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# DEBT REDUCTION, FISCAL ADJUSTMENT, AND GROWTH IN CREDIT-CONSTRAINED ECONOMIES

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This paper assesses the effects of fiscal consolidations associated with public debt reduction on medium-term output growth during periods of private debt deleveraging. The analysis covers 107 countries and 79 episodes of public debt reduction driven by discretionary fiscal adjustments during the 1980–2012 period. It shows that expenditure-based, front-loaded fiscal adjustments can dampen growth when there are credit supply restrictions. Instead, fiscal adjustments that are gradual and rely on a mix of revenue and expenditure measures can support output expansion, while reducing public debt. In this context, protecting public investment is critical for medium-term growth, as is the implementation of supply-side, productivity-enhancing reforms.

*JEL classification codes:* H30, E62
*Key words:* debt consolidation, fiscal adjustments, output growth, credit constraints, bank deleveraging

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## I. Introduction

The recent increase in the ratio of public debt to GDP in advanced economies has been accompanied by the assumption of banking sector liabilities by the public sector following the inception of the global crisis in 2007.[1] The average contribution of financial-sector support to gross public debt has been over 10 percent of GDP.[2] This has worsened public debt dynamics in some countries, raised market pressure on credit risk spreads, and undermined output recovery. In addition, access to credit by the private sector has been hampered by the deterioration in balance sheets of the banking sector, owing to the accumulation of non-performing assets, funding pressures from credit markets, and poor quality of collateral. As a result, output has been shrinking or growing modestly in advanced economies, while fiscal and financial sector weaknesses remain to be addressed (IMF 2012a).

Under these conditions, fiscal consolidations have not succeeded in lowering public debt in relation to GDP (IMF 2012b). Fiscal deficit-reducing measures in the presence of credit restrictions have worsened budget positions without being compensated by a substantial increase in private sector's activity. As a result, domestic demand, economic activity, and government revenues have declined. The beneficial effect of fiscal adjustment on interest rates (and thus private credit growth) has been limited because of the perceived link between sovereign and financial sector credit risks.[3] Furthermore, monetary policy effectiveness has been limited by impaired financial sector transmission channels.

This paper studies the effects of fiscal adjustment on output growth by focusing on credit conditions that typically follow financial crises. The center of analysis is episodes of public debt reduction arising from discretionary fiscal adjustment. In doing so, the paper departs from the existing literature on the nexus between fiscal adjustment and growth, which typically side-steps the question of whether public debt was ultimately reduced in the process. By focusing on the medium term, the paper complements recent studies on shortterm fiscal multipliers (Guajardo, Leigh and Pescatori 2011; Corsetti, Meier, and Muller 2012).

[1] This has happened during other periods in history as well: see Rogoff and Reinhart (2009) and Laeven and Valencia (2008; 2012).

[2] It is 6 percent if Ireland is excluded from the calculations. See Table 7 in IMF (2012).

[3] While the recent experience in Europe shows that credit restrictions can also be partially due to fiscal problems, the sample used in this paper shows that the correlation between the budget balance and credit variables was below 8 percent in the past.

The rest of the paper is organized as follows. Section II covers the literature review, Section III introduces a stylized framework to guide the empirical investigation, and Section IV presents the data and methodology used in the econometric analysis. Results from the empirical analysis are presented in Section V, including some robustness tests, and the final section discusses their key policy implications.

## II. What explains the link between fiscal adjustment and growth?

There is little consensus in the literature on the short-term output effects of deficit reduction. This has recently been attributed to the way in which discretionary fiscal policy is measured (Guajardo, Leigh, and Pescatori 2011). It has been argued that the "traditional" method [4] —which identifies discretionary adjustments on the basis of changes in the cyclically-adjusted primary balance (CAPB)—could be biased in favor of supporting expansionary fiscal contractions. Changes in cyclically-adjusted fiscal variables are often influenced by developments that cannot be attributed to changes in economic policy (such as a boom in the stock market that improves tax revenues or other developments that raise private consumption and investment).[5] An alternative is to identify episodes of fiscal adjustment on the basis of budget plans and government press releases to highlight true discretionary budget changes.[6] Empirical findings tend to differ, depending on the method used to identify consolidation episodes: while some authors (Alesina and Perotti 1996; Perotti 1999; Alesina and Ardagna 2010) find evidence of output growth three years after the end of a deficit-consolidation episode under the "traditional" approach, supporters of the "narrative" approach find that a 1 percent reduction in the fiscal

[4] See Alesina and Ardagna (2010).

[5] As explained by Guajardo, Leigh, and Pescatori (2011:4): "For example, a boom in the stock market improves the CAPB by increasing capital gains and cyclically-adjusted tax revenues… Such measurement error is thus likely to bias the analysis towards downplaying contractionary effects of deliberate fiscal consolidation. Moreover, a rise in the CAPB may reflect a government's decision to raise taxes or cut spending to restrain domestic demand and reduce the risk of overheating. In this case, using the rise in the CAPB to measure the effect of fiscal consolidation on economic activity would suffer from reverse causality and bias the analysis towards supporting the expansionary fiscal contractions hypothesis."

[6] The alternative "narrative" approach to identifying fiscal adjustment episodes can be found in Romer and Romer (2010) and Devries and others (2011).

deficit dampens output by 0.75 percent in the next two years (Devries and others 2011; Guajardo, Leigh, and Pescatori 2011). In empirical papers with a large sample of countries, where budget plans are not easily available, the "traditional" approach based on changes in the CAPB is still the most commonly used.

There is greater consensus in the literature on the medium-term effects of fiscal adjustment on output growth. If deficit cuts succeed in lowering public debt, they reduce uncertainty about debt sustainability and expected tax pressures, thus stimulating private investment and consumption via lower interest rates and higher labor force participation (IMF 2012a). However, the relationship between public debt and growth is complex: in empirical studies countries with higher levels of public debt tend to experience more subdued growth (Reinhart and Rogoff 2010); but low economic growth can increase public debt ratios even when fiscal adjustment is in place (Herndon, Ash, and Pollin 2013).

