Ashoka University
Economics Discussion Paper 126

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October 2024

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This draft: October 2024

Abstract

High public debt is urging policy makers to consider strategies to rebuild buffers and preserve debt sustainability. We study whether—and under which conditions—fiscal consolidation is likely to be associated with a durable reduction in public debt to GDP ratios. Our findings based on a sample of advanced and emerging countries indicate that the average fiscal consolidation has a minimal effect. However, discretionary consolidations (or an increase in the primary balance to GDP beyond what is driven by business cycle considerations) implemented during economic upturns or in scenarios where they can "crowd in" private investment, are likely to be associated with sustained reductions in debt ratios.

JEL Classifications: E62, H63, H68
Keywords: Public debt, Fiscal consolidation, Structural VAR, Fiscal policy

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1. Introduction

Public debt as a ratio to GDP ("debt ratio" henceforth) soared across the world during the COVID-19 pandemic. Despite a reduction in the following two years due to the sharp post-pandemic rebound in growth and high unexpected inflation, based on IMF forecasts, global public debt is projected to grow considerably faster than in pre-pandemic projections, urging scholars and policymakers to think about how countries could live with high public debt and how they could stabilize debt ratios and preserve debt sustainability (Rogoff 2022; Arslanalp and Eichengreen 2023).

Discretionary fiscal consolidation, defined as an increase in the primary balance (government revenues minus non-interest expenditures) to GDP not driven by the business cycle, is frequently employed as a strategy to reduce debt ratios. However, when examining existing data, periods of fiscal consolidation are roughly equally likely to result in debt ratio reductions or increases. This outcome underscores the complexity of fiscal policy and the various factors that influence its success in debt reduction. For example, Germany successfully reduced its debt ratio from 69 percent in 2016 to 59 percent in 2019 through a sustained primary balance above 2.3 percent of GDP, aided by favorable macroeconomic conditions (Rietzler and Truger 2019). In contrast, Italy's fiscal consolidation from 2011 to 2014, despite achieving an average primary balance surplus of 2.8 percent of potential GDP, coincided with an increase in the debt ratio from 120 percent to 135 percent, largely due to weak economic growth (Figari and Fiorio 2015; Andrle and others 2021).

This paper examines the conditions under which discretionary fiscal consolidations are more likely to reduce debt ratios. A key challenge is endogeneity—specifically, the difficulty in disentangling the impact of fiscal consolidation from the economic conditions that may simultaneously affect debt ratios, for instance on account of automatic stabilizers in response to growth shocks. The literature addresses these concerns through various methodologies, including the use of structural models, instrumental variables, and narrative records (Gali and others, 2007; Guajardo and others, 2014; Jorda and Taylor, 2016). In this study, we contribute to this literature by analyzing different types of fiscal consolidations using a Structural Vector Autoregression (SVAR) approach.

We focus on the debt to GDP ratio, because this is the standard metric used by policymakers. It is applied extensively in the literature on evaluating a country's repayment capacity and as a core element in debt sustainability analyses (see e.g., IMF 2022a). Debt ratios are also commonly used in empirical research assessing the impact of public debt on growth and other macroeconomic factors, as discussed in Romer and Romer's NBER (2019) study on "Fiscal Space in the Aftermath of Financial Crises" and in a decade of research papers surveyed by Salmon and de Rugy (2020).[1]

Our analysis contributes to two main strands of literature. First, we add to the studies on the macroeconomic effects of fiscal consolidations (Alesina and Perotti 1997; Alesina and others 2015; Guajardo and others 2014; Beetsma and others 2015; Jorda and Taylor 2016) by providing novel evidence on the dynamics of debt ratios following a fiscal consolidation. Second, we build on the literature discussing different strategies to reduce public debt (Reinhart and others 2015; Eichengreen and others 2020; Kose and others 2022)—from standard ones, such as growth and consolidation, to more heterodox approaches, such as debt default or restructuring, unexpected inflation, and financial repression—providing direct evidence of the role played by fiscal consolidation and of the conditions under which it is more likely to be successful in reducing debt ratios.

We employ a dataset of fiscal aggregates for 21 advanced economies (AEs) and 37 emerging markets (EMs) over the past two decades. We look at the effect of fiscal consolidation on debt ratios using a SVAR with six well-known drivers of debt: GDP growth, government revenues, primary balance, debt to GDP, inflation, and the effective interest rate on debt. The framework uses a sign-restriction-based identification similar to Mountford and Uhlig (2009), and accounts for three distinct shocks: a demand-driven GDP growth shock, a supply-driven GDP growth shock, and primary balance shocks. The latter encapsulates "discretionary" primary balance consolidations unrelated to demand and supply shocks. Further, we exploit the flexibility of the sign-restricted SVARs and characterize consolidations that end up reducing debt ratios and those that do not.

[1] See https://www.mercatus.org/research/policy-briefs/debt-and-growth-decade-studies. Interest payments to revenues is another indicator used in policy, though far less common than Debt-to-GDP ratios.

The empirical analysis is conducted in two steps. First, we estimate the effects of fiscal consolidation on debt ratios using the SVAR model with sign restrictions, which allows us to look separately at the effects of consolidations that were successful or unsuccessful in reducing debt ratios. Second, to understand which macroeconomic conditions are more likely to be associated with consolidations that entail debt ratio reductions (we refer to these episodes as successful fiscal consolidations), we build a dataset of significant successful and unsuccessful consolidations from the output of the SVAR and highlight the characteristics of successful fiscal consolidations.

The main findings from the SVAR are discussed in Section 2. First, we find that the average fiscal consolidation has a negligible effect on debt ratios. This result is consistent with a negative effect of fiscal consolidation on GDP growth found in several empirical studies (see Blanchard and Leigh (2013), Guajardo and others (2014), and Fatas and Summers (2018), among others), which could offset its effect on public debt. But lower GDP in the denominator is not the only factor explaining the negligible effect of consolidations on debt ratios. Unanticipated transfers to state-owned enterprises (SOEs) and other contingent liabilities that get realized on government balance sheets, as well as unexpected exchange rate depreciations that can increase the domestic value of foreign exchange-denominated debt, could move the numerator and historically played a role in offsetting debt reduction efforts (Abbas and others 2011). Second, despite the no-average-effect result, there are some fiscal consolidations that were successful in reducing debt ratios, and those fiscal consolidations had smaller impacts on GDP growth and a rise in inflation which helped reduce real debt burdens.

Next, in Section 3, we turn to the analysis of the potential factors that could make consolidations more likely to end up in lower debt ratios. Resorting to episodes of significant fiscal consolidations identified in the SVAR, we show that the probability of fiscal consolidation being associated with lower debt ratios improves significantly when: (1) there is a domestic or global expansion, and global risk aversion and financial volatility are low; (2) in scenarios where the fiscal consolidation is more likely to encourage ("crowd in") private investment (cases with initial high public debt, and low private credit, such that the benefits of reducing public debt can outweigh its costs); and (3) the consolidation is driven more by expenditure reductions rather than revenue increases (in AEs), a result that is consistent with the literature. Alesina and others (2019), for example, look at the macroeconomic effects of fiscal consolidation plans in 16 advanced economies and find that

while tax-based plans do not reduce debt ratios, expenditure-based consolidations have a stabilizing effect on debt dynamics. We confirm these results with a larger sample of AEs and a longer time period. Additionally, consolidations are more likely to be associated with debt ratio reductions when they are accompanied by an appreciation of the nominal exchange rate, especially in EMs, suggesting the importance of foreign currency-denominated debt in these economies.

Finally, Section 4 concludes with the main takeaways and highlights the policy implications of our analysis under the backdrop of the current debate on the need to rebuild fiscal buffers and bring debt back to more manageable levels.

As a caveat, our analysis is descriptive rather than prescriptive; it does not address the optimal level of debt to GDP for a country or the advisability of fiscal consolidation at any time. Instead, it focuses on understanding how fiscal consolidation influences debt ratios. While extensive research has been conducted on the effects of fiscal consolidation on GDP, the specific impact of such policies on debt ratios has not been as thoroughly explored. This paper aims to address this gap by focusing on the dynamics of debt ratios following fiscal consolidation, contributing a new dimension to the existing body of literature.

2. The Effects of Fiscal Consolidations on the Debt to GDP Ratio

Data

Our analysis is based on a sample of 21 AEs (1981-2019) and 37 EMs (1994-2019 and focuses on the following six variables at annual frequency: (1) the growth rate of real GDP (percent), (2) the growth rate of real government revenues (percent), (3) the change in primary balance to GDP ratio (percentage points), (4) the change in the public debt to GDP ratio (percentage points), (5) the change in effective interest rate (percentage points) and (6) the change in inflation (percentage points).

The fiscal indicators refer to general government coverage and are obtained from the IMF World Economic Outlook (WEO) database for 2002-2021, and from the Historical Public Finance Dataset (HPFD) compiled by Mauro and others (2015) for 1981-2011. Since small differences exist across the two databases for overlapping years, a smooth linear interpolation was applied to link the WEO

with the HPFD series over a 10-year period from 2002 to 2011 for all countries (except for Spain, Sweden, and Norway, for which the WEO data are available since 1981). The remaining variables are taken from the WEO database.

Methodology

We evaluate the effects of fiscal consolidation on debt ratios using a SVAR model which jointly considers the standard drivers of debt ratios—namely real GDP growth, interest rates, inflation, government revenues, and the primary balance. We use a sign-restriction based identification motivated by the methods of Uhlig (2005) and Mountford and Uhlig (2009).

We begin by identifing three structural shocks via sign restrictions (Table 1, Panel A). The first two are demand and supply GDP shocks. These are identified by their impulse on GDP and government revenue, and their distinct impact on inflation. A positive demand shock, for example, would raise inflation, while a positive supply shock would lower it. The third is a shock to the primary balance, which is assumed to be orthogonal to the demand and supply shocks and leads to a decline in GDP. The latter sign restriction is consistent with several empirical studies—see, for instance, Blanchard and Leigh (2013) and Guajardo and others (2014). The core of the analysis lies in studying the features of consolidations that are associated with lower debt ratios. To do so, we define two distinct primary balance structural shocks: i) a *successful* shock, identified by the additional condition of debt ratio declining, and ii) an *unsuccessful* one, identified by the additional condition of debt ratio increasing (Table 1, Panel B).

Notably, the primary balance shock turns out to be distinct from the demand shock: while a primary balance shock imposes a negative correlation between the primary balance and GDP, the demand (and supply) shock reveals a positive correlation of the primary balance to GDP with GDP growth.[2]

[2] As a robustness, we show in Appendix 2 that an alternate identification that imposes this co-movement explicitly yields similar results to our baseline. Our baseline identification imposes only sign restrictions (at a single horizon) to identify four shocks as in Table 1. As a robustness check, we consider an identification that in addition to the sign restrictions in Table 1 similar to the baseline, imposes that the four identified shocks together explain at least three quarters of the variance of the primary balance to GDP ratio at a one-year horizon for each country in the sample. The results reported in Appendix 3 remain similar.

