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FISCAL FRAGILITY:
WHAT THE PAST MAY SAY ABOUT THE FUTURE

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ABSTRACT

The end of the great moderation has profound implications on the assessment of fiscal sustainability. The pertinent issue goes beyond the obvious increase in the stock of public debt/GDP induced by the global recession, to include the neglected perspective that the vulnerabilities associated with a given public debt/GDP increase with the future volatility of key economic variables. We evaluate for a given future projected public debt/GDP, the possible distribution of the fiscal burden or the flow cost of funding debt for each OECD country, assuming that this in future decades resembles that in the past four decades. Fiscal projections may be alarmist if one jumps from the priors of great moderation to the prior of permanent high future burden. Prudent adjustment for countries exposed to heightened vulnerability may entail both short term stabilization and forward looking fiscal reforms.

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The global crisis has brought to the fore the fiscal vulnerabilities of OECD countries. There is a growing recognition of the fiscal vulnerabilities of some countries of the Euro block (Greece, Portugal, Spain, Italy, Ireland and others). The ability of the US to obtain relatively cheap funding of its debt delays, but does not negate the fiscal challenges facing the US.

While the crisis added to the debt burdens, the fiscal vulnerabilities are not new. Rather, they were built up gradually before the crisis, as a result of demographic transition (aging population and declining fertility) affecting most OECD countries and the commitments made by the welfare states. The "great moderation" (i.e., the drop in volatility and risk premium during the late 1990s and early 2000s), and the growing belief that this great moderation was here to stay, mitigated fiscal concerns. During that period, the sharp decline in the price of risk and in the risk free interest rate allowed a growing sense of complacency in Europe and the US regarding the exposure to fiscal challenges. The current global crisis made clear that the spell of great moderation was a transitory hiatus. The purpose of this note is to illustrate that the end of the great moderation has profound implications for the assessment of fiscal sustainability. The pertinent issue goes beyond the obvious increase in the stock of public debt/GDP induced by the global recession, to include the neglected perspective that the vulnerabilities associated with a given public debt to GDP ratio increase with the future volatility of key economic variables.

A common measure of fiscal burden is the funding flow needed to keep public debt/GDP constant. Specifically, a public debt/GDP ratio, *d,* would grow overtime at a rate equal to the gap between the real interest rate on the debt, *r*, minus the growth rate of the economy, *g,* assuming a primary balance of zero, i.e., $\dot{d} = \left(r - g - (PB/D)\right)d$, where $\dot{d}$ is change in *d* over continuous time, *PB* is the government's primary balance and *D* is the public debt.[2] Henceforth we refer to the gap (*r – g)* as the *flow cost* of public debt. The fiscal burden associated with a given public debt/GDP ratio, *d,* equals *(r-g)*d*. Vulnerability projections of the IMF and other international financial organizations frequently focus on postulating the expected future pattern of *d*. Such projections portray the path of public debt/GDP in future years by adjusting the present debt/GDP according to the expected future path of taxes and fiscal commitments. We supplement this approach with fragility analysis based on what the past data says about *(r-g)*.

[2] Obstfeld and Rogoff (1996).

Specifically, we evaluate for a given future projected public debt/GDP the possible distribution of the fiscal burden if the distribution of flow cost of funding debt in future decades resembles the past four decades. While there is no obvious threshold indicating a funding crisis, higher burden of public debt [$(r-g)*d$] increases the need for fiscal adjustment in the form of some combination of lower government expenditure and transfers, and higher taxes.

Looking at the past to provide insight about the future has been a neglected perspective since before the crisis. The low real interest rate and the moderate growth of OECD countries during the era of the "great moderation" implied very low fiscal burden. Perceiving the great moderation as an enduring state instead of a lucky draw induced fiscal laxity. Arguably, derailing short term economic stabilization based on projections of permanent gloomy growth rates today may be an equally invalid perspective. Taking the past four decades as guidance for possible future developments helps in avoiding the fallacy of framing the future in terms of a unique scenario, a strategy that may lead to either too optimistic or too pessimistic priors, possibly magnifying the resultant macro volatility. Looking at the past data is useful, as it indicates that growth rates and real interest rates are highly unstable over time, with low correlations across decades (Easterly et al., 1993; Mishkin, 1981). Fiscal projections may be alarmist if one jumps from the priors of great moderation to the prior of permanent high future burden. Yet, the importance of both r and g in determining the actual debt burdens as well as the range of scenarios faced by OECD countries in the past suggests that countries exposed to heightened vulnerability may consider both short term stabilization *and* forward looking fiscal reforms.