The link between fiscal policy and medium-term output growth becomes even more complex when credit market conditions are taken into account. A shortage of credit and impaired financial channels can damage growth, while spillovers of risks from the financial sector to sovereign debt markets can affect debt sustainability. However, studies that deal with the interaction between fiscal policy, financial markets, and output growth are limited. The existing literature can be classified into three groups:

- Studies that focus on the reaction of financial markets to fiscal policy—most papers show that financial markets value fiscal discipline (Ardagna 2004; Alesina and Ardagna 2010; and Cottarelli and Jaramillo 2012). Interest rates, particularly those on long-term government bonds, fall when fiscal conditions improve and rise in periods of budget deterioration. Stock market prices surge around times of substantial fiscal tightening and plunge in periods of loose fiscal policy.

- Studies that focus on the effect of financial crises on fiscal conditions—recent empirical analyses have shown that financial crises significantly worsen countries' fiscal position, both in terms of budget balances and public debt (Reinhart and Rogoff 2009; Laeven and Valencia 2008; 2012). In fact, the repair of the banking sector is found to be a pre-condition for fiscal consolidation to succeed (Barrios and others 2010).

- Studies that focus on the interaction between financial crises, fiscal multipliers, and economic growth—Baldacci, Gupta, and Mulas-Granados (2009) —show that expansionary fiscal policies are helpful in reducing recessions'

length after a financial crisis, while expenditure-based, fiscal consolidations are more likely to be successful in lowering public debt to sustainable levels. However, this is only partially valid in a post-financial crisis environment (Baldacci, Gupta, and Mulas-Granados 2012; IMF 2012b). Output and consumption multipliers are unusually high during episodes of financial distress (Corsetti, Meier, and Mueller 2012). The expansionary effects of expenditure-based deficit reductions start to dissipate when large public debt has been accumulated due to financial crises and there is a need for new revenue sources. Expansionary austerity is also more difficult when interest rates are close to the zero-bound and/or when countries cannot devaluate (Cottarelli and Jaramillo 2012; Baum and others 2012; Guajardo and others 2012; IMF 2012b; Blanchard and Leigh 2013; IMF 2013).

In parallel to this literature, the financial crisis and the subsequent accumulation of public debt in advanced economies have motivated research on the factors that help shorten successful public debt reduction episodes (Baldacci, Gupta and Mulas-Granados 2011; 2012; Eyraud and Weber 2013), and on the relative contribution of growth and fiscal policy to reducing debt-to-GDP ratios (Escolano 2010; Abbas and others 2013).

The present article builds on these studies and assesses the contribution of fiscal policy to medium-term economic growth in the context of private debt deleveraging and credit constraints, which typically arise after financial crises. The analysis focuses in particular on the fiscal mix that is more likely to lead to better output performance while reducing fiscal imbalances, a key challenge now facing policymakers in many countries.

## III. A stylized framework of fiscal policy and growth during financial crises

This section develops a simple framework to help underpin the econometric model tested in the paper. The framework describes an economy where the government collects taxes and engages in transfers to households who save to accumulate assets and consume out of wealth and income.

In this framework (discussed in detail in the Appendix), an increase in public debt above a risk-free threshold triggers higher interest rates via a non-zero credit risk premium (Laubach 2009), which reduces output through both lower investment and income.

Higher public debt would also have an indirect (negative) effect on growth via tax rates, which need to rise to meet the budget constraint. In this context, fiscal consolidation can increase growth by reducing equilibrium tax rates and lowering the risk premium on interest rates. This outcome is consistent with the expansionary fiscal contraction case (Alesina and Ardagna 2010).

If public debt reduction is achieved by increasing taxes, private consumption would fall and the capital stock would decline, reflecting lower savings owing to a fall in disposable income. This, in turn, would reduce labor income and output. When fiscal consolidation relies on the reduction in government current expenditure, output can be affected negatively via lower government consumption and transfers to households. However, when public debt falls, risk premia on interest rates could decline, boosting private investment and stimulating private sector growth.

In a standard Keynesian model, expenditure cuts may be more harmful than tax increases as the fiscal multiplier of the former is higher. In the steady state solution of the model used in this paper, this depends on the propensity to consume, the level of tax rates, and expenditure composition. For example, a reduction in public investment is more harmful to economic growth than a fall in government consumption as it decreases the stock of public capital and lowers productivity. In this Keynesian case, cuts in transfers are less damaging to growth as they impact private consumption only through the share of disposable income that is not saved.

The stylized model also shows that the impact of spending cuts is in general less harmful for economic growth when public debt is moderate and the tax rate is low. When adjustment needs are large and the equilibrium tax rate is high, the growth elasticity of expenditure cuts increases—a result consistent with the empirical findings in Baldacci, Gupta, and MulasGranados (2012).

When fiscal consolidation is undertaken in the context of financial sector deleveraging, spending cuts could also lower output via another channel in the model: the interaction of the fiscal adjustment mix with capital accumulation.[7]

[7] Public debt reductions that rely on higher tax rates reduce savings and lower the economy's capital stock. In normal times, a smaller capital stock would lower output by reducing capital intensity as well as total productivity. In the aftermath of a financial crisis, however, a reduced capital stock lowers the wealth effect of asset repricing, which is positive for growth. The intuition for this result is that in an economy with credit constraints, spending cuts further reduce resources available to consumers and investors, while tax rises tend to hit the share of income that is not saved. The opposite is true for spending-based fiscal consolidations.

This would call for a more balanced contribution of revenue increases and savings to deficit reduction, compared to the expansionary fiscal contraction approach. A balanced composition of fiscal adjustment in a context of private debt deleveraging is more likely to have a positive impact on medium-term economic growth, in the presence of credit restrictions, by limiting the negative effect of deficit reduction on total investment and capital accumulation available in the economy. The supply side impact of expenditure based adjustments on medium term growth would be negative if private investment falls as a consequence of budget cuts thus impacting capital accumulation. This is likely to occur in the presence of credit restrictions in the financial sector.[8] The next section will test these hypotheses empirically.

## IV. Data and methodology

The starting sample used in this paper comprises 160 episodes of public debt reduction in 107 advanced and developing economies during the 1980–2012 period. The episodes are defined as at least two consecutive years of reduction in the ratio of public debt to GDP.

