



Sustainability of Greek Public Debt

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Author's Note: For comments on an earlier draft, I thank without implicating Anders Aslund, Juan Carlos Martinez Oliva, Edwin M. Truman, and John Williamson. I thank Yimei Zou for research assistance.

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On July 21, 2011, the heads of government of the euro area announced a new plan to address the Greek debt crisis. This policy brief presents a simulation exercise that examines whether the new arrangements are likely to provide a sustainable solution. The analysis focuses on four key measures: gross debt relative to GDP; net debt relative to GDP; net interest payments relative to GDP; and amortization of medium- and long-term debt coming due during the year in question, relative to GDP. The new Greek package shows prospective future progress on all four measures, and Greek debt looks much more sustainable after the package than before. Debt also appears considerably more manageable if the criterion is net debt or interest burden rather than gross debt ratio, although even for gross debt the ratio is down substantially by 2020. It also becomes clear that the major contribution of the private-sector involvement (PSI) part of the package is in the form of sharply cutting amortization due, although by avoiding large new borrowing at crisis-level interest rates it also alleviates the interest burden that would otherwise occur.

The debt burden gauged by net debt declines from 121 percent of GDP in 2012 to 69 percent in 2020, the same ratio as that for the United States (federal debt held by the public)

in 2011. Whereas the interest burden would have reached 8.7 percent of GDP by 2020 without the July package, after the reduction in EU interest charged and with the PSI arrangements the interest burden in 2020 falls to 5.2 percent of GDP. Perhaps the greatest challenge for sustainability will be the achievement of a sustained primary fiscal surplus of about 6 percent of GDP. If instead the primary surplus reached only 3 percent, there would still be some improvement but the net debt to GDP ratio would plateau at about 95 percent of GDP by 2015 and after. A much larger privatization program than the €50 billion already planned would be one way to secure comparable improvement in the debt ratios with less ambitious primary surplus goals. Crucially, the shift to 10-year grace periods and 30-year maturities for EU support, and the exchange of the bulk of existing debt owed to private holders for 30-year bonds, means that the acute liquidity squeeze that otherwise would have occurred from prospective amortization will have been greatly alleviated, giving Greece time to consolidate solvency.

As of mid-September 2011, there was widespread expectation that Greece would default. For its part, the *Economist* judged that “Greece, which is unambiguously insolvent, ought to have a hard but orderly write-down.”¹ This view gives inadequate attention to the major reduction in the debt burden already incorporated in the reduction of interest rates on EU support and the major alleviation of the liquidity squeeze provided by the PSI. The results here suggest instead that Greece can manage its sovereign debt under the new package so long as it meets the fiscal adjustment targets. So far the evidence is that Greek political leaders are willing to take the extensive and unpopular measures necessary to do so.

BACKGROUND

In May 2010, euro area authorities and the International Monetary Fund (IMF) launched a €110 billion support program to enable Greece to overcome its debt crisis, with €80 billion coming from European governments and €30 billion

1. “How to Save the Euro,” *Economist*, September 17, 2011, 11.

from the IMF. In comparison, outstanding Greek public debt at end-2009 was €298 billion. The 2010 package was premised on the reestablishment of Greek access to private financial markets by 2012. Greece was supposed to be able to borrow on the private markets about €27 billion (medium- and long-term) in 2012, €38 billion in 2013, and about €70 billion annually in 2014–15 (IMF 2011a, 49).

Greece can manage its sovereign debt under the new package so long as it meets the fiscal adjustment targets.

In recent months it became increasingly clear that Greece would not be able to return to private markets by 2012. As euro area leaders began to consider a second support package, the issue of PSI became a source of contention. German and Dutch authorities pushed for PSI, but the European Central Bank (ECB) strongly opposed any restructuring that could cause Greek sovereign debt held by Greek and other European banks (as well as by the ECB itself in its Securities Market Program) to be considered to be in any form of default. The rating agencies indicated that a PSI initiative could cause “selective default” even if done on a relatively voluntary basis. In the end, the July package included a major private-sector initiative (led by the Institute of International Finance). The headline figure for PSI was €135 billion over 2011–20 (IIF 2011a). For their part, euro area authorities pledged €109 billion in additional support (EU Council 2011). Importantly, they also announced that the support would be on much more favorable terms than previously, with 10-year grace periods on principal and interest rates set at the level for the balance of payments facility in the European Financial Stability Fund (EFSF), or about 3.5 percent instead of the previously planned rates of about 5 percent in 2011–14 and about 7 percent by 2016–18.²

KEY ISSUES

At the outset it is important to recognize certain features of the Greek debt problem that should tend to make the debt more sustainable than might be thought from a simple focus

2. Although in March 2011 EU leaders had already agreed to reduce the interest rate from 300 basis points above Euribor (400 after 3 years) to 200 basis points (300), the more substantial reduction in the July package involved eliminating any spread and shifting the base rate from Euribor to the EU balance of payments facility rate. In this facility, “AAA loan rates obtained by the EU on international financial markets at the moment of fund-raising are passed on to the Member States in need without adding any additional margin” (EC 2011c).

on the headline debt-to-GDP ratio. First, there are relatively large privatizations planned that should reduce the debt. Second, there is a relatively large amount of public financial assets, so the net debt is considerably lower than gross debt. Third, the nature of the support program and the PSI initiative causes a misleading buildup in gross debt that is offset by a corresponding rise in assets. Fourth, the large portion of Greek debt that will be held by the official sector will bear moderate interest rates, making the debt burden lighter than might be suspected from the debt ratios alone.

For its part, the headline gross debt to GDP ratio is certainly daunting. In its July 2011 report on Greece, the IMF projected the end-2011 ratio at 166 percent, and the debt to GDP ratio was to peak at 172 percent in 2012 before declining to 130 percent by 2020 (IMF 2011b, 73). Typically it was the sticker-shock value of the 2012 ratio that led many observers to conclude that Greece is insolvent rather than illiquid and needs major debt forgiveness.

A significant part of this number, however, is misleading. The IMF’s previous report in March 2011 had placed the ratio at 153 percent at end-2011 and a peak of 158 percent in 2012 (IMF 2011a, 49). It turns out that the great bulk of the change stemmed from a cryptic category “other” including “recognition of implicit liabilities” and “bank assistance,” a category that amounted to only €4 billion for 2011 in the March report but surged to €30 billion in the July report. This increase alone amounted to about 10 percent of GDP. In contrast, the European Commission’s report, also issued in July, showed a lower gross debt/GDP ratio: 157 percent in 2011 and 161 percent in 2012 (EC 2011a, 29). The difference is apparently mainly the fact that the July IMF report included substantial increased borrowing needed to provision Greek banks in light of the anticipated selective default associated with the preliminary views about PSI, an item not included by the European Commission. With the July package, the extra amount in effect transited to being the amount required for enhancement collateral in the PSI bond exchange.

But how should one think about extra borrowing that goes into bank recapitalization and, especially, bond enhancement collateral? Surely the state acquires a consequent claim; the amount in question is not simply lost. So the severity of the debt ratio was exaggerated by a ballooning in the difference between gross and net debt in the July 2011 IMF report on the eve of the new Greek package.

More generally, the IMF and European Commission have systematically focused on gross debt rather than net debt. In contrast, the Organization for Economic Cooperation and Development (OECD) has reported figures that show there are large state assets that make net debt significantly smaller

than might be expected. The OECD estimates that at the end of 2010 gross public debt was €328 billion on the Maastricht basis; general government gross debt was €339 billion and general government financial assets were €76 billion, placing net general government debt at €263 billion (OECD 2011). With GDP at €230 billion, net debt was lower than gross debt by fully 33 percent of GDP. For 2011, the disbursement of official support and corresponding buildup of a reserve account to be used for PSI collateral, plus the acquisition of assets corresponding to bank support, boosts assets to 45 percent of GDP, far too much to ignore.