Importantly, throughout our exercise restrictions are only imposed on the sign of the co-movement between the variables, and not on the magnitude or duration of the responses.

All sign restrictions are imposed on impact, except for the sign restrictions on GDP and the debt to GDP ratio in the case of the primary balance consolidation shocks, which are imposed one year ahead to allow for potential lags in the transmission.[3]

We estimate the SVAR for each country, with two lags, using Bayesian techniques with Minnesota priors, where hyperparameters are chosen to maximize marginal data density (see, for instance, Canova 2007). The estimation is conducted using the Empirical macro toolbox of Canova and Ferroni (2022). Impulse responses are computed using inverse variance weights, as in Di Pace and others (2024).

Fiscal Consolidations and Debt Ratios

An interesting fact that motivates our analysis is that periods of simultaneous consolidations and debt ratio reductions are infrequent. Figure 1 (Panel A) shows that only 54 percent of country-years with annual increases in primary balance to GDP are also accompanied by a decrease in debt ratios. This aligns with a recent survey by the Balasundharam and others (2023), which document that at best only half of fiscal consolidations achieve their fiscal targets, including a durable debt reduction.

Our first SVAR results, based on Table 1 (Panel A) and presented in Figure 1 (Panel B), also indicate that on average, fiscal consolidations do not lead to a meaningful reduction in debt ratios. The impulse responses reveal that the point estimate of the effect remains close to zero for both advanced economies and emerging markets.[4] These findings underscore the complex and often ambiguous relationship between fiscal consolidation and debt.

[3] The results are nevertheless robust to modelling these restrictions contemporaneously or with a higher lag (4 years) as shown in Appendix 7.

[4] Throughout the paper, we report median impulse responses and confidence intervals constructed via the inverse variance weights following the approach of Di Pace and others (2024). In particular, we weight the impulse responses for each country and horizon by the inverse of the full sample variance of the respective posterior distribution and plot the median as well as the 16-84th percentile confidence bands to reflect uncertainty on average across countries.

These results resonate with the findings of Patel and Peralta-Alva (2024) who incorporate narrative restrictions in a sign-identified VAR for advanced economies and find minimal impact of consolidation shocks on debt ratios. While narrative restrictions sharpen the identification significantly, they are not available for a majority of the countries in our sample. To leverage from a larger sample when distinguishing consolidations that succeed in reducing debt ratios versus those that do not—which is the main objective of our paper—we continue to work with the pure sign restriction identification as our baseline. In Appendix 6 we show that our results are robust to incorporating narrative restrictions for the limited set of countries for which data are available.

Which fiscal consolidations could reduce debt ratios?

Given that, on average, fiscal consolidations do not reduce public debt ratios, we turn to the relevant question: what features characterize fiscal consolidations that are more or less likely to be associated with a durable reduction of debt ratios? To address this question, we consider two different structural shocks within our VAR model, as illustrated in Table 2 (Panel B). In one structural shock, we impose a negative relationship between fiscal consolidation and the debt to GDP ratio, which we identify as "successful" consolidations. In the other structural shock, we impose a positive relationship, identifying "unsuccessful" consolidations.

Figure 2 illustrates the SVAR-identified shocks for one country each from our AE (Japan) and EM (Colombia) sample. The top panel in each case shows the demand and supply shocks, which bear a strong relation to GDP growth. The bottom panel for each country plots the fiscal consolidation shocks. As a reference, shaded bars are used to indicate updated narrative consolidation shocks from Guajardo and others (2014) for Japan and Carriere Swallow and others (2019) for Colombia.[5] Notwithstanding the difference in methodology, asymmetry (narrative shocks focus only on consolidations as opposed to VAR shocks which are symmetric in covering expansions and consolidations) as well as endogeneity of narrative shocks documented in the literature (see for instance Jorda and Taylor (2016)), the two measures exhibit a positive albeit low correlation across the sample of around 0.1.

[5] We use the updated versions of these shocks available from Adler et al (2024)

The impulse responses for these two structural shocks are reported in Figure 3, separately for AEs (Panel A) and EMs (Panel B). This approach allows us to isolate and examine the characteristics of consolidations that are more likely to reduce debt ratios from those that are not.

In both samples, two characteristics distinguish consolidations that are associated with a reduction in debt ratios—successful consolidations—versus those that do not—the unsuccessful one. First, as expected, consolidations in which debt ratios decline happen when the negative effects on output are mitigated. When considering the sample of AEs (Figure 2, Panel A), the fall in GDP growth is smaller (0.5 percent reduction on impact) for consolidations in which debt ratios decline, compared to those in which they do not, where GDP growth declines sharply by 1.3 percent. For EMs (Panel B), the magnitudes are larger, with growth decelerating by 1.7 percent in unsuccessful episodes and by about half of that value (0.9 percent) in successful ones.

At the same time, it is important to note that the results we find are not mechanical. While it is true that, in the case of successful consolidations, debt to GDP falls and GDP contracts by less, in fact, movements in GDP alone are *not* the most important factor to explain the difference between successful and unsuccessful consolidations. This point is evident in a comparison of the magnitudes of the response of GDP and debt to GDP (panels 1 and 4). In successful cases (blue lines), GDP falls, yet the debt to GDP ratio also *falls*; in unsuccessful cases (green lines), GDP falls, but the debt ratio almost doubles. That is, the difference between successful and unsuccessful consolidations is driven primarily by movements in public debt levels. This shows how consolidations may fail to reduce debt, over and above the effect on GDP. One frequent cause is "below-the-line" operations that can offset the impact of fiscal consolidation on debt. Examples include transfers to state-owned enterprises in Mexico (2016), clearance of arrears in Greece (2016), and contingent liabilities in Italy (2013).[6]

Second, inflation also tends to increase more in cases where consolidation and debt reductions coincide (panel 6). Over the first two years, the median response of inflation in successful consolidations is higher than that in unsuccessful consolidation, both in AEs and EMs, with the

[6] See IMF (2016), IMF (2017), and IMF (2013), respectively. The phenomenon is not limited to AEs and EMs. The contribution of such below-the-line operations to rising debt ratios has been persistently high in recent times in Sub Saharan Africa (IMF 2023a).

latter often being below the 68 percent confidence band of the former. Several factors could rationalize this empirical regularity. For instance, the typical consolidation entails a revenue (tax increase) component which could push prices up. Moreover, any exchange rate depreciation concomitant with the consolidation could also increase import prices and contribute to inflation.[7] The differential response of effective interest rates on impact in successful versus unsuccessful consolidations (panel 5) suggests that monetary policy remains more accommodative on impact, and hence allows higher inflation in the case of successful consolidations.[8] This mitigates the decline in nominal GDP and thereby contributes to the decline in the debt ratio.[9] This also raises a potential concern of interest rate shocks that confound these results that we attribute to consolidations.

To explore the role of interest rates further, we add an interest rate shock to our model (a shock that raises the real interest rate, i.e., $i - \pi > 0$ on impact).[10] The results, reported in Appendix 4, highlight two main findings. First, the impulse responses of the fiscal shocks remain essentially unaltered with the inclusion of the interest rate shocks (Figure A4.2). This suggests that the latter are largely orthogonal to the fiscal shocks, and reside in the unidentified part in our baseline four-shock VAR.

Second, the impulse response to the interest rate shock (Figure A4.1) entails an increase in the debt ratio (symmetrically, a monetary loosening reduces debt ratios). A corollary of this finding is that consolidations that are accompanied with monetary accommodation are more likely to succeed in reducing debt ratios (or limiting the rise in debt ratios in the case of unsuccessful ones).

[7] The exchange rate implications are particularly vital for low-income countries where foreign currency-denominated debt forms a significant share of public debt. Exchange rate depreciation has been a major contributor to the increase in debt ratios in Sub-Saharan Africa (IMF 2023b). Consolidations may, however, also boost the economic outlook and investor sentiment and lead to an appreciation of exchange rates (see e.g., Corsetti, Meier, and Mueller 2012, and Kim 2015), but overall evidence for such effects is weak (Beetsma and others 2015).

[8] IMF (2010) finds that policy interest rate cuts can support output during fiscal consolidations, which would also be consistent with a positive inflation response.

[9] Appendix 6 shows that these results are robust to incorporating narrative restrictions for the countries for which narrative fiscal consolidation data is available. To incorporate these narrative restrictions in our sign-restricted VAR, we extend the methodology of Patel and Peralta-Alva (2024) for the case of two consolidation shocks by imposing that the sum of the two consolidation shocks is positive in years where the start of a fiscal consolidation is identified in the updated narrative database of Adler and others (2024).

[10] An alternate identification putting separate sign restrictions on inflation and interest rates yields similar results.

Anticipation effects and recoverability of fiscal shocks

Since fiscal plans are often announced in advance and implemented with delays, anticipation effects can hamper the ability of VARs to recover true underlying shocks based on past observables included in the model—see Ramey (2016), among others. To check if this concern is quantitatively important in our setting, we recover the shocks from the VAR and regress them on forecasts of the primary balance to GDP (and other fiscal and macro variables) based on the last information set before the realization of the shock. If anticipation effects are relevant, then these forecasts should have significant explanatory power in explaining the shocks recovered from the VAR.[11]

Columns 1 and 4 in Table 2 show that this concern is not borne out in our sample, for both the successful and unsuccessful shocks. Forecasts of future primary balance have no explanatory power for the shocks recovered from the VAR. In columns 2 and 4 we add the forecasts of variables other than the primary balance to GDP ratio, including output, inflation, debt to GDP and the effective interest rate, at both one- and five-year horizons. Despite incorporating multiple forecasts for two different horizons, the explanatory power of the model remains small, with the overall R-squared far below the 25 percent rule of thumb value that Beaudry and others (2019) recommend as a threshold below which nonfundamentalness is unlikely to be a significant concern in practice. Similar results can be obtained if we use the approach of Auerbach and Gorodnichenko (2011) based on a regression of VAR shocks on the residual of a first stage regression of the forecasted change in the primary balance on lags of the variables included in the VAR.

These results resonate with Mertens and Ravn (2010) who use economic theory to derive a SVAR that is applicable when fiscal shocks are anticipated and find that these anticipation effects are not quantitatively important to overturn existing findings from the fiscal SVAR literature.

