Fiscal Adjustment and the Costs of Public Debt Service: Evidence from OECD Countries

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Abstract

We use a panel of 21 OECD countries from 1970 to 2009 to investigate the effects of different fiscal adjustment strategies on long-term interest rates – a key fiscal indicator reflecting the costs of government debt service. A government confronted with high deficits and rising debt will sooner or later need to enact fiscal adjustments in order to avoid solvency problems. Over the last four decades, such measures taken by governments in OECD countries have varied in duration, size, composition and in their success to re-establish fiscal sustainability. Controlling for various economic, fiscal and political factors, we find that the size and the composition of a fiscal adjustment significantly affect interest rates as well as yield spreads. Adjustments that are relatively large and those that primarily depend on expenditure cuts lead to substantially lower long-term interest rates. However, periods of fiscal adjustments do not generally have an influence on interest rates, even if they were successful and led to lower deficits and debt levels. Instead, financial markets only seem to value strict and decisive measures – a clear sign that the government's pledge to cut the deficit is credible.

JEL-Code: E62, H00, H60.

Keywords: fiscal adjustment, consolidation policy, government debt, deficit, interest rates.

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1. Introduction

In 2008/09, fiscal policy of many countries was concerned with stabilizing the plunging economy. While the exact composition of the fiscal stimulus was controversially discussed, there was a widespread agreement that together with central bank interventions a distinct fiscal policy impulse was required this time (Spilimbergo, Symansky, Blanchard and Cottarelli, 2008; Elmendorf and Furman, 2008; OECD, 2009a). However, extended fiscal packages have pushed up public debt to an unprecedented level in post World War II history of close to 100% for 2010 on the OECD average (OECD, 2009b). In addition, even before the crisis fiscal sustainability was not fulfilled in many OECD countries (Afonso and Rault, 2007). The drastic increase of government indebtedness thereby met numerous countries unprepared. Therefore, the question of adequate "exit-strategies" probably represents one of the most important questions in public finance to be resolved in the coming years.

In order to meet the requirements of long-term fiscal sustainability, sooner or later many governments have to implement more or less austere fiscal consolidation policies. Substantial research efforts have been attempted to the macroeconomic effects of these fiscal adjustments as well as to identifying those determinants that favor long-lasting and sustainable consolidations.[1] In a pioneering work, Giavazzi and Pagano (1990) study two major fiscal contractions in Denmark (1983-1986) and in Ireland (1987-1989) that were associated with surprising immediate non-Keynesian expansionary economic effects. The explanation brought up by the two authors (Giavazzi and Pagano, 1996) as well as by Bertola and Drazen (1993) is that the wealth effect on consumption by a credibly announced long-lasting spending cut offsets the Keynesian recessive impact of reduced public spending (the expectation view). Note that according to that argument, the size of the fiscal contraction is decisive for causing expansionary effects as it signals a credible policy change whereas only small adjustments fail to persuade consumers anticipating their consumption to a higher level of income. In fact, Sutherland (1997), Zaghini (2001), von Hagen et al. (2002) and Ardagna (2004) provide evidence that sizeable adjustment policies are changing expectations on future tax liabilities and con-

[1] In the literature on the political economy of reform, some authors argue that the severity of the crisis is an important aspect in successfully implementing reform policies (Krueger, 1993 or Williamson, 1994). However, as Rodrik (1996) states, the argument that crisis cause reform is not free of tautology. Reform is only a political issue when actual policies are perceived not to be working. Thus, the emphasis on crisis may not be a good explanation as to what form of adjustment will be taken.

sequently boost aggregate demand immediately, especially in periods of fiscal stress, where a consolidation of the unsustainable path of fiscal policy is to be expected sooner or later.[2]

In an extension to the literature, Alesina and Perotti (1997), Alesina and Ardagna (1998) and Guichard et al. (2007) provide a non-mutually exclusive explanation for a successful fiscal stabilization through the effects on the labor market and the cost side of the firms (the labor market view or composition view). They show that expansionary fiscal consolidations are more likely if they are relying primarily on spending cuts. Even in the case where the adjustments are of the same size in terms of reducing the primary budget deficit, cutting back spending induces a more promising consolidation than tax increases. In addition, they argue that the composition of spending cuts matters. Especially successful deficit-to-GDP and debt-to-GDP reductions are associated with cuts on government transfers, welfare spending and government wages. However, if the budget consolidation relays on reductions of public investments, the adjustments tend to be unsuccessful.

Ardagna (2004) evaluated the relative importance of the two explanations. She provides evidence that the composition of the stabilization policy matters for economic growth mainly through a labor market induced effect by moderate wage agreements. The size of the fiscal contraction is key when it comes to fighting rising debts. Ardagna's empirical findings indicate that when governments engage in sizeable fiscal adjustments, the probability of success in the sense of a long-lasting debt reduction almost doubles.

While much research effort has been devoted to the question of which policy measure is particularly apt to support a successful fiscal consolidation and to the macroeconomic consequences of fiscal adjustments, the effect of fiscal adjustments on the costs of public debts service is much less elaborated. Do fiscal adjustments have an effect on the cost of public debt service?

Empirical evidence for the more general question of the impact of fiscal imbalances on long-term interest rates is mixed so far. Theoretically, government deficits as well as government debt could have an impact on treasury yields depending on the underlying model. Amongst others, important factors include the structure of debt-holders, the induced crowding-out of private capital and the underlying reason of deficits as cyclical or structural (Laubach, 2003). Since it is not easy to isolate these effects empirically, estimates vary widely in size as well as

[2] Perotti (1999) provides empirical evidence that deficit cuts are more likely to be expansionary in times where public debts are high.

in their sign (Perotti, 2005; Ardagna, Caselli, Lane, 2004; Chinn and Frankel, 2005; Thomas and Wu, 2009). However, the impact of large, discretionary fiscal policy changes has rarely been investigated. Ardagna (2009) evaluates the reaction of financial markets around episodes of larges fiscal contractions as well as expansions, concluding that the costs of public debt service are sensitive to distinct changes in fiscal discipline. Our paper bases on Ardagna (2009) and evaluates the impact of fiscal adjustments on changes of the cost of public debt service. Additionally, we analyze the effect of success, the size and the composition of fiscal adjustments on long-term interest rates. Our results suggest that real interest rates and yield spreads of long-term government bonds significantly honor large and expenditure-based fiscal adjustments as compared to small and revenue-based adjustments that have rarely an impact – independent of the fact whether the consolidation process proved to be long-lasting or not.

The paper proceeds as follows. Section 2 provides information on the empirical method and on the data set we use for our empirical analysis. In section 3 we first focus on the interpretation of descriptive findings around the episodes of fiscal adjustments followed by section 4 with the empirical analysis. Section 5 is devoted to some robustness checks whereas section 6 offers some concluding remarks.

2. Data and methodological issues

2.1. Data

In order to empirically evaluate the effect of different fiscal consolidation strategies on the cost of public debt service, we use annual data on 21 OECD countries covering a maximum time span from 1970 to 2009. The countries in the sample are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Portugal, Spain, Sweden, Switzerland, United Kingdom and the United States. Data for all other OECD member countries were either missing altogether or incomplete and could thus not be included in the analysis. All fiscal and macroeconomic data are from the OECD Economic Outlook No. 86 database (OECD, 2009b). Data on political control variables are from various sources. A description of all variables and sources is provided in Appendix A.

2.2. Methodological issues

When analyzing strategies and implementations of fiscal adjustments, ideally one would like to know the exact date the new policy was announced and could then examine the reaction of

financial markets as well as the entire economy. Furthermore, it would be useful to have information about the maturity of all bonds outstanding, a track record of past debt service and details about the structure of government debt (share of domestic and foreign bond holders, share of debt in local and foreign currency).[3] Such information is hard to gather for a panel of more than 20 countries and a time span of 40 years. Over the last few years, fiscal variables have become available on a quarterly or even monthly basis. However, such data only cover a short time period. Moreover, quarterly or monthly fiscal data might not be very meaningful. For example, while some taxes as the VAT are collected throughout the year, revenue from the income tax is often generated once a year and is therefore concentrated over a few months.[4] Expenditures on the other hand are more balanced throughout the year. This leads to fiscal contractions and fiscal expansions which do not reflect any policy changes, but are merely a statistical artifact. We thus use annual data to determine the point in time when a fiscal adjustment took place. In line with the existing literature, we also look at the three years that preceded the adjustment and the three years that followed.

2.3. Definitions of fiscal adjustments

Our method to identify episodes of budget consolidation is almost identical with the definitions used by Alesina and Perotti (1997), von Hagen, Hughes Hallett and Strauch (2001), Mierau, Jong-A-Pin and de Haan (2007), Ardagna (2004) and others. Episodes are selected on the basis of large changes of the cyclically adjusted primary deficit (CAPB) as calculated by the OECD, expressed as a percentage of GDP. Using the CAPB measure has the advantage that business cycle fluctuations such as changes in inflation and real interest rates are factored in. Since this measure also excludes interest payments, this definition largely reflects changes in discretionary fiscal policy. However, the CAPB has been criticized because it can be distorted by asset prices, extraordinary expenditure or windfall gains.[5] In the October edition of its World Economic Outlook, the IMF (2010) argued that using a statistical concept to define episodes of fiscal consolidation is a highly imperfect measure of actual policy actions. The IMF argues that the CAPB concept suffers from measurement errors that are likely to be cor-

[3] For example, Haugh, Ollivaud and Turner (2009) examine the determinants of sovereign risk premiums including factors such as the history of fiscal deficits, the share of interest payments of total government receipts, projected fiscal balance and yield spread between corporate and government bonds. Using semi-annual data, their analysis covers only four years, however.

[4] See for example monthly data under the IMF's Special Data Dissemination Standard (SDDS). Taking Switzerland (2009) as an example, it is evident that more than half of total tax revenue collected was generated between March (when tax returns are filled out) and June (when taxes are due). The last four months of the year on the other hand generated only 20% of total tax revenue.

[5] See for example Girouard and Price (2004), Koen and van den Noord (2005) or the OECD (2007).

related with economic developments, thereby downplaying contractionary effects and overstating expansionary effects of fiscal adjustment. The IMF uses an action based approach by relying on various reports by the OECD, the IMF and national sources to examine what countries actually did. However, this approach does not solve the problem of endogeneity as the reasons, intentions and discussions that led to changes in fiscal policy are not evaluated. Potential implementation lags or ripple effects are also neglected. We thus use the standard methodology in the literature by defining thresholds.[6]

Consequently, our definition reads as follows: First, a period of fiscal adjustment is a time span in which the cyclically adjusted primary balance (the primary balance) improves by at least 1.5 per cent of GDP in each year or by at least 1.2 per cent of GDP in two consecutive years. Second, a period of fiscal adjustment is successful if gross financial liabilities as a percentage of GDP are reduced by at least 5 percentage points in the three years following the adjustment.