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Finally, a central issue for resolving the Greek debt problem is that about half of the debt is already owed to (mainly) foreign public sectors. A crucial implication is that advocates of deep debt forgiveness, such as a 50 percent writedown on debt, are implicitly arguing either that official and private holders should both take a 50 percent haircut or that private holders should be wiped out entirely. Indeed, it is this danger of deep private loss because of possible senior status of public claims that seems likely to have been active in driving spreads to such extreme levels not only in Greece but also in other European economies hit by contagion.

More specifically, the composition of debt is roughly as follows. Official “program” debt (IMF and EU support) stood at €31 billion at end-2010 and will stand at €71 billion at end-2011. As of mid-June, debt held in purchases by the ECB through its Securities Markets Program has been estimated by Barclays Capital at €49 billion.³ Greek public-sector funds held €30 billion; rest-of-world official institutions, mainly in Asia, €25 billion; and the Greek central bank, €13 billion. This places total public-sector holdings at €188 billion (using the end-2011 figure for IMF-EU program), or 50.3 percent of end-2011 debt. Of the rest, eight Greek banks hold €32 billion. The half of total debt held by the private sector

(including Greek banks) is broadly consistent with the €135 billion expected in PSI.⁴

THE SIMULATION FRAMEWORK

Appendix A sets forth the debt simulation model. The base case assumptions for growth, GDP deflator price increase, primary (noninterest) fiscal surplus, and privatization amounts and timing are the same as those used by the IMF (2011b). The pre-package path of debt relative to GDP replicates that in the IMF report. For each year, the change in debt equals the amount of borrowing needed to finance the fiscal deficit, minus the amount received from privatizations.⁵ In addition, special factors further affect the debt: “debt discovery” in which the government officially recognizes previously contingent liabilities; the increase in gross debt associated with borrowing to purchase zero-coupon long-term AAA bonds to hold as collateral against debt swapped in the PSI; additional borrowing of funds used to recapitalize Greek banks; and the amount borrowed for use in buybacks, less the debt extinguished by the buybacks. The fiscal deficit equals interest paid on debt minus the primary surplus. Conservatively, no interest earnings are imputed to financial assets, although these assets are deducted in arriving at net debt.

In addition to the fiscal deficit, gross borrowing must further cover amortization coming due. For liquidity purposes, the heart of the debt package is to reduce amortization coming due in the next few years by carrying out the PSI debt exchange and by drawing on official EU financing with long grace periods instead of new private market financing. For solvency purposes, the heart of the program is to reduce the interest burden of the debt by reducing the interest rate charged on the EU lending and, for privately held debt, avoiding the higher interest rates that would otherwise be imposed by new market-based borrowing at panic rates.

4. The PSI figure refers to maturities coming due from mid-2011 through 2020. It reflects 90 percent participation of eligible debt, so the total eligible would be €150 billion. For total long-term public debt, 78 percent comes due in mid-2011 through 2020, and 22 percent thereafter (Greek Finance Ministry, 2011, 4). This implies that €150 billion coming due through 2020 would represent €190 billion total outstanding ($= 150 \times [1 + 22/78]$). That amount is almost identical to the public-sector holdings enumerated in the text, so each constitutes about half of the total.

5. The calculations do not make any reduction in financial assets as a consequence of privatization. Real estate comprises 70 percent of the privatization target, and such nonfinancial assets are not included in the OECD data on government financial assets. Concessions to infrastructure account for another 20 percent and similarly are not counted in the financial assets (IMF 2011b, 20).

3. “Greek Debt: Everyone’s Problem,” *Economist*, Economics Free Exchange, June 22, 2011.

Table 1 Greek public debt indicators with July 2011 support package (percent and billion euros)

Indicator	2010	2011	2012	2013	2014	2015	2017	2020
Gross debt/GDP	143	166	175	169	159	147	131	113
Net debt/GDP	110	121	119	113	102	88	81	69
Interest/GDP	5.5	7.2	7.5	7.6	7.2	6.6	5.9	5.2
Amortization/GDP		12	6.8	7.4	8.9	6.5	2.4	0.5
Primary surplus/GDP	-4.9	-0.8	1.5	3.5	6.4	7.7	6.4	6.4
Real growth (percent)	-4.4	-3.8	0.6	2.1	2.3	2.7	3	3
Gross debt (bn €)	328	374	399	396	386	370	357	354
Official: Program*	31	104	160	197	210	199	189	189
Private and other official	297	270	239	199	177	171	167	165
Assets (bn €)	76	101	129	130	140	149	136	139
Privatization (bn €)	0	2.9	7.5	11	13.6	15.1	0	0
GDP (bn €)	230	225	228	235	243	251	273	313
Average interest rate (percent)	4.9	4.7	4.5	4.4	4.3	4.3	4.5	4.6

*IMF, EU, EFSF

RESULTS

Table 1 reports the central baseline for Greek debt indicators through 2020 after the official support package of July 2011 (more complete detail is shown in appendix table A.3). The principal results are:

- Gross debt peaks at 175 percent of GDP in 2012, then falls to 113 percent by 2020.
- Net debt falls from 121 percent of GDP in 2011 to 69 percent by 2020.
- Purchase of PSI collateral boosts assets from €76 billion in 2010 to about €150 billion by 2015.
- The interest burden falls from 7.2 percent of GDP in 2011 to 5.2 percent by 2020.
- Amortization falls from 12 percent of GDP in 2011 to 6.5 percent by 2015, 0.5 percent in 2020.
- The primary surplus rises from -0.8 percent of GDP in 2011 to +6.4 percent by 2014 and after.
- The average interest rate on public debt plateaus in a manageable range of about 4.5 percent.

These paths all suggest sustainability of the debt given the official support, if the fiscal targets are achieved.

Figure 1 reports the results of eight simulations. The first is the central expectation for the full Greek package including PSI and €20 billion used for debt buybacks (on the chart, “central”). This case applies the lower EU interest rates and moreover assumes that the first tranche of EU support (the €80 billion agreed in 2010) is converted to repayment with 10

