

Schaltegger, Christoph A.; Weder, Martin

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## Fiscal Adjustments and the Probability of Sovereign Default

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Center for Research in Economics, Management and the Arts

# Fiscal Adjustments and the Probability of Sovereign Default

Working Paper No. 2013-06

CREMA Südstrasse 11 CH - 8008 Zürich [www.crema-research.ch](http://www.crema-research.ch)

# Fiscal Adjustments and the Probability of Sovereign Default

by

Christoph A. Schaltegger  
*University of Lucerne, University of St. Gallen, CREMA*

and

Martin Weder  
*University of Lucerne*

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## *Abstract*

Based on probit estimates, this paper analyzes the effects of fiscal consolidation on the probability of sovereign defaults in the short run. Using a panel of 104 developing countries from 1980 to 2009 and controlling for various economic, fiscal and political factors, we find that fiscal adjustments in general do not significantly reduce the probability of default even if they are large. Instead, the composition of budget consolidation is decisive in reducing default risk. In contrast to industrialized countries, expenditure based adjustments are not successful while revenue based adjustments lower the probability of default in the following year by 33 to 56 percent. This finding also holds when economic growth is low or government debt is high as well as when IMF lending is taken into account.

JEL-Classification: E62, H62, H63

Keywords: sovereign default, fiscal policy, fiscal adjustment, bailout

Corresponding Author: Christoph A. Schaltegger  
University of Lucerne  
Froburgstrasse 3  
CH-6002 Luzern  
Switzerland  
[christoph.schaltegger@unilu.ch](mailto:christoph.schaltegger@unilu.ch)

## 1. Introduction

### 1.1 Background and contribution of the paper

The global financial crisis and the collapse of several large financial institutions merged into the Great Recession, marked by the first contraction of the world economy in 2009 since World War II, a steep decline in world trade and a sharp increase in unemployment rates. Compared to other crises, governments and central banks around the world acted swiftly and comprehensively. However, fiscal packages, guarantees and bailouts for banks and a decline in government revenue led to widespread increases in government deficits and debt – particularly in industrialized countries. The severity and scope of the problem is highlighted by skyrocketing bond yields and recurrent bailouts for both governments and financial institutions. As extensive fiscal adjustments and structural reforms are implemented, the necessity and the timing of austerity measures are controversially discussed.<sup>1</sup> The emergence of a sovereign debt crisis in Europe has also raised fears about the risk and the consequences of sovereign default. Up until the outbreak of the global financial crisis, a sovereign default in an industrialized country was commonly perceived as highly unlikely.<sup>2</sup> Although almost all of them have defaulted repeatedly in the past, advanced economies have experienced several banking crises since World War II – but no sovereign debt crisis (Reinhart and Rogoff, 2009). As several European countries are facing sovereign debt problems, the question of why and when countries default is asked again.

In this paper, we use a panel of 104 developing countries from 1980 to 2009 and probit estimates to analyze the effects of economic, fiscal and political factors on the probability of sovereign default. In particular, we are interested in the role of fiscal policy in the short run. Are austerity measures an effective way for a government to avoid a sovereign default? If so, does this still hold when economic growth is low and government debt is high? Our paper contributes to the growing empirical literature on the drivers of sovereign defaults by including the effects of fiscal adjustments and the role of the IMF through external emergency lending. To our knowledge, there is no empirical work that connects the consequences of a tight fiscal policy and the probability of default in the short run.

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<sup>1</sup> For a general discussion about the necessity and timing of austerity measures see for example a collection of essays edited by Corsetti (2012), the IMF (2012), Krugman (2012) or Jayadev and Konczal (2010).

<sup>2</sup> Four months after the Greece bailout and two months before Ireland requested help, Cottarelli et al. (2010) argued that a default in advanced countries was “unnecessary, undesirable and unlikely”. In their view, “the risk of debt restructuring is currently significantly overestimated”.

## 1.2 Review of the literature

The empirical literature about sovereign defaults has grown substantially over the last few years and has produced many important insights. Several articles have stressed that the costs of sovereign defaults may be substantial (Borensztein and Panizza, 2009; Sturzenegger, 2004). They include higher borrowing costs or even complete capital market exclusion, a decline in trade, political instability or a collapse of domestic financial institutions. For example, Rose (2005) finds that debt renegotiations are followed by an average decline in trade of approximately 8 percent per year and that trade can be affected by up to 15 years. Defaults are also highly correlated with output losses, but the causality is unclear (De Paoli et al., 2006; Panizza et al., 2009). Levy-Yeyati and Panizza (2011) argue that when using quarterly data, a default actually marks the beginning of the recovery. Default expectations thus appear to be the driver of economic decline.

Others argue that while economic costs can be substantial, they often tend to be short-lived (Borensztein and Panizza, 2009). Gelos et al. (2004) find that while exclusion from the capital markets after a sovereign default lasted around four years in the 1980's, access to credit has been regained much faster since, lasting only a few months in some cases. Among the main drivers of market access are global credit cycles rather than country specific circumstances around the episode of default. According to Panizza et al. (2009) the effect of a default on borrowing costs appears small and short-lived. Cruces and Trebesch (2011) find that post-crisis market access conditions depend on the outcome of restructurings. An increase in the haircut of 20 percentage points is associated with a 50 percent lower likelihood of being able to access international capital markets in any year after the restructuring. Borensztein and Panizza (2010) rely on industry-level data and find that defaults do not tend to affect trade for more than three or four years. Borensztein and Panizza (2009) also argue that the political costs of default are sometimes significant as political instability and political turnovers rise. An attempt to postpone a default could thus be either a result of self-interested government officials trying to stay in office or an effort to avoid even higher reputational costs if the default is perceived to be strategic.

Historically, sovereign debt and banking crises have often been closely linked as private debt is frequently transformed into government debt (Reinhart and Rogoff, 2011). Default episodes also tend to occur in clusters, often following a period of strong credit expansion (Panizza et al., 2009). Among other factors, international capital markets and changes in the activities of large creditors thus have an influence on defaults (Reinhart and Rogoff, 2008). More recent evidence shows that the amount of government debt does not provide precise

information about the probability of default (Moody's, 2010b). Several defaults registered in recent years have occurred at debt levels that are substantially lower than those of today's industrialized countries.<sup>3</sup> Many developing countries are "debt intolerant", meaning that they frequently experience financial distress at much lower debt levels. Reinhart et al. (2003) argue that a safe external debt to GNP threshold for these countries might be as low as 15 percent. Countries are particularly vulnerable if they have a history of serial defaults and high inflation rates. According to Reinhart and Rogoff (2010), developing countries face lower thresholds for external debt because debt is usually denominated in foreign currencies. Their analysis of 24 developing countries shows that if external debt reaches 60 percent of GDP, economic growth declines by about two percent. For higher levels of debt, growth is almost cut in half.

More recently, the empirical literature has paid increasing attention to political determinants of debt distress. The fact that some countries have defaulted at relatively low debt levels might simply occur because government officials are no longer willing to service their debt obligations because of changes in the domestic political economy (Sturzenegger and Zettelmeyer, 2007). For example, Van Rijckeghem and Weder (2009) use a wide array of political and macroeconomic variables to predict defaults on external and domestic debt obligations. According to them, political institutions matter, but their effect depends on the type of debt (domestic or external) and the type of regime. A parliamentary system or a system of checks and balances as indicated by the number of veto players both serve as a protective shield against default in democracies. However, the authors conclude that these factors alone are not sufficient if there are liquidity issues, foreign reserves are low or debt service costs are high. The better performance of parliamentary regimes is explained by the greater control of uncertainty and better commitment technology. Non-democratic regimes on the other hand are less likely to default on domestic debt if polarization is low, tenure is long and political stability is high. Kohlscheen (2007) finds that between 1976 and 2000 presidential democracies were almost five times more likely to default on external debt than parliamentary democracies. He thus argues that since constitutions are persistent over time, they can help to explain why some developing countries have experienced serial defaults. Manasse et al. (2003)

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<sup>3</sup> According to data from Abbas et al. (2010), government debt to nominal GDP was only 21 percent when Ecuador declared it would no longer service its debt in 2008. Other cases include the Dominican Republic (2005) at 32 percent, Venezuela (1998) at 37 percent or the Ukraine (2000) at 45 percent. In contrast, according to the IMF (2012), government debt in advanced economies is currently close to 110 percent of GDP with Japan's debt level projected to reach 236 percent of GDP in 2012. However, yields on ten year government bonds in Japan are less than 1 percent and rating agencies still assign investment grades. In contrast to most developing countries which often have a large share of external debt, more than 90 percent of government debt is held by domestic investors. This fact appears to be a result of a strong home bias and risk aversion (Tokuoka, 2010).

discover that the probability of a debt crisis is significantly higher in a given year if the country is carrying out presidential elections. Manasse and Roubini (2009) find that distance to election is associated with a higher likelihood of default if international credit conditions are tense. Empirical evidence for a strong relationship between political instability and the probability of default has also been provided in earlier works by Balkan (1992) and Brewer and Rivoli (1990). Finally, Saiegh (2009) finds that coalition governments less likely default on external debts than single-party governments due to a broader representation of those having a stake on debt repayment.

The paper is structured as follows. In section two, we briefly describe the episodes of sovereign defaults over the past 30 years. Descriptive statistics on key macroeconomic and financial data around episodes of defaults are also provided. Section three includes the empirical analysis where we explain our model and present the main results. Section four offers some concluding remarks.

## **2 Descriptive findings**

### **2.1 Episodes of sovereign defaults**

When Greece defaulted in March 2012, it not only marked the largest sovereign default in world history (€100 billion or \$130 billion at that time), it was also the first among industrialized countries since the end of World War II.<sup>4</sup> Among emerging and developing countries, however, sovereign defaults have been fairly common. According to data from Sturzenegger and Zettelmeyer (2007) as well as Moody's (2010a), 47 of the 104 developing countries for which we were able to collect sufficient data went through at least one episode where they failed to meet debt obligations. Ten countries have registered multiple defaults since 1980 (Table 1). However, sovereign defaults are unevenly distributed across countries and time (Figure 1). Most of them occurred in the early 1980's and mostly included Latin American and African countries. In the early 1990's, not a single sovereign default was recorded until the onset of the Asian and Russian crisis in 1997/98.

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<sup>4</sup> It can be debated whether Greece really constituted a sovereign default since private creditors agreed on a partial cancellation of claims through a bond exchange. However, the Economist called it "the biggest sovereign default in history" (Economist, 2012), Standard and Poor's lowered its rating for Greece to "selective default" while Moody's called the debt exchange a "distressed exchange" therefore a "debt default".