Average flow costs of public debt since 1970

To construct the flow costs of public debt, we first collect data on the current average effective maturity of general government debt for OECD countries (Table 1).[3] The average OECD country had an effective maturity of general government debt of around 6 years. UK debt had the highest maturity, about 14 years and Hungary the lowest, of 3 years. We then use the series of average annual real interest rate on the government debt of maturity most closely corresponding to the actual effective maturity of general government debt, and the growth rate of

[3] The effective maturities in Table 1 correspond to the year 2010 or the latest available values. The data are sourced from Bloomberg, BIS, EU and national sources.

real GDP, to compute the annual flow cost, *(r-g)* for each country.[4] The annual series of *(r-g)* is then averaged over 5-year intervals starting in 1970. The annual real interest rate and growth rate series are plotted in figure 1, and the average flow costs for the 5-year periods are shown in Table 2. Most OECD countries had negative flow costs of public debt during the 1970's, due to the negative real interest rates owing to high inflation in this period. Most countries saw their flow costs peak in one of the three periods between 1980 and 1994. The average flow costs during the last decade were low or moderately negative. The table illustrates the large swings in flow costs for each country, indicating that the debt burden associated with any given *d* can vary considerably, depending on the difference between real interest rate and GDP growth.

In addition, the distribution of *(r-g)* may be characterized by fat tails. To test this, in Table 3, we present the statistics on relative kurtosis of the annual series of (r-g) for each country and the results of normality tests. The distribution of *(r-g)* is leptokurtic in Germany, Greece, Korea, Japan and the USA.[5] The normality hypothesis is rejected by the Shapiro-Wilk test for 12 out of the 26 countries and by the joint skewness and kurtosis test in 11 countries. In addition, in Table 4, we present the realized probabilities of bad outcomes, i.e. realizations of *(r-g)* exceeding the intra-country mean by 1.645 or more standard deviations. The last three columns of Table 4 list the ex-post probability of $(r\text{-}g) \geq \mu + 1.645\sigma$, $(r\text{-}g) \geq \mu + 1.96\sigma$ and $r\text{-}g \geq \mu + 2.3267\sigma$, respectively. For a normally distributed variable, these probabilities would equal 0.05, 0.025 and 0.01, respectively. For nine countries, the realized probability of an extremely adverse outcome (corresponding to $r\text{-}g \geq \mu + 2.3267\sigma$) exceeds 0.02, i.e. is over double what it would be in a normal distribution. For 17 out of the 26 countries, the realized probability of an (r-g) exceeding the mean by 1.96 standard deviations or more is higher than the corresponding probability in a normal distribution, 0.025. The possibility of fat tails indicates a need to evaluate carefully, both the average and extreme scenarios in projecting debt burdens.

In order to evaluate the various outlooks for the future debt burdens for OECD countries, we use the World Economic Outlook (WEO) projections of gross general government debt/GDP

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[4] The nominal interest rates on debt were converted into real interest rates by subtracting the rate of growth of GDP deflator.

[5] A leptokurtic distribution is more "peaked" than the normal distribution and has a fatter tail. Its kurtosis is greater than 3.

ratio, *d*, for each country, for the year 2015 (Table 1).[6] A majority of the OECD countries are expected to have debt/GDP ratios exceeding 60% by 2015. For the projected debt/GDP ratios, we compute the implied debt burdens for each country, for each of the scenarios in Table 2. Figure 2 plots the best case, the worst case and the average of the best and the worst scenarios for each country. We define the best case scenario as the one with the lowest flow cost, based on the historical average flow costs in Table 2. The worst case scenario is analogously defined. All but three OECD countries in Figure 2 will have a negative debt burden in the best case scenario. A negative debt burden implies that the government can run a primary deficit and yet keep the debt/GDP ratio constant (or more precisely, that it would have to run a primary deficit in order to keep the debt/GDP ratio constant, which would otherwise shrink). Only Italy, Denmark and Sweden have positive debt burdens under the historical best case, and should this scenario prevail, their gross debt burden for the projected 2015 debt/GDP ratio would be 0.03, 0.52 and 0.11 percent of GDP, respectively. Italy's debt burden in the best case scenario is lower than that of Sweden and Denmark, even though its projected debt is 124.7 percent of GDP, while Sweden and Denmark have low projected debts of 37.6 and 49.8 percent of their GDP, respectively. In fact, should the (r-g) turn out to be negative, the *higher* the debt/GDP ratio, the *lower* the debt burden. In the best case scenario, the US debt burden is lower than that of UK and Canada, although the projected US debt is higher than both countries.

Most OECD countries have worst-case projected debt burdens over 2 percent of GDP, which, if realized, would likely be onerous, given their population dynamics and the commitments of the welfare state. The US has an above-average debt burden in the worst case scenario, of about 3.9 percent of GDP. Greece by far has the highest debt burden in the worst case scenario, of about 12.4 percent of GDP. In the worst case scenario, a Greek default is not a far-fetched possibility. Another interesting case is of Portugal, which has recently seen a cut in its sovereign rating by all three international ratings agencies, but whose debt burden is moderate relative to peers even in the worst case scenario.[7]

[6] The figures are as reported in the May 2010 IMF Fiscal Monitor.

[7] Portugal's projected debt does not take into account the budget cuts announced on May 10, 2010.