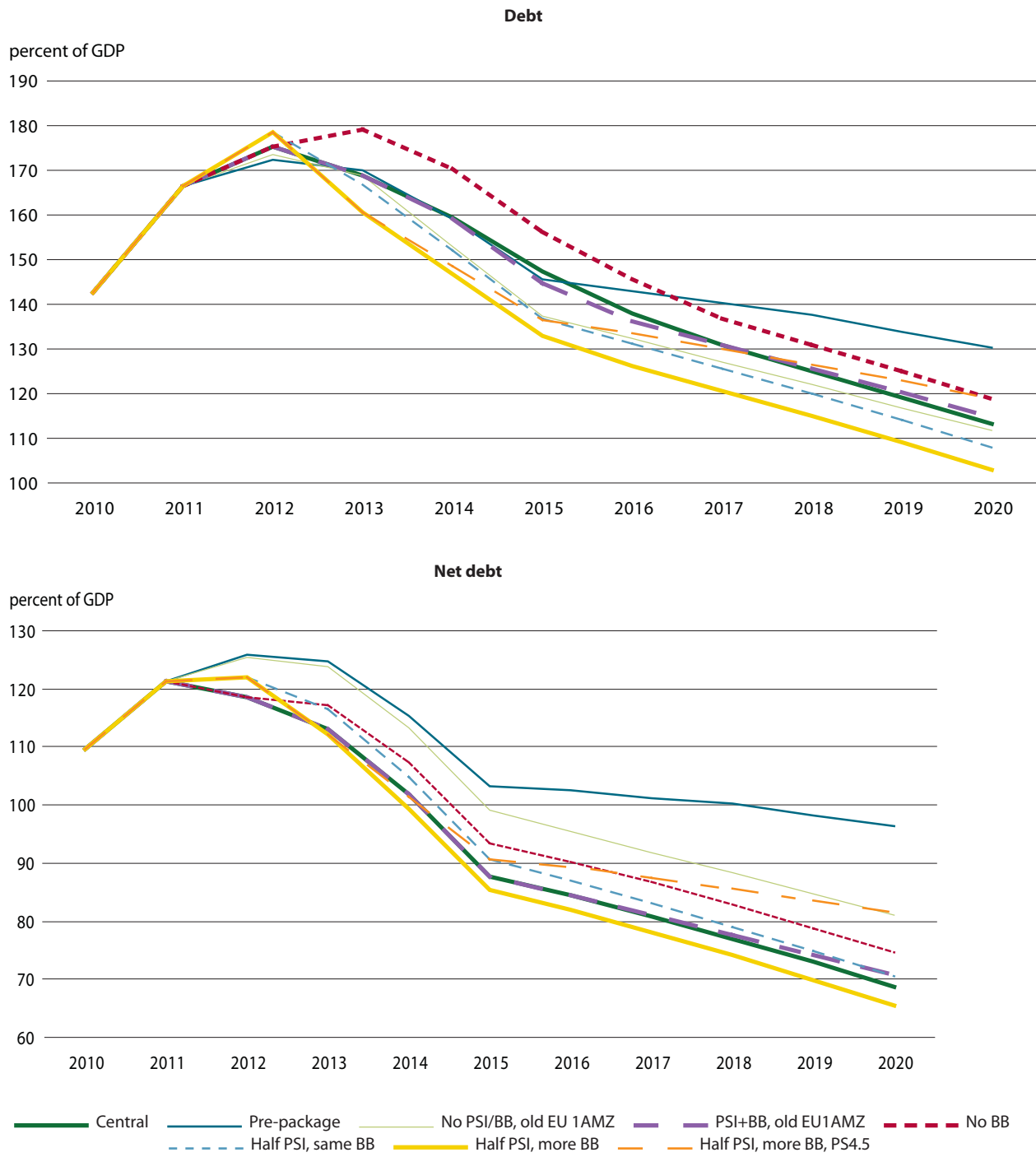
years grace, similar to the second, €109 billion tranche agreed in July 2011. The full amount of the planned PSI is undertaken, which affects €135 billion in amortization to private holders that would otherwise occur from mid-2011 through 2020, and which includes €13.5 billion in principal reduction from the “discount bond” menu option in the exchange (IIF 2011a).⁶ For the buybacks, it is assumed that debt can be repurchased at 61 percent of face value (EC 2011b).

In this central case for the July 2011 package, the gross debt ratio falls from a peak of 175 percent of GDP in 2012 to 113 percent by 2020, and net debt from a peak of 121 percent in 2011 to 69 percent by 2020. Net debt by 2020 would thus stand at almost the same level as that in the United States in 2011 (69 percent, debt held by the public; CBO 2011, 14). The ratio of interest to GDP is cut to 5.2 percent of GDP by 2020.⁷ Of the total reduction from pre-package baseline in the interest burden, by 3.5 percentage points of GDP in 2020, two-thirds comes

6. In the PSI, maturities are stretched out to 30 years, with two broad options. The first maintains full principal (par bonds) and establishes interest rates not much different from past levels but far below current market levels (4.5 percent for the first five years, 5 percent for the next five years, and then 5.5 percent thereafter). The second accepts a 20 percent reduction in principal (discount bonds) but in return boosts interest rates moderately above previous contract levels (to 6 percent for the first five years, 6.5 percent for the next five years, and 6.8 percent thereafter). Both types have zero-coupon collateral for principal.

7. Recent calculations by the IIF (2011b) arrive at similar conclusions about the impact of the package. The decline in the ratio of net debt to GDP from 2012 to 2020 in that study is 45 percentage points of GDP, almost the same as the 48 percentage point decline in the central case here (figure 1 and table A.3). Note, however, that the IIF study does not include the financial assets reported by the OECD in arriving at net debt, so the level of the path of net debt is higher. The IIF study finds that the interest burden declines from 7 percent of GDP in 2011 to 5.7 percent in 2020, similar to the decline from 7.2 to 5.2 percent over the same period in the central case examined here.

Figure 1 Alternative paths for Greek public debt



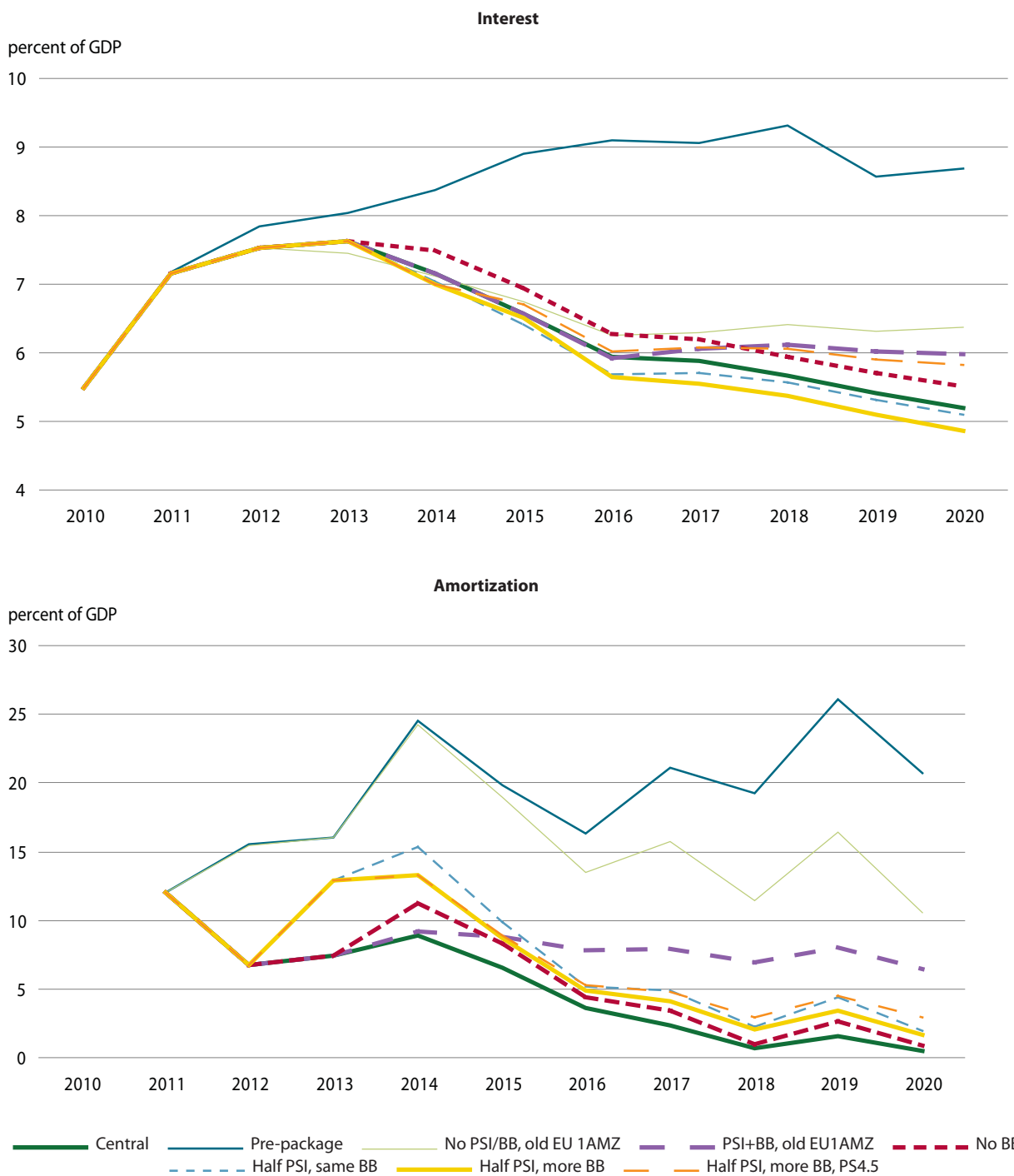
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from the reduction in the EU interest rates. One-third comes from the additional cumulative effect of PSI—which avoids the buildup of new private debt taken on at high interest rates—and buybacks. The contribution of PSI is even greater in terms of ameliorating the liquidity problem. Thus, in 2014 amortization

would be 24.5 percent of GDP in the pre-package baseline, but only 8.9 percent in the central case with PSI and buybacks.⁸

8. Almost none of the difference comes from shifting to the 10-year grace for EU1 amortization, which was to begin mainly in 2015.