While the two definitions used are almost identical with the existing literature, they are nonetheless relatively strict and thus do not include small adjustments that are undertaken over a prolonged period. Since it is the aim of our analysis to look only at substantial changes in fiscal policy, we also need to look at alternative measures to ensure that our results do not depend on the particular definition used. This is done in section 4.2.

3. Descriptive findings

Table 1 summarizes all episodes of fiscal adjustments over the past four decades using the definition of the cyclically adjusted primary balance. With the exception of France and Germany, all 21 countries experienced at least one year of budget consolidation as determined by an improvement in the cyclically adjusted primary balance. Countries like Greece, Portugal, Italy and Sweden even experienced eight or more years of fiscal adjustments. Overall, 62 fiscal adjustments took place between 1970 and 2009, covering 91 periods.

As table 2 shows, only 19 of those adjustments – a share of 31 percent – were successful. Expressed in the number of years affected, 37 of 91 periods covered were part of a successful budget consolidation, a share of 41 percent. When using the same definition for fiscal adjust-

[6] Further arguments in favor of the standard methodology can be found on Alberto Alesina's homepage: http://www.economics.harvard.edu/faculty/alesina/Alesina.

ments, but based upon the primary balance instead of the cyclically adjusted primary balance, all countries in the sample went through a period of budget consolidation at least once.

Figures 1 through 3 describe the periods of fiscal adjustments in more detail. The consolidation periods are spread unevenly over the course of time. They are particularly concentrated in the middle of the 1980's when average gross debt was rising rapidly and then again in the middle and later part of the 1990's when average debt reached new heights and many European countries were forced to consolidate in the context of the Stability and Growth Pact.[7]

Table 1: Episodes of fiscal adjustments (as defined by the cyclically adjusted primary balance)

Country	Adjustments	Periods	Successful	Year(s)
Australia	1	2	2	1986-87
Austria	3	4	0	1984, 1996-97, 2001
Belgium	5	5	2	1977, 1982, 1984, 1987, 1993
Canada	3	6	3	1981, 1986-87, 1995-97
Denmark	2	6	6	1983-86, 2004-05
Finland	6	6	1	1981, 1984, 1988, 1994, 1998, 2000
France	0	0	0	-
Germany	0	0	0	-
Greece	4	8	5	1986-87, 1991-94, 1996, 2005
Ireland	2	5	3	1983-84, 1986-1988
Italy	6	8	0	1976-77, 1982-83, 1991, 1993, 1995, 2006
Japan	1	1	0	1984
Luxembourg	2	3	0	1993-94, 1997
Netherlands	4	4	2	1972, 1983, 1991, 1993
New Zealand	5	6	5	1987, 1989, 1993-94, 2000, 2002
Portugal	5	8	0	1982-1984, 1986, 1992, 1995, 2006-07
Spain	2	2	0	1987, 1992
Sweden	6	9	4	1976, 1981, 1983-84, 1986-87, 1996-97, 2000
Switzerland	1	1	0	2000
United Kingdom	3	6	4	1980, 1982, 1995-1998
United States	1	1	0	1976
Total	**62**	**91**	**37**	

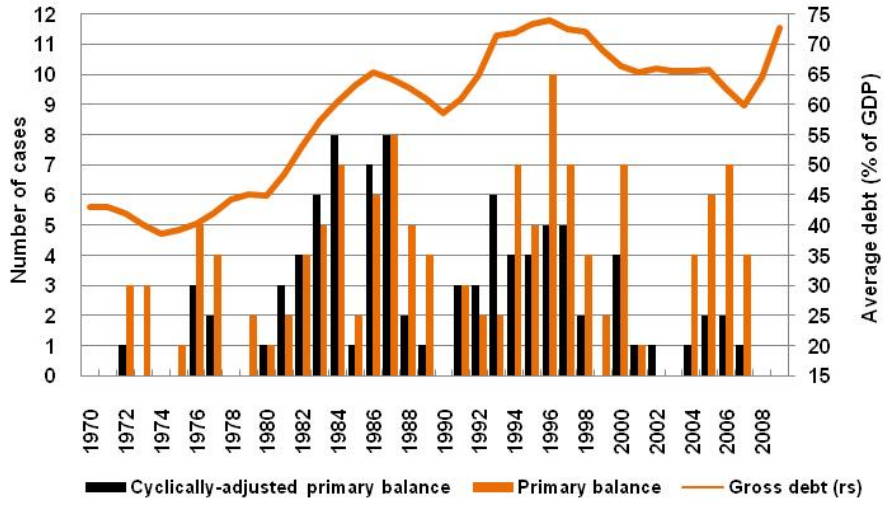
[7] For a survey on the empirical assessment of the impact of the Stability and Growth Pact and other fiscal rules on the evolvement of public debts, see IMF (2009).

Table 2: Episodes of successful fiscal adjustments (as defined by the cyclically adjusted primary balance)

Country	Successful	Year(s)
Australia	2	1986-87
Belgium	2	1987, 1993
Canada	3	1995-97
Denmark	6	1983-86, 2004-05
Finland	1	1998
Greece	5	1991-94, 2005
Ireland	3	1986-1988
Netherlands	2	1972, 1993
New Zealand	5	1987, 1993-94, 2000, 2002
Sweden	4	1986-87, 1996-97
United Kingdom	4	1995-98
Total	**37**	

The current surge in debt in almost all OECD countries suggests that we will see another concentration of fiscal adjustments over the next few years. Only 11 of 19 countries in consolidation ended up being successful. Over time, there is a trend that fiscal adjustments are more likely to be successful, though. In the 1970's, only 14 percent of all adjustments were successful. This percentage rose to 33 percent in the 1980's and 53 percent in the 1990's and has remained stable since.

Figure 1: Episodes of fiscal adjustments and average gross debt



As figures 2 and 3 show, most adjustments were relatively small in size and lasted only for a short period of time. More than half of all adjustments saw an improvement of the cyclically adjusted primary balance between 1.5 and 2.5 percent of GDP. In more than two out of three cases, the budget consolidation lasted for only one year. Overall, the average adjustment pe-

riod lasted 1.5 years. The figures seem to reflect that the measures taken were more likely to be successful the larger the size of the adjustment. If the cyclically adjusted primary balance improved by more than 6 percentage points, the consolidation was successful in five of six cases observed and failed only once in the case of Portugal (1982-1984). Similarly, five of the six adjustments that lasted more than two years were successful.

Figure 2: Episodes of fiscal adjustments: Success and size of adjustment (% of GDP)

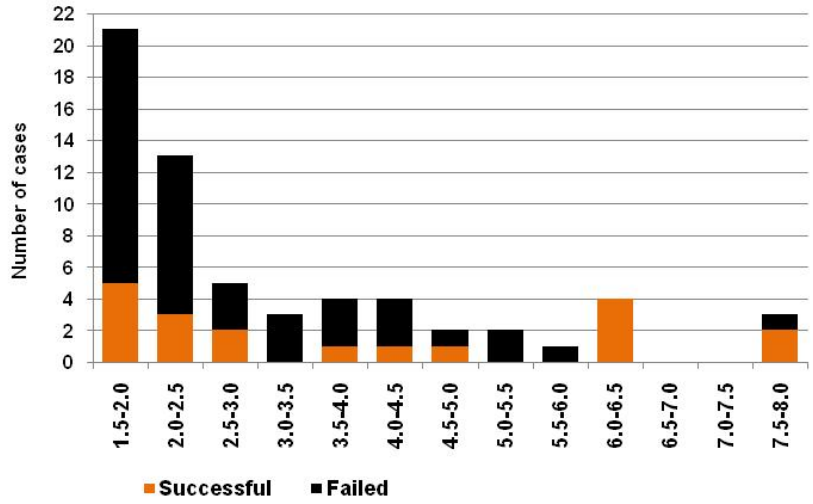


Figure 3: Episodes of fiscal adjustments: Success and duration (number of years)

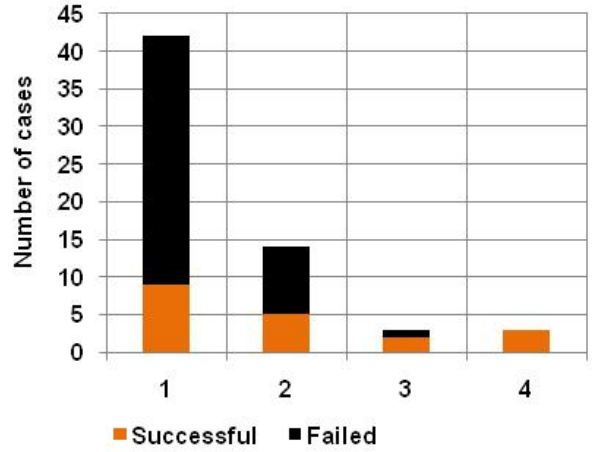


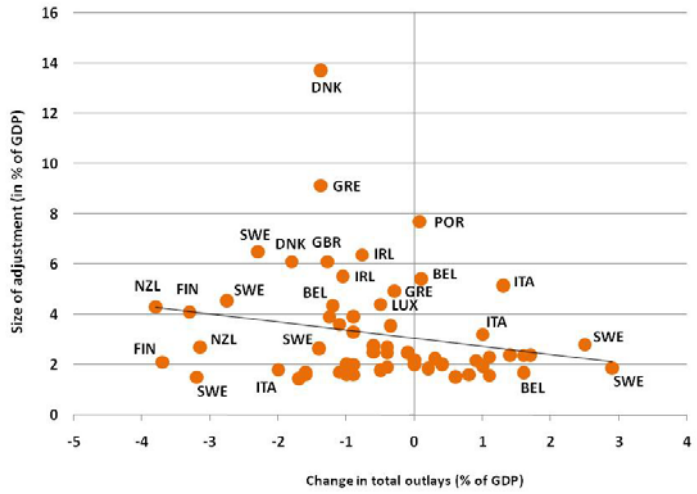
Table 3 shows that in line with the literature, countries with successful adjustments faced higher interest rates, higher debt and higher expenditure before and during budget consolidation. The size of the adjustment as expressed by the change in the cyclically adjusted primary balance was very similar, however. The major difference was in the composition of the adjustment. Successful adjustments relied primarily on expenditure cuts, reducing expenditure by 1.5 percent of GDP during consolidation. In unsuccessful cases, expenditure was cut by

only 0.2 percent. Instead, the deficit was reduced by raising taxes as indicated by the increase in revenue by 1.3 percent. Revenue increased by 0.8 percent of GDP during successful adjustments. Overall, the more extensive the adjustment, the lower seems the growth in government expenditure. Very large adjustments tend to be associated with negative expenditure growth (figure 4).