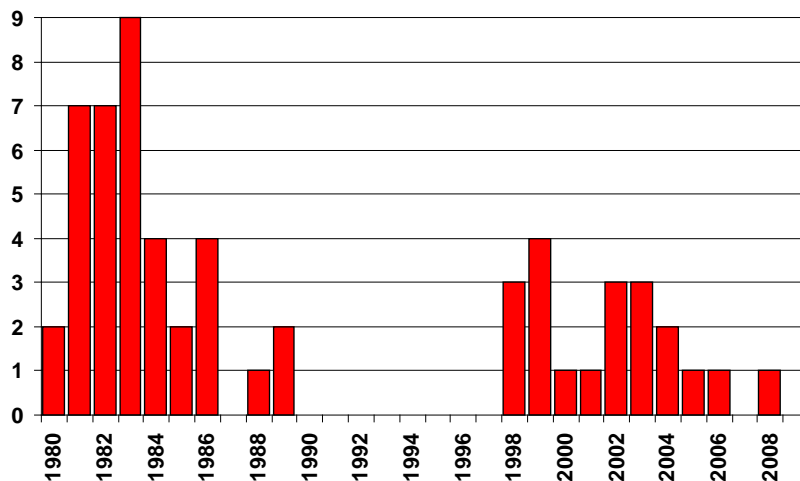
**Table 1: Sovereign defaults in developing countries (1980-2009)**

<b>Country</b>	<b># of defaults</b>	<b>Year</b>
Angola	1	1988
Argentina	2	1982, 2001
Belize*	1	2006
Bolivia	1	1980
Brazil	1	1983
Cameroon	1	1989
Chile	1	1983
Congo	1	1986
Costa Rica	1	1983
Côte d'Ivoire	2	1984, 2000
Dominica*	1	2003
Dominican Republic	2	1982, 2005
Ecuador	2	1982, 1999
Egypt	1	1984
Gabon	3	1986, 1999, 2002
Gambia	1	1986
Grenada*	1	2004
Honduras	1	1981
Indonesia	1	1999
Jordan	1	1989
Madagascar	1	1981
Malawi	1	1982
Mexico	1	1982
Moldova	1	2002
Morocco	1	1983
Mozambique	1	1984
Nicaragua	1	1980
Niger	1	1983
Nigeria	1	1983
Pakistan	2	1981, 1999
Panama	1	1982
Paraguay	2	1986, 2003
Peru	1	1983
Philippines	1	1983
Poland	1	1981
Romania	1	1981
Russia	1	1998
Senegal	1	1981
Seychelles*	2	2002, 2008
South Africa	1	1985
Tanzania	1	1984
Uganda	1	1981
Ukraine	2	1998, 2000
Uruguay	1	2003
Venezuela	2	1982, 1998
Vietnam	1	1985
Zambia	1	1983
<b>Total (47 countries)</b>	<b>58</b>	

\* These countries were not included in the empirical analysis because of missing data for control variables.

Sources: Sturzenegger & Zettelmeyer (2007), Moody's (2010a)



**Figure 1: Number of sovereign defaults (1980-2009)**

Sources: Sturzenegger & Zettelmeyer (2007), Moody's (2010a)

## 2.2 Economic and financial data around episodes of sovereign default

Descriptive statistics indicate that sovereign defaults are associated with substantial changes in economic and financial fundamentals (see Figures 4 through 9 in the Appendix). However, most of these alterations have occurred before or during the period a government announced a default. For example, using annual data, real GDP growth reaches its trough in the year the default occurs. Real GDP growth declines continually in the three years ahead of the default from 2.7 percent to 0.1 percent in the year of default. It then recovers quickly to 1.3 percent one year later and 3.2 and 4.3 percent, respectively, in the two years after that. This finding is in line with the results of Levy-Yeyati and Panizza (2011) who use quarterly data for their analysis. They discover that the trough of economic contraction coincides with the quarter the sovereign default was announced and that real GDP growth picks up thereafter. The authors conclude that a default is anticipated and that therefore a change in expectations leads to economic decline while the default itself marks the beginning of the recovery.

Looking at the current account, similar evidence is provided (Figure 5). The current account balance is highly negative three years ahead of a default at -4.1 percent and then deteriorates further to -5.5 percent two years later. It is slightly better in the year of default at -5.3 percent before improving further to -2.8 percent. For oil exporting countries, the trough of the decline coincides with the year of default. In non-oil exporting countries, the current account balance starts improving one year before the default is announced. The recovery for oil exporting countries occurs more rapidly and more intensively as the current account balance improves by 5 percentage points within two years.

The amount of international reserves declines rapidly before a sovereign default occurs (Figure 6). It then increases by almost 50 percent within three years and surpasses pre-crisis levels. Government deficits are highest one year before the default is announced at 4.9 percent. The budget balance then improves to -2.6 percent in the two years after the default. Oil exporting countries on average even record a budget surplus of 2.0 percent. Perhaps surprisingly, government expenditure and revenue both decline by around 1.5 percentage points of GDP in the three years ahead of a sovereign default. Government expenditure as a percentage of GDP continues to decrease after a default occurred, whereas government revenue exhibits a slight increase. Neither government expenditure nor revenue reach pre-crisis levels in the three years after the government failed to meet debt obligations.

Overall, it thus appears that while sovereign defaults might have substantial economic costs in some cases (i.e. Argentina in 2001), the effects are often short lived and tend to be most severe shortly before and during the year the default occurred. Investors, businesses and households seem to anticipate the government's decision to announce the default and the costs that are associated with it, thereby changing their expectations and triggering a self-fulfilling prophecy.

### **3 Empirical analysis**

#### **3.1 Baseline calculations**

In our analysis, we examine whether fiscal policy has a significant effect on the probability of default in the short run. Fiscal adjustments are usually motivated by the desire to avoid a sovereign default and the economic costs associated with it. The IMF makes this explicit, stating that borrowing from the IMF is conditional on the government agreeing to adjust the economy to overcome balance of payment problems. To remain solvent and to be able to finance public goods, transfers and civil servants, governments cut expenditure and/or raise taxes. In a best case scenario, the effects of credible austerity measures on the economy are limited or even positive because the decline in public demand is overcompensated by a rise in private demand. Such a scenario may be realized because budget consolidation reduces uncertainty for firms and households, thereby lowering bond yields as well as encouraging investment and consumption if individuals are more confident about the future.<sup>5</sup> On the other hand, if a government decides to implement austerity measures when debt and unemployment are high and

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<sup>5</sup> See Giavazzi and Pagano (1990) or Alesina and Ardagna (1998) for some of the early empirical work with evidence for expansionary fiscal adjustments or „non-Keynesian effects“.

growth is low, such a strategy might be self-defeating because it would put additional strains on the economy, leading firms and households to believe that “the worst is yet to come”. Under such a worst case scenario, austerity measures would increase the probability of default.

In order to assess the short run effect of fiscal policy on the probability of sovereign default, we obtained data for 104 developing countries from various sources to control for political, economic and financial differences. Our dependent variable, the probability of default, is a dummy taking the value 1 if a sovereign default occurred as defined by Sturzenegger and Zetelmeyer (2007) and Moody’s (2010a) and zero otherwise. A sovereign default thus refers to missed debt and interest payments, independent of the fact whether they were announced by the government or not. The complete list of countries is provided in Appendix C.

Because we are interested in the probability of sovereign default and its determinants and because our dependent variable is binary in nature, we use a probit model with clustered standard errors at the country level. As Van Rijckeghem and Weder (2009) point out, probit analysis has been the dominant method to examine the probability of default, although some authors rely on logit estimates or other methods.<sup>6</sup> In order to include all countries for which we were able to gather data, we did not include fixed effects because they are a perfect predictor of the absence of a default (see Kruger and Messmacher, 2004; Jorra, 2012). Countries without a default would thus be excluded from the sample. To check for the robustness of our results, we then also ran logit and OLS fixed effects as well as rare events logistic regressions.

We estimate the following equation for all 104 emerging and developing countries in our sample covering the period from 1980 to 2009 while using clustered standard errors for countries:

$$p_{i,t} = \alpha + \beta f_{i,t-1} + \gamma e_{i,t-1} + \delta g_{i,t-1} + \phi d_i + \varepsilon_{i,t} \quad (1)$$

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<sup>6</sup> We also ran calculations using simple logit analysis as well as OLS estimates with country and year fixed effects. Our previous results remained unchanged (see Table 12 in the Appendix). The results also remained robust when we performed rare events logistic regressions as proposed by King and Zeng (2001) and programmed by Tomz et al. (2003) for samples with binary dependent variables that include substantially fewer events than non-events such as wars, cases of political activism or epidemiological infections. Their method results in lower mean square errors and its effect is largest when the number of observations is small and the events are rare (under about 5 percent). See Table 13 in the Appendix for results of rare events logistic regressions. Our results remained unchanged when we included a time trend in our estimates.

In equation (1),  $p$  is the probability of default for country  $i$  in period  $t$ . The constant is defined as  $\alpha$  while  $f_{i,t-1}$  are lagged key fiscal indicators including the amount of international reserves, short term debt as a percentage of total debt and our variable of interest, the fiscal adjustment variable. Lagged explanatory variables are used to avoid simultaneity problems. We use different fiscal adjustment variables such as the change in the budget balance, changes in government revenue and government expenditure as a percentage of GDP and dummy variables indicating whether revenue and expenditure changed by a certain amount of GDP using different statistical thresholds. Ideally we would like to have cyclically adjusted measures of government revenue and expenditure and know about the government's intention for changes in fiscal policy by looking at historical documents as Guajardo et al. (2011) or Romer and Romer (2010) have done. However, cyclically adjusted measures of government revenue and expenditure are only available for some countries and periods. Similar to Gupta et al. (2005) or Adam and Bevan (2003) we thus rely on statistical thresholds and unadjusted measures of government finance. In addition,  $e_{i,t-1}$  are variables that reflect the economic situation in the previous year, i.e. real GDP growth, the inflation rate and a dummy indicating whether the country was affected by a national banking crisis. Finally,  $g_{i,t-1}$  measures the strength of political institutions and government as provided in the Polity IV Project by Marshall et al. (2011) While  $d_i$  is a dummy variable for Latin American countries to account for serial default and regional default clusters. The estimated coefficients are labelled  $\beta$ ,  $\gamma$ ,  $\delta$  and  $\phi$ . The error term is  $\varepsilon_{i,t}$  with satisfying standard white-noise assumptions of zero mean and constant variance. All variables, their description and sources are indicated in Appendix A. Descriptive statistics for all variables are summarized in Appendix B.

Table 2 summarizes the results for our baseline regressions. The results suggest that high rates of economic growth significantly lower the probability of sovereign default in the following year. Similarly, higher inflation rates as a proxy for currency crises reduce the likelihood of missing debt obligations in the first three specifications. Strong political institutions and a high amount of international reserves also have a statistically significant negative effect on the probability of default. A national banking crisis raises the probability of a sovereign default, but this effect is not statistically significant. Among the regional dummy variables taking account for the large heterogeneity in our sample, Latin American countries have had significantly more cases of sovereign default than any other group of countries including Africa. In the first three columns, we include the budget balance as our fiscal variable. A budget surplus

significantly reduces the probability of default in the following year in all three specifications. A fiscal adjustment on the other hand, as included in the last two columns, does not have a significant effect. In column (4), episodes of fiscal adjustments are defined by a dummy variable taking the value of one if the budget balance is improving in a given year and zero otherwise. In the last column, fiscal adjustments are limited to episodes where the budget balance improves by at least 1.5 percentage points of GDP within one year.

