

How to cut debt?

SUMMARY

This paper assesses the determinants of the duration of debt reduction episodes in a large sample of countries over the last three decades using a survival model. Results show that increases in the primary balances are the main source of debt reduction. Expenditure-based fiscal adjustments are key for reducing the length of debt consolidation spells, including in the aftermath of financial crises. Political fragmentation and the proximity of elections make debt sustainability more difficult to achieve, while structural reforms that help spur growth decrease the duration of debt reduction. In contrast to previous findings, however, we show that when adjustment needs are large – as in many advanced economies today – fiscal consolidations that rely also on revenue-enhancing measures are more likely to accelerate debt reduction. We label it as the ‘Rebalancing Adjustment Effect’. This result is particularly strong when countries experience a financial crisis.

— Emanuele Baldacci, Sanjeev Gupta and Carlos Mulas-Granados

Reassessing the fiscal mix for successful debt reduction

Emanuele Baldacci, Sanjeev Gupta and Carlos Mulas-Granados

Istat-Italian Statistical Institute; Fiscal Affairs Department of the IMF; Complutense University, IDEAS Foundation in Madrid

1. INTRODUCTION

The recent global financial crisis severely harmed public finances of many countries and raised their rollover risks. Much of the deterioration in fiscal positions of these countries is traceable to revenue losses associated with sharp declines in GDP. The adoption of countercyclical stimulus measures in response to the crisis explains only a small part of fiscal worsening. As stimulus measures have started to be unwound, the crisis has left a legacy of high public debts¹ that are expected to continue rising in the near future, in particular in advanced economies due to spillover effects (International Monetary Fund, 2010a, 2010b).

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¹ Throughout the paper, public debt indicates general government gross debt when available, otherwise central governments gross debt. While net debt would be a better indicator of fiscal solvency, data availability limits its use in cross-country analyses (Baunsgaard and Shin, 2011). We also use public debt and debt interchangeably.

However, lowering public debt will not be easy because of the large size of consolidation needs estimated for many countries and the uncertain global outlook (IMF, 2010b). Although the required adjustment to reduce public debt to pre-crisis levels² is not historically unprecedented, as some advanced and emerging economies have successfully reduced debt from high levels in the past (IMF, 2009), this time around the conditions facing the countries are more difficult. The fiscal adjustment will have to take place in a post-crisis environment of extended private sector deleveraging and uncertainty about economic prospects. This implies that debt reduction may need to be achieved over a longer time span compared to the past.

There are many reasons why countries should be concerned about long-lasting consolidations. First, a slower pace of fiscal consolidation can further weaken the confidence and cause spreads to widen, thus making public debt unsustainable.³ Second, countries need to take credible policy actions to avoid the prospect of default. This is essential to facilitate the recovery of economic activity in the private sector. Third, a delayed fiscal consolidation may not be seen as fair across generations. Finally, it is not easy to gather political support for long lasting fiscal consolidations. Thus, identifying policies to help shorten the length of the transition to debt sustainability is a key policy question for most countries.

There are a limited number of studies that directly tackle the issue of long-term debt consolidation in a systematic manner. The literature on successful fiscal consolidations stemming from seminal papers by Giavazzi and Pagano (1990) and Alesina and Perotti (1995) focuses on the size and composition of fiscal adjustment episodes and their likelihood of success in the short term. But these studies did not address the question of how fiscal adjustment contributes to sustainable debt reduction in the medium term. A related strand of literature focuses on the impact of fiscal policy on growth, both in the short and the medium term (e.g. the size of fiscal multipliers, expansionary fiscal contractions models). But a comprehensive analysis of the factors that explain the time it takes to reduce debt to sustainable levels and to exit from the debt reduction process is lacking.

This paper assesses the determinants of the duration of debt reduction episodes in a large sample of advanced and emerging economies over the last three decades. It focuses on the fiscal adjustment mix that is more likely to shorten the duration of the required debt consolidation. The paper adds to the existing literature in four ways. First, it uses survival analysis to identify determinants of public debt reduction instead of relying on an ad hoc definition of an adjustment episode. Second, the

² Pre-crisis median debt levels were about 60% of GDP in advanced countries and 40% of GDP in emerging economies. These levels are not necessarily consistent with fiscal sustainability as debt dynamics depends on the flow of future primary fiscal balances and the interest rate-growth differential (Baldacci *et al.*, 2011b). Nonetheless, Baldacci *et al.* (2011b) find similar thresholds for public debt to GDP that signals a high risk of fiscal distress in both advanced and emerging economies.

³ Afonso and Strauch (2004) and Ardagna (2009) show that interest rates of long-term government bonds and stock market prices worsen considerably in periods of fiscal expansion and improve during large fiscal consolidations. Fiscal policy can also affect corporate bond spreads (Durbin and Ng, 2005; Cavallo and Valenzuela, 2007).

analysis focuses on the channels through which the size of fiscal adjustment and its composition can affect the likelihood of debt reduction. Third, it studies the importance of political economy variables in explaining the duration of debt consolidations, given that debt reductions are politically controversial and governments face electoral constraints when designing their debt reduction strategies. Finally, it analyses whether the duration of debt consolidation after financial crises is different from other episodes.

The paper finds that fiscal adjustment (i.e., an increase in the primary balance) is the key to debt reduction, although the contribution of the interest rate-growth differential to lowering debt is not negligible, particularly for emerging economies that experienced high-growth spells. The results also confirm that, in general, expenditure-based fiscal adjustments tend to be more successful in reducing the duration of debt consolidation episodes, including when public debt accumulation is the result of a financial crisis. Expenditure composition is key to sustained deficit reductions that reduce solvency risks: fiscal adjustments that reform entitlements and increase the share of spending for capital projects are more likely to succeed as shown in earlier studies (for example, Guichard *et al.*, 2007). They lead to higher primary balances but also affect growth positively, thereby contributing to a reduction in the interest rate-growth differential component of debt dynamics. Political fragmentation, the proximity of elections and weak institutions⁴ make the adjustment process more difficult. Structural reforms that help spur growth significantly increase the likelihood of debt reduction.

In contrast to previous findings, however, we also show that when adjustment needs are large – as in many advanced economies today – revenues also matter. In these circumstances, fiscal adjustments that rely on revenue-enhancing measures are more likely to accelerate debt consolidation than expenditure-based cuts only. We label it as the ‘Rebalancing Adjustment Effect’. This result holds in general, but it is stronger when debt consolidation follows financial crises that dampen potential output and increase uncertainty. This study underscores the importance of credible fiscal measures to reduce sovereign credit risk perception by financial markets. The fall-out from the banking crisis makes the challenge of regaining fiscal sustainability more daunting.

The rest of the paper is organized as follows. Sections 2 and 3 respectively summarize the literature and propose a simple framework to assess determinants of public debt reduction. Section 4 introduces the survival analysis methodology used in the paper. Section 5 presents the data and highlights some stylized results based on past debt reduction episodes. Econometric results based on a parametric duration model are presented in Section 6 and the robustness of these results is reported in the following section. The final section draws the policy implications from these findings.

⁴ See Iara and Wolff (2010) for a discussion of the effect on sovereign bond yields of fiscal rules and other fiscal institutions.

2. LITERATURE REVIEW

The literature on public debt reduction can be grouped into three broad strands: (i) studies that describe episodes of debt accumulation and its sources; (ii) studies that assess the economic implications of high debt (on economic growth and interest rates); and (iii) studies that focus on debt reduction episodes, fiscal adjustment and its impact on the economy. Each strand of literature is relevant for understanding the implications of the current episode of large increases in public debt in many advanced and emerging economies.

2.1. Debt accumulation and its sources

There are several papers that explore periods of sharp debt accumulation in history.⁵ They show that episodes of build-up in sovereign liabilities of the magnitude observed in recent years have occurred in the past, but mostly as a result of major military events. Abbas *et al.* (2011) have compiled historical series of public debt to GDP data for 174 countries during 1880–2009. They show that for advanced economies, large debt spikes occurred after the two World Wars and that since the mid-1970s public debt ratios were trending up.⁶ Typically, debt increases have originated from a combination of factors including the deterioration in the primary fiscal balance, positive interest rate-growth differentials over sustained periods, and sharp changes in asset and liabilities valuation, including those arising from exchange rate depreciations.

A related group of studies have focused on public debt levels arising from financial crises. They show that banking crises have had large adverse fiscal consequences in both advanced and emerging market economies.⁷ In particular, Rogoff and Reinhart (2009) found that government debt on average rose by 86% in the three years following a banking crisis in a sample of historical episodes. Baldacci *et al.* (2009) report an increase in the public debt-to-GDP ratio of about 40 percentage points in a sample of banking crisis episodes. Public debt is also projected to increase by almost 40 percentage points of GDP between 2007 (the pre-crisis year) and 2015 for the largest advanced economies (International Monetary Fund, 2009), reflecting lower projected potential output and other crisis-related effects on long-term interest rates.

⁵ See Calomiris and Gorton (1991) and Gorton (1988) on pre-World War II banking panics; Reinhart and Rogoff (2008a, 2008b) for an analysis of all post-World War II banking crises in advanced economies; and Bordo *et al.* (2001) for an analysis that encompasses both advanced and emerging market economies.

⁶ Debt ratios were more volatile in emerging economies, with the largest spike occurring in Latin America in the early 1980s and in 1990s in Asia. The average (weighted by GDP levels adjusted by purchasing power parities) ratio of public debt to GDP during the 1980s and 1990s was 55% in advanced countries and 44% in emerging economies. However, the standard deviation of the ratio was slightly higher in emerging economies (24.4% of GDP) than in advanced countries (about 20% of GDP).

⁷ In the last two years, most of the literature on debt accumulation is linked to the eurozone debt crisis. Of particular relevance are the studies that make projections on debt developments (Cecchetti *et al.*, 2010) and those which study the type of debt increases that the crisis has brought about (De Broeck and Guscina, 2011).

2.2. High debt and its impact

The negative economic effects of high public debt levels have been documented in a series of recent studies. According to this strand of the literature, there are several channels through which high debt could adversely impact medium- and long-run growth: high public debt can adversely affect capital accumulation and growth via higher long-term interest rates (Gale and Orszag, 2003; Baldacci and Kumar, 2010), higher future distortionary taxation (Barro, 1979; Dotsey, 1994), inflation (Sargent and Wallace, 1981; Barro, 1995; Cochrane, 2010), financial instability, and greater uncertainty about prospects and policies (Das *et al.*, 2010).

Reinhart and Rogoff (2009, 2010) provide an estimate of the size of the economic damage generated by high public debt levels. They use simple correlation analysis and find that the difference in the median growth rate of GDP between low-debt countries (below 30% of GDP) and high-debt ones (above 90% of GDP) is 2.6 percentage points. Kumar and Woo (2010) use a regression-based model to show that a 10 percentage point increase in the initial debt-to-GDP ratio is associated with a slowdown in annual real per capita GDP growth of around 0.2 percentage points per year, with the impact being somewhat smaller in advanced economies.

2.3. Fiscal adjustment and debt reduction

Reducing debt from high levels can therefore be good for growth. But what is the best way to reduce public debt? Fiscal contractions tend to harm growth in the short run, if fiscal multipliers are positive. However, there is uncertainty about the size (and even the sign) of multipliers when the economies are open, when the exchange rate is flexible, when debt is high and when the sample comprises developing countries (Iltzsetki *et al.*, 2011). There are also circumstances under which fiscal contractions can be expansionary. The literature that developed in the 1990s on expansionary fiscal adjustments labelled episodes of deficit reduction as successful or unsuccessful depending on whether they achieved economic growth and/or a short-term reduction in the debt/GDP ratio in the 3 years following the end of the fiscal adjustment episode (Alesina and Perotti, 1995, 1996a, 1996b; Alesina *et al.*, 1998). On the basis of these studies, other papers delved into the sources of successful fiscal consolidation. Four factors emerged:⁸ size of the fiscal consolidation; composition of the adjustment; accompanying policies; and political economy and institutional factors.