Figure 1 Alternative paths for Greek public debt (continued)



The second scenario is the old baseline from the IMF (2011b) report in July just prior to the new debt package (“pre-package”). It shows that even in that baseline, the ratio of debt to GDP was projected to decline from a peak of 172 percent of GDP in 2012 to 130 percent by 2020. Moreover, net debt would have declined from a peak of 126 percent of

GDP to 96 percent. Nonetheless, as shown in figure 1 the pre-package baseline would have seen much higher interest payments by 2020.

Closest to the pre-package baseline, the third simulation examines what would have happened if there were no PSI (and no buybacks), and the 2010 tranche of EU lending were

to retain the original amortization schedule, but nonetheless the EU lending terms shifted to the lower interest rates of the July 2011 package (“No PSI/BB, old EU1AMZ”). The path of interest payments relative to GDP in this path shows that a major contribution to lowering the debt burden has come from the reduction in the EU interest rates, with the interest burden by 2020 falling from 8.7 percent of GDP in the pre-package baseline to 6.4 percent as a consequence of this change alone. However, without PSI this trajectory would have been precarious; the amortization chart shows that large amortizations would still have been coming due, especially in 2012–16.

In the next variant, the first tranche of EU support is not converted to the 10-year grace amortization path applicable to the second (“Old EU1AMZ”), but the rest of the July package (including PSI and buybacks) applies. The political economy of this issue is that the first tranche was in loans from individual governments, whereas the second is from the EFSF. Discussions are apparently under way to convert the first tranche maturities, but it is not inconceivable that some of the European governments that themselves are beginning to feel pressured on their own public debt, notably Italy and Spain, might find it more comfortable to retain their original amortization schedules in securing repayment of the first tranche. It is evident in the figure that this variant does not make much difference from the central package except in the path of amortization beginning in 2015. This variant boosts annual amortization by about 5 percent of GDP annually in 2015–20, implying a corresponding increase in the amount of new borrowing from private markets in this period. Ironically, by 2015 and after failure to convert the first tranche of EU support to 10-year grace would exert greater pressure on liquidity than would failure of PSI to attain more than half of its planned amount (see the amortization chart in figure 1).

The next three variants concern varying levels of PSI and buybacks. In the case in which the central package is applied but with no buybacks (“No BB”), the gross debt ratio reaches more intimidating heights (180 percent in 2013) before falling and remains about 10 percent of GDP above the corresponding path for the central case in 2014–18 and 8 percent by 2020. The paths are also higher, but not by as much, for net debt (by about 5 percent of GDP over 2014–20); and interest payments are also higher (by about 0.3 percent of GDP over 2014–20). With no buybacks, there is no early extinction of debt (except for the “discount bond” part of the PSI), but there is a larger buildup in a reserve account that deducts from gross debt in arriving at net debt.

If only half the participation is expected in the PSI debt exchange, and the savings on enhancements are not used to

increase buybacks (“Half PSI, same BB”), the gross debt ratio is somewhat lower than in the central case because there is only half as much need for enhancements. The net debt path is modestly changed from the central case (about 3 percent of GDP higher in 2014, 2 percent by 2017, and 1 percent by 2020); and the interest path is notably lower by 2016, reflecting the fact that more official funds can be used to amortize private debt rather than needing to be set aside to purchase enhancement collateral. However, this case shows considerably less success in avoiding the amortization spike, as amortization reaches 15.4 percent of GDP in 2014 instead of 8.9 percent in the central package case.

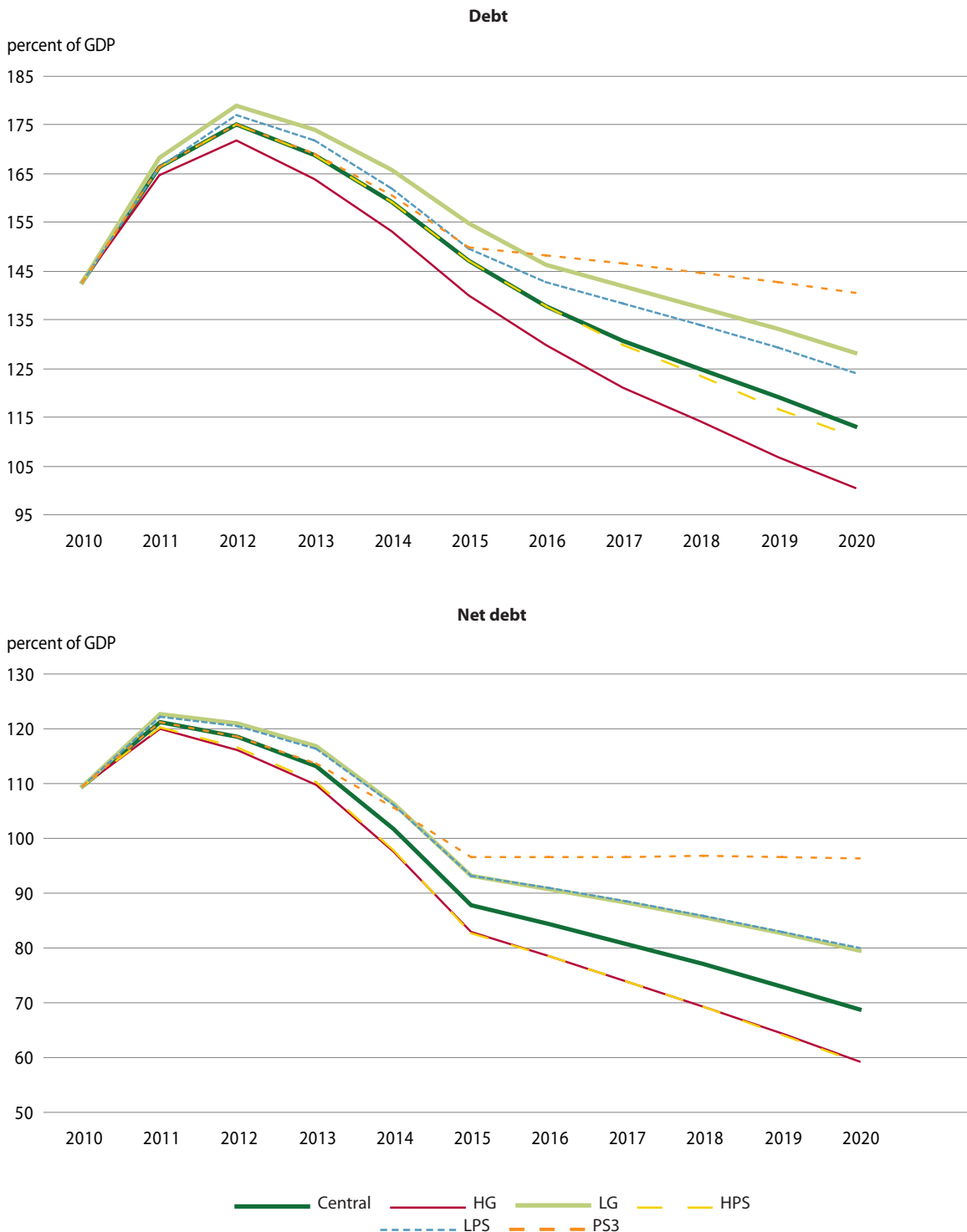
In the third of these PSI-buyback variants, enhancement funds freed up by lesser PSI are used for additional buybacks. This case (“Half PSI, more BB”) gives the lowest time path of all for the gross debt ratio, net debt ratio, and (by 2016 and after) the interest/GDP ratio. However, it too involves greater exposure to amortization in 2013–14 than the central package, albeit not by as wide a margin as the case of half-PSI with no additional buybacks.

