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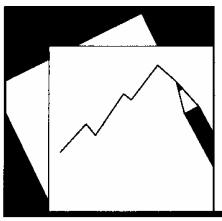

IMF Working Paper

What Sustains Fiscal Consolidations in Emerging Market Countries?

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Prepared by Sanjeev Gupta, Emanuele Baldacci, Benedict Clements, and Erwin R. Tiongson[1]

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Abstract

This paper examines the factors affecting the persistence of fiscal consolidation in 25 emerging market countries during 1980–2001. It proposes a new approach for defining spells of fiscal consolidation. The results indicate that the probability of ending a fiscal adjustment is affected by the legacy of previous fiscal failures, the size of the deficit, the composition of spending, and level of total revenues. There is also some evidence that the initial debt stock, exchange rate developments, inflation, and the unemployment rate have an impact on the persistence of adjustments.

JEL Classification Numbers: C4, E6

Keywords: fiscal adjustment, fiscal consolidation, survival analysis, emerging markets

Authors' E-Mail Addresses: sgupta@imf.org; ebaldacci@imf.org; bclements@imf.org; etiongson@worldbank.org

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Contents Page

I. INTRODUCTION

Controlling public debt and implementing durable fiscal adjustments remain major challenges for policymakers around the globe. In many industrial countries, the debt-to-GDP ratio rose to historical highs over the 1980s, leading to new debates about the macroeconomic consequences of persistent deficits and unsustainable debt. Among member states of the European Union, deficit reduction has been high on the policy agenda since the signing of the Maastricht Treaty in 1992, and many countries were able to lower their debt levels through the 1990s, aided by the discipline imposed through the Stability and Growth Pact (SGP).

Recent studies highlight the potential risks of increasing public debt in emerging market countries (IMF, 2003b). Public sector debt in these countries has in fact risen since the mid-1990s and currently stands at above 70 percent of GDP. This increase is most noteworthy in Asia and Latin America, while debt burdens have fallen in transition economies and remained stable in Middle East and Africa. This contrasts with the declining trend of public debt in industrial countries over the same period. The main factor behind the rise in public debt of the emerging market countries is their reliance on large fiscal deficits. The long-term cost of massive debt accumulation and the risk of solvency crises highlight the importance of safeguarding fiscal sustainability.[2]

For countries with unsustainable debt burdens, the benefits of sustained fiscal reforms are clear. Fiscal adjustment can reduce interest rates and expectations of larger future tax liabilities, thereby generating a positive wealth effect in the private sector. In addition, fiscal consolidation can signal that policymakers are committed to long-term fiscal sustainability and macroeconomic stability, with positive spillover effects on private investment. In a similar vein, consolidation is also central to ensuring that welfare state benefits are fiscally sustainable (Heylen and Evaraert, 2000). On the other hand, fiscal consolidations that are short lived can be harmful for growth, as they may indicate that the political will to "stay the course" to achieve long-term sustainability is lacking. Furthermore, persistent fiscal imbalances reduce national savings, leading to lower private investment and more tepid economic growth (Fischer, 1993).

Why do some fiscal reforms persist while others fail? There is now a large empirical literature on what factors drive the persistence of adjustment in industrial countries.[3] A strand of this literature examines large fiscal consolidation spells, and uses a descriptive and indirect approach to measure the determinants of sustainable adjustment. The approach is based on the methodology first proposed by Alesina and Perotti (1995) which has subsequently become the benchmark for other studies. It consists of a two-step procedure: First, episodes of large fiscal consolidation are pre-selected according to a previously defined threshold. Second, a description

[2] See for example IMF (2003a).

[3] See for example Alesina and Perotti (1995, 1997), Alesina and Ardagna (1998), and Alesina, Perotti, and Tavares (1998).

and comparison of the main characteristics of "successful" and "unsuccessful" episodes are provided, where successful consolidation is defined as the maintenance of fiscal control over a specified period of time. Studies employing this approach generally find that fiscal adjustments that rely primarily on reducing outlays on transfers and the wage bill are more likely to be sustainable than those based on tax increases and cuts in capital spending. Because cuts in public sector employment and transfers are politically more difficult—although effective in securing sustainable adjustment—only those governments determined to sustain fiscal consolidation implement them (Perotti, 1996). Revenue increases, on other hand, are easily reversed and lead to short-lived adjustments.[4]

This approach has been questioned in recent studies (see von Hagen and others, 2002, and Heylen and Everaert, 2000). For instance, the criterion on which the classification of episodes (into successful and unsuccessful consolidations) is based has been criticized as arbitrary. In addition, some argue that causal inferences cannot be made on the basis of the simple comparison of group averages for selected variables under successful and unsuccessful consolidations.[5] Finally, the standard approach does not provide a description of how long adjustments typically last (i.e., it does not model the duration of fiscal adjustment itself); and furthermore, it does not assess—based on this model—the factors that influence the duration of fiscal consolidation episodes.

Several alternative methodologies have been proposed to provide more rigorous definitions of successful and unsuccessful adjustment. For example, Heylen and Evaraert (2000), model the evolution of the debt ratio directly. Hjelm and Johansson (2002) assess the success of fiscal consolidation episodes by testing for structural breaks in long-term relationships between taxes and spending. Hallett and McAdam (2003) use stochastic simulations to study how the probability of an "excessive deficit" (above 3 percent of GDP) varies, based on alternative fiscal deficit targets. Ardagna (2001) replicates the empirical results of the standard approach using a dynamic general equilibrium model calibrated with averaged data from ten European economies for 1965–95.[6]

A number of recent papers (for example, von Hagen and others, 2002) have also tackled the issue of how to model the duration of fiscal adjustment. In these studies, the duration of fiscal consolidations over time is *endogenous*, in contrast to previous studies, with the covariates of sustained fiscal consolidation determined through survival analysis. This new method is

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[4] It has also been suggested that expenditure cuts, rather than tax increases, may be more conducive to economic growth which, in turn, leads to better fiscal performance (Perotti, 1996).

[5] Lambertini and Tavares (2001) do more than a comparison of group averages. To analyze the data, they run fixed effects panel regressions of several variables on their own lagged values and dummies for one period before, during, and immediately after either "successful" or "unsuccessful" adjustments.