In these studies, the fiscal policy mix has been found to be a key ingredient of successful fiscal adjustments. Fiscal adjustments that relied on expenditure cuts (in particular lower public sector wages and untargeted transfers) were longer lasting and had a higher likelihood of success both in advanced countries (Alesina and Ardagna, 2009) and in

⁸ See for example: Von Hagen *et al.* (2001); Gupta *et al.* (2005); Mulas-Granados (2006); Alesina and Ardagna (2009); IMF (2010c); OECD (2010).

emerging market economies (Gupta *et al.*, 2005). Fiscal consolidations that protected capital outlays also had a beneficial impact on sovereign credit premia by strengthening market confidence that governments can ensure fiscal solvency (Baldacci *et al.*, 2011a).⁹

There are a few papers that have focused on the causal relationship between the characteristics of fiscal adjustments (in terms of size and composition) and the likelihood of debt reduction over the medium term. Empirical studies based on past debt reduction attempts have found that lowering high public debt to sustainable levels requires large improvements in the structural primary balance IMF (2010c). This is a necessary condition for fiscal solvency along with a favourable projected dynamic of the interest rate-growth differential.¹⁰ In advanced economies, large fiscal adjustments have been a key driver of debt reduction while in emerging economies, a negative interest rate-growth differential has helped reduce public debt.¹¹

However, none of these studies has focused on the interplay between the size and composition of fiscal adjustments and their effect on achieving a sustainable debt level in the medium term. Also, there is no study (to the best of our knowledge) that analyses the challenge of regaining debt sustainability after banking crises.¹² As noted earlier, this is one important contribution of this study.

The starting point of our study is that when accumulated debt is large and the economic environment extremely uncertain as today, an excessive reliance on expenditure-based fiscal adjustment may generate undesirable effects. These include (i) the implementation of across-the-board cuts that may penalize the efficient delivery of government services; (ii) the adoption of exceptional measures – such as wage freezes – that could lead to short-term savings, but are reversed over the medium term; and (iii) compression of less visible but important budget items, such as allocation for operation and maintenance which could eventually harm growth.¹³ The fiscal mix may therefore have non-linear effects on the probability of successfully reducing debt.

Accompanying policies also play an important role for sustainable debt reduction. In particular, reforms to spur economic growth, accommodative monetary

⁹ Akitoby and Stratmann (2008) also show that financial markets react to the composition of the budget. In their study, revenue-based adjustments lower government spreads more than expenditure-based ones, and debt financed spending increases sovereign risks in a sample of emerging market economies.

¹⁰ In a seminal paper, Giavazzi *et al.* (2000) found that large improvements in the fiscal position help signal a regime change and can spur economic growth.

¹¹ During the largest fiscal consolidation episodes in advanced economies since the mid-1980s, the median change in the primary balance was close to 7% of GDP and the median duration of the adjustment was 7 years. In emerging economies, the median adjustment was above 8% of GDP, but the median duration of the large consolidation episode was only 3 years IMF (2010c).

¹² Claessens *et al.* (2008) studied recessions caused by credit contraction, those associated with house price declines, and episodes of equity price declines. They find evidence that recessions associated with credit crunches and house price busts tend to be deeper and longer than other recessions.

¹³ These facts have been documented in an analysis of past debt reduction episodes in Mauro (2011). Front-loaded fiscal consolidations, including when based mostly on expenditure savings do not seem to have a higher likelihood of success. Studies on duration of adjustment episodes point to adjustment fatigue, but front-loaded adjustments run the risk of being discontinued over the medium term, jeopardizing short-term results. See International Monetary Fund (2010c) for a review of the lessons from the literature on the phasing of fiscal adjustment.

conditions, and exchange rate devaluations are important ingredients of episodes of debt reduction (IMF, 2010a, 2010b). Political economy constraints may also limit the implementation of needed reforms to reduce fiscal deficits. Studies have shown that the likelihood of debt consolidation could be lowered by institutional weaknesses, lack of political cohesion, and government fragmentation (for example, Person and Tabellini, 1999 and Buti and van den Noord, 2003).

Political constraints may also lead to a weaker adjustment mix. For example, fiscal adjustment plans designed by G-20 countries rely mostly on expenditure cuts, but the underlying measures are not well specified in many cases (Bornhorst *et al.*, 2010). Harnessing sufficient political consensus to reform entitlements in advanced countries and untargted subsidies in emerging economies is also difficult. An assessment of past fiscal adjustment plans shows that in many cases implementation of planned spending cuts was problematic and had to be reversed (IMF, 2011). This could jeopardize the initial fiscal objectives and undermine the sustainability of the debt reduction strategy.¹⁴

3. PROPOSED FRAMEWORK

The paper uses a simple framework to assess successful debt reduction. To analyse the components of debt declines, we follow Escolano (2010):

$$d_t - d_{t-1} = \frac{r_t - g_t}{1 + g_t} d_{t-1} - pb_t + sfa_t \quad (1)$$

The change in the debt-to-GDP ratio ($d_t - d_{t-1}$) is the sum of three terms: (i) the product of the lagged debt ratio and the differential between the effective real interest rate on debt (r_t) and the real GDP growth rate (g_t); (ii) the primary balance (pb_t); and (iii) a residual stock-flow adjustment term (sfa_t) capturing valuation effects and ‘below-the-line’ fiscal operations, including errors and omissions (Abbas *et al.*, 2011).

The probability of successfully reducing debt to the desired target in turn depends on (i) the size of the primary balance that can be sustained during the period; and (ii) the projected growth–interest rate differential. Debt sustainability conditions can be formally derived from (1) assuming no stock-flow adjustment and defining growth and interest rates in constant terms as follows:

$$d_{t+1} = \frac{1 + r}{1 + g} d_t - pb_t \quad (2)$$

Assuming a fiscal reaction function as in Bohn (1998), with X_t indicating a set of control variables that affect the primary balance and adding a constant and an error term, we have:

¹⁴ Results show that the public opinion’s support is critical for the execution of fiscal adjustment plans.

$$pb_{i,t} = \alpha_i + \rho * d_{i,t-1} + \sum_{j=1}^J \beta_j X_{j,i,t} + \varepsilon_{i,t} \quad (3)$$

We follow Alesina and Ardagna (2009) and assume that the composition of expenditure and revenue measures can influence the sustainability of large fiscal consolidations during the adjustment process. Adjustments based on structural fiscal reforms are likely to generate larger savings and be more durable than fiscal deficit reductions relying on across-the-board spending cuts. At the same time, the fiscal mix can also affect the interest rate and growth channels through

- risk premia on government debt;
- efficiency-oriented fiscal adjustment packages that minimize the adverse effects of fiscal consolidation on growth; and
- realistic consolidation plans which reassure the private sector and have positive effects on growth.

Replacing Equation (3) in the debt dynamic equation above and expressing the equation in first differences of the debt ratio we obtain:

$$\Delta d_{t+1} = \left(\frac{r-g}{1+g} - \rho \right) d_t - x_t \quad (4)$$

which forms the basis of the empirical analysis in the next section. Changes in debt are the result of (i) initial debt; (ii) interest rate; (iii) growth; and (iv) other factors affecting the primary balance, including the fiscal mix and political economy variables.

4. METHODOLOGY

We define the length of a successful debt consolidation spell on the basis of the time interval between periods in which the ratio of debt to GDP declined from a high level to reach the prudent threshold. This threshold is set at the level of 60% of GDP for advanced economies and 40% of GDP for emerging economies as these were the values of the median debt-to-GDP ratio before the crisis.¹⁵ The debt reduction episode ends (fails) when the debt ratio reaches the threshold or when the debt-to-GDP ratio grows again. A survival model is used to estimate the likelihood of successfully reducing debt to the target level.

Survival models have been mainly used by labour economists¹⁶ to assess the duration of employment and unemployment spells and the determinants of labour

¹⁵ We test the robustness of the results to alternative thresholds in Section 5.

¹⁶ Duration models have been also used in the field of industrial organization to analyse, for example, the life duration of multinational subsidiaries in the UK manufacturing industry (McCloughan and Stone, 1998), or to analyse investment decisions (Licandro *et al.*, 1999).

market entry and exit rates.¹⁷ These models have been applied to the analysis of fiscal consolidation spells by Von Hagen *et al.* (2001), Gupta *et al.* (2005), and Maroto and Mulas-Granados (2008).

The main aim of this approach is to model the duration of debt consolidation episodes. These episodes can be long or short and the probability of ending the process depends on many factors, both economic and political. It would be normal to expect some consolidation fatigue and the probability of ending the adjustment increasing with time. Survival models are ideal for explaining the influence that time and other parameters have on the probability of reaching the optimal debt-to-GDP target (see Box 1 for a more technical explanation of duration models).

Box 1. Survival technique

If we define T as the discrete random variable that measures the time span between the periods in which debt is below the prudent thresholds and periods in which it is above, the observations in the sample consist of a series of data (t_1, t_2, \dots, t_n) which correspond to each observed durations of debt consolidation episode in the sample. The following hypothetical example explains how the data are constructed.

Country/Year	Debt/GDP	Failure	Duration	Success
Country A-2001	70.5%	1	0	
Country A-2002	70.7%	1	0	
Country A-2003	70.3%	0	1	0
Country A-2004	69.6%	0	2	0
Country A-2005	67.4%	0	3	0
Country A-2006	65.2%	0	4	0
Country A-2007	70.7%	1	0	
Country B-2001	68.3%	1	0	0
Country B-2002	65.7%	0	1	0
Country B-2003	64.2%	0	2	0
Country B-2004	63.1%	0	3	0
Country B-2005	60.4%	0	4	0
Country B-2006	59.5%	0	5	0
Country B-2007	58.6%	1	0	

The probability distribution of the duration variable can be specified by the cumulative distribution function:

$$F(t) = Pr(T < t) \quad (5)$$

¹⁷ See Kiefer (1988) for a literature review. See also Sosvilla-Rivero and Maroto (2001) for a detailed study of the duration of exchange rates regimes in the European Monetary System (EMS). This section draws on their study.

which indicates the probability that the random variable T is smaller than a certain value t . The survivor function can be defined as $S(t) = Pr(T \geq t) = 1 - F(t)$ and the resulting hazard function is $h(t) = Pr(T = t / T \geq t)$. Survival and hazard functions are linked through the following expression:

$$S(t) = \prod_{s=1|t} (1 - h(s)) \quad (6)$$

Non-parametric analysis can be used to estimate the unconditional hazard function which registers the observations for which there is a change, that is, the relative frequency of observations with $T = t$. The hazard function is calculated as follows:

$$\hat{h}(t) = \frac{d_t}{n_t} \quad (7)$$

where d_t represents the number of failures registered in t , and n_t is the surviving population in t , before the change takes place. From the hazard function, it is possible to obtain the cumulative hazard function given by $\hat{H}(s) = \sum_{s=1}^t \hat{h}(s)$. The

Kaplan-Meier survivor function for duration t is calculated as the product of one minus the existing risk until period t :

$$\hat{S}(t) = \prod_{j|t_j \leq t} \left(\frac{n_j - d_j}{n_j} \right) \quad (8)$$

The non-parametric analysis is very limited because it does not take into account other variables that can influence the probability of ending a period of fiscal consolidation. In order to address the issue of other variables determining this probability, we also include in this paper a section dedicated to parametric analysis. In the literature, the model that has usually been used to characterize the hazard function is the *model of proportional hazard*, which assumes that the hazard function can be split as follows: $h(t, X) = h_0(t) * g(X)$ where $h_0(t)$ is the baseline hazard function that captures the dependency of data to duration, and $g(X)$ is a function of individual variables. In this proportional specification, regressors intervene re-escalating the conditional probability of abandoning the period of debt consolidation, not its own duration.

A better estimation can be obtained by imposing one specific parametric form to the function $h_0(t)$. A commonly used general specification used the *Weibull* distribution for the baseline hazard: $h_0(t) = pt^{p-1}$, where p is a parameter that has to be estimated. When $p = 1$, this model is equal to the *exponential model*, where there is no dependency on duration. When the parameter $p > 1$, there is a positive dependency on duration, and a negative dependency when $p < 1$. Therefore, by estimating p , it is possible to test the hypothesis of duration dependency of fiscal consolidations.

