The Greek Debt Restructuring: An Autopsy

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Abstract

The Greek debt restructuring of 2012 stands out in the history of sovereign defaults. It achieved very large debt relief—over 50 percent of 2012 GDP—with minimal financial disruption, using a combination of new legal techniques, exceptionally large cash incentives, and official sector pressure on key creditors. But it did so at a cost. The timing and design of the restructuring left money on the table from the perspective of Greece, created a large risk for European taxpayers, and set precedents—particularly in its very generous treatment of holdout creditors—that are likely to make future debt restructurings in Europe more difficult.

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1. Introduction

This paper studies a central episode of the European debt crisis: the restructuring and near-elimination of Greece's sovereign bonds held by private investors, comprising a face value of more than 100 percent of Greek GDP. After a €200 billion debt exchange in March/April 2012 and a buyback of a large portion of the newly exchanged sovereign bonds in December, the amount of Greek bonds in the hands of private creditors was down to just €35 billion—just 13 percent of where it had stood in April 2010, when Greece lost access to capital markets.

The Greek debt exchange can claim historic significance in more than one respect. It set a new world record in terms of restructured debt volume and aggregate creditor losses, easily surpassing previous high water marks such as the default and restructuring of Argentina 2001-2005. It was the first major debt restructuring in Europe since the defaults preceding World War II[2]—defying statements by European policymakers, issued only months earlier, who had claimed that sovereign defaults were unthinkable for EU countries. It also was a watershed event in the history of the European crisis, plausibly contributing both to its expansion in the summer of 2011 and to its eventual resolution (as we will argue in this paper). Finally, it occupies a special place in the history of sovereign debt crises—along with the Brady deals, for example, and with the 2000 Ecuador restructuring—by introducing a set of legal innovations which helped to engineer an orderly debt exchange, overcoming the collective action problem facing Greek and EU policymakers as they sought to restructure a large amount debt dispersed among many private creditors.[3]

The present paper gives an account of the background, mechanics, and outcomes of the Greek debt restructuring. Beyond the basic historical narrative, we focus on three sets of questions.

First, what were the distributional implications of the restructuring—both the main exchange, and the end-2012 debt buyback? We answer this question by computing the impact of the restructuring on the present value of expected cash flows both in the aggregate and bond-by-bond. The results confirm that the exchange resulted in a vast transfer from private creditors to Greece, in the order of €100 billion in present value terms; corresponding to 50 percent of 2012 GDP (this is *net* of the costs of recapitalizing Greek banks to offset losses incurred through the restructuring). But we also show that the "haircuts" suffered by creditors on average were considerably lower than the 75 percent widely reported in the financial press at the time of the debt exchange, namely, in the order of 59-65 percent, depending on which methodology is applied. Furthermore, these losses were not equally distributed across creditors, with much higher present value losses on bonds maturing within a year (75 percent or more), and much lower losses on bonds maturing after 2025 (less than 50 percent). Finally, we show that the buyback of December 2012 did result in some debt relief for Greece, despite the

[2] Germany restructured its pre-war debt in 1953, but it had defaulted more than a decade earlier.

[3] For details on these episodes, see Cline (1995, on the Brady deals) and Sturzenegger and Zettelmeyer (2007a), on Ecuador and other emerging market restructurings after the Brady deals). Reinhart and Rogoff (2009) and Cruces and Trebesch (2013) provide broader historical perspectives.

significant rise in bond market prices after its announcement. However, the debt relief effect was small both due to the voluntary approach that was chosen and the small scale of the operation.

Second, how was the free rider problem addressed, i.e., the incentive of each creditor not to participate while hoping that all other bondholders accept? An important part of the answer is that most Greek bonds were held by banks and other institutional investors which were susceptible to pressure by their regulators and governments. They also faced peer pressure via the Greek creditor committee, which resembled the "London Club" process of the 1980s. However, large banks and regulated institutions accounted for no more than 60 percent of outstanding principal, while the final participation rate was 97 percent. To bail in the remaining creditors, Greece relied on a mix of carrots and sticks embedded in the exchange offer itself. The main stick was a change in domestic law which made the offer compulsory for all holders of local-law bonds subject to approval by creditors holding two-thirds of outstanding principal. The main carrot was an unusually high cash pay-out: creditors received more than 15 percent of the value of their old bonds in cash-like short-term EFSF bonds. A further carrot consisted of legal and contractual terms that gave the new bonds a better chance of surviving future Greek debt crises than the old ones. Ironically, these "carrots" may have turned out to be particularly appealing because market commentary thought it unlikely that Greece's proposed debt restructuring, even if it succeeded, would be the last one. In this situation, many potential holdouts opted for the bird in hand rather than the two in the bush.

Third, we assess the restructuring and its implications for the management of future European debt crises. Was the restructuring necessary and could it have been handled better? Does it provide a template for any future European sovereign debt restructuring? The flavor of our answers is mixed. On the one hand, the restructuring was both unavoidable and successful in achieving deep debt relief relatively swiftly and in an orderly manner—no small feat. On the other hand, its timing, execution, and design left money on the table from the perspective of Greece, created a large risk for European taxpayers, and set precedents—particularly in its very generous treatment of holdouts—that are likely to make future debt restructurings in Europe more difficult. Partly as a result, it will be hard to repeat a Greek-style restructuring elsewhere in Europe should the need arise. This calls for a more systematic approach to future debt restructurings, which could be achieved through an ESM treaty change.

The paper has important limitations. It is essentially a case study. Although it provides context, it focuses on the Greek debt restructuring rather than giving a fuller account of the Greek or European debt crisis. In particular, it analyzes neither the causes of the crisis nor its management except as relates to the restructuring. And while it touches on some of the big questions surrounding sovereign debt crises—including when countries should restructure their debts and how debt restructurings can be efficiently managed—we need to refer the reader to the broader literature for complete answers.[4]

[4] For recent surveys of the literature see Panizza et al. (2009), Wright (2011), Das et al. (2012), Tomz and Wright (2013) and Aguiar and Amador (2013). On the origins the European sovereign debt crisis see Lane (2012).

The paper is for the most part organized chronologically. In the section that follows, we describe the background to the 2012 restructuring: The May 2010 EU/IMF program with Greece, and the July 2011 decision to restructure in principle (euphemistically referred to as "private sector involvement," or PSI). We also briefly analyze the implications of the restructuring proposal agreed by Greece and the IIF at that time. We then turn to the main act of the Greek restructuring: the March-April 2012 debt exchange, which is the main focus of this paper. Next, we analyze the last act (for now), the December 2012 bond buyback. We conclude with an assessment of the Greek restructuring and its implications for ongoing and future debt crises in Europe.

2. From the 2010 Bailout to the July 2011 PSI Proposal

The Greek debt crisis began in October 2009, when the newly elected government of George Papandreou revealed that the country had understated its debt and deficit figures for years. The projected budget deficit for 2009, in particular, was revised upwards from an estimated 7 percent to more than 12 percent (it eventually ended up at 15.6 percent). This set the stage for months of further bad economic news, which eroded market confidence in Greece and its debt sustainability and resulted in a number of rating downgrades, first by Fitch, then by S&P and Moody's. As the situation continued to deteriorate, Greek sovereign bond yields continued to rise, until spreads over German bunds shot up from 300 to almost 900 basis points during April, effectively excluding Greece from access to bond markets. Faced with an imminent rollover crisis, the Greek government had no choice but to turn to euro area governments and the IMF.

Despite initial German resistance, a three-year rescue package was agreed on May 2,2010. It amounted to €80 billion in EU loans and a further €30 billion of IMF credit, and was to be paid out in tranches until 2012, conditional on the implementation of a fiscal adjustment package of 11 percentage points of GDP over three years, and structural reforms meant to restore competitiveness and growth. One week later, euro area leaders agreed on further rescue measures, particularly the creation of the European Financial Stability Facility (EFSF) with a lending capacity of €440 billion for troubled sovereigns, and the ECB's "secondary market purchase program" (SMP) to stabilize sovereign bond yields in secondary markets. Initially, markets rallied, spreads fell sharply. However, market skepticism soon returned, particularly after Moody's downgraded Greece in mid-June, citing substantial macroeconomic and implementation risks associated with the euro area/IMF support package.[5] By July, spreads again began to exceed 800 basis points.

In October of 2010, the debt crisis in Europe reached a watershed at the trilateral Franco-German-Russian Summit in Deauville, when President Sarkozy and Chancellor Merkel called for a permanent crisis resolution mechanism in Europe "comprising the necessary arrangements for an adequate participation of the private sector". Although it referred not to the handling of the on-going European crisis but to a European crisis

[5] See "Moody's downgrades Greece to Ba1 from A3", Global Credit Research, 14 Jun 2010. http://www.moodys.com/research/Moodys-downgrades-Greece-to-Ba1-from-A3-stable-outlook--PR_200910

resolution framework that was to replace the EFSF in 2013, the "Deauville statement" was widely interpreted as an official signal that sovereign debt restructuring would henceforth be acceptable in European Union countries. The result was a sharp widening of the bond spreads of peripheral European countries. In this setting, the prospects of a quick return of Greece to international capital markets by early 2012—as envisaged in the May program—looked increasingly unlikely.

Notwithstanding market skepticism, Greece's program achieved significant fiscal consolidation during 2010 (about 5 percent of GDP). In light of a deepening recession and growing domestic opposition to the program, however, fiscal adjustment became stuck in the first half 2011, at a time when the overall and primary deficits were still in the order of 10 and 5 percentage points, respectively, sovereign debt stood at over 140 percent of GDP, and output was expected to continue to decline at a rate of 3-4 percent for the next two years. Most worryingly, structural reforms that were supposed to restore growth in the medium term were delayed, and reform implementation was weak. An IMF review ending on June 2, 2011 and published in mid-July concluded that Greece's outlook "does not allow the staff to deem debt to be sustainable with high probability", and all but ruled out a return to capital markets until the end of the program period in mid-2013. Unless the official sector was prepared to offer additional financing in the order of €70-104 billion (depending on the timing of the assumed return to capital markets), some form of "private sector involvement" (PSI) was unavoidable, even if one took a benign view of Greece's debt sustainability.[6]

On June 6, 2011, German Finance Minister Wolfgang Schäuble wrote a letter to the ECB and IMF proposing "to initiate the process of involving holders of Greek bonds … through a bond swap leading to a prolongation of the outstanding Greek sovereign bonds by seven years."[7] Shortly afterwards, a group of major French banks issued the first detailed proposal on how a Greek bond rescheduling might look like (Kopf, 2011). The French proposal already contained many of the elements that would ultimately be part of the March 2012 exchange, namely a large upfront cash payment, a 30-year lengthening of maturities, and a new GDP-linked security as sweetener. Importantly, however, it only targeted bonds maturing in 2011-14, and it did not foresee any nominal debt reduction (face value haircut). From the perspective of the German government, this proposal was not sufficient, and talks about the form of PSI went on until the extraordinary EU summit on July 21, 2011.[8]

Immediately after the summit, euro area heads of government and the Institute of International Finance (IIF)—representing major banks and other institutional investors holding Greek bonds—each issued statements that together amounted to a new financing proposal for Greece, consisting of an official sector commitment and a private sector "offer":

[6] IMF Country Report No. 11/175.
[7] See http://www.piie.com/blogs/realtime/?p=2203
[8] See *Financial Times*, July 6, 2011, "Schäuble presses case for bond swap." http://www.ft.com/cms/s/0/f2d96d3a-a7de-11e0-a312-00144feabdc0.html

First, the official sector (EU and IMF together) promised financing in the amount of €109 billion. Since only about €65 billion of the original €110 billion May 2010 package had been disbursed up to that point, this amounted to additional official financing of €64 billion over and above the original commitment. The EU portion of the new financing was to be delivered through EFSF loans with longer maturities—between 15 and 30 years—and lower interest rates than the loans disbursed so far. A maturity extension for the bilateral EU loans that had already been disbursed was also promised.

Second, 39 financial institutions (both international and Greek) expressed their willingness "to participate in a voluntary program of debt exchange." Creditors would have a choice between four options: a 30-year "par bond" with no face value reduction paying slightly lower coupons than typical for Greece's debt stock (namely, 4 percent in the first five years, 4.5 in the next five years, and 5 percent thereafter); a 30-year "discount bond" with a 20 percent face value reduction but slightly higher coupon rates (6, 6.5, and 6.8 percent, respectively); and a 15-year discount bond with a 20 percent face value reduction and 5.9 percent coupon. The fourth option was to receive the par bond not immediately but in lieu of cash repayment at the time the time of maturity of the bond held by the creditor. Importantly, following a structure popularized in the Brady deals of the early 1990s, the principal of the 30-year bonds were to be fully collateralized using zero coupon bonds purchased by Greece from the EFSF and held in an escrow account. For the 15-year bond, the collateral would cover collateralization up to 80 percent of any loss on principal, up to a maximum of 40 percent of new principal.

Assuming a 90 percent participation rate among privately held bonds maturing between August of 2011 and July of 2020 (the bonds to be targeted in the exchange, as subsequently clarified by the Greek Ministry of Finance), this amounted to private financing of about €135 billion in total, about €54 billion of which corresponded to the period between mid-2011 and mid-2014.[9] Hence, under the July 2011 proposal, the official and private sector together would have lent Greece an extra €118 billion at low interest rates between 2011 and 2014. This exceeded the €70 billion financing gap calculated by the IMF in its July report by €38 billion corresponding to the collateral that the official sector was offering to lend to Greece in order to persuade the private sector to chip in its contribution. Hence, an extra €38 billion of official sector lending "bought" €54 billion of private sector financing through 2011-14, as well as postponing the repayment of principal falling due between 2014 and 2020, hence giving Greece and its official creditors some leeway in case it remained shut off from capital market after the program period.

From a financing perspective, the July 2011 proposal hence implied a significant contribution from the private sector. But did it also imply debt relief? The IIF claimed so

[9] These numbers come from the IIF's July 21 press release, but can also be approximately derived by taking Greece's bond amortisations (€203 billion between mid-2011 and 2020 and €89 billion between mid-2011 and mid-2014), excluding holdings by the ECB and other central banks (about €53 billion for bonds maturing during 2012-2020 and €26 billion during 2012-2014) and multiplying the result with 0.9. The ECB's holdings were not publicly known in July 2011, but became public in February 2012 for all Greek bonds maturing after January of 2012. Small discrepancies between the derived amounts and those stated by the IIF could be explained by ECB holdings of bonds maturing in the second half of 2011.

in its July press release, which stated that the debt exchange implied a 21 percent Net Present Value (NPV) loss for investors, based on an assumed discount rate of 9 percent (reflecting a guess as to what the yield of the new bonds might be following a successful exchange). However, there are several reasons to be skeptical of this claim.

First, the IIF was referring to the fact that the value of the new instruments, applying a 9 percent discount rate on the risky portion of their cash flows (together with a lower interest rate on the collateralized portion) amounted to 79 cents per euro of old principal. Hence, investors opting for the new bonds would have suffered a loss of 21 cents on the euro compared to the alternative of receiving full and immediate repayment of their old bonds. This approach to computing creditor losses reflects widespread market convention, and makes sense in some settings (when either the outstanding bonds are of very short maturity; or when bonds are "accelerated", i.e., become due and payable immediately). But it is not suitable when creditors hold bonds of longer maturity and if they do not have the right to immediate full repayment. In such a situation, the value of the new bonds should be compared not to 100 percent of face value of the old bonds, but rather to the present value of their promised payment stream, evaluated at the same discount rate as the new bonds (see next section and Sturzenegger and Zettelmeyer, 2008, for details). Using the IIF's 9 percent discount rate, this implies much smaller creditor losses, namely, just 11.5 percent (see Table 1).[10]

Second, for the purpose of computing Greece's *debt relief* (as opposed to creditor losses), it is doubtful whether 9 percent was in fact the appropriate discount rate. Sturzenegger and Zettelmeyer (2007b) argue that if the country is expected to return to capital markets over the medium term, the discount rate for the purposes of computing debt relief should be somewhere between the country's future expected borrowing rate and the international risk free rate, because the country will be using rates in this interval to transfer revenues across time (saving at the international risk-free rate, or borrowing against future revenues at a market rate).[11] One rate which was surely within this interval from the perspective of mid-2011 was the 5 percent discount rate used by the IMF in its debt sustainability calculations (since "risk free" German bonds yielded around 3-3.5 percent in July 2011, and on the assumption of a future Greek borrowing spread at least 200 basis points after re-entering capital markets). Using this 5 percent discount rate to compare old and proposed new debt flows, the debt relief implied by the July 2011 financing offer would have been approximately zero—indeed, slightly negative. Using the "risk free" discount rate of about 3.5 percent (not shown in the table), would indicate an *increase* of Greece's debt burden by about 11-15 percent the July 2011.

[10] This point—that creditor losses implicit in the IIF's financing offer were very small when properly computed—was made by several academics and analysts soon after the deal was announced; see Cabral (2011) and Ghezzi, Aksu, and Garcia Pascual (2011). See also Kopf (2011) for a similar point about the June 2011 "French proposal", Ardagna and Caselli (2012) for a broader critique of the July 2011 deal, and Porzecanski (2013) for a description of the run-up and aftermath of the July deal.

[11] Since the 9 percent rate was supposed to reflect the expectation secondary market yield on Greek bonds following a successful exchange, this implies that Greece's borrowing rate in "normal times"—following a successful re-entering of capital markets—was less than 9 percent in July 2011. Note that if Greece was not expected to re-access capital markets at all, in the foreseeable future, either a higher discount rate would appropriate (see Dias, Richmond and Wright (2012) or—on the assumption that Greece maintains access to EFSF lending—the EFSF rate. See debt relief calculations in Section 3 below.

Table 1. Creditor losses implicit in July 2011 IIF financing offer

	Assuming creditors had chosen ….					
	30-year Par bond, using discount rate of ... [1/]			30-year Discount bond, using discount rate of [1/]		
	5.0	9.0	15.0	5.0	9.0	15.0
Value of new securities received (PV_{new})	103.6	79.0	61.4	106.3	79.0	59.4
Haircut in market convention (100-PV_{new})	*-3.6*	*21.0*	*38.6*	*-6.3*	*21.0*	*40.6*
Value of old bonds (PV_{old}) [2/]	101.3	89.3	75.6	101.3	89.3	75.6
Present value haircut (100*(1-PV_{new}/PV_{old})	*-2.3*	*11.5*	*18.7*	*-4.9*	*11.5*	*21.4*

Note: In percent of outstanding principal.
1/ Refers to discount rate applied to coupons. Collateralised principal discounted at 3.787 percent which was calibrated to achieve an NPV of the new par bond of exactly 79 percent assuming a 9 percent discount rate for the coupons.
2/ Average value of non-ECB bond holdings

Sources: Hellenic Republic (Ministry of Finance), IIF, authors' calculations

In the event, the July 2011 financing offer was never implemented. The deepening recession in Greece and the difficulties of the EU and IMF to agree on a credible package of structural reforms with the Greek government lowered expectations of the growth path that Greece might realistically achieve and exacerbated worries about its debt servicing capacity. These worries were reflected in sharply rising secondary yields, making it much less likely that the largely voluntary debt exchange envisaged in July would succeed—not just in the sense of restoring Greece's solvency over the medium term, but even in the more pedestrian sense of attracting high participation.[12] On October 9, 2011, German finance minister Wolfgang Schäuble, was quoted in *Frankfurter Allgemeine* as saying "the debt reduction we aimed at in July may have been too low". This view was corroborated by a new IMF analysis prepared for the October 26 Euro Summit in Brussels, which concluded that Greece's debt was no longer sustainable except "with much stronger PSI".[13]

3. The March-April 2012 Bond Exchange

The Euro Summit statement of October 26, 2011 invited "Greece, private investors and all parties concerned to develop a voluntary bond exchange with a nominal discount of 50 percent on notional Greek debt held by private investors" and pledged to "contribute to the PSI package up to 30 billion euro" as well as additional lending to help with the

[12] Greek 10 year benchmark yields started rising sharply from mid-August onwards, stabilising at around 23 percent in mid-September—over 8 percentage points above their end-July levels. In these circumstances, the prospect of a relatively low 9 percent "exit yield" following the debt exchange envisaged in July seemed increasingly remote. If a higher exit yield of 15 percent is assumed (in line with market conditions in October), investors would have suffered a significantly higher haircut under the terms of the July proposal (see Table 1).

[13] Debt sustainability analysis dated October 21, 2011, available at http://www.linkiesta.it/sites/default/files/uploads/articolo/troika.pdf (accessed 19.3. 2013).

recapitalization of Greek banks. This set the stage for a new round of PSI negotiations, which resulted in a major debt exchange in March and April of 2012.

On the side of private creditors, the negotiations were led by a steering group of 12 banks, insurers and asset managers on behalf of a larger group of 32 creditors, which together held an estimated 30-40 percent of Greece's privately held debt (Table 2). This effectively made the March 2012 restructuring a hybrid between a "London Club" negotiation led by a steering group of banks, as had been typical for the restructuring of bank loans in the 1980s and early 1990s—and a take-it-or-leave-it debt exchange offer, which was typical for most bond restructurings since the late 1990s.[14]

The rebirth of the creditor committee was likely due to the fact that much of Greece's outstanding debt was held by large western banks. It also made it easier for Greece's official creditors—particularly the Eurogroup—to influence the terms of the restructuring (see section 3.4 below). This likely helped in designing some features of the deal, such as the co-financing agreement between Greece and the European Financial Stability Fund (EFSF) described in more detail below, that might have been more difficult without some form of formal creditor representation.