Table 3: Episodes of fiscal adjustments: Characteristics

	Consolidation	Successful	Failed
No. of observations	91	37	54
Primary balance (% of GDP)	0.85	1.86	0.16
Δ Primary balance (% of GDP)	2.21	2.17	2.24
Outlays (% of GDP)	48.49	49.43	47.85
Δ Outlays (% of GDP)	-0.72	-1.51	-0.19
Revenue (% of GDP)	44.69	46.31	43.58
Δ Revenue (% of GDP)	1.09	0.75	1.32
Real GDP Growth	2.46	2.79	2.22
Real GDP Growth vs. OECD	-0.20	0.02	-0.35
Real GDP Growth vs. G7	-0.12	0.26	-0.39
Real interest rate (10 year bond)	4.31	5.07	3.81
Δ Real interest rate (10 year bond)	0.29	-0.17	0.60
Gross Debt (% of GDP)	70.19	78.69	64.51
Δ Debt (% of GDP)	1.30	0.73	1.66

Figure 4: Size of adjustment and change in outlays (62 adjustments, 21 countries, 1970-2009)



Outlays continued to decline in the three years after successful consolidations (table 4), whereas they continued to grow by an average of 0.3 percent in each year after failed adjustments. Successful adjustments led to higher average growth, reduced debt by an average of 3.3 percentage points each year and also lowered real interest rates. However, debt and interest rates continued to climb after unsuccessful adjustments. In a simple correlation, however, higher

levels of public debt do not seem to be strongly associated with higher interest rates on government bonds (figure 5).

Table 4: Episodes of successful and unsuccessful fiscal adjustments: Characteristics

	Successful			Failed		
	Before	During	After	Before	During	After
Primary balance (% of GDP)	-1.01	1.86	2.72	-1.44	0.16	0.32
Δ Primary balance (% of GDP)	-0.14	2.17	-0.14	-0.16	2.24	-0.14
Outlays (% of GDP)	51.78	49.43	47.96	47.13	47.85	48.65
Δ Outlays (% of GDP)	-0.06	-1.51	-0.37	0.70	-0.19	0.28
Revenue (% of GDP)	46.21	46.31	47.22	42.15	43.58	44.71
Δ Revenue (% of GDP)	-0.10	0.75	-0.18	0.20	1.32	0.13
Real GDP Growth	2.58	2.79	3.00	2.15	2.22	2.47
Real GDP Growth vs. OECD	0.05	0.02	-0.18	-0.18	-0.36	-0.17
Real GDP Growth vs. G7	0.16	0.26	0.30	-0.19	-0.39	-0.04
Interest rate (10 year bond)	10.02	8.65	7.72	11.02	11.70	9.61
Δ Interest rate (10 year bond)	-0.30	-1.00	-0.02	-0.02	0.16	-0.54
Real interest rate (10 year bond)	5.11	5.07	4.26	2.90	3.81	4.48
Δ Real interest rate (10 year bond)	0.58	-0.17	-0.22	0.13	0.60	0.35
Gross Debt (% of GDP)	76.50	78.69	69.84	59.57	64.51	67.89
Δ Debt (% of GDP)	2.92	0.74	-3.28	2.52	1.67	2.11

Figure 5: Gross Debt and Real Interest Rates (Full Sample, 21 countries, 1970-2009)

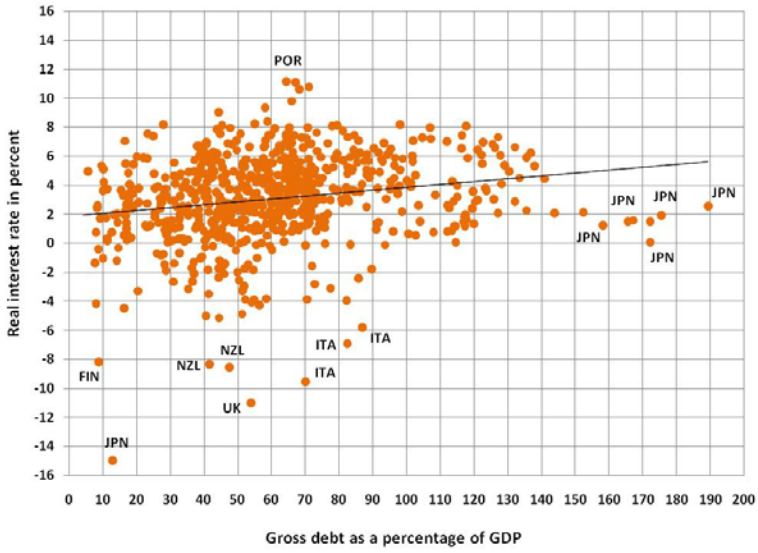
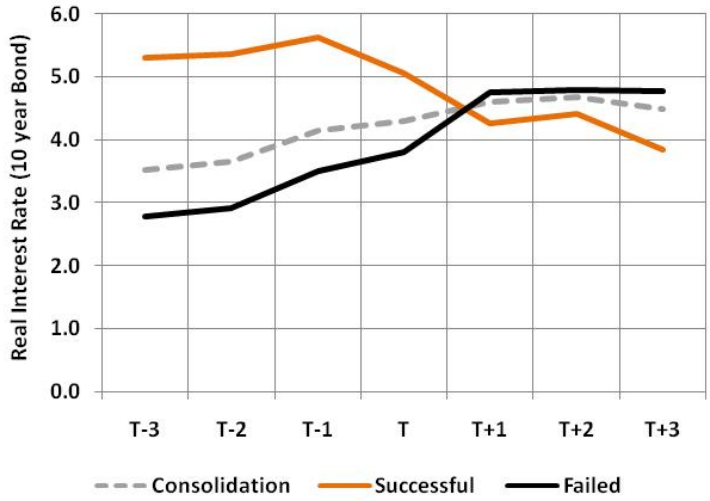


Figure 6 is of particular interest. It shows the development of long-term interest rates for the three years before and the three years after a fiscal adjustment took place. A budget consolidation does not generally affect real interest rates. Three years before the adjustment, interest rates were almost 250 basis points higher in successful cases. This yield spread narrowed only slightly over the following two years to 210 basis points in the year before the adjustment took place. With the enactment of consolidation measures, real interest rates quickly converged. Interest rates dropped by an average of 56 basis points per year during successful fiscal adjustments while they increased by 31 basis points during failed ones. One year after the

consolidation, interest rates were higher in countries that did not return to a path of fiscal sustainability. This yield spread continued to widen in the following two years as debt problems persisted or even intensified.

Figure 6: Real Interest Rates before and after budget consolidation



In summary, a look at descriptive statistics suggests that interest rates – and with it debt service costs – are considerably influenced by changes in the underlying fiscal variables. Financial markets seem to respond to measures taken during fiscal adjustments, but it seems to be more a question of how the budget consolidation takes place than if it takes place at all as depicted in figure 6. It thus appears that financial markets are able to differentiate among the wide array of possible fiscal adjustment strategies.

4. Empirical analysis

In this section we describe the data used in the empirical analysis, discuss the choice of the variables of interest and investigate the time-series properties of the variables. Since the objective is to explain the level of real long-term interest rates, we use data on the yield of long-term government bonds adjusted for inflation as the dependent variable. As indicated above, data are from the OECD's Economic Outlook database and usually refer to the 10 year government bond. If a country did not issue 10 year government bonds or data were not available, the OECD used data from bonds with similar maturity. We use long-term interest rates instead of short-term interest rates because the latter are heavily influenced by monetary policy and the business cycle. The long-term interest rate is also a better proxy for debt service costs and among other aspects reflects expectations about the future of fiscal policy. We estimate the

following linear equation for an unbalanced panel of 21 countries covering the period from 1970 to 2009:

$$r_{i,t} = \alpha_{i,t} + \beta_1 f_{i,t} + \beta_2 e_{i,t} + \beta_3 p_{i,t} + \varepsilon_{i,t} \quad (1)$$

Where r is the real long-term interest rate (and the yield spread of long term government bond rates versus Germany as another variant) for t = 40 years and i = 21 OECD countries, α is a constant, f are key indicators of the fiscal stance, e stands for variables that reflect the economic situation and p takes account of different political and institutional factors. The respective coefficients are β_1, β_2 and β_3. The error term is ε_t. All variables, their description and sources are indicated in Appendix A. The respective descriptive statistics are summarized in Appendix B. Finally, the correlation coefficients are presented in Appendix C. Fiscal indicators always refer to the general government and are expressed as a share of GDP. They include the amount of debt, the change in debt in comparison with the previous year, the primary deficit, the cyclically adjusted primary deficit, the total deficit, total revenue and total expenditure. The nominal short-term interest rate, real GDP growth and the unemployment rate constitute the economic factors. They are complemented by the variable banking crisis which is a dummy taking the value of 1 if they country was facing a domestic banking crisis at a certain point in time. Finally, political and institutional factors include the ideology of the parliament, expressed as the share of total seats of left wing and right wing parties, the type of currency system with the euro included as a dummy variable and the extent of federalism. Another dummy is used for the Bretton Woods system, covering the regime if fixed exchange rates between 1970 and 1973. Additional estimates include the fractionalization of the parliament and the type of the electoral system. We typically also use country dummies as well as year dummies. In some estimates, year dummies are substituted with a time trend variable as an additional variant.