In principle, the reduction in the debt-to-GDP ratio could stem from an amelioration of the CAPB, a reduction in interest rates, output growth, and other adjustments to the stock of debt (such as privatizations and exchange rate movements). In our subsample, the key factor behind the reduction in the debt ratio was the improvement in CAPB.

We excluded countries that benefitted from debt relief and selected the public debt reduction spells in which a discretionary fiscal adjustment had taken place.[9] This yielded a subsample of 79 episodes of public debt reduction through fiscal adjustment, with an average duration of about 3.5 years (Table 1).

[8] In our sample, the average private investment ratio is 4.1 percent of GDP. In the presence of credit restrictions, this ratio goes down to 2.4 percent of GDP during episodes of expenditure-based adjustments; but remains at 3.3 during episodes of revenue-based consolidations.

[9] We followed the traditional approach (based on the change in the CAPB) to identify episodes of discretionary fiscal adjustment. We first selected episodes in which there were at least two consecutive years of public debt reduction. In the second step, we looked at spells with increases in the CAPB of at least 0.5 percent of GDP per year, sustained for two years or more during the debt reduction episode. Only episodes of public debt reduction with at least one period of discretionary fiscal adjustment within that period were selected. If more than two fiscal adjustment periods occurred during the public debt reduction spell, average values for the fiscal adjustment variables were used. In the robustness section, we test the sensitivity of the results to these assumptions.

**Table 1. Descriptive statistics**

| Control variables | Obs. | Mean | Std. dev. | Min. | Max. |
|---|---|---|---|---|---|
| GDP growth (n+5) (percentage points) | 532 | 2.9 | 2.2 | -2.3 | 8.2 |
| Initial distance from debt target (in percent of GDP) | 371 | 28.6 | 19.1 | 2.4 | 67.1 |
| Duration of debt consolidation (in years) | 530 | 8.6 | 3.4 | 2 | 17 |
| Duration of deficit cut (in years) | 537 | 3.5 | 1.6 | 1 | 7 |
| Size of deficit cut (in percent of GDP) | 495 | 3.9 | 2.2 | 0.2 | 9.9 |
| Size of debt cut (in percent of GDP) | 536 | 30.7 | 26.6 | 0.5 | 120.1 |
| Contemporaneous growth (in percent of GDP) | 502 | 4.5 | 1.6 | 0.1 | 8.1 |
| Quality of fiscal adjustment (in percent of deficit cut) | 537 | 53.3 | 23.8 | 0 | 100 |
| **Fiscal variables** | **Obs.** | **Mean** | **Std. dev.** | **Min.** | **Max.** |
| Change in direct taxes[1] | 351 | 4.8 | 7.4 | -8.8 | 12.1 |
| Change in taxes on goods and services[1] | 330 | 2.6 | 9.6 | -7.5 | 18.3 |
| Change in transfers expenditures[1] | 396 | 2.4 | 9.1 | -16 | 13.4 |
| Change in wage expenditures[1] | 370 | 1.4 | 9.4 | -14.5 | 14.3 |
| Change in goods & services expenditures[1] | 369 | 2.7 | 7 | -6 | 10.2 |
| Change in public investment expenditures[1] | 384 | 3.6 | 8.1 | -14.1 | 12.8 |

Note: (1) In percent of total revenues or total expenditures excluding outliers.

The dataset used for the empirical analysis includes three groups of variables: (i) GDP growth and other macroeconomic variables from the IMF's *World Economic Outlook* database; (ii) a set of indicators measuring credit restrictions faced by the private sector and bank recapitalization needs from the IMF's *International Financial Statistics*,[10] and (iii) data on budget composition from the IMF's *Government Finance Statistics*.

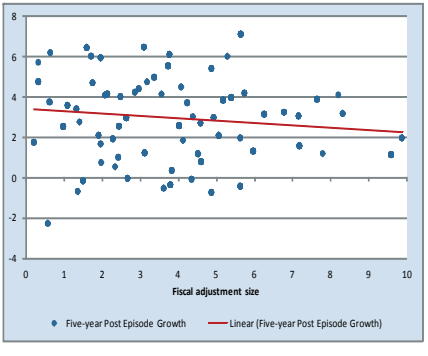
[10] We include the following variables: (i) domestic credit to private sector in percent of GDP. This variable refers to financial resources provided to the private sector, such as through loans, purchases of nonequity securities, and trade credits and other accounts receivable, that establish a claim for repayment. For some countries, these claims include credit to public enterprises; and (ii) bank recapitalization needs, using the change in the capital-to-assets ratio. This is the ratio of bank capital and reserves to total assets (in percent). Capital and reserves include funds contributed by owners, retained earnings, general and special reserves, provisions, and valuation adjustments. Total assets include all nonfinancial and financial assets.

The average distance of initial public debt from a reference (sustainable) target [11] was 28.6 percentage points of GDP. The average debt reduction during the episodes amounted to 30 percentage points of GDP. In 45 percent of the episodes, the debt ratio was reduced to levels below the sustainable threshold. During the debt reduction episodes, the average increase in CAPB was 3.9 percent of GDP, mostly owing to spending cuts (53 percent of deficit reduction was achieved through cuts in non-productive spending); annual real GDP growth averaged 3 percent in the five years after the end of the debt-reduction episode (Table 1).

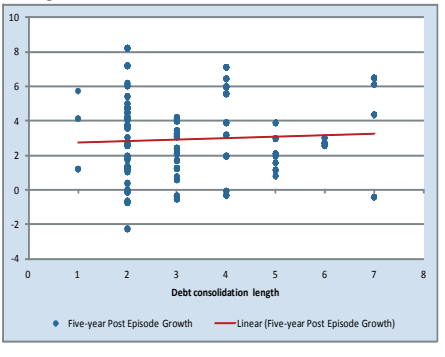
A preliminary (bivariate) analysis of the data in Figure 1 shows that after debt consolidation spells, economic growth was negatively correlated with the fiscal adjustment size (Panel A), but positively associated with the adjustment length (Panel B) and contemporaneous GDP growth (Panel C). Five-year average post-episode economic growth is also weakly associated with the quality of the fiscal adjustment, a key variable in this article which is proxied by the share of current spending contribution to total deficit reduction (Panel D).[12] The positive relationship between quality of the adjustment and post-episode growth turns negative in the presence of credit constraints (Panel E) and bank deleveraging (Panel F).