Table 2. Composition and estimated bond holdings of creditor committee

Steering Committee Members		Further Members of the Creditor Committee			
Allianz (Germany)	1.3	Ageas (Belgium)	1.2	MACSF (France)	na
Alpha Eurobank (Greece)	3.7	Bank of Cyprus	1.8	Marathon (USA)	na
Axa (France)	1.9	Bayern LB (Germany)	na	Marfin (Greece)	2.3
BNP Paribas (France)	5.0	BBVA (Spain)	na	Metlife (USA)	na
CNP Assurances (France)	2.0	BPCE (France)	1.2	Piraeus (Greece)	9.4
Commerzbank (Germany)	2.9	Credit Agricole (France)	0.6	RBS (UK)	1.1
Deutsche Bank (Germany)	1.6	DekaBank (Germany)	na	Société Gén. (France)	2.9
Greylock Capital (USA)	na	Dexia (Belg/Lux/Fra)	3.5	Unicredit (Italy)	0.9
Intesa San Paolo (Italy)	0.8	Emporiki (Greece)	na		
LBB BW (Germany)	1.4	Generali (Italy)	3.0		
ING (France)	1.4	Groupama (France)	2.0		
National Bank of Greece	13.7	HSBC (UK)	0.8		

Notes: In € billion. Estimates of bond holdings refer to June 2011, creditor committee composition to December 2011. *Sources*: Barclays (2011) and Institute of International Finance (http://www.iif.com/press/press+219.php).

On February 21, 2012, Greece and the steering committee announced in parallel press releases that a deal had been agreed. A formal debt restructuring offer followed three days later. This turned out to look very different from the IIF's July "financing offer". Investors were only offered one take-it-or-leave it package—referred to as the "PSI consideration", not a menu of four alternatives. The promised official contribution was used not to collateralize principal repayments of the new bonds, but rather to finance

[14] See Rieffel (2003) and Das et al. (2012), Table 4. During the 1990s, Bank-led creditor committees also played a role in the restructuring of Soviet-era debt in 1997 and, again, in 2000.

large upfront cash payments. Most importantly, the new bonds offered for exchange involved both much lower face value and lower coupon rates. Specifically, the "PSI consideration" comprised (see also Appendix 1 for details):

(i) One and two year notes issued by the EFSF, amounting to 15 percent of the old debt's face value;
(ii) 20 new government bonds maturing between 2023 and 2042, amounting to 31.5 percent of the old debt's face value, with annual coupons between 2 and 4.3 percent. These bonds were issued under English law and governed by a "co-financing agreement" with the EFSF which instituted a sharing provision for the private bondholders vis-à-vis the EFSF (see below);
(iii) A GDP-linked security which could provide an extra payment stream of up to 1 percentage point of the face value of the outstanding new bonds if GDP exceeded a specified target path (roughly in line with the IMF's medium- and long-term growth projections for Greece).
(iv) Compensation for any accrued interest still owed by the old bonds, in the form of six-month EFSF notes.

Another important difference with respect to the July proposal was that the offer cast a much wider net. Whereas the July plan had envisaged exchanging only sovereign and sovereign-guaranteed railway bonds with less than nine years of remaining maturity, the February 2012[15] offer was directed at all privately held sovereign bonds issued prior to 2012, with total face value of €195.7 billion, as well as 36 sovereign-guaranteed bonds issued by public enterprises with face value of just under €10 billion (not just Hellenic Railways, but also of the Hellenic Defense Systems, and of Athens Public Transport).[16] As a result, the total volume targeted in the February offer exceeded that of the July proposal by about €50 billion, in spite of the fact that Greece's bonded debt stock had shrunk by €10 billion in the meantime, as investors continued to be repaid in full and on time while negotiations dragged on.

Perhaps the only important sense in which the February proposal did *not* differ from the July plan is that it excluded the bond holdings of the ECB—Greece's single largest bondholder by far, with €42.7 billion (16.3 percent) of holdings in February 2012—national Central Banks (€13.5 billion of Greek bonds, about 5 percent of the total), and the EIB (€315 million). Just ahead of the publication of the offer, these were swapped into a new series with identical payment terms and maturity dates. As part of the February swap arrangement, the ECB committed to return any profits on Greek government bond holdings, most of which had been purchased significantly below par during 2010, to its shareholders. But this did not mean that they would be returned to Greece: the Eurogroup agreed on such a return only in late November 2012.[17]

[15] Depending on how one counts them, 81 or 99 issues (the ambiguity comes from the fact that 18 Greek-law titles were listed using two different ISIN bond numbers, notwithstanding common issue dates, maturity dates and terms).
[16] A number of sovereign guaranteed loans and bonds were left out of the exchange. However, information on these guarantees has been difficult to come by and we do not know their total volume.
[17] Some national central banks, such as the Banque de France, had previously agreed to return their profits on Greek government bond holdings to Greece, but this did not apply to SMP profits.

With some exceptions,[18] all bondholders that were offered the "PSI consideration" also received a "consent solicitation", in which they were asked to vote for an amendment of the bonds that permitted Greece to exchange the bonds for the new package of securities. Bondholders accepting the offer were considered to simultaneously have cast a vote in favor of the amendment. However, bondholders that ignored or rejected the exchange offer were deemed to have voted against the amendment only if they submitted a specific instruction to that effect.

The rules for accepting the amendment differed according to their governing law. About €20 billon of sovereign and sovereign-guaranteed bonds—just under 10 percent of eligible face value—had been issued under English law. For these bonds, the amendment rules were laid out in "collective action clauses" (CACs) contained in the original bond contracts, and voted on bond-by-bond.[19] In contrast, the large majority of Greece's sovereign bonds that had been issued under Greek law—€177.3 billion, over 86 percent of eligible debt—contained no such collective action clauses, meaning that these bonds could only be restructured with the unanimous consent of all bond holders. However, because they were issued under local law, the bond contracts themselves could be changed by passing a domestic law to that effect. In theory, Greece could have used this instrument to simply legislate different payment terms, or give itself the power to exchange the bonds for the new securities, but this might have been viewed as an expropriation of bondholders by legislative fiat, and could have been challenged under the Greek constitution, the European Convention of Human Rights and principles of customary international law.

Instead, the Greek legislature passed a law (Greek Bondholder Act, 4050/12, 23. February 2012) that allowed the restructuring of the Greek-law bonds with the consent of a qualified majority, based on a quorum of votes representing 50 percent of face value and a consent threshold of two-thirds of the face-value taking part in the vote.[20] Importantly, this quorum and threshold applied across the totality of all Greek-law sovereign bonds outstanding, rather than bond-by-bond. While this "retrofit CAC" gave

[18] The holders of a Swiss-law sovereign bond received only a consent solicitation, not an exchange offer, apparently because the latter would have been too difficult, given local securities regulations, within the short period envisaged. Holders of Japanese-law bonds, an Italian-law bond, and Greek-law guaranteed bonds received the opposite treatment, i.e., only exchange offers, but no consent solicitation. Although the Japanese-law bonds contained collective action clauses which allowed for the amendment of payment terms in principle, local securities laws made it impractical to attempt such amendments in the short period envisaged. The Greek-law guaranteed bonds also did not contain collective action clauses (or only with extremely high supermajority thresholds), and were kept outside the remit of the February 23, 2012 Greek bondholder law which "retrofitted" CACs on all Greek-law sovereign bonds.

[19] Typically, these envisaged a quorum requirement (i.e., minimum threshold of voter participation) between 66.67and 75 percent in a first attempt, followed by a quorum of between one-third and 50 percent in a second meeting if the initial quorum requirement was not met. The threshold for passing the amendment was usually between 66.67and 75 percent of face value in the first meeting, and as low as 33.33 percent in the second meeting. The Italian-law bond, as best we know, did not contain a collective action clause. The Greek-law guaranteed bonds also either did not contain collective action clauses or only with extremely high supermajority thresholds.

[20] While the quorum requirement was lower than typical for the initial bondholder meeting under English-law bonds, this was arguably justified by the fact that the Greek sovereign allowed itself only "one shot" to solicit the consent of bondholder to the amendment of Greek-law bonds, whereas under the English-law bonds, failure to obtain a quorum in the first meeting would have led to a second meeting with a quorum requirement between just one-third and one-half. The idea behind this structure is described in Buchheit and Gulati (2010).

bondholders collectively a say over the restructuring which was roughly analogous to that afforded to English-law bondholders, the sheer size of what it would have taken for bondholders to purchase a blocking position made it near impossible for individual bondholders (or coalitions of bondholders) to block the restructuring.

The offer was contingent on Greece obtaining the EFSF notes that were to be delivered to creditors in the exchange (which in turn depended on the completion of some prior actions under Greece's IMF- and EU supported program); and a "minimum participation condition", according to which the proposed exchange and amendments would *not* go forward if this were to result in a restructuring of less than 75 percent of face value. Conditions of the type had been used in most debt exchange offers since the mid-1990s to reassure tendering bondholders that they would not be left out in the cold (i.e., holding a smaller, and potentially illiquid claim) in the event that most other bondholders chose not to accept the offer. [21]

At the same time, Greece and the Troika decided to set a 90 percent minimum participation threshold as a precondition for unequivocally going forward with the exchange and amendments. This implied, in particular, that if Greece succeeded with its attempt to amend its domestic law sovereign bonds within the framework set out by the February 23 law, the exchange would likely go forward, since the Greek-law sovereign bonds alone amounted to about 86 percent of the total eligible debt. Between the two thresholds Greece would allow itself discretion, "in consultation with its official sector creditors" on whether or not to proceed with the exchange and amendments.

Greece gave its creditors just two weeks, until March 8, to accept or reject the offer. This tight deadline was needed to complete at least the domestic-law component of the exchange before March 20, when a large Greek-law bond issue was coming due for repayment.

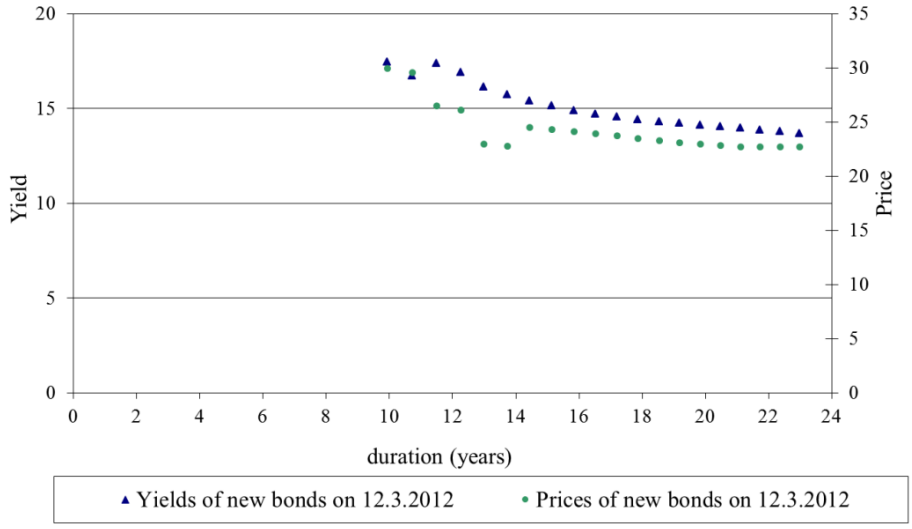
3.1. Restructuring Outcome

On March 9, Greece announced that 82.5 percent of the €177.3 billion in sovereign bonds issued under domestic law had accepted the exchange offer and consent solicitation.[22] Participation among the foreign-law bondholders was initially lower, at around 61 percent. But together, these participation levels implied that both thresholds that were critical for the success of the exchange—first the two-thirds threshold for amending all Greek-law bonds using the February 23 law, and subsequently the overall participation threshold of 90 percent—could be met by a wide margin. Since EFSF financing had also been made available in the meantime, the government announced that it would proceed with the exchange of the Greek-law bonds. At the same time, the participation deadline for foreign-law bondholders was extended twice, to early April.

[21] Hence, the minimum participation threshold can be interpreted as ruling out an inefficient equilibrium in which no bondholder tenders for fear of being in this situation. See Bi et al. (2011).

[22] These and all following numbers referring to participation exclude holdings by the ECB and national central banks, unless otherwise stated.

Figure 1. Exit yield curve, by duration of new bonds



Source: Bloomberg

Greece's new bonds started trading immediately, on March 12, at yields in the range of just under 14 (longer bonds) to about 17.5 percent (shorter bonds, see Figure 1). Weighted by principal, the average "exit yield" was 15.3 percent—higher than the sovereign yield of any other euro area country at the time, and suggesting that even after the success of a very significant debt reduction operation seemed all but assured, private creditors remained skeptical about the future of Greece's program and its longer term ability to repay. At the same time, Greece's high exit yields were not unusually high compared to emerging market debt restructurings of the past.[23]

By the end of the process, on April 26, after the last foreign law bonds were settled, Greece had achieved total participation of €199.2 billion, or 96.9 percent of eligible principal, resulting in a payout of €29.7 billion in short-term EFSF notes and €62.4 billion in new long sovereign bonds. Hence, the face value of Greece's debt declined by about €107 billion as the result of the exchange, or 52 percent of the eligible debt.[24]

Holders of €6.4 billion in face value held out. The holdouts were scattered across 25 sovereign or sovereign guaranteed bonds, of which 24 were foreign-law titles: Seven bonds for which no amendment was attempted, one inquorate bond, and 16 bonds for

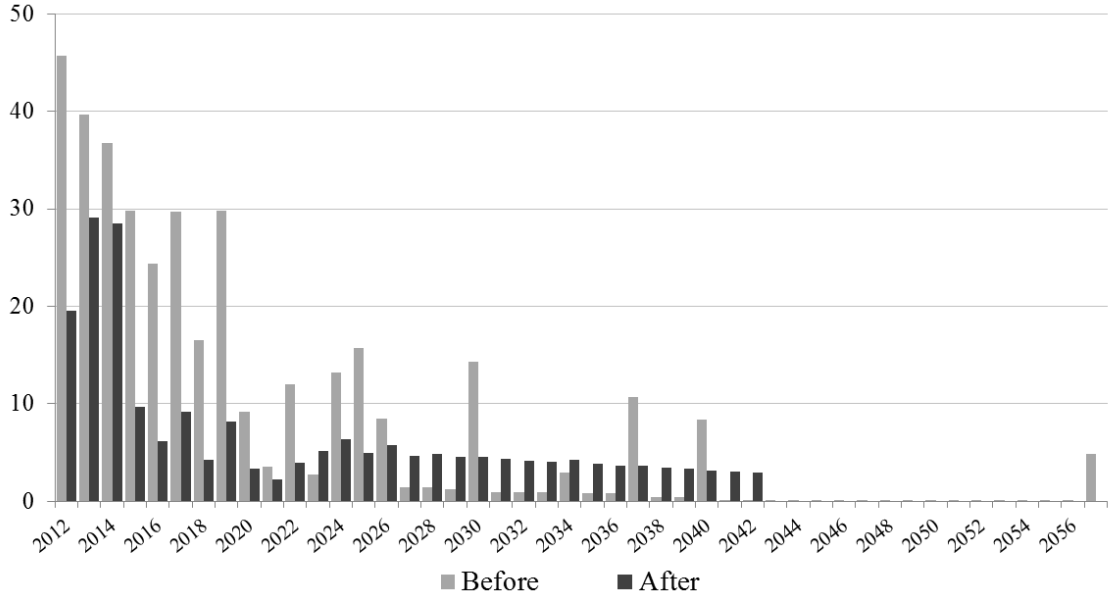
[23] See Appendix 3, which shows exit yields for all distressed debt exchanges since 1990 for which secondary market prices were available soon after the exchange. Sturzenegger and Zettelmeyer (2007b) and Cruces and Trebesch (2013) provide some evidence suggesting that exit yields tend to be abnormally high (even after restructurings that ultimately prove to be successful). Possible reasons include the high degree of uncertainty in the period immediately after a debt restructuring, and in some cases lack of liquidity in bond markets after defaults.

[24] The source of these numbers are press releases issued by the Greek Ministry of Finance on April 11 and 25, 2012. Note there is a slight inconsistency between the reported total participation of €199.2 and the €29.7 and €62.4 in new issuance: based on the face value conversion coefficient of 0.15 and 0.315 respectively, the latter should be the €29.9 and €62.7 respectively. The difference seems to be accounted for by the 2057 English law CPI-indexed bond with outstanding face value of €1.78 billion, which the Greek authorities counted as fully retired but of which only €0.67 billion was exchanged. See following footnote.

which the amendment was rejected by the bondholders.[25] In addition, there were holdouts for one Greek-law guaranteed bond (an Athens Urban Transport bond maturing in 2013). All other Greek-law sovereign and sovereign guaranteed bonds were amended and exchanged in full (see appendix tables A3 and A4 for details).

The final participation rate among foreign law bondholders was 71 percent, slightly lower than the 76 percent achieved by Argentina in 2005. However, because of the large share of domestic law debt and the application of the Greek Bondholder Act to bind in the domestic law bondholders, the share of holdouts in total eligible debt was much smaller, just 3.1 percent. So far, Greece has repaid the holdouts in full. As of July 2013, seven bonds involving holdouts have matured.[26]

Figure 2. Impact of exchange on Greece's debt service to private creditors



Note: Coupon plus principal repayments, at face value, in € billion. *Sources*: Hellenic Republic (Ministry of Finance and Public Debt Management Agency), Bloomberg, and authors' calculations.

Figure 2 shows how the debt exchange changed the payments expected by creditors. The series denoted "before" the exchange refers to the payment flows promised by Greece's old bonds, both interest and amortization. The series "after", which is decomposed in Figure 3, comprises both payment flows due to old bonds that were not exchanged (bonds in the hands of holdouts, national central banks and the ECB), flows promised by the new bonds, and payments flows associated with the short term EFSF notes (both the

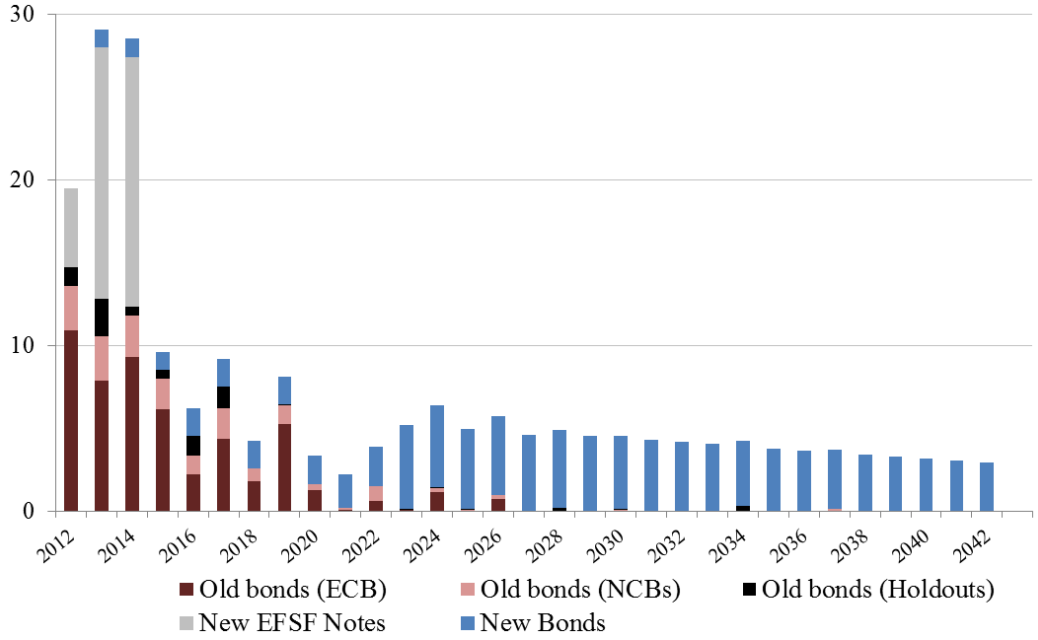
[25] This excludes a 2057 English-law CPI indexed bond, which was only partly exchanged (€0.67 out of €1.78 billion). For the remaining €1.11 billion, the government reportedly struck a deal "at terms more favourable to the Republic than PSI" (Ministry of Finance Press release, 11. April 2012). We have not been able to obtain information about these terms, but presume that these bonds were held by domestic institutional investors which may have received some other form of consideration by the Greek government.

[26] The first of these, an English-law sovereign bond with remaining face value of €435 million repaid on May 15, 2012, was reportedly almost entirely owned by Dart Management, a fund that had already held out in Brazil's 1992 Brady exchange and, recently, in Argentina (see Schumacher et al. 2013).

six-month notes that compensated investors for accrued interest, and the one and two year notes in the amount of 15 percent of the old face value).[27]

The main message from Figure 2 is that although the exchange significantly lowered the flows to investors as a whole, they did not significantly shift the payment profile into the future, as the longer maturities of Greece's new bonds (compared to most of the old ones) was offset by a bunching of payments due to the EFSF notes at the short end of the maturity profile. In addition, Greece's debts to non-participating investors—holdouts (€6.4 billion) and the ECB and national central banks (€56.7 billion)—were bunched at the short end (see Figure 3), and continued to exceed Greece's new long term bonds (€62.4 billion) in face value.

Figure 3. Post-exchange debt service



Note: In € billions, by type of creditor *Sources:* Hellenic Republic (Ministry of Finance and Public Debt Management Agency), Bloomberg, and authors' calculations.

3.2. CDS Settlement

Credit Default Swaps (CDS) held by investors seeking to protect themselves from a Greek default caught much attention in the initial phases of the Greek debt crisis. There was a fear that triggering CDS contracts would lead to bankruptcies of the institutions that had written CDS protection, much like the subprime crisis in the United States triggered the collapse of institutions that had written CDS protection on collateralized debt obligations backed by subprime loans. Many market participants interpreted the

[27] Payments associated with the GDP linked-security are ignored in the figures because of their small expected amount and the uncertainty surrounding them.

initial insistence of the official sector on a purely voluntary debt exchange (presumed not to trigger the CDS) in this light.

When it became clear, in January of 2012, that the exchange was unlikely to be purely voluntary, fears of contagion via the triggering of CDS contracts resurfaced. On March 9, 2012—the day Greece announced that the participation thresholds for amending the Greek sovereign bonds had been met—the Determinations Committee of the International Swaps and Derivatives Association (ISDA) declared a triggering credit event, citing the use of CACs to bind in non-participating creditors.