5. DATA AND STYLIZED FACTS

5.1. Data

To assess the determinants of successful public debt reduction, we use a dataset spanning over the last three decades for a large sample of advanced and emerging economies. We include (i) fiscal and other macroeconomic variables from the IMF's World Economic Outlook database; (ii) political economy variables capturing government strength and election cycles drawn from Keefer (2010);¹⁸ (iii) an expanded version of the index of structural reforms that boost growth based on Lora (2001);¹⁹ and (iv) data on budget composition from the IMF's Government Finance Statistics database. We also include a variable that captures the occurrence of banking crises using the data compiled by Laeven and Valencia (2008).^{20,21}

5.2. Stylized facts

In this section, we present a series of stylized facts based on a sample of debt reduction episodes. The following section will use survival analysis to assess the determinants of debt reduction.

During 1980–2010, there were 120 episodes of public debt reduction defined as periods of at least two consecutive years of continuous reduction in the ratio of public debt to GDP. We excluded countries that benefitted from debt relief.²² Thus, the sample covers 104 episodes of debt consolidations, with a minimum length of 2 years and a maximum duration of 13 years. Figure 1 shows that half of these episodes achieved a reduction in debt to GDP of at least 20 percentage points (this is the difference between the debt ratio at the end of the consolidation episode

¹⁸ The author created a Database of Political Institutions (DPI) which comprises information on a range of political economy variables for a large sample of countries during 1975–2009, based on four sources: Europa World Online-2010; Political Handbook of the World-2010 (printed and online editions); Parline Database; and IFES Election Guide. In cases where data were not available on a comparative basis, the authors used national sources.

¹⁹ The Index of Structural Reforms was originally developed for Latin American countries. We have extended it to the rest of the countries in our dataset using the methodology in Lora (2001). This index is an average of four sub-indexes, namely: trade policy reform; financial policy reform; labour market reform, and privatization reform. We excluded a fifth area of reform initially considered by Lora (e.g., tax policy reform) because we control directly for tax changes in our empirical analysis.

²⁰ Episodes of consolidation in the following countries are included: Albania, Argentina, Armenia, Australia, Azerbaijan, Belarus, Benin, Bolivia, Bosnia and Herzegovina, Brazil, Bulgaria, Cameroon, Canada, Cape Verde, Central African Republic, Chad, Chile, China, Colombia, Costa Rica, Croatia, Czech Republic, Côte d'Ivoire, Dominican Republic, Ecuador, Egypt, El Salvador, Equatorial Guinea, Eritrea, Finland, France, Germany, Guinea, Guyana, Haiti, Hungary, India, Indonesia, Jamaica, Japan, Jordan, Kenya, Korea, Kuwait, Kyrgyz Republic, Lithuania, FYR of Macedonia, Malaysia, Mexico, Morocco, Nepal, Nicaragua, Norway, Panama, Paraguay, Peru, Philippines, Poland, Russia, Saudi Arabia, Senegal, Slovak Republic, Slovenia, South Africa, Swaziland, Sweden, Tunisia, Turkey, United Kingdom, United States, Uruguay, Venezuela, and Yemen.

²¹ For the data on exchange rate regime, included in Table 12, we use the Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) which is a database that tracks exchange and trade arrangements for all 187 IMF member countries since 1950 (see: www.imfareaer.org)

²² Including one-year debt reduction episodes would increase the sample somewhat but not change the results presented in the paper. One-year debt reduction episodes are, however, less likely to be informative about medium-term consolidation.

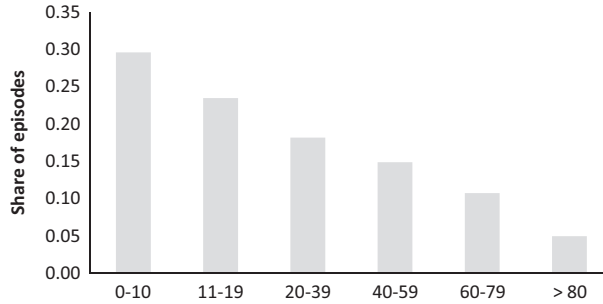


Figure 1. Distribution of public debt reduction episodes by debt consolidation size

Source: Authors' calculations.

and the initial debt level). In more than a third of cases, public debt reduction was higher than 40 percentage points of GDP.

The geographical and temporal dispersion of the adjustment episodes shows that the bulk of debt reductions took place in the late 1980s and first half of the 1990s and that fiscal consolidation was more frequent in Africa and Europe (around 60% of the episodes were concentrated in these regions; see Figure 2). The quickest and more aggressive debt reductions were experienced in countries that only needed two years to reach the sustainability thresholds. Europe had the highest concentration of debt reduction episodes during the 1990s in the run-up to the monetary union, but they were small when compared with other regions. Typically countries with high initial debt levels were forced into a faster debt consolidation (this was specially the case in Africa – with an average duration of 5.7 years – see Table 1). In relation to the composition of the fiscal adjustments that led to debt reduction, Europe was also the one that relied more heavily on spending cuts, and therefore scored higher in the Quality index. As regards the components of debt reduction, about half of the decline stemmed from stronger primary balances (particularly in

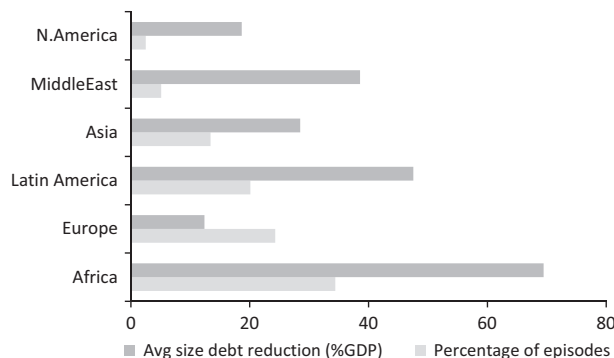


Figure 2. Distribution of public debt reduction episodes by size and region

Table 1. Average value of explanatory variables, by region

Region	Initial Debt ($t-1$)	Episode Duration	Size Debt Cut		Change Spending	Change Revenues	Av. Change Growth	Av. Change Interest	Av. Change Debt	Change Primary BBal	Quality Adjustment	Election in Episode	Majority Parliament	Supply Reform	Successful Episode
			Cut	Deficit Cut											
Africa	68.58	5.41	28.58	3.19	-0.65	2.54	1.28	1.77	-5.64	-2.88	0.32	0.51	0.58	0.39	0.52
Europe	64.12	5.76	12.41	3.11	-2.72	0.13	2.54	2.55	-2.13	-0.21	0.71	0.51	0.41	0.33	0.21
Latam	72.04	6.52	32.04	2.85	0.71	3.55	2.52	2.17	-4.41	-1.05	0.25	0.41	0.57	0.39	0.28
Asia	71.03	6.46	27.03	4.83	0.35	5.21	1.92	1.44	-3.14	-1.86	0.33	0.73	0.49	0.46	0.33
Middle East	85.01	6.28	45.01	19.62	-10.17	9.44	1.04	1.79	-14.7	2.41	0.61	0.57	0.58	0.51	0.42
N.America	84.37	7.49	24.37	4.38	-3.71	0.67	1.31	1.52	-2.43	1.02	0.49	0.51	0.76	0.27	0.51
OECD	66.69	5.99	11.51	3.71	-2.94	0.69	1.07	1.76	-1.56	-0.55	0.62	0.48	0.47	0.49	0.21
NON-OECD	71.51	6.17	31.51	5.08	-1.01	3.98	2.51	2.19	-5.81	-1.16	0.38	0.55	0.53	0.44	0.38

Table 2. Success and duration of debt reduction episodes^a

	Average duration (in years)	Complete success ^b	Partial success ^c	Initial debt (distance from target % GDP)	Debt reduction (% GDP)	Deficit reduction (% GDP)	Quality of Fiscal Adjustment Index
All episodes (105)	5.9	58.8	83.5	30.9	29.0	4.5	0.5
Exp-based (49)	5.0	50.0	75.0	37.9	29.9	7.1	0.8
Rev-based (56)	6.7	60.2	92.2	26.8	31.6	4.3	0.1
Post-crisis episodes (51)	6.8	52.0	88.0	36.7	35.5	4.3	0.3

^aDebt and deficit reduction variables, as well as the quality of fiscal adjustment index are based on differences between the start and the end of the consolidation period.

^bShare of episodes in which the debt reached the target level at the end of the episode.

^cShare of episodes in which the debt reached at least half the target level at the end of the episode.

Source: Authors' calculations.

Africa). However, for emerging economies (especially in Latin America and Asia) the bulk of debt reduction was generated by higher growth and lower interest rates.

Results also show, however, that debt consolidation takes time. The typical debt consolidation episode lasted about 6 years; debt was reduced by more than 29 percentage points of GDP reflecting an improvement in the primary balance (net of cyclical effects) of about 4.5% of GDP (Table 2). In more than about half of the cases, the country was successful in reaching a prudent debt threshold,²³ while the probability of being partially²⁴ successful was much higher, at around more than 80%.

The fiscal adjustment mix matters for the duration and the size of the fiscal consolidation. In the average episode, about half of the primary balance improvement during the consolidation period was a result of expenditure savings as measured by the quality of fiscal adjustment index.²⁵ Expenditure-based debt reduction episodes delivered larger improvements in the primary balance than revenue-based adjustments (7 percentage points of GDP in the former, compared to 4 percentage points of GDP in the latter). However, the likelihood of successfully reducing public debt below the target threshold was lower in episodes of expenditure-based adjustments, in part reflecting higher initial debt levels in these spells.

Fiscal consolidations lasted longer in countries that improved public finances mostly through revenue measures. The duration of adjustment episodes was two

²³ Our baseline results define successful adjustment with respect to an absolute prudent debt threshold. Returning to the pre-crisis public debt level may prove insufficiently ambitious for countries that had high debt ratios at the onset of the crisis, as growth could be severely harmed by high debt.

²⁴ Partial success is defined as a reduction in public debt to GDP compared to the pre-adjustment year of at least 50% of the difference between the initial debt level and the target debt threshold.

²⁵ The quality of fiscal adjustments is measured by the contribution of cyclically adjusted current primary expenditures in per cent of potential GDP to the change in the fiscal deficit in per cent of GDP (von Hagen *et al.*, 2001). This variable takes values between 0 and 1.

years shorter in expenditure-based spells at 5 years, compared to almost 7 years revenue-based episodes in the sample (Figure 3 and Table 1). The length of the adjustment was also negatively correlated with the adjustment size, but dispersion around this linear relation was large (Figure 3).