In a next step, we differentiate further among episodes of fiscal adjustments. The first column of Table 3 includes the size of the adjustment. Instead of simply using a dummy variable, we use the change in the budget balance expressed as a percentage of GDP. Again, the effect is negative, but insignificant. In the second column, we look at changes in government revenue and expenditure. While changes in government expenditure do not have a significant effect on the probability of default, an increase in government revenue reduces the risk that a sovereign default occurs in the following year. The last four columns use different composition measures of fiscal adjustments. The third column simply relies on dummy variables taking the value of one if government revenue as a percentage of GDP increases (revenue based adjustment) or if government expenditure decreases (expenditure based adjustment). In the other three columns, different statistical thresholds of revenue and expenditure based adjustments are included. Fiscal adjustments are defined to be revenue based if government revenue improves by at least 0.5, 1.0 and 1.5 percentage points of GDP, respectively. Accordingly, expenditure based adjustments are episodes where government expenditure declines by the same amount. The third column indicates that neither type of adjustment exhibits a significant effect on the probability of default. Once we rely on statistical thresholds, we find that both expenditure and revenue based fiscal adjustment lead to a lower probability of default. However, only increases in government revenue exhibit a statistically significant effect. According to marginal effects, revenue based adjustments reduce default risk by 36 to 43 percent. It does not appear that the results are driven by initial differences in the probability of default. Historical foreign currency ratings by Moody's (2010a) show that before and during episodes of fiscal adjustments, credit risks for countries with revenue based adjustments were almost identical to those who embarked on expenditure based adjustments.<sup>7</sup>

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<sup>7</sup> The average foreign currency rating was Ba3 for countries with revenue based adjustments and one grade higher (Ba2) for countries with expenditure based adjustments according to historical ratings from Moody's (2010). Ratings and differences were very similar in the three years before an adjustment took place.

**Table 2: Baseline calculations: Probability of sovereign default**

	(1) Baseline	(2) Baseline	(3) Baseline	(4) Baseline	(5) Baseline
Real GDP growth	-0.028** (-2.12)	-0.037*** (-2.81)	-0.041*** (-2.80)	-0.043*** (-2.78)	-0.044*** (-2.81)
Inflation rate	-0.002* (-1.88)	-0.002* (-1.74)	-0.003* (-1.65)	-0.001 (-1.47)	-0.001 (-1.35)
Political institutions		-0.031*** (-3.20)	-0.030*** (-2.75)	-0.029** (-2.39)	-0.030** (-2.49)
Banking crisis		0.220 (1.37)	0.186 (1.14)	0.152 (0.90)	0.173 (1.00)
Reserves			-0.063* (-1.87)	-0.054* (-1.79)	-0.056* (-1.80)
Short term debt			0.013** (2.35)	0.014*** (2.61)	0.014** (2.52)
Budget balance	-0.044*** (-2.97)	-0.037** (-2.49)	-0.027* (-1.71)		
Fiscal adjustment				-0.119 (-0.69)	-0.226 (-1.07)
Latin America	0.578*** (2.83)	0.680*** (3.13)	0.660*** (2.85)	0.696*** (3.23)	0.701*** (3.27)
No. of observations	2558	2297	2241	2142	2142
No. of countries	108	104	104	104	104
Pseudo R2	0.064	0.095	0.130	0.128	0.131
Log pseudolikelihood	-208.09	-175.11	-160.50	-141.27	-140.89
Wald chi2	32.29	40.63	54.34	56.58	58.07
Prob > chi2	0.000	0.000	0.000	0.000	0.000

*Note: dependent variable sovereign default dummy, clustered standard errors, t statistics in parentheses,*

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

**Table 3: Size and composition of fiscal adjustments**

	(1) Size	(2) Size	(3) Composition	(4) Composition	(5) Composition	(6) Composition
Real GDP growth	-0.043*** (-2.76)	-0.042*** (-2.75)	-0.042*** (-2.74)	-0.043*** (-2.87)	-0.044*** (-2.87)	-0.047*** (-3.06)
Inflation rate	-0.001 (-1.40)	-0.001 (-1.48)	-0.002 (-1.46)	-0.001 (-1.40)	-0.001 (-1.46)	-0.001 (-1.17)
Political institutions	-0.029** (-2.38)	-0.030** (-2.41)	-0.029** (-2.40)	-0.031** (-2.55)	-0.031** (-2.56)	-0.032** (-2.55)
Banking crisis	0.154 (0.89)	0.157 (0.90)	0.165 (0.97)	0.146 (0.84)	0.162 (0.92)	0.178 (1.02)
Reserves	-0.056* (-1.83)	-0.056* (-1.83)	-0.054* (-1.77)	-0.057* (-1.84)	-0.054* (-1.73)	-0.053* (-1.68)
Short term debt	0.014** (2.55)	0.014*** (2.63)	0.015*** (2.77)	0.015*** (2.74)	0.015*** (2.83)	0.015*** (2.72)
Latin America	0.692*** (3.22)	0.699*** (3.28)	0.722*** (3.40)	0.713*** (3.29)	0.696*** (3.26)	0.680*** (3.17)
Size of fiscal adjustment	-0.026 (-0.96)					
Δ Expenditure		0.022 (0.66)				
Δ Revenue		-0.032* (-1.88)				
Expenditure based			0.149 (0.82)	-0.205 (-1.26)	-0.061 (-0.36)	-0.339 (-1.54)
Revenue based			-0.132 (-0.84)	-0.459*** (-2.99)	-0.477*** (-2.82)	-0.677*** (-2.79)
No. of observations	2142	2142	2142	2142	2142	2142
No. of countries	104	104	104	104	104	104
Pseudo R2	0.131	0.132	0.133	0.147	0.144	0.154
Log pseudolikelihood	-140.82	-140.73	-140.51	-138.18	-138.80	-137.10
Wald chi2	56.71	61.65	61.74	72.65	63.34	64.30
Prob > chi2	0.000	0.000	0.000	0.000	0.000	0.000

*Note: dependent variable sovereign default dummy, clustered standard errors, t statistics in parentheses,*

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

These results are in stark contrast to the findings for OECD countries. There is a large body of empirical work confirming that expenditure based adjustments in advanced economies are more likely to be successful and to lead to lower debt levels than revenue based adjustments.<sup>8</sup>

However, several studies have pointed out that revenue increases may play an important role for budget consolidation in developing countries. For example, Baldacci et al. (2006) find that expenditure cuts are insufficient to maintain fiscal sustainability unless they are accompanied by revenue reforms. According to Adam and Bevan (2003), the probability of fiscal adjustment failure in developing countries falls by around 30 percent if domestic revenue rises by one percentage points of GDP.<sup>9</sup> For expenditure cuts of the same magnitude, the risk of failure falls by less than 10 percent. Gupta et al. (2005) analyzed a sample of 25 developing countries between 1980 and 2001 and also found that revenue increases are critical for the persistence of fiscal adjustments. Tsibouris et al. (2006) identify several cases of durable fiscal adjustments based on revenue enhancement, if the government revenue to GDP ratio was below 25 percent. In this case the success rate was 40 percent, compared to 9 percent for revenue based adjustments if the initial government revenue ratio was above 25 percent of GDP. But the authors also conclude that when countries are confronted with solvency and liquidity crises, expenditure based adjustments appear to be the dominant strategy.

When considering differences in tax levels and tax structures between advanced and developing countries, the results appear less puzzling. In our sample, emerging and developing countries have generated government revenue of about 23 percent of GDP during the 1980-2009 period. At the same time, government expenditure averaged around 26 percent (Table 4). In contrast, advanced economies averaged close to 40 percent of GDP in revenue and 42 percent in expenditure levels. Euro area countries have even bigger governments with spending levels of around 46 percent of GDP over time.<sup>10</sup> Baunsgaard and Keen (2010) show that low and middle income countries not only collect less government revenue than rich countries, but they rely to a much larger extent on trade taxes. While the significance of trade taxes has de-

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<sup>8</sup> See for example Alesina and Ardagna (1998, 2010), Alesina and Perotti (1995, 1997), Guichard et al. (2007), McDermott and Wescott (1996) or von Hagen et al. (2002).

<sup>9</sup> Adam and Bevan (2003) examine under what conditions episodes of fiscal adjustments are persistent. Failure thus means that plans to reduce the deficits were abandoned. Due to limited data availability, it is not possible to distinguish whether the increase in government revenue was brought forth by higher taxes rates or by an improved tax administration.

<sup>10</sup> Government spending in the Euro area has topped 50 percent on average during the Great Recession in 2009/10 while government revenue is projected to reach 46 percent this year – close to the highest levels seen between 1997 and 2000 (IMF, 2012).

clined over time due to trade liberalization, it still accounted for more than a quarter of total tax revenue among low income countries in 2000. On the other hand, trade taxes among industrialized countries have been negligible for the past few decades. In our sample, grants also frequently constituted a substantial part of total government revenue, in some cases reaching more than 40 percent of total revenue.

**Table 4: Government revenue and government expenditure as a percentage of GDP**

Unweighted averages	1980	1985	1990	1995	2000	2005	2009
<b>Government revenue</b>							
Sample	22.4	23.5	22.6	22.5	22.9	24.8	25.4
Advanced countries	38.3	39.6	39.7	39.6	40.3	39.8	38.9
Euro area	38.0	42.0	41.6	42.8	42.7	42.6	42.6
<b>Government expenditure</b>							
Sample	26.7	28.0	25.4	24.8	25.2	25.5	28.8
Advanced countries	40.8	42.8	41.6	43.1	40.0	39.9	44.1
Euro area	41.6	47.4	46.3	47.6	43.6	44.3	49.2

Sources: IMF International Financial Statistics, IMF World Economic Outlook Database, own calculations.

Besley and Persson (2011) note that rich countries have made continuous investments to improve fiscal capacity over time. They collect a much larger share of their income in taxes than do poorer countries and they rely particularly on income and consumption taxes. While income taxes had been established in most countries around the world by the early 20<sup>th</sup> century, the value added tax (VAT) has a much younger history. In the early 1960's, the VAT was still largely unknown and existed in only few countries. At the beginning of our sample in 1980, less than 30 countries worldwide had adopted the VAT. This number increased to around 50 countries in the early 1990's and further to around 140 countries at the end of the sample (Ebrill et al., 2001; IMF, 2011b). Furthermore, advanced economies generate much higher tax revenue than developing countries despite comparable statutory rates. Buehn and Schneider (2012) show that the size of the shadow economy in emerging and developing countries is about 37 percent of GDP between 1999 and 2007 and around 17 percent in OECD countries.<sup>11</sup> In most developing countries, informal employment accounts for more than 50 percent of the total labor force and is particularly common in Sub-Saharan Africa, South and East Asia and Latin America (OECD, 2009; Schneider and Enste, 2002).

<sup>11</sup> In some countries in our sample like Bolivia, Guatemala, Haiti, Nigeria, Panama, Peru, Tanzania, Thailand or Uruguay, it is even more than 50 percent of GDP (Buehn and Schneider, 2012).