However, the consequences were anticlimactic: there was no contagion, and even some relief that the restructuring had been recognized as a credit event.[28] A CDS settlement auction was announced for March 19, resulting in payouts of €2.5 billion to protection buyers—a very small amount compared to the total size of the restructuring (less than 2 percent). CDS exposure had dropped sharply over the course of the crisis, as the costs of buying CDS protection kept rising. According to data compiled by the Depository Trust & Clearing Corporation (DTTC), the net notional volume of Greek CDS outstanding fell from more than €7 billion in end-2009 to below €2.5 billion in early 2012.

Although contagion was limited, the CDS settlement process posed a challenge, for two reasons. First, there was still limited experience in settling sovereign CDS contracts, since this was the first major case apart of Ecuador in 2009. Second, the Greek credit event occurred after a preemptive debt restructuring, as the credit event was not triggered by an outright payment default. CDS contracts are typically settled through an auction in which bid and offer prices quoted by dealers and requests to buy or sell a defaulted reference bond (the "cheapest-to-deliver" bond) are used to determine a final settlement price. In a cash settlement, a buyer of CDS protection then receives the difference between the auction price and the par value of the defaulted bond.[29]

In the case of Greece, however, the CDS auction took place *after* the bond exchange. This meant that most of the old bonds had already been exchanged by March 19 and those remaining were insufficient for the purposes of the auction. The ISDA Committee therefore decided to base the auction on the 20 *new* English-law instruments issued by Greece on March 12. This resulted in a final auction price of 21.5 cents, consistent with the price of the 2042 new bond (the cheapest new bond), in secondary markets prior to the auction.

It is remarkable that things worked out well eventually (Gelpern and Gulati, 2012). In particular, the settlement price derived from the par value of the new 2042 *bond* (only 31.5 percent of original principal), turned out to be the same as the par value of the new *bundle* received by investors per 100 cents of original principal. Holders of CDS

[28] Against the fear of contagion via triggering the CDS, there was a countervailing fear that *not* triggering the CDS in a situation that to the holders of Greek sovereign bonds looked and felt like a default would have had even worse contagion consequences, by demonstrating the futility of CDS protection in high-profile sovereign default cases. This, it was felt, might lead to a flight out of the bond markets of other highly indebted southern European countries, and perhaps "kill the CDS market" for the sovereign asset class more generally.

[29] Alternatively, there can be a "physical settlement" in which a bond holder with CDS protection delivers the defaulted bond to the seller and receives the par value in return.

protection thereby received roughly the difference between the face value of the original bonds and the value they received through the PSI, as they should have. Had the ratio of ESFS bills to new bonds in the package received by investors been considerably lower (higher) than it was, then the CDS payouts would have been considerably lower (higher) than the amounts needed to make investors "whole".[30]

It is difficult to say to what extent this happy outcome reflected luck or design. Given what was at steak—the credibility of sovereign CDS and of the ISDA settlement process—it is conceivable that some features of the debt exchange were chosen to facilitate the settlement of the CDS contracts. This may have affected the unusual design of the new package of securities offered to investors, in particular the large cash portion and the fact that Greece issued 20 new bonds across a long maturity range, including the 2042 bond that was ultimately used for CDS settlement.

3.3. Distributional Implications

We now compute the distributional implications of the restructuring, from three angles: First, aggregate investor losses; second, distributional implications across investors, and third, total debt relief received by Greece.[31]

Investor losses in the aggregate

As already mentioned in the discussion of the July 2011 financing offer, there are several ways to compute the loss, or "haircut", suffered by a representative investor holding sovereign bonds. Market practitioners define haircuts as 100 minus the present value of the new bonds offered. For the reasons explained above, this measure tends to exaggerates creditor losses, as it implies that so long as the value of the new bonds is below par, creditors suffer a haircut—even in an entirely voluntary debt management operation in which the new bonds have higher market value than the old bonds. We therefore take an alternative approach that follows our previous work (Sturzenegger and Zettelmeyer 2008, Cruces and Trebesch, 2013), but also private sector economists such as Ghezzi, Aksu and Garcia Pascual (2011) and Kopf (2011), namely, to compute present value haircuts as the percentage difference between the present value of the new and old bonds, both evaluated at the exit yield observable immediately after the exchange. This definition has two useful interpretations:

- First, it measures the loss suffered by a participating creditor compared to a situation in which he or she had been allowed to keep the old bonds and have

[30] As argued by Duffie and Thukral, (2012) the results of future CDS settlements could be made less arbitrary, if the settlement amount were based not on the post-exchange value of either the defaulted bond or a new sovereign bond, but rather on the value of the entire bundle of securities and cash received by an investor that has been subjected to an amendment of the original payment terms.

[31] Important distributional angles that are not covered in the analysis that follows include redistribution from the official sector to Greece as a result of change in bailout terms in March 2012, and the distributional implications of the restructuring *within* Greece. For example, Greek pension funds were hard hit (like other private sector creditors of the government), whereas banks and bank creditors were not hit at all, as banks were effectively compensated for losses on their sovereign bond holdings through a bank recapitalisation scheme. Establishing the overall distributional implications of the Greek crisis, bailout and restructuring is an area for future research.

them serviced with the same probability as the new bonds that were issued in the exchange. In other words, it compares the value of the old and new bonds in a hypothetical situation in which there would have been no discrimination against the holders of the old bonds.

- In actual fact, participating creditors of course chose the new bonds, suggesting that—if the haircut was positive—there must have been discrimination against holdouts in some form. Hence, the present value haircut can equivalently be interpreted as measuring the strength of the incentives that the debtor must have offered to prevent free riding—by threatening to default, or perhaps through other means. This leads to the question of what those incentives were in the case of Greece, and how they compare to previous exchanges. We take this up in the next section.

Although the present value haircut is conceptually simple, computing it in practice is not always straightforward. One problem is that the risk characteristics of the new bonds, and hence the exit yields, can be specific to the maturity of the new bonds (or more generally, the timing of the promised payment stream), which may differ from those of the old bonds. This was the case in Greece, where exit yields are available for bonds of 10 year maturity and up (Figure 1), but it is not clear what rate to use to discount old bonds of shorter maturity. Another problem is that the market on the first day of trading after a debt exchange may not be very liquid (for example, because some institutional investors are not yet in the market pending some rating action). Hence, the exit yield may not be entirely representative for the yield that establishes itself in the market shortly after the exchange, even if there is no new information about fundamentals in the intervening period.

We seek to address these problems by computing alternative aggregate haircut estimates based on three approaches (Table 3).

- The first column of Table 3 calculates the value of the old bonds using the average discount rate corresponding to the prices of the new bonds (15.3 percent). For the purposes of discounting shorter old bonds, this is likely too low.
- The second and third columns show the sensitivity of these results to using yields on two alternative dates: March 19—one week after the first date of trading; which incidentally coincides with the date on which the result of the CDS settlement was announced (16.3 percent); and April 25, the date on which the final exchange results were announced (18.7 percent).
- Finally, the last column of Table 3 shows the average haircut using a different discount rate for each bond depending on its maturity. For this purpose, we construct a yield curve which is based on observed data at the longer end (based on the exit yields of the newly issued bonds) as well as imputed yield curve values for the shorter end where no exit yields are observed. The latter are derived using a simple valuation model which assumes that the high observed long-term yields are driven by some combination of a continued fear of default in the short run and the expectation of lower (but higher than pre-crisis) sovereign yields in the long run if a new default is avoided. Combinations of these parameters—the short- and medium-run cumulative default probability, and the long-run yield—are calibrated to reproduce the observed high but falling

exit yields at the longer end. Yields at shorter end of the curve are then calculated using these calibrated parameters and the actual cash flows of the shorter bonds Appendix 4 explains this procedure in more detail and undertakes some sensitivity analyses.

Computing the haircut also requires valuing the GDP-linked securities that were part of the offer. Each investor received the same number of units of these securities as principal units of new bonds, that is, 31.5 percent of the outstanding old principal. On the first day of trading, the price of each unit was 0.738 per 100 units of the *new* bonds; hence, the value for 100 units of the old bonds was 0.315*0.738 = 0.232. Put differently, we find that the GDP warrants were nearly worthless, less than 0.3 percent of original principal. No matter which valuation approach is chosen, we find that their value is below 0.3 percent of original principal.

Table 3. Creditor "haircut" in Greek debt restructuring

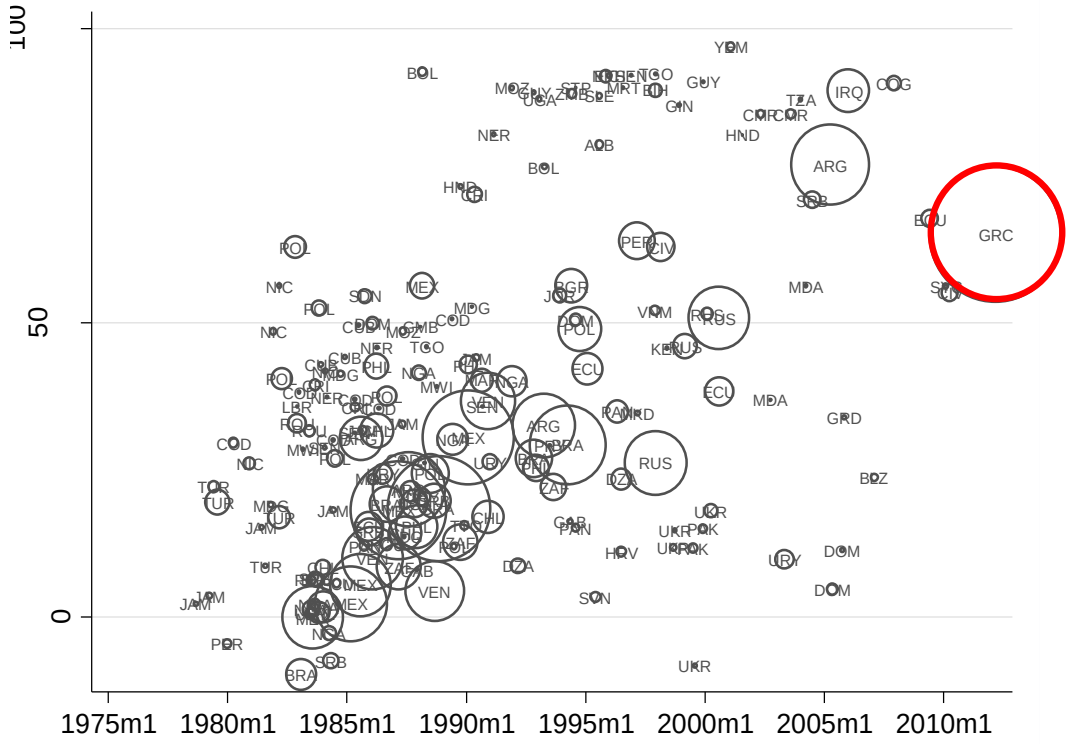
	Assumed discount rate (percent)[1/]			
	15.3	16.3	18.7	Curve[2/]
Value of new securities received (PV_{new})	23.1	22.5	21.2	22.8
Haircut in market convention (100-PV_{new})	*76.9*	*77.5*	*78.8*	*77.2*
Value of old bonds (PV_{old}) 2/	65.3	63.3	59.0	56.5
Present value haircut (100*(1-PV_{new}/PV_{old})	*64.6*	*64.4*	*64.0*	*59.6*

Notes: In percent of outstanding principal. New securities consisted of cash-like EFSF notes (valued at 15 percent of 'old' outstanding principal), new English-law government bonds (valued at 6-7.9 percent of old principal, depending on the discount rate applied) and GDP warrants (valued at 0.23 percent of old principal, corresponding to the issue price of 0.738 percent of the principal of new bonds issued).
1/ Used for discounting payment streams of both new and old Greek government bonds.
2/ Based on an imputed yield curve, see online appendix for details. The case shown is the one with assumed peak default probability after 2 years; 12 month standard deviation.
Sources: Authors' calculations based on Bloomberg and Hellenic Republic (Ministry of Finance).

Table 3 shows that the present value haircut of the Greek debt exchange was in the range of 59—65 percent. Using a fixed discount rate for all of the old bonds leads to estimates close to 65 percent regardless of whether we use the exit yield of 15.3 percent or the somewhat higher rates at which yields stabilized in subsequent weeks (16.3). However, the yield curve approach produces an average haircut that is notably lower; at around 59 percent (sensitivity analysis suggests a range from about 55 to 61 percent). The reason for this is that the valuation model used to construct discount rates for maturities of less than 10 years assumes that as of March 2012, much of the sovereign risk in Greece was concentrated in the period between the May 2012 election and mid-2015, as a result of election uncertainty, the continuing recession, and large debt repayment obligations to the ECB and (in 2014 and 2015) the IMF. As a result, the constructed discount rates in the maturity spectrum between 1 and 8 years, in which the bulk of Greece's old bonds were set to mature, are significantly higher than the average exit yield of 15.3 percent, resulting in a lower value of these bonds, and hence lower haircut estimates.

How did the losses suffered by Greek bondholders compare to previous debt restructurings? The answer is in Figure 4, which compares the current offer with virtually all debt restructuring cases involving private creditors since 1975, based on estimates by Cruces and Trebesch (2013). For the purposes of historical comparison, we stick to the 64.6 percent haircut that is obtained by using the average exit yield for discounting, since the same approach was also used by Cruces and Trebesch.

Figure 4: Haircut and size of the Greek exchange in historical perspective



Note: The figure plots the size of the present value haircut, using the methodology described in the text, for Greece (2012) and 180 restructuring cases from 1975 until 2010. The circle sizes represent the volume of debt restructured in real US$, deflated to 1980 (excluding holdouts). For Greece, we use the haircut estimate of 64.6 percent (column 1 in Table 2) and the exchange volume of US$ 199.2 billion (excluding holdouts).
Sources: Cruces and Trebesch (2013, all other deals) and authors' calculations (Greece).

Within the class of high- and middle-income countries, only three restructuring cases were harsher on private creditors: Iraq in 2006 (91 percent), Argentina in 2005 (76 percent) and Serbia and Montenegro in 2004 (71 percent). There are a number of cases of highly indebted poor countries, such as Yemen, Bolivia, and Guyana, that imposed higher losses on their private creditors. However, the Greek haircut exceeds those imposed in the Brady deals of the 1990s (the highest was Peru 1997, with 64 percent), and it is also higher than Russia's coercive 2000 exchange (51 percent).

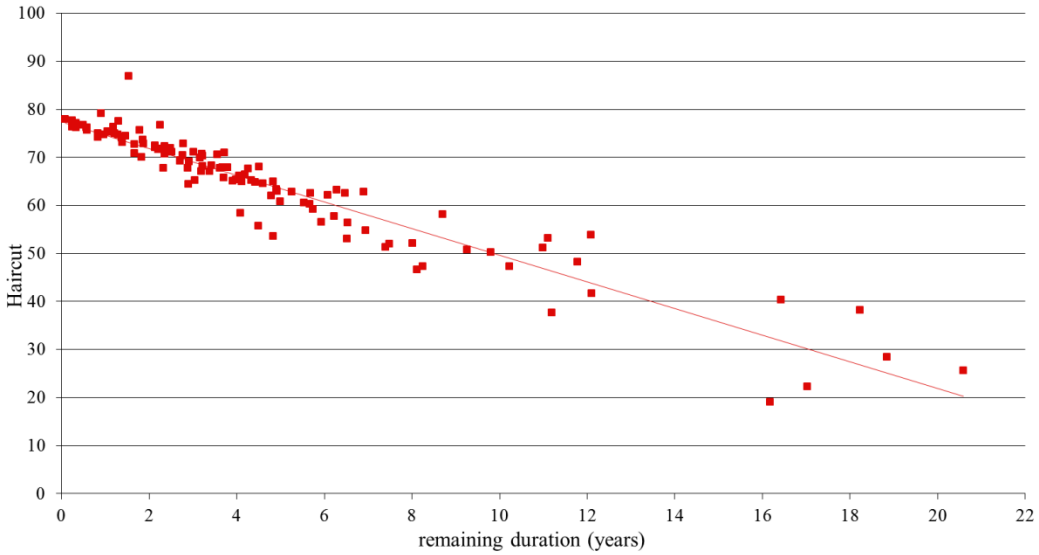
The figure also shows that the 2012 Greek exchange was exceptional in size, exceeding the next largest sovereign credit event in modern history, which to our knowledge was Russia's default on 1.7 billion British pounds in 1918, equivalent to just under 100 billion in 2011 euros. The Greek exchange also easily surpasses the German default of

1932-33, the largest depression-era default on foreign bonds, comprising 2.2 billion US dollars at the time, or approximately 26 billion in 2011 euros.

Bond-by-bond "haircuts"

An important characteristic of the Greek exchange was that every investor was offered exactly the same (and only one) package of new securities. At the same time, residual maturities across Greece's eligible bonds ranged from almost zero (March 20, 2012 bond) to 45 years (Greece had issued a CPI-indexed 50-year bond in 2007). Because coupon rates were typically in the order of 4-6 percent—much lower than the exit yields—the present value of long bonds was much less than those of short bonds (for the same face value). As a consequence, there are large differences in haircuts across bonds. Short dated bonds—were investors were asked to give up full repayment that was almost within reach—suffered much higher haircuts (up to 80 percent) than longer dated bonds, whose face value would have been heavily discounted in the high yield environment prevailing in Greece after the debt exchange (Figure 5). This fact is robust to the discounting approaches compared in Table 3.[32]

Figure 5. Bond-by-bond haircuts, by remaining duration



Note: Calculated based on a uniform 15.3 percent discount rate.
Sources: Authors' calculations based on Bloomberg and Hellenic Republic (Ministry of Finance).

We are not aware of a previous sovereign restructuring case with such a large variation in present value haircuts across instruments. There are a few examples of selective defaults, in which countries discriminate between domestic and foreign creditors as a

[32] If imputed yields are used for discounting, the drop at the beginning is much faster initially, followed by a plateau at around 50 percent, and then a further gentle drop. This reflects higher discount rates in the 2-6 year range, which imply that the values of the old bonds in this maturity range are lower in this approach than if a uniform discount rate is used.

group, or across types of debt instruments.[33] But within these groups, sovereigns typically tried to limit the variation of haircuts across bondholders by adapting the terms of the new instruments to the terms of the old instruments.[34] While there have been a number of previous exchanges with "one-size-fits-all" offers—such as in Pakistan 1999, Moldova 2002, or Cote D'Ivoire 2010—these tended to be simple operations directed at just a few outstanding instruments.

What explains the large variation in haircuts across bondholders? According to individuals close to the exchange, one motivation for the one-size-fits all approach was to keep it simple in order to get the deal done before March 20, 2012 when the next very large bond was coming due (€14.4 billion). It is also likely that the members of the creditor committee were mostly invested in longer-dated Greek instruments. Moreover, the Troika, Greece, and the creditor committee may all have been sympathetic to taking a tough approach against short-term creditors, because many of these were distressed debt investors that had deliberately bought short-dated instruments at large discounts in the hope of still being repaid in full.

Debt relief

The present values and haircuts presented in Table 3 may not be a good estimate of the debt relief received by the Greek sovereign, for three reasons. First, as already discussed, from the perspective of a debtor country it may be appropriate to apply a discount rate that reflects expected future borrowing rates over the lifetime of the new bonds, rather than the yields prevailing immediately after a debt exchange. Second, Greece borrowed the quasi-cash portion of the "PSI consideration" (€29.7 billion in short term EFSF notes) from the EFSF. As a long-term liability with relatively low interest rates (namely, the funding costs of the EFSF plus a small mark-up), its present value can be expected to be lower than the value of the EFSF notes to investors (except at very low discount rates). Third, Greece borrowed €25 billion from the EFSF to compensate Greek banks for PSI related losses.[35] The present value of this restructuring-related liability must be taken into account when computing the overall debt relief.

It is very difficult to say when, and at what rate, the government will be able to return to capital markets on a regular basis. While there are estimates for OECD countries linking debt, deficits, and growth to borrowing rates (for example, Ardagna, Caselli, and Lane, 2007), these variables are themselves extremely difficult to forecast for Greece. We

[33] Recent examples include Russia's 1998-2000 defaults and restructuring, and Jamaica's 2010 sovereign debt swap, which both involved domestically issued debt but left Eurobonds untouched. See Sturzenegger and Zettelmeyer (2007a) and Erce (2012).

[34] In Ecuador's 2000 debt exchange, for example, shorter dated instruments were exchanged at par while holders of longer dated bonds suffered a face value haircut; in addition, shorter-term bondholders were given preferential access to a shorter maturity new bond. In Argentina's 2001 "Phase 1" exchange and Uruguay's 2003 exchange, the maturities of the new bonds depended on the residual maturities of the original bonds, i.e., bondholders with shorter instruments were offered shorter new bonds.

[35] An IMF report of March 16, 2012: http://www.imf.org/external/pubs/cat/longres.aspx?sk=25781.0 states that the Greek "PSI deal will trigger impairments of about €22 billion." However, in April 2012, Greece borrowed €25 from the EFSF for bank recapitalisation purposes. To avoid overestimating the debt relief associated with the Greek PSI, we go with the higher number.

therefore compute debt relief based on three alternative assumptions about borrowing conditions in the long term.

1. The average nominal interest rate on public debt assumed by the IMF at the outer end (for 2030) of its March 2012 debt sustainability analysis, namely 5 percent.
2. The expected long-run yield on the new Greek bonds implicit in the prices at which these bonds traded after issue, which is about 8 percent.[36]
3. A rate of 3.5 percent, which can be rationalized as corresponding roughly to Greece's expected borrowing rate from the official sector. This would be appropriate in a scenario in which Greece remains dependent on official sector support in the medium term.

For reference purposes, we also show the debt relief that would be implied by the exit yield of 15.3 percent (Table 4).

