010 GDP	48%	54%
Total excluding own contribution	**110**	**67.5**
Percent of 2010 GDP	48%	42%
Projected public debt in 2013 (according to IMF baseline scenario)**	**374**	**211**
Percent of projected official lending in 2013 public debt	29%	32%

Sources: for Greece IMF Country Report No. 10/372 IMF and European Economy Occasional Paper No. 68; for Ireland IMF Country Report No. 10/366 and European Economy Occasional Paper No. 76.

Note: * The shares of participating member states in the total loan are calculated using the adjusted ECB paid capital key. ** IMF presents baseline scenario on the debt/GDP ratio and on nominal GDP growth. We have used these figures and 2010 nominal GDP data to calculate projected public debt in €.

IMF arrangements

Greece has received a 'Stand-By Arrangement' (SBA), while Ireland has received an 'Extended Fund Facility' (EFF)[2]. The SBA is of shorter duration (typically 12-24 months, though the Greek programme is for three years, similarly to the Irish programme), with a repayment period of 3¼ –5 years, while the EFF is typically three years in duration, with a longer repayment period, between 4½ –10 years.

The facilities have identical lending rates, tied to the IMF's market-related interest rate (the SDR interest rate, which is a weighted average of euro-area, Japan, UK and US 3-month interest rates; see Table 2). Large loans carry a surcharge of 200 basis points, paid on the amount of credit outstanding above 300 percent of quota. If credit remains above 300 percent of quota after three years, this surcharge rises to 300 basis points[3]. A service charge of 50 basis points is applied on each amount drawn. There is also a 15-30 basis points commitment fee on amounts that could be drawn in the period, but this fee is refunded if the amounts are borrowed during the relevant period.

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[2] See at: http://www.imf.org/external/np/exr/facts/sba.htm and http://www.imf.org/external/np/exr/facts/eff.htm

[3] Committed IMF lending to Greece amounts to 3,212 percent of Greece's quota, while in the case of Ireland 2,322 percent of Ireland's quota.

Table 2: Composition of the SDR interest rate and its expected development (percent)

		USD	EUR	GBP	JPY	SDR-weighted average
11 February 2011 data						
Interest rates used to calculate the SDR interest rate		0.12	0.81	0.53	0.12	**0.42**
Interbank interest rates		0.31	1.09	0.80	0.19	**0.64**
Spread		0.19	0.28	0.27	0.07	**0.22**
Interbank interest rate futures						
	2011	0.5	1.5	1.3	0.4	**1.0**
	2012	1.7	2.3	2.5	0.5	**1.9**
	2013	2.9	2.9	3.5	0.6	**2.7**
	2014	3.8	3.3	4.1	0.9	**3.4**
	2015	4.7	3.7	4.5	1.2	**4.0**
	2016	5.2	3.8	4.6	n.a.	
	2017	5.4	n.a.	n.a.	n.a.	
	2018	5.5	n.a.	n.a.	n.a.	
	2019	5.6	n.a.	n.a.	n.a.	
	2020	5.8	n.a.	n.a.	n.a.	

Source: Bloomberg and IMF (http://www.imf.org/external/np/fin/data/sdr_ir.aspx).
Note: The following interest rates are used to calculate the SDR interest rate: three-month Eurepo rate; three-month Japanese Treasury Discount bills; three-month UK Treasury bills; and three-month US Treasury bills. The Eurepo is the rate at which one prime bank offers funds in euro to another prime bank if in exchange the former receives from the latter the best collateral in terms of rating and liquidity. Futures are not available for the interest rates used to calculate the SDR interest rate, but available for interbank interest rates. The included interbank interest rates: EURIBOR for the euro and LIBOR for the other three currencies. The difference between the LIBOR rate and the Treasury bill yield is called the TED spread, which is a frequently used measure of liquidity. In the long run the TED spread will likely normalise close to zero. The annual interbank interest rate futures shown are the averages of the implied futures for the middle of March, June, September and December of each year.

Table 3 shows the scheduled disbursements, repayments and proximate interest rate according to December 2010 information.

Table 3: Scheduled indicators of IMF credit (SDR billions, unless otherwise noted)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Greece														
Disbursements	9.13	9.61	5.77	1.92	--	--	--	--	--					
Outstanding stock	9.13	18.74	24.51	24.96	18.08	8.74	2.70	0.30	--					
Charges	0.05	0.44	0.70	0.94	0.95	0.59	0.22	0.03	0.00					
Amortisation	--	--	--	1.47	6.88	9.34	6.04	2.40	0.30					
Charges/previous year outstanding stock (%)	--	4.8%	3.7%	3.8%	3.8%	3.3%	2.5%	1.1%	1.0%					
Ireland														
Disbursements	5.01	7.36	5.67	1.43	--	--	--	--	--	--	--	--	--	--
Outstanding stock	5.01	12.37	18.04	19.47	19.47	18.32	16.03	12.96	9.72	6.47	3.23	1.13	0.18	--
Charges	0.03	0.21	0.44	0.57	0.76	0.77	0.71	0.60	0.46	0.32	0.18	0.05	0.01	0.00
Amortisation	--	--	--	--	--	1.14	2.30	3.07	3.24	3.24	3.24	2.10	0.95	0.18
Charges/previous year outstanding stock (%)	--	4.3%	3.6%	3.2%	3.9%	4.0%	3.9%	3.7%	3.5%	3.3%	2.7%	1.5%	1.1%	1.1%

Source: First four rows of each block: Table 22 in IMF (2010a) and Table 9 in IMF (2010b). Bruegel calculation for the fifth rows.

Note: The values shown are December 2010 projections. Ireland did not draw from the facility in 2010; the first disbursement (in parallel with the first EU disbursement) was on 18 January 2011 (see IMF, 2011). Charges/previous year outstanding stock is an imperfect measure of the interest rate, because part of the charges are related to current year disbursements.

Since IMF lending is disbursed in SDRs and the loan is a floating interest rate arrangement tied to the SDR interest rate, it can be wise to hedge the exchange rate and interest rate risks. Indeed, Table 2 indicates that all components of the SDR interest rate are forecast to increase according to exchange-traded futures contracts. The SDR interest rate may increase from the current 0.42 percent to around 4 percent by 2015 and by even more thereafter. Therefore, the proximate interest rates for the coming years reported in Table 3 may prove to be too optimistic. The Irish National Treasury Management Agency (2010) argues that IMF lending could be swapped into a 5.7 percent fixed euro lending rate with a 7.5-year maturity, which is in line with the expected rise in the components of the SDR interest rate. In our calculations we have used this equivalent. For Greece, such a calculation is not available. As the Greek programme is shorter, its fixed-rate euro equivalent is likely to be lower and therefore we assumed 5.0 percent.

EU arrangements

EU funding for Greece is organised through bilateral loans from the participating member states. The loans are centrally pooled by the Commission, which transforms the bilateral loans into a single loan to Greece, conceptually similar to loan syndication. The interest is calculated on the basis of a floating rate (3-month Euribor) with a margin of 300 basis points for the first three years, and 400 basis points thereafter, for each disbursement, plus an up-front service charge of 50 basis points (see European Commission, 2010).

In order to project the EU's effective lending rate, we used the implied Euribor rates from the London International Financial Futures and Options Exchange (LIFFE) Euribor futures contracts curve, which is available up to 2016 (we assumed that Euribor stays constant in later years). The derived effective lending rate in Table 4 takes into account the different annual vintages of EU lending and the up-front service charge:

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Table 4: Implied Euribor futures and the effective EU lending rate to Greece (percent)

	2011	2012	2013	2014	2015	2016	2017
3-month Euribor	1.5	2.3	2.9	3.3	3.7	3.8	3.8
Effective EU lending rate to Greece	4.8	5.5	6.0	6.5	7.2	7.5	7.8

Source: LIFFE (Euribor 2011-16), Bruegel assumption (Euribor 2017) and Bruegel calculations (effective EU lending rate).

According to the Irish National Treasury Management Agency (2010), the European Financial Stability Mechanism (EFSM) lending rate to Ireland is 5.7 percent, while the lending rate of the European Financial Stability Facility (EFSF) is 6.05 percent[4]. The interest rate on the loans from the three non-euro area countries was not yet set at the time of publication of Irish National Treasury Management Agency (2010); the technical assumption was made that the bilateral loans from the three EU member states will be on the same terms as the funds from the EFSF, ie at 6.05 percent[5].