An important message of the comparisons of the three PSI-buyback variants is that the Greek package may be less vulnerable to incomplete PSI than might be feared. Essentially, if private holders do not sign up for the exchange, the government can use more of the official support to engage in outright buybacks rather than needing to set aside as much as planned for enhancements for the exchanged bonds. (The enhancements are zero-coupon risk-free bonds that mature in 30 years and are held as collateral for the exchanged bonds). There is some risk associated with this outcome in terms of the greater near-term amortization, but there are also rewards in terms of lower real debt burden.

In the final variant, the central package applies except that Greece does not manage to increase the primary surplus above 4.5 percent of GDP, where it remains in 2014 and after; in addition, only half the PSI target is achieved and the savings on collateral are employed in buybacks (“Half PSI, more BB, PS4.5”). Even in this case, which allows for some political slippage in the fiscal targets, there is major improvement in the debt ratios. Net debt declines from 120 percent of GDP in 2011 to 81 percent by 2020, a major improvement but not as much as in the central case (in which the ratio reaches 69 percent by 2020). The interest burden is about 0.8 percent of GDP higher by 2020 than in the central case but nonetheless is considerably lower than at the beginning of the adjustment (falling from 7.2 percent of GDP in 2011 to 5.9 percent by 2020).

For sensitivity analysis, it is useful to examine the response of the debt indicator paths under alternative assumptions about economic performance. Figure 2 reports the

Figure 2 Impact of alternative growth and primary surplus assumptions

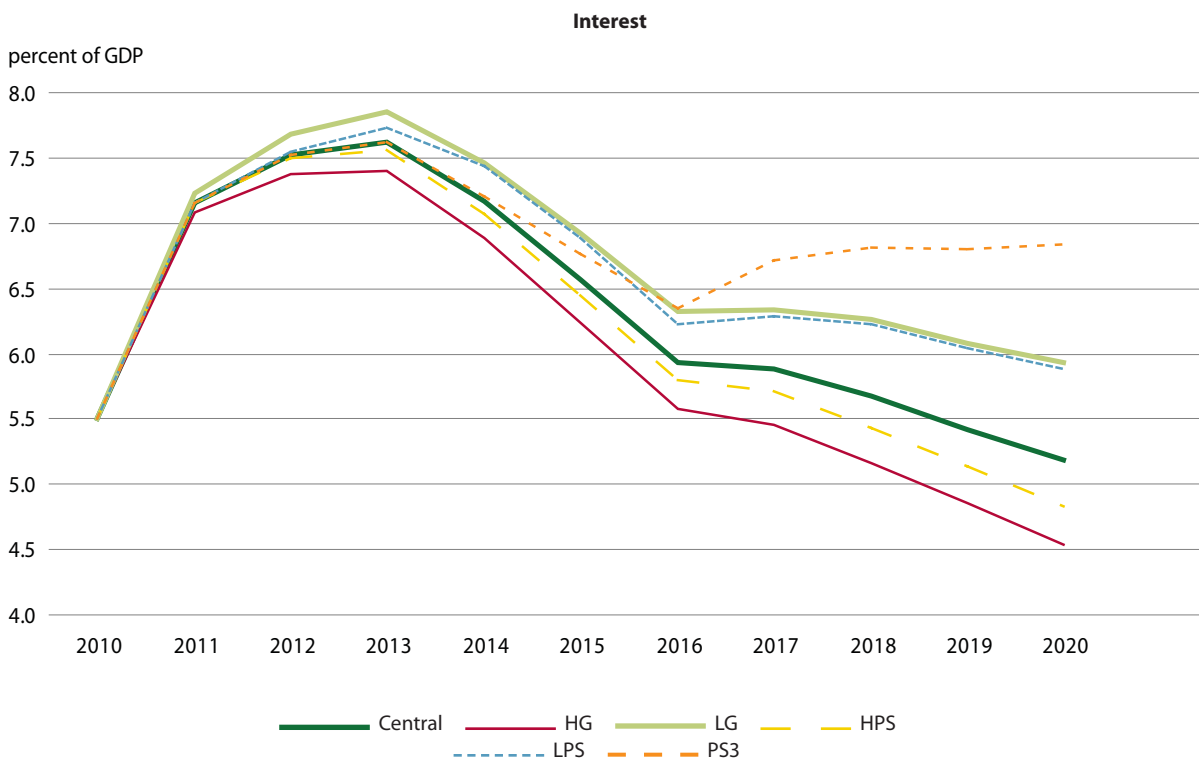


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consequences of changing the central Greek package case by increasing or decreasing the assumed growth rate, and increasing or decreasing the primary surplus. In the central case, real growth is set at -3.8 percent in 2011, 0.6 percent in

2012, 2.1 percent in 2013, 2.3 percent in 2014, 2.7 percent in 2015, 2.9 percent in 2016, and 3 percent thereafter. The primary surplus is set at -0.8 percent of GDP in 2011, 1.5 percent in 2012, 3.5 percent in 2013, 6.4 percent in 2015,

Figure 2 Impact of alternative growth and primary surplus assumptions (continued)



7.7 percent in 2016, and 6.4 percent thereafter. These are the baseline assumptions in IMF (2011b).

By mid-September 2011 it was becoming evident that the growth projections for 2011 were overly optimistic. Thus, in its September *World Economic Outlook* the IMF downgraded the growth outlook to -5 percent in 2011, -2 percent in 2012, 1.5 percent in 2013, 2.3 percent in 2014, 3 percent in 2015, and 3.3 percent in 2016, placing real GDP by 2016 4 percent below the earlier projection (IMF 2011e). This outcome would not affect the debt and interest to GDP ratios by much, leaving the main conclusions unchanged so long as the Greek authorities took additional fiscal measures as needed to offset fiscal erosion from the slower growth. It is a fair question to ask whether the baseline growth rates can be realized without exchange rate flexibility to improve competitiveness (because of euro membership). However, the average growth projected in the IMF program baseline, 2¾ percent annually in 2013–20, seems already conservative when compared to actual growth achieved over a comparable number of years before the crisis: 4¼ percent annually in 2000–07 (IMF 2011b, 2011e).

In the variants shown in figure 2, high growth (HG) applies an extra percentage point real GDP growth in each year, 2011–20. Conversely, low growth (LG) reduces the growth rate path from baseline by 1 percentage point each year. The high primary surplus (HPS) boosts the primary surplus by 1 percent

of GDP, from baseline, each year. The low primary surplus (LPS) reduces the primary surplus from baseline by 1 percent of GDP each year. As a sort of stress test, another alternative sets a ceiling of 3 percent of GDP on the primary surplus, affecting the outcome for 2013 and after (PS3).

The swing in growth makes considerable difference over the decade. With high growth, the ratio of gross debt to GDP falls to about 100 percent by 2020; net debt falls to about 60 percent, and the interest burden by 2020 falls to 4.5 percent of GDP rather than 5.2 percent in the central case. The low growth case is approximately the mirror image, leaving net debt about 10 percent of GDP higher than the central case rather than 10 percent lower, by 2020, and boosting the interest burden to 6 percent of GDP. The effect of a primary surplus higher or lower than the central case by 1 percent of GDP annually turns out to have a nearly identical effect on net debt relative to GDP as the effect of growth that is higher or lower by 1 percent. Similarly, the interest burden indicator shows an almost identical increase from the central case if the primary surplus is lower by 1 percent of GDP or the growth rate is lower by 1 percent. The interest burden reduction against the central case is somewhat greater in the high growth case than in the high primary surplus case, however, so at the margin boosting growth by 1 percent of GDP shows up in a greater reduction in the interest burden than does boosting the primary surplus by 1 percent of GDP.