Expenditure- vs Revenue-Based Consolidations

[11] As an example, if a fiscal consolidation for the year 2018 is announced in 2017, the concern is that the VAR might wrongly pick it up as an unexpected shock in 2018 if the announcement is not explicitly incorporated in the variables included in the VAR. But even in this case, the shock should be predictable based on *forecasts* for the primary balance for the year 2018, made towards the end of the year 2017.

Fiscal consolidations can be implemented via either spending cuts or revenue (tax) increases, or some combination of the two. To see if the relative importance of spending vs revenues has a bearing on the success of consolidations in reducing debt ratios, Figure 3 reports the contributions of revenues and expenditures to both successful and unsuccessful consolidation shocks, based on the estimates from the SVAR in Figure 2. The relative height of the bars shows the degree to which successful and unsuccessful consolidations are revenue vs expenditure based on impact. For instance, in panel 1, for unsuccessful consolidations, the height of the green bar is larger than that of the blue bar, indicating that unsuccessful consolidations are more revenue based on average. These contributions are based on results from a SVAR where we replace primary balance to GDP with its two components—revenue to GDP and expenditure to GDP.[12]

In AEs, successful consolidations tend to be balanced between spending cuts and tax or revenue increases, whereas those that are unsuccessful are biased toward revenue and involve fewer spending cuts.[13] These results do not hold in EMs, consistent with studies that find tax increases to hurt growth and debt ratios more than equivalent spending cuts in AEs but not necessarily in EMs (see, for instance, Guajardo and others (2014), Carrière-Swallow and others (2021), Pappa and others (2015), and Alesina and others (2019)). Indeed, for low-income countries, where the tax revenue to GDP ratio is particularly low, revenue mobilizing consolidations may be more desirable (IMF 2022b).

3. The Drivers of Successful Consolidations

Given the evidence that some consolidations can successfully bring down public debt ratios, the key question—especially from a policy standpoint—is to understand under which conditions it is more likely to observe fiscal consolidation associated with debt ratio reductions.

[12] The shock is identified in a manner similar to the original SVAR, by putting a sign restriction on primary balance to GDP (which here medians the difference between revenues to GDP and expenditures to GDP has to be positive).

[13] This pattern is consistent with both expenditure-based and revenue-based fiscal adjustments being successful in reducing the duration of debt consolidation in AEs (Baldacci and others 2012).

To answer this question, we build a panel with the historical debt decompositions from the SVAR of the previous section and isolate periods in which the fiscal consolidation shocks played a significant role in driving debt ratios. We identify successful periods as ones in which the debt ratio declines, and the successful fiscal consolidation shock contributes significantly by accounting for at least 10 percent (in the historical decomposition) of the debt ratio decline. Conversely, we identify failure periods as those for which the debt ratio increases, and the unsuccessful shock contributes to at least 10 percent of the increase in the debt ratio.[14] For example, if the debt to GDP ratio declines in a country by 5 percentage points in a given year and the successful shock contributes 2 percentage points to this decline, whereas the unsuccessful shock contributes zero, this is counted as a successful country-period. Note that since the classification is based on the historical decomposition, it incorporates the effect of both contemporaneous and past (but not future) shocks.

Using this approach, we end up classifying about a third of all country-year observations as either successful or unsuccessful episodes, suggesting that 70 percent of the time, growth and other unidentified shocks are the main drivers of debt. We restrict our analysis to the 30 percent of observations in which fiscal consolidations are a key driver of debt dynamics, as they are likely to provide more information on the factors that are associated with success or failure of consolidation in reducing debt ratios.

Figure 5 provides illustrative examples of successful and unsuccessful consolidation episodes identified with this approach. Panel A shows how from 2016-2019, Germany was able to reduce debt on account of successful fiscal consolidations, assisted by a favorable growth outlook. On the other hand, Panel B shows that in Italy, while the initial consolidation efforts in 2011 did succeed in reducing the debt ratio somewhat, the pattern quickly reversed starting in 2012 as consolidation efforts turned unsuccessful in the backdrop of declining growth.

[14] The results are qualitatively robust to different values of this threshold, for example, similar results would emerge if the value were 30 percent.

To analyze these patterns systematically across the sample and assess the role of different macroeconomic variables in explaining the likelihood that fiscal consolidations are associated with lower debt ratios, we estimate the following model:

$$y_{it} = \alpha + \sum_{j=1}^{m} \beta^j X_{it}^j + \epsilon_{it},$$

where y_{it} is a dummy variable which takes the value 1 if the respective country-year is classified as a successful consolidation, and zero if it is classified as an unsuccessful one. We use this regression setup as a convenient characterization device, emphasizing that the results represent correlations rather than causation.

We explore two broad sets of conditioning variables in the vector (X_{it}), related to: i) state of the economy, including both global and local factors, and ii) the likelihood of relatively large crowding in effects from fiscal consolidation. As proxies for state of the economy, we use domestic and global output gaps, the Chicago Board Options Exchange Volatility Index (VIX), and nominal exchange rate movements during a consolidation episode. To capture scenarios where crowding in can be large, we use the initial levels of public debt and private credit, both expressed as ratios to GDP.

Table 3 reports the regression results, using bootstrapped standard errors to allow for uncertainty in the dependent variable which is a generated regressor. The first column shows the pooled estimates, whereas the second one shows estimates obtained including country fixed effects. The estimates reveal that consolidations and debt ratio reductions are more likely to happen during good times, as the likelihood of a successful consolidation is higher during domestic and global booms as well as during periods of lower volatility as measured by the VIX. This result is consistent with prior literature on multipliers, which establishes that fiscal multipliers are likely smaller during good times and larger during recessions (Jorda and Taylor 2016, Auerbach and Gorodnichenko 2011, Auerbach and Gorodnichenko 2012, Bachmann and Sims 2012 and Riera-Crichton and others 2014).

Our results also suggest that consolidations and debt ratio reductions are also more likely to happen when the initial public debt to GDP is high and private credit to GDP is low. This points to the

importance of the crowding in effect of fiscal consolidation. In particular, crowding in effects are likely to be high when public debt levels are high, and when private credit is low. Consolidations undertaken under such circumstances are likely to have a lower negative impact on output and are hence more likely to be successful in decreasing debt ratios.

Note that, in theory, the direction of the effect of initial debt levels on the likelihood of successful consolidations could go either way (Appendix 1). When initial debt is high, the direct effect of a given size fiscal consolidation on the value of debt is small. At the same time, consolidations hurt output less when initial debt is high, likely because of greater crowding in of private investment (Ilzetzki and others 2013; Kirchner and others 2010). Our results suggest that the latter effect dominates.

Finally, we also find that consolidations and debt ratio reductions are more likely to happen when they are accompanied by an appreciation of the nominal exchange rate. This effect, which is stronger for EMs, points to the importance of foreign currency-denominated debt, the value of which can decrease more sharply during consolidations if the exchange rate appreciates. Relatedly, appreciations can also have a positive effect on growth in EMs (IMF 2023a).[15]

In terms of magnitudes, the estimates reported in Table 3 are outcomes of a logit regression and denote the partial impact of a unit change in the variable on the log odds ratio of a consolidation being successful in reducing the debt ratio. To understand their significance in terms of probabilities, the coefficients from column 1 in Table 3 can be transformed into the marginal impact of a one standard deviation change in the variable on the probability of achieving success when consolidating. The baseline probability based on the identified episodes mentioned above is 54 percent. Based on one standard deviation changes in each of the covariates, our estimates reveal that these probabilities go up to 75 percent if consolidation is undertaken during global and domestic booms, and a further 12 percent if financial conditions are loose or crowding in effects are high.

[15] We also included long-run variables, in particular, demographic variables (e.g., some fiscal consolidation plans could involve changes in the pension system) in the regression. We obtained labor force participation rate and the prime age ratio (percent of population that is of prime working age between 25 and 54 years according to US statistics) from the UN World Population Prospects. These variables, however, did not turn out to be statistically distinguishable from zero, and importantly did not alter the sign and statistical significance of the variables shown in Table 3.

4. Conclusions

Our analysis is motivated by the constraints and risks that high (and increasing) public debt pose to fiscal space, economic outcomes, and debt sustainability. Within that context, it becomes critical to identify policies which could help reverse the increasing trend of public debt ratios, or at least stabilize them. The paper focuses on fiscal policies and asks whether and under which conditions fiscal consolidations can raise the likelihood of a durable reduction in debt ratios.

What are the characteristics of a successful fiscal consolation (or a consolidation that succeeds in reducing debt ratios)? Our results show that adequately timed (for example, during economic expansions) and appropriately designed (for example, growth friendly—which in AEs includes more expenditure- than revenue-based measures) fiscal consolidations have a high probability of being associated with durable debt ratio reductions.

How large are the estimated effects of a successful fiscal consolation? The average successful fiscal consolidation in the data (equal to 0.4 percentage points of GDP) coincides with a reduction in the debt ratio of 0.7 percentage points during its first year and, cumulatively, by up to 2.1 percentage points after 5 years.

The analysis in this paper suggests that well designed fiscal consolidations, beyond automatic stabilizers or what would be implemented during economic cycles could be effective to gradually reduce debt ratios. Such fiscal consolidation should ideally coincide with domestic recovery and/or favorable external conditions. Ultimately, strong institutions are crucial to durable debt reduction. Robust fiscal and monetary frameworks can prevent operations that undermine the success of consolidations to reduce debt ratios (Gaspar and others 2016; Caselli and others 2022).

Finally, a caveat to note is that while our analysis focuses on determining the effects of fiscal consolidation on debt ratios, it does not consider the desirability of fiscal consolidation from a welfare perspective. The results have nevertheless to be contextualized within the broader scope of economic literature. Notably, research on optimal policy, such as the works in optimal sovereign default literature (e.g., Cuadra and others 2010), suggests that fiscal consolidation may still be optimal even if it results in a short-term output contraction.

