Fiscal Space

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EXECUTIVE SUMMARY

The fiscal challenges facing advanced economies are unprecedented, and bring to the fore questions about how to assess fiscal sustainability. Intertemporal solvency—the notion that governments *eventually* repay their debts—requires only that adjustments to bring debt dynamics back on track occur *at some point* in the future. Given the sovereign's right to tax and (not) spend, changes in these variables can always make the problem of insolvency disappear. But markets are not impressed by promises that are unsupported by countries' track record of adjustment (words unsupported by deeds), and so it is critical to examine this track record to see whether it is indeed consistent with satisfying the intertemporal constraint.

In this note, we reexamine the issue of debt sustainability in a large group of advanced economies. Our hypothesis is that, when debt is in a moderate range, its dynamics are sustainable in the sense that increases in debt elicit sufficient increases in primary fiscal balances to stabilize the debt-to-GDP ratio. At high debt levels, however, the dynamics may turn unstable, and the debt ratio may not converge to a finite level. Such a framework allows us to define a "debt limit" that is consistent with the country's historical track record of adjustment in the sense that, without an extraordinary fiscal effort, any debt increment beyond this limit would cause debt to increase without bound. It bears emphasizing that this debt limit is not an absolute and immutable barrier, but it does define a critical point above which the country's *historical* fiscal response to rising debt becomes insufficient to maintain debt sustainability. Nor should the limit be interpreted as being the optimal level of public debt. Indeed, since the limit delineates the point at which fiscal *solvency* is called into question—and the analysis abstracts entirely from liquidity/rollover risk—prudence dictates that countries target a debt level well below the limit. Given the country's normal pattern of adjustment, *fiscal space* is then simply the difference between the debt limit and current debt.

Applying our concepts to a sample of 23 advanced economies, we find a number of countries that have either very little or no additional fiscal space (again, based on their historical adjustment patterns). In particular, Greece, Italy, Japan, and Portugal appear to have the least fiscal space, with Iceland, Ireland, Spain, the United Kingdom, and the United States also constrained in their degree of fiscal maneuver, the more so owing to the run-up in public debt projected in coming years. An absence of fiscal space should not be taken to mean that some form of fiscal "crisis" is imminent, or even likely, but it does underscore the need for credible adjustment plans—and it is noteworthy therefore that a number of countries have already demonstrated the political willingness to undertake adjustment that departs markedly from their historical performance. By the same token, other countries in the sample that have more fiscal space may still need to undertake medium-term adjustment on account of future demographic pressures and the possible realization of contingent liabilities. In all countries, fiscal strategies must internalize both the need to support a still fragile recovery and the potential for financial stress prompted by concerns over sovereign risk—which underscores the criticality of firm commitment to credible strategies to lower fiscal deficits over time and, where funding pressures are present or seem imminent, supported by upfront measures.

I. Introduction

A key issue confronting the global economy today concerns the degree to which countries have room for fiscal maneuver—fiscal space—and, relatedly, the extent to which adjustments in fiscal policies are necessary to achieve/maintain debt sustainability.[2] Financial markets have brought fiscal concerns to the front pages, and a more general reassessment of sovereign risk across a number of countries—given the fiscal legacy of the global financial crisis and looming demographic pressures—remains a palpable threat to the global recovery. But talk about what fiscal space is, how to measure it, and possible policy implications has been rather fuzzy. This note sets out to remedy that problem by providing a definition of fiscal space, making it operational, and estimating it for a number of advanced economies.

One way of thinking about fiscal sustainability is simply to ask whether the "intertemporal budget constraint" of the government is likely to be satisfied. However, the notion that governments eventually repay their debts so that these do not grow without bound requires only that adjustments to bring debt dynamics back on track occur at some point in the future. Given the sovereign's right to tax and (not) spend, credible changes in these variables can always make the problem of insolvency disappear. But markets are not impressed by promises that are unsupported by countries' track record of willingness to adjust (words unsupported by deeds) and, hence, it is critical to examine this track record to see whether it is indeed consistent with satisfying the intertemporal constraint.

This brings us to the approach followed in this note, which is to draw implications from how fiscal policy has responded to increases in public debt in the past for the sustainability of public debt positions at the present time. The approach, pioneered by Bohn (1998, 2008), looks at whether the primary fiscal balance (i.e., the balance net of interest payments on the debt) responds positively to increases in the level of debt, controlling for other determinants of the primary balance. A sufficiently positive response ensures that a no-Ponzi-scheme rule is satisfied and that public debt is repaid in the long run. Under this setup, fiscal space is either infinite (the policy response is strong enough at any debt level) or zero.

This approach is clearly too crude, however, along two dimensions. The first is that it cannot literally be true that, as debt rises, primary balances rise *over the entire possible range of debt* (since at some point these balances would have to be as large as a country's GDP itself). This raises the issue of how the relationship between primary balances and debt varies with the level of debt itself. Abiad and Ostry (2005) and Mendoza and Ostry (2008) find (looking at the broad cross-country evidence) that the marginal response of the primary balance to debt is significantly weaker at high levels of debt than at more moderate levels. This suggests that when debt gets very large, it may be difficult to generate a primary balance that is sufficient to ensure sustainability. Helpfully, the (nonlinear) relationship between fiscal policy and debt provides a natural definition of a public debt *limit* and, thus, of fiscal space as well.

[2] By fiscal space, we mean the scope for further increases in public debt without undermining sustainability; when and whether such space (if available) should be used is a separate question, beyond the scope of this note.

A second critical issue relates to how uncertainty alters the basic story. Specifically, countries whose debt appears sustainable (based on their normal pattern of fiscal adjustment) may find that shocks can push them beyond their debt limit—at which point sustainability can be restored (and default avoided) only by an extraordinary fiscal effort. Thus, adverse shocks can take a country above its debt limit from a seemingly comfortable initial position while, conversely, favorable shocks can reestablish solvency from an initially unfavorable position. Uncertainty is thus a critical element of the story, since markets will factor in the probability that a sovereign will be on the wrong side of the debt limit in the lending rates they charge, and those lending rates will in turn affect the probability that the debt limit will be breached. It is thus essential in conceptualizing these issues to simultaneously account for the probability of default, the interest rate faced by the sovereign, and the debt limit.

This is what we do in this note, but with one essential caveat that must be borne in mind throughout. In the empirical implementation, estimates of fiscal space are based on policy reactions to debt increases in the future as in the past. Since behavior can change, a finding that a country has little or no fiscal space is not a prediction that public debt will explode or that the government will default—history is not destiny—but rather that something must change and fiscal policy cannot proceed on a "business as usual" basis. Specifically, fiscal policy will need to react more strongly to debt than past behavior would suggest, and governments will need to engage in reforms that place debt on a sustainable footing. That said, we would also emphasize that since the analysis focuses entirely on maintaining fiscal solvency, and does not take account of liquidity/rollover risk, countries will generally want to ensure that they remain well below the estimated debt limits. As such, alternative analyses that seek to identify "desirable" debt levels and fiscal adjustment (as opposed to the maximum fiscal space to deal with extraordinary shocks) typically point to much lower debt targets.