Table 4. Debt relief attributable to March-April 2012 debt restructuring

	Assumed discount rate (percent)			
	3.5	5.0	8.0	15.3
Present value (PV) of €199.2 billion old bonds (PV_{old})	217.2	199.5	171.9	130.1
PV of €29.7 billion EFSF PSI sweetener (PV_{efsf})[1/]	31.4	25.3	17.2	8.2
Present value of €62.4 new bonds (PV_{newb})	61.9	49.8	33.6	15.7
Present value debt relief (percent)[2/]	*57.1*	*62.4*	*70.5*	*81.7*
PV of €25 billion EFSF bank recap loan (PV_{bnk})[1/]	25.7	21.5	15.3	7.6
PV debt relief net of recap costs (percent)[3/]	*45.3*	*51.6*	*61.6*	*75.9*
PV debt relief net of recap costs (€ billion)[4/]	*98.3*	*103.0*	*105.9*	*98.7*
in percent of GDP[5/]	*50.7*	*53.1*	*54.6*	*50.9*

Notes: In billions of euros unless otherwise stated.

1/ Present value of Greece's liabilities to the EFSF, see http://www.efsf.europa.eu/about/operations/ for details. Uses Bloomberg and the IMF World Economic Outlook forecasts to project EFSF funding costs and assumes that Greece pays a 100 basis point spread over funding costs.

2/ $100*(PV_{old}-PV_{newb}-PV_{efsf}-PV_{gdp})/PV_{old}$ where PV_{gdp} denotes the present value of the GDP kicker, valued at €0.45 billion (0.738 per 100 unit of new principal, consistent with valuation assumption in Table 3)

3/ $100*(PV_{old}-PV_{newb}-PV_{efsf}-PV_{bnk}-PV_{gdp})/PV_{old}$ where PV_{gdp} is valued at €0.45 billion (see note 2/)

4/ $PV_{old}-PV_{newb}-PV_{efsf}-PV_{bnk}-PV_{gdp}$, where PV_{gdp} is valued at €0.45 billion (see note 2/)

5/ Using preliminary 2012 GDP of Greece from Eurostat, €193.75 billion

Sources: Authors' calculations based on Bloomberg and Hellenic Republic (Ministry of Finance).

The first line of Table 4 shows the present value, at various discount rates, of Greece's €199.2 billion old bonds that were restructured in the exchange. The next two lines show the present values of the two new liabilities incurred by Greece as a result of the

[36] To rationalize the exit yield curve mapped out by Greece's new bonds, one needs to assume not only high default probability in the short run, but also a long-term yield (in the event that default in short to medium term can be avoided), which turns out to be about 8 percent (see Appendix 4 for details). If Greece remains in the euro area, this would imply long-term *real* interest rates of about 6 percent, which is not implausible for a high-debt OECD country (for example, Italy borrowed at long term real interest rates of 6.5-7 percent between the late 1980s and the mid-1990s).

exchange—to the holders of the new bonds, and to the EFSF. The following line, "present value debt relief (percent)" is the mirror image of the "present value haircut" line in Table 3. At a discount rate of 15.3 percent, this is much higher than the haircut computed for the same discount rate in Table 3, reflecting the fact that at this discount rate, Greece effectively obtained debt relief from two sources—the private bondholders, but also the EFSF, from which it had borrowed the €29.7 billion in quasi-cash given to investors at much more favorable rates than 15.3. However, at the lower discount rates meant to reflect Greece's *future* borrowing costs, percentage debt relief—ignoring bank recapitalization costs—is about in line with the haircuts suffered by investors.

Next, the table computes debt relief net of bank recapitalization costs in both percentage and absolute terms. The main result is that the restructuring resulting in debt relief of €98 billion to €106 billion in present value, or about 51-55 percent of GDP, very close to the face value reduction of €107 billion. This is very large in historical comparison. The next largest operation to restructure privately held debt, Argentina's 2005 debt exchange, achieved less than half that amount as a share of GDP, namely, about 22.5 percent of GDP, based on a discount rate of 7.7 percent (Sturzenegger and Zettelmeyer 2007b).

3.4. How the Free Rider Problem Was Overcome

Every holder of Greek bonds, even members of the steering committee that negotiated the terms of the exchange offer with Greece, was in principle free to accept or reject Greece's exchange offer. Furthermore, every creditor was a potential free rider in the sense that no individual creditor was large enough to "sink" the exchange on its own (in the sense that Greece would have missed the 90 percent participation threshold). This leads to the question of what ultimately induced the high creditor participation of almost 97 percent, notwithstanding a present value haircut of more than 50 percent for all but the most long-term creditors.

Creditor composition and political pressure are an important part of the answer. The majority of Greek bonds were in the hands of large Greek and other European banks and insurance companies. This meant that European governments and regulators, i.e., Greece's official creditors, were able to exert pressure on these banks to participate. As famously remarked by Commerzbank's Chief Executive Martin Blessing, the participation of large European banks in the restructuring was "as voluntary as a confession during the Spanish inquisition".[37] The same is probably true for domestic Greek banks, which were asked by the Greek sovereign to participate. Hence, it is not surprising that on March 6, just prior to the exchange deadline, the major members of the creditor committee released press statements reiterating their commitment to participate in the offer.[38]

However, the members of the creditor committee held at most 40 percent of the debt eligible for the exchange. Additional debt may have been in the hands of other

[37] WSJ.com, February 24 2012
[38] *Financial Times*, March 6, "Greece inches closer to €206bn debt deal."

institutions amenable to official pressure, but according to market estimates in early 2012, these institutions together held at most €120 billion out of the almost €200 billion that were eventually exchanged. The problem was how to deal with the remaining €80 billion (at least) of potential free riders that might be tempted to hold out in the hope of being repaid in full or receiving a better deal.

In solving this problem, Greece and its legal and financial advisors could look to the experience of previous distressed debt exchanges. Following the return to bonds as the predominant form of emerging market finance in the early 1990s, there was a widespread fear that the dispersion of these bonds in the hands of many creditors would make it virtually impossible to achieve orderly debt restructuring. Yet, history by and large proved these fears wrong: Almost all debt exchange offers since the Brady deals of the 1990s have been successes in the sense that creditor participation has been high, and restructurings much quicker than in the era of bank finance (see Bi et al., 2011 and Das et al., 2012 for details). To deter free riding among dispersed bondholders, countries used a combination of three mechanisms:

- Most frequently, threatening potential holdouts with non-payment—an approach that is particularly credible when an exchange offer follows a default, as happened in Russia (2000), Argentina (2005), and a number of other cases—or undertaking actions to weaken their legal position in the event of litigation. In some exchanges, such as Ecuador (2000) and Uruguay (2003), countries used consent solicitations ("exit consents") to weaken the legal protections in the bonds of holdout creditors, taking advantage of the fact that the non-payment clauses of bond contracts can generally be changed with simple majority (Buchheit and Gulati, 2000).
- Less frequently, "collective action clauses" that allow a qualified majority of creditors to change the payment terms of the bonds against the opposition of a group of holdouts, if such clauses were present.[39]
- Finally, legal devices or financial enhancements that put tendering bondholders at advantage in future sovereign debt crises.[40] This can be achieved through the already mentioned "exit consents", which weaken the position of holdouts in absolute and relative terms, or by offering creditors cash, collateralized securities, securities issued by a more creditworthy borrower, or securities that are harder to restructure and hence de facto senior. Examples include the collateralized "Brady bonds" offered to bank creditors that had suffered default in the 1980s and the Russian 2000 debt exchange, which replaced debt owed by

[39] Prior to Greece (2012), collective action clauses had been used in Ukraine (2000), Moldova (2002), to restructure Uruguay's yen-denominated bond (2003), in Belize (2007), and in Seychelles (2009). However, in the first three cases they were used for only one bond, and in the last two the number of bonds involved was small. Possible reasons include the fact that bonds issued in New York tended to lack such clauses prior to 2003, and that CACs are of limited utility in restructurings involving multiple bond issues, because they have to be voted on bond-by-bond, and holdouts can acquire blocking positions in individual bond issues.

[40] This effect can lead an individual creditor to accept even when suffering a large haircut, and even conditional on all other creditors accepting, because it implies that the original instrument is riskier, and hence needs to be discounted at a higher rate, following a successful exchange. This is true even in a "voluntary" setting in which the debtor genuinely would continue servicing a holdout's instrument so long as it has the funds to do so. See Gulati and Zettelmeyer (2012a) for details.

a state-owned bank with Eurobonds owed directly by the Russian sovereign and issued under foreign law.

The July 2011 proposal was an attempt to deal with free riding only through the last mechanism, by offering an upgrade from Greek law to English law combined with collateralized principal. Even after the official creditors had decided on "stronger PSI" in October 2011, the idea of undertaking a "purely voluntary" debt exchange relying only on positive participation incentives lingered on. By January 2012, however, it became clear that there was a problem with this approach: offering a combination of cash incentives and a safer instrument would not, by itself, address the free rider incentive for creditors holding sufficiently short-term bonds. Conditional on a successful voluntary exchange, short-term bondholders are very likely to be repaid in full even if the claim is junior to the new debt, as the chance of a new debt crisis in the (short) period between the exchange and the maturity date is very low. Hence, it seemed very unlikely that the holders of a €14.5 billion March bond, whose participation was considered essential, would agree to tender (Gulati and Zettelmeyer, 2012a).

The end result was that Greece relied on all three of the above mechanisms, although with different emphasis, and in new ways:

First, and most importantly, it introduced a powerful collective action mechanism into domestic law bonds. In February 2012, the Greek parliament enacted the Greek Bondholder Act, which allowed it to impose the new payment terms on holdouts with the agreement of two-thirds of face value weighted votes. Unlike the English-law bonds, this threshold applied across bonds rather than just bond-by bond, subject only to a participation quorum of at least 50 percent of face value. In the end, this aggregation feature turned out to be pivotal for the results of the debt exchange, as it allowed the restructuring of 100 percent of the Greek-law sovereign bonds, which themselves made up over 86 percent of the bonds covered by the restructuring.

Second, the bundle of new securities was designed to be as attractive as possible, for a given haircut, to bondholders who feared (correctly) that Greek sovereign risk would remain high even after a successful debt exchange. Three features of the "PSI consideration" made it particularly valuable to investors in these circumstances:

- Bondholders were offered an exceptionally large cash sweetener, in the form of highly rated EFSF notes—worth 15 percent of the 'old' bond's face value and due to mature in 2013 and 2014.[41] These notes turned out to be by far the most valuable component of the securities bundle offered to creditors, representing almost two-thirds of its value (15 out of 23; see Table 3). Regardless of what happened to Greece, participating investors would have this "bird in hand".
- The new bonds were issued under English law, and included standard creditor protections such as pari passu, negative pledge, and cross-default clauses. Greek-law sovereign bonds contained almost none of these protections. However, the contract provisions were arguably less important than the governing law itself.

[41] To our knowledge, this was the largest cash sweetener ever offered in a sovereign debt restructuring (aside from outright cash buybacks). According to data by Cruces and Trebesch (2013), the average cash sweetener across 180 debt restructurings since 1975 amounted to only 3.6 percent.

Greek-law bondholders who had just experienced the power of the local legislature to change contract provisions retroactively would find some comfort in the fact that English law bonds would preclude a change of their contractual rights through legislative fiat.

- Furthermore, the new bonds were issued under a "co-financing agreement" that created an exact symmetry between Greece's debt service to the new bondholders and its debt service to the EFSF related to the EFSF notes and bills that it had received for the purposes of the debt exchange. In the event of a shortfall in payments by Greece, a common paying agent committed to distributing this shortfall pro rata between the EFSF and the bondholders. Hence, the co-financing agreement made it difficult for Greece to default on its bondholders without also defaulting on the EFSF. The co-financing agreement also stipulates that the payment terms of the new bonds cannot be amended without the consent of the EFSF, and imposed a cap on new bond issues.

Apart from making the "PSI consideration" more attractive to risk-averse investors, the implication of the last two features was to commit Greece to an aggressive stance vis-à-vis holdouts in the event of a future default. Faced with the choice of defaulting on "old" Greek-law bonds whose terms could be changed through an act of parliament or on new bonds that exposed the Greek sovereign to litigation in foreign courts and forced it to also default on the EFSF, Greece would surely opt for the latter.

Finally, although the Greek government went out of its way to appear non-coercive before and during the exchange offer—for example, the February 24 invitation refers to the exchange as a "voluntary liability management transaction by way of a voluntary bond exchange"—it did, at the last minute, adopt a harsher tone towards potential holdouts. On March 5, three days before the expiry of the exchange deadline, Greece issued a press release stating that "Greece's economic program does not contemplate the availability of funds to make payments to private sector creditors that decline to participate in PSI." On the same day, Greek finance minister Evangelos Venizelos was quoted as saying that "Whoever thinks that they will hold out and be paid in full, is mistaken" (Reuters, March 5, 2012).[42]

Although it is impossible to say exactly how much either the upgrade in "safety" or fear of discrimination contributed to the success of the exchange offer, it is clear that the safety upgrade was viewed as essential ex ante and that one or both played a significant role ex post. Even a solid commitment by members of the creditor committee would not have been enough to ensure that the two-thirds majority threshold specified by the Greek Bondholder Act would be met. With hindsight, we know that over 82 percent of Greek law bondholders exchanged their bonds and an additional 3.3 percent voted in favor of the amendment, far exceeding the holdings of the institutions that were either members of the creditor committee or otherwise susceptible to regulatory pressure. Thus, there must have been a significant contingent of potential free riders (perhaps 20 to 30 percent

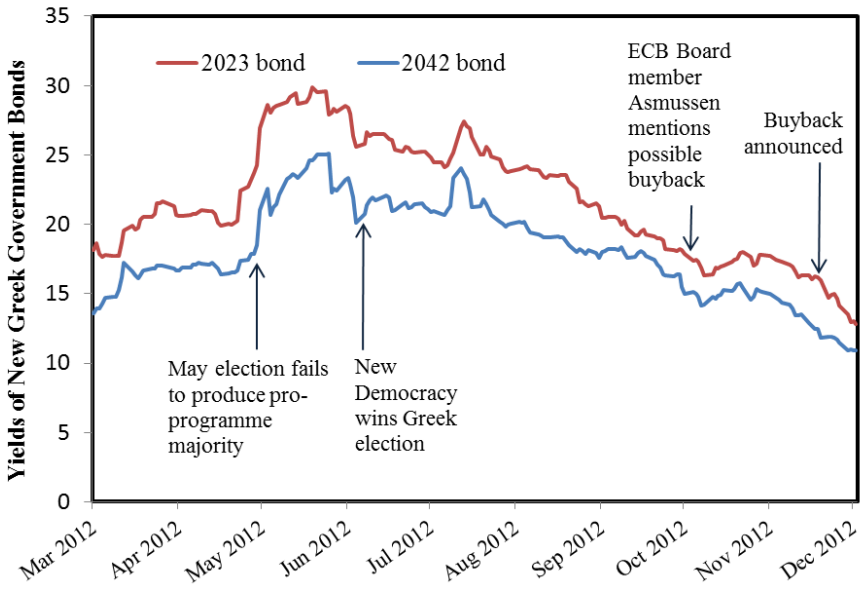
[42] Even so, an analysis of Greece's behaviour using an index of government coerciveness developed by Enderlein et al. (2012) indicates that the Greek government's actions were among the least coercive in a sample that includes all distressed debt exchanges since 1990. Only Uruguay 2003 was less coercive as far as debtor behaviour is concerned. See Appendix 5.

of old principal) that opted in favor of the offer or amendment as a result of some combination of sweeteners and fear of discrimination.

4. From Debt Exchange to Buyback

Despite the success of the debt exchange and the associated approval of a second official bailout program for Greece on March 14, 2012, high yields on the new bonds signaled the market's view that a second default in Greece continued to be a clear and imminent danger. Part of this had to do with domestic political and social opposition to the adjustment program, which materialized in the general elections in May with the unexpected rise of the left-wing Syriza party. The ensuing political deadlock receded only after a second election in June enabled a pro-bailout coalition government under a new Prime Minister, Antonis Samaras (Figure 6).

Figure 6. Yields of new Greek sovereign bonds from issue date until buyback



Source: Bloomberg

However, continued high default risk also had to do with the design of the March debt exchange and the associated second bailout program itself. Greece had received a high degree of debt relief, but only at the price of promising more austerity and structural reform which—given its economic and social troubles—did not seem plausible to many outside observers. At the same time, debt service after the exchange continued to be surprisingly high in the short term. This reflected the compromise that had made the debt exchange possible in the first place: getting official Europe and the ECB to agree to a restructuring required exempting the ECB and national central banks from a haircut, and also taking a soft approach vis-à-vis free riders. At the same time disproportionately high haircuts discouraged particularly short term bondholders from taking part in the exchange. As a result of all these factors, the debts to ECB, national central banks and

holdouts implied payments of more than €10 billion in each year between 2012 and 2015 (see Figure 3). This meant that there was no room for slippage: if official disbursements under the program stopped or were delayed, a default on the ECB, in particular, was very much in the cards, and with it, potential exit from the euro.

In the event, program payments *were* delayed, as the program ran off track almost immediately as result of the May and June elections and protracted negotiations with the new government. An initial set of disbursements under the March program—€75.6 billion in total, three quarters of which was financing for the debt restructuring and the associated bank recapitalization—took place between March and June, but over €36 billion in additional EFSF and IMF payments promised for the second and third quarter were withheld. Greece coped by continuing to cut spending, accumulating arrears on other government liabilities and selling T-bills to its banks. A critical moment came on August 20 when Greece repaid over €3 billion to the ECB, using ad-hoc financing from the ECB through the Emergency Liquidity Assistance (ELA) mechanism.[43]

At the same time, the economic news was not encouraging, especially with respect to growth. As summarized by the IMF (2013, p. 11) "the deepening recession created further headwinds for fiscal adjustment, increased the burden of Greece's debt, and raised substantially the probability that Greece would get stuck in a weak-confidence, high-debt, low-growth trap". The privatization program came to a near-complete halt, yields on Greek bonds remained high even after the political crisis had been resolved, and by September 2012, it became clear that the budget shortfall was even larger than expected, up to €30 billion, thus substantially increasing the Greek debt/GDP ratio for 2012.

Against this backdrop, the IMF began to demand further debt relief for Greece as a condition for further IMF disbursements. Given that by far the largest creditor of Greece at this point was the EU—both through the EFSF, and through the "Greek Loan Facility" (GLF) that had financed the first bailout program—meaningful debt relief could only come from the official sector. At the same time, euro area leaders balked at the idea of large scale debt relief so soon after large scale official lending had been made available to Greece at terms that were already significantly more favorable than the first package. There was particular resistance against politically highly visible cuts in the face value of debt owed by Greece.

The result was a compromise within the Troika, involving four elements. First, longer maturities and lower interest rates on GLF and EFSF lending (but no face value reduction). Second, a commitment to return profits made in connection with ECB purchases of Greek bonds to Greece. Third, EFSF funding for a partial buyback of Greece's newly issued bonds, which were still trading at a large discount (prior to the

[43] According to press reports, on August 2, 2012 the ECB governing council approved a request from the Bank of Greece to raise the ceiling of short-term paper that it could accept as collateral for emergency liquidity assistance to Greek banks from €3 billion to €7 billion. This allowed the Greek government to raise the money to repay the ECB by selling €4 billion in T-Bills to Greek banks on August 14. See "ECB saves Greece from bankruptcy by securing emergency loans paper", Reuters, 3. August 2012; "Greece avoids default ... for now", CNN Money, 17. August 2012.

announcement, about 28 cents for each euro of face value). Finally, a commitment by the Eurogroup to "consider further measures and assistance, including inter alia lower co-financing in structural funds and/or further interest rate reduction of the Greek Loan Facility, if necessary, for achieving a further credible and sustainable reduction of Greek debt-to-GDP ratio, when Greece reaches an annual primary surplus, as envisaged in the current MoU, conditional on full implementation of all conditions contained in the programme."[44] The latter was likely important to the IMF, which was concerned that the debt relief granted by the EU was not going far enough.[45]

4.1. The December Buyback: A Boondoggle?

The most controversial element of the November package, and the only one involving private creditors, was the proposed buyback of Greek sovereign bonds issued only nine months earlier. From the perspective euro area leaders, the appeal of this proposal was that it allowed a face value reduction of Greek debt without requiring an unpopular nominal write down on the official debt. Indeed, when the buyback was carried out on December 12, 2012, it used €11.3 billion in EFSF financing to retire €31.9 billion of Greek bonds, hence reducing the face value of Greece's debt by €20.6 billion.[46] On this basis, it was declared an important success in the quest to put Greece's debt on a sustainable path,[47] and cleared the way for the next installments of EFSF and IMF disbursements.

At the same time, the average price at which Greece had bought back its debt, 34 cents per euro of face value, had increased by over 20 percent since the buyback was announced in late November. This seemed to confirm a problem with voluntary buybacks that economists had been pointing out for some time, triggered by the experience of the Bolivian buyback of 1988:[48] namely, that their benefits tend to be appropriated by the creditors, in the form of a higher market value of debt, rather than by the debtor country.

The question is to what extent this is true for the case of Greece, and whether and to what extent Greece improved its debt sustainability as a result of the buyback. To answer these questions, it is necessary to briefly recall the essence of the "buyback boondoggle" argument—that is, the claim that voluntary debt buybacks are generally a waste of public funds. The argument consists of two parts.[49]

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[44] See Eurogroup statement on Greece, 27. November 2012.

[45] In its January 2013 report on Greece, the IMF states that, if macro risks played out, "additional debt relief and financing would be needed from Greece's European partners". Specifically, this "would require an upfront haircut of about 25 percent on EFSF loans, GLF loans, and ECB SMP bond holdings." (IMF 2013, p. 39).

[46] Initially, a ceiling of €10 billion EFSF financing had been set for the buyback, but following the buyback auction, the EU agreed to finance a slightly higher amount.

[47] See Eurogroup statement on Greece, 13. December 2012.

[48] Key contributions include Bulow and Rogoff (1988) who coined the term "buyback boondoggle", Krugman (1989), Froot (1989), Dooley (1989), and Krugman et al. (1991). For summaries and commentaries in the context of the euro area crisis see Claessens and Dell'Ariccia (2011), Manasse (2011) , Adam (2012), Sterne (2012) and various FT Alphaville blogs; for example "The return of the Greek buyback (boondoggle)", October 19, 2012.