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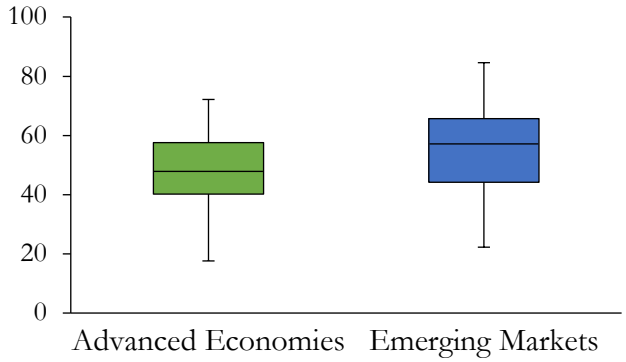
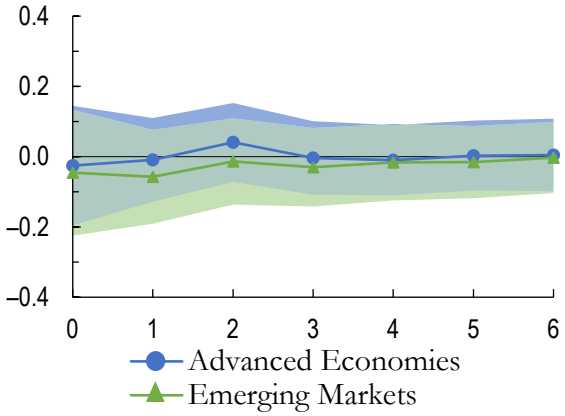
Figure 1. Fiscal consolidations and debt ratios

Panel A: Unconditional probability of observing fiscal consolidations with reduction in debt to GDP



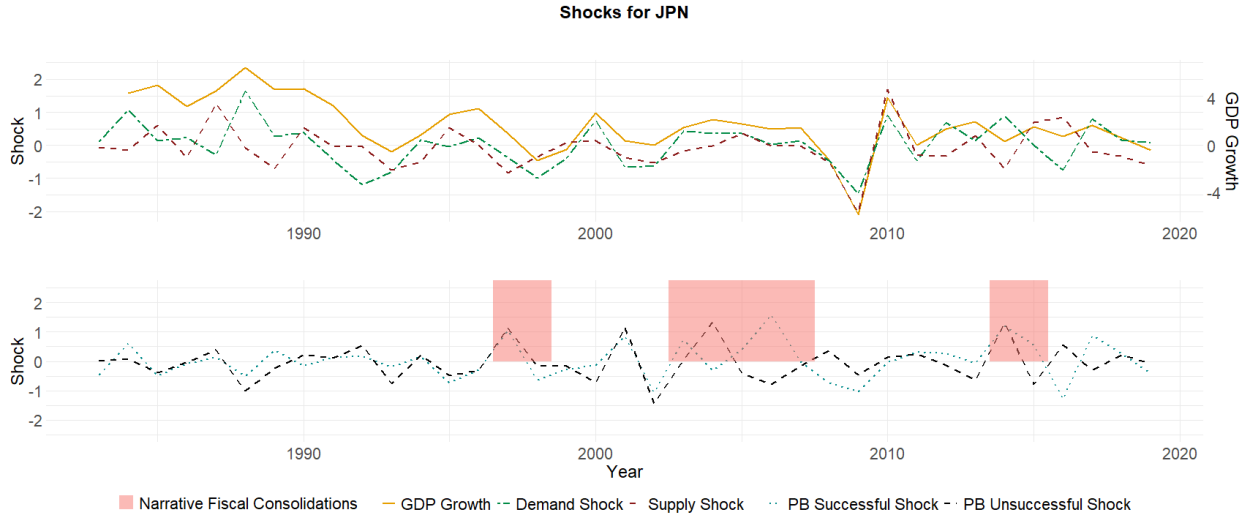
Panel B: Impulse responses of debt to GDP to a primary balance shock, average fiscal consolidations



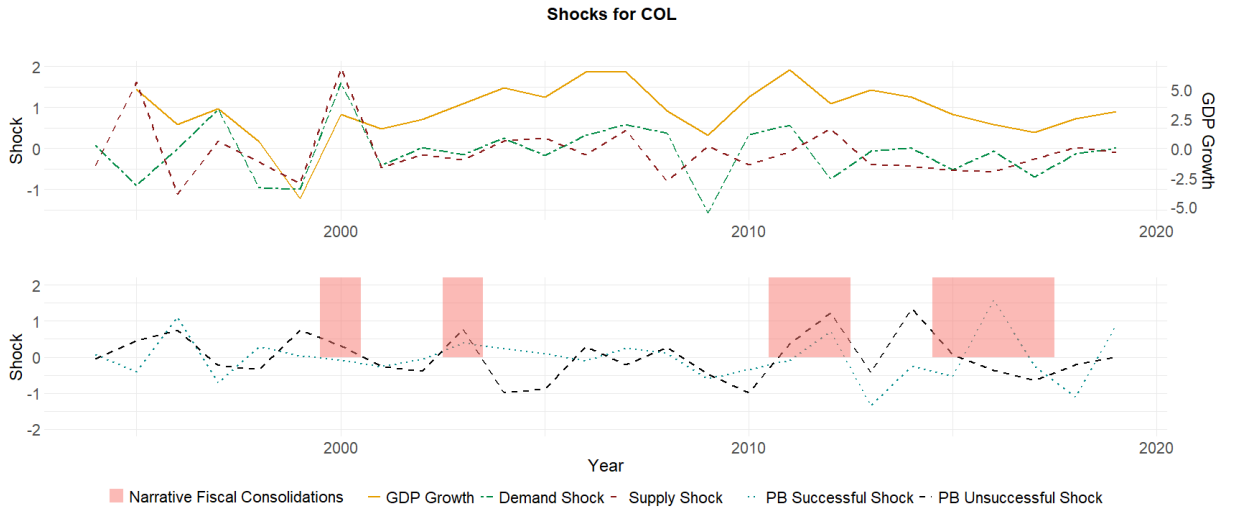
Sources: IMF World Economic Outlook; IMF, Historical Public Finance Dataset (Mauro and others 2013).
Note: Panel A reports stylized facts based on the sample of 21 advanced economies from 1980 to 2020 and 37 emerging market economies from 1991 to 2020. It shows the distribution of the probability of observing consolidations (defined as defined as a period of positive change in the primary balance to GDP ratio at annual frequency) with a contemporaneous reduction in debt to GDP ratio. The probabilities are calculated by taking simple ratios of the number of country-years with an increase in the primary balance to GDP ratio and a decline in debt to GDP ratio to the total number of country-years with an increase in the primary balance to GDP ratio. The horizontal line stands for the median, the box represents the 25th and the 75th percentiles, and the whiskers represent the extremes, excluding the outliers. In Panel B, primary balance shock is scaled to one percentage point of GDP on impact on average. Displayed impulse responses are inverse variance weighted medians across countries from a Bayesian vector autoregression estimated country by country at annual frequency. Shaded areas represent the 16th–84th percentile range of the posterior distribution based on inverse variance weights.

Figure 2: Examples of Time Series of Shocks Extracted from the VAR

Panel A: Japan



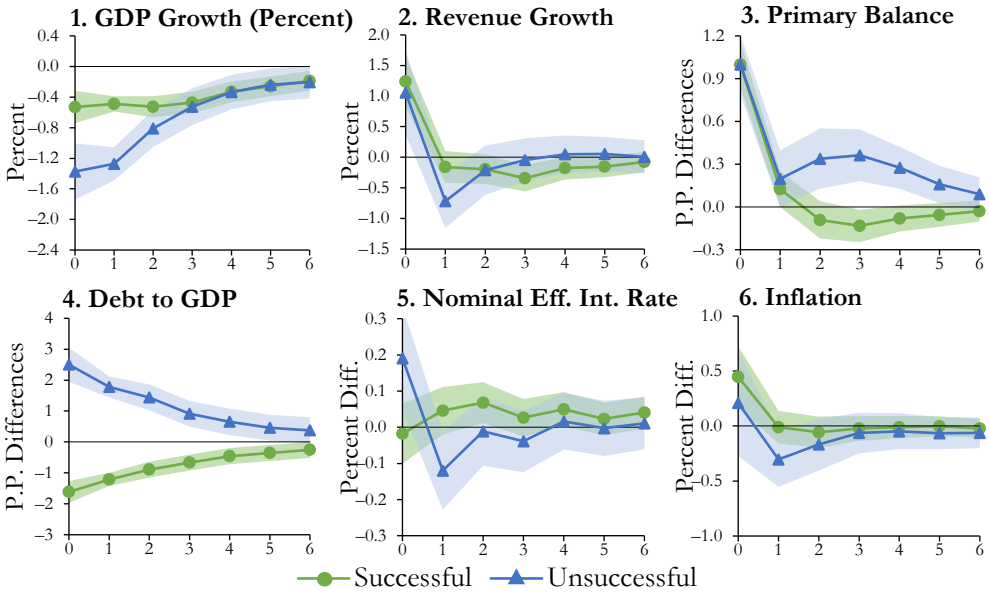
Panel B: Colombia



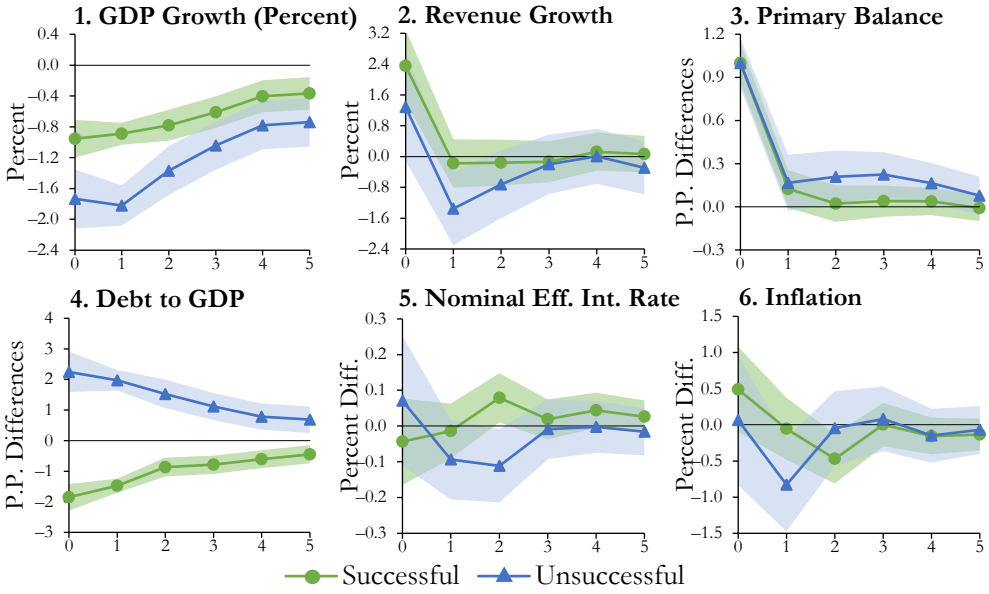
Notes: Posterior medians of the VAR-identified shocks based on sign restrictions in Table 2, Panel B. The narrative shock dummies (red bars) are from Adler and others (2024)

Figure 3. Impulse responses of debt to GDP to a primary balance shock, successful and unsuccessful fiscal consolidations

Panel A: Advanced Economies



Panel B: Emerging Markets

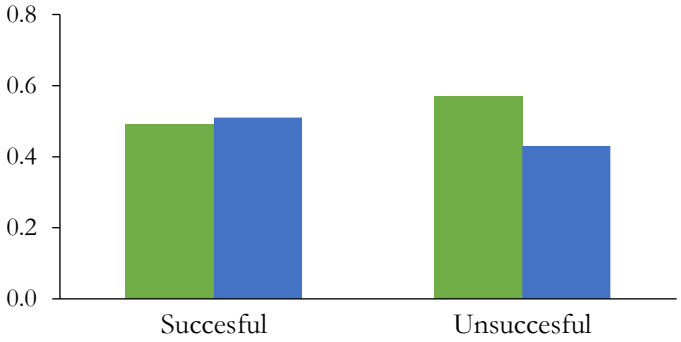


Sources: IMF World Economic Outlook; IMF, Historical Public Finance Dataset (Mauro and others 2013), author calculations.