While the resulting estimates of fiscal space presented below depend on several assumptions, both the rough orders of magnitude and ranking across countries are robust. In particular, Greece, Italy, Japan, and Portugal appear to have the least fiscal space (i.e., least scope for increasing public debt without a fundamental shift in the behavior of the primary balance), with Iceland, Ireland, Spain, the United Kingdom, and the United States also constrained in their degree of fiscal maneuver, the more so owing to the run-up in public debt projected in coming years as well as demographic pressures and the possible realization of contingent liabilities. Finally, among the advanced economies, Australia, Denmark, Korea, New Zealand, and Norway generally have the most fiscal space to deal with unexpected shocks—although of course they, too, must be mindful of future fiscal pressures. For countries that have limited fiscal space, the analytical framework in this note can also be used to quantify the extent to which policy and institutional changes can help increase fiscal space. In all countries, fiscal strategies must internalize both the need to support a still fragile recovery and the potential for financial stress prompted by concerns over sovereign risk—which underscores the criticality of firm commitment to credible strategies to lower fiscal deficits over time and, where funding pressures are present or seem imminent, supported by upfront measures.

This note is organized as follows. In Section II, we sketch out the theory of how to estimate fiscal space, taking account of the endogenous reaction of market interest rates to rising default risk. We next turn, in Section III, to some stylized facts about the relationship between primary balances and public debt and associated empirical estimates. Section IV applies our fiscal space concept to a sample of 23 advanced economies. Section V concludes.

II. Defining Fiscal Space

The term "fiscal space" is used variously in the literature—for example, to refer to the scope for financing the deficit *tout court* or for financing the deficit without either a sharp increase in funding costs or undue crowding out of private investment. Here we employ a simpler, starker definition—namely, fiscal space is the difference between the current level of public debt and the debt limit implied by the country's historical record of fiscal adjustment.

Our starting point is the observation that governments typically behave responsibly, generally increasing the primary surplus in response to rising debt service so as to stabilize the debt ratio at a reasonable level. Of course, there may be large shocks—such as wars or fiscal outlays associated with financial crises—that cause deviations from this (implicit or explicit) "rule," but as long as the subsequent increase in the primary balance is sufficient to (more than) offset the higher interest payment, the public debt ratio will eventually return to its long-run value. But it cannot literally be true that the primary balance always increases sufficiently to offset the rising interest payments since, at sufficiently high levels of debt, this would require a primary balance that exceeded GDP. Indeed, as elaborated on below, a stylized fact is that, while fiscal effort is increasing in the debt level, effort eventually peters out as tax increases or spending cuts become politically infeasible. If, as debt rises, the primary balance does not keep pace with the higher effective interest payments (equal to the interest rate–output growth rate differential multiplied by the debt ratio), there will be a debt level above which the dynamics become explosive, with the public-debt-to-GDP ratio rising without bound. At that point, the government must either undertake extraordinary fiscal adjustment (i.e., primary adjustment beyond the country's historical response to rising debt) or default on its debt. It is natural to consider this point the debt limit—and the distance to it from the current debt ratio to be the available fiscal space.

Naturally, creditors would not be willing to lend to the point that default is imminent. Recognizing that (in the absence of an extraordinary fiscal effort) debt becomes unsustainable once the debt limit is exceeded, creditors will demand an increasing risk premium as debt approaches its limit, since it becomes more likely that a negative fiscal shock will push debt beyond the point of sustainability. The analysis is complicated by this endogeneity of the interest rate, because a higher risk premium requires a larger primary surplus to offset the growing debt service, making default more likely—and thus implying the need for a higher premium to compensate creditors for the greater risk. Solving this "fixed point" problem between the risk premium and the risk of default is quite involved (see Ghosh and others, 2010), but the basic intuition is straightforward.

Figure 1 provides a heuristic treatment. The solid line is a stylized representation of the behavior of the primary balance as a function of debt. At very low levels of debt, there is little response of the primary balance to rising debt. As debt increases, the balance responds more vigorously, but eventually the adjustment effort peters out as it becomes increasingly more difficult to raise taxes or cut primary expenditures further. The other line represents the effective interest rate schedule, given by the interest rate–output growth rate differential multiplied by the debt ratio. At low levels of debt, the interest rate is the risk-free rate and, assuming that output growth is independent of the level of public debt or the interest rate, this schedule is simply a straight line with slope given by the risk-free interest rate–growth rate differential.[3] The lower intersection between the primary balance and the interest payment schedules defines the long-run public debt ratio to which the economy normally converges. This equilibrium is conditionally stable: if a shock raises debt above this point (but not beyond the upper intersection), the primary balance in subsequent periods will more than offset the higher interest payments, returning the debt ratio to its long-run average, d^*.

There is another (upper) intersection as well, however. Abstracting from stochastic shocks and the endogeneity of the interest rate, this is the intersection between the risk-free interest rate–growth rate differential and the primary balance reaction function. This intersection yields a debt limit (denoted $\tilde{d}$) above which debt becomes unsustainable: if debt were to exceed this point, it would rise forever because (in the absence of extraordinary adjustment) the primary surplus would never be enough to offset the growing debt service. Therefore, public debt is unsustainable and, in effect, the interest rate becomes infinite as the government loses market access and is unable to roll over its debt.

In the presence of stochastic shocks to the primary balance and an endogenous response of the interest rate to rising risk, the interest rate schedule is not simply the extrapolation of the risk-free rate but rather bends upward as debt approaches its limit.[4] In particular, beyond some debt ratio $\hat{d}$, the market needs to charge a risk premium, as there is some chance that a negative shock to the primary balance will push debt above the sustainable point. The debt limit, $\bar{d}$, is defined by the point at which there is no finite interest rate that solves the "fixed point" problem of a rising risk premium with higher default risk and higher default risk with the rising risk premium. As illustrated, this point may occur at the intersection of the upward-bending interest payment schedule and the primary balance reaction function or—depending, inter alia, on the recovery value in the event of default and the steepness of the primary balance reaction function—somewhat to the right of that intersection.[5] Beyond $\bar{d}$, there is no sequence of positive shocks to the primary balance (in the absence of an extraordinary fiscal effort) that would be sufficient to offset the rising interest payments. Therefore, debt becomes unsustainable, and the interest rate effectively becomes infinite.