Fiscal consolidation was harder to achieve after banking crises. Initial debt conditions were less favourable in these cases, owing to crisis-related deterioration in public finances. As a consequence, it took longer than the average adjustment spell to reach the debt target. The success probability was lower (at 52%) than in the

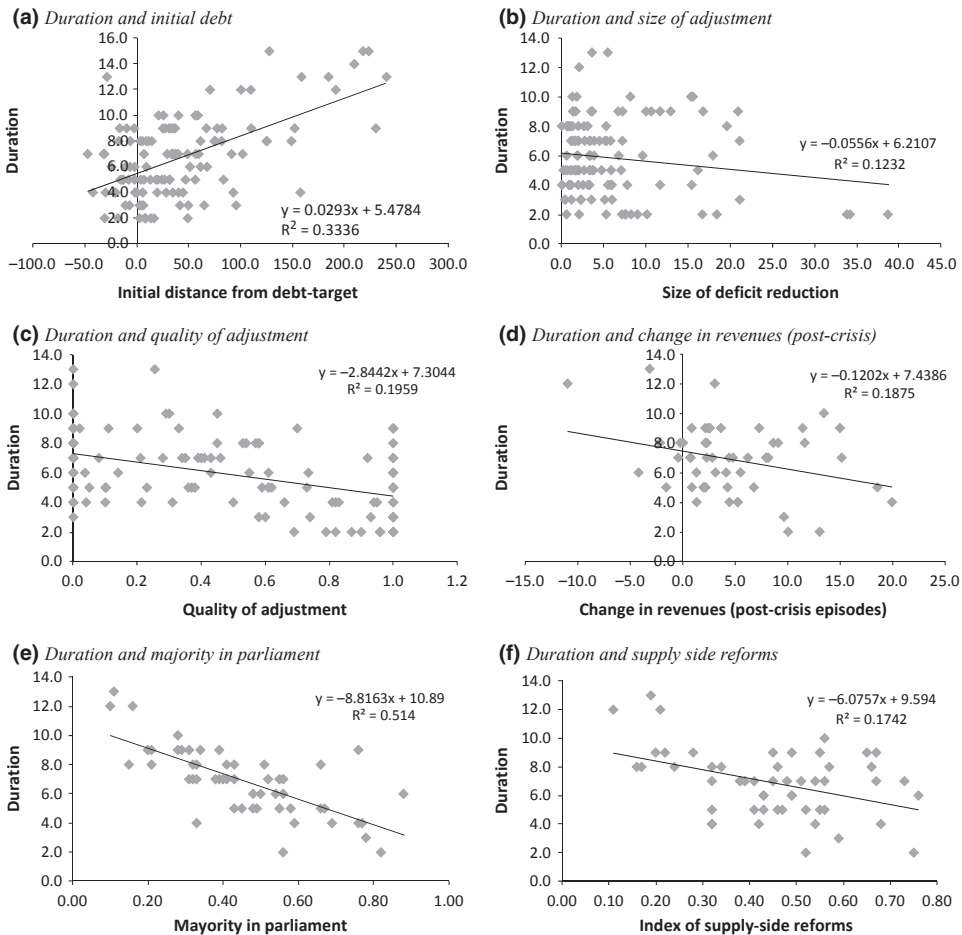


Figure 3. Debt reduction and characteristics of fiscal consolidation

Notes: Duration is in years. Initial distance from debt target is in per cent of GDP. Quality of Adjustment is a continuous variable that takes values between 0 and 1, and measures the percentage of the fiscal adjustment due to cuts in cyclically adjusted current spending. The larger the contribution of spending cuts to the adjustment, the higher the value of the variable. The variable that measures Majority in Parliament also varies from 0 to 1 and measures the percentage of seats in Parliament (Congress) held by the party in government. The Index of Supply-side reforms is an expanded version of the index of structural reforms that boost growth based on Lora (2001). Change in revenues and deficit reductions are in per cent of GDP.

average episode while the improvement in the primary balance was similar at about 4% of GDP (Table 2). However, less demanding partial success was slightly more likely in these episodes.

In post-crisis episodes, the contribution of spending cuts to fiscal adjustment was lower than in the overall sample (about a third of the primary balance improvement reflected savings), as revenue-based adjustments were more likely to achieve successful debt reduction. Furthermore, debt reductions took less time to implement when revenue contribution was large (Figure 3).

Larger public debt reductions were also associated with weaker initial conditions. High levels of public debt made fiscal adjustment needs more pressing in these countries (Figure 3), including in post-crisis episodes. Success of debt consolidation was, however, less likely in countries with higher initial public debt (Table 2): this did not only reflect lower fiscal adjustment during the debt reduction spell, but also the adverse implication on debt dynamics of the difference between interest rate and growth in countries with high levels of sovereign liabilities.

The length of fiscal consolidation episodes was also associated to non-fiscal variables (Figure 3). Political economy factors played a role. The duration of debt reduction spells was longer in countries where governments commanded a smaller majority in parliament, which made sustaining fiscal adjustment policies more difficult. Supply-side reforms that boosted growth helped reduce public debt more quickly by improving debt dynamics.

6. ECONOMETRIC RESULTS

We use the survival model described in Section 4 to assess the determinants of successful debt reduction. The length of a successful debt consolidation spell is defined on the basis of the time interval between periods in which the ratio of debt to GDP declined until it reached (or stayed within) the prudent threshold defined above. The debt reduction episode ends (fails) when the debt ratio reaches the threshold or increases again. The model is used to estimate the likelihood of successfully reducing debt to the target level.

The average length of a successful debt reduction episode is almost 7 years (Table 3). This is slightly higher than the average length of debt consolidation episodes found in the previous section (which included also unsuccessful adjustment attempts). As we relax the definition of success, the duration shortens and the likelihood of success increases. The average duration of partially successful episodes (that is, the episodes with a decline in debt equivalent to 50% of distance from the target) is slightly more than 5 years.

We use a duration model to assess what factors affect the likelihood of successful debt reduction based on the following specification:

Table 3. Duration of successful debt reduction episodes

Absolute debt target ^a	Mean	Std. Dev.	Absolute debt target ^b	Mean	Std. Dev.
Complete success	6.62	2.231		5.14	2.345
Partial success	5.18	2.420		3.89	2.876

^aDebt lower or equal to 60% of GDP in advanced economies and 40% of GDP in emerging economies. Episodes where initial debt was below the debt target are not included.

^bDebt lower or equal to 80% of GDP in advanced economies and 50% of GDP in emerging economies. Episodes where initial debt was below the debt target are not included.

Source: Authors' calculations.

$$h(t, X) = h_0(t) * \exp(X'\beta) \tag{5}$$

where $h_0(t)$ is a baseline hazard function and $g(X) = \exp(X'\beta)$ is a function of individual variables. As discussed in Section 3, we estimate this model using a parametric form for the function $h_0(t)$ based on the *Weibull* distribution.²⁶

6.1. Estimation results

The following variables are included in the baseline regressions reported in Table 4:

- *Initial conditions.* These include the initial distance from the debt target (in per cent of GDP) at the onset of the debt consolidation attempt and a dummy for an OECD country, which is a proxy for institutional quality.
- *Political economy factors,* controlling for the presence of a majority in parliament and elections held during the adjustment using the DPI dataset. Political fragmentation and uncertainty about government stability may be detrimental for fiscal adjustment success.
- *Accompanying economic policies and conditions.* These variables include an indicator of structural supply-side reforms that indicate the extent to which fiscal adjustment has been accompanied by pro-growth policies.²⁷ It also includes real interest rates, in order to capture the effect of both higher premia stemming from increased credit risk perception and higher monetary policy rates (triggered by responses to inflation).²⁸ Higher interest rates are expected to delay recovery, to increase debt service and thus to increase duration. In addition to interest rate, we control for output growth. This variable is expected to be important for

²⁶ Using alternative parametric distribution does not alter the results, but the Weibull model is found to have the best fit of the data. It also allows to test the assumption of hazard dependency on duration.

²⁷ We did not control for structural fiscal reforms on entitlements for lack of data. However, long-term spending pressures are important for fiscal risks. However, long-term spending pressures are found to be highly correlated with debt to GDP ratios in most countries.

²⁸ Real interest rates are constructed as follows: $RIR = [(1+Lending\ Interest\ Rate)/(1+InflationRate\ (taken\ as\ the\ GDP\ deflator)]-1 * 100$. We also tried with nominal interest rates and the effects are similar although the statistical significance is much weaker. We would like to thank Michael Devereux for suggesting the use of real interest rates.

Table 4. Regression results: baseline model

Duration of adjustment to reach debt threshold ^a	(1)	(2)	(3)	(4)	(5)	(6)
Initial distance from debt target	1.022*** (4.77)	1.023*** (4.86)	1.017*** (3.38)	1.021*** (4.38)	1.021*** (4.44)	1.019*** (3.68)
OECD country	5.156*** (3.03)	3.861** (2.52)	9.050*** (3.41)	7.673*** (3.05)	7.201*** (2.96)	6.956*** (3.05)
Majority in Parliament	-0.952** (-2.35)	-0.965* (-1.69)	-0.958** (-2.06)	-0.959** (-1.98)	-0.959* (-1.97)	-0.961* (-1.90)
Elections during adjustment	7.761*** (3.06)	11.601*** (3.51)	8.162*** (3.16)	11.440*** (3.62)	11.540*** (3.62)	9.040*** (3.25)
Interest rates	1.052*** (4.07)	1.053*** (4.13)	1.054*** (3.85)	1.054*** (3.82)	1.055*** (3.87)	1.056*** (3.98)
GDP growth	-0.022*** (-3.82)	-0.014*** (-4.06)	-0.029*** (-3.63)	-0.022*** (-3.84)	-0.212*** (-3.89)	-0.023*** (-3.75)
Supply-side reforms	-0.946** (-2.42)	-0.931*** (-3.12)	-0.970 (-1.77)	-0.952** (-1.99)	-0.949** (-2.09)	-0.957* (-1.69)
Quality of adjustment	-0.936*** (-4.07)	-0.095*** (-3.36)	-0.942** (-2.53)	-0.947*** (-3.05)	-0.947*** (-3.09)	-0.941*** (-2.99)
Quality of adjustment*Size of fiscal adj.		1.001** (2.18)	1.001* (1.81)	1.001** (2.00)	1.001** (2.02)	1.001* (1.89)
Change in tax revenues ^b			-0.610** (-2.46)			
Change in goods & services expenditures ^b				1.357* (1.77)		
Change in transfers expenditures ^b					1.317 (1.71)	
Change in public investment expenditures ^b						-0.727* (-1.97)
Constant (/ln_p)	0.275 (1.48)	0.277 (1.48)	0.312 (1.71)	0.289 (1.57)	0.283 (1.53)	0.271 (1.47)
<i>P</i>	1.317	1.320	1.367	1.336	1.327	1.312
Wald chi ²	86.63	92.07	99.67	95.36	94.76	94.92
No. of failures	22	22	22	22	22	22
Number of obs.	2652	2652	2652	2652	2652	2652

Notes: This sample includes all episodes of debt consolidation (including those performed in normal times, and those during post-financial crises).

^aReported coefficients are hazard-ratios. The numbers in parentheses under the coefficients are ζ -tests.

^bThese variables are expressed as a share of total revenue or total expenditure, in order to avoid multi-collinearity.

***Significant at a 1% level; ** significant at a 5% level; * significant at a 10% level. *Source:* Authors' calculations.

raising budget revenues, trimming the duration of adjustment, and increasing the likelihood of success in reducing debt.²⁹

- *Fiscal adjustment mix and size.* We include the composition of fiscal adjustment based on the quality of adjustment index and its interaction with the adjustment

²⁹ We also estimate the model by controlling for growth and interest rate for a subsample of debt reduction spells that were mostly caused by contractions in the primary fiscal deficit and not by the contribution of the growth-adjusted interest rate. And results are very similar to those reported in Table 4. They are available upon request.

size, measured by the change in the cyclically adjusted primary fiscal balance (in per cent of potential GDP) during the debt reduction period.³⁰ We measure the impact of these variables one at a time and we interpret the combined effect of these two variables to assess how the fiscal mix affects the likelihood of debt reduction when adjustment needs are large. As discussed above, in countries that have large consolidation needs, relying only on spending cuts may not be sufficient to generate the needed fiscal deficit reduction. This implies that the adjustment may need to be based on a more balanced combination of spending cuts and revenue increases.

- *Budget composition* variables capturing the change in the weight of specific expenditure and revenue programmes in the budget.

We then add a few more controls to assess the channels through which the fiscal mix affects the likelihood of debt reduction. In particular, we control for the following variables:

- *Banking crises*. We also account for the effect of banking crises by running separate regressions for the subsamples of episodes that followed banking crises and debt consolidation attempts that were not triggered by such crises (Tables 5 and 6).³¹ This assesses the legacy of weak fiscal conditions, high debt, and uncertain economic prospects after these crises and allows us to test whether the fiscal mix effects change in these episodes.

Consistent with previous studies, we find that debt consolidation is less likely when the initial distance from the debt target is high.³² High public debt levels are a constraint to achieving a prudent debt target, because adjustment needs are larger and because of the negative impact of high debt on interest rates and growth. Countries with weaker initial positions are therefore forced to implement more ambitious consolidation plans if they want to credibly lower public debt.