[6] Her results indicate that fiscal stabilizations that rationalize public employment can, in some instances, stimulate the economy.

superior to the approaches described above as it makes use of all the information available in the data, rather than constraining the analysis to episodes of large fiscal consolidation.[7]

While duration analysis is a step forward in understanding sustained fiscal reform, there are some important gaps in the literature. First, in applying survival analysis and defining "fiscal consolidation," past works have generally been based on either a specified threshold for the deficit or a reduction of the deficit at some specified minimum rate. Each approach has its own strengths and weaknesses, but a superior approach could account for *both* the level and the trajectory of fiscal consolidation. [8] Thus, for countries that have already achieved low budget deficits, "successful" fiscal consolidation could imply maintaining their low deficits, while for countries with less favorable conditions, fiscal consolidation can only be considered as ongoing if deficits are continuing to fall.

Second, while existing studies have analyzed fiscal adjustments in industrial countries and developing countries, only Adam and Bevan (2003) present results for a subsample of middle-income countries. Studies focusing on a large sample of emerging market economies are, however, lacking. The robustness of existing results for industrial and developing countries needs to be tested by taking into account the specific factors affecting middle-income countries' debt sustainability problems. For example, preliminary evidence suggests that the covariates of sustained fiscal consolidation vary across countries by income levels. In particular, expenditure reduction is central to fiscal adjustment in advanced economies, while increased revenue effort is critical in low-income countries.[9]

Third, existing studies offer inconclusive evidence on the impact of selected variables on the persistence of fiscal consolidation. For example, von Hagen and others (2002) report that high debt-to-GDP ratios raise the likelihood of persistent consolidation in industrial countries. On the other hand, Adam and Bevan (2003) find that higher debt levels raise the risk of failure. While this may reflect offsetting forces—in particular, high debt levels makes fiscal reform more urgent but also makes fiscal consolidation harder to sustain—the net impact is yet to be established conclusively.

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[7] Some papers have used the Alesina-Perotti method to implement a multivariate analysis of fiscal consolidation. They recode data on episodes of fiscal consolidation (pre-specified as "successful" or "unsuccessful") into dichotomous variables and use logit or probit regression to determine the covariates of fiscal consolidation (see for example, McDermott and Wescott, 1996; von Hagen and Strauch, 2001; Lambertini and Tavares, 2001; and Purfield, 2003). While this is more sophisticated than the simple comparison of group averages, this method still makes use of only a subset of available information (i.e., pre-selected large consolidation episodes) and does not model duration directly. With respect to the *duration* of spells, Adam and Bevan (2003) suggest that one could model it by using censored regression, with explicit assumptions about the independence of multiple spells in a given country and the time-invariance of explanatory variables.

[8] See Adam and Bevan (2003) and Gupta (2003) for a review of measurement issues.

[9] In transition economies, expenditure cuts, rather than revenue increases, lead to more lasting consolidation (Purfield, 2003).

Finally, relatively little work has been undertaken to examine the impact of expenditure composition on fiscal consolidation in developing countries.[10] Gupta and others (forthcoming) show that a larger share of capital expenditure in total government outlays is positively related to the persistence of adjustment in low-income countries. Whether this empirical finding also holds for emerging market countries is yet to be verified.

This paper fills up the above-noted gaps in the existing literature on fiscal consolidation and persistence. Survival analysis is used to assess the factors determining the duration of fiscal consolidations using a pooled sample of emerging market countries during 1980–2001. The paper introduces a new "composite approach" to define fiscal consolidation, and uses both semi-parametric and parametric approaches to model the risk of ending a fiscal adjustment spell. The baseline model uses a proportional hazard specification to model the persistence of fiscal consolidation. Persistence is modeled as a function of macroeconomic variables, aggregate fiscal variables, the composition of expenditure, and variables that control for institutional quality and the external environment. Alternative specifications are used to test the robustness of the results.

The rest of the paper is structured as follows: Section II presents the analytical framework and reviews recent literature. Section III describes the data and empirical framework, and Section IV presents the results of the econometric analysis. Section V concludes the paper with policy implications.

II. Analytical Framework and Review of Related Literature

A growing number of empirical papers have used survival analysis to document the covariates of fiscal consolidation and persistence. These studies typically specify and estimate hazard functions, *h(t)* or the probability that a period of fiscal consolidation ends at time *t*. The following is a brief review of the analytical framework. Technical details are provided in the appendix.

Hazard functions are based on the following components: a definition of fiscal consolidation; a measure of the length of the current spell of fiscal consolidation, *T*; a survival function *S(t)* to measure the probability that a spell of fiscal consolidation exceeds time *t*, $S(t)=Pr(T>t)$; and the failure function *F(t)* or the cumulative probability that *T* is lower or equal to *t*, where *F(t)* is also *1-S(t)*. This yields the following hazard function:

$$h(t) = \frac{f(t)}{S(t)} \tag{1}$$

[10] Adam and Bevan (2003) found that the composition of adjustment (in terms of whether it is revenue- or expenditure-based) is critical for the persistence of adjustment episodes. However, data limitations prevented them from assessing the importance of expenditure composition on the duration of fiscal adjustments.

where *f(t)* denotes the probability density function for *T*, *f(t)=dF(t))/dt*. In effect, *h(t)* represents the probability that a spell of fiscal consolidations ends at *t,* given that it has survived until *t*.

Past studies have used both parametric and nonparametric analyses to describe the hazard function. Although nonparametric analysis is informative of the duration process, it cannot assess the covariates of the hazard function. In contrast, parametric analysis assumes that the hazard function can be linked to a vector of covariates *X* using proportional hazard models:

$$h(t, X) = h_0(t) * \exp(X'\beta) \tag{2}$$

where $h_o(t)$ is the baseline hazard function. Two different classes of models have been used: semi-parametric and pure parametric models. Semi-parametric models do not require specific assumptions on the form of the underlying baseline hazard ratio $h_o(t)$, while pure parametric models usually require the *ex-ante* knowledge of the hazard function shape.

A widely used semi-parametric model is Cox's proportional hazard function model (Cox, 1972). This model can be estimated without imposing any specific functional form to the baseline hazard function. A fundamental property of Cox's model is that when comparing two individuals with a different set of covariates the ratio of their hazard function is independent from the baseline hazard rate, which does not need to be specified. In the case of parametric models, a commonly assumed functional form for the hazard function is the *Weibull* distribution. Under this model, the baseline hazard function is the following:

$$h_0(t) = pt^{p-1} \exp(\beta_0) \tag{3}$$

where *p* is a parameter to be estimated and β_0 is a constant parameter. By estimating *p*, it is possible to test the hypothesis of duration dependency during fiscal consolidations. In particular, this provides a test of the hypothesis that sustaining fiscal adjustment becomes more difficult over time.