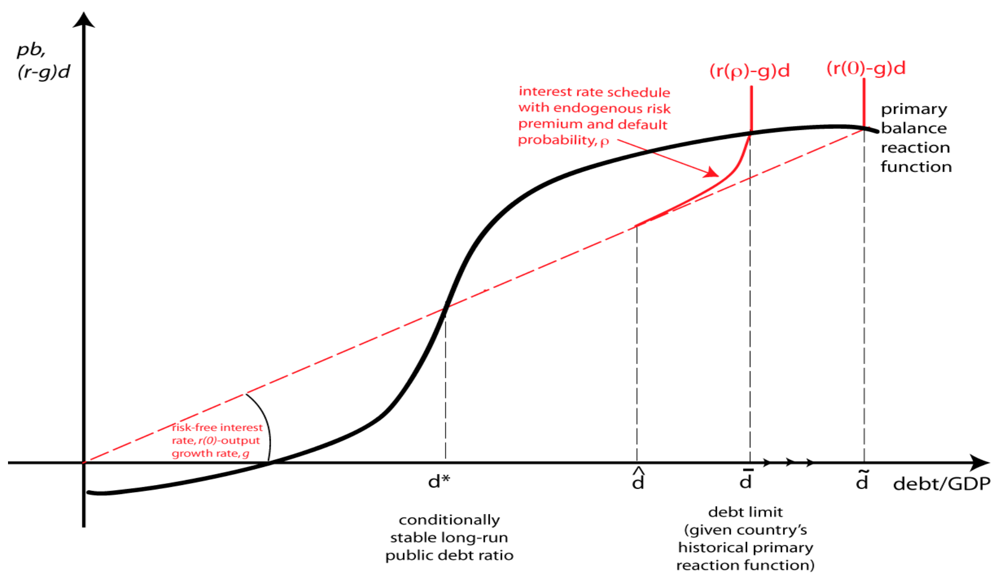
[3] In practice, with rising debt and interest rates, growth is likely to decline; see, for example, IMF (2010).

[4] The discussion assumes that shocks to the primary balance have finite support (i.e., the primary balance cannot suddenly become infinitely positive or infinitely negative)—a reasonable assumption since the primary surplus or deficit cannot exceed GDP (and, empirically, seldom exceeds more than a few percentage points of GDP).

[5] Our empirical analysis, however, does not find any cases in which $\bar{d}$ occurs to the right of the intersection point.

It is readily seen that $\bar{d}$ is increasing in the country's willingness to undertake primary adjustment (as captured by the position and shape of the primary balance reaction function) and decreasing in the interest rate–growth rate differential. A shock to the primary balance or to the interest rate–growth rate differential could thus put the country on the wrong side of the debt limit. Interestingly, the mere recognition that negative shocks to the primary balance could be larger than previously considered would imply a higher probability of default for any given level of debt—and thus a larger risk premium. This would steepen the interest rate–growth rate schedule and shift the debt limit leftward—possibly driving a formerly sustainable country into a situation of unsustainability, and therefore requiring an adjustment effort that is extraordinary relative to the country's historical track record (as captured by the primary balance reaction function) to maintain fiscal solvency.

Figure 1. Determination of Debt Limit

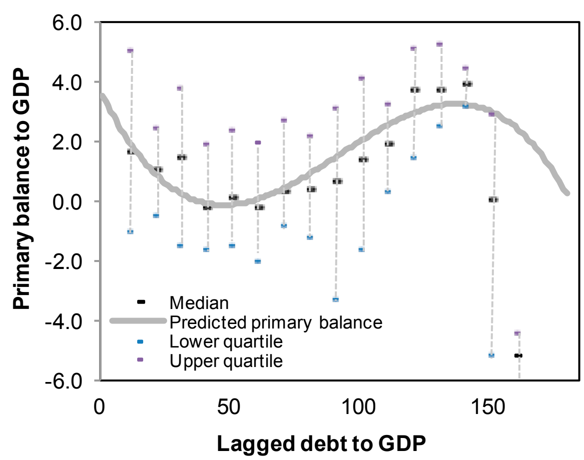


Note: The figure illustrates the determination of the debt limit, with the solid line representing the reaction of the primary balance to rising public debt (in percent of GDP) and the dashed line the effective interest payment schedule, given by the differential between the interest rate (r) and the output growth rate (g), multiplied by the debt ratio (d). The lower intersection, d^*, portrayed in the figure is the long-run debt ratio to which the economy will converge, conditional on debt never exceeding the debt limit. Abstracting from endogeneity of the interest rate to the risk premium, there is a second intersection of the risk-free interest rate–growth rate schedule ($r(0)$-g) and the primary balance reaction function. Taking account of the endogeneity of the interest rate to the rising default risk, the market charges a risk premium when debt exceeds $\hat{d}$. Therefore, the interest rate schedule ($r(\rho)$-g) bends upward with rising default risk (ρ) as debt approaches its limit, $\bar{d}$, where the position of the limit is itself endogenous to the behavior of the interest rate.

III. Behavior of Primary Balances—Some Stylized Facts

Do primary balances increase with debt but at a decreasing rate, as postulated above?[6] Figure 2 plots the primary balance against public debt (lagged one year, in percent of GDP) for a sample of 23 advanced economies over the period 1970–2007.[7] The figure suggests that the behavior postulated is plausible: at very low levels of debt, the primary balance does not respond positively to lagged debt. As debt increases beyond about 40 percent of GDP, however, the primary balance rises significantly with increasing debt. But eventually, the response of the primary balance begins to flatten out and then actually decreases as debt rises further (though this finding is driven by relatively few observations).

Figure 2. Primary Balance and Lagged Public Debt, 1970–2007
(In percent of GDP)



Source: IMF's WEO database and staff estimates.

Table 1 reports the more formal regression analysis relating primary balances to lagged debt (allowing for a cubic function to capture the two apparent inflection points in the curvature of the response) and various economic, structural, and institutional variables, as well as country-specific fixed effects.[8] Estimates for two sample periods are reported, where data availability

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[6] The literature on this question, which has focused mainly on the United States (Bohn, 1998, 2008), finds that fiscal effort *increases* with the debt level. By contrast, Mendoza and Ostry (2008) look at a cross section of countries and find support for the notion that sustainability is less assured when public debt is high than when it is moderate. Empirically, they find that the behavior switch occurs when debt reaches about 50 percent of GDP.

[7] We focus in this note on advanced economies not only because the issue of fiscal space seems at this stage more acute in this group, but also because the cross-country empirical specification needs in any case to differentiate between advanced and emerging market economies (see Mendoza and Ostry, 2008).