1.2.2 Market rates

For market borrowing up to 2010 we have used the average coupon value of fixed interest rate bonds, which are (in percent) 3.53 percent in Germany, 4.97 in Greece, 4.64 in Ireland, 4.39 in Portugal and 4.35 in Spain. For simplicity we assumed that these average interest rates apply to all pre-2010 borrowing, but we track different yearly vintages and phase them out according to expiry[6].

There are two main possibilities for incorporating new market borrowing into our calculations:

1. making assumptions concerning different maturity borrowing in each year and using their maturity-specific interest rates,
2. assuming that the maturity of all new borrowing equals the average maturity and using the average interest rate across all maturities.

Implementing the first choice would be cumbersome and in our view the simplification incorporated in the second assumption does not distort the calculations; therefore, we use this second option. Since the current average maturity in the four countries ranges from 6.5-7.7 years, we assume that new debt issuances will have a 7-year maturity and will carry the average interest rate across all maturities.

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[4] See information about the EFSF at http://www.efsf.europa.eu/. We could not find an official website for the EFSM. See Box 10 of European Commission (2011) for details about the EFSF and EFSM financing to Ireland.

[5] While we used the 6.05 percent rate for the bilateral loans according to the technical assumption provided in Irish National Treasury Management Agency (2010), more recent information suggested that bilateral lending of UK to Ireland was provided at the 5.9 percent, see http://debates.oireachtas.ie/dail/2010/12/16/00115.asp .The difference in interest rate (0.15 percentage points) is very small on an otherwise relative small portion of assistance loans and therefore our result would not change much by using this somewhat lower interest rate.

[6] To be more precise, we had information on the maturity structure of about 85/95 percent of tradable securities, which constitute 56 percent of total borrowing in Germany, and 95 percent in Greece, 61 percent in Ireland, 81 percent in Spain and 89 percent in Portugal. The large discrepancy in the case of Germany is primarily due to state and local level government borrowing, which took the form of loans. We assumed that the remaining tradable securities and all loans have the very same maturity structure as the tradable securities for which we have information.

The most difficult assumption concerns the future development of interest rates on newly issued debt. One obvious choice is the expected interest rate derived on the basis of the expectations hypothesis of the term structure of interest rates (EHTS, see Box 1). However, it can be argued that trading volume in peripheral bond markets is low, and thus current interest rates may not properly reflect expectations, or that the term premium of longer maturity bonds is sizeable. Furthermore, the probability of default and the implied losses are likely priced in current market yields (especially for Greece). However, market yields will fall if the adjustment programmes succeed and the countries concerned avoid default.

Therefore, in our optimistic scenario, we assume much lower interest rates (especially for Greece and Ireland) than those implied by the EHTS[7]. We make spread assumptions compared to German Bunds, which are optimistically assumed to fall from the current high levels. We emphasise that our spread assumptions apply to the average interest rate (according to our choice made above), ie the average over various maturities and not just the spread over the 10-year interest rate, which is the most closely watched indicator. For example, using our January 2010 data, the Greek spread over 10-year German Bunds was about 800 basis points, while the spread over 3-year German Bunds was about 1150 basis points. Using the maturity structure of the debt to calculate weights, the average spread over German Bunds was 970 basis points in Greece, 550 basis points in Ireland, 370 basis points in Portugal and 200 basis points in Spain. Using EHTS, these spreads would stay broadly stable in the next few years in Ireland, Portugal and Spain, while in Greece the spread would fall to about 780 basis points by 2014. But in our optimistic scenario we assume a more significant fall of the spread in Greece and also falls in the other three countries: we assume that these spreads will gradually fall to 350 basis points in Greece by 2014, 200 basis points in Ireland by 2014, 150 basis points in Portugal by 2013 and 100 basis points in Spain by 2013. They will then stay at these levels.

Figure 1 shows the average market interest rate on newly issued public debt in the two scenarios, relative to Germany. It is interesting to note that, while not deliberate, in the optimistic scenario, the market rate for Ireland in the second half of the decade — close to 6 percent — is quite close to the EU lending rates to Ireland, while the rate in Greece — close to 8 percent — is also very close to the expected cost of EU lending to Greece (see Table 4).

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[7] Yet we use the EHTS to proximate future German interest rates, because the concerns mentioned above do not apply to Germany. Consensus Economics (2010) — which was based on an October 2010 survey of professional forecasters — included forecast for the German 10-year bond for 2016-2020, which was 4.1 percent. Our calculation based on EHTS — using January 2011 data — indicated 4.2 percent for the same period.

Figure 1: Average market interest rate on newly issued public debt

A: *Cautious scenario*   B: *Optimistic scenario*
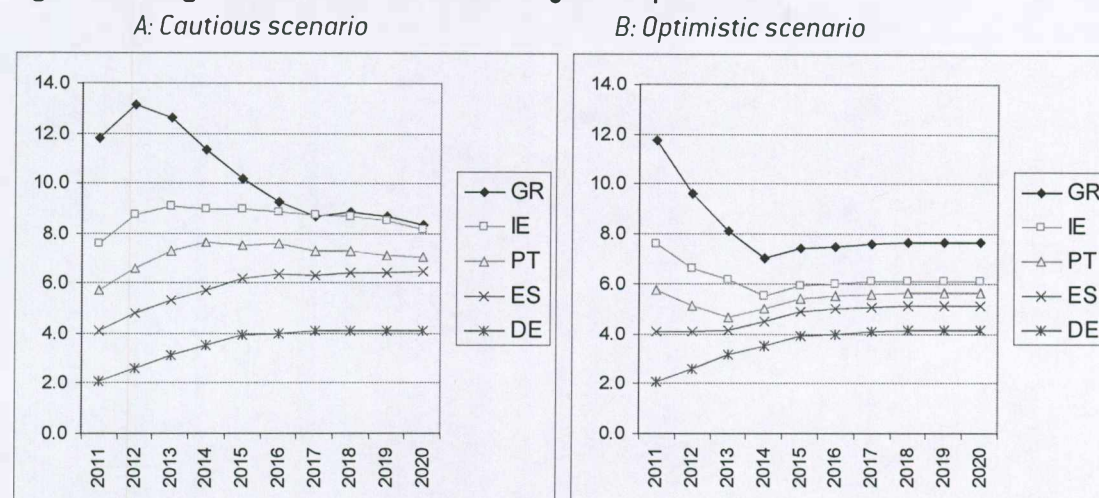
Source: Bruegel calculations.

Box 1: Using EHTS to calculate expected future interest rates

The expectation hypothesis of the term structure of interest rates (EHTS) states that yield on a long maturity bond equals the average of the current and the expected future short maturity yields, plus possibly a term premium, which can compensate for risk related to liquidity for instance, or to the segmented nature of short and long maturity bond markets. For example, the (annualised) yield on a 2-year bond is the average of the current yield on a 1-year bond and the expected 1-year yield one year from now, plus possibly a term premium. By assuming that the term premium is negligible, one can calculate the expected future interest rates using current interest rates. For example, let $i_t^{(1)}$ denote the current 1-year yield, $i_t^{(2)}$ the current 2-year yield and $E\left(i_{t+1}^{(1)}\right)$ expected 1-year yield one year from now (all measured in percent per year). Then, taking aside the term premium, $\left(1+i_t^{(2)}\right)=\sqrt{\left(1+i_t^{(1)}\right)\left(1+E\left(i_{t+1}^{(1)}\right)\right)}$, which allows the calculation of $E\left(i_{t+1}^{(1)}\right)$ from the currently observed $i_t^{(1)}$ and $i_t^{(2)}$. The empirical results on EHTS are mixed: some papers reject the hypothesis while some others find support, using various currencies and time periods. In their seminal work Bekaert and Hodrick (2001) find more support for EHTS; see also the recent paper of Bulkley et al (2011) and references therein for similar results.

Ideally, zero coupon yields would be needed for using the EHTS, but we could acquire only benchmark yields for the four countries. However, for Germany both zero coupon and benchmark yields are available which are quite similar. We have calculated the implied expected future interest rates for all maturities between 1-year and 10-year up to 2020 (assumed that within year bills pay the 1-year rate and over-10-year bonds pay the 10-year rate). EHTS allows us to derive expected future interest rates for each maturity. But to calculate an average over all maturities we need to make an assumption concerning the future maturity structure of public debt. Lacking a better benchmark, we assumed that the current maturity structure will not change. Consequently, we have then weighted these expected 1, 2, ɛ, 10-year rates (in every year between 2011 and 2020) with the assumed constant maturity structure of the debt to arrive at the average interest rate of newly issued debt in each year.