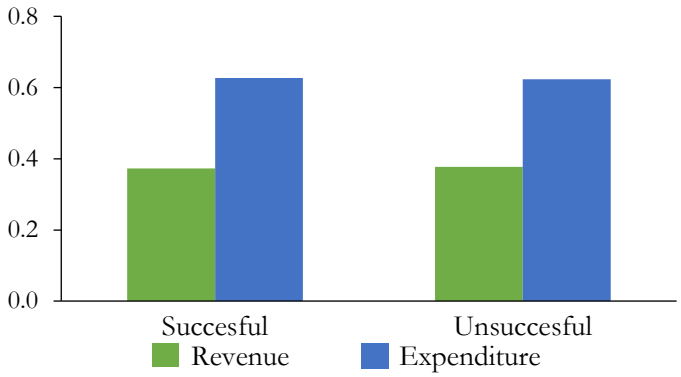
Note: Impulse responses to successful and unsuccessful primary balance shocks identified via sign restrictions in Table 1, Panel B. Primary balance to GDP is scaled to one percentage point of GDP on impact on average. Displayed impulse responses are inverse variance weighted medians across countries from a Bayesian vector autoregression estimated country by country with 2 lags at annual frequency. Variables in panels 3-6 are in first differences to ensure stationarity. Shaded areas represent the 16th–84th percentile range of the posterior distribution. The sample includes 21 advanced economies (Panel A) and 37 emerging markets (Panel B).

Figure 4. Contribution to primary balance shock on impact, revenue- versus expenditures-based fiscal consolidations

Panel A: Advanced Economies



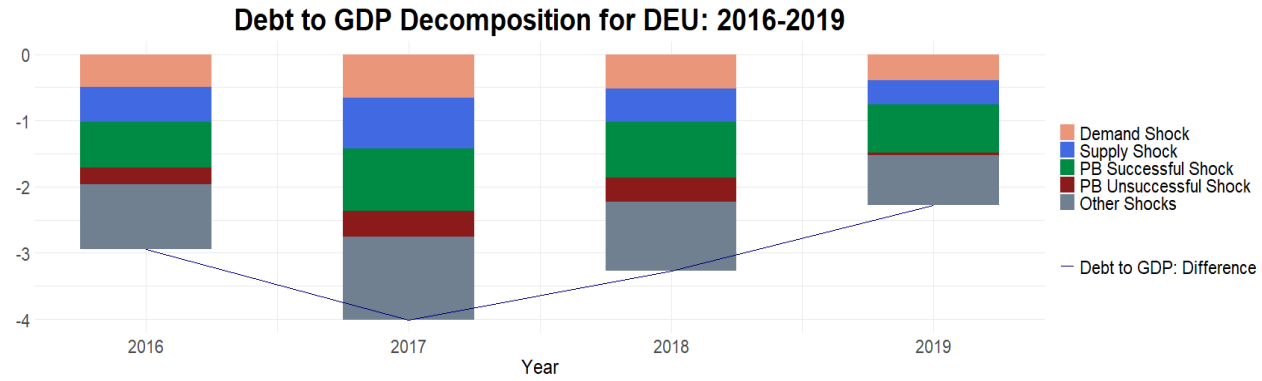
Panel B: Emerging Markets



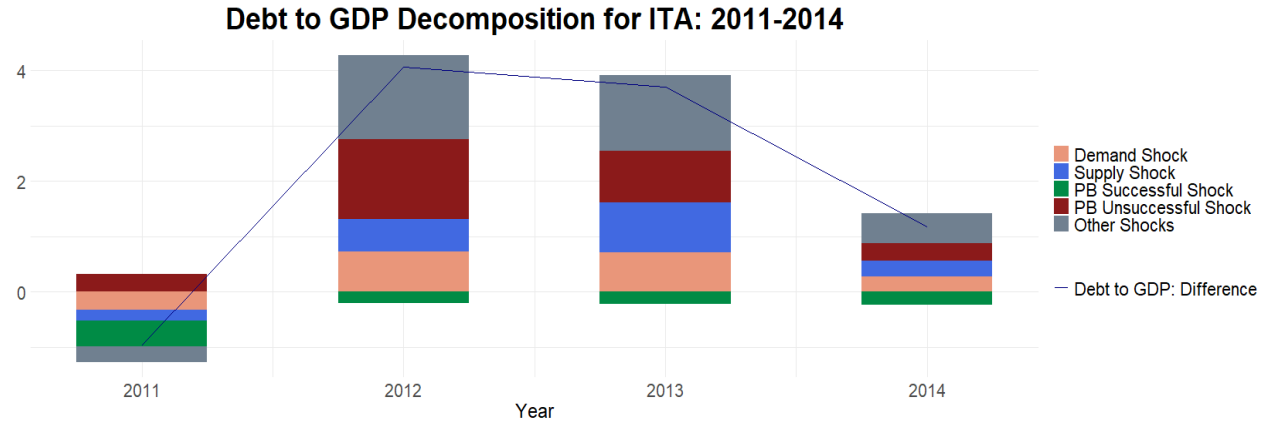
Sources: Canova and Ferroni (2022); IMF World Economic Outlook; IMF, Historical Public Finance Dataset (Mauro and others 2013); and IMF staff calculations.
Note: The sample includes 21 advanced economies (Panel A) and 37 emerging markets (Panel B). The figure reports the contributions of revenues and expenditures to the response of primary balance/GDP on impact. These are based on estimates from a VAR where we replace primary balance to GDP with its two components—revenue to GDP and expenditure to GDP. The shock is identified in a manner similar to the original SVAR, by putting a sign restriction on primary balance to GDP (which here medians the difference between revenues to GDP and expenditures to GDP has to be positive). Impulse responses are then scaled so that their impact on GDP is the same as in the baseline SVAR.

Figure 5. Examples of successful and unsuccessful consolidation episodes

Panel A: Germany 2016-2019



Panel B: Italy 2011-2014



Notes: Historical decompositions denote the contribution of the four identified (and remaining unidentified shocks denoted by "other shocks") to the observed change in the debt to GDP ratios, posteriod medians from the VAR identified with sign restrictions in Table 2, Panel B.

Table 1. Structural Vector Autoregression sign restrictions

Panel A: Single Primary Balance Shock

	GDP	Real Revenue	Primary Balance to GDP	Debt to GDP	Interest Rate	Inflation
Demand Shock	+	+				+
Supply Shock	+	+				–
Primary Balance Shock	–		+			

Panel B: Splitting the Primary Balance Shock based on Impact on Debt Ratio

	GDP	Real Revenue	Primary Balance to GDP	Debt to GDP	Interest Rate	Inflation
Demand Shock	+	+				+
Supply Shock	+	+				–
Successful Primary Balance Shock	–		+	–		
Unsuccessful Primary Balance Shock	–		+	+		

Source: IMF staff calculations.
Note: Sign restrictions on debt to GDP and GDP growth for consolidation shocks are imposed one period ahead, i.e., a consolidation shock is assumed to affect debt to GDP, and GDP in the following year. All other sign restrictions are imposed on impact.

Table 2. Anticipation effects

VARIABLES	(1) Successful Consolidation Shock	(2) Successful Consolidation Shock	(3) Unsuccessful Consolidation Shock	(4) Unsuccessful Consolidation Shock
Primary Balance to GDP forecast (One year ahead)	-0.0010	-0.0097	-0.0017	0.0049
	(0.0040)	(0.012)	(0.0033)	(0.0096)
Constant	0.012	-0.26	0.0056	0.21
	(0.018)	(0.19)	(0.016)	(0.16)
Observations	1,215	1,026	1,215	1,026
R-squared	0.000	0.014	0.000	0.019
Additional Controls	No	Yes	No	Yes

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes: The table reports coefficients of panel regression on VAR shocks on forecasts of primary balance to GDP and other variables made in the period just before the realization of the shock. The sample consists of 21 advanced economies from 1981 to 2019 and 37 emerging market economies. The VAR shocks are based on sign-restriction based identification in Table 2, Panel B).

Table 3. Drivers of successful consolidations: Logit regression results for identified episodes

	(1) Pr(Success)	(2) Pr(Success)
Domestic Output Gap	16.1***	17.6***
	(3.76)	(5.53)
World Output Gap	33.8***	29.0**
	(12.0)	(14.1)
Lagged Debt/GDP	0.0084**	0.026**
	(0.0034)	(0.012)
Lagged Private Credit/GDP	-0.0054**	-0.016
	(0.0025)	(0.011)
VIX (log)	-1.50***	-1.29***
	(0.38)	(0.49)
Nominal Depreciation (EMs)	-0.12***	-0.12**
	(0.028)	(0.049)
Nominal Depreciation (AEs)	-0.033**	-0.046
	(0.016)	(0.034)
Constant	4.75***	
	(1.17)	
Observations	406	356
Country FEs	No	Yes

Notes: The table shows the estimates of multivariate logit regression with the dependent being a dummy variable equal to one for a successful consolidation, in which the debt to GDP declines and the successful shock from the VAR contributes at least 10 percent to the decline, and equal to zero for an unsuccessful one (for example, if debt to GDP increases and the unsuccessful consolidation shock from the VAR contributes at least 10 percent to the increase). The world output gap variable is orthogonalized with respect to domestic output gap to recover the exogenous component. The sample consists of 21 advanced economies 37 emand emerging market economies from 1990 to 2019. VIX = Chicago Board Options Exchange Volatility Index. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Online Appendix

Appendix 1: Analytical Framework

This section aims to provide a framing device for understanding the impact of fiscal consolidations on debt to GDP ratios. To keep the expressions manageable, it makes several simplifying assumptions, including fixing the maturity of the entire stock of debt to one year and assuming that the debt dynamics are governed only by interest rate and primary balance. The results are therefore best suited to learn qualitative features rather than a precise quantification.