[8] The response of the primary balance is thus allowed to vary across countries by the country fixed effect and the effects of other independent explanatory variables. The coefficients on the debt ratio, however, are common across countries; this is necessary because (as hypothesized) the response of the primary balance varies by the

(continued…)

Table 1. Estimation Results for the Fiscal Reaction Function, 1970–2007[1]

Sample	1970-2007		1985-2007	
Specification	(1)	(2)	(3)	(4)
Lagged debt	-0.2080***	-0.2249***	-0.0805	-0.0864
	(0.059)	(0.061)	(0.076)	(0.070)
Lagged debt_square	0.0032***	0.0034***	0.0016*	0.0017*
	(0.001)	(0.001)	(0.001)	(0.001)
Lagged debt_cubic	-0.00001***	-0.00001***	-0.00001*	-0.00001**
	(3.0e-06)	(3.0e-06)	(3.0e-06)	(3.0e-06)
Output gap	0.4974***	0.4910***	0.4849***	0.4408***
	(0.047)	(0.046)	(0.053)	(0.053)
Government expenditure gap	-0.1847***	-0.1837***	-0.1831***	-0.1826***
	(0.047)	(0.045)	(0.052)	(0.047)
Trade openness		0.0908*		0.1461***
		(0.050)		(0.054)
Inflation		3.4005		4.6201**
		(2.519)		(2.008)
Oil price[a]		8.7747***		9.5288***
		(3.216)		(3.244)
Age dependency				-0.0717
				(0.101)
Future age dependency				-0.0154
				(0.067)
Nonfuel commodity price[a]				3.0049
				(8.362)
Political stability				0.0678**
				(0.030)
IMF arrangement				-1.1421
				(0.999)
Fiscal rules				0.3000
				(0.347)
Observations	642	642	496	491
Number of countries	23	23	23	23
R-squared	0.282	0.316	0.304	0.405
AR (1) coefficient	0.791	0.760	0.819	0.749

Source: IMF staff estimates.

[1]Dependent variable is general government primary balance to GDP (in percent); in all specifications, country-specific fixed effects included, and error term assumed to follow an AR (1) process; robust standard errors reported in parentheses; ***, **, and * denote significance at 1, 5, and 10 percent levels, respectively. Estimated coefficients indicate that the response of primary balance to lagged debt depends on the level of debt. For example, col. (1) indicates that the response of primary balance to lagged debt is increasing but eventually at a declining rate; for example, an increase in debt from 50 to 60 percent of GDP raises the primary balance ratio by 0.53 percentage points, while an increase in debt from 160 to 170 percent of GDP improves the primary balance ratio by 0.31 percentage points.

[a] Applies to oil and nonoil commodities exporters only.

debt level, but the full range of debt is not observed for any individual country. Nevertheless, in almost every case (and in all cases where there is a reasonably large range of debt levels observed for the country), the hypothesis that a country's slope coefficients on debt are equal to those of the panel cannot be rejected.

for the shorter one allows for inclusion of a richer set of structural variables as determinants of the primary balance (see Table A2 on the data). To take into account any persistence in the behavior of the primary balance, the estimation allows for serial correlation in the error term; results based on an alternative specification that includes the lagged primary balance in the regression, as postulated by Blanchard (1984), are discussed in the appendix.

In both sample periods, the coefficients of the cubic functional form, capturing the increasing but slowing response of the primary balance to debt, are statistically significant. The estimated coefficients of other determinants are also plausible and broadly in line with earlier studies: for example, primary balances respond positively to the output gap (output above potential implies a large balance, and vice versa); temporary increases in government outlays (for example, military spending), as captured by the government expenditure gap variable, affect the primary balance negatively; and more open economies, in terms of international trade, experience better fiscal performance, as do countries with stronger institutional performance (as proxied by the political stability variable). While the impact of de jure fiscal rules is statistically insignificant, it is possible that such rules (revenue, expenditure, debt, or balanced budget) affect the response of the primary balance to lagged debt. To take into account the joint effect of lagged debt and fiscal rules, an alternative specification including an interaction term between debt and the fiscal rule is estimated. The fiscal space estimates based on this specification are similar to those reported in Section IV.[9]

IV. Estimates of Fiscal Space

The sobering evolution of public debt in advanced economies since the crisis, as well as IMF projections for debt ratios over the next five years (see IMF, 2010), are reported in Table 2. On average, public debt rose from 60 percent of GDP on the eve of the crisis (end-2007) to almost 75 percent by end-2009. More striking, IMF country teams project debt ratios to continue rising over the next five years, averaging more than 85 percent of GDP by 2015. Also reported are various interest rate–growth rate differentials: the first is the historical average (over the past 10 years) of the implied nominal interest rate on government debt (interest payments divided by end-period debt) relative to the growth rate of nominal GDP. The second replaces historical averages with IMF projections of long-term government bond yields and for GDP growth (WEO). With minor exceptions, projected interest rate–growth rate differentials are considerably less favorable than historical differentials, reflecting the expectation of both higher interest rates and lower real GDP growth rates. This may in turn

[9] The main differences are for a few euro area countries that have little fiscal space based on their historical record; taking interactions between debt and fiscal rules into account would give these countries somewhat greater fiscal space. It bears noting, however, that these estimates are predicated on the debt rules being respected, which has clearly not been the case for some euro area countries in recent years. Distinguishing by other characteristics (e.g., the strength of institutions) does not yield statistically significant differences in the response of primary balances to debt: see Ghosh and others (2010) for further details.

reflect the worse outlook for public debt (see Baldacci and Kumar, 2009) and a more subdued outlook for potential growth in many countries (see Abiad and others, 2009).

Implementation of the analytical framework laid out above requires estimating the primary balance reaction function and the interest rate schedule. For the former, the 1985–2007 (Table 1, column 4) coefficient estimates are used. For the latter, there are two possible approaches. The first is to use current (or projected) market interest rates on government debt for the risky interest rate on the assumption that the market rate reflects the perceived probability of default. This overestimates the true maximum sustainable level of debt implied by the model because it ignores the fact that the interest rate will rise sharply as debt approaches its limit and default risk increases. In terms of Figure 1, if the market interest rate is close to the risk-free interest rate, this would be equivalent to extrapolating the risk-free interest rate until it intersects the primary balance reaction function at $\tilde{d} > \bar{d}$.

An alternative approach, therefore, is to calculate the interest rate schedule endogenously, taking account of the rising risk of default as debt approaches its limit. The drawback of the latter approach is that it requires various assumptions about the risk-free interest rate, the distribution (and support) of the shocks to the primary balance, and the recovery rate in the event of default.[10] For robustness, therefore, Table 3 reports the debt limit (as well as the long-run debt ratio to which each country's public debt conditionally converges, d^*) using both market and model-generated interest rates.