The prudence of fiscal adjustment increases with the uncertainty of the future debt burden. In Figure 3, we use three different measures to capture the uncertainty implied by the variation in (r-g). In Figure 3.a., we plot the difference between the historical worst and best case scenarios. The country with the greatest uncertainty in the future debt burden is Japan, followed by Greece, Belgium, Ireland, France and Canada. The US has the 11th highest uncertainty in terms of (worst-best) scenarios. While most countries that have low projected debt ratios occupy the lower end of the scale, that is, they have lower uncertainty in future debt burdens, this uncertainty does not increase monotonically with the size of projected debt. The US projected debt for 2015 is higher than the projected debt of 7 of the countries that face greater uncertainty in debt burden than the US.

In figure 3.a, Japan's figure is inflated by the very negative flow costs it saw in its period of high growth in the 1970's and 1980's. In figure 3.b and 3.c, we narrow our focus to less extreme events. In order to figure 3.b, we use an alternative measure of uncertainty after excluding the possibility of an extremely lucky draw for all countries. We re-define best and worst scenarios after excluding the periods (from Table 2) with the highest average *g* or the lowest average *r*. The uncertainty is lower for most countries[8], than in figure 3.a. It is lower still in figure 3.c, where we use the standard deviation of the annual series of *(r-g)*, times *d*. Nevertheless, the size of the uncertainty faced by most countries, those with high projected debt and those with relatively lower projected debt, indicates a need for caution in formulating short term policy based on overtly pessimistic scenarios, and also for forward looking fiscal reforms.

Several caveats apply to the above analysis. In so far as the debt projections do not include unfunded liabilities, the actual debt burden may be higher in all scenarios. The debt burden, or the primary balance needed to keep the debt/GDP ratio constant, is computed here using gross government debt (due to easier data availability), but an accurate measure of the debt burden would use net government debt. While these considerations would change the actual numbers of projected debt burdens, they wouldn't undermine the overall message, which is that the debt burden, *(r-g)*d*, depends on the realization of *(r-g)* as much as on the size of *d*.

[8] Except for 6 countries, for which it is the same.

Conclusions

Our analysis highlights the uncertainty in future debt burdens facing OECD countries and the importance of future real interest rates and growth rates in determining the debt burden, particularly for countries with high projected debt/GDP ratios. In so far as the future growth may depend on short term stabilization during or in the aftermath of a financial crash and a deep recession, the additional debt incurred for such stabilization may not translate into excessively high future flow costs of public debt. However, we also emphasize that the uncertainty of future debt burden is likely to increase with the size of the future debt/GDP ratios. Prudent fiscal policy therefore may involve both short term stabilization *and* forward looking fiscal reforms. Admittedly, doing both simultaneously has challenged the political capacities of the US and Europe. Yet, going overboard with only one of the two adjustments (i.e., focusing only on short term stabilization, or on forward looking fiscal reforms in the form of early belt tightening) may increase vulnerabilities. Focusing only on stabilization in the form of fiscal stimulus and monetary easing raises concerns about the cost of government borrowing (as in the case of Greece and the weaker underbelly of the Euro area). Focusing only on belt tightening today may delay the global recovery. Finding the proper balance remains a work in progress.

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Table 1: Summary Statistics on General Government Gross Debt by Country

	Average Effective Debt Maturity (years)	Projected 2015 debt as percent of GDP
Australia	4.97	20.9
Austria	7	77.3
Belgium	6	99.9
Canada	6	71.2
Czech Republic	6.40	49.9
Denmark	8	49.8
Finland	5	76.1
France	6.96	94.8
Germany	6	81.5
Greece	7.9	140.4
Hungary	3	64.0
Ireland	7	94.0
Italy	7.07	124.7
Japan	6.25	250.0
Korea, South	5	26.2
Netherlands, the	6.02	77.4
New Zealand	4	36.1
Norway	5	53.6
Poland	5	62.1
Portugal	6.0	98.4
Slovak Republic	5	41.9
Spain	7	94.4
Sweden	7	37.6
Switzerland	6	36.2
UK	13.98	90.6
US	4.58	109.7

Source: Average effective maturity from Bloomberg and national sources. Projected debt/GDP percentage from April 2010 WEO and IMF staff calculations, as reported in May 2010 IMF Fiscal Monitor.