The stationarity properties of real long-term interest rates, real yield spread, revenue, expenditure, gross debt, real GDP growth and monetary policy were calculated by using the Fisher test. Since we do not have complete data for all countries and variables dating back to 1970, we are estimating an unbalanced panel and thus cannot rely on standard unit root tests for panel data as proposed for example by Im, Pesaran and Shin (2003). The Fisher test is designed specifically for unbalanced panels and is provided in STATA. The null hypothesis

states that the variable is non-stationary. Results of the Fisher test are summarized in Appendix D. The existence of a unit root can be rejected at all levels for the real yield spread and real GDP growth. At the 5% significance level, we can reject the hypothesis that the real interest rate and total revenue are non-stationary. The evidence against non-stationarity also applies for total expenditure, but only at the 10% level. However, gross debt and monetary policy appear to be non-stationary. The results from the Fisher test allow us to estimate our models in levels. Instead of gross debt, we use first differences of gross debt, however.[8]

4.1. Baseline calculations

In our baseline calculations, we use a fixed-effects estimation technique in levels with country fixed effects and year dummies and the real long-term interest rate as the dependent variable. Fiscal control variables include the change in total debt, total revenue and total expenditure. Economic factors include real GDP growth, the unemployment rate, the short-term interest rate and the dummy banking crisis. The political and institutional factors are the euro, ideology, federalism and the dummy Bretton Woods. The estimations include 641 observations.

Results show that rapidly rising debt levels are associated with significantly higher long-term interest rates (table 5). Economic growth and the unemployment rate as a proxy for structural problems also push interest rates higher. Countries that adopted the euro saw their interest rates decline significantly (figure 7), while interest rates were much higher during the Bretton Woods system. The level of expenditure does not have an influence while the level of total taxes and receipts pushes up interest rates. This can be interpreted that financial markets estimate that there is less room for tax increases when solvency becomes a government issue, thereby demanding a risk premium if the government is already significantly relying on income and savings from the private sector. Another explanation could be that the majority of government bond holders in OECD countries are usually domestic residents.[9] Because high deficits make tax increases more likely, wealth of domestic bond holders would be negatively affected. Therefore they are no longer willing to lend money at present conditions, pushing interest rates higher.

[8] An alternative would be to use the primary deficit or cyclically adjusted primary deficit instead of the change in gross debt. The null hypothesis according to the Fisher test can be rejected for both variables. We ran calculations using the primary and cyclically adjusted primary balance as our independent variable. The results were very similar in all models estimated (see section 5.2 and table 12 for details).

[9] This is particularly striking in Japan, where in 2008, 94% of all government debt was held by domestic investors, a result of a strong home bias and risk aversion (Tokuoka, 2010). This is part of the reason why Japan's long-term interest rates remain extremely low despite the highest amount of government debt as a share of GDP among all OECD member countries.

Table 5: Baseline calculations: Dependent variable real interest rate[10]

Variables	(1)	(2)	(3)	(4)	(5)
Short-term interest rate	-0.03 (-0.76)	-0.03 (-0.66)	-0.02 (-0.66)	0.18*** (5.96)	0.18*** (5.87)
GDP growth	0.23*** (4.79)	0.23*** (4.84)	0.23*** (4.80)	0.41*** (8.50)	0.40*** (8.36)
Δ Government debt	0.07*** (3.01)	0.07*** (2.94)	0.07*** (2.97)	0.07*** (2.80)	0.08*** (2.91)
Revenue	0.09** (2.11)	0.09** (2.12)	0.09** (2.14)	0.17*** (3.55)	0.17*** (3.52)
Expenditure	0.02 (0.70)	0.02 (0.72)	0.02 (0.72)	0.09** (2.19)	0.09** (2.18)
Euro	-1.02*** (-3.40)	-1.02*** (-3.49)	-1.02*** (-3.52)	-2.04*** (-6.64)	-2.05*** (-6.66)
Banking crisis	0.04 (0.17)	0.04 (0.14)	0.03 (0.13)	0.72** (2.38)	0.73** (2.41)
Unemployment rate	0.17*** (4.19)	0.17*** (4.27)	0.17*** (4.21)	0.32*** (6.74)	0.31*** (6.57)
Federalism	-0.20 (-0.68)	-0.21 (-0.72)	-0.21 (-0.71)	-0.08 (-0.21)	-0.06 (-0.16)
Ideology	0.01*** (3.56)	0.01*** (3.58)	0.01*** (3.57)	0.01*** (2.98)	0.01*** (2.95)
Bretton Woods	3.80*** (5.15)	3.80*** (5.14)	3.81*** (5.16)	2.19*** (4.04)	2.18*** (4.02)
Consolidation (primary)		-0.16 (-0.85)		-0.34 (-1.58)	
Consolidation (cyclical)			-0.16 (-0.76)		-0.11 (-0.42)
Country Dummies	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	No	No
Trend Dummy	No	No	No	Yes	Yes
No. of observations	641	641	641	641	641
R2	0.662	0.662	0.662	0.449	0.447
F-statistic	24.43	23.91	23.90	38.05	37.72

t-values in parentheses
dependent variable: real interest rate
*** p<0.01, ** p<0.05, * p<0.1

Finally, interest rates are higher the larger the share of left and right wing parties in the parliament. In other words, when centralist parties constitute a majority in the upper house, interest rates tend to be lower than would otherwise be the case.

In a next step, we examined whether the implementation of a budget consolidation affected interest rates. For that matter, we defined a dummy taking the value of 1 if a country was in a state of fiscal adjustment as determined in section 2.3. We tested for adjustments of both the primary deficit and the cyclically adjusted primary deficit, but the results were almost exactly identical. Finally, we used a time trend instead of year dummies to test for robustness of our

[10] Note: The OECD Economic Outlook database does not provide complete data for all fiscal indicators and for all countries since 1970. Hence, the number of observations varies depending on the fiscal variable or fiscal adjustment strategy variable used.

results. Equations (2) through (5) in table 5 show the regression outputs. In all cases, real long-term interest rates were not significantly influenced in either direction if a country was in a period of fiscal adjustment. All coefficients had the expected negative sign, but were not statistically significant. We obtained the same results if we used the real yield spread as our dependent variable instead of the real interest rate (table 6). This is not surprising as fiscal adjustments can take many forms and be either successful or unsuccessful in reducing the deficit and stabilizing debt. Our next step is thus to distinguish further among various fiscal adjustment strategies.

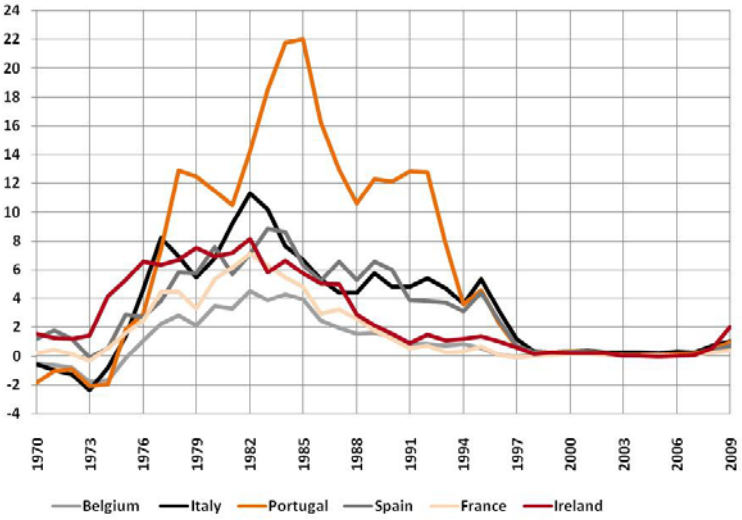
Table 6: Baseline calculations: Dependent variable real yield spread[11]

Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Short-term interest rate	-0.03 (-0.76)	-0.02 (-0.66)	-0.02 (-0.66)	0.10*** (3.62)	0.10*** (3.64)
GDP growth	0.23*** (4.79)	0.23*** (4.84)	0.23*** (4.80)	0.27*** (6.04)	0.26*** (5.91)
Δ Government debt	0.07*** (3.01)	0.07*** (2.94)	0.07*** (2.97)	0.10*** (4.09)	0.10*** (4.20)
Revenue	0.09** (2.11)	0.09** (2.12)	0.09** (2.14)	0.10** (2.29)	0.10** (2.32)
Expenditure	0.02 (0.70)	0.02 (0.72)	0.02 (0.72)	0.06* (1.73)	0.06* (1.74)
Euro	-1.02*** (-3.50)	-1.02*** (-3.49)	-1.02*** (-3.52)	-1.31*** (-4.61)	-1.31*** (-4.64)
Banking crisis	0.04 (0.17)	0.04 (0.14)	0.03 (0.13)	0.35 (1.25)	0.34 (1.23)
Unemployment rate	0.17*** (4.19)	0.17*** (4.27)	0.17*** (4.21)	0.23*** (5.32)	0.22*** (5.21)
Federalism	-0.20 (-0.68)	-0.21 (-0.72)	-0.21 (-0.71)	-0.15 (-0.46)	-0.14 (-0.42)
Ideology	0.01*** (3.56)	0.01*** (3.58)	0.01*** (3.57)	0.01*** (3.24)	0.01*** (3.21)
Bretton Woods	3.82*** (5.17)	3.81*** (5.16)	3.82*** (5.18)	3.22*** (6.45)	3.23*** (6.46)
Consolidation (primary)		-0.16 (-0.85)		-0.32 (-1.62)	
Consolidation (cyclical)			-0.16 (-0.76)		-0.30 (-1.29)
Country Dummies	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	No	No
Trend Dummy	No	No	No	Yes	Yes
No. of observations	641	641	641	641	641
R2	0.547	0.547	0.547	0.373	0.372
F-statistic	15.04	14.73	14.72	27.72	27.60

t-values in parentheses
dependent variable: spread vs. Germany
*** p<0.01, ** p<0.05, * p<0.1

[11] Note: The OECD Economic Outlook database does not provide complete data for all fiscal indicators and for all countries since 1970. Hence, the number of observations varies depending on the fiscal variable or fiscal adjustment strategy variable used.

Figure 7: Nominal Yield Spreads versus Germany (Euro Area, 1970-2009)



4.2. Success and size of fiscal adjustments

We use three different equations to test whether and how the success (or failure) of a fiscal adjustment moved long-term interest rates. In the first model, we include two dummies in our regression, taking the value of 1 if the budget consolidation was successful and unsuccessful, respectively, as defined in section 2.3. In the second model, we used the same definition, but applied to the primary deficit instead of the cyclically adjusted primary deficit. Third, we used a different definition for the success of an adjustment. A period of successful fiscal adjustment was defined as a period of consolidation that led to a stabilization of gross debt as a percentage of GDP. Holding debt in relation to the size of the economy constant can be sufficient for financial sustainability under usual assumptions and is less strict than the required reduction of 5 percentage points stated in section 2.3. While the number of adjustments remains the same under that definition, the share of successful adjustment periods increases from 41 to 53 percent. The results of our estimations are summarized in table 7. In all three models, the fact that a fiscal adjustment was successful did not influence interest rates in a meaningful way. The same holds for unsuccessful adjustments from which one could expect that interest rates would increase further as seen in figure 6. The results are also stable when we use the real yield spread as our dependent variable (table 8). In all cases, the simple fact that a successful budget consolidation was under way was not enough to influence interest rates.