1.2.3 Average interest rate on outstanding public debt

The volume of newly issued market securities is calculated as the total debt minus the stock of official lending (in Greece and Ireland) minus the stock of pre-2011 market debt. Total debt is determined by debt dynamics and therefore the average interest rate on outstanding debt (Figure 2) depends on the particular scenario used to calculate debt dynamics. Figure 2 is based on our benchmark scenario, though the average interest rate is only slightly different in other scenarios.

For both market and official lending we track their annual vintages[8] and calculate the actual interest to be paid (in euros) in a given year as the product of the interest rate and the debt stock of the particular vintage at the end of the previous year. Dividing total interest payments in a year with the total stock of debt at the end of the previous year provides a measure of the average interest rate on outstanding public debt. The results are shown in Figure 2.

Figure 2: Average interest rate on outstanding public debt
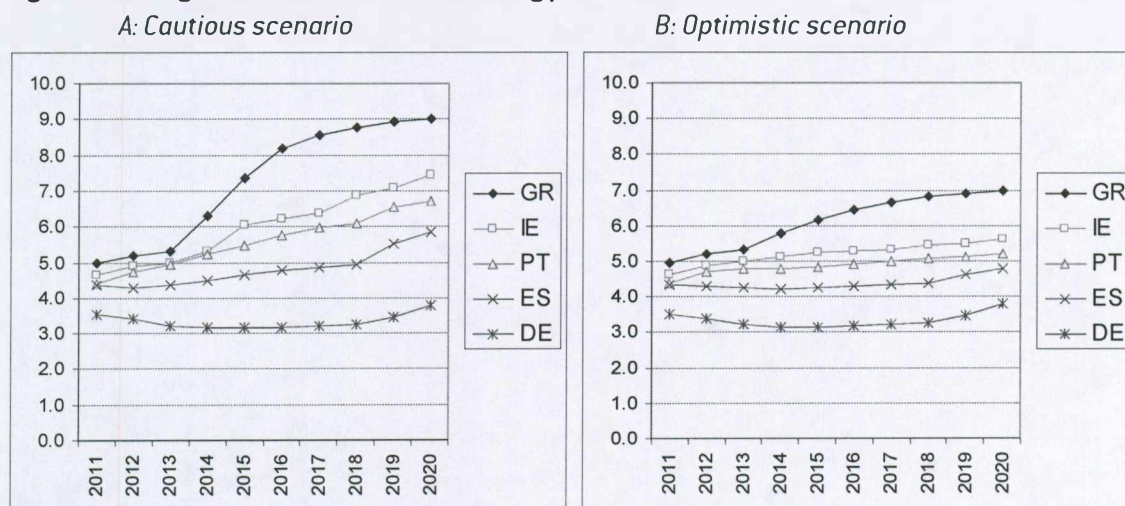
Source: Bruegel calculations.

1.3 GDP Growth

The four countries have different growth outlooks; in particular, Ireland has better growth prospects than Greece, Portugal and Spain.

Table 5 presents some structural indicators for Greece, Ireland, Portugal and Spain in comparison to Germany, the average of the other ten EU15 countries, and the USA. Ireland clearly stands out in almost every respect: it has an excellent business environment, institutions, educational system and technological capacity. In the latter aspect, it even has a better score than Germany and has scores comparable to those of the USA for a couple of other aspects. Towards the end of the pre-crisis boom, by 2007, Ireland had the third highest share of manufacturing in GDP of all EU15 countries (after Finland and Germany), a share that had risen to the highest level within the whole EU by 2009. It had a significant surplus (9 percent of GDP) in the external balance of goods and services in 2007, which has even expanded to 19 percent of GDP in 2010. All of these are indication of a strong Irish

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[8] While interest rates vary within year as well, we treat all borrowing in a given year as paying the same interest rate.

tradable sector and an excellent business climate. However, the three Mediterranean countries, and especially Greece, are weaker in all these dimensions when compared to Ireland, Germany and other EU15 countries, and the data suggests that their tradable sectors are weak.

Table 5: Some structural indicators

	Greece	Ireland	Portugal	Spain	Germany	Other EU-15	USA
Quality of institutions (scale: from 1 to 7)*	4.1	5.4	4.8	4.6	5.7	5.4	4.9
Corruption perception (scale: from 1 to 10)*	3.8	8.0	5.8	6.1	8.0	7.8	7.5
Ease of doing business rank 2009, (out of 183)**	109.0	7.0	48.0	62.0	25.0	29.8	4.0
Infrastructure (scale: from 1 to 7)*	4.3	4.0	5.1	5.3	6.7	5.6	6.1
Markets (scale: from 1 to 7)*	4.9	5.5	5.0	5.1	5.8	5.4	5.9
Quality of the educational system (scale: from 1 to 7)*	3.3	5.6	3.5	3.8	4.9	5.1	5.0
Technology access (scale: from 1 to 7)*	4.2	5.5	5.2	5.0	5.4	5.5	5.7
Absorptive capacity (scale: from 1 to 7)*	4.3	5.1	4.0	4.5	4.7	5.0	5.4
Creative capacity (scale: from 1 to 7)*	4.1	5.0	4.1	4.3	4.9	5.0	5.8
Share of manufacturing (% of GDP) in 2007	9.2	21.8	14.6	15.0	23.8	16.2	13.7
Share of manufacturing (% of GDP) in 2009	10.3	24.2	13.0	12.7	19.1	13.7	n.a.
Balance of goods and services (% of GDP) in 2007	-12.0	9.0	-8.0	-6.7	7.1	6.0	-5.1
Balance of goods and services (% of GDP) in 2010	-7.3	19.3	-8.0	-2.1	4.7	5.5	-3.7
Current account balance (% of GDP) in 2007	-15.7	-5.5	-10.2	-10.0	7.6	3.4	-5.1
Current account balance (% of GDP) in 2010	-10.6	-1.1	-10.7	-4.8	4.8	2.2	-3.4

Sources: World Economic Forum's Global Competitiveness Report (Quality of institutions, Infrastructure, and Quality of the educational system), Transparency International (Corruption perception), World Bank (Ease of doing business), AMECO (share of manufacturing, balance of goods and services, current account balance) and the various sources indicated in Veugelers (2010) for Markets, Technology access, Absorptive capacity and Creative capacity using her methodology.

Note: Other EU-15 is the un-weighted average of the ten other EU-15 countries (EU-15 excluding Greece, Ireland, Portugal, Spain and Germany). *: the higher the better; **: the lower the better

Figure 1 in Darvas et al (2011), showing unit labour cost developments, suggests that Ireland did not have a competitiveness problem in the manufacturing sector even during the boom years[9] and total economy unit labour costs have started to decline substantially since 2008. But Greece, Portugal and Spain need to gain price competitiveness, which will likely lead to a long period of low inflation and growth.

On the basis of the above observations Greece, Portugal and Spain have weaker growth prospects than Ireland and we see significant downward risk compared to the forecasts of Consensus

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[9] See Darvas (2010) for further details on sectoral unit labour costs developments in euro-area countries.

Economics (2010). Furthermore, in our assessment the gap between Ireland and the three Mediterranean countries should be greater than what is included in Consensus Economics (2010). Therefore, while we use the GDP forecasts of Consensus Economics (2010)[10] in the optimistic scenario, in the cautious scenario, growth in Greece, Portugal and Spain is downgraded more than growth in Ireland compared to the optimistic scenario (Table 6). Whereas in our assessment the three Mediterranean have slightly different outlooks, for simplicity we assume the same growth rate for these three countries in the cautious scenario. For comparison, Table 6 also includes official projections.