Table 2: Average difference between real interest rate and real growth rate

a. Eurozone OECD Economies

	Austria*	Belgium	Finland	France	Germany	Greece	Ireland	Italy	Netherlands	Portugal	Slovak Republic	Spain
1970-74	-4.5	-5.1		-6.9	-0.9		-5.1		-4.8			
1975-79	-0.1	-0.3		-10.5	0.5		-7.0		-0.9			
1980-84	2.8	5.5		-5.8	3.7		0.2		4.8			2.6
1985-89	1.3	2.9	-0.9	1.8	1.7		2.5	3.1	3.0	-4.2		0.7
1990-94	2.0	3.8	10.0	4.3	-0.5	8.8	2.3	6.1	3.1	1.5		4.2
1995-99	2.3	2.2	-0.4	3.9	3.1	1.8	-7.4	2.2	-0.2	-0.3		0.4
2000-04	1.3	0.8	0.3	1.1	2.7	-2.9	-5.6	0.0	-0.2	0.1	-3.4	-2.8
2005-09	0.1	0.9	1.4	-0.2	1.9	-0.6	2.2	1.9	0.8	1.5	-2.7	-0.6
2010 Q1	0.3	-2.3	1.9	2.8	0.2	10.9	10.7	2.3	4.3	1.1	-0.9	5.8

*Real rates for Austria are based on the average return on bonds with maturities greater than one year for 1970-1982, and with a 9-10 year maturity for 1983-2010

b. Non-Eurozone OECD Economies

	Australia	Canada	Czech Republic	Denmark	Hungary	Japan	Korea	New Zealand	Norway	Poland	Sweden	Switzerland	UK	USA
1970-74	-8.1	-5.5				-9.0						-5.7	-2.4	-2.8
1975-79	-4.4	-3.6				-2.6						2.0	-5.6	-3.2
1980-84	1.5	3.1		4.3		1.7						-1.4	2.1	3.5
1985-89	2.1	2.1		4.4		-0.8	-3.1	3.5	5.9		2.0	-1.3	0.5	1.8
1990-94	5.1	5.5		4.9		1.8	-2.3	5.0	4.0		5.3	1.8	3.6	1.8
1995-99	1.2	1.4	3.3	1.9	-0.3	2.0	1.8	3.0	-1.3	0.4	1.7	1.8	0.8	0.3
2000-04	-1.3	-0.5	-1.6	1.0	-3.0	1.3	-2.1	-0.5	-1.8	2.4	0.4	0.9	-0.4	-0.6
2005-09	-1.5	0.3	-1.6	1.3	3.4	2.4	0.1	1.5	-2.9	-2.1	0.3	-1.0	1.3	-0.1
2010 Q1	1.1	-2.4	1.4	0.0	5.8	-0.2	-5.5	-0.8	-0.2	-0.5	2.2	0.5	1.8	-0.3

Note: The real interest rate is the average annual real interest rate on general government debt of maturity most closely corresponding to the latest available average maturity of general government debt. These average maturities are listed in Table 1. The growth rate of GDP deflator was used to convert nominal interest rate to real rate.

Source: Authors' calculations using data from OECD, BIS, EU and national sources

Table 3: Relative Kurtosis and tests for normality in the annual *(r-g)* series.

Country	Observations	Relative Kurtosis	Shapiro-Wilk W-test		Joint Skewness and Kurtosis Test	
			W	P-value	Chi-2	P-Value
Australia	38	0.59	0.97	0.29	2.61	0.27
Austria	39	-0.12	**0.93**	0.02	**4.71**	0.09
Belgium	39	0.35	0.96	0.25	4.18	0.12
Canada	39	0.19	0.98	0.54	1.21	0.55
Switzerland	39	0.65	0.96	0.76	3.79	0.15
Czech Republic	13	-1.07	0.98	0.52	1.07	0.59
Germany	39	**3.95**	**0.91**	0.00	**15.80**	0.00
Denmark	27	-0.84	0.98	0.75	1.05	0.59
Spain	30	-1.01	**0.93**	0.06	2.80	0.25
Finland	22	0.27	**0.87**	0.01	**5.81**	0.05
France	39	-0.67	0.97	0.37	1.82	0.40
UK	39	**2.71**	**0.93**	0.02	**11.01**	0.00
Greece	18	-0.86	**0.90**	0.05	2.71	0.26
Hungary	13	0.83	0.90	0.12	**5.74**	0.06
Ireland	39	0.14	0.96	0.19	3.05	0.22
Italy	22	-0.35	**0.90**	0.03	3.35	0.19
Japan	39	**2.93**	**0.87**	0.00	**14.95**	0.00
Korea	23	**5.96**	**0.80**	0.00	**18.83**	0.00
Netherlands	39	-0.52	0.98	0.70	0.32	0.85
Norway	25	-0.53	0.97	0.54	1.44	0.49
New Zealand	25	0.99	**0.92**	0.05	**7.16**	0.03
Poland	11	-0.21	0.97	0.89	1.32	0.52
Portugal	24	1.09	0.96	0.35	3.96	0.14
Slovak Republic	10	2.56	**0.76**	0.00	**11.35**	0.00
Sweden	23	1.03	0.94	0.17	**6.35**	0.04
USA	39	**1.77**	**0.95**	0.06	**7.20**	0.03

Note: The number in bold denote significance at 10 percent level. For the relative kurtosis, the cut-off for significance used was 2*√(24/N)