While there is, of course, significant variation across countries (reflecting the country-specific intercepts of the primary balance reaction function—given by the fixed effects and the values of the other non-debt independent variables in the regression—and the interest rate–growth rate gaps), the long-run debt ratio to which countries will conditionally converge ranges from a zero or positive asset position (indicated by $d^* = 0$) to debt of about 100 percent of GDP, with a median debt of 50 percent of GDP. Turning to the estimated debt limits, using the historical interest rate–growth rate differential, $\bar{d}$ ranges from about 150 to 260 percent of GDP, with a median of 192 percent. Since interest rate–growth rate differentials are generally projected to be less favorable than the historical experience, the corresponding median long-run debt ratio is 63 percent of GDP, and the median maximum debt ratio is 183 percent of GDP.

The right-hand columns of Table 3 report d^* and $\bar{d}$ using the model-implied (risky) interest rate. In general, these are similar to the estimates based on market interest rates—and in most cases somewhat lower (consistent with the intuition that the market-based interest rate will likely overestimate the available fiscal space).

[10] In the empirical work, we assume a triangular distribution for the shocks to the primary balance, calibrated for each country to its shocks to the primary balance in the estimation sample. For the recovery rate, we assume a value of 90 percent.

Table 2. Public Debt and Interest Rate–Growth Rate Differential (In percent)

Country	Debt/GDP			Interest Rate-Growth Rate Differential	
	2007	2009	2015 1/	Historical 2/	Projected 1/
Australia	9.4	15.5	20.9	0.1	1.2
Austria	59.5	67.3	77.3	1.4	0.8
Belgium	82.8	97.3	99.9	1.2	2.1
Canada	65.0	82.5	71.2	1.7	0.4
Denmark	34.1	47.3	49.8	3.2	0.1
Finland	35.2	44.0	76.1	0.0	1.4
France	63.8	77.4	94.8	0.8	0.5
Germany	65.0	72.5	81.5	2.6	1.5
Greece	95.6	114.7	158.6	-1.5	2.2
Iceland	29.3	105.1	86.6	-1.4	4.1
Ireland	24.9	64.5	94.0	-5.8	3.2
Israel	78.1	77.8	69.9	0.1	0.2
Italy	103.4	115.8	124.7	1.4	1.7
Japan	187.7	217.7	250.0	2.0	1.0
Korea	29.6	32.6	26.2	-0.7	-2.3
Netherlands	45.5	59.7	77.4	0.5	0.6
New Zealand	17.4	26.1	36.1	1.1	2.5
Norway	58.6	53.6	53.6	-3.4	-0.7
Portugal	63.6	77.1	98.4	-0.6	2.2
Spain	36.1	55.2	94.4	-2.4	2.6
Sweden	40.5	40.9	37.6	-0.5	-0.7
United Kingdom	44.1	68.2	90.6	0.4	1.3
United States	62.1	83.2	109.7	0.3	1.6
Median	58.6	68.2	81.5	0.3	1.3
Mean	57.9	73.7	86.1	0.0	1.2

Source: IMF's WEO database.

1/ WEO Projections. Interest rate-growth rate differential is based on the long-term government bond yield (average for 2010-14).

2/ Average of 1998-2007 based on the implied interest rate on public debt.

Table 3. Long-Run d^* and $\bar{d}$ under Alternative Interest Rate–Growth Rate Assumptions[1]
(In percent of GDP)

Country	Debt (end-2015)	Market Interest Rate				Model-implied Interest Rate[2]	
		d^*		$\bar{d}$		d^*	$\bar{d}$
		Historical	Projected	Historical	Projected		
Australia	20.9	0.0	0.0	203.9	193.2	0.0	202.7
Austria	77.3	63.9	54.3	179.7	187.3	55.1	170.7
Belgium	99.9	60.3	76.3	182.0	168.4	53.7	172.0
Canada	71.2	110.8	82.6	152.3	181.1	75.2	173.1
Denmark	49.8	0.0	0.0	175.7	208.7	0.0	195.9
Finland	76.1	0.0	0.0	200.4	184.5	0.0	167.0
France	94.8	94.8	89.8	170.9	176.1	92.7	159.7
Germany	81.5	94.5	71.0	154.1	175.8	63.6	170.0
Greece	158.6	80.5	…	196.5	…	…	…
Iceland	86.6	0.0	…	213.5	…	0.0	157.3
Ireland	94.0	0.0	90.7	245.7	149.7	42.9	157.6
Israel	69.9	79.7	82.1	184.8	182.4	65.0	183.9
Italy	124.7	…	…	…	…	…	…
Japan	250.0	…	…	…	…	…	…
Korea	26.2	0.0	0.0	217.2	229.2	0.0	220.3
Netherlands	77.4	50.2	50.7	190.5	190.1	58.0	168.7
New Zealand	36.1	0.0	0.0	201.0	186.4	0.0	197.6
Norway	53.6	0.0	0.0	263.2	249.2	0.0	233.5
Portugal	98.4	77.1	…	191.6	…	…	…
Spain	94.4	0.0	94.8	218.3	153.9	70.2	168.4
Sweden	37.6	0.0	0.0	203.5	204.9	0.0	167.8
United Kingdom	90.6	79.6	94.9	182.0	166.5	75.5	166.0
United States	109.7	78.7	101.2	183.3	160.5	77.6	173.1
Median	81.5	50.2	62.6	191.6	183.4	53.7	170.7
Mean	86.1	41.4	49.3	195.7	186.0	38.4	179.2

Source: IMF's WEO database and staff estimates.
[1] $\bar{d}$ is the debt limit, above which debt grows without bound given the country's historical primary balance behavior; d^* is the long-run average debt ratio to which the economy converges conditional on not exceeding $\bar{d}$; … indicates that given the fiscal reaction function and the interest rate-growth differential, the public debt dynamics are not on a sustainable path to converge to a finite stable steady state debt ratio; 0 indicates that convergence is achieved at a negative d^*, implying a positive asset position. All results are based on the estimated fiscal reaction function reported in the last column of Table 1.
[2] The estimates of $\bar{d}$ are obtained assuming a recovery rate of 90 percent in the event of default.

In a few cases (Greece, Iceland, Italy, Japan, Portugal) and depending on the interest rate used, no estimate of d^* (or $\bar{d}$) is reported. This is because, given these countries' estimated primary balance reaction function and assumed interest rate–growth rate differential, public debt would not be expected to converge to a finite steady-state debt ratio (it follows that there is no maximum debt level below which convergence occurs, so it is not meaningful to calculate $\bar{d}$ either).[11] For Italy and Japan, d^* does not exist even using the historical interest rate–growth rate differential, implying that these countries' debt ratios had not been on a convergent path even prior to the crisis (and indeed, especially for Japan, the public debt ratio has been rising steadily over much of the sample period).[12] For Iceland, there is a finite long-run debt ratio using the historical and the model-generated interest rate, but not using projected interest rates. For Greece and Portugal, d^* exists only using the historical interest rate–growth rate differential—not at market or model-implied interest rates.