Table 6: GDP growth assumptions for the sustainability analysis

		Real GDP growth						Nominal GDP growth					
		2011	2012	2013	2014	2015	2016-20	2011	2012	2013	2014	2015	2016-20
Greece	Official	-3.0	1.1	2.1	2.1	2.7	2.6	-1.5	1.5	2.9	3.3	4.0	4.2
	Optimistic	-2.2	0.6	1.4	1.9	2.1	2.3	-1.2	1.1	1.9	3.0	3.5	4.3
	Cautious	-3.0	0.6	1.0	1.0	1.0	1.0	-1.5	1.1	1.9	2.0	2.0	2.0
Ireland	Official	0.9	1.9	2.4	3.0	3.4	n.a.	1.3	2.7	3.8	4.6	5.1	n.a.
	Optimistic	1.4	2.3	2.6	2.7	2.9	2.9	2.0	3.6	4.1	4.4	4.8	4.8
	Cautious	0.9	1.9	2.4	2.5	2.5	2.5	1.3	2.7	3.8	4.0	4.0	4.0
Portugal	Official	-1.0	0.8	1.1	1.2	1.2	n.a.	0.3	1.8	2.5	2.8	3.0	n.a.
	Optimistic	0.2	0.9	1.4	1.6	1.8	1.9	1.2	1.8	2.9	3.2	3.6	3.8
	Cautious	-1.0	0.8	1.0	1.0	1.0	1.0	0.3	1.8	2.0	2.0	2.0	2.0
Spain	Official	0.7	1.7	2.1	2.1	2.0	n.a.	1.7	3.2	3.5	3.8	3.9	n.a.
	Optimistic	0.6	1.2	1.5	1.8	2.1	2.0	1.9	2.7	3.1	3.5	3.8	3.8
	Cautious	0.6	1.0	1.0	1.0	1.0	1.0	1.7	2.0	2.0	2.0	2.0	2.0

Note. **Official**: for Greece and Ireland IMF country reports December 2010 (IMF 2010a and 2010b), for Portugal and Spain ECFIN November 2010 forecasts for 2011-12 and IMF World Economic Outlook October 2010 forecasts for 2013-15; **Optimistic**: Consensus Economics (2010) forecast made in October 2010; **Cautious**: lower of the Consensus Economics forecast and the official programme assumption, but not larger than 1% real/2% nominal growth for Greece, Portugal and Spain and 2.5% real/4.0% nominal growth for Ireland.

1.4 Bank bail-out and privatisation

In both scenarios we use estimates from Barclays Capital of potential additional bank recapitalisation by governments. For Ireland and Spain we use their high-risk estimate, but for Greece and Portugal we use the benchmark, as Barclays does not report high-risk estimates for these countries. The corresponding public finance cost amounts to €10 billion in Greece, €31.5 billion in Ireland, €10 billion in Portugal and €75 billion in Spain. We take into account the fact that the Irish government has put aside €17.5 billion from its cash reserves and liquid assets to support banks and therefore only bank capital needs above this value will add to public debt. The Spanish value does not include support already provided by the government. We do not assume any privatisation revenue in order to remain on the conservative side[11].

1.5 Primary balance (excluding bank support and privatisation)

The primary balance (in percentage of GDP) in Greece and Ireland is assumed to evolve according to the EU-IMF programme assumptions as indicated in the IMF country reports published in December

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[10] Consensus Economics (2010) was formed in October 2010 and therefore its short-term forecasts may be somewhat out-dated. However, since our focus is on the medium term, the change in short term forecasts do not matter much for the medium-term analysis.

[11] Note that for Greece, IMF (2010a) estimates privatisation revenue of about an average 0.5 percent of GDP per year between 2011 and 2020 (somewhat higher values in 2012-2015 and somewhat lower in 2011 and after 2015). IMF (2010b) does not assume any privatisation revenue for Ireland.

2010 (IMF 2010a and 2010b). For Portugal and Spain we use the European Commission's November 2010 forecast up to 2012, and assume that the primary balance will improve by 1.5 percentage point of GDP both in 2013 and 2014. Table 7 details these assumptions along with historical data.[12]

Table 7: Primary balance assumptions (percent of GDP)

	Actual					Forecasts and projections			
	2006	2007	2008	2009	2010	2011	2012	2013	2014
Greece	-1.4	-1.9	-4.5	-10.1	-3.7	-0.8	1.1	3.5	6.0
Ireland (excluding bank support)	3.9	1.1	-5.9	-12.2 -9.7	-29.3 -9.6	-6.7	-4.1	-1.4	1.2
Portugal	-1.4	0.0	0.0	-6.5	-4.4	-1.2	-1.1	0.4	1.9
Spain	3.7	3.5	-2.6	-9.4	-7.3	-4.1	-2.7	-1.2	0.3

Sources: Actual: AMECO and IMF (2010b); Forecasts and projections: for Greece IMF (2010a), for Ireland IMF (2010b), for Portugal and Spain European Commission Autumn 2010 forecast for 2011-12 and Bruegel assumption for 2013-14.

Concerning the primary balance from 2015 onward we calculate two measures: the persistent primary surplus needed in order to:
- stabilise the debt/GDP ratio at its 2015 level[13],
- reduce the debt/GDP ratio from its simulated 2014 level to a level by 2020 that is consistent with a further fall to 60 percent of GDP (the Maastricht criterion) by 2034[14].

For simplicity, we refer to the second case as the case in which the debt ratio is reduced to 60 percent by 2034.

Figure 3 shows the adjustment needed in the primary balance (as a percent of GDP) by 2015 from the 2010 level to achieve these two objectives. For example, the Greek primary balance was -3.7 percent of GDP in 2010 (the bottom of the blue bar). The debt stabilising primary surplus in every year from 2015 onward is 3.7 percent in the optimistic scenario and 10.5 percent in the cautious scenario (top of the blue bar), while the debt reducing primary surplus in every year from 2015

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[12] In order to project the average interest rate of outstanding debt in Germany (see Figure 2) we also needed to make an assumption for the German primary balance (as a percent of GDP) developments. We use the European Commission's Autumn 2010 forecast for 2011 (-0.34 percent) and 2012 (0.63 percent). For 2013 and 2013 we assumed 0.5 percentage point improvement in both years. We calculated the persistent primary surplus from 2015 onward as the one that allows to reach a 0.35 percent of GDP overall budget deficit in 2016 in line with the German fiscal rule, which is 1.9 percent.

[13] Figure 2 indicates that the average interest rate on outstanding public debt continues to increase in the second half of the decade, while we have assumed constant GDP growth in 2016-20 (Table 5). Therefore, with a constant primary surplus in 2015-20 it is not possible to stabilise the debt ratio. However, for expositional purposes we did not calculate a time-varying primary surplus for 2015-20, but assumed that it would be constant, and calculated this constant level as the one that minimised the standard deviation of the debt ratio in 2015-20.

[14] For example, for a 160 percent debt ratio in 2014 (which is 100 percentage points higher than the 60 percent Maastricht criterion) we require that fall in the debt ratio be 5 percentage points in each year. This interpretation of the Maastricht criteria has already been adopted in Darvas (2009).

onward is 8.4 percent in the optimistic scenario and 14.5 percent in the cautious scenario (top of the
dark red bar).

**Figure 3: Required improvement in the primary balance (% GDP) from its 2010 annual level to its
2015 annual level under different macroeconomic scenarios and different debt stabilisation
objectives**
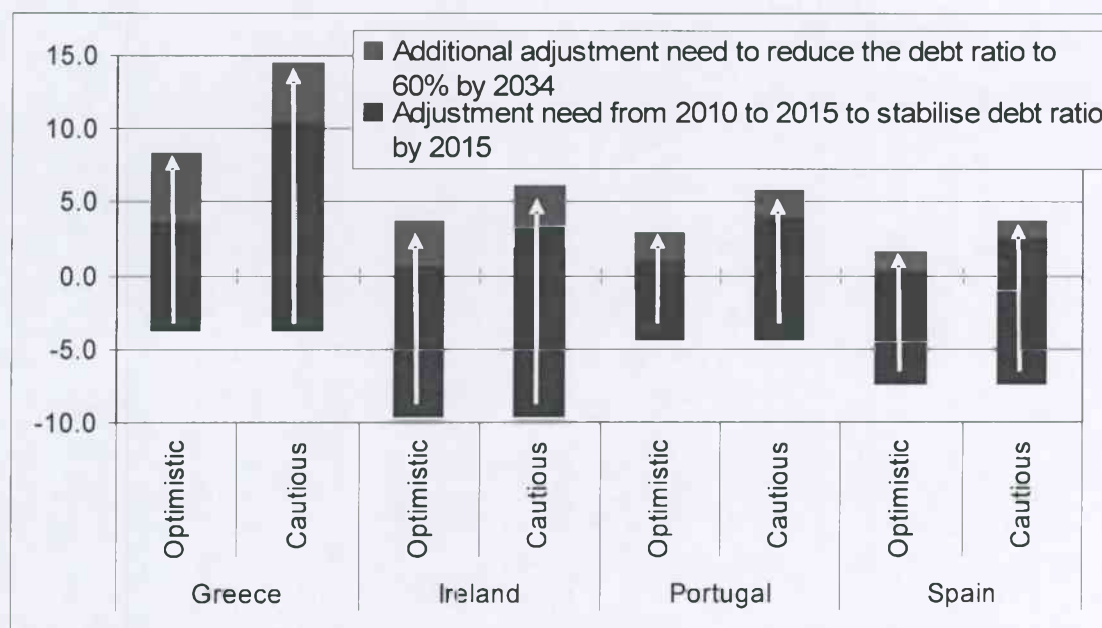
Note: the bottom of the blue bar shows the 2010 primary balance (excluding bank support in the case of Ireland); the top of the blue
bar shows the debt stabilising level of primary balance in every year from 2015 onward; and the top of the dark red bar shows the debt
reducing level of primary balance in every year from 2015 onward. The stabilised levels of debts in the case of the adjustment
indicated by the blue part of the bars are the following: 160% in Greece, 123% in Ireland, 98% in Portugal and 84% in Spain.