Using proportional hazard models, von Hagen and others (2002) study the persistence of fiscal consolidation in the European Union, while Maroto and Mulas-Granados (2001) examine consolidation in 15 EU member states.[11] Bayar (2001) provides complementary evidence by examining both entry and exit dynamics of "excessive deficits" (i.e., higher than 3 percent of GDP) in EU member states from 1970–96.[12] Gupta and others (forthcoming) use a Cox

[11] Both confirm that successful consolidations are associated with expenditure reductions, rather than revenue increases.

[12] Using a similar method, he finds that government receipts and economic growth determine the *exit* from excessive deficits, while primary expenditures determine the *entry* into excessive deficits. To secure lasting fiscal consolidation, then, he concludes that fiscal policy should focus on expenditure control.

proportional hazard model to confirm a strong link between public expenditure reform[13] and sustained fiscal adjustment in a sample of 39 low-income countries over the 1990s.[14]

Other authors have preferred to model the hazard function directly using a parametric approach. Adam and Bevan (2003) use a "piecewise-constant hazard" model for a sample of 108 developing and industrial countries over the 1970 to 2000 period.[15]

For classifying existing studies of fiscal adjustment using duration analyses, Adam and Bevan (2003) also provide a useful typology of the definition of "fiscal consolidation and persistence": (1) the "level" approach, which provides a specified threshold for the deficit; that implies that if the deficit is below that threshold, in time period t the fiscal consolidation is considered to be ongoing (with deficits above that level, the consolidation fails); (2) the "gradient" approach, under which a fiscal consolidation is considered ongoing in year t as long as the deficit falls in year t relative to t-1 (e.g., by ½ percentage point of GDP); and (3) the composite approach or a combination of (1) and (2).

Studies of fiscal consolidation generally fall under the first two categories. For example, Bayar (2001) and Adam and Bevan (2003) employ variants of the level approach. Maroto and Mulas-Granados (2001) use the gradient approach. They define consolidation as instances where the cyclically-adjusted budget deficit improves. Gupta and others (forthcoming) follow a similar approach but define fiscal consolidation based on the reduction of the overall fiscal deficit.

The level and gradient approaches both have methodological weaknesses. First, the level approach imposes a common threshold on a diverse group of countries facing different policy environments. These thresholds are not necessarily consistent with country-specific efforts required to achieve fiscal sustainability, nor with country-specific constraints. Second, the level approach classifies as a "failure" instances where significant fiscal adjustments may have already taken place. There are weaknesses in the gradient approach as well. In particular, it would be unreasonable to expect a period of continued reduction in the fiscal deficit, once a low and sustainable level of deficit and public debt are achieved.

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[13] In contrast to the literature on industrial countries, the results show that the probability of ending an adjustment is lower when fiscal consolidations are supported by an acceleration of the revenue effort. Where revenue ratios to GDP are relatively modest, higher tax revenue collection can be achieved through improvements in tax administration, elimination of exemptions, and the curbing of tax evasion, as well as by increases in tax rates.

[14] Abed and others (1998) suggest that low-income countries that experienced relatively more interruptions of IMF-supported programs tend to have higher level of current spending and lower capital outlays.

[15] Total duration time is divided into *M* intervals. If the hazard function is piecewise-constant, this means it is constant over each interval but may vary from interval to interval. The authors also allow the parameters of the hazard function to vary with time and account for unobserved heterogeneity.

A more suitable approach seems to be a "composite" approach. In this paper, we propose one form of the composite approach that seeks to capture the marginal cost of adjustment as the economy gets closer to the chosen threshold. This approach then recognizes that further reductions in the fiscal deficit are difficult as an economy moves closer to sustainable deficit levels. On the other hand, the distance from sustainable deficit levels may signal the commitment (or lack thereof) to fiscal sustainability. Moving closer to sustainable levels may therefore reinforce government credibility.

We use two definitions of sustained fiscal consolidation. First, the baseline model defines the persistence of fiscal consolidation on the basis of the gradient approach, but conditions the estimates of the probability of ending the fiscal consolidation effort on the existing level of budget deficit. Second, an alternative estimate is presented in the robustness section, where the definition of sustained fiscal consolidation is based explicitly on both a specified minimum rate of reduction of the fiscal deficit *and* a specified threshold for the targeted level of the deficit.

III. Data and Empirical Framework

This paper examines fiscal adjustment in a sample of 25 emerging markets over the period 1980-2001.[16] The countries are: Argentina, Bolivia, Brazil, China, Colombia, Côte d'Ivoire, Ecuador, Egypt, India, Indonesia, Jordan, Lebanon, Mexico, Nigeria, Pakistan, Peru, Philippines, Poland, Russia, South Africa, Thailand, Turkey, Ukraine, Uruguay, and Venezuela.

Periods of fiscal adjustment are identified by the observed *change* in the overall fiscal deficit as a share of GDP. In the baseline model, a dummy variable is generated called "failure," which takes a value of zero when the annual variation of the budget deficit is above 1 percentage point of GDP (years of fiscal consolidation), and takes a value of one when the annual change is equal to or lower than this threshold (lack of adjustment). This criterion, though arguably arbitrary, is broadly consistent with previous empirical studies.[17] For example, Alesina and Perotti (1995); Perotti (1998); and Von Hagen, Hallett, and Strauch (2001, 2002), define episodes of fiscal consolidation as those periods in which the fiscal impulse (measured by the average cyclically adjusted primary deficit) falls by at least 1¼ percent of GDP over two consecutive years, or when it increases by more than 1½ percent of GDP in one year.

The hazard function or probability of interrupting a spell of fiscal consolidation is regressed on fiscal and macroeconomics variables that have been identified in the literature as likely determinants of the duration of the adjustment. The fiscal variables include: (1) fiscal history, measured as the number of previous failures at fiscal consolidation; (2) the composition of

[16] These countries constitute the J.P. Morgan Emerging Markets Bond Index Global (EMBI), a debt benchmark.

[17] In order to assess the robustness of the empirical results to alternative thresholds for the change in the fiscal deficit, we also used two alternative definition of fiscal consolidation based on a change in the fiscal deficit of 0.5 percent of GDP and 1.5 percent of GDP per year, respectively. Results are broadly consistent with the baseline model.

spending, including expenditure on goods and services, interest payments, subsidies and transfers, and capital spending, in percent of GDP; and (3) the level of total revenue in percent of GDP. In countries where there is a recent history of failure on fiscal consolidation, the authorities tend to have low credibility, both at home and abroad. In this context, markets may perceive that future attempts at fiscal consolidation will also fail and be reversed in the short run. Under these circumstances, the first periods of fiscal adjustment may have little effect on long-term interest rates and the investment climate. As such, fiscal adjustment will not yield the same benefits as it does where policymakers enjoy more credibility; hence, a history of past failure is likely to increase the probability that fiscal consolidations will be aborted. The composition of adjustment is also assumed to have a critical role in the persistence of the consolidation. The last variable, total revenues (proxied by revenue and grants), captures the contribution of improvements in tax collection to the consolidation effort.