Table 4: Realized probabilities of bad outcomes

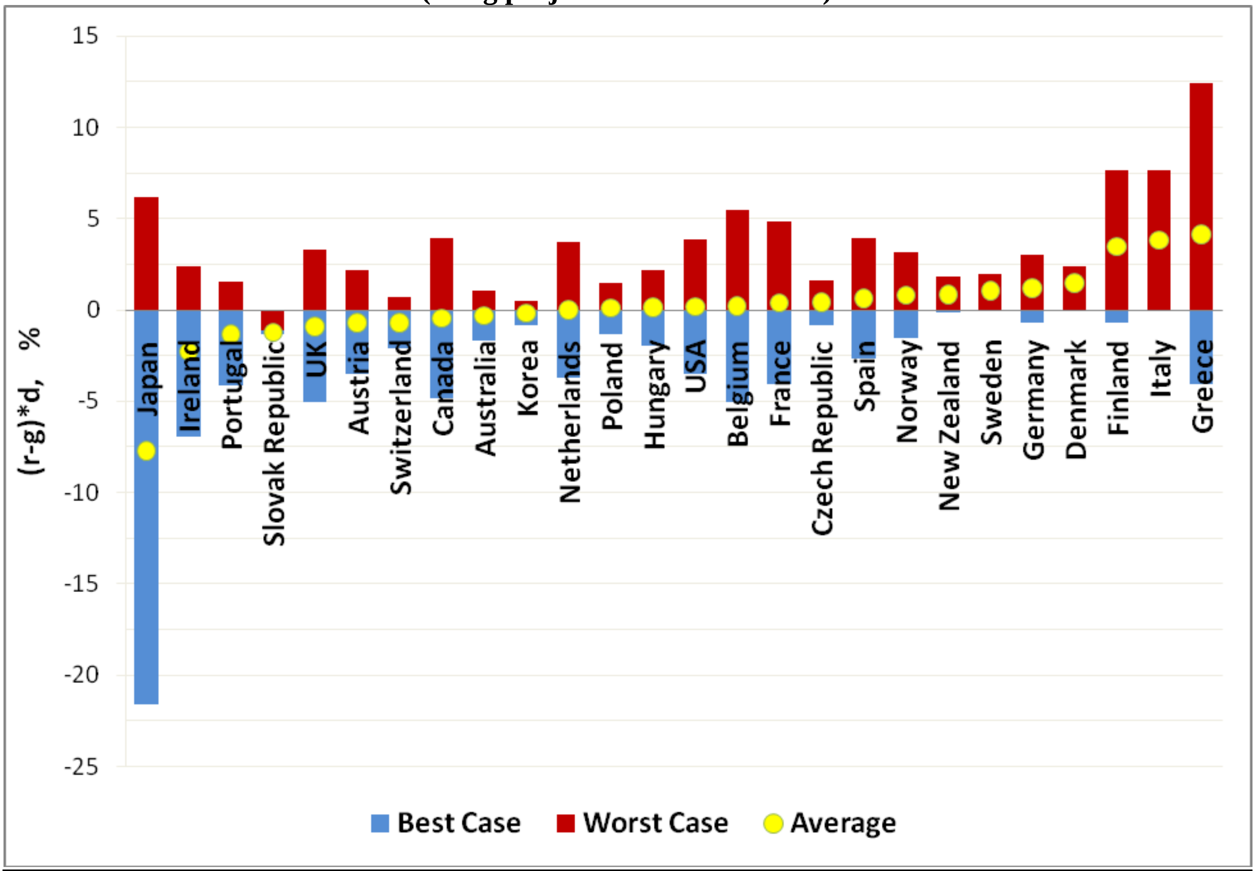
Total	*No. Of Observations for which (r-g) is greater than*			*Realized Probability at cut-off where probability in a Normal Distribution equals*			*Country*
	$\mu + 1.645\sigma$	$\mu + 1.96\sigma$	$\mu + 2.3267\sigma$	*0.05*	*0.025*	*0.01*	
39	1	1	0	0.026	**0.026**		Belgium
39	1	1	0	0.026	**0.026**		Switzerland
39	1	1	0	0.026	**0.026**		UK
39	1	1	1	0.026	**0.026**	**0.026**	USA
39	1	0	0	0.026			Germany
39	1	0	0	0.026			France
39	1	0	0	0.026			Japan
38	1	1	1	0.026	**0.026**	**0.026**	Australia
27	1	0	0	0.037			Denmark
25	1	1	1	0.040	**0.040**	**0.040**	New Zealand
23	1	1	1	0.043	**0.043**	**0.043**	Korea
23	1	1	1	0.043	**0.043**	**0.043**	Sweden
39	2	1	1	**0.051**	**0.026**	**0.026**	Ireland
39	2	1	0	**0.051**	**0.026**		Netherlands
39	2	0	0	**0.051**			Canada
18	1	1	0	**0.056**	**0.056**		Greece
30	2	1	0	**0.067**	**0.033**		Spain
13	1	1	1	**0.077**	**0.077**	**0.077**	Hungary
24	2	0	0	**0.083**			Portugal
22	2	2	1	**0.091**	**0.091**	**0.045**	Finland
22	2	2	0	**0.091**	**0.091**		Italy
11	1	1	0	**0.091**	**0.091**		Poland
10	1	1	1	**0.100**	**0.100**	**0.100**	Slovak Republic
39	0	0	0				Austria
13	0	0	0				Czech Republic
25	0	0	0				Norway