The probability of achieving debt reduction is higher when fiscal adjustments rely on current expenditure cuts. This is also in line with previous studies showing the importance of relying on expenditure savings to reduce debt. However, for countries that require large improvements in the cyclically adjusted primary balance,³³ successful debt reduction is delivered more effectively by a combination of spending cuts and revenue-generating measures. It seems that cutting spending beyond a point is counterproductive; we label it as the ‘Rebalancing Adjustment Effect’.

³⁰ Using the headline fiscal balance in per cent of GDP does not alter the results.

³¹ We also use an alternative method to estimate the effect of fiscal policy after financial crises on debt consolidation. We include a dummy, which is interacted with the adjustment mix-size factor. Results are reported in the Appendix (Table A1).

³² To control for possible endogeneity of some regressors we also run the model with lagged exogenous variables and estimate a probit model of the probability of reducing debt below the target threshold with instrumental variables (using lagged exogenous variables as instruments). These results confirm that reverse causality is not an issue in our sample.

³³ Large adjustments are estimated as changes in the cyclically adjusted primary balance of at least 11% of GDP. This is equivalent to an annual adjustment of almost 2% of GDP per year for the sample.

Table 5. Regression results: sub-sample excluding financial crises

Duration of adjustment to reach debt threshold ^a	(1)	(2)	(3)	(4)	(5)	(6)
Initial distance from debt target	1.023*** (4.82)	1.023*** (4.69)	1.016*** (3.11)	1.021*** (4.29)	1.021*** (4.36)	1.019*** (3.58)
OECD country	4.039** (2.51)	3.449** (2.04)	13.525*** (2.84)	7.712** (2.39)	6.844** (2.26)	6.529** (2.11)
Majority in Parliament	-0.962** (-1.98)	-0.964* (-1.83)	-0.954** (-2.32)	-0.958** (-2.10)	-0.959** (-2.07)	-0.961* (-1.99)
Elections during adjustment	8.309*** (2.75)	7.579** (2.54)	5.849** (2.28)	7.276** (2.55)	7.348** (2.56)	6.726** (2.41)
Interest rates	1.043*** (3.63)	1.043*** (3.65)	1.048*** (3.71)	1.045*** (3.51)	1.045*** (3.55)	1.047*** (3.64)
GDP Growth	-0.001*** (-4.41)	-0.001*** (-4.31)	-0.002*** (-4.02)	-0.001*** (-4.20)	-0.001*** (-4.23)	-0.001*** (-4.18)
Supply-side reforms	-0.954** (-2.09)	-0.952** (-2.18)	-1.003 (-0.10)	-0.977 (-0.79)	-0.973 (-0.94)	-0.974 (-0.78)
Quality of adjustment	-0.917*** (-3.00)	-0.920*** (-2.87)	-0.946* (-1.95)	-0.928*** (-2.57)	-0.928*** (-2.59)	-0.928** (-2.51)
Quality of adjustment*Size of fiscal adj.		1.001 (0.70)	1.001 (0.67)	1.002 (0.70)	1.003 (0.70)	1.010 (0.64)
Change in tax revenues ^b			-0.556** (-2.14)			
Change in goods & services expenditures ^b				1.339 (1.44)		
Change in transfers expenditures ^b					1.281 (1.22)	
Change in public investment expenditures ^b						-0776 (-1.32)
Constant (/ln _p)	0.373 (1.95)	0.360 (1.88)	0.432 (2.27)	0.378 (1.98)	0.370 (1.94)	0.363 (1.90)
<i>P</i>	1.452	1.434	1.541	1.460	1.448	1.438
Wald chi ²	80.89	81.41	86.51	83.56	82.96	82.50
No. of failures	21	21	21	21	21	21
Number of obs.	1490	1490	1490	1490	1490	1490

^aReported coefficients are hazard-ratios. The numbers in parentheses under the coefficients are ζ -tests.

^bThese variables are expressed as a share of total revenue or total expenditure, in order to avoid multi-collinearity.

***Significant at a 1% level; ** significant at a 5% level; * significant at a 10% level.

Source: Authors' calculations.

However, we find that the composition of spending and revenue measures is also important. Raising tax revenues (as a share of total revenues) in the aftermath of the crisis increases the likelihood of reducing public debt, reflecting the impact of more stable revenue sources to the budget. Reducing the share of goods and services in public expenditure is also significantly related to successful fiscal adjustments. Relying less on transfers for pensions and other entitlements

Table 6. Regression results: sub-sample of financial crises

Duration of adjustment to reach debt threshold ^a	(1)	(2)	(3)	(4)	(5)	(6)
Initial distance from debt target	1.021*** (4.55)	1.023*** (4.70)	1.017*** (3.40)	1.020*** (4.29)	1.021*** (4.34)	1.019*** (3.68)
OECD country	4.841*** (2.92)	3.577** (2.39)	8.100*** (3.25)	6.994*** (2.95)	6.586*** (2.86)	6.191*** (2.87)
Majority in Parliament	-0.956** (-2.18)	-0.968 (-1.58)	-0.961* (-1.97)	-0.962* (-1.89)	-0.962* (-1.88)	-0.964* (-1.80)
Elections during adjustment	7.607*** (3.02)	11.654*** (3.47)	8.680*** (3.21)	11.596*** (3.59)	11.696*** (3.59)	9.528*** (3.28)
Interest rates	1.051*** (3.98)	1.052*** (4.03)	1.053*** (3.78)	1.053*** (3.72)	1.053*** (3.77)	1.054*** (3.90)
GDP growth	-0.025*** (-3.72)	-0.015*** (-4.00)	-0.027*** (-3.69)	-0.023*** (-3.85)	-0.021*** (-3.90)	-0.023*** (-3.79)
Supply-side reforms	-0.949** (-2.29)	-0.934*** (-3.03)	-0.969 (-1.23)	-0.953* (-1.95)	-0.951** (-2.04)	-0.956* (-1.74)
Quality of adjustment	-0.931*** (-4.20)	-0.945*** (-3.55)	-0.938*** (-2.68)	-0.941*** (-3.20)	-0.941*** (-3.24)	-0.938*** (-3.16)
Quality of adjustment*Size of fiscal adj.		1.001** (2.22)	1.003* (1.84)	1.002** (2.03)	1.009** (2.05)	1.001* (1.94)
Change in tax revenues ^b			-0.625** (-2.37)			
Change in goods & services expenditures ^b				1.350* (1.77)		
Change in transfers expenditures ^b					1.313 (1.62)	
Change in public investment expenditures ^b						-0.745 (-1.63)
Constant (/ln_p)	0.289 (1.57)	0.295 (1.59)	0.328 (1.80)	0.308 (1.67)	0.301 (1.63)	0.289 (1.57)
<i>P</i>	1.335	1.344	1.389	1.361	1.352	1.335
Wald chi ²	79.72	85.38	92.33	88.73	88.15	87.86
No. of failures	22	22	22	22	22	22
Number of obs.	1152	1152	1152	1152	1152	1152

^aReported coefficients are hazard-ratios. The numbers in parentheses under the coefficients are ζ -tests.

^bThese variables are expressed as a share of total revenue or total expenditure, in order to avoid multi-collinearity.

***Significant at a 1% level; ** significant at a 5% level; * significant at a 10% level.

Source: Authors' calculations.

raises the likelihood of debt reduction. This is because spending on transfers is not easily reversible after a crisis (despite unwinding of automatic stabilizers, such as unemployment insurance) and imposes a heavy burden on the budget over time. Finally, increasing the share of public investment raises the likelihood of successful debt reduction by shifting the composition of the budget toward pro-growth programmes.

Debt reduction is more successful when it is combined with supply-side structural reforms to support growth. Policies to reduce interest rates and strengthen output growth boost revenue collection and ameliorate debt dynamics. Growth also helps reduce the ratio of public expenditure to GDP and enhances the fairness of fiscal consolidation. Indeed, growth surprises have also been found to be critical in fiscal adjustment (International Monetary Fund, 2011).

As expected, political risks can weigh on the chance of achieving fiscal consolidation. This, points to the importance of government cohesion during periods of fiscal retrenchment. Countries that have a strong majority in parliament are more likely to experience successful adjustment spells compared to politically unstable economies. Political elections during the adjustment period, however, can lower the chances of success. The strength of institutions is another significant factor: OECD countries, with relatively stronger institutions, tend to have a higher probability of success in lowering their debt compared to other economies.

We also find evidence of adjustment fatigue (since P values are >1). Results point to time-dependency: other things being equal, as the duration of the adjustment episodes increases the probability of ending the episode also rises. This is related to waning political support for reforms that take long to achieve debt reduction. This suggests that front-loaded fiscal adjustment may be more successful in lowering debt.

6.2. Interpreting the results

Based on the results reported in Table 4 we can predict how many months or days are added or subtracted to the length of a debt reduction episode. This is done by transforming estimated hazard rates into standard coefficients. Table 7 reports these estimated coefficients and transforms them in terms of time. Having a majority in parliament reduces the duration of the episodes by 4.7 months. By improving the quality of the fiscal adjustment, duration can be reduced by an average of 31 months, but this same result can be obtained by increasing the share of tax revenues in total public spending. And the implementation of supply-side reforms, that increase growth and private investment, are all conducive to significant reductions in the length of the debt reduction episodes.

7. ROBUSTNESS ANALYSIS

As a robustness check of the baseline model results presented in Table 4, we introduced several modifications.

- *A different definition of debt thresholds.* The results above are robust to an alternative definition of the debt threshold (80% of GDP for advanced economies and 50%

Table 7. Impact of a unit change in the estimated variables on the duration of debt consolidation

Variable	Coefficient	Months	Days
Initial Debt	2.78***	33.34	1014.24
Majority	-0.39**	-4.67	-142.01
Supply Reforms	-2.59**	-31.06	-944.73
Quality Adj.	-2.62***	-31.40	-955.18
Quality Adj*Size	2.72**	32.62	992.17
Interest	0.98***	11.74	357.06
GDP Growth	-2.78***	-33.34	-1014.24
Inflation	-0.42**	-5.03	-153.07
Private Investment	-0.51*	-6.17	-187.71
Ch. Tax Revenues	-0.54**	-6.52	-198.32
Ch. Goods & Serv	3.88*	46.61	1417.85
Ch. Transfers	3.73*	44.79	1362.26
Ch. Transfers	-2.07*	-24.83	-755.14

Notes: Coefficients in this table are obtained by taking the exponential of the coefficients (hazard rates) reported in first columns of Tables 4 and Table 12 (the latter only for inflation and private investment variables).

***Significant at a 1% level; ** significant at a 5% level; * significant at a 10% level.

Source: Authors' calculations.

of GDP for emerging economies). The findings in the text are confirmed as illustrated in Table 8.

- *A different definition of success (partial success).* A requirement of debt consolidation to reach at least half (50%) of the distance between the initial debt and the debt target does not alter the findings. Our results still hold, but as expected the size of the initial conditions coefficient is lower than in the case when success is defined as attaining the debt threshold (Table 9).³⁴
- *A redefinition of the dependent variable.* We tested our results using an alternative definition of the dependent variable: we assessed the determinants of changes in the debt-to-GDP ratio using a continuous variable which measures the annual change in the ratio of public debt to GDP.^{35,36} This new dependent variable was regressed on the same set of variables as in the baseline model. Results show that our findings based on the survival analysis are robust to these alternative specifications (Table 10). The reduction in public debt is larger when fiscal consolidation is based mostly on current expenditure savings measures. However, when

³⁴ This definition of partial success may seem arbitrary. In previous versions of this paper we included a much softer definition of partial success (based on reducing only 10% of the gap). The most important variables were still significant then. The major difference was the relative importance of spending cuts. The softer the threshold we established, the easier it was to reach it only through high quality expenditure-based adjustments. The stronger the criteria we imposed the higher the role for other accompanying policies and for revenue-based strategies.

³⁵ A positive change is an increase in the debt ratio and a negative change is a reduction in the ratio. We are indebted to David Romer for suggesting this approach.