The model also controls for: (4) the stock of initial debt in percent of GDP; (5) increases in oil prices, measured as the percent change in the international oil price deflator; (6) exchange rate depreciation; (7) unemployment rate[18]; (8) corruption; and (9) the interaction between corruption and capital spending. The stock of debt provides a further dimension of fiscal vulnerability; fiscal stability may be harder to sustain with higher levels of debt because the burden of debt service may have already squeezed discretionary spending to low levels, making additional cuts in these outlays politically difficult. On the other hand, higher debt stocks also increase the urgency of putting the economy on a sustainable debt path. Furthermore, higher levels of debt and interest payments imply that the gains from fiscal adjustment, once sustained, can be relatively large; given large debt stocks, falling interest rates can lead to large reductions in the interest bill and the budget deficit, inducing a virtuous circle of fiscal adjustment. Changes in oil price levels and nominal exchange rates, on the other hand, measure the external environment in which economies operate. The change in exchange rate also captures to some extent the macroeconomic policies that have been found to accompany successful fiscal consolidation. Lambertini and Tavares (2001), for example, find that lasting fiscal adjustments are often preceded by large exchange rate depreciations.[19] Unemployment, meanwhile, captures the social cost of adjustment. As social costs rise, the probability of ending fiscal adjustment may increase. Finally, we assume that the lack of corruption is a proxy for institutional quality. This signals credibility and the ability to carry out lasting structural fiscal reforms, thereby positively affecting the probability of continuing a fiscal consolidation spell. [20]

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[18] Unemployment rates are not significantly correlated with growth in our sample. This reduces the risk that this regressor is not exogenous, which would bias the estimate of the coefficients in the proportional hazard model.

[19] Hjelm (2002) also finds that fiscal contractions preceded by real depreciations improve individual expectations about future disposable income and generate higher private consumption growth. Rational individuals thus perceive that real depreciations followed by fiscal adjustment are more durable.

[20] The interaction between capital spending and corruption was found to affect significantly gross investment in a sample of developing countries. For countries with high levels of corruption the marginal growth effect of additional capital spending was found to be negative (Baldacci, Hillman, and Kojo, 2003).

As noted above, the hazard function is based on the gradient approach to defining fiscal consolidation. To capture the level aspect of the composite approach, the vector of covariates includes a measure of the distance[21] between the deficit at the beginning of the consolidation spell and a specified threshold.[22] This "distance" variable takes into explicit account the difficulty of securing further reduction in the deficit as an economy moves closer to sustainable deficit levels, and the offsetting impact of greater credibility associated with more manageable deficit levels. This approach is more flexible than the alternative of imposing that the distance variable has a truncated distribution, with the distance equaling zero for any initial deficit below the specified threshold.

Data are drawn from several databases. Data on macroeconomic variables, such as inflation, exchange rates, unemployment rate, real GDP per capita in PPP terms, and aggregate general government budget are from the *World Economic Outlook* (WEO) database. Disaggregated data on the components of government expenditure are drawn from the *Government Finance Statistics* (GFS) database. Data on the structure of the economy are from the World Bank's *World Development Indicators* (WDI) database.

IV. Empirical Results

A. Non-Parametric Analysis

The results of the nonparametric analysis suggest that 56 percent of the episodes of fiscal consolidation end within a year. There is a large dispersion in the episodes, and the confidence intervals indicate that the risk of interrupting a fiscal consolidation ranges between 33 percent and 94 percent.

In order to assess the importance of initial fiscal conditions, we split the sample into episodes, where the initial fiscal deficit was below 2 percent of GDP and episodes where the fiscal deficit was above this threshold. Figure 1 compares the Kaplan-Meier survival function of the two groups. A significantly lower proportion of fiscal adjustments end within a year when the initial deficit is lower than the threshold. Tests for the equality of survival functions reject this assumption, thus lending empirical support to the use of the composite approach instead of the level or gradient approach.[23]

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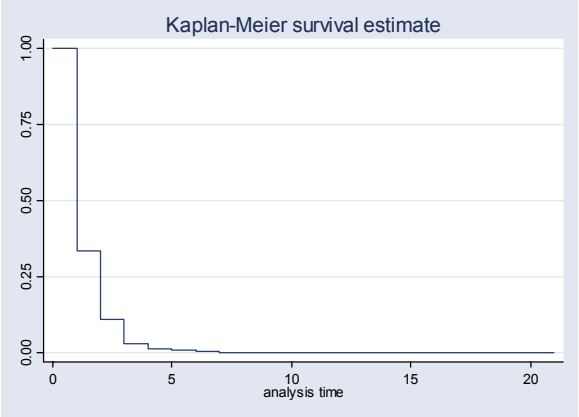
[21] As constructed, the distance variable is equal to the specified threshold minus the current deficit level. It is therefore a continuous variable that can assume both positive and negative values.

[22] The threshold fiscal deficit is set to 2 percent of GDP. This threshold is consistent with a non-increasing ratio of public debt to GDP in our sample.

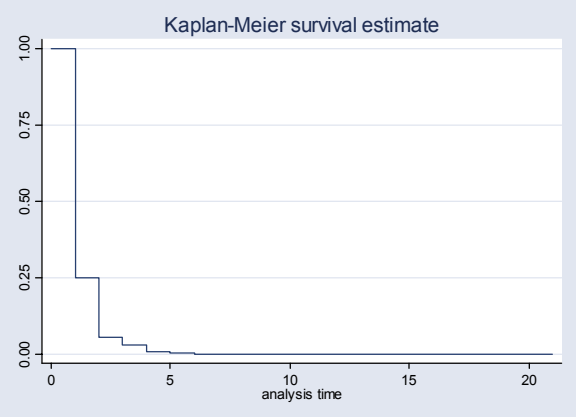
[23] The tests include the Wilcoxon, Tarone-Ware, and Fleming-Harrington tests. Results are available from the authors on request.