Among the first, Kaldor (1963) argued that developing countries would have to collect taxes in the amount of 25 to 30 percent of GDP in order to finance basic public services such as education, health care and infrastructure, enable income redistribution and achieve economic progress. He and many others after him argued that political will is essential for a successful tax reform. Bird et al. (2004) argue that the sum of government revenue in a given country does not only depend on the ability of its tax administration to collect taxes, but also on taxpayers' perceptions about government spending and its effectiveness. Their findings indicate that societal institutions, measured by the prevalence of corruption, political stability or governance indicators as well as willingness to pay (i.e. tax morale or the size of the shadow economy), have a significant influence on government revenue.

These characteristics of tax systems and tax policies in emerging and developing countries imply that there may be strong constraints that keep governments from generating higher revenue. Given their low levels of government revenue, macroeconomic effects associated with a tax increase might be less detrimental than in industrialized countries and could therefore help to reduce the risk of sovereign default. Correspondingly, there is perhaps less room than in advanced economies to cut spending without causing high economic and social costs. Expenditure cuts in developing countries may therefore not significantly reduce the likelihood of default.

### 3.2 Probability of default in bad times

Sovereign defaults frequently occur in bad times (Tomz and Wright, 2007; Panizza et al., 2009). Strategic defaults are rare and have been excluded from our sample. In addition, fiscal policy is not simply a result of government ideology, but strongly influenced by economic and fiscal factors. In a next step, we therefore analyze whether our results change if we only include cases in which either the economic or the fiscal situation was particularly serious. That a tight fiscal policy reduces the probability of default might be seen as a trivial, but it is less straight forward if we only look at its effects in the short run (one year) and in economically difficult times. If growth is below trend or even negative, governments often rely on a countercyclical fiscal policy in order to dampen the effects of the downturn. If, on the other hand, the government for some reason decides to have a restrictive fiscal policy, this could lead to potentially spiraling effects and a severe recession, thereby leading to lower government revenue and an increased probability of default.

We use two different definitions for bad times. First, a period is defined as bad if economic growth is below its average long-term growth rate. We use the average growth rate between 1980 and 2009 as an indicator for potential economic growth. Second, as an alternative measure, bad times are periods in which total government debt as a percentage of GDP is above the country's long-term average. The results of these specifications are summarized in Table 5.

In the first two columns, a budget consolidation is defined by a dummy variable taking the value of one if the budget balance improved by at least 1.5 percentage points of GDP in comparison with the previous year. The results show that if economic growth is below trend or government debt above average, the effect of fiscal adjustments on the probability of default is negative, but insignificant as before. The middle two columns use statistical thresholds of 0.5 percent of GDP to define expenditure and revenue based adjustments, whereas the limit for the last two columns is 1.2 percent of GDP. As before, revenue based adjustments significantly reduce the risk of sovereign default in the following year. Real GDP growth and strong political institutions continue to be associated with a significantly lower probability of sovereign default. Computed marginal effects indicate that revenue based adjustments are even more important in bad times. Depending on the model specification, revenue based adjustments reduce the probability of default in the following year by 41 to 56 percent.

**Table 5: Bad times: High debt and low growth**

	(1) Low growth	(2) High debt	(3) Low growth	(4) High debt	(5) Low growth	(6) High debt
Real GDP growth	-0.045* (-1.96)	-0.035* (-1.92)	-0.044* (-1.96)	-0.034* (-1.95)	-0.046** (-1.98)	-0.036* (-1.96)
Inflation rate	-0.002 (-1.10)	-0.002 (-0.80)	-0.001 (-1.26)	-0.002 (-0.80)	-0.001 (-1.18)	-0.003 (-0.86)
Political institutions	-0.035** (-2.00)	-0.029* (-1.91)	-0.035** (-2.02)	-0.030* (-1.95)	-0.036** (-2.00)	-0.028* (-1.84)
Banking crisis	0.165 (0.75)	0.032 (0.14)	0.119 (0.57)	0.012 (0.05)	0.147 (0.68)	0.039 (0.15)
Reserves	-0.034 (-1.01)	-0.084* (-1.91)	-0.037 (-1.11)	-0.085* (-1.88)	-0.033 (-0.97)	-0.081* (-1.79)
Short term debt	0.019** (2.53)	0.003 (0.42)	0.020*** (2.74)	0.004 (0.55)	0.021*** (2.98)	0.004 (0.53)
Latin America	0.683** (2.45)	0.630** (2.27)	0.677** (2.37)	0.619** (2.20)	0.661** (2.34)	0.633** (2.27)
Fiscal adjustment	-0.362 (-1.20)	-0.263 (-0.97)				
Expenditure based			-0.293 (-1.25)	-0.042 (-0.22)	-0.247 (-0.90)	0.191 (0.92)
Revenue based			-0.368** (-1.99)	-0.525* (-1.84)	-0.410** (-2.06)	-0.670** (-2.08)
No. of observations	844	982	844	982	844	982
No. of countries	85	97	85	97	85	97
Pseudo R2	0.145	0.117	0.152	0.137	0.149	0.145
Log pseudolikelihood	-90.26	-79.29	-89.46	-77.51	-89.80	-76.80
Wald chi2	32.18	34.62	33.09	33.09	31.23	43.83
Prob > chi2	0.000	0.000	0.001	0.000	0.001	0.000

*Note: dependent variable sovereign default dummy, clustered standard errors, t statistics in parentheses,*

*\* p < 0.10, \*\* p < 0.05, \*\*\* p < 0.01*

### 3.3 The role of the IMF

So far, we have treated all countries and adjustments the same way. While we differentiated between good and bad times, we have ignored whether the countries in our sample had received any help from international institutions like the IMF. Since the outbreak of the global financial crisis in 2007, the need for IMF funding has increased considerably, but the IMF has already played a significant role in many Latin American and African countries in the 1980's by implementing structural adjustment programs. The conditions and effectiveness of these structural adjustment programs have been intensively discussed and examined.<sup>12</sup> Among others, Reinhart and Rogoff (2009) point out that economic crises have become more frequent since the establishment of the IMF. Qian et al. (2010) show numerous cases where an IMF program was introduced that resulted in subsequent default within the next two years. Examples include some of the most recent defaults in Argentina, the Dominican Republic, Indonesia and Uruguay. Jorra (2012) finds that IMF programs significantly increase the probability of sovereign defaults by 1.5 to 2 percentage points. According to Rogoff (2010), the austerity charges against the IMF are not justified, because IMF loans usually relieve austerity and allow countries to engage in a less procyclical fiscal policy. He argues that the problem with IMF programs is not their focus on excessive austerity, but rather the IMF's generosity towards creditors. This is a result of overestimating the costs of a negotiated default and underestimating the moral hazard problems that are likely to occur in the long term because of recurrent bailouts. In an extensive survey of the literature on the IMF and its programs, Dreher (2009) examines over 180 sources and concludes that IMF conditionality is ineffective. He argues that if IMF conditions are not implemented, one cannot expect an influence (positive or negative) of IMF conditionality on the economy. This confirms earlier findings by Bulir and Moon (2004) who did not find any statistically significant effect of IMF supported programs on fiscal performance. In programs with structural conditionality, expenditure declined significantly, but they also found that programs with too many conditions are associated with worse economic results than those with only few conditions (the question of ownership) and often suffer from a high risk of reversal.<sup>13</sup>

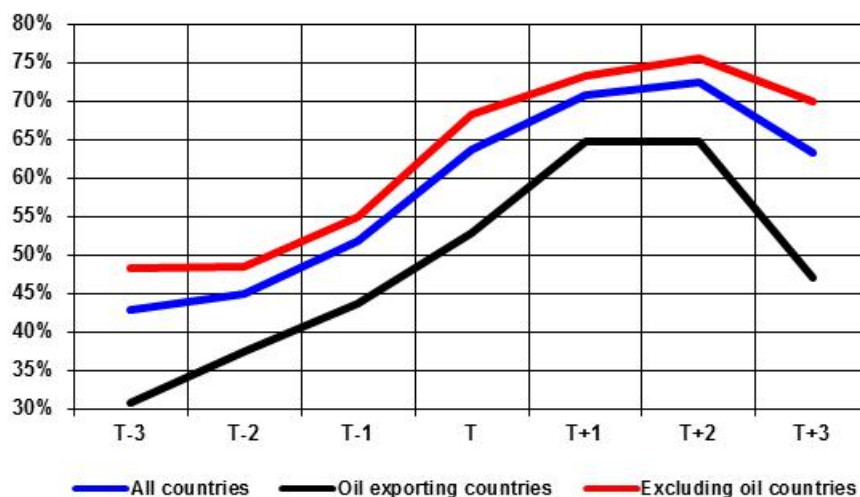
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<sup>12</sup> See for example Stiglitz (2002) for one of the most prominent critics of the IMF.

<sup>13</sup> A different question is whether conditions are not implemented because they are associated with costs that are too heavy to bear. Bird (2001) argues that the weak compliance record suggests that IMF conditionality is excessive. In this case, a program tied to many conditions that are only partially implemented might have less severe macroeconomic consequences than a program with few conditions that are fully implemented. But many authors have pointed out that borrowing countries are faced by a moral hazard problem. In addition as Ramcharan (2003) argues, the IMF has its own incentives to approve loans particularly when debt is high because postponing the default might be associated with lower costs for the IMF.

On average between 1980 and 2009, the IMF approved 23 new arrangements with member countries each year. Of these, about 60 percent were stand-by arrangements (IMF, 2010). Figure 2 shows the importance of the IMF for all countries included in our sample. Overall, in almost two out of three cases of sovereign defaults, the country affected was under an agreement with the IMF. This share is lower for oil-exporting countries (53 percent) in comparison with all other countries (68 percent). Perhaps surprisingly, the share of countries under an IMF agreement continues to increase after a sovereign default occurred. Almost three out of four countries have received help from the IMF in the two years following default. Covering all countries and episodes in our sample, the probability that a developing country is under an IMF agreement in a given year is almost 45 percent. Oil-exporting countries tend to be less likely to reach an agreement with the IMF and draw the requested money.

**Figure 2: Share of countries under an IMF agreement**



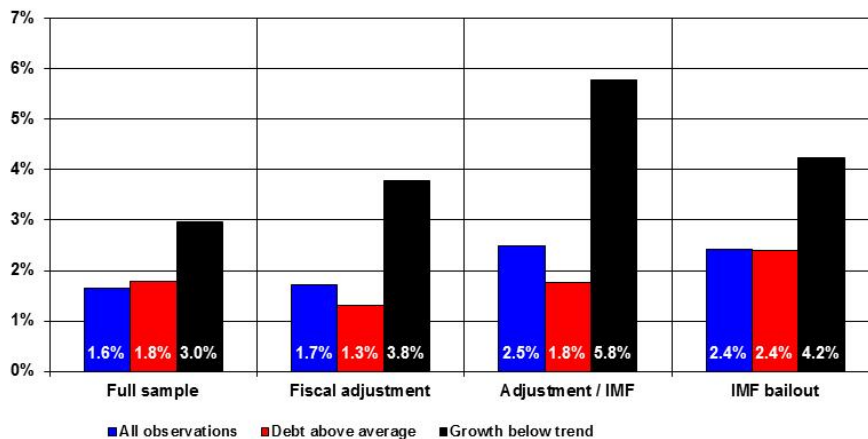
The high correlation between IMF agreements and episodes of sovereign defaults is not surprising given the fact that one of the fund's key purposes is to provide member countries with temporary assistance during a balance of payments crisis.<sup>14</sup> The causality between IMF support and sovereign default is thus unclear. On one hand, the IMF will only step in if a member country is in serious financial distress and therefore more likely to default to start with. On the other hand, it could be the case that the conditions tied to financial support from the IMF are too severe and might have negative consequences for economic growth. In this case, the costs

<sup>14</sup> Article I of the IMF's Articles of Agreements lists the Fund's purposes. The fifth paragraph states that one of those purposes is „to give confidence to members by making the general resources of the Fund temporarily available to them under adequate safeguards, thus providing them with opportunity to correct maladjustments in their balance of payments without resorting to measures destructive of national or international prosperity“ (IMF, 2011a).

associated with additional credit would be too high and a default might seem like a viable option for the government.