³⁶ We also tried a second alternative specification of the dependent variable. In this case, the dependent variable was a dummy that took the value of one when the target was reached or maintained, and zero otherwise. Results are consistent with the most important findings of this article (see Appendix Table A2).

Table 8. Regression results: robustness (1) Debt target 80/50% GDP

Duration of adjustment to reach debt threshold ^a	(1)	(2)	(3)	(4)	(5)	(6)
Initial distance from debt target	1.021*** (5.13)	1.022*** (5.22)	1.020*** (4.47)	1.022*** (5.11)	1.022*** (5.14)	1.021*** (4.79)
OECD country	3.479** (2.34)	2.982* (2.00)	4.371** (2.48)	3.643** (2.14)	3.499** (2.08)	3.352** (2.08)
Majority in Parliament	-0.944*** (-3.27)	-0.949*** (-2.99)	-0.952*** (-2.78)	-0.950*** (-2.95)	-0.949*** (-2.97)	-0.950*** (-2.91)
Elections during adjustment	6.506*** (2.85)	7.124*** (2.97)	6.842*** (2.88)	7.586*** (3.03)	7.489*** (3.01)	6.690*** (2.88)
Interest rates	1.038*** (2.76)	1.038*** (2.81)	1.039** (2.68)	1.038** (2.70)	1.038*** (2.73)	1.039*** (2.78)
GDP growth	-0.160** (-2.09)	-0.165** (-1.98)	-0.171** (-1.98)	-0.159** (-2.05)	-0.158** (-2.05)	-0.176* (-1.90)
Supply-side reforms	-0.951** (-2.47)	-0.946*** (-2.82)	-0.958** (-2.05)	-0.949** (-2.55)	-0.949*** (-2.60)	-0.949** (-2.48)
Quality of adjustment	-0.962*** (-2.81)	-0.967** (-2.50)	-0.971* (-1.94)	-0.968** (-2.37)	-0.968** (-2.40)	-0.968** (-2.41)
Quality of adjustment*Size of fiscal adj.		1.000 (1.31)	1.000 (1.31)	1.000 (1.35)	1.000 (1.33)	1.000 (1.32)
Change in tax revenues ^b			-0.780 (-1.47)			
Change in goods & services expenditures ^b				1.115 (1.74)		
Change in transfers expenditures ^b					1.092 (0.60)	
Change in public investment expenditures ^b						-0.932 (-0.45)
Constant (/ln _p)	0.134 (0.73)	0.129 (0.71)	0.148 (0.82)	0.134 (0.73)	0.131 (0.72)	0.127 (0.70)
<i>P</i>	1.144	1.138	1.159	1.143	1.140	1.136
Wald chi ²	72.76	74.59	76.66	75.15	74.95	74.31
No. of failures	23	23	23	23	23	23
Number of obs.	2652	2652	2652	2652	2652	2652

Notes: This sample includes all episodes of debt consolidation (including those performed in normal times, and those during post-financial crises).

^a Reported coefficients are hazard-ratios. The numbers in parentheses under the coefficients are Z -tests.

^b These variables are expressed as a share of total revenue or total expenditure, in order to avoid multi-collinearity.

*** Significant at a 1% level; ** significant at a 5% level; * significant at a 10% level.

Source: Authors' calculations.

adjustment needs are large, fiscal consolidations accompanied by reforms to boost revenue collection are more successful. These findings are stronger when the debt consolidation attempt follows a banking crisis.

Table 9. Regression results: robustness (2) partial success

Duration of adjustment to reach debt threshold ^a	(1)	(2)	(3)	(4)	(5)	(6)
Initial distance from debt target	1.016*** (4.06)	1.020*** (4.26)	1.022*** (4.23)	1.029*** (4.62)	1.028*** (4.52)	1.021*** (4.07)
OECD country	4.265*** (2.88)	2.964** (2.12)	9.454*** (3.56)	8.745*** (3.23)	8.221*** (3.12)	7.118*** (3.14)
Majority in Parliament	-0.984 (-0.92)	-0.987 (-0.74)	-0.990 (-0.55)	-0.984 (-0.93)	-0.984 (-0.95)	-0.988 (-0.66)
Elections during adjustment	5.448*** (3.05)	6.890*** (3.45)	5.498*** (2.94)	8.327*** (3.72)	8.183*** (3.69)	5.516*** (2.99)
Interest Rates	1.052*** (4.87)	1.051*** (4.81)	1.053*** (4.65)	1.054*** (4.88)	1.054*** (4.89)	1.052*** (4.64)
GDP Growth	-0.057*** (-4.43)	-0.056*** (-4.22)	-0.076*** (-3.84)	-0.042*** (-4.62)	-0.042*** (-4.60)	-0.072*** (-3.91)
Supply-side reforms	-0.975 (-1.57)	-0.967 (-1.56)	-0.988 (-1.53)	-0.977 (-1.06)	-0.976 (-1.11)	-0.982 (-0.82)
Quality of adjustment	-0.941*** (-5.32)	-0.964*** (-3.22)	-0.968** (-2.37)	-0.963*** (-3.02)	-0.963*** (-3.03)	-0.964*** (-2.79)
Quality of adjustment		1.001*** (2.97)	1.002*** (3.11)	1.002*** (3.26)	1.002*** (3.21)	1.002*** (2.99)
*Size of fiscal adj.						
Change in tax revenues ^b			-0.643*** (-3.00)			
Change in goods & services expenditures ^b				1.404*** (2.62)		
Change in transfers expenditures ^b					1.379** (2.44)	
Change in public investment expenditures ^b						-0.711** (-2.36)
Constant (/ln_p)	0.183 (1.16)	0.192 (1.21)	0.249 (1.61)	0.247 (1.57)	0.236 (1.50)	0.215 (1.38)
<i>P</i>	1.201	1.211	1.283	1.280	1.266	1.240
Wald chi ²	01.52	11.50	22.14	18.62	17.65	17.18
No. of failures	30	30	30	30	30	30
Number of obs.	2652	2652	2652	2652	2652	2652

Notes. This sample includes all episodes of debt consolidation (including those performed in normal times, and those during post-financial crises).

^aReported coefficients are hazard-ratios. The numbers in parentheses under the coefficients are χ^2 -tests.

^bThese variables are expressed as a share of total revenue or total expenditure, in order to avoid multi-collinearity.

*** Significant at a 1% level; ** significant at a 5% level; * significant at a 10% level.

Source. Authors' calculations.

Table 10. Regression results: robustness (3) dependent variable change in Debt-to-GDP (fixed effects)

Change in Debt-to-GDP	(1)	(2)	(3)	(4)	(5)	(6)
Initial distance from debt target	0.118*** (6.42)	0.170*** (9.04)	0.135*** (6.96)	0.163*** (8.61)	0.162*** (8.52)	0.131*** (6.82)
OECD country	—	—	—	—	—	—
Majority in Parliament	-0.193 (-0.74)	-0.121 (-0.48)	-0.113 (-0.46)	-0.089 (-0.35)	-0.088 (-0.35)	-0.109 (-0.44)
Elections during adjustment	8.461*** (4.88)	6.954*** (4.16)	7.398*** (4.51)	5.857*** (3.40)	5.857*** (3.40)	7.306*** (4.47)
Interest rates	0.330*** (4.98)	0.263*** (4.11)	0.266*** (4.24)	0.250*** (3.90)	0.248*** (3.87)	0.268*** (4.29)
GDP growth	-9.70e-10 (-0.10)	-4.07e-10 (-0.05)	-1.13e-09 (-0.13)	-1.18e-10 (-0.01)	-9.93e-11 (-0.01)	-1.17e-09 (-0.13)
Supply-side reforms	-0.382 (-0.99)	-0.364 (-0.99)	-0.319 (-0.88)	-0.458 (-1.54)	-0.453 (-1.53)	-0.340 (-0.94)
Quality of adjustment	-0.018 (-1.04)	-0.032* (-1.82)	-0.049*** (-2.81)	-0.026 (-1.47)	-0.027 (-1.56)	-0.047** (-2.68)
Quality of adjustment *Size of fiscal adj.		0.008*** (8.00)	0.007*** (7.21)	0.008*** (8.27)	0.008*** (8.29)	0.007*** (6.90)
Change in tax revenues ^a			-2.740*** (-6.22)			
Change in goods & services expenditures ^a				-1.601** (-2.53)		
Change in transfers expenditures ^a					-1.701* (-2.55)	
Change in public investment expenditures ^a						-3.656*** (-6.73)
Constant	13.921 (0.50)	-0.675 (-0.03)	10.524 (0.40)	-0.721 (-0.03)	-2.281 (-0.08)	13.733 (0.52)
Prob >F	0.000	0.000	0.000	0.000	0.000	0.000
Semi R-squared	0.127	0.197	0.238	0.204	0.204	0.244
Number of obs.	2652	2652	2652	2652	2652	2652

Notes: This sample includes all episodes of debt consolidation (including those performed in normal times, and those during post-financial crises).

^aThese variables are expressed as a share of total revenue or total expenditure, in order to avoid multi-collinearity.

***Significant at a 1% level; ** significant at a 5% level; * significant at a 10% level.

Source: Authors' calculations.

- *Alternative interactions and additional independent variables:* We also estimate the model without the interaction variable to check the robustness of the results. The findings are consistent with the preferred model (Table 11) but

Table 11. Regression results: robustness (4) baseline model including quality and size as independent variables

Duration of adjustment to reach debt threshold ^a	(1)	(2)	(3)	(4)	(5)
Initial distance from debt target	1.017*** (2.70)	1.013* (1.87)	1.014** (2.09)	1.015** (2.23)	1.015** (2.23)
OECD country	5.051** (2.47)	14.708*** (3.40)	12.088*** (3.03)	10.779*** (2.88)	9.908*** (2.83)
Majority in Parliament	-0.972 (-1.13)	-0.969 (-1.56)	-0.967 (-1.36)	-0.968 (-1.53)	-0.972 (-1.16)
Elections during adjustment	9.071*** (2.79)	9.531*** (2.96)	10.959*** (3.04)	10.807*** (3.01)	9.565*** (2.90)
Interest rates	1.043** (2.10)	1.038* (1.89)	1.034 (1.79)	1.035* (1.66)	1.040* (1.97)
GDP growth	-0.018*** (-3.70)	-0.031*** (-3.22)	-0.026*** (-3.40)	-0.024*** (-3.48)	-0.023*** (-3.43)
Supply-side reforms	-0.943** (-2.37)	-0.980 (-0.71)	-0.966 (-1.25)	-0.962 (-1.38)	-0.964 (-1.24)
Quality of adjustment	-0.919*** (-3.45)	-0.930** (-2.15)	-0.921** (-2.68)	-0.921*** (-2.77)	-0.918*** (-2.98)
Size of fiscal adj.	-0.908 (-1.79)	-0.931 (-1.75)	-0.894 (-1.78)	-0.898 (-1.88)	-0.923 (-1.97)
Change in tax revenues ^b		-0.570** (-2.04)			
Change in goods & services expenditures ^b			1.502 (1.62)		
Change in transfers expenditures ^b				1.413 (1.40)	
Change in public investment expenditures ^b					-0.733 (-1.68)
Constant (/ln_p)	0.281 (1.41)	0.318 (1.60)	0.289 (1.46)	0.279 (1.41)	0.267 (1.34)
P	1.325	1.374	1.335	1.322	1.306
Wald chi ²	72.11	76.47	75.00	74.27	73.09
No. of failures	19	19	19	19	19
Number of obs.	2652	2652	2652	2652	2652

Notes: This sample includes all episodes of debt consolidation (including those performed in normal times, and those during post-financial crises).

^aReported coefficients are hazard-ratios. The numbers in parentheses under the coefficients are χ^2 -tests.

^bThese variables are expressed as a share of total revenue or total expenditure, in order to avoid multicollinearity.