**Figure 1. Bivariate relationships between adjustment variables and post 5-year growth**

A. Fiscal adjustment size



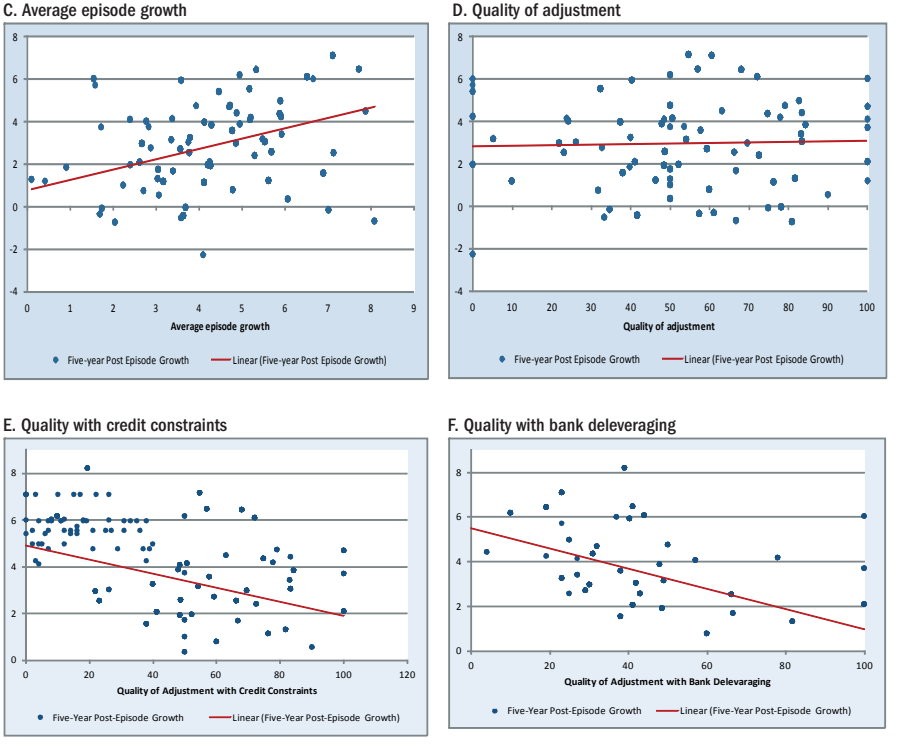

B. Length of consolidation




[11] The debt distance variable measures the difference between public debt at the beginning of the episode and a target debt level of 60 percent of GDP in advanced economies (the pre-crisis median) and 40 percent of GDP in emerging economies. These targets are also used in the IMF's Fiscal Monitor under an illustrative adjustment scenario (IMF 2012b).

[12] The quality of fiscal adjustments is measured by the contribution of cyclically adjusted current primary expenditures in percent of GDP to the change in the cyclically adjusted budget balance in percent of GDP (von Hagen, Hallett, and Strauch 2001). This variable takes values between 0 and 1.

Figure 1. Bivariate relationships between adjustment variables and post 5-year growth (*continued*)




The relationship between budgetary composition, fiscal adjustment, and economic growth is estimated by regressing the average real GDP growth 5 years after the consolidation episode has ended on a set of regressors, including fiscal and financial variables. The specification is consistent with earlier studies on fiscal consolidation and growth during crises (Baldacci, Gupta and Mulas-Granados 2012). It is also consistent with the result of the illustrative model presented in Section III. The estimation equation is specified as follows.

$$g_{i,t} = \alpha + \sum_{l=1}^{k} \beta_l CON_{ilt} + \sum_{h=1}^{q} \beta_h ADJ_{iht} + \sum_{j=1}^{m} \beta_j FIN_{ijt} + \delta\ FIN_{it} ADJ_{it} + \sum_{n=1}^{p} \beta_n BUD_{\text{int}} + u_{it}\text{,} \quad (1)$$

where $g_{i,t}$ is the average growth rate of real GDP (5 years after the episode of debt consolidation); $CON_{ilt}$ is a vector of control variables (initial distance from

the "sustainable" debt target;[13] average annual GDP growth during the episode);[14] $ADJ_{iht}$ is a vector of variables that define the fiscal adjustment strategy (duration, size, and quality of the fiscal adjustment(s) during the episode); $FIN_{ijt}$ is a vector of financial variables in a continuous form (domestic credit growth and bank deleveraging measured by the change in the capital-to-assets ratio); and $BUD_{int}$ is a vector of variables that capture the relative composition of the budget (share of direct and indirect tax revenues in total public revenues; share of expenditures on goods and services in total public spending; share of transfers in total public spending, and share of public investment in total public spending). See Table 2 for a description of the variables used in the regression.

**Table 2. Description of variables used in the regressions**

| Variable name | Description | Source |
|---|---|---|
| $g_{i,t}$ | The average growth rate of real GDP, 5 years after the episode of debt consolidation | WEO |
| *Initial distance from debt target* | Debt-to-GDP ratios minus the debt target (60 for advanced and 40 for emerging) | WEO |
| *Duration of consolidation* | The number of years there was a positive change in the CAPB during the episode | |
| *Size of deficit cut* | Average of positive change in CAPB during the episode | |
| *Contemporaneous growth* | Average of real GDP growth during episode | WEO |
| *Quality of fiscal adjustment* | Contribution of expenditure based adjustments on the positive change in the CAPB | |
| *Quality * Credit constraints* | 100 * quality variable * a dummy for private credit growth. The dummy holds the value of 1 if private credit growth was above the sample average and 0 otherwise | WDI |
| *Quality * Bank deleveraging* | 100 * quality variable * a dummy for the capital-to-assets ratio. This dummy holds a value of 1 if the change in the capital-to -assets ratio is below the sample average | WDI |
| *Change in direct taxes* | Change in direct taxes in percent of total revenue | WEO |
| *Change in taxes on goods and services* | Change in taxes on goods and services in percent of total revenue | WEO |
| *Change in goods & services expenditures* | Change in goods & services expenditures in percent of total expenditure | WEO |
| *Change in wage expenditures* | Change in wage expenditures in percent of total expenditure | WEO |
| *Change in transfers expenditures* | Change in transfers expenditures in percent of total expenditure | WEO |
| *Change in public investment expenditures* | Change in public investment expenditures in percent of total expenditure | WEO |

Note: WEO stands for World Economic Outlook; WDI stands for World Development Indicators

[13] Results do not vary if we use initial debt instead, but the fit worsens.