Table 7: Success and size of fiscal adjustments: Dependent variable real interest rate[12]

Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Short-term interest rate	-0.02	-0.02	-0.02	0.01	0.02	-0.00	0.01	-0.03
	(-0.64)	(-0.61)	(-0.61)	(0.19)	(0.56)	(-0.14)	(0.27)	(-0.83)
GDP growth	0.23***	0.23***	0.23***	0.31***	0.28***	0.30***	0.29***	0.27***
	(4.84)	(4.79)	(4.87)	(6.48)	(5.83)	(6.22)	(6.11)	(5.62)
Δ Government debt	0.07***	0.07***	0.06***	0.05**	0.06***	0.05**	0.06***	0.05**
	(2.94)	(2.93)	(2.90)	(2.59)	(2.87)	(2.29)	(2.76)	(2.19)
Revenue	0.09**	0.09**	0.09**	0.10**	0.11***	0.09**	0.09**	0.08**
	(2.14)	(2.16)	(2.20)	(2.59)	(2.79)	(2.25)	(2.25)	(2.04)
Expenditure	0.02	0.02	0.02	0.01	0.01	0.03	0.02	0.02
	(0.70)	(0.72)	(0.75)	(0.38)	(0.22)	(0.81)	(0.70)	(0.63)
Euro	-1.02***	-1.04***	-1.03***	-0.89***	-0.87***	-1.13***	-0.86***	-0.96***
	(-3.49)	(-3.57)	(-3.53)	(-3.22)	(-3.11)	(-4.01)	(-3.10)	(-3.34)
Banking crisis	0.04	0.05	0.02	0.01	-0.04	0.07	0.01	0.05
	(0.14)	(0.18)	(0.06)	(0.03)	(-0.18)	(0.29)	(0.04)	(0.20)
Unemployment rate	0.17***	0.17***	0.17***	0.20***	0.20***	0.18***	0.18***	0.20***
	(4.29)	(4.21)	(4.26)	(4.99)	(5.05)	(4.52)	(4.65)	(4.87)
Federalism	-0.21	-0.22	-0.21	-0.32	-0.29	-0.26	-0.29	-0.23
	(-0.73)	(-0.75)	(-0.71)	(-1.15)	(-1.03)	(-0.92)	(-1.05)	(-0.80)
Ideology	0.01***	0.01***	0.01***	0.01**	0.01**	0.01***	0.01**	0.01***
	(3.58)	(3.60)	(3.62)	(2.53)	(2.47)	(3.82)	(2.49)	(3.51)
Bretton Woods	3.79***	3.25***	3.80***	2.76***	5.57***	1.92***	4.55***	3.45***
	(5.13)	(4.33)	(5.15)	(3.80)	(5.95)	(2.71)	(6.12)	(4.66)
Successful adjustment	-0.18	0.04	-0.34					
	(-0.66)	(0.12)	(-1.33)					
Failed adjustment	-0.19	-0.31	-0.40					
	(-0.84)	(-1.12)	(-1.32)					
Δ Primary deficit				-0.12***				
				(-2.79)				
Δ Adj. primary deficit					-0.20***			
					(-3.57)			
Δ Deficit						-0.14***		
						(-3.04)		
Δ Deficit during adj.							-0.16*	
							(-1.93)	
Δ Revenue								0.05
								(0.80)
Δ Expenditure								0.17***
								(3.27)
Country Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Trend Dummy	No	No	No	No	No	No	No	No
No. of observations	641	641	641	613	592	631	613	640
R2	0.663	0.663	0.664	0.712	0.714	0.685	0.710	0.673
F-statistic	23.39	23.41	23.53	28.65	27.85	26.10	28.36	24.43

t-values in parentheses
dependent variable: real interest rate
*** p<0.01, ** p<0.05, * p<0.1

[12] Note: The OECD Economic Outlook database does not provide complete data for all fiscal indicators and for all countries since 1970. Hence, the number of observations varies depending on the fiscal variable or fiscal adjustment strategy variable used.

Table 8: Success and size of fiscal adjustments: Dependent variable real yield spread[13]

Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Short-term interest rate	0.10***	0.10***	0.10***	0.16***	0.17***	0.13***	0.16***	0.10***
	(3.54)	(3.65)	(3.59)	(5.52)	(5.81)	(4.65)	(5.48)	(3.61)
GDP growth	0.27***	0.26***	0.27***	0.36***	0.32***	0.35***	0.32***	0.32***
	(6.05)	(5.90)	(6.01)	(7.43)	(6.83)	(7.40)	(6.97)	(6.93)
Δ Government debt	0.10***	0.10***	0.10***	0.09***	0.10***	0.09***	0.10***	0.08***
	(4.11)	(4.18)	(4.15)	(3.95)	(4.30)	(3.74)	(4.18)	(3.46)
Revenue	0.10**	0.10**	0.10**	0.11**	0.11**	0.12**	0.09**	0.11**
	(2.32)	(2.32)	(2.36)	(2.34)	(2.43)	(2.59)	(2.05)	(2.49)
Expenditure	0.06*	0.06*	0.06*	0.07*	0.06	0.06	0.08**	0.06
	(1.72)	(1.74)	(1.74)	(1.83)	(1.61)	(1.55)	(2.19)	(1.60)
Euro	-1.32***	-1.31***	-1.32***	-1.27***	-1.19***	-1.43***	-1.21***	-1.29***
	(-4.64)	(-4.63)	(-4.65)	(-4.52)	(-4.19)	(-5.13)	(-4.31)	(-4.60)
Banking crisis	0.34	0.35	0.33	0.25	0.18	0.33	0.25	0.33
	(1.23)	(1.24)	(1.18)	(0.91)	(0.66)	(1.19)	(0.91)	(1.18)
Unemployment rate	0.23***	0.22***	0.23***	0.26***	0.28***	0.25***	0.24***	0.26***
	(5.33)	(5.20)	(5.24)	(5.86)	(6.07)	(5.87)	(5.42)	(5.67)
Federalism	-0.15	-0.14	-0.13	-0.21	-0.16	-0.17	-0.17	-0.12
	(-0.46)	(-0.44)	(-0.39)	(-0.64)	(-0.51)	(-0.52)	(-0.54)	(-0.38)
Ideology	0.01***	0.01***	0.01***	0.01**	0.01**	0.01***	0.01**	0.01***
	(3.24)	(3.22)	(3.25)	(2.47)	(2.48)	(3.30)	(2.48)	(3.06)
Bretton Woods	3.22***	3.23***	3.20***	3.71***	3.90***	3.41***	3.80***	3.18***
	(6.45)	(6.45)	(6.42)	(7.07)	(6.20)	(6.88)	(7.23)	(6.43)
Successful adjustment	-0.43	-0.21	-0.41					
	(-1.41)	(-0.60)	(-1.41)					
Failed adjustment	-0.25	-0.37	-0.37					
	(-1.04)	(-1.23)	(-1.13)					
Δ Primary deficit				-0.15***				
				(-3.15)				
Δ Adj. primary deficit					-0.22***			
					(-3.59)			
Δ Deficit						-0.18***		
						(-3.64)		
Δ Deficit during adj.							-0.21**	
							(-2.24)	
Δ Revenue								-0.01
								(-0.08)
Δ Expenditure								0.19***
								(3.38)
Country Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	No	No	No	No	No	No	No	No
Trend Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	641	641	641	613	592	631	613	640
R2	0.373	0.372	0.373	0.408	0.413	0.398	0.403	0.386
F-statistic	25.72	25.60	25.74	30.72	30.14	30.42	30.09	27.20

t-values in parentheses
dependent variable: yield spread vs. Germany
*** p<0.01, ** p<0.05, * p<0.1

[13] Note: The OECD Economic Outlook database does not provide complete data for all fiscal indicators and for all countries since 1970. Hence, the number of observations varies depending on the fiscal variable or fiscal adjustment strategy variable used.

This changes when we look at the size of the adjustment as summarized in equations (4) through (7) in tables 7 and 8. As expected, the larger the change in the primary balance in comparison with the previous fiscal year, the more likely it is that interest rates increased or decreased in a significant way. The negative sign suggests that a large improvement in the primary balance significantly reduces the real yield of 10 year government bonds. To put it differently, if a government suddenly implements a very loose fiscal policy, for example to counter falling demand from the private sector during a recession, this is likely to drive up interest rates (see also Ardagna, 2009). The results were very similar when we either used the change in the total deficit or the change in the cyclically adjusted primary balance. In all cases, the coefficient was at least twice as large as the one measuring the effect of an increase in debt. Our fiscal adjustment strategy variable is significant at the 1% level in all estimations. With our model, roughly 70 percent of the variation in interest rate levels can be explained. In equation (7) we focus only on changes in the primary balance when an actual fiscal adjustment took place as defined in section 2.3. In this case, the evidence is less clear. The coefficient is negative and significant, but only at the 10% level. When using the real yield spread as our dependent variable, the results are similar: An improvement of the primary balance during a period of fiscal adjustment lowered long-term interest rates. This is what we expected, but not straight forward. Since debt often continues to increase during the first year of consolidation, it could be the case that long-term interest rates respond with a time lag as well. The results do not rule out this possibility, but show that interest rates already react during the first year of consolidation if the size of the adjustment is substantial.

4.3. Composition of fiscal adjustments

We differentiate further among fiscal adjustments by looking at the share and size of changes in revenue and expenditure. First, we once again look at the size of measures taken during a period of budget consolidation. Unlike before when we simply looked at the change in the primary balance in comparison with the previous year, we now distinguish between changes in revenue and changes in expenditure. Equations (1a) and (1b) in table 9 show the results.