Starting from the standard debt dynamics equation:

$$D_t = (1 + i_t)D_{t-1} - PB_t + O_t, \tag{1}$$

where D_t denotes the nominal stock of debt, PB_t denotes the nominal primary balance, O_t is a residual (accounting, e.g., for below-the-line operations and valuation effects due to exchange rate fluctuations), Y_t is nominal GDP and i_t the nominal effective interest rate, we can get the following expression for the growth of public debt:

$$\Delta \ln D_t \approx i_t - \frac{PB_t}{D_{t-1}}. \tag{2}$$

Then, from the definition of the fiscal multiplier ($m_y > 0$), we can get the following expression for GDP growth as a function of the change in the primary balance:

$$\Delta \ln Y_t = -m_y \frac{\Delta PB_t}{Y_{t-1}}. \tag{3}$$

Combining the above two expressions yields:

$$\Delta \ln \left(\frac{D_t}{Y_t}\right) = \Delta \ln D_t - \Delta \ln Y_t = i_t - \frac{PB_{t-1}}{D_{t-1}} + \frac{\Delta PB_t}{Y_{t-1}}\left(m_y - \frac{Y_{t-1}}{D_{t-1}}\right). \tag{4}$$

The above expression highlights that a consolidation ($\frac{\Delta PB_t}{Y_{t-1}}$) reduces the debt ratio when the following inequality holds:

$$m_y \frac{D_{t-1}}{Y_{t-1}} < 1. \tag{5}$$

Two takeaways follow from this condition. First, the size of the multiplier is a key determinant of whether consolidations reduce debt ratios. The larger the multiplier is, the less likely a consolidation is to reduce debt ratios (denominator effect). Second, all else equal, higher debt ratios tend to mitigate the impact of consolidations in reducing debt ratios. This is because the direct effect of a proportional fiscal consolidation on the value of debt is smaller (the numerator effect), higher the debt ratio.

Appendix 2: Alternate Identification using Primary Balance to Identify Growth Shocks

Our baseline identification (Table 2) follows Mountford and Uhlig (2009) in using the co-movement between government revenue and GDP growth to identify demand and supply shocks. As an alternative to check robustness of our findings, we estimate a version of the SVAR where we impose sign restrictions on the primary balance to GDP ratio instead of revenues to identify the supply and demand shocks. While this restriction is not as agnostic as the one on revenues, it is fairly general and allows for any degree of countercyclical fiscal policy, as well as a fair degree of procyclical fiscal expenditures.

Let y denote GDP, r government revenues, e government expenditures and $p\ (=r-e)$ the primary balance (all in real terms). We begin with the definition of the primary balance to GDP ratio:

$$\frac{p}{y}=\frac{r-e}{y}$$

Differentiating both sides with respect to y (the case of a GDP/demand or supply shock):

$$\frac{d(\frac{p}{y})}{dy}=\frac{\left(\frac{dr}{dy}-\frac{de}{dy}\right)-\frac{(r-e)}{y}}{y}$$

Rearranging terms in the above expression and using the identity $(p\ =r-e)$ we get:

$$y\frac{d(\frac{p}{y})}{dy}=\frac{dr}{dy}-\frac{de}{dy}-\frac{p}{y}$$

So imposing a sign restriction on the primary balance to GDP ratio in response to a shock to GDP (y) entails the following:

$$y\frac{d(\frac{p}{y})}{dy}\geq 0\ \Leftrightarrow\ \frac{d(\frac{p}{y})}{dy}\geq 0\ \Leftrightarrow\frac{dr}{dy}-\frac{de}{dy}-\frac{p}{y}\geq 0\ \Leftrightarrow\ \frac{dr}{dy}-\frac{p}{y}\ \geq\frac{de}{dy}$$

To simplify, we can assume that $\frac{dr}{dy}-\frac{p}{y}=\frac{dr}{dy}$, since $\frac{p}{y}$ is close to zero on average in the sample,

and in any case would tend to be an order of magnitude smaller than $\frac{dr}{dy}$. This simplifies the above inequality to:

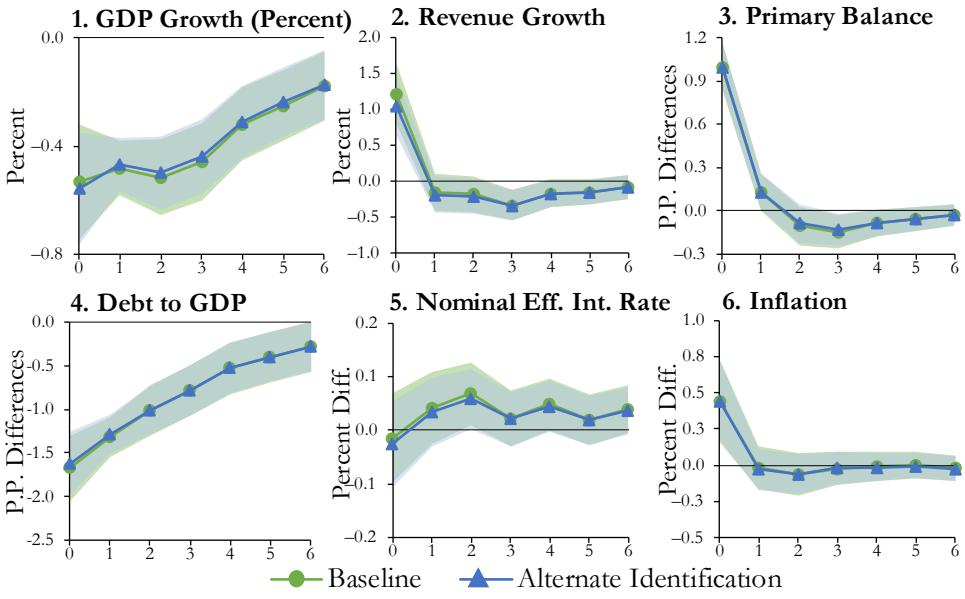
$$\frac{d(\frac{p}{y})}{dy} \geq 0 \Leftrightarrow \frac{dr}{dy} \geq \frac{de}{dy}$$

The above inequality is satisfied as long as the degree of procyclicality of government expenditures is less than that degree of procyclicality of revenues, i.e it is satisfied for all degrees of countercyclical expenditure policies (including on account of automatic stabilizers as suggested in the comment of the referee) as well as a moderate degree of procyclicality, so it is fairly broad.

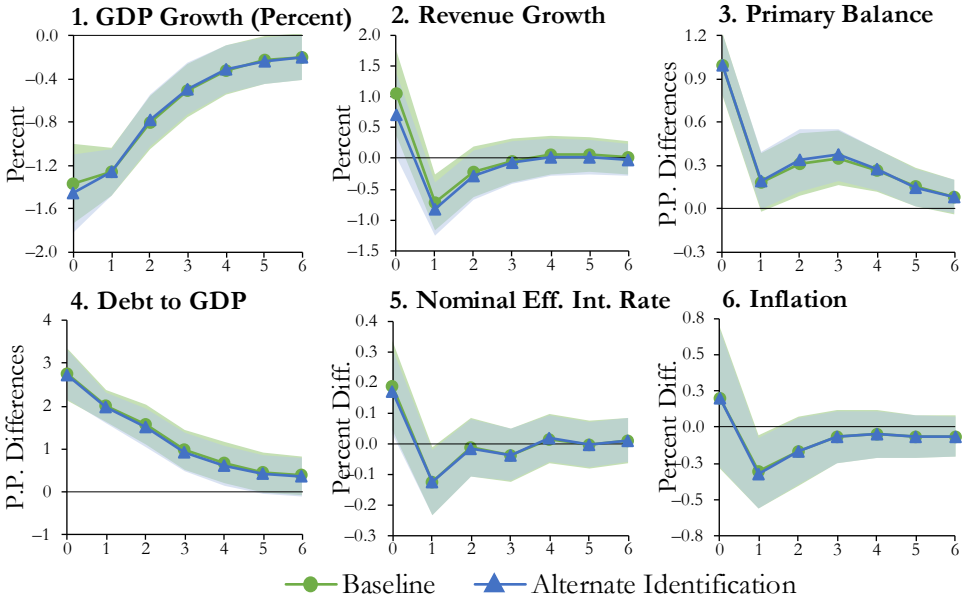
The figures below show that due to this, in practice, it makes little difference to the identification of the two fiscal shocks.

Figure A2

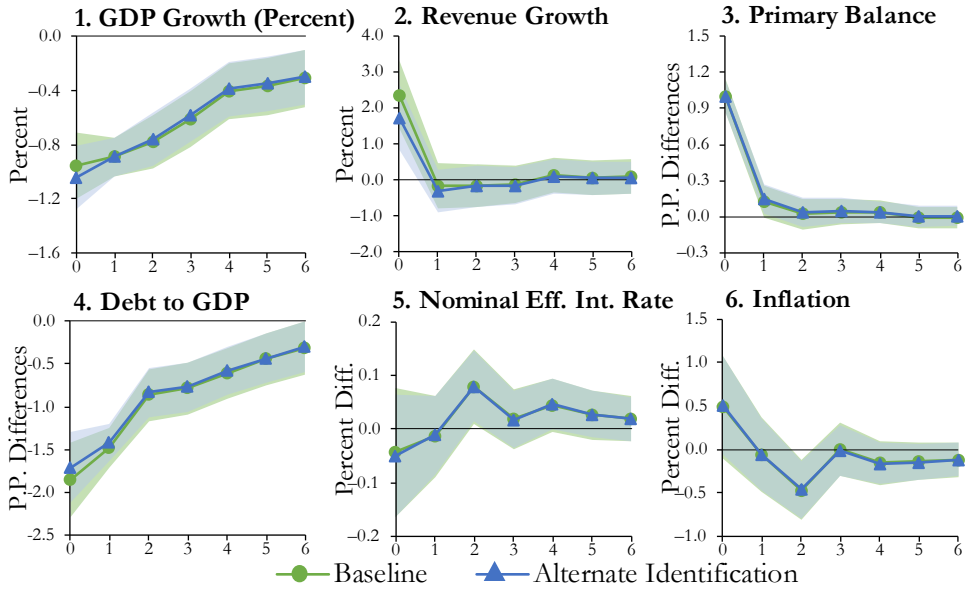
Panel A. Advanced economies: Successful fiscal consolidation shock