In contrast to the steady improvement in the debt indicators under the central and principal alternative cases, there is considerably less improvement over time in the stress test in which the primary surplus never exceeds 3 percent of GDP (PS3). Instead of declining to 69 percent of GDP by 2020 (central case), net debt stabilizes at about 95 percent of GDP by 2015 and after. One important reason the net debt ratio is falling from 2012 to 2015 despite lower primary surpluses in those years is that there are relatively large privatizations in that period. In contrast, by 2016 and after the projections do not include any further privatization receipts. Similarly, the interest burden hovers at about 6.75 percent in 2017–20 instead of persistently declining to 5.2 percent of GDP in this case.

POLICY IMPLICATIONS

Under the central assumptions of the debt projections, Greece should be able to reestablish confidence in its solvency, thanks to generous official support in providing lower interest rates and liquidity as well as a large, if somewhat expensive, PSI effort.⁹ The terms of the PSI seem appropriately consistent with the goal of conducting the exchange on a voluntary basis while at the same time achieving a high participation for the relevant debt (90 percent; IIF 2011a). The net debt to GDP ratio of 69 percent by 2020 would compare favorably with the G-7 average of 73 percent in 2010 and would be more favorable than the G-7 current policy baseline of 91 percent by 2016 (IMF 2011c, 138). Despite the exaggeration by the enhancements, even the gross debt ratio of 113 percent by 2020 would be lower than the 2016 G-7 average of 122 percent. These comparisons also suggest that it would be misleading to declare insolvency because Greece is not back to a Maastricht 60 percent debt ratio by 2020 (although it comes surprisingly close on what is arguably the more proper concept, net debt).¹⁰

9. In contrast, Darvas, Pisani-Ferry, and Sapir (2011) concluded that public debt needs 30 percent forgiveness in order for Greece to return to a debt to GDP ratio of 60 percent by 2034, their criterion for solvency. This conclusion is based on the calculation that under optimistic growth assumptions, it would require a primary surplus sustained at 8.4 percent for 2015 and after, and the required level would be 14.5 percent under more cautious assumptions, to reach the 2034 target without forgiveness. However, as suggested below, net rather than gross debt is probably the more appropriate concept for a 60 percent target, and on this criterion the central projections of the present study show near-success already by 2020. Moreover, their projections did not take account of the larger volume of EU support and lower interest rates decided in the July package subsequent to their study nor the debt exchanges under the PSI and the prospective buybacks. Nor do their estimates take account of large privatizations planned.

10. Thus, if there are gross assets that equal gross debt, there is no debt burden whatsoever, so long as the interest rate on assets is no lower than that on debt. The Maastricht use of gross debt seems to reflect political and statistical

A key to the consolidation of solvency is the achievement of a relatively high primary surplus, which plateaus at 6.4 percent of GDP in 2016–20. In comparison, for the decade 2006–16 the three highest-surplus major economies will have sustained average primary surpluses of 3.8 percent of GDP for Korea, 3.3 percent for Singapore, and 3.0 percent for Brazil (IMF 2011c, 124). In contrast, the G-20 average for 2006–07 and 2012–16 (to omit the crisis and its early aftermath) will amount to –0.5 percent. A primary surplus target of about 6

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percent of GDP is thus ambitious. At the same time, primary government spending starts at a moderately high base, at an average of almost 46 percent of GDP in 2009–10 (IMF 2011b, 73) compared with about 42 percent for the G-7 (IMF 2011c, 123–25), suggesting scope for cutbacks.

A powerful means of reducing the needed primary surplus would be to escalate sharply the program of privatizations and use the proceeds for buybacks. Some accounts place state assets capable of being privatized at as high as €300 billion.¹¹ Suppose that the privatization target were doubled from €50 billion to €100 billion. Suppose that debt could be

practicality more than any underlying economic sense of debt burden and is particularly misleading for countries that have large assets relative to debt. For example, Norway has gross public debt of 54 percent, seemingly threatening to violate the Maastricht ceiling. However, its assets are 210 percent of GDP, placing its net debt at –156 percent of GDP (IMF 2011d). Net debt stabilizes at a ratio to GDP that equals the ratio of the fiscal deficit to the nominal growth rate. (The marginal debt ratio has as its numerator the deficit percent multiplied by GDP, or change in net debt, and as its denominator the nominal growth rate multiplied by GDP, or change in GDP. Cancelling, the marginal debt ratio equals the deficit as a percent of GDP divided by the nominal growth rate. When this marginal ratio equals the average ratio the debt to GDP ratio is constant.) With real growth of 3 percent and inflation of 2 percent, a 60 percent of GDP target for *net* debt would be consistent with a fiscal deficit of 3 percent of GDP. With the interest rate at 5 percent (3 percent real), the deficit would be wholly comprised of net interest payments; the primary surplus would be zero. It seems unlikely that the Maastricht architects sought more stringent fiscal outcomes than this, even though the use of the gross rather than net concept is indeed more stringent.

11. ECB member Juergen Stark indicated this number to the German newspaper *Welt am Sonntag*; Reuters, May 28, 2011.

repurchased at an average price of 66 cents on the euro, so the extra €50 billion could be used to retire €75 billion in debt. Applying an interest rate of 5 percent, the result would be to cut the interest burden by €3.75 billion annually, or 1.5 percent of 2015 GDP. The primary surplus target could then

...the package agreed for Greece has a sufficient chance of succeeding and validating Greek solvency that it would be at the least highly premature to declare it a failure and call for a new, more radical program of debt forgiveness.

be cut from 6.4 percent of GDP to 4.9 percent. The target could be cut further to 4.4 percent if in addition the combination of less debt exchange and more buybacks discussed above were pursued (figure 1).

For purposes of European debt policy in the near term, the broad implication of the estimates here is that the package agreed for Greece has a sufficient chance of succeeding and validating Greek solvency that it would be at the least highly premature to declare it a failure and call for a new, more radical program of debt forgiveness. Instead, the most prominent debt policy issues facing European economic authorities over the coming several months would seem to be how to go well beyond the Greek package in order to stem further contagion of the debt problem, especially to Spain and Italy.

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APPENDIX A THE DEBT SIMULATION MODEL

Table A.1 and equations (A.1) through (A.6) report the main structure of the European Debt Simulation Model for Greece (EDSM-GR).

$$DEF_t = INT_t - PS_t = \sum_i r_i D_{i,t-1} - \pi_t Y_t \quad (A.1)$$

Equation (A.1) states that the fiscal deficit equals net interest payments minus the primary surplus. Interest payments are the sum of this year's interest rate for the category in question, multiplied by the debt outstanding in that category at the end of the previous year. The primary surplus is the product of GDP and the planned target primary surplus as a percent of GDP, π . There is a negative interest payment entry for interest earnings on a reserve fund that builds up as official support arrives in advance of its use for amortization, purchase of enhancements, bank capitalization, or buybacks. The interest rate earned on the reserve fund is set conservatively at 3 percent. Note also that financial assets are treated even more conservatively as having no interest earnings at all. This category includes the initial (2010) 33 percent of GDP reported by the OECD as financial assets, as well as subsequent increases from government funds used in recapitalizing banks.

$$BG_t = DEF_t - PVZ_t + AMZ_t + DD_t + BR_t + ENHP_t + BBP_t \quad (A.2)$$

Equation (A.2) identifies the gross borrowing requirement. Borrowing is needed to cover the fiscal deficit, amortization of debt, newly "discovered" debt such as outright recognition of previously contingent liabilities, amounts for bank recapitalization, the amount to be used in the purchase of zero-coupon AAA bonds for "enhancement" collateral backing new debt exchanged for old debt in the PSI program, and the amount to be spent on repurchasing outstanding debt in the buyback program. Against these requirements, there is a reduction in borrowing needs associated with receipts from the privatization program.

$$GAP_t = BG_t - BO_t \quad (A.3)$$

Equation (A.3) identifies the gross borrowing "gap" between gross borrowing requirements and gross borrowing from official sources (IMF and European Union). This gap can be filled in one of two ways, or in a combination of them: (a) new borrowing from private sources; (b) drawdown of any amounts available in a reserve fund that may have been built up when official financing for the year in question exceeded borrowing requirements. It turns out that the resulting amount of new private borrowing needed is that shown in equation