Figure 1. Kaplan-Meier Survivor Function by Level of Initial Deficit Level

Low Deficit



High Deficit



B. Semi-Parametric Analysis

The empirical results of the baseline model using the Cox proportional hazard model are reported in Table 1. The overall fit of the three models is good.[24] The specification test rejects the hypothesis of omitted regressors, while the result of the generalized Grambsch and Therneau test, based on Schoenfeld residuals, confirms that the proportional hazard assumption is valid.

The baseline results suggest that the probability of ending a spell of fiscal adjustment is positively and significantly affected by fiscal history, or the number of previous failures at fiscal reform. Exchange rate depreciation and corruption are also positively associated with failure, though this result is weaker and much less robust. The weak association between exchange rates and consolidation is not surprising. The impact of devaluation on fiscal adjustment may reflect two offsetting forces: exchange rate devaluation raises competitiveness and economic growth, but may also enhance expectations of further devaluation and lead to higher interest rates and lower demand (Heylen and Everaert, 2000) as well as increase the domestic currency cost of interest payments on foreign debt.[25]

The level of public debt is negatively associated with the risk of ending a spell of consolidation. This implies that the potentially large and positive effects of deficit reduction on the interest

[24] We assess the goodness of fit of the model by calculating the Cox-Snell residuals for each observation. In all models the distribution of these residuals was not different from a standard exponential distribution with hazard equal to one for all *t*, thus indicating a good fit of the model.

[25] McDermott and Wescott (1996) find that significant currency depreciation occurred during periods of fiscal expansion. They also report, however, that exchange rate movements are not significantly associated with successful consolidation episodes.

bill—which are sizeable for high debt countries—more than outweigh the difficulties in cutting discretionary spending to achieve such deficit reduction. This result is consistent with those obtained by von Hagen and others (2001, 2002) and Illera and Mulas-Granados (2002), who find that high debt levels exert pressure for correction on OECD and EU governments, respectively.

With respect to other fiscal variables, the probability of ending a spell of fiscal consolidation increases with spending on subsidies and transfers and decreases with interest payments. The hazard is also weakly related to outlays on goods and services (including wages). Capital spending is negatively associated with the probability of ending a fiscal adjustment, but is generally not significant. The results, thus, cumulatively suggest that reallocating spending away from wages, salaries, subsidies, and transfers supports fiscal consolidation, and allocating more spending on capital outlays is not harmful for the sustainability of adjustment. In contrast to the consensus on the limited role of revenue increases in sustaining fiscal adjustment in industrial countries, the results in Table 1 indicate that buoyant tax revenues support fiscal adjustment in emerging markets. In this sense, the fiscal consolidation experience of emerging market countries with respect to the beneficial impact of tax effort seems more consistent with that of low-income countries (Gupta and others, forthcoming).

A new empirical result based on the composite approach indicates that distance from the deficit threshold is *positively* associated with the probability of ending fiscal adjustment. While further reduction in the deficit becomes arguably more difficult as an economy moves toward sustainable deficit level, there is, instead, some evidence that sustained fiscal consolidation becomes *easier* as the fiscal policy stance moves closer to the deficit threshold. This is also consistent with the results depicted in Figure 1 using nonparametric analysis, where a significantly lower proportion of adjustments end within a year when the deficit is initially lower.

The robustness of these results is tested by, among other things, letting the parameters of the hazard function vary with time; accounting for unobserved heterogeneity; and allowing the hazard rate to be group-specific. Dummy variables for capital accounts crises and for countries under IMF-supported programs are also included to capture other dimensions of the external environment. Case studies demonstrate that crises lead authorities to undertake major structural fiscal reforms in emerging market economies. The adverse impact of an economic downturn on revenue is offset by the fiscal adjustment measures required by the crisis; fiscal deficits, thus, tend to decline following a crisis (Hemming and others, 2003). On the other hand, during financial crises, solvency concerns may constrain access to new financing from international capital markets.

Table 1. Persistence of Fiscal Consolidation, 1980–2001: Probability of Ending Fiscal Adjustment
(Results from Cox Proportional Hazard Model unless otherwise indicated; z-statistics in parentheses)

	Baseline Model (1)		Stratified Model: Based on Deficit (2)		Stratified Model: Based on Corruption (3)		Time-Varying Debt and Deficit (4)		Dummy Variables: Fund Program (5)		Dummy Variables: Financial Crises (6)		Time-Varying Capital Spending and Corruption (7)		Weibull (8)	
Previous number of failures	1.24	***	1.19	***	1.17	*	1.24	***	1.25	***	1.25	***	1.25	***	1.06	
	(5.05)		(3.13)		(1.74)		(4.72)		(5.33)		(4.76)		(4.85)		(1.92)	
Distance from deficit threshold	1.09	***	1.08	***	1.07	***	1.00	***	1.09	***	1.09	***	1.09	***	1.07	
	(5.38)		(3.85)		(4.23)		(5.44)		(5.23)		(5.65)		(5.36)		(5.24)	
Debt (% of GDP)	-0.99	***	-0.99	***	-0.99	*	-0.99	***	-0.99	***	-0.99	***	-0.99	***	-0.99	
	(-3.87)		(-3.23)		(-1.83)		(-3.01)		(-3.02)		(-3.82)		(-4.26)		(-3.42)	
Change in oil prices	1.01		1.00		-0.99		1.00		1.01		1.00		1.00		-0.99	
	(1.14)		(1.11)		(-0.57)		(0.85)		(0.86)		(0.99)		(0.99)		(-4.94)	
Exchange rate depreciation	1.00	*	1.00		1.00	**	1.00		1.00	*	1.00	*	1.00	*	1.00	
	(1.70)		(0.77)		(2.49)		(1.42)		(1.65)		(1.66)		(1.83)		(2.98)	
Unemployment rate	-0.99		1.00		1.00		-0.99		1.00		1.00		-0.99		1.01	
	(-0.03)		(0.38)		(0.02)		(-0.37)		(0.26)		(0.10)		(-0.29)		(1.26)	
Corruption 1/	0.82	***	0.82		5.84		0.82	**	0.82	**	0.81	**	0.76	***	0.93	
	(2.29)		(1.19)		(.)		(2.18)		(2.17)		(2.45)		(3.36)		(0.73)	
Spending on goods and services (% of GD	1.02	*	1.03	*	1.02		1.02	*	1.02	*	1.03	*	1.02	*	1.00	
	(1.69)		(1.77)		(1.18)		(1.65)		(1.68)		(1.71)		(1.71)		(0.49)	
Interest payment (% of GDP)	-0.95	**	-0.95	**	-0.94	***	-0.95	**	-0.96	**	-0.95	**	-0.96	**	-0.95	
	(-2.41)		(-2.22)		(-3.34)		(-2.16)		(-2.32)		(-2.55)		(-2.35)		(-2.57)	
Subsidies and transfers (% of GDP)	1.06	***	1.06	***	1.05		1.05	***	1.06	***	1.06	***	1.07	***	1.03	
	(3.32)		(3.33)		(1.88)		(3.25)		(3.26)		(3.29)		(4.31)		(1.99)	
Capital spending (% of GDP)	-0.96		1.04		-0.81		-0.95		-0.96		-0.95		-0.99	*	1.00	
	(-0.88)		(1.00)		(-1.62)		(-1.38)		(-0.77)		(-1.22)		(-1.82)		(0.07)	
Total revenue and grants (% of GDP)	-0.95	***	-0.95	***	-0.96	*	-0.96	***	-0.95	***	-0.95	***	-0.95	***	-0.97	
	(-4.01)		(-3.01)		(-1.82)		(-4.19)		(-3.94)		(-3.91)		(-4.26)		(-2.48)	
Capital spending*Corruption	-1.01		-1.04		-1.08	*	-1.02	*	-1.01		-1.02		-1.00	'	-1.01	
	(-1.37)		(-1.37)		(-1.99)		(-1.99)		(-1.21)		(-1.48)		(-2.48)		(-0.60)	
Fund program dummy																
Stand-by/EFF 2/									-0.95							
									(-0.37)							
ESAF 3/									1.07							
									(0.25)							
Capital accounts crises dummy											1.11					
											(0.95)					
Number of countries	15		15		15		19		15		15		15		15	
Number of failures	120		120		120		199		120		120		120		120	
No. of observations	159		159		159		266		159		159		159		159	
Log likelihood	-261.34		-207.53		-96.61		-262.31		-261.29		-261.29		-261.08		164.22	
Wald chi-square	1662.03		992.78		.		1175.29		.		1412.70		303.00			
P-value	0.00		0.00		.		0.00		.		0.00		0.00			