Note: μ refers to the mean of (r-g) and σ to its standard deviation. Both are computed from annual observations on (r-g) and are country-specific. The last three columns give the ex-post probability of $(r\text{-}g) \geq \mu + 1.645\sigma$, $(r\text{-}g) \geq \mu + 1.96\sigma$ and $r\text{-}g \geq \mu + 2.3267\sigma$, respectively. The probability of $(r\text{-}g) \geq \mu + 1.645\sigma$ for a normally distributed variable equals 0.05, etc. Where realized probabilities are missing, they equal zero.

Figure 1: Annual real interest rate on government debt and real GDP growth rate in OECD countries.

Note: *Real rates for Austria are based on the average return on bonds with maturities greater than one year for 1970-1982, and with a 9-10 year maturity for 1983-2010. Real rates for all other countries are the real rates on the maturity closes to the most recent average maturity of general government debt in Table 2. The growth rate of GDP deflator was used to convert nominal interest rate to real rate.

Figure 2: General Government Gross Debt Burden of Selected OECD Economies, Historical Best Case, Worst Case and Average Scenarios (using projected 2015 debt/GDP)



Note: The gross debt burden representing the lowest flow costs is calculated by taking an average of the two lowest values of the difference *(r-g)*, respectively, and multiplying it with the projected debt to GDP ratio. For countries for which flow costs for less than 4 periods are available, the single highest and lowest costs are used. *Real rates for Austria are based on the average return on bonds with maturities greater than one year for 1970-1982, and with a 9-10 year maturity for 1983-2010. Real rates for all other countries are the real rates on the maturity closes to the most recent average maturity of general government debt in Table 2. The growth rate of GDP deflator was used to convert nominal interest rate to real rate.