1.6 Assessment of recently emerged alternatives

In this section we assess three types of measures currently under consideration:

- **Interest rate cut:** A lowering of the interest rate charged on all official EU loans (IMF rates
  cannot be lowered) to 3.5 percent annually;
- **Maturity extension:** An extension of the maturity of all official EU loans to 30 years (1/30 of
  the principal to be paid back in each year), and the transformation of the Greek IMF Stand-by
  Agreement into an Extended Fund Facility (which would extend the repayment date from
  2018 to 2023, as in Ireland (Table 3); however, due to the extended maturity, the fixed-rate
  euro equivalent of the floating IMF SDR-based lending rate is assumed to the same as in
  Ireland, which would imply a 0.7 percentage point increase in the effective interest rate; see
  Section 1.2.1);
- **Debt buy-back from ECB:** The purchase by the European Financial Stability Facility (EFSF) of
  all government bonds currently held by the European Central Bank within the framework of
  its Securities Market Programme and the retrocession of the corresponding haircut to the

issuing country[15]. We assume that retrocession takes the form of an EFSF lending to the issuing country.

We wish to assess the individual impact of these measures as well as their joint impact. However, the individual impact of the second and third measures is very small, or even could have a seemingly perverse impact.

- Maturity extension. As shown in Table 4, the EU lending rate to Greece is expected to increase to 7.8 percent by 2017, which is broadly similar to our assumed market interest rate in the optimistic scenario (Figure 1). Therefore, maturity extension would not reduce the interest burden (though it would lead to lower borrowing needs from the market, which could be helpful).
- Debt buy-back from the ECB. The average market discount on Irish and Portuguese bonds is reasonably small (see Section 2) and therefore the implied reduction in debt would also be reasonably small. The debt buy-back would reduce the stock of securities issued in previous years which had an average coupon of 4.64 percent in Ireland and 4.39 percent in Portugal (Section 1.2.2). However, if the retrocession of the corresponding haircut from the debt buy-back to the issuing country would be done through an EFSF lending to the countries at 6.05 percent, as in the current EFSF lending to Ireland, then this higher interest rate debt could gradually neutralise and even overturn the positive impact of a reduced debt level.

Consequently, while we assess the impact of interest rate cuts on EU lending on its own, we assess maturity extension and debt buy-back alongside a rate cut on EU lending.

We would expect a positive market reaction to these measures, but it is very difficult to assess its likely impact. For illustration, we also provide an evaluation of the effect of a drop of 100 basis points in market yields and the joint impact of the three policies and the drop in market yields just mentioned. Note that a 100 basis points drop in market interest implies that in the optimistic scenario, the spread to German bunds would decline to 250 basis points in Greece, 100 basis points in Ireland, 50 basis points in Portugal and zero in Spain.

Obviously calculations only apply to measures that are currently applicable. We only consider maturity extension for the countries (Greece and Ireland) that benefit from financial assistance, while for Portugal we only consider the buy-back of current ECB bond holdings. Table 8 shows the results.

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[15] We only consider here buy-backs from the ECB, which is feasible without any market interference. Note also that as the current market value of ECB holdings is close to their value at the time of purchase, we consider this retrocession to be broadly neutral for the ECB profit-and-loss account.

Table 8: Assessment of alternative policies

Panel A: Persistent primary surplus needed in every year from 2015 onwards to stabilise the debt/GDP ratio at its 2015 level (% GDP)

		(a)	(b)	(c)	(d)	(e)	(f)	(g)
			Deviation from baseline					
	scenario	Baseline	Rate cut on EU lending	Rate cut + Maturity extension	Rate cut + Debt buy-back from ECB	All three policies	100 bps lower market yields	All three policies + market reaction
Greece	Optimistic	3.7	-0.22	-1.13	-0.37	-1.31	-1.04	-2.05
	Cautious	10.5	-0.44	-2.32	-0.75	-2.65	-1.02	-3.35
Ireland	Optimistic	0.7	-0.35	-0.46	-0.38	-0.54	-0.55	-1.04
	Cautious	3.3	-0.44	-0.65	-0.44	-0.75	-0.53	-1.24
Portugal	Optimistic	1.2			-0.04	-0.06	-0.66	-0.74
	Cautious	4.1			-0.04	-0.07	-0.71	-0.79
Spain	Optimistic	0.5					-0.61	
	Cautious	2.7					-0.65	

Panel B: Persistent primary surplus needed in every year from 2015 onwards to reduce the debt/GDP ratio from its 2014 level to 60 percent by 2034 (% GDP)

		(a)	(b)	(c)	(d)	(e)	(f)	(g)
			Deviation from baseline					
	scenario	Baseline	Rate cut on EU lending	Rate cut + Maturity extension	Rate cut + Debt buy-back from ECB	All three policies	100 bps lower market yields	All three policies + market reaction
Greece	Optimistic	8.4	-0.47	-1.26	-0.97	-1.76	-0.84	-2.35
	Cautious	14.5	-0.67	-2.35	-1.30	-2.97	-0.85	-3.55
Ireland	Optimistic	3.7	-0.46	-0.55	-0.63	-0.76	-0.44	-1.14
	Cautious	6.1	-0.55	-0.72	-0.68	-0.94	-0.44	-1.33
Portugal	Optimistic	2.9			-0.13	-0.14	-0.64	-0.79
	Cautious	5.8			-0.12	-0.14	-0.69	-0.84
Spain	Optimistic	1.6					-0.61	
	Cautious	3.8					-0.65	

Source: Bruegel.

Note: Column (g) is not the sum of columns (e) and (f) because the marginal impact of policy measures is smaller (in absolute terms) when market interest rates are lower. Column (d) for Portugal considers debt-buy back financed from a 3.5 percent EFSF loan for the same maturity as the current Irish EFSF lending, while column (e) also considers the 30-year extended repayment maturity.

1.7 An illustrative calculation for the haircut needed to restore fiscal sustainability in Greece

Our illustrative calculation considers the following aspects:

- Assistance loans will be exempt from the haircut;
- All three policies considered in Section 1.6 are implemented before the haircut in order to minimise its magnitude;
- The haircut will lead to increased confidence and therefore will result in a drop of the spread vis-à-vis Germany to 200 basis points immediately and permanently;
- The persistent primary surplus from 2015 onward will be 6 percent of GDP (the programme assumption);

- The magnitude of the haircut should be sufficient to reach the 60 percent debt ratio by 2034 in our cautious growth scenario.

With these assumptions the haircut should be about 30 percent on the marketable public debt in 2011. Clearly, with such a haircut, the debt ratio would fall faster in the optimistic growth scenario (Figure 4) and the haircut itself could lead to faster GDP growth due to increased confidence.[16]

Figure 4: Debt ratio developments in Greece with a 6 percent of GDP persistent primary surplus and 30 percent haircut to marketable debt
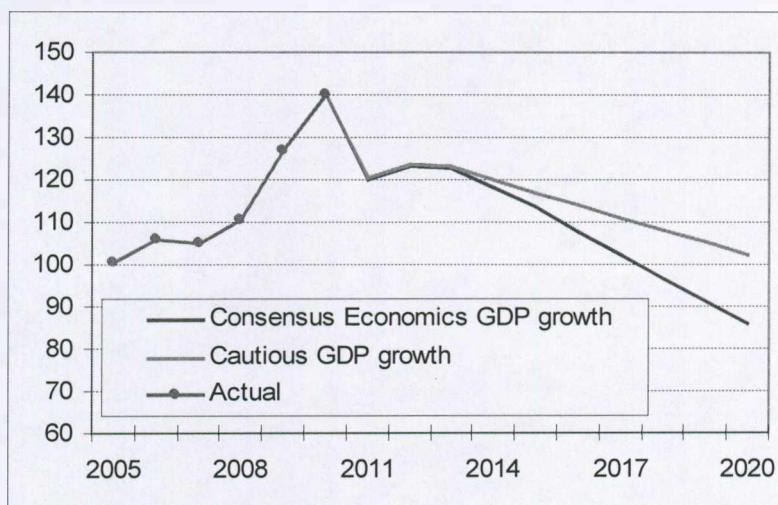
Source: Bruegel calculations.
Note: extrapolation of the blue curve will lead to a less than 60 percent debt ratio by 2025

These haircut calculations are merely illustrative. In addition to uncertainties over future GDP growth developments, there are uncertainties over the Greek banking losses and public recapitalisation needs, which may be higher after a haircut (recall that we have assumed a €10 billion public recapitalisation in our calculations); there are uncertainties concerning the actual conditions of the three policy measures considered in section 1.6; and most importantly there is also uncertainty about market reactions: we assumed that the spread vis-à-vis German Bunds would immediately fall to 200 basis points and would remain at this level. Furthermore, it is also uncertain if the Greek government will be able to maintain a six percent persistent primary surplus from 2015 onward: the market assessment of this would likely be a key factor in market reactions.