Differentiating further among fiscal policy reactions and circumstances reveals interesting results (Figure 3). Overall, the probability of default for the entire period 1980-2009 is 1.6 percent. It is higher when government debt is above its long-term average (1.8 percent) and when real GDP growth is below trend (3.1 percent). The probability of default is similar when the government implemented a fiscal adjustment program and did not receive any help from the IMF (1.7 percent). This still holds when debt is above average and growth is below trend.<sup>15</sup> On the other hand, under an IMF agreement, the probability of default is higher independent of the fact whether a fiscal adjustment took place or not (2.5 percent and 2.4 percent). When economic growth is below trend, the probability of default is significantly higher under all circumstances.

**Figure 3: Probability of default**



To check whether IMF support affects our previous results, we use a dummy variable with a value of 1, if the country observed was under any kind of IMF agreement and drawing money in a given period and zero otherwise. Similarly, adjustments that took place without any IMF support are also defined by a dummy variable. The results are summarized in Table 6. In the first column, the size of the adjustment as measured by the improvement in the budget balance is used as our fiscal adjustment variable. While large adjustments tend to reduce the probability of default, the effect is insignificant independent of the question whether the coun-

<sup>15</sup> A fiscal adjustment was here defined as an improvement of the budget balance of at least 1 percentage point of GDP. Different definitions yielded largely comparable results. Setting the threshold at 1.5 percent, the corresponding probabilities of default are 1.9 percent for all episodes, 1.6 percent if debt is above average and 3.8 percent if growth is below trend (instead of 1.7 percent, 1.3 percent and 3 percent, respectively).

try received support from the IMF. In the second column, the size of fiscal adjustments is further broken down into revenue and expenditure components. A reduction in government expenditure lowers the risk of default with and without IMF lending, but the coefficients are not statistically significant. In the last four columns, we use different statistical thresholds of revenue and expenditure based fiscal adjustments of 0.5, 1.0, 1.2 and 1.5 percentage points of GDP. In all four models, revenue based adjustments are associated with a significantly lower probability of default. In two cases, this finding also applies for episodes where countries received IMF support. Expenditure based adjustments were found to be significant in only one specification, namely when countries did not receive any IMF support. Computed marginal effects indicate that revenue based adjustments without IMF lending reduce the probability of sovereign default in the following year by 33 to 42 percent, depending on the exact specification.

Keen and Lockwood (2010) provide a possible explanation for this finding. According to their estimates, participation in an IMF program significantly increases the probability of adopting a VAT in the following year. They argue that the IMF has played a dominant role in the rapid spread of the VAT across the globe over the past few decades. The introduction of the VAT has also led to an average increase in the government revenue to GDP ratio of about 4.5 percentage points.

As in section 3.2, we also split the sample to see if it affects our results. Table 9 in the Appendix summarizes the results for all periods in which countries received IMF support. In line with our baseline regressions as well as in bad times, fiscal adjustments generally do not reduce the probability of default in the following year, but revenue increases do. Similarly, economic growth, strong political institutions and the share of short term debt constitute other important determinants of sovereign default.

**Table 6: Role of the IMF**

	(1) IMF support	(2) IMF support	(3) IMF support	(4) IMF support	(5) IMF support	(6) IMF support
Real GDP growth	-0.043*** (-2.79)	-0.042*** (-2.76)	-0.038*** (-2.60)	-0.040*** (-2.79)	-0.042*** (-2.82)	-0.045*** (-3.01)
Inflation rate	-0.001 (-1.44)	-0.001 (-1.51)	-0.002 (-1.21)	-0.001 (-1.23)	-0.001 (-1.29)	-0.001 (-1.12)
Political institutions	-0.029** (-2.36)	-0.030** (-2.41)	-0.031** (-2.54)	-0.032*** (-2.61)	-0.032*** (-2.62)	-0.032** (-2.56)
Banking crisis	0.159 (0.94)	0.161 (0.95)	0.123 (0.71)	0.122 (0.69)	0.149 (0.84)	0.167 (0.96)
Reserves	-0.056* (-1.84)	-0.056* (-1.86)	-0.046 (-1.48)	-0.053* (-1.68)	-0.051 (-1.68)	-0.052* (-1.65)
Short term debt	0.014** (2.54)	0.014*** (2.63)	0.020*** (3.20)	0.018*** (2.98)	0.017*** (3.02)	0.017*** (3.04)
Latin America	0.694*** (3.22)	0.702*** (3.30)	0.737*** (3.40)	0.720*** (3.34)	0.702*** (3.33)	0.682*** (3.16)
Adjustment / IMF lending	-0.029 (-0.92)					
Adjustment / no lending	-0.017 (-0.47)					
$\Delta$ Exp. / IMF lending		0.023 (0.50)				
$\Delta$ Rev. / IMF lending		-0.037** (-2.19)				
$\Delta$ Exp. / no IMF lending		0.015 (0.41)				
$\Delta$ Rev. / no IMF lending		-0.021 (-0.57)				
Exp. based / IMF lending			0.280 (1.38)	-0.049 (-0.24)	0.093 (0.44)	-0.143 (-0.59)
Rev. based / IMF lending			-0.032 (-0.16)	-0.373 (-1.59)	-0.466* (-1.93)	-0.668* (-1.83)
Exp. based / no lending			-0.118 (-0.52)	-0.461* (-1.88)	-0.284 (-1.16)	-0.700 (-1.64)
Rev. based / no lending			-0.371* (-1.76)	-0.586** (-2.51)	-0.505* (-1.79)	-0.717** (-2.22)
No. of observations	2142	2142	2142	2142	2142	2142
Pseudo R2	0.131	0.132	0.152	0.156	0.149	0.160
Log pseudolikelihood	-140.78	-140.68	-137.44	-136.79	-137.94	-136.14
Wald chi2	59.85	81.40	84.29	77.64	78.48	69.05
Prob > chi2	0.000	0.000	0.000	0.000	0.000	0.000

Note: dependent variable sovereign default dummy, clustered standard errors, *t* statistics in parentheses,

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

### 3.4 Definition of sovereign default and sample heterogeneity

In this section, we conduct a series of robustness checks to test the validity of our results. First, we include all defaults reported by Sturzenegger and Zettelmeyer (2007) and Moody's (2010a). So far, we have excluded cases where a sovereign default occurred because the government was no longer willing to meet its obligations.<sup>16</sup> For example, according to Moody's (2010a), Ecuador failed to meet its debt obligations in 2008 after it declared its global bonds

<sup>16</sup> Others argue that a sovereign default is always a case of „willingness to pay“ rather than „ability or capacity to pay“. These authors argue that unlike private households or companies, a government is always able to draw additional resources from the economy through its power to tax. While this argument has some merit (with the constraints in mind mentioned in section 3.1), it is irrelevant for our purpose as we defined a sovereign default as a failure of the government to meet its obligations as previously agreed, independent of the fact whether it could have met them.

as “illegal” and “illegitimate”. The rating agency states that the default was entirely based on ideological and political grounds. Indeed, at that time, total government debt was only 21 percent of GDP and declining rapidly. Economic growth was robust and the country had a current account surplus. Other cases include Côte d’Ivoire (2000) when General Guéï proclaimed himself as the new leader and temporarily suspended external debt payments and Peru (2000), where the government initially missed four interest payments. However, the payments were then delivered within the 30-day grace period. Using this extended definition of sovereign defaults does not change our previous results. Fiscal adjustments do not significantly affect the probability of default unless they are revenue based (see Table 10 in the Appendix for details).

In addition, since our sample consists of over 100 very heterogeneous countries (i.e. large differences in per capita income, political systems, size of population), we extend the analysis by differentiating further between low income and middle income countries as well as small and large governments (see Table 7). In both low income and middle income countries, revenue based adjustments significantly reduce default risk in the following year. Expenditure based adjustments appear to be more harmful in low income countries. The corresponding coefficient is positive, but insignificant. The last two columns split the sample between countries with small and countries with big governments as measured by the total government revenue to GDP ratio. As suggested by Kaldor (1963) and others, a critical threshold of government revenue appears to be around 25 percent of GDP. The fifth column thus includes countries and periods where government revenue was below 25 percent of GDP, whereas the last column includes all observations when government revenue was above this threshold. In both cases, revenue based adjustments are associated with a lower likelihood of default, but the effect is larger in countries with small governments.

We also tested whether excluding small economies and countries with a small population altered our results (see Table 11 in the Appendix). These countries might be particularly vulnerable to any sudden political and economic changes abroad – which in return could have an influence on our results. As with the definition of fiscal adjustments, using thresholds to exclude small countries and economies is largely arbitrary. We therefore use different criteria of exclusion. In the first two columns, we exclude high income and upper middle income countries as well as nations with a total population of less than 1 million. In columns three and



four, countries with real GDP below \$2 billion are omitted.<sup>17</sup> The reduced sample is then again tested for revenue and expenditure based adjustments of 0.5 and 1.0 percentage points of GDP, respectively. In the fifth column, all 20 oil-exporting countries in our sample are excluded. Since oil exports in these countries account for a large share of GDP as well as government revenue, this potentially distorts our results. Revenue based adjustments might simply be a result of rising oil prices and the subsequent windfall gains. Finally, in the last column, all previous criteria are applied simultaneously. Rich countries, small economies and oil-exporting nations are thus excluded. In all cases, our previous results were confirmed.