[49] See Claessens and Dell'Ariccia (2011) for a slightly different and more detailed rendering of the same two points, and an overview of the pros and cons of buybacks.

The first is that the reduction in debt service obligations expected from the buyback—and hence the increase in the probability that a distressed sovereign will actually be able to service the remaining debt—will also result in a secondary market increase of the debt, after the buyback is announced. The average buyback price will therefore be generally higher than the initial price of the debt. This result is an inescapable consequence of the voluntary nature of the buyback. If debtors expect the debt to decline as a result of the buyback, they will no longer be willing to sell at the initial price, because this no longer reflects the true value of the debt. As a result, "negotiated buybacks", which cap the extent of the price rise (or try to lock in the pre-announcement price), are always preferable to voluntary buybacks, at least from the perspective of debt reduction.

Note, however, that the extent to which the price actually rises in a voluntary buyback will depend on the circumstances. For example, compare a situation where the cash used in the buyback is a gift from donors (as in the famous 1988 Bolivian case) with another where it is borrowed from a senior lender such as the IMF. In both cases, the expected net reduction in the face value of debt service obligations will tend to push the price up. But in the case of the IMF-financed buyback, there is a countervailing effect: private borrowers realize that if there is a debt problem, they will be last in line. This means that the buyback price will rise less compared to the pre-buyback price (it is even possible to construct examples where it would fall).

The second part of the argument, which is more controversial,[50] assumes that the benefits of the buyback to the country can be judged by the change in its net asset position as a result of the buyback, with debt measured at market prices. For example, the buyback critics of the late 1980s would feel that a situation in which the market value of the debt is unchanged after the buyback—because the reduction in face value is offset by an increase in the price of the debt, as happened in Bolivia—is clear waste of public money. Implicit in this view is the assumption that debt repayment involves a zero-sum game between a debtor country and external creditors in which the value of the debt reflects the expected resource flow from debtors to creditors.[51] However, this may not be true in situation in which a default has large domestic costs, or involves a deadweight loss. In such cases, a buyback that helps the country avoid default may well be welfare improving even when it leaves the market value of the debt unchanged (indeed, even if it increases the market value of the debt).

In the case of Greece, which had large domestic creditors and undertook the buyback in the context of a broader deal with its official creditors, it is almost surely wrong to use the change in the market value of its net assets as the yardstick for whether the buyback should be considered a success. Nonetheless, since the literature used this yardstick for other famous cases, it is interesting to see how the Greek exchange would fare by comparison. To do this, it is necessary to select a "pre-buyback price". The most

[50] See, for example, Cline (1995), pp. 187-93, in the context of the Bolivian buyback debate; or the discussion section of Bulow and Rogoff's 1988 paper.

[51] The classic papers written during the buyback debate of the late 1980s all model the costs of default in terms of creditors seizing debtor resources. That is, in these papers, all costs arising to the country from either debt repayment or default involve a corresponding gain to creditors, and vice versa.

obvious candidate is the price on November 23, 2012, just before the official buyback announcement.[52] Note that this could be wrong in either direction. In particular, the change in price between November 23 and December 12 could well overstate the impact of the buyback announcement because it was a reaction not just to the buyback but also to the other elements of the November package (including the resumption of EU-IMF disbursements, and official sector debt relief); but it is also possible that it understates the impact of the buyback, as the latter may have been priced in to some extent, following remarks by ECB board member Jörg Asmussen in mid-October.[53] As an alternative, one can hence use the secondary market price of 11. October (just before Asmussen's remarks became public); this would generate an upper bound on the price change that may have been driven by the buyback.

Based on the November 23 reference price (27.8 cents/euro), the market value of Greek bonds dropped by €7 billion as a result of the buyback: from €17.1 billion to €10.1 after the operation was completed on December 12. To finance this debt reduction, Greece's debt to the EFSF went up by €11.3 billion in face value. There are, of course, no observable market prices for this debt; but it is a fair assumption that the default risk faced by the EFSF following the buyback is no longer very different from that of the private sector: given what little privately held debt Greece has left at this point (see below), it is hard to imagine a scenario where Greece would again restructure its debts to private creditors and not also to the EU. Using the average bond yield prevailing immediately after the buyback (11.75 percent) to discount debt service flows to the EFSF leads to a present value of just €2.7 billion—reflecting the low interest rates and very long maturity of this EFSF loan (it amortizes linearly between 2023 and 2042). Hence, the market value of Greece's net asset position would have improved by €7 - €2.7 = €4.3 billion, a net return of 157 percent on the €2.7 billion value of extra borrowing from the EFSF.

What if the price of October 11 is used as the reference? In this case, the initial market value of the debt that was bought back would be much smaller, namely just €13.7 billion, but this still implies a drop of €3.5 billion in market value as a result of the buyback, which exceeds the €2.7 billion increase in the value of the EFSF borrowing by €0.8 billion. The net return is 31 percent.

These calculations are obviously sensitive to the way in which the EFSF debt is discounted. If it is discounted at a sufficiently lower discount rate than the market yield of 11.75 percent, the improvement in Greece's net asset position due to the buyback goes away. Using the November 23 reference price, that threshold discount rate would be about 6 percent; using the October 11 reference price, it would be 10 percent. But the point here is merely that based on a market value yardstick, it is not possible to condemn

[52] The Eurogroup statement of November 27, 2012 itself seems to view the price November 23 as the relevant pre-buyback reference: "The Eurogroup was informed that Greece is considering certain debt reduction measures in the near future, which may involve public debt tender purchases of the various categories of sovereign obligations. If this is the route chosen, any tender or exchange prices are expected to be no higher than those at the close on Friday, 23 November 2012."

[53] See Reuters, "ECB's Asmussen says Greece could buy back own debt", October 12, 2012.

this buyback unless one assumes that the risk of a Greek default to the EFSF is significantly lower than that of a new default to the private sector.

We next move to the question whether the buyback achieved debt relief that made it easier for Greece to repay its remaining debt *in full*. Given that this was the stated purpose of the buyback, this strikes us as the key issue. To answer this question, we compute the impact of the buyback on the Greek debt burden use the same discount rates as in the previous section—3.5, 5, and 8 percent—to discount both the old flow (Greek bonds bought back) and the new one (new debt service to the EFSF). As explained before, the justification for using these rates is that they represent different guesses for the rates at which Greece might be able to transfer revenues over time, based on borrowing from either the market after it reopens or from the EFSF.

Table 5. Debt relief attributable to December debt buyback

	Discount rate (percent)		
	3.5	5.0	8.0
Reduction in Greek government bonds			
Face value	31.9	31.9	31.9
Present value	31.7	25.4	17.0
Increase in debt to the EFSF			
Face value	11.3	11.3	11.3
Present value	10.8	8.2	4.9
Debt relief			
Face value	20.6	20.6	20.6
Present value	20.9	17.1	12.1
Present value (percent of GDP)[1/]	*10.8*	*8.8*	*6.2*

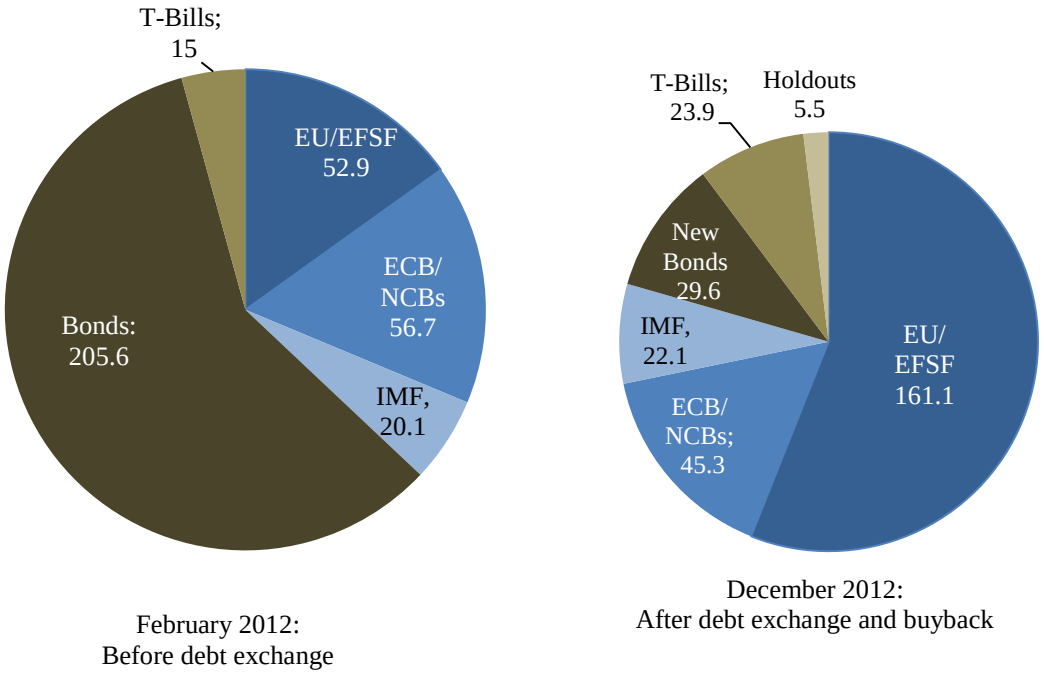
Notes: In € billion unless otherwise stated.
1/ Using preliminary 2012 GDP of Greece from Eurostat, €193.75 billion
Sources: Authors' calculations based on Bloomberg and Greek Ministry of Finance.

The main result, given in the bottom two rows of Table 5, is that in addition to a face value reduction of €20.6 billion, the buyback operation did in fact achieve a reasonable volume of present value debt relief, ranging from €12 billion for the highest of the three discount rates to just under €21 billion for the lowest discount rate, or 6.2 to 10.8 percent of 2012 GDP. These are not very large amounts, but respectable, given Greece's dire situation and the limited scale of the operation.[54]

[54] One might ask at this point whether these amounts need to be adjusted by public money used to compensate Greek banks which, according to IMF information, contributed €14.1 billion of the €31.9 bought back in the operation. The answer is no: although the EFSF subsequently released a €16 billion loan tranche to Greece that was earmarked for recapitalisation, this was motivated by the generally poor asset quality of banks, not by the buyback. There is no reason why the buyback, even if it was not fully voluntary, would have inflicted a loss on Greek banks. In economic sense, banks made a capital gain, since they received the bonds for an average price of 25 cents/€ or less, and were

The finding that the buyback did in fact reduce Greece's debt burden does not, of course, imply that this was the best to use the extra EFSF financing. Leaving aside the fact that the EFSF money might have been better spent addressing social needs, preparing privatization or supporting structural reforms, there could have been more effective ways of using the extra financing even from the narrow vantage point of reducing Greece's debt burden—in particular, by conducting the buyback at a negotiated price that would not have distributed the buyback induced appreciation of Greek bonds back to investors. In the next section, we show some counterfactual calculations that illustrate this point.

Figure 7: Change in composition of Greek sovereign debt



February 2012:
Before debt exchange

December 2012:
After debt exchange and buyback

Note: The Figure shows Greek government and government-guaranteed debt owed to private creditors (brown, bonds and T-bills only as well as guaranteed debt issued by banks) and official creditors (blue) in € billion as of end-December 2012. ECB/NCB debt refers to ECB SMP holdings as well as holdings by national central banks in the euro area. EU/EFSF loans include the bilateral GLF loans as well as the EFSF loans. T-bills are privately held short-term debt instruments. *Sources*: Authors' calculations based on Bloomberg and Hellenic Rep. (Ministry of Finance).

Figure 7 shows the overall effect of the Greek restructuring on Greece's creditor structure. In less than a year, the structure of Greek government debt was turned upside down, with privately held debt (bonds and T-Bills) now accounting for only about 20 percent of total. Most strikingly, there was a near elimination of privately held sovereign bonds. In mid-February 2012, banks and other investors still held almost €206 billion of Greek bonds. But after the March/April exchange and the subsequent buyback this

selling it for 34 cents/€. In accounting terms, banks were either marking their holdings to market, in which case the buyback made no difference or were holding them to maturity, in which case the would have been valued at the initial 25 cents/€ price, in which case banks realised a profit.

figure had shrunk to a mere €35 billion (€29.5 billion in the form of new bonds and €5.5 billion of old GGBs held by holdouts). At the same time, official loans by other euro area governments increased from €58 billion in early 2012 to more than €160 in late 2012, with a further €35 billion committed for 2013. We are not aware of any other similarly drastic case of "credit migration" from private into official hands in the history of sovereign debt.

Finally, what was the combined effect of the debt exchange and buyback on Greece's creditors? A creditor participating in both would have received 15 cents in quasi-cash and 31.5 cents of new face value per old unit of face value of quasi-cash in March or April, followed by 34 cents per unit of new face value in December. This sums to 15+0.315*34 = 25.7 cent per original face value. The creditor's alternative was to keep the original debt. Discounted at the 11.75 percent yield prevailing in the market after the buyback, this would have been worth just under 74 cents on the euro, implying a haircut of (1-25.7/73.9) = 65 percent—almost exactly the same result as obtained in Table 3 using the exit yield of 15.3. We conclude that participating investors lost about 65 percent of the value of their claims on average as a result of both restructuring operations, with wide difference between holders of short maturities, who lost up to 74 percent, and of longer maturities, who lost far less, as indicated in Figure 5.

5. Assessment and Outlook

For students of debt restructurings, there were many aspects of the Greek restructuring that were, to use the technical term, cool. The retrofit CACs, the size of the exchange and the size of the haircut have all received attention from the financial press. The Greek deal also hit firsts (or near firsts) in terms of the use of aggregation provisions, the attempt to link repayments of new bonds and repayments to a multilateral, and in giving official creditors a veto over changes in bond payment terms or new debt issues beyond a specified maximum.

For the people of Greece and Europe, however, it is not legal and financial pyrotechnics that count, but what the restructuring ultimately delivered. In this section, we draw some normative implications from our case study. Was the decision to restructure Greek debt the right one? Could Greece (and/or its official creditors and the taxpayers they represent) have gotten a better deal? Will the restructuring make future debt restructuring in Europe easier or more difficult? And to what it extent does Greece's restructuring provide a template for other euro area countries seeking to restructure their debts?

5.1. Was the Restructuring a Good Idea?

Economic theory answers the question of when it is optimal for countries to default roughly the same as common sense would. In the presence of default costs—financial disruptions and output costs—defaults should be rare events, but can be desirable when countries face high debt and large solvency shocks (see Adam and Grill (2012) and references therein). The presence of collateral damage on other countries—contagion—changes the interpretation of default costs, but does not change the answer; except for one key complication: it implies that there may be a second instrument—transfers across

countries—as an alternative to default. This may help ex post, but creates a moral hazard problem ex ante, since debtor countries have control over their debt levels, the contracts they enter into, and ultimately, their resilience to shocks.

Deciding whether the Greek restructuring was the right decision hence involves two questions. First, had Greece reached the threshold level of distress and high debt which would justify a debt restructuring purely from a domestic standpoint, abstracting from contagion? Second in light of the collateral damage that the Greek restructuring was likely to inflict on other countries—and arguably did—was there a better alternative?

With respect to the first question, a first pass are the IMF's debt sustainability analyses (DSAs), conducted every three to six months since the beginning of the May 2010 program. While for the first year or so IMF staff reluctantly concluded that Greek debt was sustainable (although it consistently refused to say that this was true "with high probability") the Fund gave up by October 2011, when its DSA noted a more severe drop in output than expected (projected at -5.5 percent in -2011 and 3 percent in 2012), a slower expected recovery, continued exclusion from capital markets, and lower privatization proceeds. Under the baseline scenario, the debt to GDP ratio would rise to 184 percent by 2014 and remain above 130 percent even in 2030, despite a continued primary surplus of at least 3.5 percent.

Was the IMF's take on Greece too pessimistic? In an analysis conducted a month earlier, Cline (2011) argued that the preliminary PSI agreement of July 2011 greatly helped debt sustainability and would suffice if Greece only stuck to its fiscal adjustment targets. In his baseline scenario the Greek debt ratio would peak at 175 percent in 2012 and then fall to 113 percent by 2020. Several reasons explain Cline's more favorable view. He assumed a more optimistic growth path (of +0.6 percent in 2012, and +2.1 percent in 2013), as well as higher privatization receipts than the IMF. He also predicted a primary surplus of 6 to 7 percent from 2014 onwards. With hindsight, these assumptions do not seem plausible, particularly for a country with a weak fiscal track record. Between 1990 and 2007, the average Greek primary surplus was 0.6 percent or GDP despite the economic prosperity of these two decades.[55]

This leads to the second question: accepting that the debt was unsustainable; might a better approach have been to deal with the Greek debt problem through a mixture of conditionality and large transfers—genuine transfers, not just loans? The Greek PSI decision arguably contributed to the widening of the euro area turmoil in mid-2011, when the crisis spread to Italy and Spain (see Ardagna and Caselli, 2012). Given the enormous costs of a euro area break-up and the risk of disorderly defaults in larger countries, would it have been better to resolve the Greek crisis through official transfers rather than PSI? We do not think so, for three main reasons:

- Even after a €100 billion transfer from the private sector and a maturity extension and interest reduction in its official loans, Moody's (2012) continues to consider the Greek debt unsustainable, and the IMF continues to suggest that further "official sector involvement" in Greece might be needed. Hence, to both

[55] See also Cline (2013), in which he takes a darker view of sovereign debt sustainability in Greece.

substitute for the private restructuring and address the Greek debt sustainability issue, the official transfer (not just loan) to Greece would have had to be enormous. Cross-country transfers of this magnitude should not occur outside a fiscal union which exercises centralized control.

- Even though the decision to restructure was risky, the euro area had instruments to contain these risks—primarily, vested in the European Central Bank—and eventually exercised them, albeit reluctantly, and after an initial learning period.
- Finally, the outcome of the March-April exchange itself proved many critics wrong, some of which had gone as far as arguing that there could be no such a thing as an orderly debt restructuring (Bini-Smaghi, 2011). Not only was it orderly, but it took place swiftly (within six months since the start of negotiations), with high participation and no significant legal disputes. The losses imposed by the restructuring did not trigger knock-on insolvencies of systemically important institutions. And the much-feared triggering of CDS contracts in March of 2012 went by with barely a whimper (Section 3.2).

We conclude that even if the alternative of a large-scale official transfer had been politically feasible—which it was not—the debt restructuring was the right thing to do. It was a necessary, albeit not sufficient, step towards ending the debt crisis.

5.2. Could the Restructuring Have Been Handled Better?

The Greek restructuring was both unavoidable and successful in the sense of being orderly, reasonably quick, and in providing significant debt relief. At the same time, it can be subjected to a battery of criticisms. Most importantly, it was too little, too late, or both; hence failing to clearly restore Greece's debt sustainability. The question is whether this reflected avoidable policy mistakes or unavoidable trade-offs—in the sense that Greece and its official creditors faced difficult choices, and did their best given what was feasible. To answer this question, it is helpful to step back and recall the constraints faced by policymakers at the time.

The design of the Greek restructuring can be interpreted as an attempt to treat creditors as gently as possible subject to two important Troika-imposed constraints: to reach the ambitious nominal debt reduction target set in October 2011, and to exclude the holdings of central banks. Granted, the exchange may not have felt very "gentle" to bondholders suffering losses of 65 percent or more, particularly if they were among the majority whose bond contracts had been retroactively changed by the Greek parliament to make them easier to restructure. Subject to this, however, the authorities went out of their way to maximize carrots and minimize sticks in almost every conceivable way, including:

- Offering exceptionally high cash "sweeteners" (15 percent of the value of old debt, the largest such sweetener ever recorded);
- Offering an upgrade of governing law for most creditors (from old Greek law bonds to new English law bonds), as well as the "co-financing agreement" with the EFSF which tried to align the priority of bondholders with that of some official loans;
- Leaving sovereign guaranteed bonds untouched and outside the reach of the 23. February bondholder law.

- Using domestic law merely to introduce a collective action provision rather than to change payment terms;
- Eschewing legal techniques such as exit consents to discourage potential holdouts among the holders of English law bonds;
- Offering unsuccessful holdouts exactly the same bundle as participating creditors (as opposed to keeping their old bonds with modified payment terms, for example, which would have put them at a disadvantage);
- Avoiding default threats directed at potential holdouts (with few last-minute exceptions, see section 3), hence giving the impression that except for the use of collective action provisions, the exchange was indeed voluntary—and indeed confirming that impression ex post by repaying holdouts in full and on time;
- Carrying out the December buyback at market prices, rather than using a fixed negotiated buyback price.

Using this approach, the exchange succeeded in meeting the conditions imposed by the Troika and in avoiding financial collapse in Greece and beyond (with one significant glitch: the large damage inflicted on Cypriot banks, which unlike their Greek counterparts were not compensated for restructuring-related losses). This was no small feat.

At the same time, a number of costly policy mistakes were made with respect to the timing, design, and execution of the exchange—that is, costs to Greece and/or Europe that cannot be justified either by overall success of the exchange or the objective of minimizing contagion.

First, the restructuring was delayed until it was (almost) too late. Notwithstanding Greece's exceptionally dire debt situation, the decision not to seek a restructuring immediately in April of 2010 (when Greece lost market access) may have been defensible. It gave Greece a chance to adjust and reform so as to avoid default, and it gave the remainder of Europe time to bring their fiscal and financial houses in order to as to minimize the necessary contagion. What cannot be defended, however, is the continuing delay after the Greek program had gone off track in early 2011. Time was wasted on fruitless "soft PSI" discussions, while bonds were continuously being repaid in full. Implementing a deep restructuring by mid-2011 could have saved at least €10 billion in bond amortizations between July 2011 and early 2012.