[14] The average economic growth variable controls for the effect of current output on future economic activity. It also captures the developments of the monetary sector. In addition, we also control for the potential effect of the business cycle by multiplying fiscal variables in the equation by the output gap. For reasons of space these results are not reported but are available from the authors upon request. In general, these tests confirm previous findings (Auerbach and Gorodnichenko 2012), showing that expenditure-based adjustments have a more damaging impact on post-episode growth when the output gap is large.

In order to test the interplay between credit constraints and fiscal adjustment strategies, we include a term that takes into account nonlinear effects. To do so, we focus on the fiscal consolidation mix and calculate its interaction with private sector credit and bank deleveraging.[15] We expect that when credit conditions are weak, reflecting a weak financial sector, fiscal adjustments based on spending cuts are less effective than deficit reductions based on a more balanced contribution of revenue measures and expenditure savings.

The budget composition is also expected to have an impact on economic growth: increases in indirect taxes are expected to reduce private consumption, potentially harming growth via lower domestic demand. Public investment is expected to have a greater positive growth impact than public spending on wages and goods and services, via increases in domestic demand and productivity.

The model specifications above are estimated in steps, from the basic model (no interaction term and no budget mix variables) to the augmented versions. Coefficients are estimated using a GLS estimator. Results are reported in the next section along with a range of other robustness tests.

## V. Empirical results

### A. General results

In general, the basic results confirm our expectations. Fiscal adjustments relying on public expenditure cuts that preserve public investment contribute positively to medium-term output growth.

During debt reduction episodes, gradually paced fiscal adjustments are positive for output expansion, but large deficit cuts have a contractionary effect. As shown in Table 3 model 1, a 1 percent of GDP reduction in the cyclically-adjusted fiscal deficit reduces average medium-term growth by almost 0.28 percentage points. However, one more year in the length of the debt consolidation episode raises average economic growth by around 0.23 percentage points in the subsequent five-

[15] We also tried an alternative approach by introducing indicators of both revenue and spending discretionary changes in the equation (instead of the quality variable) and interacting them with the credit-constraint variables. Results did not vary substantially.

year period. Initial public debt is not a significant impediment for future growth.[16] The fiscal adjustment mix can have an impact on growth: a 1 percent increase in contribution of cuts to fiscal adjustment increases medium-term growth by about 0.03 percentage points.

This relationship between the fiscal adjustment mix and growth is, however, affected by financial conditions. The results show that spending-based adjustments support output growth after the debt consolidation episode, except in cases where there is sustained bank deleveraging and tight private sector credit conditions. In both cases, the coefficients of the interacted variables turn negative and are larger than the quality-of-adjustment coefficient. As a result, the potential benefits of expenditure cuts on medium-term growth would be offset under difficult financial conditions. The shrinkage of banks' balance sheet in response to capitalization needs makes banks less willing to finance the private sector. In these cases, revenue-based adjustments can be more effective in stimulating growth than expenditure-based adjustments. Similar results hold when private sector credit supply is scarce. However, adequately paced deficit reductions that help lower public debt to sustainable levels are positive for economic growth both in normal times and in periods of financial sector distress.

Results for budget composition variables highlight the importance of the tax and spending mix (Table 4). An increase in the share of direct taxes in total revenue affects output growth positively, while increasing the share of indirect taxes during the debt consolidation episodes is generally insignificant for output growth thereafter. The expenditure mix also matters for growth. Higher spending (as a share of total expenditure) on public investment and transfers spurs output growth, while increasing the weight of spending on wages and purchases of goods and services is harmful for output expansion. Protecting public investment during adjustment periods and continuing to provide funds for critical investment in infrastructure is essential for raising productivity and potential output.

[16] This is in line with results on the economic growth effects of public debt (IMF 2012a).

**Table 3. Basic model. Dependent Variable 5-year average post-episode growth**

| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 |
|---|---|---|---|---|---|---|
| *Initial distance from debt target* | 0.0073 | 0.00573 | 0.00383 | 0.0142** | 0.0113* | 0.0177** |
| | (1.312) | (0.992) | (0.747) | (2.082) | (1.771) | (2.472) |
| *Duration of debt consolidation* | 0.228*** | 0.287*** | 0.330*** | 0.175** | 0.272*** | 0.455*** |
| | (3.495) | (4.274) | (5.386) | (2.365) | (3.841) | (6.229) |
| *Size of deficit cut* | -0.276*** | -0.267*** | -0.278*** | -0.282*** | -0.300*** | -0.310*** |
| | (5.903) | (5.587) | (6.488) | (4.996) | (5.674) | (5.240) |
| *Contemporaneous growth* | 0.491*** | 0.448*** | 0.516*** | 0.513*** | 0.536*** | |
| | (8.188) | (7.229) | (9.37) | (7.05) | (7.869) | |
| *Quality of fiscal adjustment* | 0.0329** | 0.344*** | 0.0295*** | 0.0298*** | 0.0384*** | 0.0428*** |
| | (3.247) | (3.909) | (6.033) | (3.758) | (6.587) | (6.521) |
| *Quality * Credit constraints* | | | -0.0342*** | | -0.0249*** | -0.0214*** |
| | | | (7.834) | | (5.961) | (4.577) |
| *Quality * Bank deleveraging* | | | | -0.0241*** | -0.0193*** | -0.0165*** |
| | | | | (3.146) | (2.789) | (4.206) |
| *Quality * G&S Index*[1] | | -0.384*** | | | | |
| | | (3.903) | | | | |
| Constant | 1.039** | 1.134*** | 0.523 | 0.347 | -0.00887 | 1.360** |
| | (2.553) | (2.627) | (1.379) | (0.618) | (0.0168) | (2.436) |
| Number of obs. | 330 | 288 | 330 | 245 | 245 | 249 |
| R-squared | 0.299 | 0.334 | 0.411 | 0.406 | 0.484 | 0.327 |
| Prob> F | 0 | 0 | 0 | 0 | 0 | 0 |

Note: *** Significant at 1percent; ** significant at 5 percent; * significant at 10 percent. (1) Goldman & Sachs Index on Financial Conditions. Note that this column is not fully comparable with the other as the sample size is slightly different due to data availability.