Source: See text.
(***), (**), and (*) denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.
1/ Rescaled. Higher values indicate weaker institutions.
2/ Indicates whether a country had an adjustment program supported by the IMF's Stand-by or Extended Fund Facility.
3/ Indicates whether a country had an adjustment program supported by the IMF's Structural Adjustment Facility (in force until 1999) or the Enhanced Poverty Reduction Growth Facility (1999 onward).

The results are robust to alternative specifications. Across various specifications in Table 1, the coefficient estimates are consistent. One robustness test assesses the effect of the initial deficit and corruption on the duration of fiscal adjustments based on a stratified Cox proportional hazard regression. This model allows the baseline hazard rate to differ by groups based on whether the initial deficit is above or below 2 percent of GDP and on the level of corruption. The coefficients based on the stratified model are reported in columns (2) and (3) in Table 1 and are almost identical to those in column (1).

The dummies for IMF-supported programs and dummies for capital accounts crises are all insignificant (columns (5) and (6)). This is consistent with Adam and Bevan's (2003) finding that Fund-supported programs are insignificantly related to fiscal consolidation. This is not surprising. Existing review of fiscal targets set under IMF-supported programs indicate that they vary widely across countries, highlighting the role of country ownership in the formulation of macroeconomic adjustment programs.[26] A report recently issued by the IMF's Independent Evaluation Office (IEO, 2003) found that IMF-supported programs did not adopt a one-size-fits-all approach to fiscal adjustment. The evidence in the study did not support the perception that programs always involve austerity by targeting reductions in fiscal deficits, with primary surpluses allowed to shrink in more than one third of the cases.

Allowing parameters of the model to vary with time produces some interesting results, though still broadly consistent with the baseline results. For example, the results suggest that the negative impact of debt and the distance variable increases with duration of the spell. Similarly, spending more on capital supports the persistence of fiscal consolidation. In addition, the impact of capital expenditure increases with the duration of fiscal adjustment. The sign and significance of the interaction of corruption and capital spending suggests that the positive impact of capital spending on fiscal consolidation is offset by the adverse impact of increased corruption. In contrast, unemployment is insignificantly related to fiscal consolidation, when allowed to vary with time.

We also replicated these results using a definition of fiscal adjustment based on the primary deficit instead of the overall deficit. Changes in the primary deficit are a better measure of discretionary fiscal policy because they disregard the effect of spending on interest that is beyond the control of the government. However, use of the primary deficit as a measure of fiscal consolidation leads to a dramatic reduction in the sample size. Nonetheless, results for the reduced sample are consistent with the baseline findings. [27]

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[26] Using a different methodology that controls for the separate effects of initial conditions, external shocks, and domestic policies, Bulir and Moon (2003) find that IMF-supported programs were not associated with improvements in the overall balance in a large sample of developing countries during the 1990s.

[27] Further, robustness tests were carried out to assess the degree to which results were sensitive to the assumption of pooling together different countries. We relaxed the assumption that individual observations were uncorrelated by allowing within-country correlations to be nonzero, using a shared frailty model. See Hosmer and Lemeshow (1999) for a discussion of this model. The results confirm the findings in the text and reject the assumption of heterogeneity across groups.

C. Parametric Analysis

The results of the semi-parametric analysis reported in the previous section are based on a proportional hazard model. This specification allowed to avoid the choice of the distribution of the baseline hazard. An alternative method is to assume that the baseline hazard follows the Weibull distribution. In this case, whether the failure rate falls or increases with time is based on the sign of the estimated ancillary parameter, *p,* thus allowing a direct test of the presence of "consolidation fatigue."

The result of the parametric hazard model are reported in column (8) of Table 1. The ancillary parameter *p* is greater than one which translates into monotonically increasing baseline hazard functions. There is then some evidence that the baseline risk (not the total risk) of ending a spell of fiscal consolidation is increasing with time. One important new result is the significant negative impact of oil price increases on the hazard. For oil-exporting countries an increase in international oil prices has a positive impact on exports and revenue collection thereby sustaining the fiscal consolidation effort.[28] For other countries, this result appears to be consistent with the findings obtained by von Hagen and Strauch (2001) that suggest that consolidation in industrial countries is more likely to be successful under bleak domestic economic and international economic circumstances.