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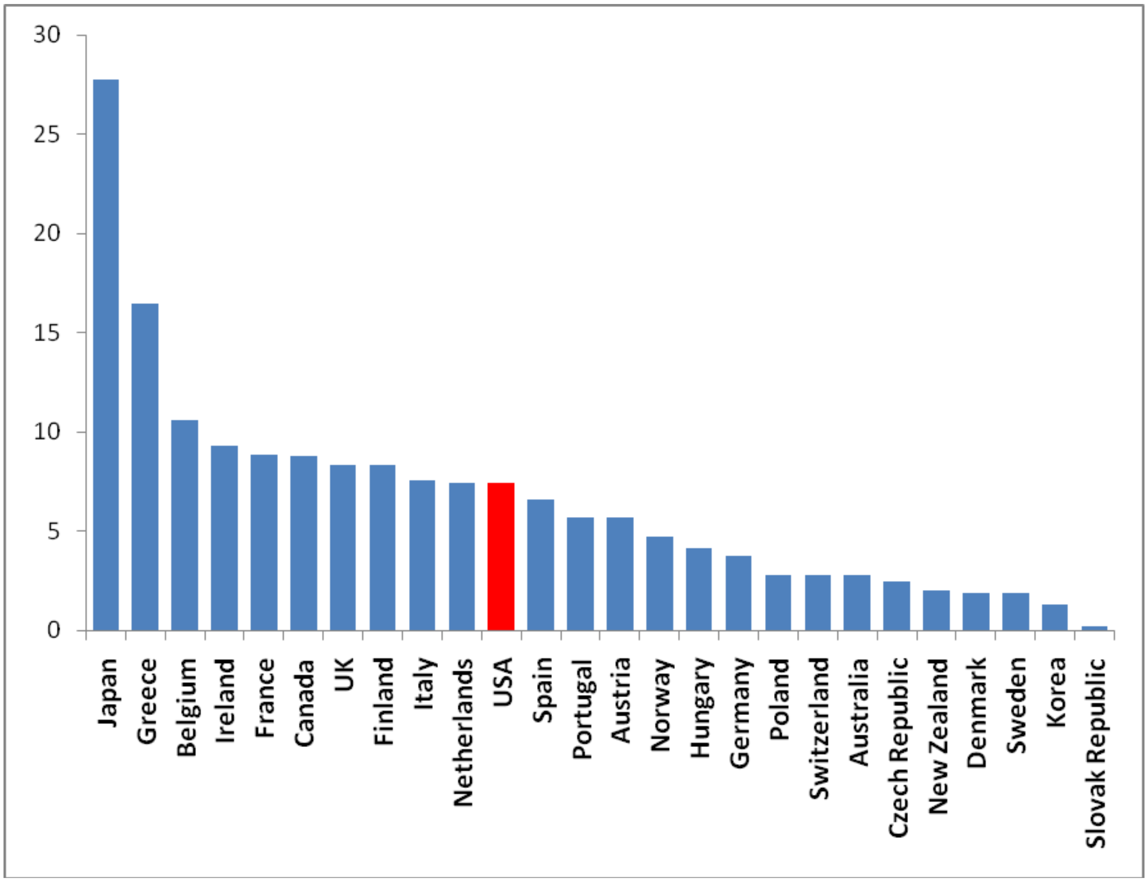
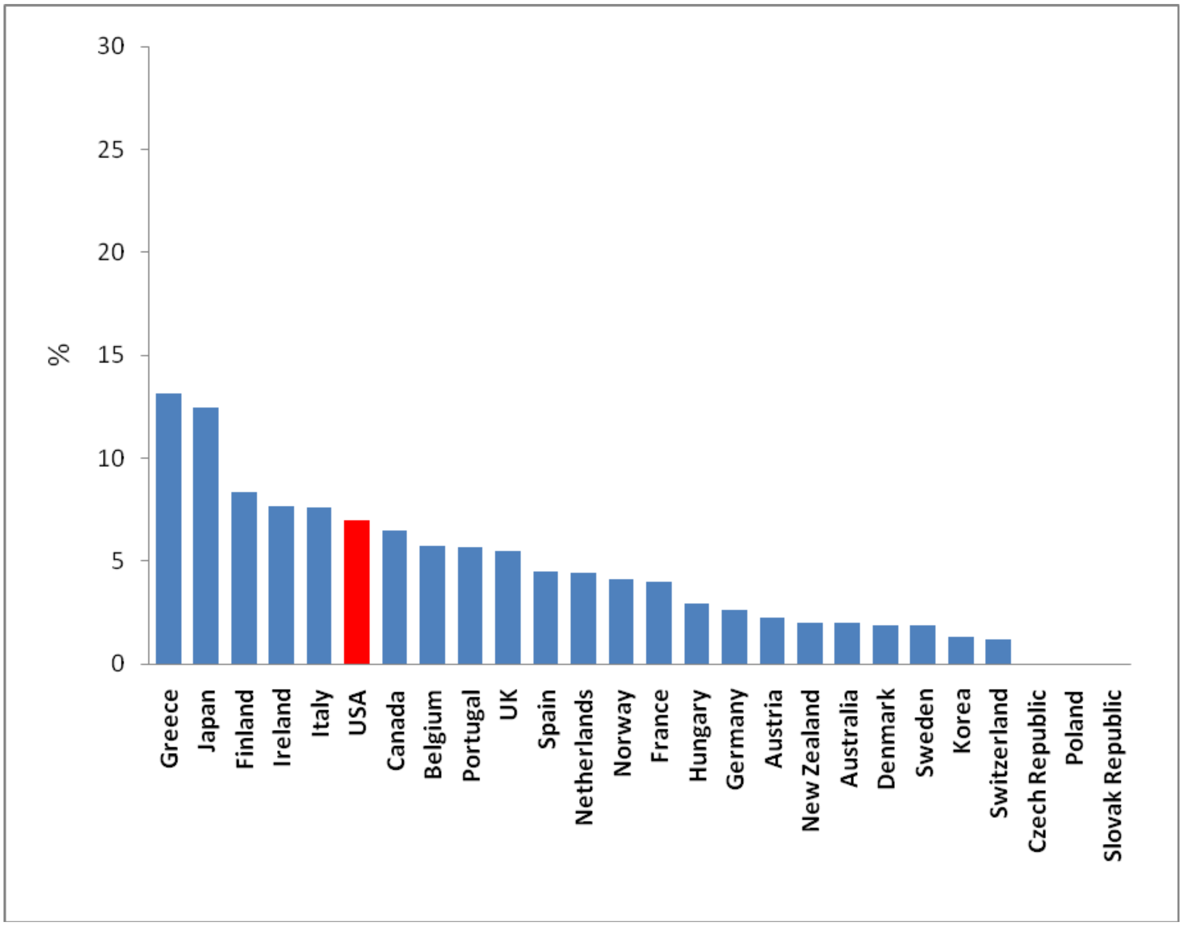
Figure 3: Uncertainty in General Government Gross Debt Burden of Selected OECD Economies, (using projected 2015 debt/GDP)