**Table 4. Augmented model. Dependent variable 5-year average post-episode growth**

| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 |
|---|---|---|---|---|---|---|
| Initial distance from debt target | 0.0147** | 0.0156** | 0.00961 | 0.0121* | 0.0173* | 0.0105 |
| | (2.64) | (2.706) | (1.65) | (1.741) | (1.81) | (1.007) |
| *Duration of deficit cut* | 0.286*** | 0.306*** | 0.232*** | 0.266*** | 0.187** | 0.257*** |
| | (4.699) | (4.747) | (4.746) | (3.798) | (2.892) | (3.789) |
| *Size of consolidation* | -0.279*** | -0.276*** | -0.295*** | -0.322*** | -0.191*** | -0.290*** |
| | (3.525) | (3.554) | (3.537) | (3.531) | (3.671) | (3.605) |
| *Contemporaneous Growth* | 0.479*** | 0.496*** | 0.545*** | 0.592*** | 0.532*** | 0.502*** |
| | (3.696) | (3.733) | (3.687) | (3.704) | (3.763) | (3.823) |
| *Quality of fiscal adjustment* | 0.0340*** | 0.0337*** | 0.0390*** | 0.0396*** | 0.0315*** | 0.0462*** |
| | (3.603) | (3.689) | (3.592) | (3.584) | (3.77) | (3.848) |
| *Quality * Credit constraints* | -0.0264*** | -0.0288*** | -0.0295*** | -0.0299*** | -0.0334*** | -0.0307*** |
| | (3.414) | (3.421) | (3.425) | (3.416) | (3.469) | (3.514) |
| *Quality * Bank deleveraging* | -0.0145** | -0.0111*** | -0.0147** | -0.0112*** | -0.0144** | -0.0182*** |
| | (2.369) | (3.374) | (2.184) | (3.376) | (2.221) | (3.412) |
| *Change in direct taxes*[1] | 0.0366*** | | | | | |
| | (3.122) | | | | | |
| *Change in taxes on goods and services*[1] | | -0.0298 | | | | |
| | | (0.809) | | | | |
| *Change in goods & services expenditures*[1] | | | -0.0383 | | | |
| | | | (0.432) | | | |
| *Change in wage expenditures*[1] | | | | -0.0756*** | | |
| | | | | (3.264) | | |
| *Change in transfers expenditures*[1] | | | | | 0.104*** | |
| | | | | | (3.352) | |
| *Change in public investment expenditures*[1] | | | | | | 0.0454** |
| | | | | | | (2.209) |
| Constant | -0.385 | -0.454 | 0.093 | -0.264 | 0.927 | 0.0652 |
| | (0.534) | (0.611) | (0.535) | (0.541) | (0.688) | (0.549) |
| Number of obs. | 245 | 245 | 240 | 240 | 190 | 212 |
| R-squared | 0.503 | 0.488 | 0.485 | 0.497 | 0.433 | 0.508 |
| Prob > F | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

Note: *** Significant at 1percent; ** significant at 5 percent; * significant at 10 percent.

## B. Robustness analysis

The results presented in the previous section are significantly different from previous studies on fiscal adjustments and growth (Alesina and Perotti 1996;

Alesina and Ardagna 2010), mostly because we incorporate in the analysis the effect of credit restrictions on the relationship between fiscal consolidation and economic activity. These results are robust to alternative estimation methods and do not change when the baseline and augmented models are estimated with robust standard errors. Results also hold when potential outliers are dropped and robust regression used. We further estimate the model using random effects and OLS with panel-corrected standard errors and find consistent results; results are confirmed when we change the dependent variable to capture average output growth three years after the episode.[17] They also hold when the variable that controls for contemporaneous GDP growth is not included in the baseline model.[18]

Findings are robust to the choice of alternative subsamples.[19] These are built by selecting episodes that have a higher-than-average value of key variables. In general, the main results in relation to the effect of fiscal adjustments on growth in a context credit constraints are confirmed (for a summary of main results, see Table 5; for detailed robustness results see tables A1-A9 in the Online Appendix):[20]

**Table 5. The interaction between quality of adjustment and credit constraints in different subsamples: summary table**

| | High unemployment | High tax revenue | Non-major debt reduction | Post-crisis | High credit constraints |
|---|---|---|---|---|---|
| Quality of fiscal adjustment | -0.014* | -0.010 | 0.022*** | 0.049** | 0.029*** |
| | (1.71) | (1.52) | (4.15) | (2.16) | (4.47) |
| Quality * Credit growth | -0.071* | -0.014** | -0.026*** | -0.390*** | -0.033*** |
| | (1.72) | (2.57) | (5.07) | (8.84) | (5.36) |
| | Structural reforms | 160 episodes | Advanced economies | Open economies | |
| Quality of fiscal adjustment | 0.006 | 0.065 | 0.064 | 0.063* | |
| | (1.16) | (1.60) | (1.62) | (1.65) | |
| Quality * Credit growth | -0.012** | -0.018** | -0.017** | -0.015** | |
| | (2.34) | (2.29) | (2.24) | (2.27) | |

Note: *** significant at 1 percent; ** significant at 5 percent; * significant at 10 percent.

[17] We do not report these results, as they are similar to those in Tables 2 and 3. They are available from the authors upon request.

[18] We tested the potential collinearity between contemporaneous GDP Growth and the fiscal variables such as size or quality of the adjustment, but results remained unchanged. See Table 2, model 6.

[19] We also interacted the fiscal mix variable with the Goldman and Sachs' Financial Conditions Index, for a reduced sample of countries where data are available. Results in the paper are confirmed using this alternative indicator.