1.8 Sensitivity analysis

We assess the sensitivity of our key result, the debt-ratio reducing level of primary surplus, to:

- 1 percentage point faster/slower nominal GDP growth (in every year starting in 2011);
- 1 percentage point lower/higher market interest rate on newly issued debt (in every year starting in 2011);

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[16] This is an important reason for our argument in Darvas, Pisani-Ferry and Sapir (2011) that investors who had to face a haircut should be able to benefit from an upturn in economic conditions through eg GDP-indexed bonds.

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- 50 percent lower/higher public recapitalisation need compared to our baseline assumption (in 2011);

Table 9 shows the results.

Table 9: Sensitivity analysis - Persistent primary surplus needed in every year from 2015 onwards to reduce the debt/GDP ratio from its 2014 level to 60 percent by 2034 (% GDP)

		(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
			Deviation from baseline							
	scenario	Baseline	1 pp faster GDP growth	1 pp slower GDP growth	100 bps lower market yields	100 bps higher market yields	50% lower bank recap.	50% higher bank recap.	The 3 deficit-lowering measures	The 3 deficit-increasing measures
Greece	Optimistic	8.4	-1.81	1.98	-0.84	0.84	-0.29	0.28	-2.84	3.20
	Cautious	14.5	-2.17	2.36	-0.85	0.84	-0.39	0.38	-3.30	3.71
Ireland	Optimistic	3.7	-1.27	1.38	-0.44	0.44	-0.56	0.66	-2.11	2.70
	Cautious	6.1	-1.36	1.47	-0.43	0.43	-0.89	1.01	-2.50	3.16
Portugal	Optimistic	2.9	-1.08	1.16	-0.64	0.65	-0.21	0.21	-1.82	2.12
	Cautious	5.8	-1.23	1.34	-0.68	0.71	-0.28	0.28	-2.09	2.43
Spain	Optimistic	1.6	-0.90	0.97	-0.61	0.62	-0.20	0.20	-1.61	1.90
	Cautious	3.8	-1.01	1.10	-0.65	0.68	-0.27	0.28	-1.84	2.17

Source: Bruegel simulations. Note: column (h) is not the sum of columns (b), (d) and (f) and column (i) is not the sum of columns (c), (e) and (g) because the marginal impact of the individual events is different when the other events are also considered.

2. Spillovers map: exposure to euro-area periphery

2.1 Main tables and figures

In order to assess the potential magnitude of spillovers, and to clearly identify the different situations in each of the countries considered, we compile a set of estimates of the breakdown of holdings of government debt by creditor and bank exposure. Due to the imperfect comparability of the data we use, as well as the assumptions made in our calculations, these estimates should be regarded as illustrative. Table 10 (which was reproduced without explanations in Darvas et al, 2011) summarises the key interdependencies, while Tables 11, 12 and 13, and Figures 5-9 provide further details and country-specific exposures.

Table 10: Estimated exposure to periphery government debt and banking system (€ bn, unless otherwise noted), end-2010

	Greece	Ireland	Portugal	Spain	Total
Total government debt (at face value)	325	153	142	677	1297
of which held by :					
Domestic banks (1)	68	11	19	227	336
Other euro-area banks (1)	52	14	33	79	166
Other banks	6	9	5	24	43
Non-banks (both domestic and foreign) (2)	119	97	64	347	627
ECB	50	22	21	0	93
IMF, EU and official lenders	32	0	0	0	32
Ratio of average market value to face value of government debt (3)	0.75	0.85	0.90	1.00	
Foreign banks' exposure to national banking systems (4)	10	119	43	209	381
of which euro-area banks	6	66	37	154	264
Eurosystem lending to banks (5)	95	132	41	65	333

Sources: Bruegel calculations and estimates using data from BIS, IMF, World Bank, Eurostat, Eurosystem, CEBS, Datastream, National Sources, Barclays Capital.

Note. (1) The total is not equal to the sum of the columns as intra-country exposures are netted out
(2) Non-Banks is calculated as the unidentified portion of government debt (financial institutions not classified as banks are included in this category)
(3) Average weighted discount based on clean price of fixed-rate, non zero-coupon bonds.
(4) As of June 2010 ; the total also includes intra-country exposures
(5) Lending to euro area credit institutions relating to monetary policy operations by the national central banks

Table 11: External debt of general government, 2010-Q3 (as percent of gross government debt)

Finland	96
Austria	91
Netherlands	70
Belgium	69
France	69
Portugal	68
Ireland	64
Greece	64
Germany	59
Spain	53
Italy	48
Luxembourg	35

Source : Eurostat, World Bank (JEDH).

Table 12: Breakdown of foreign bank exposure to sovereign debt (bn €, end-2010 estimates)

	GR	IE	PT	ES	Total (1)
Foreign Banks Exposure to Sovereign	58	23	38	103	209
of which :					
DE	20	3	6	24	54
FR	16	6	12	37	71
IT	2	1	1	2	6
ES	1	0	7	-	8
Other euro-area	13	3	6	15	38
UK	3	4	2	8	17
JP	1	2	1	8	12
USA	1	2	1	4	8
Rest of the world	1	2	1	3	7

Source : BIS, Bruegel calculations.
(1) The total is not always equal to the sum of the columns as intra-country exposures are netted out.

Table 13: Breakdown by Country of Banks' Exposure to National Banking Systems (bn €, June 2010)

	GR	IE	PT	ES	Total
Foreign Banks Exposure to Domestic Banking System	10	119	43	209	381
of which :					
DE	4	39	14	66	123
FR	1	15	11	41	68
IT	1	2	2	8	13
ES	0	3	6	0	8
Other euro-area	1	7	4	39	52
UK	1	25	5	24	55
JP	0	1	0	4	6
USA	1	16	1	19	37
Rest of the world	1	10	1	8	19

Source : BIS, Bruegel calculations.