Second, the design of the exchange left money on the table, in very large sums. Appendix 6 presents a number of alternative ways in which the exchange could have been carried out that could have been used either to significantly increase debt relief or to reduce the large volume of EFSF financed cash incentives. The costliest mistake in this regard was the "one size fits all" approach of offering the same bundle of new bonds and cash to all investors, irrespective of the maturity of their old bonds, and with no distinction between foreign law bonds and Greek law bonds. Appendix 6 shows that imposing the same 70 percent haircut on all investors would have resulted in an additional debt relief of almost €30 billion in face value terms and €23 billion in present value terms. A 70 percent haircut would have been lower than the haircut that was deemed to be acceptable for short term creditors, and hence surely feasible. A differentiation by governing law, by imposing an additional 5 percent haircut on Greek law bondholders, could have achieved a further €24 billion in face value debt relief. Alternatively it could have been used to reduce official cash incentives by almost €15

billion, or some combination of the two. Of course, implementing this approach would have meant tougher negotiations—particularly with banks that held longer-dated instruments—which may well have required more time. But Greece and its official creditors could have taken that time, either by starting negotiations earlier or by imposing a moratorium on amortizations so as to push back the March 20 bond repayment that effectively became the deadline for the actual negotiations.

Third, the soft approach to private sector holdouts was costly not just for Greece but also for future European crisis management. For Greece, full private sector participation could have achieved a further €3 billion in debt relief. More importantly, the decision to continue servicing the bonds of holdouts on time and in full set a bad precedent for future debt restructurings in Europe. Given the success of holdouts in the Greek exchange, small investors will feel encouraged to reject future debt exchange offers. In addition, larger investors will be emboldened to acquire blocking positions in foreign law bonds—a strategy that worked well for distressed debt funds in the case of Greece.

The fourth policy error was to conduct the December buyback at market prices (via an auction mechanism), instead of opting for a negotiated buyback at predetermined prices. This decision consumed an additional €11 billion in official financing for modest gain. Appendix 6 shows that a negotiated approach could have achieved significantly higher debt relief, or required significantly less cash financing, without necessarily making private creditors worse off relative to where they would have stood in October or the first half of November. More generally, it would have been better to conduct the March debt exchange as a full negotiated buyback from the start. Compared to the actual debt restructuring and buyback, this could have achieved deeper relief, in the order of €40 billion in face value, while saving the official sector cash.

What explains these bad decisions? In our interpretation, they had to do with the huge distance that the European official sector had to travel between denying the need for any sovereign debt restructuring in Greece (or anywhere else in Europe) as late as early 2011, and the necessity to implement a deep restructuring. To climb down from its initial position, the Eurogroup and the ECB resorted to the notion of a voluntary exchange as an intellectual and political compromise. Unfortunately, this compromise critically hurt both the timing of the eventual restructuring—via fruitless discussions on soft PSI options—and weighed negatively on its design.

Other aspects of the restructuring were also problematic—in particular, the decisions to exempt the central banks from the exchange, and not to bail-in bank bondholders. The ECB exemption perpetuated the mutual dependency between Greece and its official creditors and contributed to its continuing debt burden. The full compensation of Greek banks for PSI-related losses led to a large discrepancy between the treatment of sovereign bond holders and bank bondholders. It is nonetheless difficult to pass judgment on these decisions, as they involved real trade-offs. Political and legal constraints with respect to ECB participation could have prevented the debt restructuring

from happening in the first place.[56] And combining a sovereign restructuring with a bail-in of bank bondholders clearly would have made the restructuring operation more difficult to manage and perhaps more risky with respect to contagion.

To summarize, the debt restructuring could have been handled better, even without involving the ECB or bailing in bank bondholders. In particular, it should have been conducted earlier and used a different design, involving modestly higher average present haircuts applied consistently to all bondholders. The combination of earlier timing (for example, conducting an exchange in June of 2011 rather than March/April of 2012) and different design would have achieved additional debt relief of perhaps €60 billion in face value terms and €45 billion in present value terms—almost 25 percent of GDP. This would almost surely have been sufficient to make the remaining Greek debt sustainable.

5.3. Implications for Future Sovereign Debt Restructurings in Europe

What does the Greek case teach us for future sovereign debt restructurings in Europe? At first glance, it would appear that the techniques used with Greece would be readily applicable elsewhere in the monetary union. After all, most euro area nations share the key characteristic that enabled Greece's restructuring—over 90 percent of their debt stock is governed by local law. Greece also used a new bargaining approach, which combined a classic creditor committee with a take-it-or-leave-it exchange offer. This two-part negotiation scheme proved to be suitable vehicle in a context in which banks are the main type of creditors, as is the case in many other European countries. Moreover, the Greek deal showed that having local law debt instruments can ease restructuring ex post. Countries like Italy, Spain, and Ireland could use retrofit CACs to restructure sovereign debt and achieve high creditor participation just the way Greece did. Local law also opens the option to offer a seniority upgrade, meaning that creditors can be offered new foreign law bonds as a sweetener to dissuade free riders in a debt exchange. More generally, in a situation of debt distress, countries may exploit the fear of local law instruments by swapping them against foreign law bonds at a discount—a purely voluntary operation, but one that might achieve a haircut (Gulati and Zettelmeyer, 2012b). So the Greek deal did contain some elements that are worth imitating.

However, there are at least four reasons why the approach chosen in Greece will be difficult to imitate elsewhere in Europe:

First, in many countries, bond contracts and/or the legal environment are not as restructuring-friendly as in Greece. The US constitution, for example, guarantees the payment of the federal government's debts. A similar example is Cyprus, where the constitution envisages that government debt payments take priority over most other obligations of the state. Removing a constitutional protection is possible, but harder than a simple legislative action. Cyprus also has a much higher share of foreign-law bonds (close to half were issued under English jurisdiction). The same is true for Estonia,

[56] Importantly, this argument rationalizes some form of special treatment for the ECB, but not the fact that the ECB was excluded from the restructuring entirely, without (until late November 2012) making any commitment to returning profits on Greek bondholdings to Greece.

Slovakia, and Slovenia and many emerging market economies. In these contexts, retrofit CACs via parliamentary legislation are not a solution.

Second, we expect that more creditors will be encouraged to hold out and litigate instead of accepting future exchange offers, for two reasons. First, due to the precedent of treating holdouts so gently in Greece, as already discussed; and second, two major court decisions unrelated to Greece, *Assenagon Asset Management SA v. Irish Bank Resolution Corporation Ltd.* and *NML Capital Ltd. v. Republic of Argentina* (the former under English law and the latter under New York law) which have arguably enhanced the ability of holdout creditors to block restructurings.[57] Holdouts and legal disputes are therefore likely to become a more serious stumbling block than they were in Greece.[58]

Third, the Greek restructuring approach required large volumes of official financing. In total, about €87 billion, 45 percent of 2012 GDP, were transferred in cash and underwritten by the European taxpayer, who became the main holder of Greek sovereign risk. As a result, there is no private "buffer" left at this point that could protect the European taxpayer from the consequences of a deterioration of the crisis. In future restructurings, some cash transfers may be avoided by bailing in bank creditors, but the rest is the price of the idea of implementing "voluntary" debt restructurings and of taking a soft approach to dissuading free riding. Cash transfers of this scale could be spent otherwise—for example, on crisis lending that helps sustain public investment or social spending while a country is adjusting. Moreover, rescue money is becoming scarce in the euro area, both because of public and political opposition to further bailouts and because the pool of available resources is shrinking, as demand continues to increase and the potential roles of the EFSF/ESM are being expanded (most recently to direct recapitalization of banks).

Finally and perhaps most importantly, a large fraction of the bonds issued by the weaker euro area sovereigns have been moving out of the hands of foreign investors and into the hands of local banks and other domestic institutions (Brutti and Sauré, 2013). That means that any significant restructuring of the government's debt will present the danger of causing an internal banking crisis. Of course, this is the very reason why the migration of sovereign debt to domestic holders, and banks in particular, could be happening. Domestic banks are relatively immune from restructurings because they expect to be recapitalized, for financial stability reasons, if their losses from domestic sovereign bond holdings are sufficiently high. Indeed, if the holdings of the banking system as a whole are high enough, the restructuring will likely not happen at all (see Broner et al. 2010).

Hence, we conclude that the Greek debt restructuring approach can be useful in specific cases, but it falls far short of providing a template that could be a permanent fixture of the European financial architecture.

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[57] The cases are at [2012] EWHC 2090 and 699 F.3d 246 (2d. Cir. 2012) respectively. See Gelpern (2013) and Weidemaier et al. (2012).

[58] Schumacher et al. (2013) document the rise of creditor litigation in sovereign debt markets since the 1970s. In recent years, about 50 percent of debt restructurings involved legal disputes.

Is help already on the way? Euro area countries have recently agreed to introduce CACs into all new sovereign debt from January 2013 on, regardless of governing law. However, as the case of Greece illustrates, CACs are no panacea, as they need to be voted on bond by bond (see Gelpern and Gulati, 2013). It is telling that distressed debt investors explicitly targeted Greek bonds with English-law CACs: these holdout investors succeeded by purchasing blocking minorities in individual bond series, which could not be offset by pro-restructuring majorities elsewhere. While euro area CACs contain an "aggregation feature" that allows changes at the individual bond level to be decided with a lower majority if enough investors across all bonds vote for a restructuring, this feature is weak. First, the aggregate voting threshold is higher than in the Greek "retrofit" CAC (75 rather than 66.67 percent). Second, euro-CACs require at least a 66.67 percent vote in *each* individual bond issuance, while in Greece it was sufficient to reach this threshold in aggregate.[59] This means that the holdout problem faced by Greece would not be avoided.[60]

Against this backdrop, it may be time for setting up a more systematic mechanism to deal with restructurings in Europe. One solution would be to reform the newly introduced euro-CACs in a way that they allow aggregation across bond series, without bond-by-bond voting. However, even if this happened, it will take another 5 to 10 years until they will be contained in the majority of euro area sovereign bonds. Until then, there will be a mixed regime of pre-2013 bonds (mostly without CACs), and post-2013 bonds (with euro-CACs). All of this does not inspire confidence that European sovereigns will have an easier time in future restructurings, especially if there is less public money to finance cash incentives or collateral to minimize holdouts.

A more ambitious but immediate solution could be achieved in a fairly straightforward fashion by modifying the treaty of the European Stability Mechanism to say that the assets and revenues of any euro area member nation that is undertaking an ESM-endorsed debt restructuring will be immune from attachment by holdout creditors (see Buchheit, Gulati, and Tirado, 2013). A template for doing so exists already, and has worked in the context of Iraq's post-war restructuring of 2006.[61] Such a restructuring approach, in pre-agreed circumstances and based on pre-agreed principles, could have more political and legal legitimacy than the current system, with its ad hoc debt exchanges that rely either on threats towards creditors or on retroactive changes in domestic law.

Whatever the specific approach, it is essential to make it less likely that the day of reckoning will again be postponed at great social and economic cost, as happened in Greece.

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[59] Details on the Euro-CACs are provided by the following note. Clifford Chance—Briefing Note, 2012. Euro Area Member States Take Collective Action to Facilitate Sovereign Debt Restructuring, December (http://www.cliffordchance.com/publicationviews/publications/2012/12/euro_area_me).

[60] In the 17 out of the 18 bonds for which amendments were voted on bond-by-bond in the Greek restructuring, the blocking majority was well above the 33.34 threshold required to block an amendment attempt under euro-CACs.

[61] United Nations Resolution 1483 (May 22, 2003) put into place instructions to enable the restructuring of Iraq's debts after Saddam Hussein's removal. In response to the resolution, legislation was passed in both the EU and US and, as a result, Iraq was able to obtain close to a 90 NPV reduction of its external long-term debts.

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Appendix 1. New Instruments Issued in the March/April Greek Debt Exchange

The Hellenic Republic offered eligible creditors a bundle of three new instruments. Specifically, participating investors received the following bundle for every old bond:

1) 15 percent of face value in the form of **EFSF notes** in two separate series. 50 percent will be due in March 2013 and carry a coupon of 0.4 percent. The other 50 percent are due in March 2014 with a coupon of 1 percent.
2) 31.5 percent of face value in the form of **new English-law bonds** with a maturity of up to 30 years (until 2042). Rather than issuing one bond, Greece issued a bundle of 20 new bonds each maturing in a different year starting in 2023. This replicates an (almost even) amortization schedule of 5 percent per annum between 2023 and 2042. The coupon on the new bonds will be 2 percent from February 2012 until February 2015, 3 percent from February 2015 until February 2020, 3.65 percent in 2021 and 4.3 percent from February 2020 until February 2042.
3) A set of detachable **GDP-linked securities**, which offer a modest increase in the coupon on the new principal of up to 1 percent provided that real growth and nominal GDP exceed a specified path from 2015 onwards. These targets closely resemble IMF GDP projections as of early 2012.

Any accrued interest (due from February 24, 2012 until the exchange date) was paid in the form of a six-month EFSF zero coupon note.

The EFSF Notes

Issuance	Amounts to 15 percent of face value of the old bonds
Final Maturity	March 12, 2013 and March 12, 2014, respectively, for each of the two series
Coupon	Fixed at 0.4 percent for the 2013 Notes and 1 percent for the 2014 Notes.
Start of interest payments	March 12, 2012
Issue Price	100 percent. of the Aggregate Nominal Amount
Form	Global Bearer Note deposited with Clearstream, Frankfurt
Listing	Luxembourg
Clearing	The Notes will clear through Clearstream, Frankfurt
Governing law	English law

Source: Credit Suisse (2012) and Greek Ministry of Finance (Press Releases and Offering Memoranda)

The New Greek Government Bonds

Issuance	Amounts to 31.5 percent of face value of the old bonds. 20 series of equal nominal value due between 2023 and 2042.
Final Maturity	2042
Coupon	Fixed at 2.0 percent per year for payment dates in 2012, 2013, 2014, 2015 3.0 percent per year for payment dates in 2016, 2017, 2018, 2019, 2020 3.65 percent per annum for payment date in 2021 4.3 percent per annum for payment dates in 2022 and thereafter
Amortization	Starts in on the 11th anniversary of the issue date (12.03.2023) with equal principal repayment across 20 years. In practice this is achieved because the first of the 20 bonds matures in 2023 and the last in 2042
Start of interest payments	March 12, 2012
Listing	Athens Stock Exchange and the Electronic Secondary Securities Market Listing (HDAT) operated by the Bank of Greece
Clearing	All New Bonds will clear through the Bank of Greece (BOGs) clearing system
Negative Pledge	Yes
Collective Action Clause	The New Bonds will contain new euro-CACs, based on the draft collective action clause published by the EU Economic and Financial Committee's Sub-Committee on EU Sovereign Debt Markets.
Co-financing agreement	Holders of the New Bonds will be entitled to the benefit of, and will be bound by, a Co-Financing Agreement among, inter alios, the Republic, the New Bond Trustee and the European Financial Stability Facility (the "EFSF") linking the New Bonds to the Republic's loan from the EFSF of up to 30 billion euros in a variety of ways, including the appointment of a common paying agent, the inclusion of a turnover covenant and the payment of principal and interest on the New Bonds and the EFSF loan on the same dates and on a pro rata basis

Source: Credit Suisse (2012) and Greek Ministry of Finance (Press Releases and Offering Memoranda)

GDP Warrant

A detachable GDP warrant was issued along with each new government bond. Each warrant has a face value which initially equals the face value of the new bond and is reduced by about 5 percent per year from 2024 to 2042 (replicating the bond amortization schedule). The notional amount is only used to calculate the annual payments (see below). Holders are not entitled to receive principal.

Dates of potential payment are on October 15 every year, starting from 2015 until the final payment date in 2042. The payments depend upon and are determined on the basis of GDP performance in the following way:

Condition for Payments: Annual payments are only made if each of the following three conditions is met:

- Nominal GDP in the year preceding any payment must equal or exceed the Reference Nominal GDP (see Table A1)
- Real GDP Growth must equal or exceed the Reference Real GDP Growth Rate (Table A1)
- Real GDP Growth must equal or exceed 0

The Nominal GDP and the Real GDP Growth Rate (year on year changes) are those published by EUROSTAT.[62]

Table A1: Reference GDP path for warrant payments

Reference Year	Reference Nominal GDP level (€ mn)	Reference Real GDP growth (yoy)
2014	210.1014	2.345000%
2015	217.9036	2.896049%
2016	226.3532	2.845389%
2017	235.7155	2.796674%
2018	245.4696	2.596544%
2019	255.8822	2.496864%
2020	266.4703	2.247354%
2020-2041	266.4703	2.000000%

Source: Greek Ministry of Finance

Size of Payments: The warrants pay a maximum of 1 percent of the initial notional. More specifically, the size of the payments is computed as follows:

Payment Amount = GDP Index Percentage x Notional

where the *GDP Index Percentage* equals

1.5 x [Real GDP Growth Rate—Reference Real GDP Growth Rate],

and the *Notional* in each year is determined as shown in Table A2.

The GDP Index Percentage is set to zero if the real growth rate is below 0 or below the reference real growth rate (see above).

[62] The Offering Memoranda notes the following: "From and including 2021, if the Real GDP Growth Rate for any calendar year preceding the Reference Year is negative, the Real GDP Growth Rate for Reference Year shall be deemed to be the sum of the Real GDP Growth Rates for both such years"

Table A2: Notional for each reference year

Date	Fraction of Original Notional	Original Notional	Notional (%)
Up to 15-Oct-23	315	315	100.00%
15-Oct-24	300	315	95.24%
15-Oct-25	285	315	90.48%
15-Oct-26	270	315	85.71%
15-Oct-27	255	315	80.95%
15-Oct-28	240	315	76.19%
15-Oct-29	224	315	71.11%
15-Oct-30	208	315	66.03%
15-Oct-31	192	315	60.95%
15-Oct-32	176	315	55.87%
15-Oct-33	160	315	50.79%
15-Oct-34	144	315	45.71%
15-Oct-35	128	315	40.63%
15-Oct-36	112	315	35.56%
15-Oct-37	96	315	30.48%
15-Oct-38	80	315	25.40%
15-Oct-39	64	315	20.32%
15-Oct-40	48	315	15.24%
15-Oct-41	32	315	10.16%
15-Oct-42	16	315	5.08%

Source: Source: Greek Ministry of Finance

Finally, it should be noted that the Greek Government can "call" the warrants anytime from 2020 on, based on a trailing 30 day market price.

Appendix 2. Overview of Eligible Securities

The exchange involved 117 eligible instruments with a total volume of €205.6 billion owed to private creditors. Besides their payment terms (maturity, coupon, etc.), the eligible titles differ with regard to their issuer, governing law and restructuring method. 81 titles were central government bonds with an eligible volume of €195.8 billion, while 36 instruments had been issued by three public entities: Hellenic Railway Company (OSE), Hellenic Defense Systems (EAS) and Athens Urban Transport Organization (OASA). These guaranteed titles amounted to €9.8 billion.

Most importantly, one can categorize the eligible securities by restructuring method, as explained in the exchange memoranda and their Annexes:

(i) An exchange offer *and* consent solicitation (amendment attempt) was made to holders of Greek-law sovereign debt (issued by the Hellenic Republic, termed as "Eligible Titles") and of all English-law titles, regardless of whether they are sovereign or guaranteed (termed as "Foreign Law Republic Titles" and "Foreign Law Guaranteed Titles"). This category accounted for 88 instruments with a total of €197 billion in eligible debt. The offer details were released in the "Reg S Invitation Memorandum" and the "US Invitation Memorandum".

(ii) Only the exchange offer, but *no* consent solicitation was made to holders of Greek-law guaranteed debt, as well as to holders of Japanese-law debt (four titles issued by Hellenic Republic and two titles issued by Hellenic Railways), as well as to holders of Italian law debt (one Hellenic Republic title). These debt categories were termed as "Guaranteed Titles" and "Guaranteed Titles in Physical Form", with details released in the "Exchange Offer Memorandum". Together, these accounted for 28 instruments with a total volume of €7.9 billion.

(iii) Only the consent solicitation, but *no* exchange offer was made to holders of one Swiss-law CHF bond amounting to €0.54 billion outstanding. The details were released in a separate "Consent Solicitation Memorandum".

Table A3 provides a summary on the eligible securities with restructuring method and holdouts. Further details can be found in Table A4, which shows the characteristics for each of the 117 eligible securities, in particular the haircut for each instrument, the result of the amendment attempts, and the share of holdouts.

Table A3: Summary of eligible securities

	Amount held by Private Sector (€ mn)	% of Total	Exchange Offer	Amendment Attempt	Holdouts (in%)
Greek Law - Government Bonds ("Eligible Titles")	177,305	86.2%	Yes	Yes, aggregated	0.0%
Greek Law - Guaranteed Titles (Defense, Railway etc.)	6,701	3.3%	Yes	No	4.3%
English Law - Government & Guaranteed	19,870	9.7%	Yes	Bond-by-Bond	44.1%
Italian or Japanese Law - Government & Guaranteed	1,206	0.6%	Yes	No	20.6%
Swiss Law (One Government Bond)	538	0.3%	No	Yes	100.0%
	205,621	100.0%			3.1%

Note: For Greek law bonds the amendment attempt (and the bond exchange) was passed via collective action causes with aggregation features. The CACs had been "retrofitted" through an act of parliament. The amount in € million excludes bond holdings by the ECB, which were not exchanged.