[20] We also assessed the importance of simultaneous financial and corporate/household sector deleveraging in the regressions, but results do not change. From Table 4 onwards, the interaction variable "Quality*Bank deleveraging" is dropped, due to a lack of observations when running the model in the subsamples. We keep the "Quality*Credit constraints" variable which captures similar information.

- High unemployment. In this subsample of countries with higher-than-average unemployment, results hold except for the duration variable. Gradual (longer) debt consolidations are less clearly associated with stronger growth performance. This suggests the presence of reform fatigue in countries where social cohesion pressure, as measured by unemployment, is high. Moreover, spending cuts are more harmful for growth in this sample compared to the baseline model, and this negative impact is also valid in the absence of credit constraints.
- High-tax countries. Results are confirmed when we perform the analysis on a subsample of high-tax countries, which includes most advanced economies. Interestingly, in this subsample of countries, starting with a high level of public debt is more harmful for post-episode growth than in the baseline model.
- Countries that did not reduce debt. In countries that implemented a fiscal adjustment but did not manage to achieve a significant debt reduction (or even increased their debt-to-GDP ratio during the period), the negative impact of expenditure-based adjustments on growth in the presence of credit constraints is weaker than in the baseline model, but still statistically significant.
- Post-crisis episodes. When focusing on post-crisis debt consolidation episodes, we find stronger results. The negative growth impact of spending cuts in periods of high debt deleveraging and credit crunch is higher than in the baseline model.
- High credit constraints. Results are confirmed in the subsample of countries in which credit growth was below the sample average. They show that fiscal adjustments that rely excessively on spending cuts when credit restrictions are significant can harm growth. The coefficients of the key variables are larger in this subsample than in the baseline model.
- Countries that apply structural reforms. We used an expanded version of the index of structural reforms based on Lora (2001),[21] and estimated the model for a subsample of countries that implemented structural reforms during the

[21] The Index of Structural Reforms was originally developed for Latin American countries. We have extended it to our sample using the methodology in Lora (2001). The index is an average of four sub-indexes, namely: trade policy reform; financial policy reform; labor 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.

debt consolidation episodes. Major results are confirmed. In this case, the composition of fiscal adjustment is less important for post-episode average output growth than in the baseline model, but the output-enhancing impact of public investment growth (as a share of total spending) is reinforced. As in Lora's article, reforming product and labor markets in the context of fiscal consolidation episodes has a more positive effect for subsequent output growth. However, if credit restrictions are strong, these positive effects are not as significant.

- Larger sample of debt reduction episodes. Finally, we estimated the model using the original sample of 160 episodes of debt reduction. This included countries that received debt relief, and does not differentiate between debt reductions driven by fiscal-adjustments and those caused by other factors (e.g., exchange rate appreciation and privatization). Key results largely hold. In this case, countries with high initial debt benefit from lower growth than in the baseline. The positive contribution of spending-based adjustment is weaker.
- Other specific country characteristics. We ran the model on a subsample of advanced economies, and the major difference with respect to the baseline model is that the negative effect of weak credit conditions on medium term growth is higher than before. In addition, when we ran the model on a subsample of open economies, the importance of the quality variable and other fiscal variables is reduced, possibly reflecting the fact that medium-term growth in these economies is more dependent on external conditions and less strongly impacted by domestic fiscal policy.

## VI. Concluding remarks

This paper shows that gradual and adequately balanced fiscal adjustments may be more appropriate to spur medium-term economic growth than deficit reductions driven by spending cuts in the context of financial constraints. If credit is not available to consumers and investors, private demand cannot compensate for cutbacks in public demand and strong fiscal adjustments can have a negative effect on growth. Crowding-in of the private sector when the public sector adjusts is also difficult in the presence of credit constraints.

Post-crisis uncertainty about financial sector health could affect the degree to which fiscal policy can raise medium-term growth through public debt consolidation. The combination of bank deleveraging and public debt consolidation could change the way economic agents assess the effects of government policies.

In particular, the fiscal mix that under normal circumstances would have delivered growth-boosting public debt consolidations may not be successful under an environment of credit redstrictions.

These findings are consistent with those of Eggertsson and Krugman (2010), who illustrate the growth consequences of deleveraging when the effectiveness of monetary policy is constrained by a liquidity trap. They are also consistent with the findings in the expansionary fiscal contraction literature (Alesina and Ardagna 2010) in cases where credit supply to the private sector is not affected by financial sector weaknesses.

The results presented in this paper show that both the size and pace of fiscal adjustment are relevant for medium-term output growth. When private debt remains high and lending to the private sector subdued, the fiscal mix is critical for post-episode output expansion:

- Spending cuts may reduce aggregate demand and exacerbate real debt pressures by causing price deflation, while protecting public investment during deficit-reduction spells can support medium-term output growth.
- Revenue increases may be less damaging for economic growth to the extent that they have a less adverse effect on consumption in the medium term. Deficit-reduction measures that succeed in raising direct tax revenues by broadening the tax base can be beneficial for medium-term growth.

The policy implications of these results are significant: when bank deleveraging is high and credit is not flowing to the private sector, public debt consolidations should be gradual and based on an appropriate combination of revenue and expenditure measures rather than spending cuts alone (IMF 2012b). The fiscal policy mix should rely on cutting non-priority spending and protecting pro-growth public investment, especially when there is high structural unemployment. Revenue raising measures should aim at reducing inefficiencies and encouraging labor market participation and consumption. This calls for removing tax exemptions, lowering incentives for tax avoidance and evasion, and shifting tax pressure away from labor to property and low-elasticity consumer goods and services.

Reforms to enhance competitiveness in product and labor markets and strengthen fiscal institutions (Schaechter and others 2012) can also help support debt consolidation strategies over time sustaining the needed fiscal reforms while limiting the risk of "adjustment fatigue" (IMF 2012a).

## Appendix

This Appendix presents a simplified economic framework that illustrates the interaction between fiscal policy and economic growth in the steady state using comparative statics analysis. The model is meant to be illustrative and does not present a comprehensive derivation of fiscal multipliers. It nevertheless provides an intuitive rationale for the factors at play when fiscal policy affects growth under difficult financial sector conditions.