**Table 7: Reduced sample specifications**

	(1) Low income	(2) Low income	(3) Middle income	(4) Middle income	(5) Low revenue	(6) High revenue
Real GDP growth	-0.054*** (-2.72)	-0.046** (-2.55)	-0.046* (-1.71)	-0.063* (-1.91)	-0.038** (-2.23)	-0.081*** (-2.71)
Inflation rate	-0.007 (-1.55)	-0.006* (-1.69)	-0.001 (-1.57)	-0.000 (-1.15)	-0.000 (-1.31)	-0.006 (-1.16)
Political institutions	-0.025 (-1.25)	-0.035* (-1.77)	-0.049*** (-3.06)	-0.049** (-2.55)	-0.007 (-0.40)	-0.046** (-2.11)
Banking crisis	0.096 (0.34)	0.207 (0.87)	0.146 (0.53)	0.013 (0.15)	0.245 (1.10)	0.166 (0.48)
Reserves	-0.094* (-1.77)	-0.064 (-1.49)	-0.034 (-0.97)	-0.035 (-0.78)	-0.014 (-0.49)	-0.218** (-2.58)
Short term debt	0.036*** (4.77)	0.018** (2.38)	0.016* (1.95)	0.027** (2.34)	0.022*** (3.22)	0.012 (1.09)
Latin America	0.729 (1.61)	0.661* (1.78)	0.992** (2.52)	5.393*** (7.00)	0.394* (1.88)	1.026*** (3.43)
Exp. based adjustment	0.227 (0.81)	0.284 (1.30)	-0.373 (-1.33)	-0.832* (-1.90)	0.170 (0.97)	-0.419 (-1.02)
Rev. based adjustment	-0.786* (-1.83)	-0.628* (-1.76)	-0.341* (-1.84)	-0.429** (-2.14)	-0.701** (-2.03)	-0.495** (-2.12)
No. of observations	1029	1298	905	661	1340	802
Pseudo R2	0.227	0.167	0.157	0.225	0.126	0.298
Log pseudolikelihood	-53.89	-71.88	-74.44	-55.50	-87.20	-43.78
Wald chi2	54.55	46.33	64.51	299.18	43.97	34.64
Prob > chi2	0.000	0.000	0.000	0.000	0.000	0.000

*Note: dependent variable sovereign default dummy, clustered standard errors, t statistics in parentheses,  
\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$*

### 3.5 Role of the credit and banking system

To further test the robustness of our results, we substitute our banking crisis dummy variable with more detailed information about the credit market. As Roubini and Setser (2004) argue, in developing countries the domestic banking system is often a major creditor of the sovereign. We use three different variables that measure access to credit or the situation of the credit market more accurately. “Change in credit” is defined as the alteration of total private credit by money banks expressed as a percentage of GDP in comparison with the previous year (Beck and Demirgüç-Kunt, 2009). Highly positive values can thus be interpreted as a credit

<sup>17</sup> Higher thresholds of 2 or 3 million people or GDP of \$3 billion or \$4 billion yielded identical results.

boom, while negative values can be seen as a credit crunch. In case of a credit boom, access to loans is easy, but could increase the risk of a credit or real estate bubble, thereby triggering a banking crisis and elevating the likelihood that the government will inherit debt from the private sector. According to the results in Table 8, an increase of total private credit in the previous year shows a positive correlation with the probability of sovereign default. However, the causality and the channels through which private sector lending affects fiscal policy are unclear. According to Reinhart and Rogoff (2011), banking crises and sovereign debt crises are historically highly interconnected. The time before a banking crisis emerges is typically associated with a rapid expansion in credit, but governments often add fuel to this boom by following a loose fiscal policy and allowing ever larger deficits. If a banking crisis erupts, government revenue is directly and indirectly affected and there has been a tendency that debt from the private sector is converted into government debt.

When we simply look at the development of private bank assets or the ratio of private sector credit to total deposits, the effect on the probability of default is still positive, but insignificant. We also tested other credit system measures provided by Beck and Demirgüç-Kunt (2009). They include changes in deposits as a share of GDP as a proxy for bank runs as well as changes in central banks assets as a percentage of GDP to account for unconventional monetary policy such as quantitative easing or using reserves for government purposes. Neither of them turned out to be significant. Results from Table 8 indicate that credit booms rather than a credit crunch increase the probability of sovereign default. Financial sector deleveraging on the other hand reduces the risk of default although not in a significant way. All our previous determinants of sovereign default are still significant. Most importantly, revenue based adjustments are still significant while expenditure based episodes of budget consolidation are not.

**Table 8: Banking crisis**

	(1) Credit crunch	(2) Credit crunch	(3) Deleveraging	(4) Deleveraging	(5) Credit deposit ratio	(6) Credit deposit ratio
Real GDP growth	-0.035* (-1.79)	-0.036* (-1.82)	-0.035* (-1.74)	-0.035* (-1.75)	-0.045*** (-2.90)	-0.045*** (-2.89)
Inflation rate	-0.000 (-1.07)	-0.000 (-0.76)	-0.000 (-1.04)	-0.000 (-0.69)	-0.002 (-0.96)	-0.002 (-1.06)
Political institutions	-0.034*** (-2.65)	-0.034*** (-2.63)	-0.034*** (-2.63)	-0.033*** (-2.60)	-0.031** (-2.47)	-0.030** (-2.47)
Reserves	-0.048 (-1.50)	-0.043 (-1.37)	-0.047 (-1.49)	-0.043 (-1.37)	-0.056* (-1.75)	-0.052* (-1.65)
Short term debt	0.016*** (2.67)	0.016*** (2.67)	0.016*** (2.71)	0.017*** (2.71)	0.015*** (2.75)	0.016*** (2.87)
Latin America	0.659*** (2.93)	0.653*** (2.94)	0.657*** (2.93)	0.652*** (2.94)	0.652*** (3.01)	0.645*** (3.03)
$\Delta$ Credit / GDP	2.218 (1.38)	2.618 (1.59)				
$\Delta$ Bank assets / GDP			1.590 (0.92)	2.098 (1.19)		
$\Delta$ Credit deposit ratio					0.102 (0.49)	0.110 (0.53)
Exp. based adjustment	-0.241 (-1.39)	-0.028 (-0.16)	-0.239 (-1.39)	-0.021 (-0.12)	-0.237 (-1.45)	-0.019 (-0.11)
Rev. based adjustment	-0.482*** (-2.61)	-0.446** (-2.46)	-0.478** (-2.56)	-0.444** (-2.45)	-0.494*** (-2.93)	-0.422** (-2.52)
No. of observations	1823	1823	1828	1828	2077	2077
Pseudo R2	0.145	0.136	0.143	0.135	0.141	0.131
Log pseudolikelihood	-112.93	-114.09	-113.21	-114.32	-131.09	-132.69
Wald chi2	72.24	68.06	70.91	66.05	66.63	62.64
Prob > chi2	0.000	0.000	0.000	0.000	0.000	0.000

Note: dependent variable sovereign default dummy, clustered standard errors, *t* statistics in parentheses,

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

## 4 Conclusions

In this paper, we estimate the effects of fiscal adjustments on the probability of default in the short run by using a panel of 104 developing countries from 1980 to 2009 and analyzing over 50 cases of sovereign default. Controlling for economic, fiscal and political factors, we find that fiscal adjustments do not significantly reduce the probability of sovereign default in the following year even if they are large. Instead of size, the composition of adjustments are decisive in reducing default risk. Along with real GDP growth, the amount of international reserves, the share of short-term debt and the strength of political institutions, fiscal adjustments are among the main determinants of default in the short run. We find that revenue based adjustments may lower the probability of default in the following year by as much as 33 to 56 percent, depending on model specification and the statistical threshold used to define episodes of budget consolidation. This finding also holds in bad times, that is, when economic growth is below trend or debt is above average. Similar results are obtained when IMF support is taken into account and when excluding small or poor countries as well as oil-exporting countries. These findings are in contrast to a large strand of the empirical literature about fiscal adjust-

ments in industrialized countries which suggests that expenditure based adjustments are more likely to be successful, more likely to lead to lower debt levels and less likely to be harmful for growth. This difference may be due to significantly lower levels of government revenue and expenditure in developing countries. Low and middle income countries appear to be more limited in both raising additional revenue and cutting expenditure, but more research and better data may be necessary to delve deeper into the causes of these differences. Furthermore, due to limited data availability, we were unable to differentiate whether revenue based adjustments were realized by raising taxes, by improving tax administration and compliance or by revenue reforms that were associated with a broadening of the tax base.

The inflation rate as a proxy for a currency crisis and the existence of a banking crisis do not appear to have any statistically significant effect on the likelihood of a default. Concerning the former, the effect of high inflation rates on debt levels and default is much larger in the long run as Reinhart and Sbrancia (2011) and others have shown. The fact that banking crises do not have an effect may be because their influence works through other channels such as economic growth and government finance which are already controlled for.

As a sovereign default is often anticipated and its costs thus frequently accumulate before a default is announced, delaying fiscal adjustments or postponing a default appear to have limited benefits. This finding might be of particular relevance for industrialized countries who have built up much higher debt levels. In these countries, a haircut would entail substantial losses for banks and pension funds, thereby potentially aggravating the crisis. On the other hand, it is unclear whether we are observing too many or too few sovereign defaults from society's point of view because austerity measures may entail substantial social costs such as strong increases in unemployment, social unrest and political instability, higher poverty rates or a rise in income inequality. Whether austerity or default is the lesser evil thus remains ambiguous and depends on country specific circumstances.

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<b>Appendix A: Data and Sources</b>		
Variable	Description	Sources
Sovereign default	Indicates whether the country failed to live up to the original terms of the contract (default = 1, otherwise = 0)	Sturzenegger and Zettelmeyer (2007), Moody's (2010a)
Real GDP Growth	Annual growth in real gross domestic product in percent	IMF World Economic Outlook
Reserves	International reserves including gold expressed in number of months of imports	UNCTAD
Inflation rate	Annual inflation rate in percent	IMF World Economic Outlook
Banking crisis	Indicator whether there was a national banking crisis in a given year (banking crisis = 1, otherwise = 0)	Reinhart and Rogoff (2009)
Political institutions	Combined polity score, scale from -10 (strongly autocratic) to +10 (strongly democratic) measuring the strength of institutions and the extent of civil liberties	Marshall et al. (2011)
Short-term debt	Short-term debt (one year or less) as a percentage of total external debt	World Bank Global Development Finance (2010)
Fiscal adjustment	Improvement of government budget balance by at least one or 1.5 percentage points of GDP (adjustment = 1, otherwise = 0)	IMF World Economic Outlook, IMF Financial Statistics Yearbook
Expenditure based adjustment	Reduction of total government expenditure by at least 0.5 / 1 / 1.2 / 1.5 percentage points of GDP (adjustment = 1, otherwise = 0)	IMF World Economic Outlook, IMF Financial Statistics Yearbook
Revenue based adjustment	Improvement of total government revenue by at least 0.5 / 1 / 1.2 / 1.5 percentage points of GDP (adjustment = 1, otherwise = 0)	IMF World Economic Outlook, IMF Financial Statistics Yearbook
Change in credit	Change in private credit by deposit money banks and other financial institutions in percent of GDP	Beck and Demirgüç-Kunt (2009)
Change in bank assets	Change in claims on domestic real non-financial sector by deposit money banks as a share of GDP	Beck and Demirgüç-Kunt (2009)
Credit deposit ratio	Private credit by deposit money banks as a share of saving deposits in deposit money banks	Beck and Demirgüç-Kunt (2009)