Table A4: Characteristics and haircut of each bond
Part A: Greek law government bonds

Issuer	ISIN	Currency	Governing Law	Maturity	Amount held by Private Sector (€ mn)	Haircut (uniform rate)	Haircut (yield curve)	Amendment Outcome	Holdouts (in %)
Hellenic Republic	GR0110021236	EUR	Greek Law	20/03/2012	9765.6	69.1	78.2	passed	0%
Hellenic Republic	GR0124018525	EUR	Greek Law	18/05/2012	4665.7	69.1	77.7	passed	0%
Hellenic Republic	GR0124020547	EUR	Greek Law	20/06/2012	413.7	68.6	77.2	passed	0%
Hellenic Republic	GR0106003792	EUR	Greek Law	30/06/2012	140.3	67.3	76.3	passed	0%
Hellenic Republic	GR0114020457	EUR	Greek Law	20/08/2012	4586.0	68.4	76.8	passed	0%
Hellenic Republic	GR0326042257	EUR	Greek Law	22/12/2012	2026.3	65.7	73.9	passed	0%
Hellenic Republic	GR0508001121	EUR	Greek Law	31/12/2012	22.9	67.2	75.6	passed	0%
Hellenic Republic	GR0512001356	EUR	Greek Law	20/02/2013	5376.7	66.8	74.2	passed	0%
Hellenic Republic	GR0110022242	EUR	Greek Law	31/03/2013	36.4	67.8	76.1	passed	0%
Hellenic Republic	GR0124021552	EUR	Greek Law	20/05/2013	4490.6	67.7	73.8	passed	0%
Hellenic Republic	GR0128001584	EUR	Greek Law	20/05/2013	1492.7	69.4	75.2	passed	0%
Hellenic Republic	GR0124022568	EUR	Greek Law	03/07/2013	326.0	66.8	72.1	passed	0%
Hellenic Republic	GR0110023257	EUR	Greek Law	31/07/2013	64.3	72.5	78.6	passed	0%
Hellenic Republic	GR0114021463	EUR	Greek Law	20/08/2013	3680.2	67.5	72.2	passed	0%
Hellenic Republic	GR0124023574	EUR	Greek Law	30/09/2013	149.4	83.4	85.5	passed	0%
Hellenic Republic	GR0326043263	EUR	Greek Law	22/12/2013	1853.8	62.9	65.2	passed	0%
Hellenic Republic	GR0128002590	EUR	Greek Law	11/01/2014	2699.0	67.5	69.2	passed	0%
Hellenic Republic	GR0124024580	EUR	Greek Law	20/05/2014	4368.7	66.6	65.9	passed	0%
Hellenic Republic	GR0124025595	EUR	Greek Law	01/07/2014	394.0	66.2	63.9	passed	0%
Hellenic Republic	GR0112003653	EUR	Greek Law	25/07/2014	155.4	65.7	69.1	passed	0%
Hellenic Republic	GR0114022479	EUR	Greek Law	20/08/2014	8541.2	66.9	64.2	passed	0%
Hellenic Republic	GR0112004669	EUR	Greek Law	30/09/2014	85.7	71.0	75.7	passed	0%
Hellenic Republic	GR0514020172	EUR	Greek Law	04/02/2015	2020.0	65.9	59.1	passed	0%
Hellenic Republic	GR0124026601	EUR	Greek Law	20/07/2015	6093.5	64.1	54.5	passed	0%
Hellenic Republic	GR0114023485	EUR	Greek Law	20/08/2015	4811.7	67.0	58.9	passed	0%
Hellenic Republic	GR0114024491	EUR	Greek Law	30/09/2015	171.4	69.4	72.2	passed	0%
Hellenic Republic	GR0124027617	EUR	Greek Law	10/11/2015	375.0	67.5	57.3	passed	0%
Hellenic Republic	GR0516003606	EUR	Greek Law	21/05/2016	170.3	65.3	66.5	passed	0%
Hellenic Republic	GR0124028623	EUR	Greek Law	20/07/2016	5442.4	62.7	50.4	passed	0%
Hellenic Republic	GR0116002875	EUR	Greek Law	13/09/2016	142.9	65.4	65.2	passed	0%
Hellenic Republic	GR0326038214	EUR	Greek Law	27/12/2016	334.3	53.3	32.8	passed	0%
Hellenic Republic	GR0118014621	EUR	Greek Law	01/03/2017	342.9	66.1	67.0	passed	0%
Hellenic Republic	GR0528002315	EUR	Greek Law	04/04/2017	4937.0	61.4	48.1	passed	0%
Hellenic Republic	GR0118012609	EUR	Greek Law	20/04/2017	3646.2	66.6	57.5	passed	0%
Hellenic Republic	GR0518072922	EUR	Greek Law	01/07/2017	415.5	62.1	60.8	passed	0%
Hellenic Republic	GR0518071916	EUR	Greek Law	01/07/2017	71.6	64.6	59.3	passed	0%
Hellenic Republic	GR0124029639	EUR	Greek Law	20/07/2017	7562.5	62.9	51.0	passed	0%
Hellenic Republic	GR0118013615	EUR	Greek Law	09/10/2017	214.3	59.6	57.3	passed	0%
Hellenic Republic	GR0120003141	EUR	Greek Law	03/04/2018	440.0	66.1	65.7	passed	0%
Hellenic Republic	GR0124030645	EUR	Greek Law	20/07/2018	5875.8	63.7	52.4	passed	0%
Hellenic Republic	GR0122002737	EUR	Greek Law	27/02/2019	112.0	64.4	59.7	passed	0%
Hellenic Republic	GR0122003743	EUR	Greek Law	04/03/2019	425.0	67.4	64.1	passed	0%
Hellenic Republic	GR0124031650	EUR	Greek Law	19/07/2019	11747.6	65.2	55.2	passed	0%
Hellenic Republic	GR0120002135	EUR	Greek Law	17/09/2019	350.0	65.0	58.6	passed	0%
Hellenic Republic	GR0133001140	EUR	Greek Law	22/10/2019	6175.0	65.0	54.5	passed	0%
Hellenic Republic	GR0124032666	EUR	Greek Law	19/06/2020	3633.7	65.7	56.1	passed	0%
Hellenic Republic	GR0133002155	EUR	Greek Law	22/10/2022	7623.3	64.7	53.8	passed	0%
Hellenic Republic	GR0133003161	EUR	Greek Law	20/03/2024	9156.9	59.4	48.1	passed	0%
Hellenic Republic	GR0338001531	EUR	Greek Law	25/07/2025	8584.9	56.5	41.0	passed	0%
Hellenic Republic	GR0133004177	EUR	Greek Law	20/03/2026	6063.3	61.0	50.5	passed	0%
Hellenic Republic	GR0338002547	EUR	Greek Law	25/07/2030	8244.8	46.5	27.0	passed	0%
Hellenic Republic	GR0138001673	EUR	Greek Law	20/09/2037	8867.2	49.9	34.6	passed	0%
Hellenic Republic	GR0138002689	EUR	Greek Law	20/09/2040	7920.0	39.3	35.2	passed	0%

Source: Greek Ministry of Finance (exchange offer memoranda). *Note*: The amount in € million excludes bond holdings by the ECB, which were not exchanged. The haircut estimates with "uniform rate" are based on a 15.3 percent discount rate. The imputed yield curve rates used for computing the alternative "yield curve" haircut measure is discussed in Appendix 4 below.

Table A4 (Ct'd) - Part B: Foreign law titles

Issuer	ISIN	Currency	Governing Law	Maturity	Amount held by Private Sector (€ mn)	Haircut (uniform rate)	Haircut (yield curve)	Amendment Outcome	Holdouts (in %)
English Law Titles									
Hellenic Republic	XS0147393861	EUR	English law	15/05/2012	450.0	67.4	76.4	not passed	97%
Hellenic Republic	XS0372384064	USD	English law	25/06/2013	1083.9	67.5	73.2	not passed	79%
Hellenic Republic	XS0097596463	EUR	English law	21/05/2014	69.0	66.1	65.3	passed	0%
Hellenic Republic	XS0165956672	EUR	English law	08/04/2016	400.0	65.1	55.0	passed	0%
Hellenic Republic	XS0357333029	EUR	English law	11/04/2016	5547.2	62.5	50.0	passed	0%
Hellenic Republic	XS0071095045	JPY	English law	08/11/2016	376.6	63.5	51.9	not passed	53%
Hellenic Republic	XS0078057725	JPY	English law	03/07/2017	282.4	62.5	50.2	not passed	79%
Hellenic Republic	XS0079012166	JPY	English law	08/08/2017	470.7	60.9	47.3	not passed	92%
Hellenic Republic	XS0260024277	EUR	English law	05/07/2018	2086.0	58.9	43.7	passed	0%
Hellenic Republic	XS0286916027	EUR	English law	22/02/2019	280.0	60.6	46.9	passed	0%
Hellenic Republic	XS0097010440	JPY	English law	30/04/2019	235.4	57.0	42.2	passed	0%
Hellenic Republic	XS0097598329	EUR	English law	03/06/2019	110.0	59.8	46.6	passed	0%
Hellenic Republic	XS0224227313	EUR	English law	13/07/2020	250.0	58.2	43.5	passed	0%
Hellenic Republic	XS0251384904	EUR	English law	19/04/2021	250.0	54.9	39.7	passed	0%
Hellenic Republic	XS0255739350	EUR	English law	31/05/2021	100.0	59.2	45.3	passed	0%
Hellenic Republic	XS0256563429	EUR	English law	09/06/2021	150.0	56.1	40.3	passed	0%
Hellenic Republic	XS0223870907	EUR	English law	07/07/2024	250.0	58.7	45.1	passed	0%
Hellenic Republic	XS0223064139	EUR	English law	06/07/2025	400.0	53.8	37.4	passed	0%
Hellenic Republic	XS0260349492	EUR	English law	10/07/2026	130.0	62.9	52.3	passed	0%
Hellenic Republic	XS0110307930	EUR	English law	14/04/2028	200.0	63.7	54.1	not passed	100%
Hellenic Republic	XS0192416617	EUR	English law	10/05/2034	1000.0	47.5	29.7	passed	0%
Hellenic Republic	XS0191352847	EUR	English law	17/07/2034	1000.0	56.6	44.1	not passed	31%
Hellenic Republic	XS0292467775	EUR	English law	25/07/2057	1778.4	-9.4	-5.5	inquorate /1	0%
Athens Urban Transport	XS0354223827	EUR	English Law	26/03/2013	240.0	67.7	74.6	not passed	100%
Athens Urban Transport	XS0198741687	EUR	English Law	12/08/2014	160.0	65.8	62.7	not passed	100%
Athens Urban Transport	XS0308854149	EUR	English Law	18/07/2017	200.9	64.3	53.4	passed	0%
Hellenic Railways	FR0000489676	EUR	English law	13/09/2012	190.0	67.9	76.3	not passed	97%
Hellenic Railways	XS0208636091	EUR	English law	21/12/2012	250.0	66.9	74.8	not passed	100%
Hellenic Railways	XS0165688648	EUR	English law	02/04/2013	412.5	67.8	74.3	not passed	89%
Hellenic Railways	XS0142390904	EUR	English law	30/01/2014	197.0	66.5	68.2	not passed	100%
Hellenic Railways	FR0010027557	EUR	English law	29/10/2015	200.0	64.8	54.6	not passed	87%
Hellenic Railways	XS0193324380	EUR	English law	24/05/2016	250.0	62.8	50.5	not passed	100%
Hellenic Railways	XS0215169706	EUR	English law	17/03/2017	450.0	63.3	52.1	not passed	100%
Hellenic Railways	XS0160208772	EUR	English law	27/12/2017	165.0	63.1	50.9	not passed	76%
Hellenic Railways	XS0280601658	EUR	English law	20/12/2019	255.0	59.4	45.5	passed	0%
Italian, Japanese and Swiss Law Titles									
Hellenic Republic	CH0021839524	CHF	Swiss law	05/07/2013	538.4	65.6	71.1	inquorate /2	100%
Hellenic Republic	JP530000CR76	JPY	Japanese law	14/07/2015	188.3	65.9	57.5	not attempted	58%
Hellenic Republic	JP530000BS19	JPY	Japanese law	01/02/2016	282.4	64.7	51.7	not attempted	44%
Hellenic Republic	JP530000CS83	JPY	Japanese law	22/08/2016	376.6	64.0	52.5	not attempted	61%
Hellenic Republic	IT0006527532	EUR	Italian law	11/03/2019	182.9	63.8	53.6	not attempted	19%
Hellenic Railways	JP530005AR32	JPY	Japanese law	03/03/2015	94.1	68.4	63.1	not attempted	84%
Hellenic Railways	JP530005ASC0	JPY	Japanese law	06/12/2016	81.9	63.2	51.4	not attempted	100%

Notes: The entry "not attempted" means that no consent solicitation (amendment attempt) was made to the holders. The amount in € million excludes bond holdings by the ECB, which were not exchanged. The haircut estimates with "uniform rate" are based on a 15.3 percent discount rate. The imputed yield curve rates used for computing the alternative "yield curve" haircut measure is discussed in in Appendix 4 below.
1/ Inquorate (and not adjourned) according to April 2 press release and April 3 "Notice of Result I-W". However, an April 11 press release suggests that a special deal with these bondholders was struck.
2/ Inquorate according to April 2 press release. Since only consents had been solicited (no exchange solicitation) this presumably means no outstanding principal was exchanged.

Table A4 (Ct'd) - Part C: Greek law guaranteed titles

Issuer	ISIN	Currency	Governing Law	Maturity	Amount held by Private Sector (€ mn)	Haircut (uniform rate)	Haircut (yield curve)	Amendment Outcome	Holdouts (in %)
Athens Urban Transport	GR2000000106	EUR	Greek Law	13/07/2012	350.0	68.2	76.8	not attempted	0%
Athens Urban Transport	GR2000000072	EUR	Greek Law	16/09/2015	200.0	63.2	52.7	not attempted	0%
Athens Urban Transport	GR2000000080	EUR	Greek Law	03/02/2016	149.5	62.8	50.6	not attempted	0%
Athens Urban Transport	GR1150001666	EUR	Greek Law	19/09/2016	320.0	64.4	53.1	not attempted	50%
Athens Urban Transport	GR2000000098	EUR	Greek Law	09/08/2018	340.0	61.0	47.9	not attempted	0%
Hellenic Defence Systems	GR2000000221	EUR	Greek Law	05/05/2014	3.6	68.2	59.6	not attempted	0%
Hellenic Defence Systems	GR2000000239	EUR	Greek Law	22/06/2014	14.3	61.5	58.4	not attempted	0%
Hellenic Defence Systems	GR2000000304	EUR	Greek Law	12/08/2014	162.5	65.2	61.9	not attempted	0%
Hellenic Defence Systems	GR2000000247	EUR	Greek Law	20/12/2014	6.5	64.1	57.8	not attempted	0%
Hellenic Defence Systems	GR2000000254	EUR	Greek Law	24/03/2015	17.5	64.4	56.7	not attempted	0%
Hellenic Defence Systems	GR2000000262	EUR	Greek Law	30/06/2015	32.3	62.9	52.7	not attempted	0%
Hellenic Defence Systems	GR2000000270	EUR	Greek Law	25/04/2018	125.4	61.5	49.2	not attempted	0%
Hellenic Defence Systems	GR2000000296	EUR	Greek Law	16/05/2023	213.0	59.6	47.2	not attempted	0%
Hellenic Defence Systems	GR2000000288	EUR	Greek Law	18/05/2027	175.0	56.0	42.6	not attempted	0%
Hellenic Railways	GR2000000064	EUR	Greek Law	11/10/2013	635.0	63.4	67.1	not attempted	0%
Hellenic Railways	GR2000000023	EUR	Greek Law	27/12/2014	157.6	64.3	57.9	not attempted	0%
Hellenic Railways	GR1150003688	EUR	Greek Law	28/08/2015	700.0	66.5	58.2	not attempted	0%
Hellenic Railways	GR2000000049	EUR	Greek Law	04/03/2016	265.0	55.9	37.6	not attempted	0%
Hellenic Railways	GR2000000056	EUR	Greek Law	25/08/2016	800.0	54.5	34.8	not attempted	0%
Hellenic Railways	GR2000000031	EUR	Greek Law	02/06/2018	713.7	61.5	49.0	not attempted	0%
Hellenic Railways	GR2000000015	EUR	Greek Law	12/08/2020	520.0	57.5	43.0	not attempted	0%
Hellenic Railways	GR1150002672	EUR	Greek Law	14/06/2037	800.5	55.2	42.6	not attempted	0%

Note: The entry "not attempted" means that no consent solicitation (amendment attempt) was made to the holders. The haircut with "uniform rate" is based on a 15.3 percent discount rate. The imputed yield curve rates used for computing the alternative haircut measure is discussed in Appendix 4 below.

Appendix 3: Historical Comparison of Exit Yields

Table A5: Exit yields following previous distressed debt exchanges, 1990-2010

Debt restructuring case	Date	Exit yield unadjusted	Exit yield adjusted 1/	Subsequent default or debt restructuring?
Mexico (Brady deal)	4.2.90	22.3	12.2	No
Nigeria (Brady deal)	1.12.91	22.6	13.4	Yes, in 2001
Venezuela (Brady deal)	5.12.90	17.9	7.5	No
Philippines (Brady deal)	1.12.92	14.1	5.3	No
Argentina (Brady deal)	7.4.93	15.0	6.9	Yes, in 2001
Jordan (Brady deal)	23.12.93	10.9	3.2	No
Brazil (Brady deal)	15.4.94	18.2	9.6	No
Bulgaria (Brady deal)	29.6.94	23.5	14.9	No
Dom. Rep. (Brady deal)	1.8.94	17.0	8.3	Yes, in 2005
Poland (Brady deal)	27.10.94	13.5	4.3	No
Ecuador (Brady deal)	1.2.95	28.1	19.2	Yes, in 1999
Panama (Brady deal)	1.5.96	12.0	3.7	No
Croatia	31.7.96	9.8	1.4	No
Peru (Brady deal)	1.3.97	11.5	3.4	No
Russia (Soviet-era debt)	1.12.97	12.4	5.1	Yes, in 1998
Cote d'Ivoire (Brady deal)	1.3.98	11.7	4.4	Yes, in 2000
Pakistan (Bond debt)	13.12.99	21.4	13.2	No
Ukraine (Global Exchange)	7.4.00	28.6	20.2	No
Ecuador	23.8.00	22.2	13.9	Yes, in 2008
Russia (PRINs & IANs)	25.8.00	16.4	8.1	No
Moldova (External bonds)	1.10.02	21.0	13.3	No
Uruguay	29.5.03	12.2	5.8	No
Argentina (External debt)	1.4.05	8.2	2.2	No
Dom. Rep. (Bond debt)	11.5.05	9.6	3.5	No
Grenada	15.11.05	9.1	2.7	No
Iraq	1.1.06	11.9	5.7	No
Belize	20.2.07	8.4	2.1	No
Ecuador	5.6.09	16.0	8.5	No
Cote d'Ivoire	16.4.10	11.1	4.9	No
AVERAGE		**15.7**	**7.8**	
Greece	**9.3.12**	**15.3**	**10.2**	**n.a.**

1/ Exit yield minus average yield on Baa rated corporate bonds according to Moody's

Source: Database underlying Cruces and Trebesch (2010).

Appendix 4. Imputation of Short- and Medium-Term Exit Yields

Following the exchange, Greece lacked a yield curve for short and medium residual maturities. This makes it difficult to value the old bonds for the purposes of constructing a present-value haircut as defined in Section III—that is, conditional on a hypothetical scenario in which Greece would have kept servicing these bonds in the same way as the new ones. Discounting at the average yield of the new bonds may not be the best approach, because sovereign risk may have been greater or smaller at the shorter maturities.

To construct valuations for the shorter maturities, one can combine assumptions about the distribution of default probability in Greece following the exchange with the information expressed in the observed exit yields. Commentary immediately after the announcement of the initial exchange results indicates that markets believed that the risk of a new default would remain high for the foreseeable future after the exchange, driven by Greece's continued high debt, the worsening recession, political uncertainty, and the repayments due to the official sector, which were set to rise sharply in 2014.[63]

As a way of quantifying these risks, we assumed a normal distribution of default risk with a left-truncated probability density function (pdf). That is, we assume, the probability of a new default is assumed to start at some level immediately after the exchange, then continue to rise until a peak, and then tail off. We experimented with two alternative assumptions on where the peak might be located:

- Six months after the exchange time (taken to be February 24). This corresponds to an interpretation where default would be triggered by the March program going off track soon, perhaps as a result of political changes following the April 2012 parliamentary elections;
- Twenty-four months after the exchange: this is a story where the March program is either implemented or renegotiated, but the default probability nonetheless rises and peaks in 2014 as a result of the increasing official repayment burden at around that time.

Given these assumptions, we experimented with different assumptions about the standard deviation of default risk to see how this would affect the results (three months, six months, and 12 months for the distribution with peak density after six months; and six months, 12 months, and 18 months for the distribution with peak density after 24 months).

Finally, given the assumed means and standard deviations of the default pdf, we used the observed prices of the new bonds on March 12, 2012 to calibrate two additional parameters, namely, the total cumulative probability of default over the short and medium term (i.e., the area under the assumed pdf), and the long-run borrowing cost of Greece. These two parameters were set to reproduce both the level and the falling

[63] "Market Looks to Next Day of Reckoning", *Wall Street Journal*, 10. March 2012; "Greece's New Bonds Yield More Than Portugal's on Growth, Repayment Concern", Bloomberg News, March 9, 2012; "Doubting traders unpersuaded by Athens debt deal", Reuters, March 9, 2012). Some of these worries have in the meantime been confirmed by events.

shape of the observed portion of Greece's yield curve, given the assumed shape of the default probability density function.

To impute yields, it is also necessary to also make an assumption on a third parameter, namely, the recovery rate in the event of a new default. There is not enough information to calibrate this parameter independently (since all we have to go by is the level and shape of the observed new bond yield curve). Hence, we took the approach of setting this parameter to zero. We could also have assumed a positive recovery value level; this would have translated into a correspondingly higher total default probability in order to reproduce the risky bond prices, and not made any difference to the imputed values and yields.