Let us define output $Y$ as a sum of private consumption $C$, investment $I$, government expenditure $G$, and exports minus imports ($X$-$M$):

$$Y_t = C_t + G_t + I_t + (X_t - M_t). \tag{A1}$$

We assume for simplicity that the economy is closed and drop the term ($X$-$M$). Our results do not change if we relax this assumption.[22]

The government's budget constraint requires that excess government spending $G$ over taxes $T$ be financed by borrowing $B$ each year:

$$G_t - T_t = B_t . \tag{A2}$$

The government budget can be rewritten as:

$$B_t = -(PB_t - rD_{t-1}), \tag{A3}$$

where $r$ is the effective interest rate on public debt and $PB$ is the primary balance $T$-($G$-$rD$), where primary spending $PG$ is ($G$-$rD$). The intertemporal budget constraint implies that debt can only be sustained if the net present value of the

[22] In this simplified framework we do not model explicitly the supply side. A complete treatment of fiscal multipliers in a dynamic setting can be found in Perotti (1999).

stream of future primary balances is sufficient to cover the (discounted) flow of debt service payments. And public debt $D$[23] is

$$D_{t+1}=-PB_t+(1+r)\,D_t. \tag{A4}$$

When $D$ and $B$ are large, governments will need to intervene with fiscal adjustment by increasing taxes, reducing spending or doing both. $YL$ is labor income and it is assumed to be exogenous. Taxes are proportional to labor income with a tax rate $t$.

$$T_t= t\,YL_t. \tag{A5}$$

The behavioral equations of the output components are as follows:

$$C_t=c\,(1-t)YL_t + v\,A_t, \tag{A6}$$

$$I_t= (1-c)\,(1-t)\,YL_t. \tag{A7}$$

In this simple framework, private consumption depends on after-tax income from labor, through the average propensity to consume $c$ and returns on accumulated assets ($v\,A_t$). Investment (assumed to equal savings supply) is based on disposable income and propensity to consume, with

$$A_{t+1}= I_t+ r\,A_t +(1-d)\,A_t - s\,A_t\,. \tag{A8}$$

[23] Public debt is assumed to be held abroad for simplicity.

The asset stock motion equation takes into account new investment, initial capital, and capital depreciation *d*. We also add a term *sA* that accounts for deleveraging in the banking sector and its effect on capital accumulation and ultimately growth. When a financial crisis erupts assets are worth less, as a result of valuation changes due to higher financial market risks, re-pricing of assets and higher funding costs in the banking industry. Bank deleveraging in response to reduced asset valuation leads to lower private capital. This affects consumption via return on assets if the banking sector is unable to provide sufficient credit to the economy to smoothen consumption because of balance sheet weaknesses.

The authorities can change tax rates and transfers, which would affect consumption and investment, or decide to change government consumption and public investment. However, debt service for the government depends on interest rates *r* which can be decomposed into $r = i+R$ where *i* is the policy interest rate that is defined by monetary policy and *R* is a credit risk spread that depends on market perceptions about fiscal sustainability (Poghosyan 2012). *R* is higher than zero only when public debt is higher than a market-perceived risk-less threshold $D^*$ (Panizza, Sturzenegger, and Zettelmeyer 2009), with *e* being the long-run elasticity of credit risk premia to the difference between actual debt and the risk-free threshold:[24]

$$R = max[0,\ e(D - D^*)]. \tag{A9}$$

The above equations can be used to derive steady-state conditions for comparative statics analysis as stated below.[25]
For a given level of *R,*

$$(t\ YL - PG\ ) / r = D, \tag{A10}$$

[24] In Poghosyan (2012) this elasticity takes a value of 0.02 in advanced economies.
[25] With I=(s+d-r) A.

$$C=c(1-t)\ YL+vA, \tag{A11}$$

$$I=(1-c)(1-t)\ YL, \tag{A12}$$

$$A=(1/h)\ (1-c)\ (1-t)\ YL, \tag{A13}$$

$$Y=c(1-t)\ YL+vA+G+h\ A. \tag{A14}$$

Substituting $YL=(1/t)\ (rD+PG)$ in the output equation:

$$Y=c\ (1/t)\ r\ D+c\ (1/t)\ PG+(v+h)\ A, \tag{A15}$$

where $h=(s+d-r)$. It shows that fiscal savings are necessary for debt reduction but higher interest rates make adjustment more difficult. Also fiscal consolidation affects growth negatively via a reduction in after-tax income and the direct effect of government consumption on output.

We get the following partial derivatives that provide an illustration of the size of fiscal multipliers for taxes and expenditure and the output effects of changes in assets and interest rates in the model. Based on these partial derivatives, fiscal multipliers depend on the propensity to consume, the inverse of the tax rate, the public debt stock, interest rates (which in turn depends on credit risk premia and debt stock) and primary spending:[26]

$$dY/dPGc/t>0, \tag{A16}$$

[26] The size of multipliers has been found to be cycle-dependent in several recent empirical studies (for example, Auerbach and Gorodnichenko 2012; Corsetti, Meier, and Muller 2012).

$$dY/dt = -c(rD+PG)\ t^{-2})<0. \quad \text{(A17)}$$

The output impact of a change in the asset stock depends on the develeraging rate, capital depreciation, return on assets and interest rates.

$$dY/dA = v+h>0 \text{ if } s+d+v>r. \quad \text{(A18)}$$

The impact of a change in interest rates on output is negative and depends on the propensity to consume, the inverse of the tax rate, the stock of public debt and the asset stock.

$$dY/dr = (1/t)\ c\ D - A < 0. \quad \text{(A19)}$$

Finally, a change in bank deleveraging affects output negatively, in proportion to the stock of assets.

$$dY/ds = -A < 0. \quad \text{(A20)}$$

Since asset stock depends on the saving rate, which in turn is affected by the economy's tax rate, fiscal policy has an impact on asset accumulation. The asset stock derivative with respect to the tax rate can be expressed as:

$$dA/dt = -(1/h)(1-c)YL < 0, \quad \text{(A21)}$$

which implies that higher taxes reduce the stock of capital, in particular when the propensity to save and credit risk premia are high. Since $dA/ds = -A$, this result leads to the conclusion that a change in taxes can increase the negative impact of bank deleveraging on output.

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