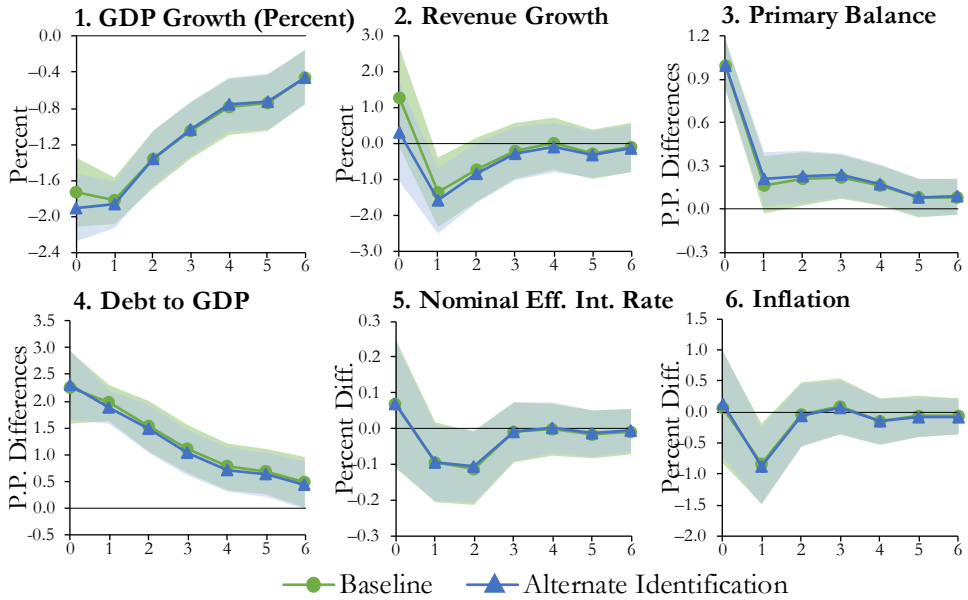
Panel B. Advanced economies: Unsuccessful fiscal consolidation shock



Panel C. Emerging markets: Successful fiscal consolidation shock



Panel D. Emerging markets: Unsuccessful fiscal consolidation shock



Impulse responses to successful and unsuccessful primary balance shocks identified via sign restrictions in Table 1, Panel B. Primary balance to GDP is scaled to one percentage point of GDP on impact on average. Displayed impulse responses are inverse variance weighted medians across countries from a Bayesian vector autoregression estimated country by country with 2 lags at annual frequency. Variables in panels 3-6 are in first differences to ensure stationarity. Shaded areas represent the 16th–84th percentile range of the posterior distribution. The sample includes 21 advanced economies (Panel A) and 37 emerging markets (Panel B).

Appendix 3: Robustness to the share of variance of the primary balance to GDP explained by the identified shocks in the VAR

Our baseline identification imposes only sign restrictions (at a single horizon) to identify four shocks as in Table 1. As shown in the first row of Table A3, these restrictions alone turn out to explain a large share of the variance of the primary balance to GDP ratio at a one-year horizon at around 70 percent on average for both AEs and EMs.

As a robustness check, we consider an identification that in addition to the sign restrictions in Table 1 similar to the baseline, imposes that the four identified shocks together explain at least 75 percent of the variance of the primary balance to GDP ratio at a one-year horizon for each country in the sample. As shown in the bottom row of Table A3, this leads to the identified shocks explaining more than 90 percent of the target variance for both sets of economies.

Figure A3 shows that the alternate identification generates dynamics that are fairly similar to the baseline. While the GDP decline in the case of successful consolidations under the alternate identification is somewhat larger, it is within the confidence bands of the baseline and remains well below the GDP decline in the case of unsuccessful consolidations for both sets of economies.

These results are robust to changing the precise value of the threshold (fixed at 75 percent in Table A3 and Figure A3) as well as the horizon over which the forecast error variance is computed.

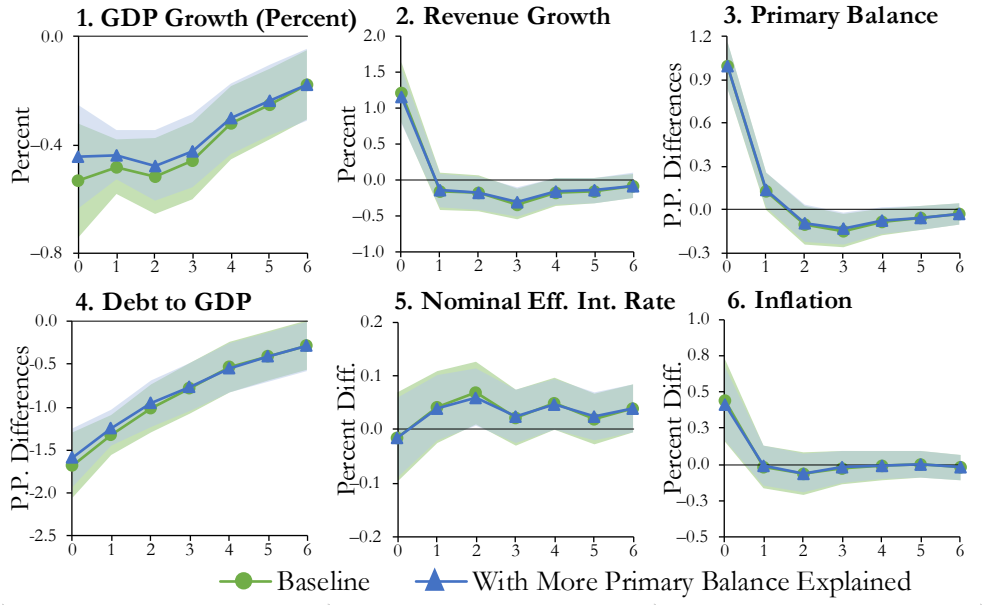
Table A3. Share of forecast error variance of primary balance to GDP explained by the four identified shocks in Table 2, Panel B

	AEs	EMs
Baseline identification	70.2	69.3
Alternate identification	93.3	93.4

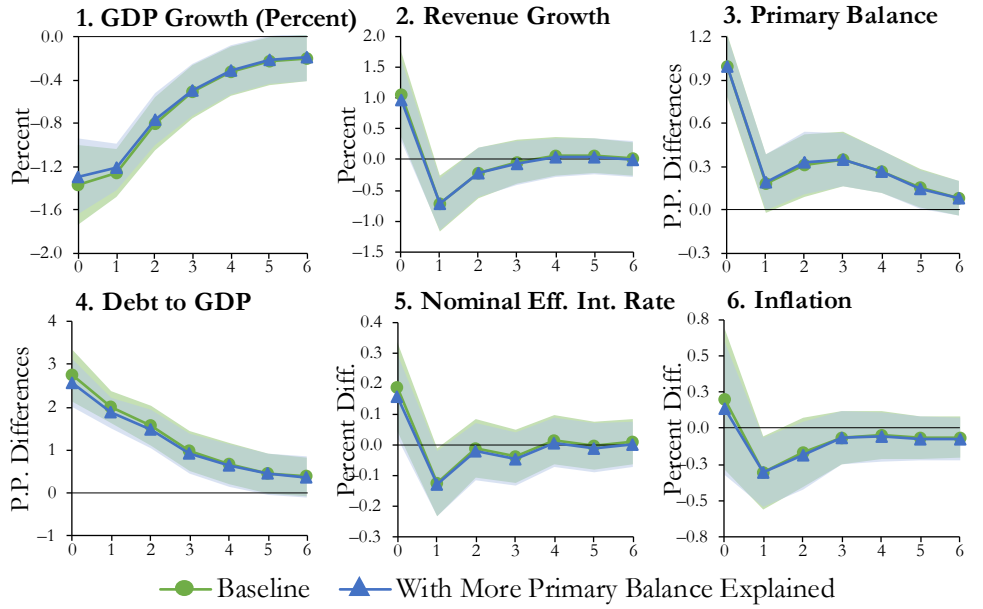
Notes: The Table displays the share of the variance of the primary balance to GDP ratio at a one-year horizon explained by the four identified shocks in the VAR: Demand, supply, successful consolidation and unsuccessful consolidation.

Figure A3

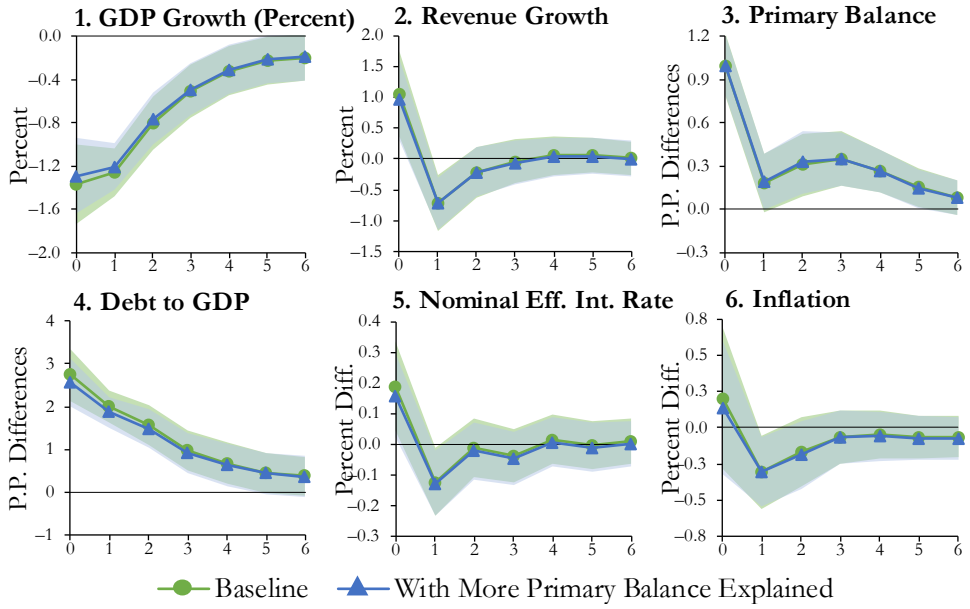
Panel A. Advanced economies: Successful fiscal consolidation shock



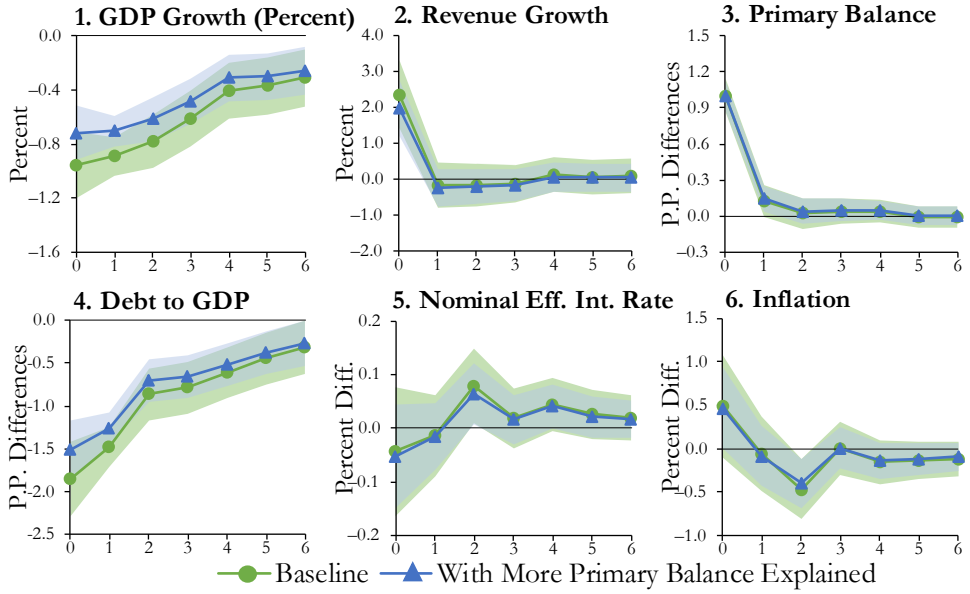
Panel B. Advanced economies: Unsuccessful fiscal consolidation shock



Panel C. Emerging markets: Successful fiscal consolidation shock



Panel D. Emerging markets: Unsuccessful fiscal consolidation shock



Notes: Impulse responses to successful and unsuccessful primary balance shocks identified via sign restrictions in Table 1, Panel B. Primary balance to GDP is scaled to one percentage point of GDP on impact on average. Displayed impulse responses are inverse variance weighted medians across countries from a Bayesian vector autoregression estimated country by country with 2 lags at annual frequency. Variables in panels 3-6 are in first differences to ensure stationarity. Shaded areas represent the 16th–84th percentile range of the posterior distribution. The sample includes 21 advanced economies (Panel A) and 37 emerging markets (Panel B).