Our definition of fiscal space is then simply the difference between the debt ratio projected for 2015 and the debt limit, $\bar{d}$. But this difference just gives the point estimate, which is a complicated function of the underlying parameter estimates of the primary balance reaction function. Since the debt limit is essentially the annuity value of the primary balance, even modest uncertainty in the estimates of the primary balance translates into significant differences in the calculation of the debt limit.[13] To take account of uncertainty about the coefficient estimates in the primary balance regression, Table 4 therefore reports the estimates of fiscal space (i.e., the difference between 2015 projected debt levels and the debt limit) in terms of the *probability* that a country has a given amount (0, 50, or 100 percent of GDP) of remaining fiscal space; cells are shaded red or yellow when the probability is less than 50 percent or between 50 and 85 percent, respectively.

Consistent with the discussion above, the probability that Greece, Italy, Japan, and Portugal have additional fiscal space is low. Next are Iceland, Ireland and Spain, where the probability that these countries have at least some additional fiscal space is about 50–70 percent (rising to more than 80 percent for Spain using the model-implied interest rate). For the United States and the United Kingdom, the probability of any remaining fiscal space is about 70–80 percent. Australia, Denmark, Israel, Korea, New Zealand and Norway have the highest probabilities of some additional fiscal space—although the point estimate of that space is substantially lower for Israel than for the other countries in this group. Intuitively, the

[11] In terms of Figure 1, the primary balance reaction function is always below the interest rate schedule, so there is no intersection.

[12] This holds even if net debt rather than gross debt is used in the analysis for Japan. Of course, a sufficiently large shift of the primary balance reaction function would return public debt to a sustainable path going forward. In the case of Italy, the debt ratio has been declining since the mid-1990s, which suggests that re-estimating the reaction function over a more recent sample would yield a positive d^* and associated $\bar{d}$.

[13] To put this in perspective, if the primary balance the country can run is 1 percent of GDP greater than estimated, and if the interest rate–growth rate differential is 1 percent a year, the debt limit increases by 100 percent of GDP.

estimates of fiscal space depend on the debt level projected for 2015 and the debt limit, which depends on the country's historical track record of primary balance adjustment to rising debt. Thus even a country whose current debt is relatively high may enjoy additional fiscal space (and thus scope for dealing with unexpected shocks) if, in the past, it has been fiscally responsible, adjusting the primary balance to rising debt once the shock had passed. By the same token, countries can expand their fiscal space through credible adjustment plans.

In assessing these results, several points should be borne in mind. First, the reported estimates of fiscal space are against projected debt levels in 2015, and do not take account of future age-related spending and possible contingent liabilities (though if estimates of such liabilities are available, it is straightforward to subtract them from the reported fiscal space).[14] Relatedly, the debt limit—on which the fiscal space estimates are predicated—is by no means a "desirable" or "optimal" level of debt: for a variety of reasons, including rollover risk, governments will want to ensure that they do not exhaust their fiscal space and that debt remains well below its calculated limit. Thus, even countries that are currently estimated to have substantial fiscal space may need to undertake medium-term fiscal adjustment.

Second, as discussed above, a key feature of the model is that a revision in market estimates of the support of a possible shock to the primary balance—even if the shock does not occur—can trigger a rise in market interest rates, potentially undermining debt sustainability.

Third, though not evident in the reported estimates of fiscal space, simulations to calculate the fiscal space under the model endogenous interest rate suggest that the increase from the risk-free to the risky interest rate tends to happen quite abruptly as debt reaches its limit. Indeed, it can be shown that, in the theoretical model, and assuming that all government debt has one-year maturity, the debt range over which the interest rate goes from the risk-free rate to the prohibitive interest rate (i.e., where market access is denied at the debt limit) is no greater than the support of the negative shock to the primary balance.[15] As an example, if the largest shock to the annual primary balance is 5 percent of GDP, then at 5 percent of GDP below the debt limit, the government should be able to borrow at the risk-free rate; but as debt rises by a mere 5 percent of GDP more, the government loses market access and the marginal interest rate effectively becomes infinite. Although the analysis is more complicated with multiperiod debt, these orders of magnitude imply that market signals of rising interest rates will likely come very late (that is, just on the eve of a loss of market access).

The last two properties resonate with the experience of some southern European countries in the past few months and underscore the importance of maintaining sufficient fiscal space by undertaking timely adjustment. Finally, while the analysis underscores the risks of suddenly

[14] For countries not highlighted in Table 4, age-related spending is projected to increase by some 3 to 7 percent of GDP over the period 2011–30 (IMF, 2010).

[15] This is because at a distance from the debt limit equal to the support of the negative shock to the primary balance, the worst possible realization of the shock will leave debt at a level at which rollover is always possible (though rollover in the next period may be at a risky interest rate).

running out of fiscal space, it should not be taken to imply that exceeding the debt limit is inevitable in such cases. Rather, the message is that countries in this situation need to implement fiscal adjustment efforts that are extraordinary by their historical standards—either on a one-time basis (driving their debt below their debt limit and back on track toward its long-run level) or involving structural reforms that raise their sustainable debt limit.

Table 4. Estimated Probability of Given Fiscal Space (In percent)

	Projected Market Interest Rate			Model-implied Interest Rate		
	FS > 0	FS > 50	FS >100	FS > 0	FS > 50	FS >100
Australia	99.8	99.5	99.5	99.8	99.8	99.8
Austria	97.9	97.8	75.1	81.4	81.4	38.1
Belgium	95.9	89.7	2.9	95.5	92.0	5.2
Canada	92.2	92.1	70.3	80.9	80.9	57.1
Denmark	100.0	100.0	100.0	100.0	100.0	100.0
Finland	96.2	96.0	69.3	72.8	72.8	37.1
France	88.7	86.6	12.0	65.5	63.1	4.3
Germany	93.0	92.3	35.3	82.6	82.3	25.8
Greece	6.3	0.1	0.1	0.3	0.0	0.0
Iceland	49.1	44.0	5.8	57.9	57.3	20.4
Ireland	66.0	55.9	1.7	60.9	58.8	4.3
Israel	97.1	97.1	80.7	95.1	95.1	81.4
Italy	17.3	1.7	0.2	0.1	0.1	0.1
Japan	0.1	0.1	0.1	0.0	0.0	0.0
Korea	100.0	100.0	100.0	100.0	100.0	100.0
Netherlands	99.3	99.2	83.1	81.0	80.8	35.1
New Zealand	93.3	93.0	92.1	94.5	94.5	94.5
Norway	100.0	100.0	100.0	99.9	99.9	99.9
Portugal	34.4	27.1	0.4	27.6	23.8	0.5
Spain	69.9	61.0	1.6	82.6	79.8	6.3
Sweden	99.9	99.9	99.9	71.3	71.3	70.6
United Kingdom	78.1	75.9	8.9	69.3	68.9	12.1
United States	71.8	52.2	1.2	82.9	71.2	2.8
Median	93.0	92.1	35.3	81.0	79.8	25.8
Mean	75.9	72.2	45.2	69.7	68.4	38.9

Source: IMF staff estimates.
Note: Red and yellow cells indicate probability less than 50 percent, and between 50 and 85 percent, respectively.