D. An Alternative Definition of the Composite Approach

The robustness of these results is further tested by letting the hazard function be based explicitly on *both* the level and trajectory of the fiscal deficit while keeping all the regressors from the baseline model. In particular, we generate a new dummy variable called "failure," which takes a value of one when the annual variation of the budget deficit is equal to or lower than 1 percentage point of GDP *and* the deficit is more than 2 percentage points of GDP (lack of adjustment), and takes a value of zero otherwise (years of fiscal consolidation). Under this definition, annual reductions in the deficit lower than 1 percentage point of GDP are not considered failures unless a country breaches the deficit threshold of 2 percent of GDP.[29] This definition represent a stricter interpretation of the composite approach than the one used for the baseline model in the previous section.

This new definition of the hazard takes into explicit account the possibility that a country that does not reduce the fiscal deficit by more than 1 percentage point of GDP in a given year may nonetheless maintain fiscal control within the deficit threshold. In addition, within the specified

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[28] For example, in Indonesia where almost one third of revenue come from oil and gas, an increase in crude oil prices by US$1 per barrel lowers the deficit by 0.1 percentage point of GDP.

[29] The same analysis was also carried out replacing the budget deficit threshold with the debt to GDP ratio. Fiscal consolidations were defined to fail if the deficit adjustment was less than 1 percent of GDP per year and the ratio of public debt to GDP exceeded 35 percent. Results were consistent with the ones presented in the text and were robust to alternative thresholds for the debt ratio.

deficit threshold, no further reductions in the fiscal deficit are necessary. Using this definition, the average survival rate after one year of fiscal consolidation increases from 44 percent in the baseline model to 52 percent in the current model.

The new regression results are similar to the baseline results. Results of semi-parametric and parametric analyses are reported in Table 2. The previous number of failures, the distance from the deficit threshold, and subsidies and transfers in percent of GDP are all positively related to the probability of ending fiscal adjustment. The hazard decreases with interest payments and total revenues and grants in percent of GDP.

In contrast to the baseline results, the change in exchange rate and the level of spending on goods and services are no longer significant. There is some evidence that unemployment (our proxy for social cost) is positively related to the probability of ending fiscal adjustment. The evidence, however, is weak and not robust.

One important departure from the baseline results is the insignificance of the initial stock of debt. This is due in large part to the concentration of failed fiscal adjustment episodes, under the baseline definition, among high debt countries. This provides some empirical support for preferring the use of the baseline composite approach to defining fiscal consolidation (i.e., using a gradient approach to define failure and including the threshold effect as a regressor) rather than the alternative composite approach (where both the level and trajectory of the deficit are used to define failure) to identify the factors underlying sustained fiscal consolidation.

V. Conclusion

The reduction of government debt and deficits is high on the policy agenda of many countries. In recent years, a large literature has emerged on the characteristics of successful and unsuccessful fiscal consolidations. In general, studies have found that expenditure-based adjustments have led to lasting fiscal consolidations, while revenue-based reforms have been short lived.

Addressing weaknesses in earlier studies and methodologies, this paper uses survival analysis to assess the factors underlying the duration of fiscal adjustment episodes in a sample of 25 emerging market economies over the period 1980 to 2001. It proposes a new approach to model fiscal consolidation capturing both the pace of deficit reduction and the deficit level. The results indicate that the risk of ending a fiscal adjustment episode falls as an economy moves closer to sustainable deficit levels. This implies that the size of the fiscal adjustment is critical to its sustainability over time, in particular for countries with high initial fiscal deficits.

Table 2. Persistence of Fiscal Consolidation, 1980–2001: Alternative Composite Approach
(Results from Cox Proportional Hazard Model unless otherwise indicated; z-statistics in parentheses)

	Baseline Model (1)		Time-Varying Debt and Deficit (2)		Time-Varying Capital Spending and Corruption (3)		Weibull (4)	
Previous number of failures	1.17	**	1.17		1.13	*	1.14	**
	(2.20)		(1.44)		(1.75)		(2.12)	
Distance from deficit threshold	1.24	***	1.01	***	1.23	***	1.22	***
	(6.13)		(6.02)		(6.09)		(5.34)	
Debt (% of GDP)	-0.99		-0.99		-0.99		-0.99	
	(-0.46)		(-0.27)		(-0.07)		(-0.87)	
Change in oil prices	1.01		1.01		1.02		-0.99	*
	(1.09)		(1.07)		(1.35)		(-1.73)	
Exchange rate depreciation	-0.99		-0.99		-0.99	*	1.00	
	(-1.32)		(-0.29)		(-1.72)		(0.50)	
Unemployment rate	1.05	**	1.03		1.07	***	1.03	
	(2.50)		(0.85)		(2.89)		(1.27)	
Corruption 1/	-1.27	***	-1.12		-1.42	**	-1.16	
	(-2.89)		(-0.93)		(-2.19)		(-1.25)	
Spending on goods and services (% of GDP)	1.01		1.02		1.00		1.02	
	(0.53)		(0.94)		(0.14)		(0.82)	
Interest payment (% of GDP)	-0.87	***	-0.89	***	-0.87	***	-0.87	***
	(-3.98)		(-2.93)		(-4.25)		(-3.26)	
Subsidies and transfers (% of GDP)	1.06	*	1.06	**	1.07	**	1.03	
	(1.95)		(2.08)		(2.26)		(1.06)	
Capital spending (% of GDP)	1.08		1.01		1.01	*	1.06	
	(0.78)		(0.14)		(1.70)		(0.49)	
Total revenue and grants (% of GDP)	-0.92	***	-0.94	***	-0.92	***	-0.95	
	(-3.12)		(-2.93)		(-3.90)		(-1.56)	
Capital spending*Corruption	0.95		0.98		0.99		0.94	
	(1.52)		(0.48)		(1.65)		(1.57)	
Number of countries	15		19		15		15	
Number of failures	85		136		85		85	
No. of observations	159		266		159		159	
Log likelihood	-172.77		-178.70		-172.49		102.29	
Wald chi-square	6747.77		3127.99		684.21		.	
P-value	0.00		0.00		0.00		.	

Source: See text.
(***), (**), and (*) denote significance at the 1, 5, and 10 percent levels, respectively.
1/ Rescaled. Higher values indicate weaker institutions.

The appropriate composite definition (whether the baseline approach or the alternative approach presented in the text) may ultimately depend on whether the research questions are, in strict terms, about fiscal control *per se* rather than sustained fiscal adjustment. In the context of our study, we prefer the baseline approach that defines persistent fiscal consolidations as deficit reductions exceeding 1 percent of GDP per year. Under this approach we control for the relative fiscal position of each country by regressing the probability of ending a fiscal adjustment episode on a variable measuring the distance of the current fiscal deficit in the country from a deficit consistent with fiscal sustainability.