3.a. Historical (Worst – Best) Scenarios



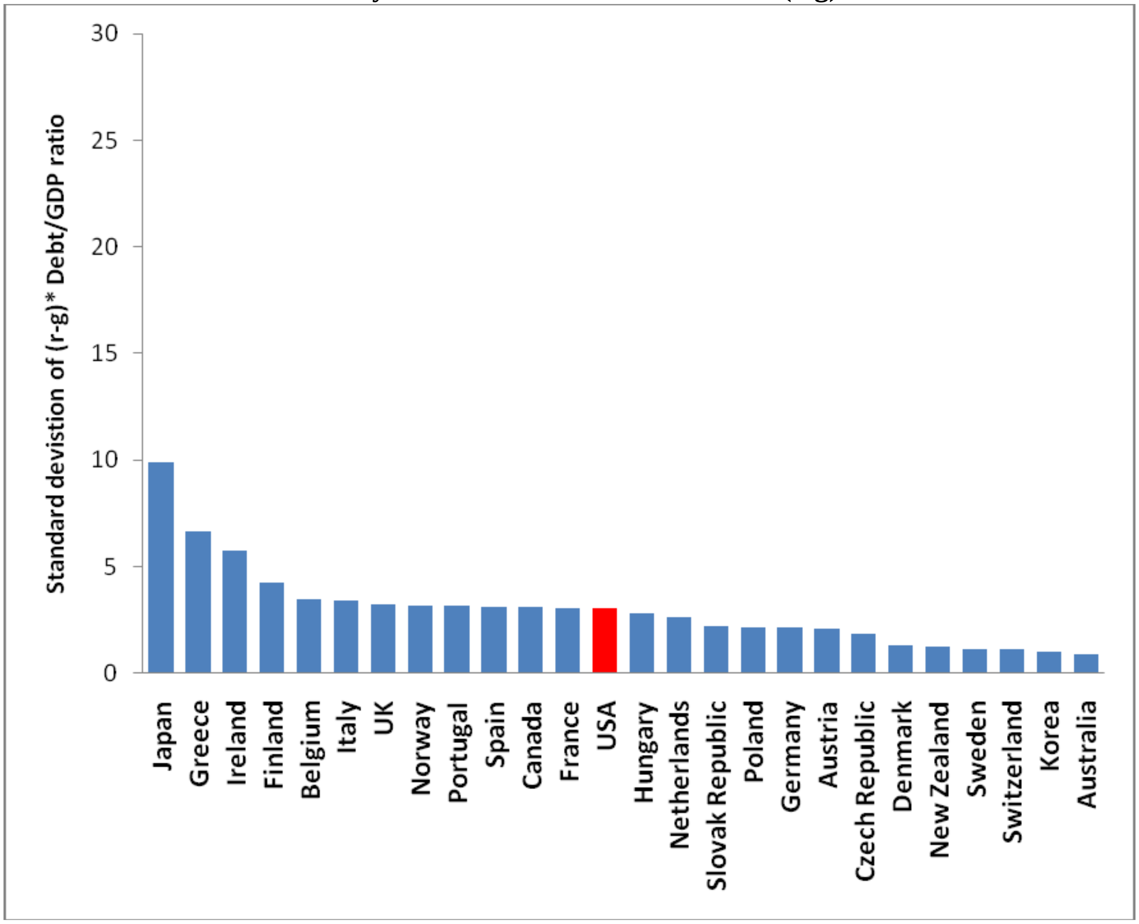
Note: The gross debt burden (or the flow cost of projected debt) representing the lowest (best scenario) and the highest (worst scenario) flow costs is calculated by taking an average of the two lowest and the two highest historical values, respectively, of the r-g from Table 1, and multiplying it with the projected debt to GDP ratio. For countries for which data for less than 4 periods is available, the single lowest and highest flow costs are used. Real rates for Austria are based on the average return on bonds with maturities greater than one year for 1970-1982, and with a 9-10 year maturity for 1983-2010. Real rates for all other countries are the real rates on the maturity closes to the most recent average maturity of general government debt in Table 2. The growth rate of GDP deflator was used to convert nominal interest rate to real rate.

3.b. Historical (Worst – Best) Scenarios, after excluding periods with highest g and lowest r



Note: The gross debt burden (or the flow cost of projected debt) representing the lowest (best scenario) and the highest (worst scenario) flow costs is calculated by taking an average of the two lowest and the two highest historical values, respectively, of the r-g from Table 1, and multiplying it with the projected debt to GDP ratio. For countries for which data for less than 4 periods is available, the single lowest and highest flow costs are used. Real rates for Austria are based on the average return on bonds with maturities greater than one year for 1970-1982, and with a 9-10 year maturity for 1983-2010. Real rates for all other countries are the real rates on the maturity closes to the most recent average maturity of general government debt in Table 2. The growth rate of GDP deflator was used to convert nominal interest rate to real rate.

3.c. Uncertainty: Standard Deviation of annual (r-g) x Debt/GDP



Note: The gross debt burden (or the flow cost of projected debt) representing the lowest (best scenario) and the highest (worst scenario) flow costs is calculated by taking an average of the two lowest and the two highest historical values, respectively, of the r-g from Table 1, and multiplying it with the projected debt to GDP ratio. For countries for which data for less than 4 periods is available, the single lowest and highest flow costs are used. Real rates for Austria are based on the average return on bonds with maturities greater than one year for 1970-1982, and with a 9-10 year maturity for 1983-2010. Real rates for all other countries are the real rates on the maturity closes to the most recent average maturity of general government debt in Table 2. The growth rate of GDP deflator was used to convert nominal interest rate to real rate.