V. Conclusions

The aftermath of the financial crisis is posing significant fiscal challenges for a number of advanced economies. On a practical level, a key issue for policymakers is to have information about where the danger points are as far as public debt sustainability is concerned, so that timely action can be taken to steer the economy away from possible limits on public debt. A second issue relates to situations in which the economy—as a result of some shock—actually finds itself on an explosive debt path, and the options for restoring fiscal sustainability in such situations. This note aims to shed some light on both questions.

The approach taken has been to ground the notion of a public debt limit in the actual responsiveness of countries' fiscal balances to changes in the level of public debt. A look at the cross-country evidence suggests that debt limits vary considerably across countries, as does the distance between current and maximum debt (fiscal space). For example, our results suggest that the probability that fiscal space is positive is very high for a number of countries—including Australia, Denmark, Korea, New Zealand, and Norway—but is small or nonexistent for a number of southern European countries and for Japan. For countries facing a low probability of positive fiscal space the message is that they need to undertake fiscal adjustment that departs markedly from their historical performance—and indeed several of these countries have already demonstrated the political willingness to do so. Conversely, even countries that are estimated to have ample space may need to undertake medium-term adjustment to take account of future commitments and contingent liabilities.

Our take on the findings is that if one is "close" to an estimated public debt limit (i.e., if the probability of positive fiscal space is lower than, say, 80–90 percent), timely policy measures are needed to increase the probability that public debt will remain on a sustainable path and convince markets that fiscal policy is not proceeding on a "business as usual" basis. Moreover, since this analysis does not take account of rollover risk, governments will typically want to keep their debt well below the estimated limit, to ensure that fiscal space remains comfortably positive, as illustrated by the probabilistic results in this note. Fiscal strategies in all countries should internalize both the need to support a still fragile recovery and the potential for financial stress prompted by concerns over sovereign risk—which underscores the criticality of firm commitment to strategies to lower fiscal deficits over time and, where funding pressures are present or seem imminent, supported by upfront measures.

A key and worrisome conclusion of this analysis is that a reevaluation by markets of the size of potential negative shocks to the primary balance could itself trigger an increase in interest rates that would drive a formerly sustainable country into a situation of unsustainability. The framework thus makes clear why unpleasant surprises about past fiscal performance, including revisions to deficit estimates, could easily undermine debt sustainability.

Policy options for reducing the risk of unsustainability include an increase in fiscal effort to reduce public debt relative to baseline over a number of years (temporary fiscal effort, which could even be supported by an external anchor from multilateral or regional institutions) or structural reforms to institutions and related determinants of fiscal space that could have a more permanent impact on surplus-generating capacity. While this note does not shed light on how to choose among these various options, the proposed framework can help quantify the impact of different measures on the debt path (helping distinguish between what is likely to be feasible—and thus credible—given country characteristics, and what is not). As such, the proposed framework could provide guidance to policymakers and markets that would underpin fiscal credibility in situations of limited fiscal space.

APPENDIX: SENSITIVITY ANALYSIS OF FISCAL SPACE ESTIMATES

In this appendix, we examine the robustness of our main results to alternative estimation strategies for the fiscal reaction function: (i) using the cubic specification but estimated over the sample period, 1970-2007 (coefficients reported above in Table 1, column 1); and (ii), allowing for a lagged dependent variable, which yields a quadratic specification for the primary balance reaction function (coefficient estimates reported in Table A1). Variable definitions and data sources are reported in Table A2.

Reaction Function Estimated Over 1970–2007 Sample

The estimated fiscal space across countries is very similar to that obtained for the 1985–2007 sample. A comparison of countries' ranking in terms of estimated fiscal space is given in Figure A1, panel a (where points along the 45 degree line imply the same ranking under the two estimation samples). In particular, Japan and Greece remain the countries with the least fiscal space, while Australia, New Zealand, and the Nordic countries have the most room for fiscal maneuver.

Lagged Primary Balance

As noted above, the estimation of the primary balance reaction function used in the text allows for serial correlation in the error term of the regression. An alternative strategy to allow for possible sluggish adjustment of the primary balance (as tax and expenditure changes may take time to implement) is to include the primary balance as a lagged dependent variable in the regression. Table A1 reports the coefficient estimates for this dynamic specification, which are obtained using Blundell and Bond (1998)'s System Generalized Methods of Moments estimator. Inclusion of the lagged primary balance variable renders the cubic term insignificant. Therefore, we estimate a quadratic function to capture the curvature of the response of the primary balance to lagged debt. The general shape of the response is similar across models, however. In particular, for both sample periods, the coefficients of the quadratic functional form capturing the increasing but slowing response of the primary balance to debt are statistically significant. The estimated coefficients of output gap, government gap, and oil price also retain their significance.

Figure A1 (panel b) shows the ranking of countries in terms of the available fiscal space (from lowest to highest) obtained from the estimates (presented in column 4 of Tables 1 and A1, respectively) of the cubic (Model A) and quadratic (Model B) models. For countries at the lowest and highest ends of the spectrum, the rankings of available fiscal space estimates from the two models are broadly similar. The main differences apply to the precise ranking of countries with moderate levels of available fiscal space.