<b>Appendix B: Descriptive Statistics (104 countries)</b>					
Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Sovereign default	3224	0.016	0.127	0.000	1.000
Real GDP growth	3040	3.588	5.385	-41.890	34.500
Reserves	2795	5.054	4.794	0.000	48.044
Inflation rate	2989	59.430	461.032	-31.248	13109.5
Banking crisis	3016	0.120	0.325	0.000	1.000
Political institutions	2777	0.588	6.750	-10.000	10.000
Short-term debt	2895	12.347	12.039	0.000	88.930
Government deficit	2561	-2.688	4.843	-25.400	40.339
Fiscal adjustment	2440	0.334	0.472	0.000	1.000
Exp. based adjustment	2440	0.321	0.467	0.000	1.000
Rev. based adjustment	2440	0.306	0.461	0.000	1.000
Latin America	3224	0.173	0.378	0.000	1.000
Change in credit	2246	0.008	0.041	-0.293	0.351
Change in bank assets	2247	0.007	0.044	-0.306	0.349
Change credit deposit ratio	2614	-0.003	0.226	-2.271	3.628

## Appendix C: Country groups: Full sample

(108 countries)

Albania	Gabon	Nicaragua
Algeria	Gambia	Niger
Angola	Georgia	Nigeria
Argentina	Ghana	Pakistan
Armenia	Grenada*	Panama
Azerbaijan	Guatemala	Papua New Guinea
Bangladesh	Guinea	Paraguay
Belarus	Guinea-Bissau	Peru
Belize*	Guyana	Philippines
Benin	Haiti	Poland
Bhutan	Honduras	Romania
Bolivia	India	Russia
Botswana	Indonesia	Rwanda
Brazil	Iran	Senegal
Bulgaria	Jamaica	Seychelles*
Burkina Faso	Jordan	Sierra Leone
Burundi	Kazakhstan	Solomon Islands
Cambodia	Kenya	South Africa
Cameroon	Kyrgyz Republic	Sri Lanka
Central African Republic	Laos	Sudan
Chad	Latvia	Swaziland
Chile	Lesotho	Syria
China	Lithuania	Tajikistan
Colombia	Macedonia	Tanzania
Comoros	Madagascar	Thailand
Republic of Congo	Malawi	Togo
Costa Rica	Malaysia	Tunisia
Côte d'Ivoire	Mali	Turkey
Djibouti	Mauritania	Turkmenistan
Dominica*	Mauritius	Uganda
Dominican Republic	Mexico	Ukraine
Ecuador	Moldova	Uruguay
Egypt	Mongolia	Venezuela
El Salvador	Morocco	Vietnam
Ethiopia	Mozambique	Yemen
Fiji	Nepal	Zambia

## Appendix D: Country groups: Oil-exporting countries

(20 countries)

Algeria	Chad	Iran	Sudan
Angola	Republic of Congo	Kazakhstan	Syria
Azerbaijan	Ecuador	Mexico	Venezuela
Bolivia	Gabon	Nigeria	Vietnam
Cameroon	Indonesia	Russia	Yemen

## Appendix E: Correlations

Correlation coefficients (104 countries, 1980-2009)

	Sovereign default	Real GDP growth	Reserves	Inflation rate	Banking crisis	Political institutions	Short-term debt	Fiscal adjustment	Deficit	Exp. based adj.	Rev. based adj.
Sovereign default	1.00										
Real GDP growth	-0.09*	1.00									
Reserves	-0.07*	0.11*	1.00								
Inflation rate	-0.01	-0.15*	-0.03	1.00							
Banking crisis	0.07*	-0.12*	-0.02	0.12*	1.00						
Polit. institutions	-0.03	0.00	0.10*	0.03	0.01	1.00					
Short-term debt	0.03	0.03	-0.02	0.02	0.04	0.08*	1.00				
Fiscal adjustment	0.01	0.08*	-0.02	0.02	0.01	-0.05	-0.02	1.00			
Deficit	-0.03	0.21*	0.25*	-0.06	-0.10*	0.03	-0.12*	-0.04	1.000		
Exp. adjustment	0.03	0.02	-0.04	0.05	-0.00	-0.13*	-0.04	0.43*	0.02	1.00	
Rev. adjustment	-0.01	0.05	0.05	0.03	0.01	-0.04	-0.01	0.27*	0.18*	-0.22*	1.00

\*  $p < 0.05$

## Appendix F: Additional estimates

**Table 9: Role of the IMF: Split sample**

	(1) IMF support	(2) IMF support	(3) IMF support	(4) IMF support	(5) IMF support
Real GDP growth	-0.070*** (-3.60)	-0.068*** (-3.45)	-0.066*** (-3.53)	-0.068*** (-3.58)	-0.069*** (-3.55)
Inflation rate	-0.003 (-1.05)	-0.003 (-0.96)	-0.002 (-0.89)	-0.003 (-0.91)	-0.003 (-0.91)
Political institutions	-0.033** (-2.11)	-0.034** (-2.09)	-0.035** (-2.12)	-0.036** (-2.19)	-0.035** (-2.14)
Banking crisis	-0.409 (-1.58)	-0.397 (-1.56)	-0.432 (-1.64)	-0.409 (-1.53)	-0.396 (-1.48)
Reserves	-0.064 (-1.40)	-0.068 (-1.49)	-0.069 (-1.50)	-0.067 (-1.45)	-0.066 (-1.44)
Short term debt	0.023*** (2.65)	0.022** (2.47)	0.022** (2.44)	0.022** (2.46)	0.022** (2.53)
Latin America	0.194 (0.78)	0.210 (0.85)	0.215 (0.85)	0.190 (0.76)	0.223 (0.89)
Fiscal adjustment	0.094 (0.42)	-0.248 (-0.90)			
Expenditure based			-0.229 (-1.09)	-0.126 (-0.55)	-0.038 (-0.16)
Revenue based			-0.352* (-1.79)	-0.590** (-2.55)	-0.790** (-2.44)
No. of observations	1020	1020	1020	1020	1020
No. of countries	90	90	90	90	90
Pseudo R2	0.146	0.150	0.158	0.168	0.177
Log pseudolikelihood	-84.05	-83.68	-82.87	-81.89	-81.05
Wald chi2	39.05	36.44	49.30	60.09	50.76
Prob > chi2	0.000	0.000	0.000	0.000	0.000

*Note: dependent variable sovereign default dummy, clustered standard errors, t statistics in parentheses,*

*\* p < 0.10, \*\* p < 0.05, \*\*\* p < 0.01*

**Table 10: Extended definition of sovereign defaults**

	(1) All defaults	(2) All defaults	(3) All defaults	(4) All defaults	(5) All defaults
Real GDP growth	-0.042*** (-2.74)	-0.042*** (-2.75)	-0.041*** (-2.79)	-0.042*** (-2.79)	-0.042*** (-2.79)
Inflation rate	-0.002 (-1.51)	-0.002 (-1.41)	-0.002 (-1.46)	-0.002 (-1.50)	-0.002 (-1.46)
Political institutions	-0.031*** (-2.76)	-0.032*** (-2.86)	-0.033*** (-2.89)	-0.033*** (-2.83)	-0.032*** (-2.78)
Banking crisis	0.187 (1.41)	0.195 (1.46)	0.164 (1.24)	0.178 (1.34)	0.184 (1.40)
Reserves	-0.050* (-1.78)	-0.051* (-1.78)	-0.053* (-1.85)	-0.051* (-1.76)	-0.050* (-1.73)
Short term debt	0.013** (2.41)	0.012** (2.29)	0.013** (2.40)	0.013** (2.46)	0.013** (2.47)
Latin America	0.812*** (3.60)	0.814*** (3.60)	0.823*** (3.62)	0.812*** (3.62)	0.820*** (3.60)
Fiscal adjustment	-0.010 (-0.05)	-0.261 (-1.22)			
Expenditure based			-0.236 (-1.50)	-0.077 (-0.46)	-0.072 (-0.39)
Revenue based			-0.379*** (-2.96)	-0.320** (-1.98)	-0.341* (-1.88)
No. of observations	2142	2142	2142	2142	2142
No. of countries	104	104	104	104	104
Pseudo R2	0.131	0.136	0.147	0.139	0.139
Log pseudolikelihood	-151.80	-150.87	-148.99	-150.30	-150.26
Wald chi2	54.87	55.35	95.13	75.97	86.39
Prob > chi2	0.000	0.000	0.000	0.000	0.000

*Note: dependent variable sovereign default dummy, clustered standard errors, t statistics in parentheses,*

*\* p < 0.10, \*\* p < 0.05, \*\*\* p < 0.01*

**Table 11: Reduced sample specifications**

	(1) Small coun- tries	(2) Small coun- tries	(3) Low GDP	(4) Low GDP	(5) Oil countries	(6) All restrictions
Real GDP growth	-0.040** (-2.46)	-0.041** (-2.47)	-0.051** (-2.30)	-0.053** (-2.31)	-0.042** (-2.40)	-0.056** (-2.21)
Inflation rate	-0.001 (-1.43)	-0.001 (-1.50)	-0.001 (-1.15)	-0.001 (-1.18)	-0.001 (-1.48)	-0.001 (-1.01)
Political institutions	-0.026* (-1.94)	-0.027** (-2.03)	-0.032** (-2.30)	-0.033** (-2.35)	-0.030* (-1.85)	-0.036** (-2.06)
Banking crisis	0.076 (0.39)	0.097 (0.49)	0.050 (0.24)	0.077 (0.35)	-0.168 (-0.74)	-0.214 (-0.90)
Reserves	-0.074* (-1.95)	-0.071* (-1.88)	-0.072* (-1.84)	-0.068* (-1.73)	-0.102* (-1.81)	-0.099* (-1.70)
Short term debt	0.012** (2.03)	0.012** (2.10)	0.010 (1.46)	0.010 (1.53)	0.017** (2.22)	0.014 (1.61)
Latin America	0.679*** (3.03)	0.667*** (3.03)	0.677*** (2.97)	0.661*** (2.94)	0.615** (2.54)	0.553** (2.22)
Exp. based adjustment	-0.171 (-1.04)	-0.021 (-0.12)	-0.256 (-1.42)	-0.112 (-0.60)	0.037 (0.22)	-0.055 (-0.28)
Rev. based adjustment	-0.480** (-2.48)	-0.541*** (-2.60)	-0.475** (-2.45)	-0.533** (-2.54)	-0.438** (-2.08)	-0.414* (-1.92)
No. of observations	1757	1757	1524	1524	1587	1218
Pseudo R2	0.141	0.140	0.151	0.149	0.177	0.181
Log pseudolikelihood	-123.48	-123.53	-111.72	-112.06	-88.33	-76.80
Wald chi2	52.23	47.50	59.59	48.64	59.90	60.15
Prob > chi2	0.000	0.000	0.000	0.000	0.000	0.000

Note: dependent variable sovereign default dummy, clustered standard errors, *t* statistics in parentheses, \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