***Significant at a 1% level; ** significant at a 5% level; * significant at a 10% level.

Source: Authors' calculations.

goodness of fit is lower.^{37,38} We finally estimated the baseline model including additional control variables in the right-hand side of the equation (Table 12). The additional controls are: the rate of inflation, the share of

³⁷ Similar results are obtained when we estimate the model excluding the quality variable and including only the size variable. We further tried an interaction between the quality of adjustment and size of debt accumulated during the crisis, which yields results that are similar to the ones presented in Table 11. Finally, we checked the potential dependence of the fiscal mix on the adjustment length and found no significant evidence of such a link.

³⁸ We also estimated the baseline model for a subsample of advanced economies. The main results are confirmed. The only difference is that for advanced economies a decline in the ratio of transfers to GDP has a stronger impact on successful debt reduction (see Appendix Table A3).

Table 12. Regression results: robustness (5) baseline model including additional independent variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Duration of adjustment to reach debt threshold ^a								
Initial distance from debt target	1.019*** (3.57)	1.021*** (4.26)	1.024*** (4.90)	1.023*** (4.84)	1.021 (0.93)	1.024*** (4.64)	1.024*** (4.89)	1.024*** (4.90)
OECD country	3.310** (2.25)	6.633*** (3.00)	3.596** (2.38)	3.659** (2.40)	10.848** (2.36)	3.829** (2.19)	3.570** (2.35)	3.616** (2.39)
Majority in Parliament	-0.955** (-2.06)	-0.955** (-2.14)	-0.966* (-1.77)	-0.955** (-2.08)	1.023 (1.75)	-0.961* (-1.67)	-0.966* (-1.65)	-0.966* (-1.67)
Elections during adjustment	11.721*** (3.54)	10.157** (3.46)	11.314** (3.49)	8.947*** (2.98)	6.665** (2.06)	30.826** (3.59)	11.180** (3.47)	11.354*** (3.50)
Interest rates	1.083*** (3.40)	1.055*** (3.79)	1.053*** (4.17)	1.047*** (3.59)	1.049** (2.52)	1.053*** (4.00)	1.053*** (4.14)	1.053*** (4.17)
GDP growth	-0.023*** (-3.67)	-0.020*** (-3.91)	-0.013*** (-4.09)	-0.011*** (-4.17)	-0.018*** (-2.49)	-0.008*** (-3.66)	-0.013*** (-4.08)	-0.013*** (-4.09)
Supply-side reforms	-0.926*** (-3.22)	-0.950** (-2.14)	-0.932*** (-3.15)	-0.932*** (-3.04)	-0.968*** (-2.65)	-0.982*** (3.01)	-0.932*** (-3.15)	-0.932*** (-3.15)
Quality of adjustment	-0.952*** (-3.23)	-0.949*** (-3.16)	-0.948*** (-3.28)	-0.950*** (-3.31)	-0.940** (-2.65)	-0.946** (-2.93)	-0.948*** (-3.28)	-0.948*** (-3.28)
Quality of adjustment *Size of fiscal adj.	1.001** (2.14)	1.002* (1.91)	1.003 (1.89)	1.001** (2.25)	1.000 (1.76)	1.001** (2.26)	1.001 (1.71)	1.002* (1.81)
Inflation	-0.869*** (-2.67)							
Private investment		-0.665* (-1.81)						
Openness			-0.999 (-0.67)					
IMF programme				2.412 (1.56)				
Trade balance					1.089 (1.49)			
Exchange rate regime ^b						1.106 (0.16)		

Table 12. Continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Duration of adjustment to reach debt threshold ^a								
Exchange rate level							-0.999 (-0.66)	
Left-wing seats in Parliament								-0.999 (-0.63)
Constant ($\ln p$)	0.305 (1.59)	0.286 (1.54)	0.285 (1.53)	0.311 (1.66)	0.252 (1.00)	0.344 (1.74)	0.287 (1.54)	0.284 (1.53)
P	1.357	1.331	1.330	1.365	1.287	1.410	1.332	1.329
Wald χ^2	91.46	95.88	92.62	94.52	51.14	94.35	92.60	92.55
No. of failures	21	22	22	22	12	20	22	22
Number of obs.	2652	2652	2652	2652	2652	2652	2652	2652

^aNotes: This sample includes all episodes of debt consolidation (including those performed in normal times, and those during post-financial crises).

^bReported coefficients are hazard-ratios. The numbers in parentheses under the coefficients are \tilde{z} -tests.

^cThis is a dummy variable that takes value 0 if exchange rate regime is pegged/non-floating, and takes value 1 for floating exchange rate regimes. This is a way to summarize the 10 categories initially established by the ARE/AER database (i.e.: 1 = no separate legal tender; 2 = currency board; 3 = conventional peg; 4 = stabilized arrangement; 5 = crawling peg; 6 = crawl-like arrangement; 7 = pegged exchange rate with horizontal bands; 8 = other management arrangement; 9 = floating; 10 = free-floating).

***Significant at a 1% level; ** significant at a 5% level; * significant at a 10% level.

Source: Authors' calculations.

private investment as a percentage of GDP, the degree of trade openness, a dummy for IMF programmes, the trade balance, the exchange rate regime; the level of exchange rate, and the number of parliamentary seats held by left-wing parties. Only the rate of inflation and the share of private investment show statistical significance, and both help to reduce the duration of debt consolidation episodes.

8. POLICY IMPLICATIONS

Many countries around the world have accumulated large public debts in the aftermath of the recent financial crisis. As the economies recover from the recession, the challenge for governments is to regain fiscal stability by unwinding the exceptional fiscal stimulus when economic conditions permit and reducing public debt with credible adjustment plans. The unprecedented simultaneous increase in public debt levels worldwide, however, makes this effort particularly demanding. Debt consolidation tends to be less successful when countries are hit by severe banking crises. This reflects higher uncertainty and permanent output losses resulting from these crises that make fiscal consolidation more challenging.

Successful debt consolidations are in general more likely when they are based on cuts in current expenditures, including reforms to lower entitlements that put upward pressure on deficits. Reducing expenditures is key for sustaining primary fiscal balances required to reduce debt to prudent levels in many countries. Reforms that preserve capital outlays and ensure that current expenditures are reduced have the highest likelihood of achieving the required debt reduction.

In contrast with the previous literature, however, we find that raising tax revenues is important for debt reduction in countries with large adjustment needs (in particular after banking crises). We label it as the ‘Rebalancing Adjustment Effect’. This reflects the need to maintain a balance between expenditure savings and revenue-raising measures when the debt challenge is large by avoiding inefficient across-the-board expenditure cuts.

Curtailing essential programs may also lead to unsustainable and unfair outcomes that could jeopardize public support for reforms and harm fiscal consolidation efforts in the medium term. Political fragmentation and political cycles may also make debt reduction more challenging and call for credible medium-term fiscal plans backed by strong and transparent fiscal institutions.

These results challenge the traditional argument of non-Keynesian effects of expenditure-based adjustments. We find that in the aftermath of banking crises, when credit is restrained and agents lack confidence, revenue-based strategies decrease the duration of debt-reduction episodes. However, higher taxation should not harm efficiency and has to minimize distortions, particularly in countries with high tax ratios. Simplifying the tax system by reducing excessive tax rates and broad-

ening the tax base could help enhance revenue collection while shifting the burden of taxes from income and capital to consumption, fuel products and property taxes.

Accompanying policies are also important; when monetary conditions are allowed to remain accommodative and risk premia are contained by credible adjustment plans, public debt reduction is more likely to be achieved. This result also highlights the importance of fiscal adjustment strategies that anchor market expectations about fiscal sustainability.

These fiscal adjustment strategies require supporting actions to revive growth. This includes structural reforms to enhance productivity and reduce economic distortions in the economy. Improving the budget composition towards a greater share of public investment could be an additional important ingredient in the strategy to support growth by increasing efficiency in the medium term.

Discussion

Michael B. Devereux

University of British Columbia

This paper makes a nice contribution to the growing literature on the economics of fiscal re-balancing. Although the process of post-crisis fiscal readjustment is taking place at different speeds and with different structural composition across countries, there is a wide consensus that at least in the advanced economies, which are saddled with high current deficits, large debt-to-GDP ratios, ageing populations, and exploding healthcare costs, sharp fiscal consolidation will be inevitable over the medium term. The contribution of this paper is to outline the main structural factors that have historically been important in successful fiscal consolidations. The paper is therefore highly topical and has a real potential to contribute to the current policy debate.

The novelty of the paper is in the methodology, which is borrowed from the labour economics literature. Duration analysis is normally used to understand the determinants of unemployment spells. The objective is to determine which features of an individual's background are most important in explaining the probability of job finding. In the present paper, the authors construct a duration model of fiscal consolidations. Using a large sample of episodes of public debt reduction, the model investigates how various structural and political determinants can explain the probability of successfully reducing the debt-to-GDP ratio by a certain amount.

The results of the paper are clear but somewhat eclectic. It is generally not fully supportive of solely expenditure-based fiscal consolidations, especially not when the required consolidation is very large. In that case, it is advisable to combine spending cuts with revenue increases in order to increase the probability of success. As to

be expected, having a political majority in Parliament is good for adjustment, reducing the time needed to achieve a prudent debt ratio. The model also supports the widespread belief that fiscal adjustment after financial crises is likely to be much more drawn out than during normal episodes of debt reduction. Finally, the well-known maxim that it is always easier to consolidate in a growing economy is clearly established in the empirical estimates.

Although the paper's main results are interesting and intuitive, they are not impervious to the common identification problems in the fiscal macroeconomics – fiscal consolidation is faster with higher growth, but in many cases a rebound in economic growth may itself follow from fiscal adjustment, at least in the medium term, the duration of analysis with which the paper is concerned. Beyond that, it is not implausible to think that debt consolidation would affect political stability and other indicators (such as private investment) used as predictors in the conditional hazard analysis. Hence, the estimates may be teaching us more about what is associated with successful debt reduction rather than what causes it. But that being said, we should acknowledge that there is not a lot that can be done about this problem, at least within the scope of the current paper.

One dimension that has historically been important in successful fiscal adjustment is economic openness. Perotti (2011) examines in detail the features of four European fiscal adjustments (Ireland, Denmark, Finland and Sweden). He finds that in three of these (Ireland, Finland and Sweden), real depreciation facilitated fiscal adjustment, and a resurgent trade surplus represented the primary driver of economic growth. A similar experience was evident in the mid-1990s fiscal adjustment episode in Canada. This suggests to me that the present analysis is at best incomplete. A major ingredient in enhancing the probability of successful debt consolidation must be real exchange rate depreciation and growth in net exports. It would be desirable to explore this question more fully within the current methodology – does a flexible exchange rate regime and/or economic openness facilitate faster fiscal consolidation, according to the measures used here? Another relevant variable should be country size. Presumably, it would be substantially easier to achieve quicker debt reduction in a smaller country, which can easily generate real depreciation and improve its trade balance in a short space of time.

How relevant are the results in this paper for the fiscal adjustment problems facing many countries at the present juncture? While not minimizing the contribution of the paper, I would suggest that the historical record on the ingredients for fast debt consolidation are not sufficient to fully inform us of the fiscal dilemmas of European and other OECD economies at this moment in time. First of all, in most cases in the sample, it would be presumed that monetary policy operated normally. Fiscal contractions could in that case be compensated by lower interest rates. But in the current environment, most countries are at, or close to the zero lower bound in nominal interest rates, and cannot rely on compensating rate reductions, therefore substantially compounding the difficulties of debt reduction. Secondly, in many

countries, as a result of a large build-up of housing-related debt, there is a continuing and lengthy process of private sector deleveraging on a scale scarcely seen before in the data. Again, this is likely to substantially prolong the time necessary for a successful fiscal consolidation relative to that seen in existing sample data. Thirdly, the fiscal overhang now is essentially a global phenomenon. In the historical sample, fiscal consolidations could be more easily assumed to be country specific, independent episodes. Finally, the sample does not fully take account of the more contemporaneous constraint placed on European countries attempting to reduce their public sector debts; membership of the Eurozone. These countries cannot avail of quick nominal depreciation which seems to have been an important ingredient in many examples of successful fiscal adjustments.