(A.4) as either zero or the excess of the gap over the amount of the reserve fund at the end of the prior year. That is, if the gap is less than the reserve fund available to be drawn down, there is no need for new private borrowing. If the gap is greater, then the amount of new borrowing from private sources is the excess of the gap over what is available in the reserve fund.

$$BPN_t = \max \{0, GAP_t - REF_{t-1}\} \quad (A.4)$$

Correspondingly, the amount left in the reserve fund at the end of the year equals the amount in the previous year plus the change in the reserve fund. When there is a positive gap (official borrowing smaller than total borrowing need), then if this gap exceeds what was available at the end of the prior year the new level of the reserve fund will be zero. If the gap is smaller than what was available, the new level of the reserve fund will be the excess of what was available in the reserve fund over what is needed to fill the gap. In years in which official borrowing exceeds the total borrowing requirement, the gap is negative, and the reserve fund builds up by the absolute value of this negative gap. Equation (A.5) generates this behavior in the reserve fund.

$$REF_t = \max \{0, REF_{t-1} - GAP_t\} \quad (A.5)$$

In accounting relationships, total debt is the sum of debt types (IMF, EU1 from the 2010 program, EU2 from the EFSF in the July 2011 program, old private and other official debt unstructured, restructured private debt, and new private debt). Financial assets K begin with the €76 billion reported by the OECD and add any amount of public recapitalization of the banks, BR . For purposes of conservative estimation, it is assumed that there are no interest earnings on financial assets (as distinct from the reserve fund, which is posited to earn 3 percent). Another non-interest-earning asset is the amount of the zero-coupon collateral bonds acquired to back the PSI conversion. Net debt then equals gross debt minus the financial assets, enhancement amount, and reserve fund (equation A.6). (The stock of enhancement assets is the cumulative sum of annual purchases, although the bulk is acquired in the first year, 2012.)

$$D_t = \sum_i D_{i,t}; K_t = K_{t-1} + BR_t; ND_t = D_t - K_t - ENHS_t - REF_t \quad (A.6)$$

Table A.2 reports the estimates of this model for the pre-package baseline identified by the IMF in its July report. Because the package made major changes, the principal purpose of this table is to confirm consistency of the main simulations with the IMF framework and data. The four summary debt burden and

Table A.1 Definitions

D	Gross public debt
ND	Net public debt
BG	Gross borrowing
BO	Gross borrowing, official (IMF, EU)
BPN	Gross borrowing, new private
AMZ	Amortization
GAP	Financing gap
REF	Reserve fund stock
PVZ	Privatization
BBP	Buy back purchases, outlay
K	Financial assets
ENHP	Enhancements purchase
ENHS	Enhancements stock
DD	Debt discovery
BR	Bank recapitalization
DEF	Fiscal deficit
PS	Primary surplus
r_i	Interest rate, debt category i
INT	Interest payments, net
Y	GDP
π	Primary surplus, fraction of GDP

liquidity indicators appear in the initial section of the table. In the pre-package baseline, gross debt relative to GDP would have risen to a peak of 172 percent in 2012 and then declined gradually to 130 percent by 2020. The table shows that the model baseline almost exactly replicates that of the July IMF report. Importantly, the IMF did not report the concept of net debt, nor did it mention the sizable financial assets of the government. The pre-package baseline would have meant a peak of about 126 percent of GDP in 2012 for net debt, which then would have declined to 96 percent by 2020.

The next block of entries in the table shows the components of the borrowing requirement. It can be seen that the net borrowing requirement before amortization was relatively modest, a cumulative total of about €80 billion over the decade. In contrast, gross borrowing needs including the amount needed to roll over amortization were much larger. Amortization would have been on the order of €50 billion to €55 billion annually in 2014–18, and even higher thereafter. The schedule for amortization of existing private debt would have been about €35 billion annually in 2012–13, and €50 billion by 2014. These amortization estimates are from the total reported by the Greek Finance Ministry (2011) after deducting the amortization due on official support from the IMF and European Union in the 2010 round of lending.¹²

12. Amortization and new private borrowing exclude short-term, €6.2 billion rolled over annually in 2012 and thereafter.

The amount needed in new borrowing from private markets is then obtained in the next section of the table, as the difference between the gross borrowing requirement and gross official disbursements (IMF, EU1 as first tranche of EU support, EU2 as second tranche). New borrowing from private markets would need to have escalated rapidly after 2013, reaching about €65 billion annually by 2017–18.

The next section of the table reports corresponding paths of debt by category. Interest rates applicable to each category are then shown. Interest payments equal the interest rate for the year multiplied by the stock of debt at the end of the preceding year, for the category in question.¹³ Finally, the table reports the baseline assumptions on real growth, inflation, and the primary surplus as a percent of GDP.

Table A.3 shows the same projections in the central, post-package scenario. Amortization is now set at zero for the two EU support programs, assuming 10-year grace for both. For other official and private debt, 62 percent is assumed to be converted in the PSI program, generating the reduction in amortization otherwise due amounting to €135 billion through 2020 (IIF 2011a). On this restructured debt there is no amortization, because the debt is converted to 30-year maturities. Gross borrowing now requires amounts for enhancement purchases, however, and also for any buybacks carried out in the year.

Given the official (IMF and EU) disbursements in comparison with the gross borrowing requirement, there is an excess of available funds amounting to €10 billion in 2011 that goes into a reserve fund that is subsequently drawn down. This reserve fund earns interest at 3 percent. Debt by category is now shown with detail for the restructured debt components.

Table A.3 reports the new interest rates by category. For the European Union, the rate is set at the 10-year German Bund rate plus 30 basis points, with the yearly rates (based on private-sector consensus forecasts) weighted by shares in the schedule of disbursements. For the components of the PSI package, the par bonds pay 4 percent initially and then 4.5 percent; the discount bonds, about 6 percent (but on a principal that has been reduced by 20 percent). The indirect interest costs include the interest the Greek government pays on the enhancements. With about €34 billion (initially) in enhancements, and a rate of about 4 percent on the EU support, this indirect interest cost is €1.4 billion per year. When this amount is added to direct interest payments of about €6.9 billion annually on the restructured debt, the total interest amounts to €8.2 billion annually. The direct and indirect interest costs thus translate to an effective rate of 5.8 percent on the total stock of €141.5 billion in restructured debt.

13. For IMF loans, interest rates are 3.8 percent in 2012–14 and 3.5 percent in 2015–18; calculated from IMF (2011b, 65).