Table 9: Composition of fiscal adjustments: Dependent variable real interest rate[14]

Variables	(1a)	(1b)	(2)	(3)	(4)	(5)	(6)
Short-term interest rate	-0.03 (-0.95)	0.08*** (2.80)	-0.03 (-0.87)	-0.03 (-0.93)	-0.02 (-0.60)	-0.02 (-0.51)	0.00 (0.12)
GDP growth	0.25*** (5.19)	0.45*** (8.21)	0.25*** (5.21)	0.25*** (5.25)	0.28*** (5.76)	0.28*** (5.74)	0.29*** (6.10)
Δ Government debt	0.07*** (3.02)	0.07** (2.27)	0.06*** (2.86)	0.07*** (2.94)	0.06*** (2.76)	0.06*** (2.67)	0.06*** (2.80)
Revenue	0.10** (2.43)	0.23*** (4.23)	0.10** (2.45)	0.10** (2.45)	0.08* (1.89)	0.08* (1.90)	0.09** (2.27)
Expenditure	0.02 (0.60)	0.09* (1.95)	0.02 (0.70)	0.02 (0.62)	0.03 (1.06)	0.04 (1.07)	0.02 (0.60)
Euro	-0.87*** (-3.00)	-1.37*** (-4.04)	-0.89*** (-3.06)	-0.87*** (-2.99)	-1.04*** (-3.65)	-1.06*** (-3.70)	-0.84*** (-3.03)
Banking crisis	0.00 (0.01)	0.59* (1.80)	0.00 (0.01)	0.00 (0.01)	0.06 (0.22)	0.06 (0.25)	0.01 (0.06)
Unemployment rate	0.15*** (3.80)	0.35*** (6.31)	0.15*** (3.67)	0.15*** (3.78)	0.16*** (4.11)	0.16*** (4.08)	0.18*** (4.71)
Federalism	-0.18 (-0.63)	0.26 (0.65)	-0.19 (-0.67)	-0.19 (-0.66)	-0.25 (-0.87)	-0.23 (-0.80)	-0.29 (-1.03)
Ideology	0.01*** (3.47)	0.01*** (2.81)	0.01*** (3.53)	0.01*** (3.50)	0.01*** (3.70)	0.01*** (3.70)	0.01** (2.50)
Bretton Woods	3.14*** (4.23)		3.74** (5.11)	3.12** (4.19)	3.47*** (4.69)	4.09*** (5.58)	4.53*** (6.09)
Δ Rev. during fiscal adj.	0.04 (0.39)	0.07 (0.46)					
Δ Exp. during fiscal adj.	0.14* (1.74)	0.20* (1.83)					
Δ Rev. successful adj.			0.07 (0.39)	0.07 (0.40)			
Δ Exp. successful adj.			0.23* (1.89)	0.23* (1.93)			
Δ Rev. failed adj.				0.04 (0.29)			
Δ Exp. failed adj.				0.10 (0.95)			
Share Δ Exp.					-0.61* (-1.89)		
Exp. based adjustment						-0.45* (-1.71)	
Rev. based adjustment						-0.25 (-0.90)	
Δ Deficit exp. based							-0.24** (-2.05)
Δ Deficit rev. based							-0.06 (-0.57)
Country Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Trend Dummy	No	No	No	No	No	No	No
No. of observations	629	599	629	629	625	625	613
R2	0.676	0.677	0.676	0.677	0.684	0.684	0.710
F-statistic	24.30	24.78	24.33	23.34	25.66	25.08	27.76

t-values in parentheses
dependent variable: real interest rate
*** p<0.01, ** p<0.05, * p<0.1

[14] Note: The OECD Economic Outlook database does not provide complete data for all fiscal indicators and for all countries since 1970. Hence, the number of observations varies depending on the fiscal variable or fiscal adjustment strategy variable used.

Overall, discretionary tax increases during adjustments do not seem to affect long-term interest rates in the short run. On the other hand, expenditure cuts reduce long-term interest rates and henceforth debt service costs. The effect becomes larger and remains significant when we limit our sample to the period after the Bretton Woods system (1b). In this case, the coefficient of expenditure cuts is almost three times as large as the one measuring the effect of changes in total debt.

Our next step is to distinguish between successful and unsuccessful fiscal adjustments and their respective changes in revenue and expenditure as summarized in equations (2) and (3). We find that discretionary fiscal policy significantly influences real interest rates, but only during successful fiscal adjustments. Changes in expenditure during failed adjustments do not affect the real yield on government bonds. As described in table 3, we assume that this is because in the past 40 years, outlays have changed only very little during failed adjustments. On the other hand, tax and non-tax receipts were raised substantially, but this did not shift interest rates in either direction. Changes in revenue during successful adjustments also do not have an effect on long-term interest rates. Overall, the results of section 4.2 are confirmed. Indeed, it is the size of the adjustment that matters, but this statement only holds when we look at the expenditure side of the government budget. Tax increases, although substantial during some adjustments, do not seem to influence interest yields in the short run. We obtain the same results when we use the real yield spread as our dependent variable and substitute the year dummies with a time trend variable (table 10). The only difference is visible in equation (3): Expenditure cuts affected interest rates even during unsuccessful adjustments. The effect is smaller than during successful adjustments, however, and the variable is only significant at the 10% level.

Equation (4) includes the share of measures taken through expenditure cuts. This variable takes the value of zero if the consolidation was based entirely upon tax increases. It is one, if revenue was left unchanged and the improvement in the primary balance was completely due to expenditure cuts. Using that definition, the size of the adjustment does not matter. Descriptive statistics show that historically, roughly two thirds of the improvement in the primary balance during consolidation was due to tax increases while expenditure cuts contributed only one third.

Table 10: Composition of fiscal adjustments: Dependent variable real yield spread[15]

Variables	(1a)	(1b)	(2)	(3)	(4)	(5)	(6)
Short-term interest rate	0.11*** (3.81)	0.12*** (3.92)	0.11*** (3.90)	0.11*** (3.76)	0.13*** (4.40)	0.13*** (4.39)	0.16*** (5.28)
GDP growth	0.29*** (6.48)	0.29*** (6.24)	0.29*** (6.36)	0.29*** (6.50)	0.31*** (6.67)	0.30*** (6.61)	0.32*** (6.99)
Δ Government debt	0.10*** (4.18)	0.11*** (4.28)	0.10*** (4.02)	0.10*** (4.15)	0.10*** (4.13)	0.10*** (4.07)	0.10*** (4.19)
Revenue	0.11** (2.44)	0.12*** (2.65)	0.11** (2.38)	0.11** (2.48)	0.08* (1.87)	0.08* (1.85)	0.09** (2.10)
Expenditure	0.07* (1.85)	0.07* (1.77)	0.08** (2.07)	0.07* (1.85)	0.08** (2.08)	0.08** (2.08)	0.08* (2.08)
Euro	-1.22*** (-4.30)	-1.18*** (-4.12)	-1.26*** (-4.43)	-1.23*** (-4.31)	-1.36*** (-4.81)	-1.36*** (-4.81)	-1.21*** (-4.31)
Banking crisis	0.30 (1.09)	0.26 (0.94)	0.29 (1.05)	0.30 (1.07)	0.35 (1.26)	0.36 (1.28)	0.28 (0.99)
Unemployment rate	0.22*** (5.09)	0.24*** (5.25)	0.21*** (4.85)	0.22*** (5.08)	0.23*** (5.40)	0.23*** (5.36)	0.25*** (5.52)
Federalism	-0.12 (-0.35)	-0.01 (-0.02)	-0.11 (-0.35)	-0.12 (-0.35)	-0.18 (-0.55)	-0.16 (-0.50)	-0.17 (-0.53)
Ideology	0.01*** (3.19)	0.01*** (3.03)	0.01*** (3.22)	0.01*** (3.19)	0.01*** (3.33)	0.01*** (3.32)	0.01** (2.50)
Bretton Woods	3.24*** (6.49)		3.24*** (6.49)	3.23*** (6.46)	3.47*** (6.89)	3.47*** (6.89)	3.76*** (7.14)
Δ Rev. during fiscal adj.	0.02 (0.17)	0.03 (0.23)					
Δ Exp. during fiscal adj.	0.26*** (2.84)	0.27*** (2.96)					
Δ Rev. successful adj.			-0.01 (-0.06)	-0.02 (-0.08)			
Δ Exp. successful adj.			0.32** (2.42)	0.33** (2.48)			
Δ Rev. failed adjustment				0.06 (0.39)			
Δ Exp. failed adjustment				0.20* (1.74)			
Share Δ Exp.					-0.74** (-2.05)		
Exp. based adjustment						-0.53* (-1.79)	
Rev. based adjustment						-0.17 (-0.56)	
Δ Deficit exp. based							-0.33** (-2.47)
Δ Deficit rev. based							-0.07 (-0.55)
Country Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	No	No	No	No	No	No	No
Trend Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	629	599	629	629	625	625	613
R2	0.380	0.389	0.377	0.381	0.389	0.386	0.404
F-statistic	25.95	27.61	25.67	22.72	28.64	26.45	28.04

t-values in parentheses
dependent variable: yield spread vs. Germany
*** p<0.01, ** p<0.05, * p<0.1

[15] Note: The OECD Economic Outlook database does not provide complete data for all fiscal indicators and for all countries since 1970. Hence, the number of observations varies depending on the fiscal variable or fiscal adjustment strategy variable used.

Our regression results indicate that long-term interest rates will tend to be lower the larger the share of expenditure cuts. The size of the coefficient is particularly striking. The effect is larger than an increase in real GDP growth by more than 2 percentage points and similar to an increase in total debt by 10 percentage points.

In equation (5) we use two dummies to define whether the fiscal adjustment undertaken was either revenue or expenditure based. A revenue based adjustment is defined as a period of budget consolidation during which tax increases account for more than 50 percent of the improvement in the primary balance. All other adjustments are then defined as expenditure based. We find that expenditure based adjustments significantly lower the real return on government bonds while budget consolidations based primarily on tax increases do not.

Finally, we combined the size of the adjustment with the distinction whether the adjustment was primarily revenue or expenditure based. As expected, expenditure based adjustments significantly dampen long-term interest rates. Revenue based adjustments do not lead to changes in yields, even when the size of the adjustment is taken into account. Alternatively, we ran calculations using the yield spread between the country observed and German bunds while substituting the year dummies once again with a time trend variable. While not entirely comparable with each other, we find that difference in long-term interest rates become smaller if large and expenditure based fiscal adjustments are implemented. Our results were almost identical when we used the same model as in table 9, but with the real yield spread as our dependent variable.

5. Discussion

The results obtained in section 4 are robust to an array of changes in specification. In this section, we extend the analysis by using an IV-model to account for possible endogeneity of our consolidation variables, performing robustness checks by controlling for additional political and institutional measures and by using a different measure for the dependent variable.