In summary, while this paper presents a highly topical and informative study of the ingredients of successful fiscal consolidations in the historical data, it leaves many questions unanswered, and in my view, can provide only a partial guide to the problems to be faced by fiscal authorities in many countries in the coming years. Nevertheless, for what it does, the paper is an excellent contribution to this literature.

Panel discussion

Johannes Spinnewijn was uncertain about the welfare consequences from achieving a faster rate of debt reduction. As he indicated, there are clear arguments in the literature that gradual rather than abrupt debt reduction is more favourable in terms of welfare.

Patrick Bolton had a similar reaction. He could not understand why reducing the duration of the debt consolidation spell was a natural policy objective. In addition, he wondered if the authors could investigate whether spending cuts or tax revenue increases lead to greater negative effects on growth. Related to the empirical methodology employed for duration analysis, Agustín Bénétrix thought it would be interesting to see if the same results hold under a semi-parametric approach. Fabrizio Coricelli argued that duration may be an indicator of the credibility and quality of the financial institutions of a country. Contributing further to the discussion, he posed the question of whether it is easier to consolidate in a country characterized by a larger public sector. Carlo Favero also felt that equations for GDP growth and inflation were missing in the analysis. These equations are pertinent because what matters is not the time it will take a country to reduce its debt to the desired level, but rather the environment in which it can do it. That is, it might be more prudent for a nation to gradually attenuate debt levels over a longer non-contractionary time frame than to attain this reduction faster over a shorter recessionary period. Of course, when GDP growth and inflation are present, one needs to focus on

exogenous stabilization. This is an issue that should be addressed in the duration model according to Favero. Lastly, Favero asks if there is a truncation problem in the model, and if so, how it is dealt with.

Michalis Haliassos also expressed his reservations about the use of duration and moreover the fact that the same constant threshold ratio of debt-to-GDP across countries in a particular group is assumed. Second, he suggested that the authors include 'consensus between the main parties' in the model as another political variable. Third, he alluded to the point that there could indeed be an issue of reverse causality. Specifically, one may observe massive debt reductions engendering elections due to political instability etc. Finally, Haliassos argued that the means through which government spending is cut also matters. For instance, shrinking an oversized public sector should induce different effects to making marginal adjustments. Thus he recommended that the productivity or efficiency of the public sector be controlled for by utilizing measures of corruption or the efficiency of the judicial system, for example. Francis Kramarz shifted attention to the point that tax increases are easier to achieve in already high tax rate countries such as France while more difficult to attain in low tax rate nations such as the US, due to political reasons. Furthermore, he noted that it would be a useful exercise for the authors to investigate how inequality levels are affected by debt consolidation phases. His final comment was in the form of a question, itself related to the preceding remarks on growth. Kramarz asked what form of government spending cuts should be favoured when endeavouring to achieve quick debt reduction. For instance, reducing expenditure on defence could be difficult but might be the most effective in terms of reaching the target in some countries. Conversely, in other nations defence spending could be relatively more important for growth and thus may be a less viable option for cuts. Finally, Philippe Martin suggested that the authors employ their techniques, that is, if they have enough confidence in them, to predict how long it will take for countries like Ireland and Italy to stabilize their debt levels.

Sanjeev Gupta responded to some of the issues raised by the panellists. First, he made it clear that the African countries that received debt relief were discarded from the sample because they subsequently observed significant declines in their respective debt-to-GDP ratios (debt write-offs). However, he reassured the audience that the episodes of the 1980s in Latin America were not omitted from the study as they were of a different variety. Responding to the question of 'why duration?', Gupta said that asking how long it will take for a country to revert back to its pre-crisis debt level is interesting in its own right. He also stressed that in addition to duration, the debt-to-GDP ratio itself was considered and the same type of results still held. Moreover, he pointed out that the threshold debt-to-GDP level is the median and not average pre-crisis level.

APPENDIX

Table A1. Regression results: model with financial crises dummy

Duration of adjustment to reach debt threshold ^a	(1)	(2)	(3)	(4)	(5)
Initial distance from debt target	1.024*** (4.93)	1.017*** (3.43)	1.021*** (4.42)	1.022*** (4.49)	1.019*** (3.74)
OECD country	3.891** (2.55)	9.044*** (3.40)	7.645*** (3.07)	7.164*** (2.98)	6.872*** (3.03)
Majority in Parliament	-0.964* (-1.78)	-0.957** (-2.13)	-0.958** (-2.06)	-0.958** (-2.05)	-0.960 (-1.97)
Elections during adjustment	11.275*** (3.48)	8.103*** (3.15)	11.116*** (3.58)	11.201*** (3.59)	8.968*** (3.23)
Interest rates	1.053*** (4.10)	1.054*** (3.84)	1.054*** (3.79)	1.054*** (3.84)	1.055*** (3.96)
GDP growth	-0.014*** (-4.09)	-0.028*** (-3.65)	-0.021*** (-3.87)	-0.020*** (-3.93)	-0.022*** (-3.78)
Supply-side reforms	-0.931*** (-3.14)	-0.969 (-1.18)	-0.952* (-1.98)	-0.949** (-2.08)	-0.956* (-1.72)
Quality of adjustment	-0.945*** (-3.69)	-0.938*** (-2.72)	-0.942*** (-3.33)	-0.942*** (-3.38)	-0.938*** (-3.24)
Quality of adjustment *Size of fiscal adj *Postcrisis.	1.145** (2.23)	1.172* (1.76)	1.161** (2.02)	1.159** (2.04)	1.153* (1.88)
Change in tax revenues ^b		-0.613** (-2.39)			
Change in goods & services expenditures ^b			1.356* (1.76)		
Change in transfers expenditures ^b				1.314 (1.58)	
Change in public investment expenditures ^b					-0.735* (-1.68)
Constant ($\ln p$)	0.276 (1.48)	0.307 (1.68)	0.286 (1.55)	0.279 (1.51)	0.268 (1.45)
P	1.318	1.360	1.331	1.322	1.307
Wald χ^2	92.43	99.46	95.70	95.08	94.90
No. of failures	22	22	22	22	22
Number of obs.	2652	2652	2652	2652	2652

Notes: This sample includes all episodes of debt consolidation (including those performed in normal times, and those during post-financial crises).

^aReported coefficients are hazard-ratios. The numbers in parentheses under the coefficients are \tilde{z} -tests.

^bThese variables are expressed as a share of total revenue or total expenditure, in order to avoid multi-collinearity.

***Significant at a 1% level; ** significant at a 5% level; * significant at a 10% level.

Source: Authors' calculations.

Table A2. Regression results: dependent variable complete success (probit)

Complete success	(1)	(2)	(3)	(4)	(5)	(6)
Initial distance from debt target	-0.206** (-2.56)	-0.193** (-2.32)	-0.177** (-2.02)	-0.193** (-2.33)	-0.193** (-2.32)	-0.177** (-2.05)
OECD country	0.572* (1.67)	0.589* (1.71)	0.996** (2.43)	0.538 (1.38)	0.600* (1.54)	0.918** (2.28)
Majority in Parliament	3.153** (2.11)	2.786* (1.79)	2.743* (1.78)	2.779* (1.79)	2.788* (1.79)	2.744* (1.72)
Elections during adjustment	-0.167 (-0.59)	-0.139 (-0.49)	-0.090 (-0.31)	-0.140 (-0.49)	-0.139 (-0.48)	-0.099 (-0.34)
Interest rates	0.078 (0.91)	0.066 (0.75)	0.033 (0.38)	0.069 (0.78)	0.065 (0.74)	0.040 (0.45)
GDP growth	-1.08e-09 (-0.28)	-1.10e-09 (-0.29)	-9.43e-10 (-0.28)	-1.12e-09* (-0.29)	-1.10e-09 (-0.29)	-9.76e-10 (-0.28)
Supply-side reforms	2.941** (2.02)	2.898* (1.98)	2.498* (1.66)	2.946** (2.00)	2.888* (1.96)	2.582* (1.73)
Quality of adjustment	1.213** (2.08)	1.041* (1.67)	0.884 (1.39)	1.056* (1.69)	1.037* (1.66)	0.911 (1.44)
Quality of adjustment *Size of fiscal adjustment		-0.020 (-0.83)	-0.016 (-0.67)	-0.019 (-0.82)	-0.020 (-0.83)	-0.017 (-0.71)
Change in tax revenues ^a			0.198** (2.05)			
Change in goods & services expenditures ^a				-0.026 (-1.67)		
Change in transfers expenditures ^a					-0.005 (-1.06)	
Change in public investment expenditures ^a						0.161* (1.72)
Constant	-3.162** (-2.48)	-3.032** (-2.36)	-3.964*** (-2.83)	-2.912** (-2.15)	-3.060** (-2.24)	-3.897*** (-2.77)
Wald chi ² (10)	19.73	20.49	25.29	20.57	20.50	23.76
Prob chi ²	0.011	0.015	0.004	0.024	0.024	0.008
Number of obs.	104	104	104	104	104	104

Note: Probit estimates. This sample includes all episodes of debt consolidation (including those performed in normal times, and those during post-financial crises).

^aThese variables are expressed as a share of total revenue or total expenditure, in order to avoid multi-collinearity.

***Significant at a 1% level; ** significant at a 5% level; * significant at a 10% level.

Source: Authors' calculations.

Table A3. Regression Results: Model for Sub-Sample of Advanced Economies

Duration of adjustment to reach debt threshold ^a	(1)	(2)	(3)	(4)	(5)	(6)
Initial distance from debt target	-0.995 (-0.12)	-0.958 (-1.14)	-0.955 (-1.23)	-0.956 (-1.19)	-0.957 (-1.17)	-0.957 (-1.15)
OECD country	-	-	-	-	-	-
Majority in Parliament	1.069* (1.99)	1.214* (1.89)	1.320* (1.96)	1.352* (1.80)	1.329* (1.73)	1.255 (1.51)
Elections during adjustment	7.368** (2.12)	11.165** (2.24)	7.343* (1.95)	13.113** (2.43)	12.946** (2.40)	9.602** (2.08)
Interest rates	1.088 (1.24)	1.067 (0.86)	1.106 (1.28)	1.092 (1.12)	1.089 (1.08)	1.085 (0.99)
GDP growth	-0.003** (-2.37)	-0.001*** (-2.62)	-0.002** (-2.29)	-0.002*** (-2.65)	-0.001*** (-2.63)	-0.001** (-2.25)
Supply-side reforms	-1.049 (-0.72)	-1.069 (-0.96)	-1.178 (-1.52)	-1.178 (-1.36)	-1.160 (-1.24)	-1.120 (-0.91)
Quality of adjustment	-0.794** (-2.14)	-0.781** (-2.23)	-0.823 (-1.68)	-0.798* (-1.95)	-0.801* (-1.94)	-0.779** (-2.19)
Quality of adjustment *Size of fiscal adj *Postcrisis.		1.002* (1.70)	1.003* (1.84)	1.004* (1.76)	1.004* (1.69)	1.003 (1.77)
Change in tax revenues ^b			-0.501 (-1.63)			
Change in goods & services expenditures ^b				1.875 (1.04)		
Change in transfers expenditures ^b					1.707 (0.87)	
Change in public investment expenditures ^b						-0.798 (-0.34)
Constant (/ln_p)	0.441 1.44	0.533 1.72	0.580 1.89	0.567 1.83	0.552 1.79	0.525 1.70
<i>P</i>	1.554	1.704	1.787	1.764	1.737	1.691
Wald chi ²	33.16	36.22	36.73	37.24	36.94	35.65
No. of failures	8	8	8	8	8	8
Number of obs.	2652	2652	2652	2652	2652	2652

Notes: This sample includes all episodes of debt consolidation (including those performed in normal times, and those during post-financial crises).

^aReported coefficients are hazard-ratios. The numbers in parentheses under the coefficients are \tilde{z} -tests.

^bThese variables are expressed as a share of total revenue or total expenditure, in order to avoid multi-collinearity.

***Significant at a 1% level; ** significant at a 5% level; * significant at a 10% level.

Source: Authors' calculations.

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