Figure 5: Exposure to Greece
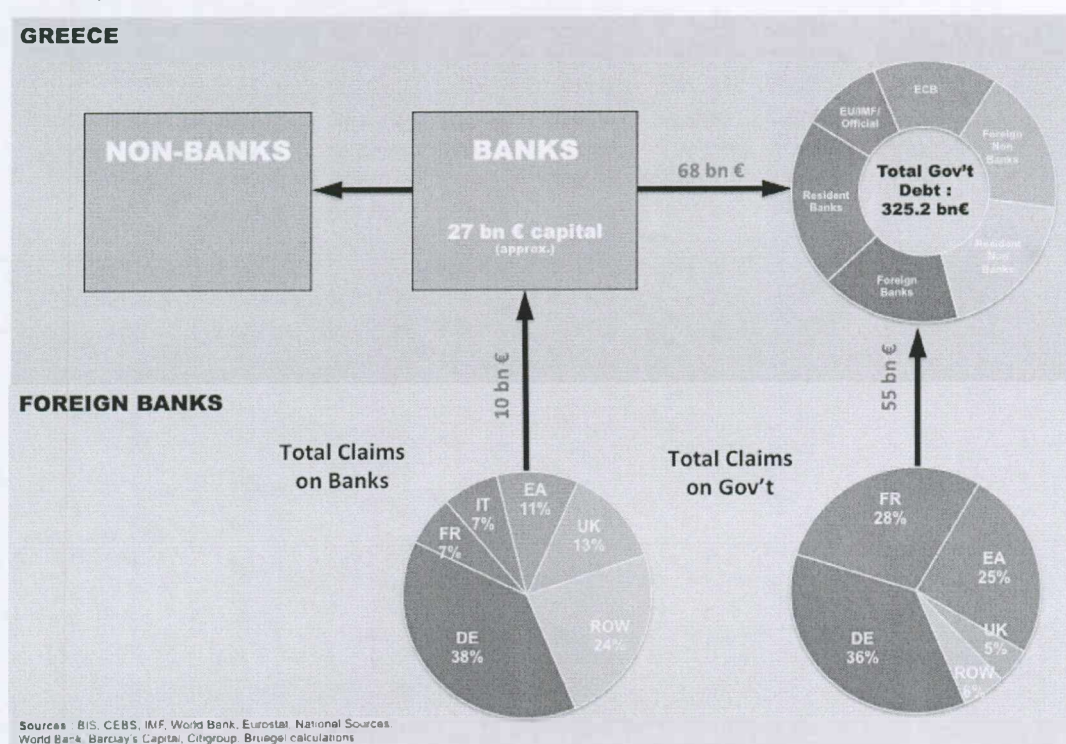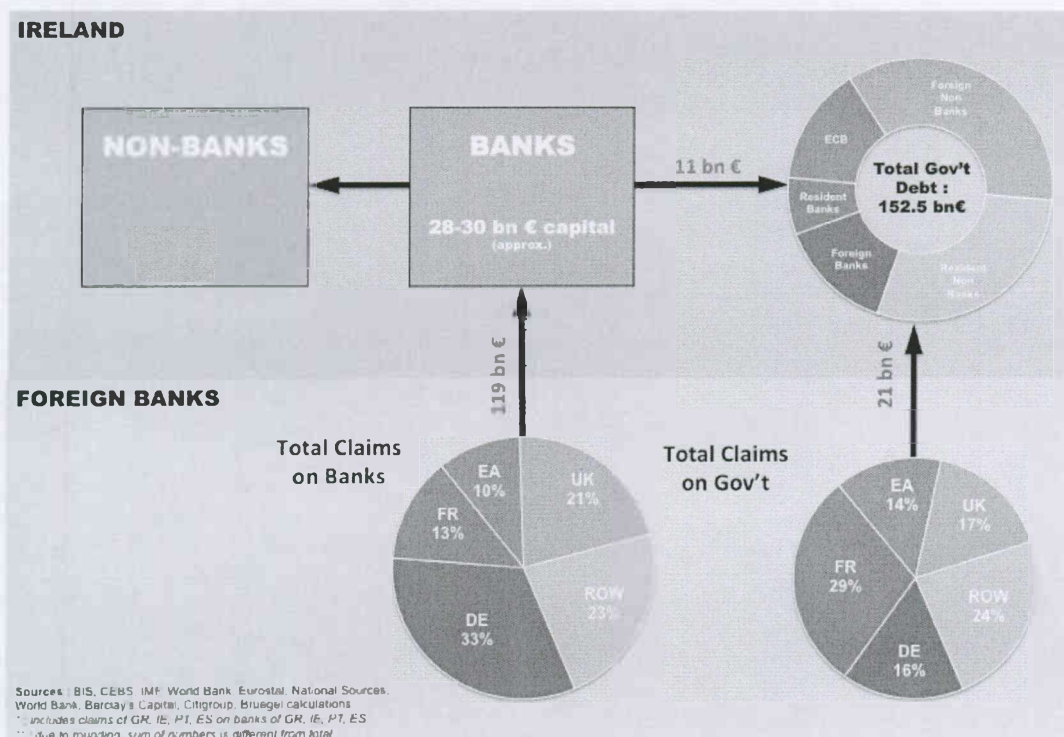

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Figure 6: Exposure to Ireland

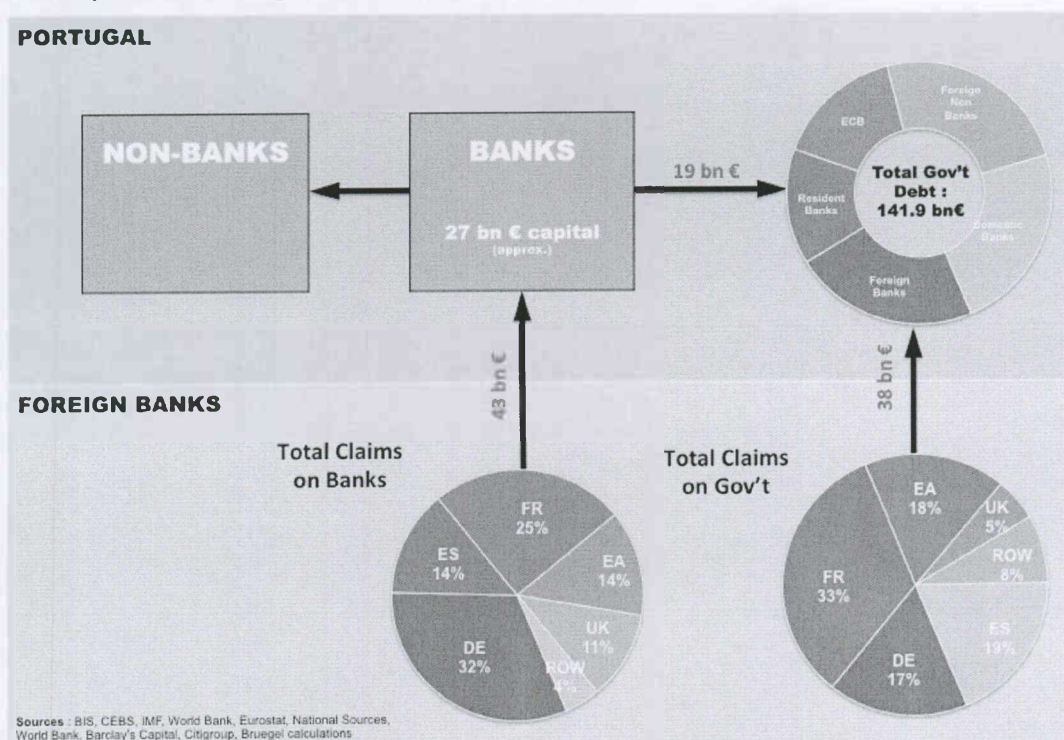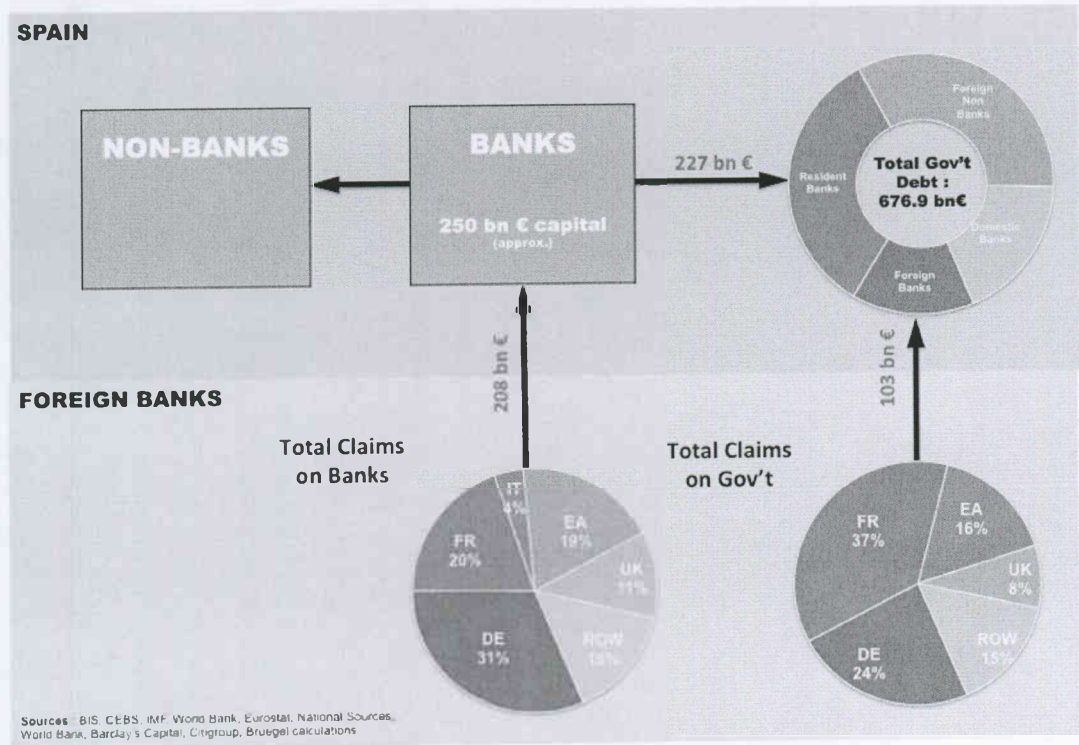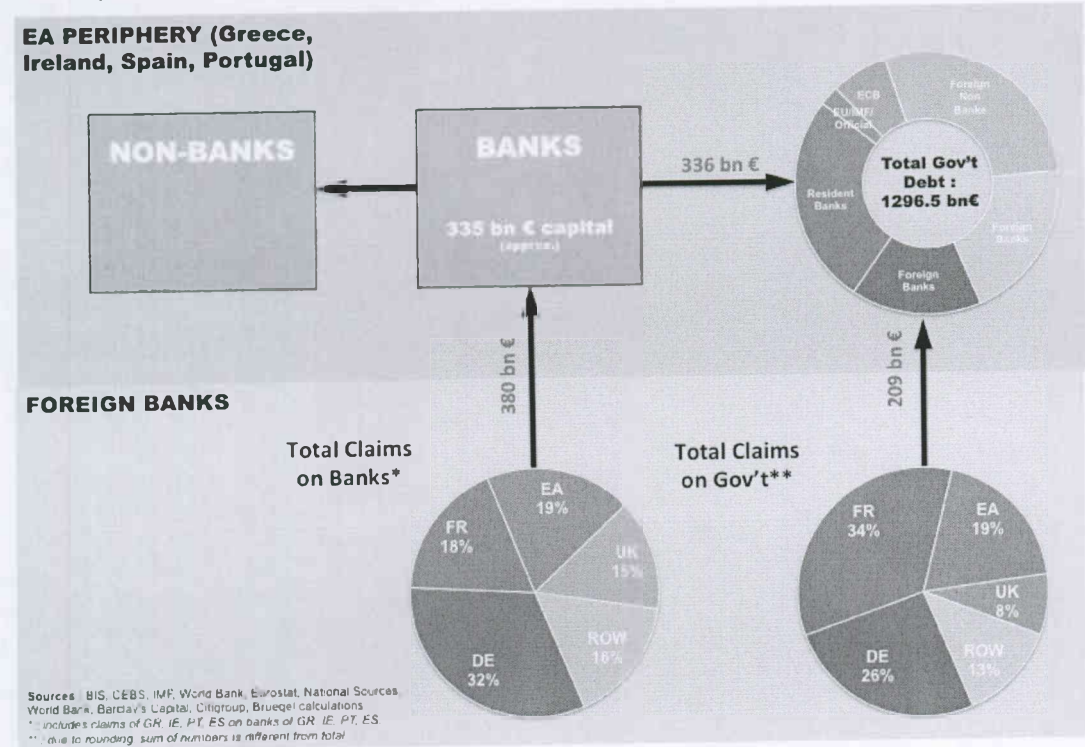**Figure 7: Exposure to Portugal**