5.1. Endogeneity and instrumental variables

A potential problem with our model could be endogeneity, that one or more of our independent variables are correlated with the error term. This would imply that the regression coefficients in our fixed-effects regression are biased. By assuming fixed effects, time independent effects are imposed for each country that are potentially correlated with the regressors. A

commonly used method to overcome the potential problem of endogeneity is to include instrumental variables in the regression. The Wu-Hausman test did not consistently show a need for instrumental variables, however, as the null hypothesis that the regressor is exogenous could only be rejected in some cases (depending on the model used). Nonetheless, we used the total deficit and the total debt level as an instrument for our fiscal adjustment variables since it can be debated whether these two variables should have explanatory power in the original regression.[16] The idea is that a fiscal adjustment often takes place when deficits and debt levels are substantial, independent of the question which political party is in charge and which fiscal policy it would otherwise prefer. In the first stage regression, the coefficient of the total debt level is significant at the 1% level in all four models estimated. The coefficient of the total deficit is significant at the 1% level as well, but only in two models. The estimation results are summarized in Appendix E. We also tested whether our model is either underidentified as measured by Anderon's canonical correlation test or is suffering from overidentifying restrictions as examined by the Sargan test. The results show that our IV variables are appropriate. The results of the corresponding two stage least squares estimations are summarized in table 11.

All four models tested show similar results as the fixed-effects regressions did. In the first model, the previous result holds that the success of a fiscal adjustment alone was not sufficient to affect long-term interest rates. On the other hand, the size of the adjustment as examined in equations (2) and (3) significantly lowers debt service costs. Finally, the composition of the adjustment is of relevance. Equation (4) confirms that the share of expenditure cuts is important in determining changes in interest rate levels. The higher the percentage of expenditure cuts of total changes in the primary balance, the larger will be the change in long-term interest rates.

[16] As the OECD (2009a) points out, the effect of fiscal imbalances on interest rates is both mixed and controversial. Examples cited often include Japan with the highest level of government debt and the lowest level of interest rates among all OECD countries as well as Australia and New Zealand with long-term interest rates close to 6 percent despite very low debt levels of 20 and 31 percent of GDP, respectively. Caporale and Williams (2002) as well as Ardagna et al. (2004) even find a negative and statistically significant relationship between the stock of public debt and long-term interest rates. Recent findings in the economic literature also suggest that future fiscal deficits rather than current ones have an effect on interest rates (i.e. Laubach, 2003).

Table 11: Fiscal Adjustment Strategies: Comparison of IV and OLS model regressions[17]

Variables	**(1a)**	**(1b)**	**(2a)**	**(2b)**	**(3a)**	**(3b)**	**(4a)**	**(4b)**
Short-term interest rate	0.00 (0.00)	-0.03 (-0.95)	0.03 (0.80)	0.01 (0.24)	0.06 (1.45)	0.02 (0.58)	-0.05 (-1.05)	-0.03 (-0.79)
GDP growth	0.29*** (5.41)	0.23*** (4.81)	0.42*** (6.41)	0.32*** (6.54)	0.30*** (5.69)	0.29*** (5.89)	0.35*** (5.15)	0.29*** (5.83)
Δ Government debt	0.07*** (2.75)	0.07*** (3.21)	0.05** (2.28)	0.06*** (2.87)	0.05** (2.05)	0.06*** (2.94)	0.07*** (2.63)	0.07*** (2.98)
Revenue	0.08* (1.85)	0.09** (2.19)	0.17*** (3.46)	0.11*** (2.70)	0.19*** (3.34)	0.11*** (2.66)	0.12** (2.26)	0.08** (2.02)
Expenditure	0.04 (1.09)	0.02 (0.56)	-0.02 (-0.56)	0.01 (0.22)	-0.02 (-0.50)	0.01 (0.17)	0.02 (0.43)	0.03 (0.89)
Euro	-0.88*** (-2.60)	-1.03*** (-3.51)	-0.90*** (-3.18)	-0.88*** (-3.17)	-0.87*** (-2.88)	-0.87*** (-3.07)	-0.82** (-2.26)	-1.04*** (-3.61)
Banking crisis	-0.13 (-0.42)	0.04 (0.14)	-0.11 (-0.42)	-0.00 (-0.01)	-0.23 (-0.81)	-0.04 (-0.14)	-0.27 (-0.77)	0.04 (0.17)
Unemployment rate	0.19*** (4.21)	0.18*** (4.37)	0.25*** (5.53)	0.20*** (5.13)	0.25*** (5.39)	0.21*** (5.24)	0.22*** (4.05)	0.17*** (4.32)
Federalism	-0.15 (-0.48)	-0.13 (-0.44)	-0.38 (-1.28)	-0.25 (-0.89)	-0.44 (-1.41)	-0.27 (-0.93)	-0.40 (-1.08)	-0.18 (-0.63)
Ideology	0.01*** (2.83)	0.01*** (3.38)	0.01** (2.52)	0.01** (2.42)	0.01** (2.33)	0.01** (2.43)	0.01*** (3.08)	0.01*** (3.48)
Successful adjustment	-3.79 (-1.62)	0.14 (0.43)						
Δ Primary deficit			-0.48*** (-2.92)	-0.12*** (-2.79)				
Δ Adj. primary deficit					-0.83*** (-2.85)	-0.19*** (-3.30)		
Share Δ Exp.							-6.30** (-2.05)	-0.68** (-2.09)
Country Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Trend Dummy	No	No	No	No	No	No	No	No
No. of observations	602	602	586	586	572	572	595	595
F-statistic	20.29	24.30	26.22	29.43	22.80	28.44	16.88	26.25
	IV (2SLS)	**OLS**	**IV (2SLS)**	**OLS**	**IV (2SLS)**	**OLS**	**IV (2SLS)**	**OLS**

Note: Instruments are the total deficit and total debt
t-values in parentheses
dependent variable: real interest rate
*** p<0.01, ** p<0.05, * p<0.1

5.2. Different fiscal, political and institutional measures

To further test the robustness of our results from section 4, we use alternative and additional variables. First, we use the budget balance instead of the growth in debt as our variable for the fiscal stance. The corresponding correlation coefficient between the two is -0.563. Next, we omit the expenditure variable since government revenue and government expenditure are

[17] Note: The OECD Economic Outlook database does not provide complete data for all fiscal indicators and for all countries since 1970. Hence, the number of observations varies depending on the fiscal variable or fiscal adjustment strategy variable used.

highly correlated (c = 0.894) and might thus negatively affect our estimation results. Third, we add two additional variables to account for differences in the political system. We include a fractionalization variable that measures the probability that two randomly chosen deputies from among the government parties will be of different parties. The regime type variable captures whether the country observed is presidential, assembly-elected presidential or parliamentary. Four of our previously defined fiscal adjustment strategies are examined. The results are summarized in table 12. The number of observations is slightly lower than in previous estimations because the additional political variables only cover the period 1975-2006.

Equations (1a) and (1b) show that the share of expenditure as a percentage of the total improvement in the primary balance continues to be significant for both the long-term interest rate as well as for the yield spread. The budget balance variable is highly significant, meaning that a high deficit is associated with higher interest rates. The political variables are also of interest. Our previous result that the more seats the left- and right wing parties have, the higher interest rates will be, still holds. Parliamentary regimes tend to be associated with higher interest rates in comparison with presidential or assembly-elected presidential systems. The latter include the United States covering the entire period from 1970 to 2009 as well as Greece, Portugal and Spain during the 1970's and early 1980's. This result thus needs to be interpreted with care.

In our second and third equation, we once again test for the size of the fiscal adjustment. A substantial improvement of the cyclically adjusted primary balance will lower the long-term interest rate and hence also debt service costs. Revenue based adjustments, although large in some cases, do not affect interest rates and yield spreads at all. On the other hand, expenditure based adjustments are found to be associated with lower rates. All other control variables are in line with our previous results. Finally, the negative effect of successful adjustments on interest rates can be attributed to changes in expenditure. Changes in revenue during successful adjustments do not seem to influence debt service costs.

Overall, our previous results are thus confirmed and seem to be robust. Our fiscal adjustment strategy variables were found to be significant in all equations. Additionally, we found evidence that political factors might be just as important as economic and fiscal indicators when determining interest rates and yield spreads.

Table 12: Fiscal Adjustment Strategies: Alternative fiscal, political and institutional factors [18]

Variables	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)
Short-term interest rate	0.01 (0.36)	0.18*** (5.95)	0.07* (1.96)	0.21*** (6.75)	0.02 (0.54)	0.18*** (6.20)	0.01 (0.17)	0.17*** (5.76)
GDP growth	0.26*** (5.35)	0.21*** (4.49)	0.25*** (5.47)	0.21*** (4.62)	0.27*** (6.06)	0.22*** (5.09)	0.28*** (6.25)	0.23*** (5.22)
Budget balance	-0.13*** (-3.86)	-0.19*** (-5.15)	-0.11*** (-3.32)	-0.15*** (-4.07)	-0.11*** (-3.59)	-0.17*** (-4.98)	-0.12*** (-3.76)	-0.18*** (-5.10)
Revenue	0.09*** (2.82)	0.12*** (3.56)	0.07** (2.51)	0.10*** (2.92)	0.08*** (2.83)	0.12*** (3.93)	0.08*** (2.97)	0.12*** (3.95)
Euro	-1.12*** (-3.69)	-1.31*** (-4.43)	-0.99*** (-3.62)	-1.22*** (-4.03)	-1.00*** (-3.59)	-1.23*** (-4.45)	-1.09*** (-3.97)	-1.31*** (-4.79)
Unemployment rate	0.19*** (4.26)	0.25*** (5.19)	0.20*** (4.84)	0.30*** (5.93)	0.20*** (4.96)	0.26*** (5.81)	0.19*** (4.78)	0.25*** (5.68)
Ideology	0.01** (2.20)	0.01*** (2.77)	0.00 (1.59)	0.01* (1.79)	0.01* (1.90)	0.01*** (2.62)	0.01** (2.34)	0.01*** (2.88)
Fractionalization	-0.93* (-1.86)	-0.92* (-1.66)	-1.00** (-2.23)	-1.01** (-1.90)	-0.98** (-2.16)	-0.99* (-1.93)	-0.84* (-1.84)	-0.94* (-1.82)
Regime type	3.56*** (8.88)	3.50*** (7.85)	2.61*** (3.45)	2.16** (2.47)	2.21*** (5.69)	2.21*** (5.51)	2.46*** (4.46)	2.12*** (3.37)
Share Δ Exp.	-0.58* (-1.71)	-0.63** (-1.70)						
Δ Adj. primary deficit			-0.15*** (-2.62)	-0.19*** (-3.02)				
Δ Deficit exp. based					-0.28** (-2.45)	-0.33*** (-2.66)		
Δ Deficit rev. based					0.01 (0.10)	-0.00 (-0.00)		
Δ Exp. successful adj.							0.29** (2.58)	0.35*** (2.85)
Δ Rev. failed adj.							0.10 (0.57)	-0.01 (-0.07)
Country Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	No	Yes	No	Yes	No	Yes	No
Trend Dummy	No	Yes	No	Yes	No	Yes	No	Yes
No. of observations	568	568	541	541	561	561	561	561
R2	0.680	0.428	0.689	0.381	0.700	0.420	0.699	0.400
F-statistic	26.17	36.49	25.83	28.48	27.60	31.90	27.57	29.34

t-values in parentheses
dependent variable: real interest rate in equations (a), real yield spread in equations (b)
*** p<0.01, ** p<0.05, * p<0.1