Table A1. Estimation Results for the Fiscal Reaction Function, 1970–2007[1]

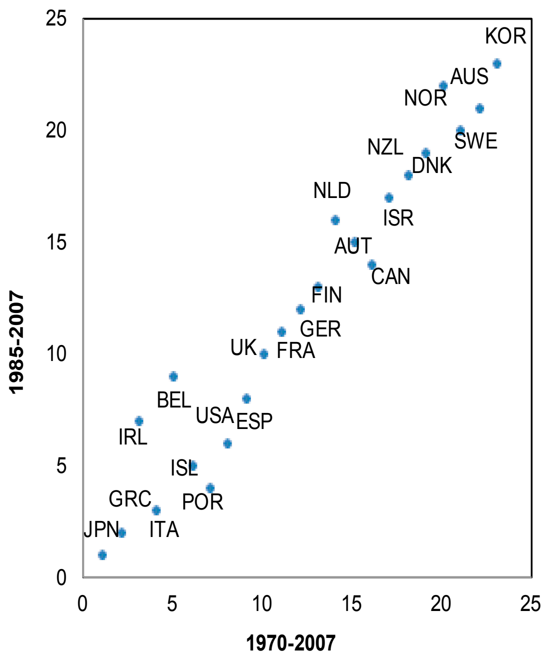
	1970-2007		1985-2007	
	(1)	(2)	(3)	(4)
Lagged primary balance	0.7119***	0.6840***	0.7224***	0.6551***
	(0.04)	(0.05)	(0.03)	(0.03)
Lagged debt	0.0412***	0.0343***	0.0644***	0.0695***
	(0.01)	(0.01)	(0.02)	(0.02)
Lagged debt_square	-0.0001*	-0.0001	-0.0002***	-0.0002**
	(0.00)	(0.00)	(0.00)	(0.00)
Output gap	0.3242***	0.3285***	0.3103***	0.3235***
	(0.05)	(0.06)	(0.06)	(0.06)
Govt. expenditure gap	-0.2979***	-0.2931***	-0.3052***	-0.2971***
	(0.04)	(0.04)	(0.04)	(0.05)
Trade openness		0.0207		0.0069
		(0.02)		(0.03)
Age dependency		0.03185		-0.0041
		(0.03)		(0.06)
Inflation		-0.2476		1.1903
		(1.21)		(1.21)
Oil price		3.3059***		2.7356***
		(0.66)		(0.60)
Nonfuel commodity price				4.5099
				(3.40)
Political stability				0.0316
				(0.02)
IMF arrangement				0.8369*
				(0.45)
Fiscal rules				0.3821
				(0.30)
Observations	632	632	494	489
Number of countries	23	23	23	23
Arellano-Bond test of zero second-order AR in first-differenced errors (p-value)	0.435	0.200	0.194	0.220

Source: IMF staff estimates.

Note: Dependent variable is primary balance to GDP (in percent); Country-specific effects included in all estimations; Robust standard errors in parentheses; ***, **, and * indicate significance at 1, 5, and 10 percent levels, respectively.

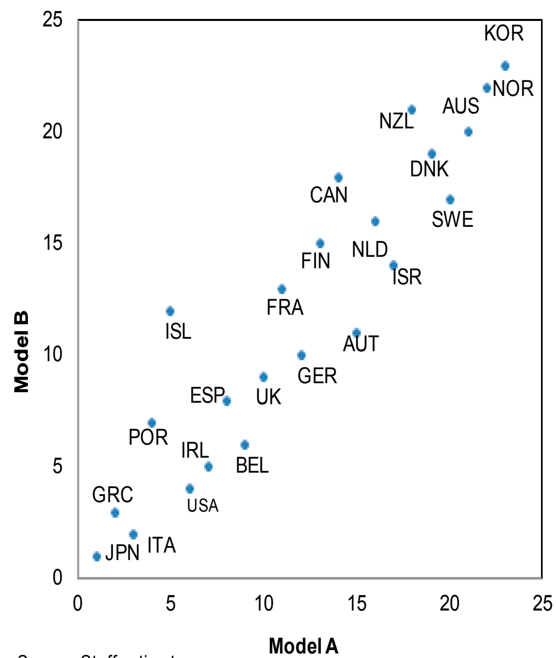
Figure A1. Sensitivity Analysis of Fiscal Space Estimates

(a) Ranking based on cubic model [1]



Source: Staff estimates.
1/ Ranking (1=lowest, 23=highest) based on fiscal point estimates obtained from the 1970-2007 and 1985-2007 samples of the cubic (AR1) model; AUT=Austria; AUS=Australia; BEL=Belgium; CAN= Canada; DNK= Denmark; FIN=Finland; FRA=France; GER= Germany; GRC=Greece; ISL=Iceland; IRL=Ireland; ISR=Israel; ITA=Italy; JPN=Japan; KOR=Korea; NLD=Netherlands; NZL= New Zealand; NOR=Norway; POR=Portugal; ESP=Spain; SWE= Sweden; UK=United Kingdom; USA=United States.

(b) Ranking based on cubic vs. quadratic models [1]



Source: Staff estimates.
1/ Ranking based on fiscal point estimates obtained from the 1985-2007 sample; Model A and B refer to the cubic (AR1) and dynamic quadratic specifications, respectively; ; AUT=Austria; AUS= Australia; BEL= Belgium; CAN= Canada; DNK=Denmark; FIN= Finland; FRA=France; GER= Germany; GRC=Greece; ISL=Iceland; IRL=Ireland; ISR=Israel; ITA=Italy; JPN=Japan; KOR=Korea; NLD= Netherlands; NZL= New Zealand; NOR=Norway; POR=Portugal; ESP=Spain; SWE= Sweden; UK=United Kingdom; USA=United States.

Table A2. Variable Definitions and Data Sources

Variable	Description	Source
Dependent variable		
Primary balance to GDP ratio	In percent	IMF's World Economic Outlook (WEO) and OECD databases.
Explanatory variables		
Lagged debt to GDP ratio	In percent	WEO database.
Output gap	Difference between actual and potential (calculated using the Hodrick-Prescott filter) real GDP.	Staff calculations based on WEO database.
Government expenditure gap	Difference between actual and potential (calculated using the Hodrick-Prescott filter) real government consumption spending.	Staff calculations based on WEO database.
Trade openness	Sum of exports and imports to GDP (in percent)	Staff calculations based on WEO database.
Inflation	Three year lagged moving average of CPI inflation.	Staff calculations based on WEO database.
Oil price	Log of (trend) oil price applied to oil exporters only.	Staff calculations based on WEO database.
Nonfuel commodity price	Log of (trend) nonfuel commodity price index applied to nonfuel commodity exporters only.	Staff calculations based on WEO database.
Age dependency ratio	Ratio of the dependent to working age (15-64 years) population.	UN's database. Available online at: http://data.un.org/Data.aspx?q=dependency+ratio+(per+cent)&d=PopDiv&f=variableID%3a42
Future age dependency ratio	Projected age dependency ratio 20 years ahead.	UN's database. Available online at: http://data.un.org/Data.aspx?q=dependency+ratio+(per+cent)&d=PopDiv&f=variableID%3a42
Political stability index	Smaller (larger) values indicating higher (lower) political risk.	International Country Risk Guide (ICRG) dataset.
IMF arrangement	Binary variable equal to one if a country has an IMF support program in a given year, and zero otherwise.	IMF's History of Lending Arrangements database. Available online at http://www.imf.org/external/np/fin/tad/extarr1.aspx.
Fiscal rules	Binary variable equal to one if a country has any type (expenditure, revenue, balanced budget, and debt) of fiscal rule in a given year, and zero otherwise.	IMF's Fiscal Rules database, 1985-2009.

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