**Table 12: Comparison of Probit, Logit and OLS with fixed effects estimates**

	(1a) Probit	(1b) Logit	(1c) OLS	(2a) Probit	(2b) Logit	(2c) OLS
Real GDP growth	-0.043*** (-2.87)	-0.087*** (-2.81)	-0.002* (-1.71)	-0.044*** (-2.87)	-0.089*** (-2.78)	-0.002* (-1.72)
Inflation rate	-0.001 (-1.40)	-0.002 (-1.31)	-0.000** (-2.05)	-0.001 (-1.46)	-0.002 (-1.29)	-0.000** (-2.02)
Political institutions	-0.031** (-2.55)	-0.070** (-2.39)	-0.002* (-1.98)	-0.031** (-2.56)	-0.070** (-2.34)	-0.001* (-1.96)
Banking crisis	0.146 (0.84)	0.375 (0.92)	0.012 (1.08)	0.162 (0.92)	0.395 (0.96)	0.012 (1.11)
Reserves	-0.057* (-1.84)	-0.125 (-1.54)	-0.002** (-2.12)	-0.054* (-1.73)	-0.118 (-1.45)	-0.002** (-2.12)
Short term debt	0.015*** (2.74)	0.037*** (2.74)	0.001** (2.00)	0.015*** (2.83)	0.037*** (2.78)	0.001** (2.00)
Latin America	0.713*** (3.29)	1.685*** (3.06)		0.696*** (3.26)	1.628*** (2.97)	
Expenditure based	-0.205 (-1.26)	-0.575 (-1.39)	-0.004 (-0.55)	-0.061 (-0.36)	-0.263 (-0.61)	-0.004 (-0.50)
Revenue based	-0.459*** (-2.99)	-1.090*** (-2.71)	-0.013*** (-2.98)	-0.477*** (-2.82)	-1.144** (-2.50)	-0.015*** (-3.35)
No. of observations	2142	2142	2142	2142	2142	2142
No. of countries	104	104	104	104	104	104
Pseudo R2	0.147	0.144		0.144	0.138	
Log pseudolikelihood	-138.18	-138.81		-138.80	-139.64	
Wald chi2	72.65	75.94		63.34	66.22	
Prob > chi2	0.000	0.000		0.000	0.000	

Notes:

dependent variable sovereign default dummy, clustered standard errors, *t* statistics in parentheses, statistical thresholds for fiscal adjustments: 1 percent of GDP in columns (1a) through (1c), 1.2 percent of GDP in columns (2a) through (2c), country and year fixed effects included in columns (1c) and (2c), \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

**Table 13: Comparison of Probit, Logit and rare events logistic regressions**

	(1a) Probit	(1b) Logit	(1c) Relogit	(2a) Probit	(2b) Logit	(2c) Relogit
Real GDP growth	-0.043*** (-2.87)	-0.087*** (-2.81)	-0.087*** (-2.80)	-0.044*** (-2.87)	-0.089*** (-2.78)	-0.089*** (-2.84)
Inflation rate	-0.001 (-1.40)	-0.002 (-1.31)	0.001 (0.70)	-0.001 (-1.46)	-0.002 (-1.29)	0.002 (0.85)
Political institutions	-0.031** (-2.55)	-0.070** (-2.39)	-0.069** (-2.06)	-0.031** (-2.56)	-0.070** (-2.34)	-0.069** (-2.03)
Banking crisis	0.146 (0.84)	0.375 (0.92)	0.399 (0.94)	0.162 (0.92)	0.395 (0.96)	0.414 (0.97)
Reserves	-0.057* (-1.84)	-0.125 (-1.54)	-0.101 (-1.24)	-0.054* (-1.73)	-0.118 (-1.45)	-0.099 (-1.23)
Short term debt	0.015*** (2.74)	0.037*** (2.74)	0.037*** (2.67)	0.015*** (2.83)	0.037*** (2.78)	0.037*** (2.61)
Latin America	0.713*** (3.29)	1.685*** (3.06)	1.466** (2.25)	0.696*** (3.26)	1.628*** (2.97)	1.460** (2.25)
Expenditure based	-0.205 (-1.26)	-0.575 (-1.39)	-0.253 (-0.60)	-0.061 (-0.36)	-0.263 (-0.61)	-0.268 (-0.61)
Revenue based	-0.459*** (-2.99)	-1.090*** (-2.71)	-1.045* (-1.96)	-0.477*** (-2.82)	-1.144** (-2.50)	-1.160* (-1.95)
No. of observations	2142	2142	2142	2142	2142	2142
No. of countries	104	104	104	104	104	104

Notes:

dependent variable sovereign default dummy, clustered standard errors, *t* statistics in parentheses, statistical thresholds for fiscal adjustments: 1 percent of GDP in columns (1a) through (1c), 1.2 percent of GDP in columns (2a) through (2c), rare events logistic regression based on King and Zeng (2001) and programmed by Tomz et al. (2003) in columns (1c) and (2c), \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$



## Appendix G: Event study

Figure 4: Real GDP Growth in percent before, during and after episodes of sovereign defaults<sup>18</sup>

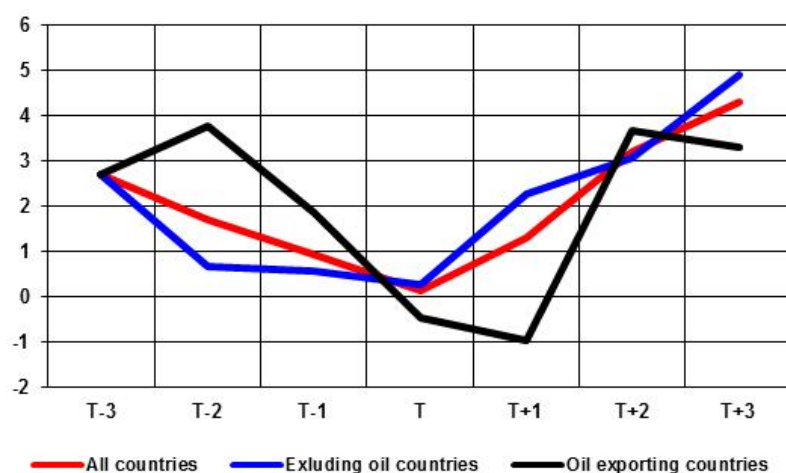


Figure 5: Current Account (% of GDP) before, during and after episodes of sovereign defaults

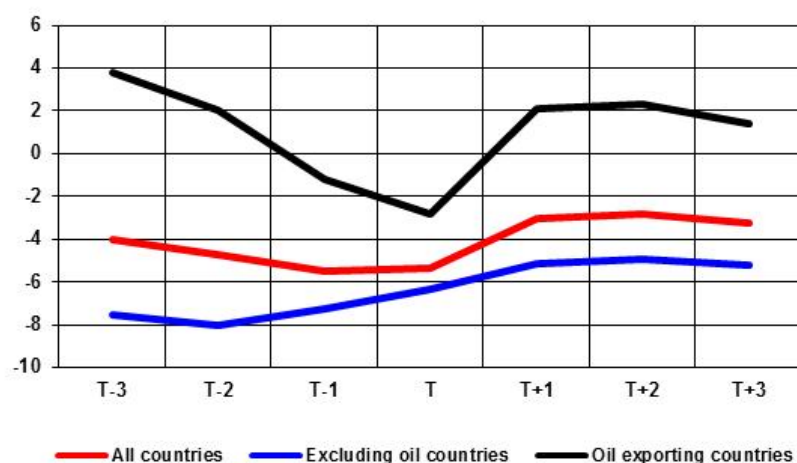
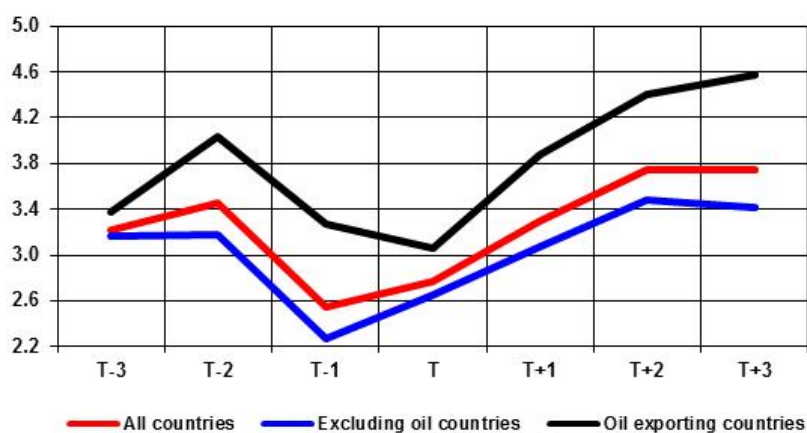


Figure 6: International reserves (in months of imports) and episodes of sovereign defaults



<sup>18</sup> In all figures the year of default is marked as T, whereas the three years ahead of default are T-3, T-2 and T-1. Correspondingly, the three years after a sovereign default occurred are T+1, T+2 and T+3.

Figure 7: Government budget balance (% of GDP) before, during and after episodes of sovereign defaults

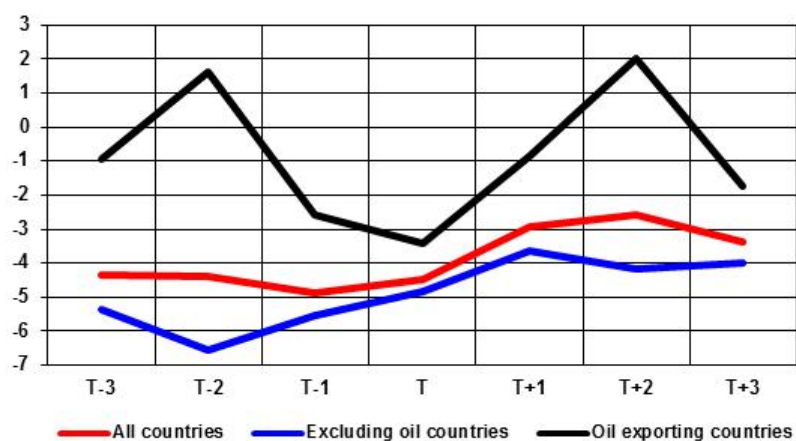


Figure 8: Government expenditure (% of GDP) before, during and after episodes of sovereign defaults

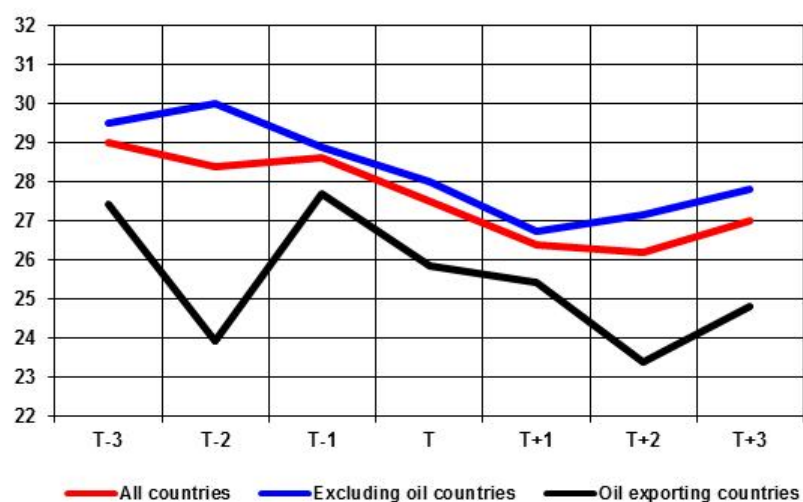


Figure 9: Government revenue (% of GDP) before, during and after episodes of sovereign defaults