5.3. Alternative dependent variable

In section 4 we calculated the real interest rate by taking the yield on long-term government bonds and subtracting the annual inflation rate as measured by the consumer price index. We ran alternative calculations by using the GDP deflator as calculated by the OECD instead of the consumer price index. The results for the adjustment strategy variables as well as for the various control variables were very similar. A large fiscal adjustment significantly reduces the

[18] Note: The OECD Economic Outlook database does not provide complete data for all fiscal indicators and for all countries since 1970. Hence, the number of observations varies depending on the fiscal variable or fiscal adjustment strategy variable used.

long-term interest rates. Substantial expenditure cuts are important to reduce debt service costs. Tax increases of similar magnitude do not lead to lower interest rates. Economic growth and structural problems as expressed by the unemployment rate both raise real government bond yields. An increase in government debt or a high fiscal burden has a similar effect. A large share of left and right wing politicians also pushes up interest rates. Federalism on the other hand does not have a significant effect. These results are not surprising given the fact that the GDP deflator and the consumer price index are highly correlated with each other. The corresponding correlation coefficient is 0.946.

5.4. Distribution of residuals

A potential problem could arise if our residuals are not normally distributed. In that case, at least one explanatory variable or the dependent variable may be wrongly specified. We used the Shapiro-Wilk test which tests the null hypothesis that a given sample is normally distributed. While the Shapiro Wilk W-statistic is often close to one, the p-value leads us to reject the null hypothesis at least in some estimations. However, the qualitative nature of our results remains unchanged, even when the null hypothesis can be rejected. The p-value is greater than 0.05 when we use a trend variable instead of year dummies. We can thus no longer reject the null hypothesis that the data are from a normally distributed population. In this case, our results remain stable.

6. Conclusions

This paper focuses on periods of fiscal adjustments in 21 OECD countries from 1970 to 2009. It shows that historically, governments have employed different fiscal adjustment strategies when confronted with high deficits and rising debt. Accordingly, these measures not only differ in duration, size and composition, but also in their success. Controlling for various economic, fiscal and political factors, we find that the size and the composition of a fiscal adjustment significantly affect long-term interest rates as well as yield spreads. Large adjustments and those that mainly depend on expenditure cuts lead to substantially lower interest rates. On the other hand, a budget consolidation that predominantly relied on tax increases, or on modest and gradual measures – even it was successful and led to lower deficits and debt levels – did not have an influence on interest rates. These results are significant and are robust to a variety of specifications and alternative models. We thus conclude that financial markets only seem to value strict and decisive measures. Therefore, expenditure cuts are a clear sign that the government's pledge to cut the deficit is credible. Since financial markets participants

cannot foresee whether the adjustment will be successful and carried out as announced, they will continue to demand higher yields unless the government sends a clear signal by cutting expenditure.

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Appendix A: Data and Sources		
Variable	*Description*	*Sources*
Real interest rate	Yield on long-term government bonds (10 year) minus inflation as measured by the consumer price index in percent	OECD Economic Outlook
Real interest spread	Differences in real interest rates between the country observed and Germany in percentage points	OECD Economic Outlook
Monetary policy	Nominal short-term interest rates (3 month interest rate) set by central banks in percent	OECD Economic Outlook
Real GDP Growth	Annual growth in real gross domestic product in percent	OECD Economic Outlook
Public Debt	Gross Financial Liabilities as a Percentage of Nominal GDP	OECD Economic Outlook
Revenue	Total general government tax and non-tax receipts as a percentage of Nominal GDP	OECD Economic Outlook
Expenditure	Total general government expenditure as a percentage of GDP	OECD Economic Outlook
Euro	Dummy variable, taking the value of 1 if the country had adopted the Euro in a given year	European Central Bank
Banking crisis	Dummy variable, taking the value of 1 if the country was facing a national crisis in a given year	Reinhart und Rogoff (2009)
Primary balance	General government balance as a percentage of potential GDP adjusted for the cycle and for one-offs and excluding net interest payments	OECD Economic Outlook
Budget balance	General government balance as a percentage of nominal GDP including one-offs	OECD Economic Outlook
Cyclically adjusted balance	General government balance as a percentage of potential GDP adjusted for the cycle and one-offs	OECD Economic Outlook

Ideology	Right and left party cabinet portfolios as a percentage of total cabinet posts, weighted by the days the government was in office in a given year	Armingeon et al. (2009)
Federalism	Degree of federalism taking the value 0 if the system of a given country is not federal, 1 if there is weak federalism and 2 if there is strong federalism	Huber et al. (2004)
Unemployment rate	Harmonized unemployment rate as a percentage of the civilian labor force	OECD Economic Outlook
Fractionalization	The probability that two randomly chosen deputies from among the government parties will be of different parties	Beck et al. (2001), Keefer (2007)
Regime type	Captures whether countries are presidential, assembly-elected presidential or parliamentary	Beck et al. (2001), Keefer (2007)

Appendix B: Descriptive Statistics

Variable	*Mean*	*Std. Dev.*	*Minimum*	*Maximum*
Real interest rate	2.797	3.406	-19.146	11.185
Real interest spread	-0.835	3.070	-21.945	8.405
Monetary policy	7.587	4.721	0.029	24.900
Real GDP growth	2.675	2.564	-7.470	11.490
Public Debt	59.969	29.884	4.100	189.300
Revenue	41.382	8.677	22.200	64.800
Expenditure	43.764	9.230	19.300	70.900
Euro	0.155	0.362	0.000	1.000
Banking crisis	0.080	0.271	0.000	1.000
Primary balance	-0.088	3.030	-11.600	9.530
Budget balance	-2.560	3.945	-15.960	7.812
Cyclically adjusted balance	-0.025	2.812	-9.160	8.030
Ideology	72.640	31.729	0.000	100.000
Federalism	0.517	0.820	0.000	2.000
Unemployment rate	6.126	3.539	0.000	19.500
Fractionalization	0.282	0.277	0.000	0.830
Regime type	1.835	0.533	0.000	2.000

Appendix C: Correlations

Correlation coefficients (21 countries, 1970-2009)

	Real interest rate	Spread	Monetary policy	Real GDP growth	Debt	Δ Debt	Revenue	Expenditure	Euro	Banking crisis	Δ Adj. deficit	Federalism	Ideology	Unemployment	Budget balance	Fractionalization	Regime type
Real interest rate	1.000																
Spread	0.865	1.000															
Monetary policy	0.314	0.127	1.000														
Real GDP growth	0.060	-0.015	-0.154	1.000													
Debt	0.115	0.117	-0.174	-0.119	1.000												
Δ Debt	0.152	0.164	0.182	-0.440	0.122	1.000											
Revenue	0.202	0.222	-0.054	-0.177	0.118	-0.080	1.000										
Expenditure	0.298	0.292	0.087	-0.304	0.339	0.162	0.899	1.000									
Euro	-0.349	-0.179	-0.435	0.076	0.060	-0.224	0.084	-0.016	1.000								
Banking crisis	0.162	0.101	0.201	-0.220	-0.002	0.248	-0.021	0.057	-0.158	1.000							
Δ Adj. deficit	0.063	0.008	0.069	0.072	0.110	-0.047	0.073	0.075	-0.103	-0.079	1.000						
Federalism	-0.083	-0.055	-0.173	-0.064	-0.024	-0.030	-0.271	-0.275	-0.046	-0.018	-0.017	1.000					
Ideology	0.110	0.113	-0.002	0.032	-0.145	-0.063	-0.005	-0.092	0.000	0.066	-0.004	-0.216	1.000				
Unemployment	0.329	0.304	0.217	-0.003	0.270	0.112	0.031	0.190	-0.020	0.100	0.116	-0.087	-0.076	1.000			
Budget balance	-0.253	-0.197	-0.314	0.291	-0.486	-0.562	0.161	-0.270	0.227	-0.175	0.007	0.002	0.180	-0.378	1.000		
Fractionalization	0.025	0.035	-0.148	-0.117	0.064	0.012	0.431	0.382	0.076	-0.035	-0.004	-0.042	-0.174	-0.115	0.085	1.000	
Regime type	0.062	0.076	0.001	-0.047	0.065	0.003	0.336	0.316	0.115	-0.124	0.007	-0.440	0.090	0.078	0.030	0.250	1.000

Appendix D: Tests for stationarity

	Fisher Test for unbalanced panels	
	H0: Unit root, non-stationarity	
Variable	Chi2	Prob > Chi2
Real Interest Rate	62.27**	0.0227
Real Yield Spread	89.44***	0.0000
Revenue (% of GDP)	63.48**	0.0177
Expenditure (% of GDP)	55.38*	0.0809
Gross Debt (% of GDP)	26.11	0.9740
Real GDP Growth	243.51***	0.0000
Monetary Policy	32.99	0.8388

Appendix E: Results for first stage regressions and tests for IV regressions

Variables	**(1a)**	**(2a)**	**(3a)**	**(4a)**
First stage regressions				
Deficit	0.01 (0.68)	0.25*** (3.46)	0.16*** (2.81)	0.01 (1.14)
Debt	0.00*** (3.34)	0.03*** (5.41)	0.02*** (3.77)	0.00*** (2.65)
Summary results				
Shea partial R2	0.022	0.077	0.045	0.016
F-statistic	5.90	21.77	11.82	4.36
p-value	0.003	0.000	0.000	0.013
Anderson's CC test	12.52	43.65	24.59	9.30
p-value	0.003	0.000	0.000	0.010
Sargan statistic	9.71	8.08	5.98	8.37
Sargan p-value	0.002	0.005	0.015	0.004
	IV (2SLS)	**IV (2SLS)**	**IV (2SLS)**	**IV (2SLS)**

t-values in parentheses
*** p<0.01, ** p<0.05, * p<0.1