The results also show that the reallocation of public expenditure toward more productive uses is important for achieving more sustained fiscal adjustments. In particular, fiscal consolidation achieved through cuts in selected current expenditures, while protecting or increasing capital spending, tends to be more lasting. Revenue increases are also found to be critical to the persistence of fiscal consolidation.

There is evidence, though generally weaker, that other variables are important for the duration of fiscal adjustments. For example, high levels of public debt exert pressure to implement fiscal reforms and maintain a tight fiscal policy. We also find that exchange rate depreciations and oil price increases are significantly associated with the probability of sustaining fiscal adjustments. Finally, both poor governance and high unemployment are obstacles to achieving sustained fiscal adjustments.

These results have several policy implications for emerging market countries. First, strong institutions and a good policy track record are critical to achieve this sustainability. Countries with a history of "stop and go" fiscal adjustments are less likely than other countries to stay the course and achieve durable fiscal consolidation. Second, fiscal deficit reductions should be based on cuts in wasteful spending and revenue mobilization efforts. This can be achieved if across-the-board expenditure reductions are avoided and important expenditure programs (e.g., investment in infrastructure) are protected. Furthermore, revenue increases—which can be achieved by broadening the tax base, removing exemptions, and combating tax evasion, as well as by higher tax rates—are associated with more durable fiscal adjustments. Enhancing revenue collection also helps minimize fiscal vulnerability stemming from low and volatile revenue bases. This contributes to reducing the probability of liquidity crises and risk of default, which may short-circuit both growth and fiscal adjustment (IMF, 2003b). Finally, in view of the adverse effects of unemployment on the persistence of adjustment, there is an important role for social safety nets in ensuring there is a social consensus in favor of fiscal consolidation.

Although our results are promising, further research is needed. In particular, the role of accompanying policies on the persistence of fiscal consolidation needs to be better understood. Existing studies indicate the importance of appropriate monetary and exchange rate policies to support sustained fiscal consolidation. However, incorporating these policies into survival analysis is not straightforward, in particular, because of endogeneity issues. Further research should aim at exploring the role of policy interdependencies on the persistence of fiscal adjustments.

METHODOLOGY

Based on the definition of fiscal consolidation, duration data can be summarized by the hazard function. The unconditional hazard function *h(t)* expresses the relative risk that a fiscal consolidation ends at time t, provided, it was still ongoing in the previous period. If we assume that the underlying time variable is continuous, we can express the survivor function as follows:

$$S(t) = e^{-H(t)} \tag{1}$$

where $H(t) = -\ln[S(t)]$ can be written as $\int_0^t h(u)du$. Taking the logarithm of (1) and differentiating with respect to *t* yields:

$$h(t) = \frac{f(t)}{S(t)} \tag{2}$$

where $f(t) = -S'(t)$ denotes the probability density function for the time random variable.

Using the above equations, a life table can be constructed where the initial sample of fiscal adjustments is subject to the duration-specific failure rate. From the life table, summary information can be obtained of the survival process and the equality of two or more survival functions across groups of countries can be formally tested using an extension of the Mantel-Haenszel test or the generalized Wilcoxon test (Cleves, Gould, and Gutierrez 2002).

Although nonparametric analysis is usually informative of the duration process, it cannot help assess what are the factors underlying the persistence of fiscal adjustments. In the literature, two different classes of models have been used: semi-parametric and parametric.

A semi-parametric model that has been widely used in the empirical studies to estimate the effects of covariates on the hazard function is the *Model of Proportional Hazard* (PH), which assumes that the hazard function can be described as follows:

$$h(t, X) = h_0(t) * g(X) \tag{3}$$

where $h_0(t)$ is the baseline hazard function and $g(X)$ is a function of individual covariates. This is usually defined as $g(X)=\exp(X'\beta)$. In this proportional specification, regressors rescale the conditional probability of ending the period of fiscal consolidation. This model

can be estimated without imposing any specific functional form to the baseline hazard function, following Cox (1972):[30]

$$h(t, X) = h_0(t) * \exp(X'\beta) \tag{4}$$

Once the parameters of the model are estimated, the model's proportional hazard assumption can be tested using a generalization of the Grambsh and Therneau test (Cleves, Glould, and Gutierrez, 2002).[31] Although a general goodness of fit statistic can be easily calculated as:

$$pseudoR^2 = 1 - \left\{ \exp\left[\frac{2}{n}\right]\left(L_0 - L_p\right)\right\} \tag{5}$$

its interpretation is not straightforward as it depends on the number of censored events in the sample. An alternative approach is based on the analysis of the residual as suggested in Hosmer and Lemeshow (1999). This approach entails calculating the Cox-Snell residuals for each observation *j* according to the following formula:

$$CSr_j = \hat{H}_0(t_j)\exp(\mathbf{x}_j\hat{\beta}_\mathbf{x}) \tag{6}$$

where $\hat{\beta}_x$ is the estimate of the coefficient in the proportional hazard model and $\hat{H}_0$ is the cumulative baseline hazard function calculated from equation (4). If the model fits the data well, these residuals are distributed as an exponential distribution with hazard function equal to one for each time period *t*. To verify the model fit, one can estimate the Nelson-Aalen cumulative hazard function and verify whether the cumulative residuals are distributed as a straight 45º line.

An alternative specification can be obtained by imposing one specific parametric form to the baseline hazard function $h_0(t)$. This produces more efficient estimates only when there is sufficient *a priori* information on the shape of the hazard function. In the case of parametric models, the functional form most commonly assumed for the hazard function is the *Weibull* distribution. The baseline hazard function under this model is:

$$h_0(t) = pt^{p-1}\exp(\beta_0) \tag{7}$$

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[30] Mathematically, the baseline hazard function, *ho(t),* is defined for all time *t* in which a change has taken place, and is not defined for other moments of time. But the survivor function *So(t)* is defined for all values of *t*.

[31] This test is based on the assumption that if the model is correctly specified, the Schoenfeld residuals would not be correlated with time.

where p is a parameter to be estimated and β_0 is a constant parameter. The hazard functions can be written as follows, assuming a proportional hazard specification:

$$h(t, X) = h_0(t) * \exp(X'\beta) \tag{8}$$

When $p=1$, this specification is equal to the *exponential* distribution that assumes the absence of any dependency on duration. The conditional probability of failure in a given interval is the same regardless of when the observation is made. When $p>1$, there is a positive duration dependency, and a negative one when $p<1$.

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