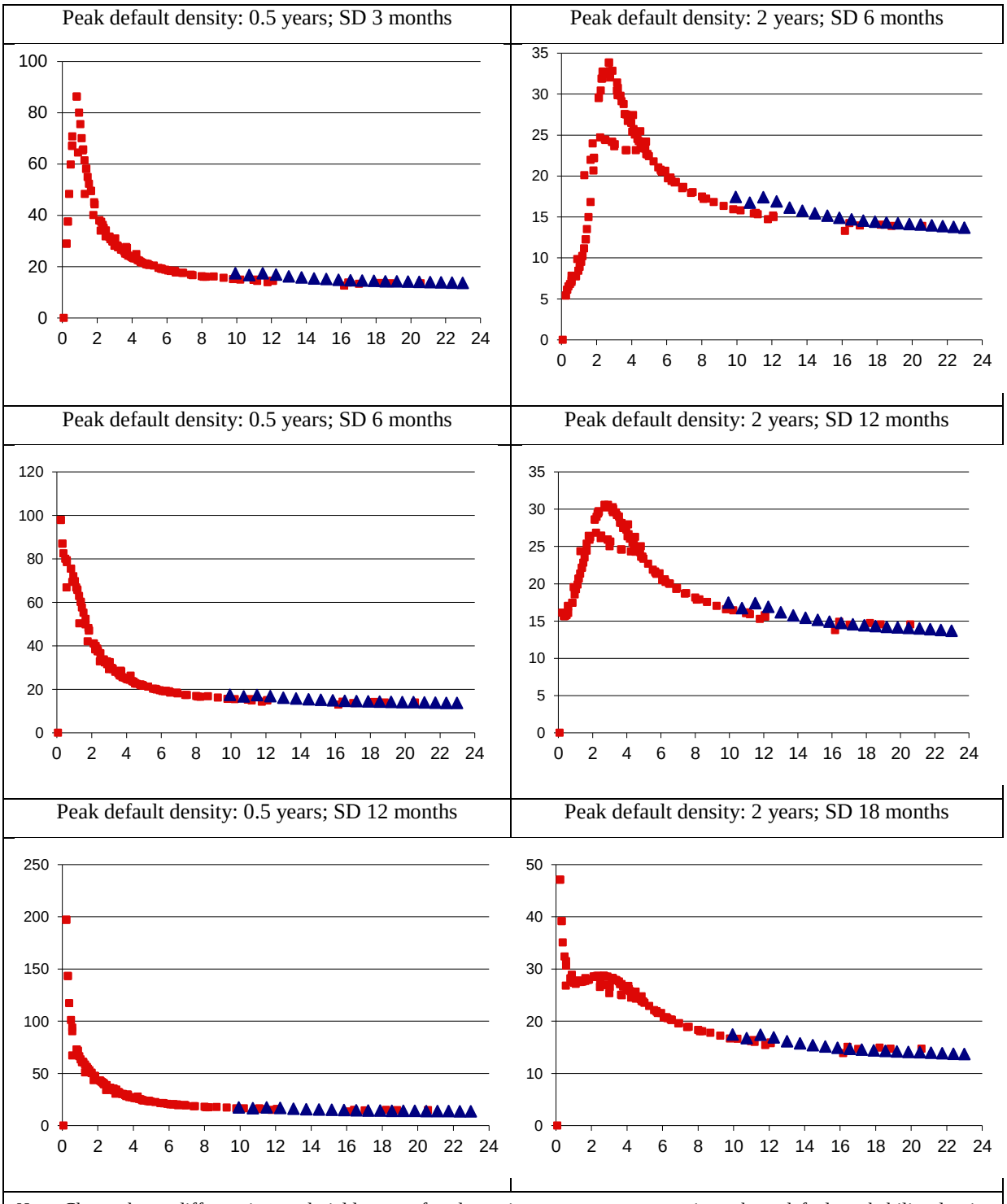
As it turns out, the two calibrated parameters (total probability mass and long run borrowing costs) are very insensitive to the assumed distributional parameters (mean, i.e., location of peak probability density, and standard deviation). In all cases, the implicit total cumulative default probability in the short and medium term (roughly, in first 10 years after the exchange), is between 0.52 and 0.55 (assuming zero recovery); while the implicit expected long run yield is 8.0-8.2 percent.

Figure A1 shows the results, i.e., the imputed yield curves for six different assumed parameter combinations of the default pdf. As one would expect, these assumptions make quite a dramatic difference to the imputed yields at the shorter end. The question is how these affect the overall present-value haircut. Table A6 gives the answer for the six cases shown.

Table A6. Aggregate present value haircuts based on alternative short-run yield curves

Assumed peak probability of default			
August 2012 (after 0.5 year)		February 2014 (after 2 years)	
Assumed std. dev. (months)	Implicit haircut	Assumed std. dev. (months)	Implicit haircut
3	57.5	6	59.6
6	56.1	12	58.2
12	54.4	18	57.5

Figure A1. Imputed yield curves for alternative assumptions about the distribution of default probability in the short and medium run



Note. Charts shows different imputed yield curves for alternative parameters assumptions about default probability density functions. Normal distributions are assumed, which are truncated to the left at time zero (corresponding to February 2012. SD stands for standard deviation. Vertical axes denote yield to maturity in percent, horizontal axes remaining maturity in years. Red squares denote imputed yields, blue triangles denote actual observed yields on 12 March 2012.

The main result is that the aggregate present-value haircut corresponding to the imputed yield curves varies between about 55 and 60 percent, against an aggregate haircut of 65 percent if a flat yield curve of 15.3 percent is assumed. The reason for these lower estimates is that the imputation results for the most part results in higher yields at the short and medium end, where most of the old bonds were concentrated. Hence, the present value of these bonds is deemed to have been lower, and hence also the losses from giving up these bonds. In effect, the imputed yield curve approach acknowledges the fact that investors with shorter old bonds would have faced an extremely risky environment in the first two years after the exchange, even under a successful exchange and even if the Greek government had continued to give their repayments equal priority to the payments on the new bonds.

Appendix 5. Historical Comparison of Government Coerciveness

Table A6 benchmarks the procedural approach in the Greek exchange to that of previous cases of the 1990s and 2000s, using an index of government coerciveness during sovereign debt crises developed by Enderlein et al. (2012). The index captures nine dimensions of payment and negotiation behavior vis-à-vis creditors and is additive, so that the maximum degree of debtor coerciveness is 10 (all criteria fulfilled in the run-up to a restructuring).

Table A6. Debtor coerciveness in previous distressed debt exchanges, 1990-2010

	Date	Overall Coerciveness (max. 10)	Post-Default	Full Mora-torium?	Forced Exchange	Explicit Threats
Mexico (Brady deal)	4.2.90	**3**	Yes	No	No	Yes
Nigeria (Brady deal)	1.12.91	**8**	Yes	No	Yes	Yes
Venezuela (Brady deal)	5.12.90	**5**	Yes	No	No	Yes
Philippines (Brady deal)	1.12.92	**3**	No	No	No	Yes
Argentina (Brady deal)	7.4.93	**6**	Yes	Yes	No	Yes
Jordan (Brady deal)	23.12.93	**7**	Yes	Yes	Yes	Yes
Brazil (Brady deal)	15.4.94	**7**	Yes	Yes	No	Yes
Bulgaria (Brady deal)	29.6.94	**6**	Yes	Yes	No	Yes
Dom. Rep. (Brady deal)	1.8.94	**7**	Yes	Yes	No	Yes
Poland (Brady deal)	27.10.94	**5**	Yes	Yes	No	No
Ecuador (Brady deal)	1.2.95	**7**	Yes	Yes	No	Yes
Panama (Brady deal)	1.5.96	**5**	Yes	Yes	No	No
Peru (Brady deal)	1.3.97	**9**	Yes	Yes	No	Yes
Russia (Soviet-era debt)	1.12.97	**5**	Yes	Yes	No	No
Pakistan (Bond debt)	13.12.99	**3**	No	No	No	Yes
Ukraine (Global Exch.)	7.4.00	**2**	No	No	No	Yes
Ecuador	23.8.00	**6**	Yes	No	Yes	No
Russia (PRINs & IANs)	25.8.00	**6**	Yes	Yes	No	No
Moldova (Bond debt)	1.10.02	**2**	No	No	No	Yes
Uruguay	29.5.03	**1**	No	No	No	No
Argentina (Ext. debt)	1.4.05	**9**	Yes	Yes	Yes	Yes
Dom. Rep. (Bond debt)	11.5.05	**2**	No	No	No	No
Grenada	15.11.05	**2**	Yes	No	No	No
Belize	20.2.07	**2**	Yes	No	No	No
AVERAGE		**4.9**				
Greece	**9.3.12**	**2**	**No**	**No**	**No**	**Yes**

Source: Enderlein, Trebesch, and von Daniels (2012), except for coding of Greece. The column on "Overall Coerciveness" shows the total index value for each agreement. The table also shows the binary coding results of four sub-indicators: "Post-default" captures whether the country missed any payments prior to the exchange, or not. "Full Moratorium" captures whether the country fully suspends interest and principal payments, even refusing to make token payments. "Forced exchanges" are cases without formal or informal negotiations between the government and its creditors. The criterion on "explicit threats" is fulfilled whenever a key government actor publicly threatens to repudiate on debt, e.g., via an indefinite moratorium.

Appendix 6. Counterfactual Scenarios

Table A7 presents the counterfactual implications, in terms of either additional debt relief or lower official financing (cash transfers), of designing the Greek debt restructuring differently along a number of dimensions: (1) a tougher approach to holdouts and involvement of central banks, leading to higher participation; (2) a uniform present value haircut of 70 percent for all creditors, regardless maturity; (3) an additional 5 percent haircut for holders of Greek law bonds, as these benefitted from the seniority upgrade into new English-law bonds; (4) a negotiated rather than voluntary buyback in late 2012. We also compute what would have happened if the March 2012 deal would have been a negotiated buyback right from the start, instead of the two-step restructuring that was actually implemented.[64]

To keep the analysis simple, we assume that in each of these scenarios, creditors would have received either cash or the same bundle of bonds (in terms of maturities and coupons) as were offered in the actual exchange, except possibly in different amounts. For example, in the scenario that equalizes present-value haircuts we assume that all investors would have received the same face value of new bonds, with short term investors receiving more cash, in addition to bonds, than longer term investors (unlike the actual exchange, were all investors received the same amount of bonds and cash per unit of face value)

The results can be summarized as follows.

(i) Higher participation. Our first counterfactual broadens the base of participating bondholders, either by taking a tougher approach on potential holdouts (full participation of private creditors) or by additionally including the holdings of central banks. Row 2 of Table A7 shows that binding in the approximately 3 percent of private sector holdouts would have implied approximately €3 billion in additional debt relief in face value terms and almost €4 billion in present value. Including euro area central banks would have increased the present value debt relief by €31 billion, assuming central banks would have been given the same bundle of cash and new bonds as private investors (row 3). However, it would also have required almost €10 billion in extra cash.

(ii) Uniform haircut of 70 percent for all maturities. Our second counterfactual is to impose the same present-value haircut on all bondholders. The haircut of 70 percent is only somewhat higher than the actual average haircut of about 65 percent, and lower than the haircut that was deemed to be acceptable for short-term creditors. Assuming that official cash would have remained capped at €30 billion as in the actual debt exchange, a uniform 70 percent haircut would have created additional debt relief of almost 30 billion in face value terms and 23 billion in present value terms (row 5). Alternatively, one can fix debt relief

[64] One counterfactual not addressed in the table is the bail-in of bank bond holders. Assuming no compensation of banks for PSI related losses, this could have saved up to €25 billion in official financing and led to additional debt relief for Greece in the amount given by the fifth row of Table 4. However, some recapitalization might have been needed even with a bond holder bail-in, requiring a fuller analysis of how a bail-in of Greek bank creditors might have played out for the public purse. This analysis beyond the scope of our paper.

(€103 billion in present value terms, as in the actual exchange) and compute the minimum of cash that would have been needed to implement this debt relief target, namely, just under €23.9 billion, €6 billion less than was actually used (see row 6, and Appendix 7 for the formula used).

Table A7. Debt relief and official cash use in counterfactual restructuring scenarios

Row		Debt reduction		Official cash used
		Face value	Present value	
	Counterfactuals with respect to March/April debt exchange			
(1)	*Benchmark: actual March/April debt exchange*	107.1	103.0	29.7
	Identical haircuts as in actual restructuring:			
(2)	Full participation of private sector[1/]	110.0	106.6	30.8
(3)	Full participation of both private sector and central banks[1/]	140.4	144.1	39.4
	Uniform haircut of 70 percent:			
(4)	Same cash use, actual participation	134.2	122.8	29.7
(5)	Using €30 billion cash, full private participation	136.1	125.6	30.0
(6)	Using minimum cash,[2/] full private participation	115.6	103.0	23.9
	Haircut of 75 percent for Greek law and 70 percent for foreign law, full private participation:			
(7)	Using €30 billion cash	160.2	143.2	30.0
(8)	Using minimum cash[2/]	130.5	103.0	15.5
(9)	Using €30 billion cash, with central bank participation	172.0	169.8	30.0
	Counterfactuals with respect to December buyback			
(10)	*Benchmark: actual buyback*	20.6	17.1	11.3
	Buyback at negotiated prices:			
(11)	Secondary market prices of 23.11.2012	27.8	22.9	11.3
(12)	Secondary market prices of 11.10.2012	38.0	31.0	11.3
(13)	Secondary market prices of 12.03.2012	31.8	26.1	11.3
	Combined counterfactuals: full negotiated buyback at the time of the March/April restructuring			
(14)	*Benchmark: cumulative effect of debt exchange and actual buyback*	127.7	120.1	41.0
	Full buyback in March/April			
(15)	Identical haircuts and participation as in actual exchange	153.1	138.8	46.1
(16)	Uniform haircut of 70 percent, full private participation	165.6	148.6	40.0

Notes: In € billion. Haircuts evaluated at average exit yield of 15.3 percent, debt relief at a discount rate of 5 percent. Scenarios involving higher average haircuts assume that PSI-related recapitalization costs of Greek banks would have been proportionally higher.

1/ Creditors assumed to receive same bundle of cash and new bonds as in actual restructuring.
2/ Minimum cash needed consistent with maintaining the same present value debt reduction as achieved in the actual exchange; assuming discount rate of 5 percent. See Appendix 6 for formula used.

(iii) 75 percent haircut on Greek law bonds, 70 percent on foreign law bonds. Another thought experiment assumes a modestly higher haircut on Greek-law bonds compared to English-law bonds, reflecting the fact that the former benefitted from an upgrade in governing law that makes them harder to restructure in the future. Row 7 shows that compared to the actual restructuring, this would have translated into additional debt relief of €53 billion in face value and €40 billion in present value terms. Alternatively the official cash used in the exchange could have reduced by nearly €15 billion (row 8).

(iv) December 2012 buyback based on negotiated prices. Our fourth counterfactual relates to the December buyback. The table shows what could have been gained if the buyback had been conducted at negotiated (ex-ante) prices rather than market prices, so as to minimize the boondoggle effect of increasing bond prices once the buyback is announced. If the buyback had happened at the reference price mentioned in the Eurogroup statement of 27. November—the price of 23. November 2012, just before the buyback was officially announced—Greece would have obtained an extra debt €6 billion in debt relief in present value terms (or over 7 billion in face value terms, see row 11). If it had been conducted at the price that prevailed just before the possibility of a buyback was first mentioned in the press, around October 11, the debt relief would have been €14 billion higher than what was actually achieved (row 12). Finally, if the issue price of March 12 had been used—which could have been justified by the fact that it would have implied no further losses for investors beyond those already sustained in the debt exchange—debt relief would have exceeded that in the actual buyback by about €9 billion in present value terms (row 13).

(v) Full cash buyback in March/April; no bond exchange. Finally, it is interesting to ask what would have happened if the Greek debt restructuring had been designed as a pure negotiated buyback from the outset—that is, if bondholders would have exclusively received cash, rather than a package of cash and new bonds, during the March-April exchange. Row 15 shows that, on the assumption that both participation and bond-by-bond haircuts would have been exactly the same as in the actual debt exchange, the cash needed for this full buyback operation would have been €46 billion, only €5 billion more than what the official sector actually spent for the cash sweetener in March and the cash-buyback in December (a combined €41 billion). This additional cash would have "bought" an extra €25 billion debt relief in face value terms (€19 billion in present value). Conducting the full buyback in a way that would have led to a uniform 70 percent present-value haircut for all maturities would both have led to both much higher debt relief than in the actual exchange—an extra €39 billion in face value and €29 billion in present value—and used €1 billion *less* in cash than was actually used for the March/April debt exchange and December buyback combined (row 16).

Appendix 7. Computing the Cash Minimizing Debt Restructuring

This appendix derives the formulas used in section 5 of the paper (and in Appendix 6 above) to establish the minimum volumes of official cash that would have been needed to restructure the Greek debt subject to the following assumptions:

1) Either a uniform PV haircut across all bonds (assumption used in row 6 of Table A7), or within Greek law bonds and foreign law bonds (assumption used in row 8 of Table A7).
2) Debt relief at least as high as Greece received in the actual restructuring.
3) A higher haircut must lead to proportionally higher bank recapitalization.
4) Same bundle of bonds would have been used as in the actual restructuring.

That is, for each unit of face value of each old bond i, we seek the units of cash c_i and units of the new bond "bundle" b_i to minimize total cash use, subject to 1), 2), and 3).

In a first step, we write down a constraint that incorporates 2) and 3). Let $V_d(b)$ denote the present-value debt burden for Greece associated with new bonds of face value b and discount rate d (e.g., 5 percent), $V_d^{EFSF}(c)$ the present value debt burden for Greece of borrowing total cash sweetener in the amount c from the EFSF, and V_d^{old} the present value of Greece's old bonds exchanged in the actual exchange, V_d^{recap} the present value of Greece's debt obligations to the EFSF resulting from actual PSI related bank recapitalization, and h the assumed uniform present value haircut (for example, 0.7). Then, 2) and 3) imply:

$$(1)\quad V_d^{old} - V_d^{recap} - V_d^{EFSF}(29.7\text{bn}) - V_d(61.4\text{bn}) \;\le\; V_d^{old} - \frac{h}{0.646}V_d^{recap} - V_d^{EFSF}\{\textstyle\sum_i c_i\} - V_d\{\textstyle\sum_i (b_i)\}$$

where the left side of the inequality denotes the debt relief received by Greece in the actual restructuring, and the right hand side the debt relief it would obtain in a counterfactual restructuring which applies a uniform present value haircut h to all bonds regardless of maturity (0.646 is the average haircut achieved in the actual restructuring, using the exit yield as the uniform discount rate, and the coefficient $\frac{h}{0.646}$ reflects an upward adjustment to the bank recapitalization cost in the event that $h > 0.646$.

Using the notation $V_y(b_i)$ to denote the value of b_i, discounted at exit yield y, from the perspective of the holder of old bond i, $v_{i,y}^{old}$ the value of one unit of old bond i discounted at the same exit yield and h the uniform haircut (e.g., 0.7), the minimization problem can then be written as:

$$(2)\quad \min_{c_i,b_i} \textstyle\sum_i c_i \text{ , subject to}$$
$$\text{(i)}\ c_i + V_y(b_i) = (1-h)v_{i,y}^{old}$$
$$\text{(ii)}\quad V_d^{EFSF}\{\textstyle\sum_i c_i\} + \textstyle\sum_i V_d(b_i) \le K$$

where $K \equiv \left(1 - \frac{h}{0.646}\right)V_d^{recap} + V_d^{EFSF}(29.7\text{bn}) + V_d(61.4\text{bn})$ (from equation (1)).

It is clear from the present value formula that all value functions that appear in the constraints (i) and (ii) are linear in their arguments: the present value of x units of face value equals x times the present value of one unit of face value, which is just a constant. Using lower case notation to denote the present values associated with one unit of face value for each of the value functions in (i) and (ii), the constraints can be rewritten as:

(i) $c_i + v_y b_i = (1-h)v_{i,y}^{old}$ and

(ii) $v_d^{EFSF}\sum_i c_i + v_d \sum_i b_i \leq K$

After solving (i) for b_i and substituting into (ii) this means that the minimization simplifies to $\min_{c_i} \sum_i c_i$ s.t. $v_d^{EFSF}\sum_i c_i + \frac{v_d}{v_y}\sum_i\{(1-h)v_{i,y}^{old} - c_i\} \leq K$ or equivalently:

$$\min_{c_i} \sum_i c_i \text{ s.t. } \left[v_d^{EFSF} - \frac{v_d}{v_y}\right]\sum_i c_i + \frac{v_d}{v_y}(1-h)\sum_i v_{i,y}^{old} \leq K$$

Now, observe that $v_d^{EFSF} - \frac{v_d}{v_y} < 1$ for relevant assumptions about cash flows and discount rates (as an empirical matter, one unit of face value of cash sweetener borrowed from the EFSF implies a burden of about 0.86 when discounted at 5 percent, one unit of face value of new Greek bonds a burden of about 0.8, and one unit of new Greek bonds a value of investors of about 0.25 when discounted at the exit yield of 15.3). This implies that minimization of $\sum_i c_i$ implies that the term $\left[v_d^{EFSF} - \frac{v_d}{v_y}\right]\sum_i c_i$ must be maximised, which means that the constraint must hold with equality. Hence, the minimum cash sweetener needed, subject to the assumptions made, is given by:

$$\sum_i c_i = \frac{v_d(1-h)}{v_d - v_y v_d^{EFSF}}\sum_i v_{i,y}^{old} - \frac{v_y}{v_d - v_y v_d^{efsf}}K.$$

Now suppose that Greece had decided to treat Greek law and foreign law bondholders differently. In that case, assumption 1) is replaced by:

1) *(alt) Uniform PV haircut within Greek law bonds and within foreign law bonds*

and constraint (i) is replaced by:

(i.g) $c_g + V_y(b_g) = (1-h_G)v_{g,y}^{old}$

(i.f) $c_f + V_y(b_f) = (1-h_f)v_{f,y}^{old}$

where the subscripts f and g now refer to foreign law and Greek law bondholders, respectively. Adding (i.g) and (i.f) over all g and f, respectively, and substituting into (2) after exploiting the linearity of the present values in the face values results in a new expression for the minimum cash needed to meet the assumptions,

$$\sum_i c_i = \frac{v_d}{v_d - v_y v_d^{EFSF}}\{(1-h_g)\sum_g v_{g,y}^{old} + (1-h_f)\sum_f v_{g,y}^{old}\} - \frac{v_y}{v_d - v_y v_d^{EFSF}}K.$$