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Figure 8: Exposure to Spain

SPAIN

NON-BANKS ← BANKS (250 bn € capital (approx.)) → 227 bn € → Total Gov't Debt: 676.9 bn€

FOREIGN BANKS

208 bn €

103 bn €

Total Claims on Banks

- IT 4%
- FR 20%
- EA 19%
- UK 11%
- DE 31%
- ROW 15%

Total Claims on Gov't

- FR 37%
- EA 16%
- UK 8%
- DE 24%
- ROW 15%

Sources: BIS, CEBS, IMF, World Bank, Eurostat, National Sources, World Bank, Barclay's Capital, Citigroup, Bruegel calculations

Figure 9: Exposure to euro-area periphery

EA PERIPHERY (Greece, Ireland, Spain, Portugal)

NON-BANKS ← BANKS (335 bn € capital (approx.)) → 336 bn € → Total Gov't Debt: 1296.5 bn€

FOREIGN BANKS

380 bn €

209 bn €

Total Claims on Banks*

- FR 18%
- EA 19%
- UK 15%
- DE 32%
- ROW 16%

Total Claims on Gov't**

- FR 34%
- EA 19%
- UK 8%
- DE 26%
- ROW 13%

Sources: BIS, CEBS, IMF, World Bank, Eurostat, National Sources, World Bank, Barclay's Capital, Citigroup, Bruegel calculations
* includes claims of GR, IE, PT, ES on banks of GR, IE, PT, ES
** due to rounding, sum of numbers is different from total

2.1 Methodology

2.2.1 Sovereign exposure of foreign banks

The source for these estimates is the BIS's International Consolidated Banking Statistics, as of June 2010 (the latest date for which data broken down by creditor country and debtor sector is available). We report claims on the public sector on an ultimate risk basis. We assume that the public sector is equivalent to general government. Reporting institutions are domestic banks that have their head offices in the reporting country. Only Monetary Financial Institutions are considered as banks (so a large share of the financial sector is excluded from the reporting). As the claims are consolidated, they take into account exposures worldwide. We consider that 15 percent[17] of the reported claims are on the trading book and thus marked to market, and apply an adjustment factor to approach face value. As the claims are from June 2010, while we present estimates for December 2010, we consider that exposures grew at the same rate as total government debt[18].

2.2.2 Sovereign exposure of domestic banks

As the BIS data only report foreign exposures, we use the information disclosed during the European-wide stress tests to estimate the exposures of domestic banks to the governments of their own countries. The reporting basis is not exactly the same, but the level of consolidation is comparable. In most cases, the stress-test data and the BIS statistics yield results that are similar in terms of magnitude. The BIS has explained differences and warned against direct comparisons (BIS, 2010) but for our needs, the two sources can be juxtaposed. As the stress-tests did not cover the whole domestic banking sector in all of the countries considered (apart from Spain which also included all of the non-listed *cajas*), we apply an adjustment factor to take this into account[19]. Values as of December 2010 are estimated in the same manner as for foreign banks. The final column in Table 10 is not equal to the sum of the four countries, because intra-bloc exposures are netted out. Exposures between periphery countries are reallocated to the domestic banking sector.

2.2.3 Sovereign exposure of ECB

The figures reported in the table are estimates of the face value of the debt held by the European Central Bank. The ECB reports its weekly purchases (at market prices) under the Security Markets Programme, but does not give a breakdown by country. We use estimates provided to us by Barclays Capital and our own estimates on the maturity structure of purchases to calculate an estimate of the face value of the debt held by the ECB. Since we apply no adjustments to the BIS data, we implicitly assume that all of these purchases were made from what we call the non-bank sector. We do this in order to avoid forming hypotheses about how ECB purchases have affected banks' exposures.

2.2.4 Sovereign exposure of IMF, EU and Official Lenders

As of December 2010, no disbursements had yet been made to Ireland under the joint IMF/EU programme. Only in the case of Greece is a portion of its debt identifiable as lending from official sources. The numbers reported are those from the IMF (2010a).

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[17] Blundell-Wignall and Slovik (2010) report that around 83 percent of sovereign debt exposures in the European-wide stress-tests were held on the banking book.

[18] The BIS has published provisional statistics as of Q3 2010, but these are not yet available with the appropriate breakdown.

[19] In the case of Ireland we only take into account the six government guaranteed banks.

2.2.5 Sovereign exposure of non-banks

The non-banks category simply corresponds to the unidentified portion of government debt. Because the basis for allocating claims to countries in the case of banks is not residence, we do not provide a breakdown of non-banks between resident and non-resident creditors. Note that non-banks include all financial institutions that do not fall under the category of banks, such as investment funds.

2.2.6 Ratio of average market value to face value of government debt

The average weighted discount is based on the clean price of euro-denominated, fixed-rate, non zero-coupon bonds as of the end of January 2011. Note that bonds of some of these countries were traded above face value before the crisis, and the fall in market price therefore does not reflect the current discount. Spain still has a non-negligible stock of bonds trading above face value, so that on average the discount is close to zero. Due to the limitations of our data and calculations, we choose to round the calculated discount to the nearest multiple of 0.05.

2.2.7 Foreign banks' exposure to national banking systems

The source for these figures is the BIS Consolidated Banking Statistics, and those we report are on an ultimate risk basis. The reporting institutions and the scope of consolidation are the same as for the figures we report for exposures to sovereigns. As the figures are consolidated, they do not include claims on subsidiaries and branches. Note that the criterion for allocating claims on countries is residency of the ultimate obligor (debtor) and not nationality.

2.2.8 Eurosystem lending to banks through the national central bank

The balance sheets of national central banks are the sources for these figures. The line we report is *"Lending to euro area credit institutions relating to monetary policy operations"*. It can be assumed that national central banks lend nearly exclusively to domestic institutions. The figures are as of December 2010 for Ireland and Portugal, and as of November 2010 for Greece and Spain.

3. References

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