Table A.2 General government debt 2010–20, pre-package baseline (billion euros and percent of GDP)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Gross debt (percent of GDP)	143	166	172	170	159	145	143	140	138	134	130
Memo: IMF July 2011	143	166	172	170	160	146	143	140	138	134	130
Net debt (percent of GDP)	110	121	126	125	115	103	102	101	100	98	96
Interest payments (percent of GDP)	5.5	7.2	7.9	8	8.4	8.9	9.1	9.1	9.3	8.6	8.7
Amortization (percent of GDP)	12	15.5	15.5	16.1	24.5	19.8	16.4	21.1	19.3	26.1	20.7
Gross borrowing requirement	72.4	72.4	54.1	43.9	46.8	29.4	51.1	66	64.4	85.6	73.2
Primary deficit	11.3	1.8	-3.4	-8.2	-15.5	-19.4	-16.7	-17.5	-18.2	-19.1	-20
Interest payments	16.1	16.1	17.9	18.9	20.3	22.4	23.8	24.7	26.5	25.6	27.2
Debt discovery	5.4	5.4	6.9	6.6	-3.9	-8.3	1.3	1.1	1.1	1.2	1.3
Bank recapitalization	25	25	5								
Privatization receipts	2.9	2.9	7.5	11	13.6	15.1					
Amortization	27	27	35.3	37.7	59.5	49.8	42.8	57.7	55	77.9	64.8
IMF	0	0	0	1.7	7.8	10.6	6.9	2.7	0.3	0	0
EU1	0	0	0	0	0.7	5.8	11	13.9	14.6	14.6	12
EU2+PSI	0	0	0	0	0	0	4.9	11	16.8	20.7	20.7
Private and other official, old	19.5	27	35.2	35.9	50.3	30	14	19.6	7.2	21.8	4.8
Private new			0.1	0.1	0.7	3.4	6	10.5	16.1	20.9	27.4
Gross borrowing, disbursements	72.4	72.4	54.1	43.9	46.8	29.4	51.1	66	64.4	85.6	73.2
Official	31.4	71.2	54.2	37.4	19.3						
IMF	10.4	10.9	6.5	2.2							
EU1	21	35.6	17.6	5.9							
EU2 + PSI	0	24.7	30.1	29.3	19.3						
Financing gap	1.2	1.2	-0.1	6.5	27.5	29.4	51.1	66	64.4	85.6	73.2
Private new	1.2	1.2	-0.1	6.5	27.5	29.4	51.1	66	64.4	85.6	73.2
Debt, end-of-year	328	374	393	399	386	366	374	382	392	400	408
Official: Program	31.4	103	157	193	203	187	164	137	105	69.6	37
IMF	10.4	21.3	27.8	28.3	20.5	9.9	3.1	0.3	0	0	0
EU1	21	56.6	74.2	80.1	79.4	73.6	62.6	48.8	34.2	19.6	7.6
EU2 + PSI	24.7	24.7	54.8	84.1	103	103	98.5	87.5	70.7	50	29.3
Private and other official, old	297	270	235	199	149	119	105	85.1	77.9	56.1	51.4
Private new	1.2	1.2	0.9	7.4	34.2	60.2	105	161	209	274	320
Assets, end-of-year	76.2	101	106	106	106	106	106	106	106	106	106
Net debt, end-of-year	252	273	286	293	280	260	268	276	286	293	302

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Table A.2 General government debt 2010–20, pre-package baseline (billion euros and percent of GDP) (continued)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Real GDP growth (percent)	-4.4	-3.8	0.6	2.1	2.3	2.7	2.9	3	3	3	3
GDP deflator growth (percent)	2.5	1.5	0.7	1	1	0.9	1.1	1.3	1.4	1.7	1.8
Nominal GDP	230	225	228	235	243	251	262	273	285	299	313
Primary surplus (percent of GDP)	-4.9	-0.8	1.5	3.5	6.4	7.7	6.4	6.4	6.4	6.4	6.4
Interest rates (percent)											
EU1	3.37	3.97	4.29	4.67	5.25	5.73	6.89	6.98	7.5	6.1	6.31
EU2 + PSI			4.29	4.67	5.25	5.73	6.89	6.98	7.5	6.1	6.31
Private old	5	5	5	5	5	5	5	5	5	5	5
Private new			7.1	5.7	9.2	11.1	9	7.8	7.5	7.3	7.3
Average interest rate, weighted by Dt-1		4.91	4.78	4.81	5.1	5.8	6.53	6.63	6.94	6.52	6.81

Table A.3 General government debt 2010–20, central scenario (billion euros and percent of GDP)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Gross debt (percent of GDP)	143	166	175	169	159	147	138	131	125	119	113
Memo: IMF July 2011	143	166	172	170	160	146	143	140	138	134	130
Net debt (percent of GDP)	110	121	119	113	102	88	84	81	77	73	69
Interest payment (percent of GDP)	5.5	7.2	7.5	7.6	7.2	6.6	5.9	5.9	5.7	5.4	5.2
Amortization (percent of GDP)		12	6.8	7.4	8.9	6.5	3.7	2.4	0.7	1.5	0.5
Gross borrowing requirement	62.3	66	66	39.3	13.4	-8.2	10.4	7.3	1.5	4.1	-0.6
Primary deficit	11.3	1.8	-3.4	-8.2	-15.5	-19.4	-16.7	-17.5	-18.2	-19.1	-20
Interest payments, net	16.1	17.1	17.1	17.9	17.4	16.5	15.5	16	16.2	16.2	16.2
Debt discovery	5.4	6.9	6.9	6.6	-3.9	-8.3	1.3	1.1	1.1	1.2	1.3
Bank recapitalization	15	5	5								
Privatization receipts	2.9	7.5	7.5	11	13.6	15.1					
Amortization	27	15.5	15.5	17.5	21.5	16.4	9.5	6.5	2	4.6	1.7
IMF	0	0	0	1.7	7.8	10.6	6.9	2.7	0.3	0	0
EU1	0	0	0	0	0	0	0	0	0	0	0
EU2	0	0	0	0	0	0	0	0	0	0	0
Private and other official old, unstructured	19.5	27	15.5	15.8	13.7	5.8	2.7	3.8	1.4	4.2	0.9
Private old, restructured	0	0	0	0	0	0	0	0	0	0	0
Private new	0	0	0	0	0	0	0	0	0.3	0.4	0.8
Enhancement purchases			32.5	1.7	2.5	1.6	0.8	1.1	0.4	1.2	0.3
Buyback outlays			15	5							
Gross borrowing, disbursements											
Official	31.4	72.5	56.1	39.1	20						
IMF	10.4	10.9	6.5	2.2							
EU1	21	35.6	17.6	5.9							
EU2 + PSI		26	32	31	20						
Financing gap		-10.2	9.8	0.3	-6.6	-8.2	10.4	7.3	1.5	4.1	-0.6
Reserve drawdowns		0	9.8	0.3	0	0	10.4	4.5	0	0	0
Private new		0	0	0	0	0	0	2.8	1.5	4.1	0
Debt, end-of-year	328	374	399	396	386	370	361	357	356	356	354
Official	31.4	104	160	197	210	199	192	189	189	189	189
IMF	10.4	21.3	27.8	28.3	20.5	9.9	3.1	0.3	0	0	0
EU1	21	56.6	74.2	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1
EU2 + PSI	0	26	58	89	109	109	109	109	109	109	109

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Table A.3 General government debt 2010–20, central scenario (billion euros and percent of GDP) (continued)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Private and other official old, total	297	270	239	199	177	171	168	165	163	159	158
Private and other official old, unstructured	297	270	97.5	57.3	35.4	29.6	26.9	23.2	21.8	17.6	16.6
Private new	0	0	0	0	0	0	0	2.8	4	7.6	6.9
Total assets, end-of-year	76.2	101	129	130	140	149	140	136	137	138	139
Financial assets	76.2	91.2	96.2	96.2	96.2	96.2	96.2	96.2	96.2	96.2	96.2
Reserve fund	10.2	10.2	0.4	0.1	6.7	14.9	4.5	0	0	0	0.6
Credit enhancement			32.5	34.1	36.7	38.3	39.1	40.2	40.5	41.7	42
Net debt, end-of-year	252	273	270	266	247	221	221	220	220	218	215
Real GDP growth (percent)	-4.4	-3.8	0.6	2.1	2.3	2.7	2.9	3	3	3	3
GDP deflator growth (percent)	2.5	1.5	0.7	1	1	0.9	1.1	1.3	1.4	1.7	1.8
Nominal GDP	230	225	228	235	243	251	262	273	285	299	313
Primary surplus (percent of GDP)	-4.9	-0.8	1.5	3.5	6.4	7.7	6.4	6.4	6.4	6.4	6.4
Interest rates (percent)											
EU1	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65
EU2 + PSI	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.08
Private old, unstructured	5	5	5	5	5	5	5	5	5	5	5
Private old, restructured (par)			4	4	4	4	4	4.5	4.5	4.5	4.5
Private old, restructured (discount)			5.95	5.95	5.95	5.95	5.95	6.2	6.2	6.2	6.2
Private new			7.1	5.7	9.2	11.1	9	7.8	7.5	7.3	7.3
Average interest rate, weighted by Dt-1		4.89	4.66	4.49	4.39	4.33	4.35	4.51	4.53	4.54	4.56