Appendix 4: Incorporating a Role for Interest Rate Shocks

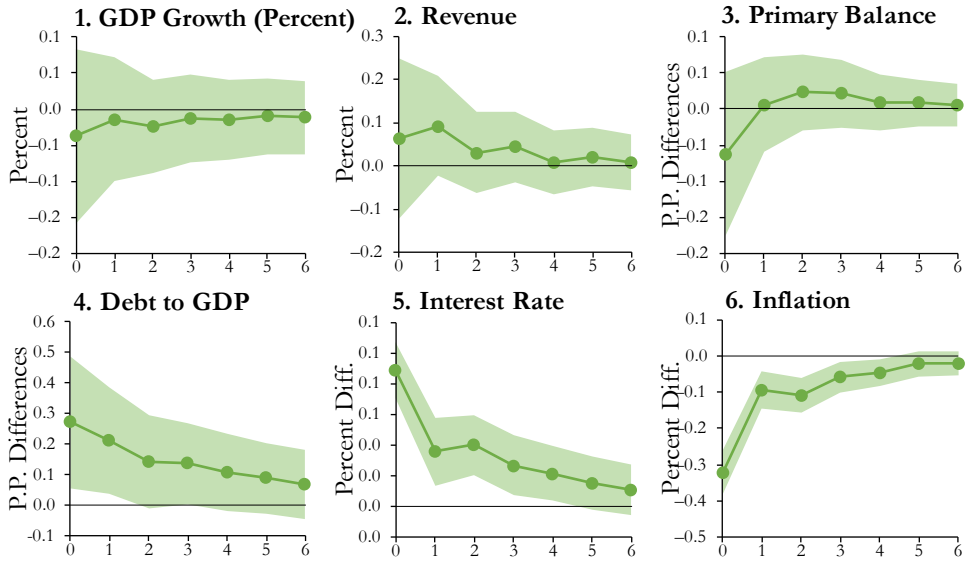
In this section we augment the baseline four shock identification in Table 1 by adding a fifth shock. The additional shock is identified by imposing that the real interest rate (nominal effective interest rate minus inflation) rises on impact. It can be interpreted as a real interest rate shock, or a monetary policy shock following the agnostic approach of Uhlig (2005).

Figure A4.1 shows that a positive interest rate shock (interpretable as a monetary tightening) is associated with an increase in the debt ratio for both AEs and EMs. A corollary of this finding is that consolidations that are accompanied by monetary accommodation (a decrease in the real interest rate) would we favorable towards debt reduction, i.e. they would entail a larger reduction in debt ratios in the case of successful consolidations, and a smaller rise in the case of unsuccessful consolidations. These findings resonate with evidence on the role of monetary accommodation in the case of fiscal multipliers that is studied extensively in the literature (see for instance Canova and Pappa, 2011).

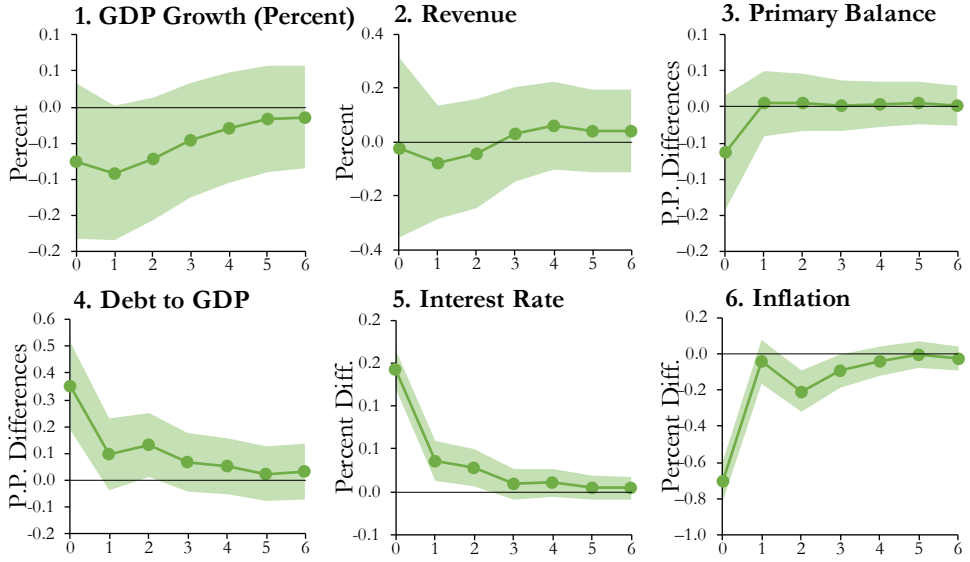
Furthermore, Figure A4.2 reveals that as far as the propagation of the two fiscal consolidation shocks is concerned, the identification of an additional monetary shock makes little difference, suggesting that the latter, even if unidentified, is orthogonal to, and does not confound the identification of the four shocks in the baseline.

Figure A4.1

Panel A. Advanced economies: Monetary Shock



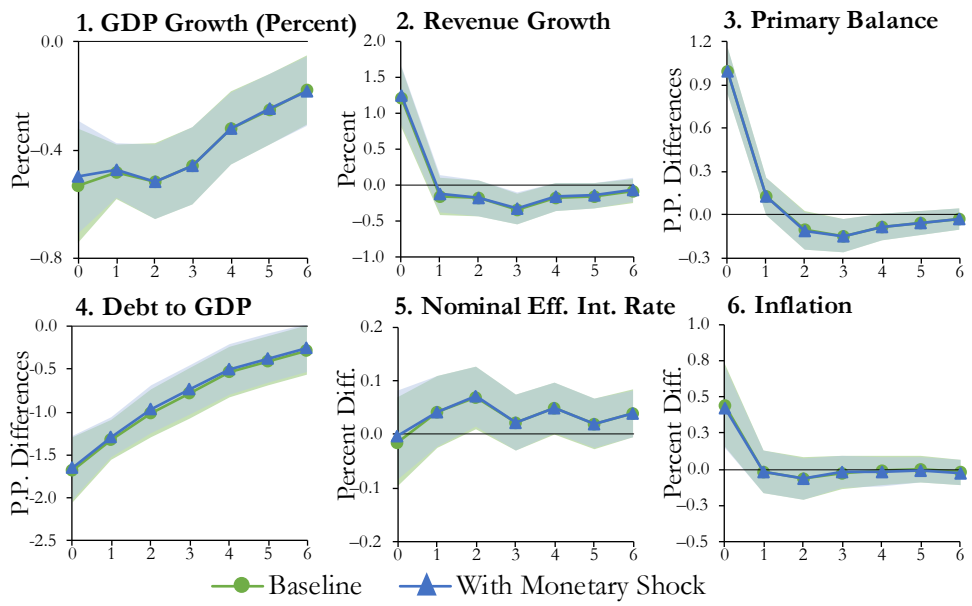
Panel B. Emerging markets: Monetary Shock



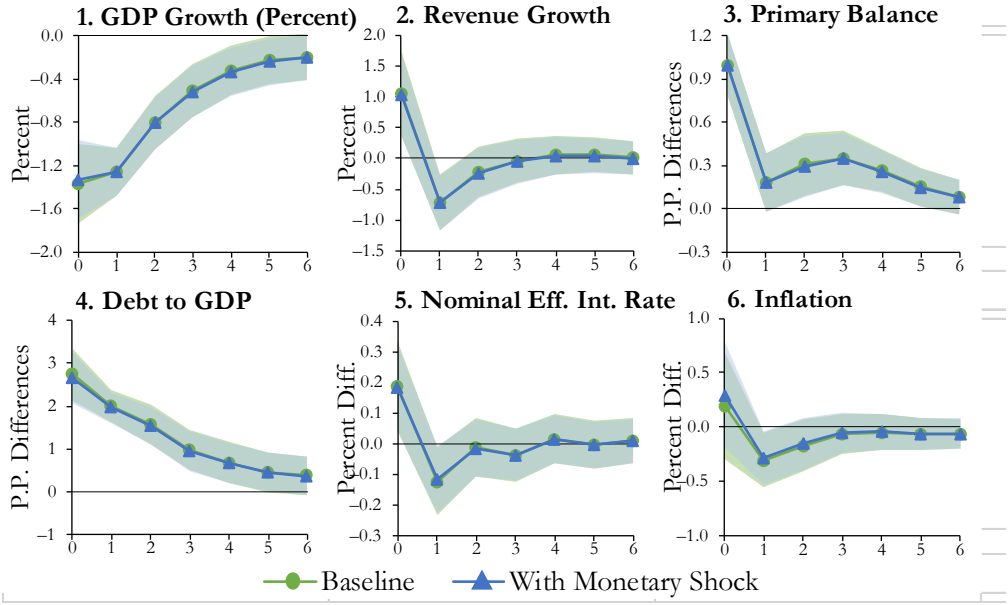
Notes: Impulse responses to interest rate shock identified via sign restrictions in Table 1, Panel B complemented with an additional interest rate shock that generates a rise in real interest rates in impact. Displayed impulse responses are inverse variance weighted medians across countries from a Bayesian vector autoregression estimated country by country with 2 lags at annual frequency. Variables in panels 3-6 are in first differences to ensure stationarity. Shaded areas represent the 16th–84th percentile range of the posterior distribution. The sample includes 21 advanced economies (Panel A) and 37 emerging markets (Panel B).

Figure A4.2

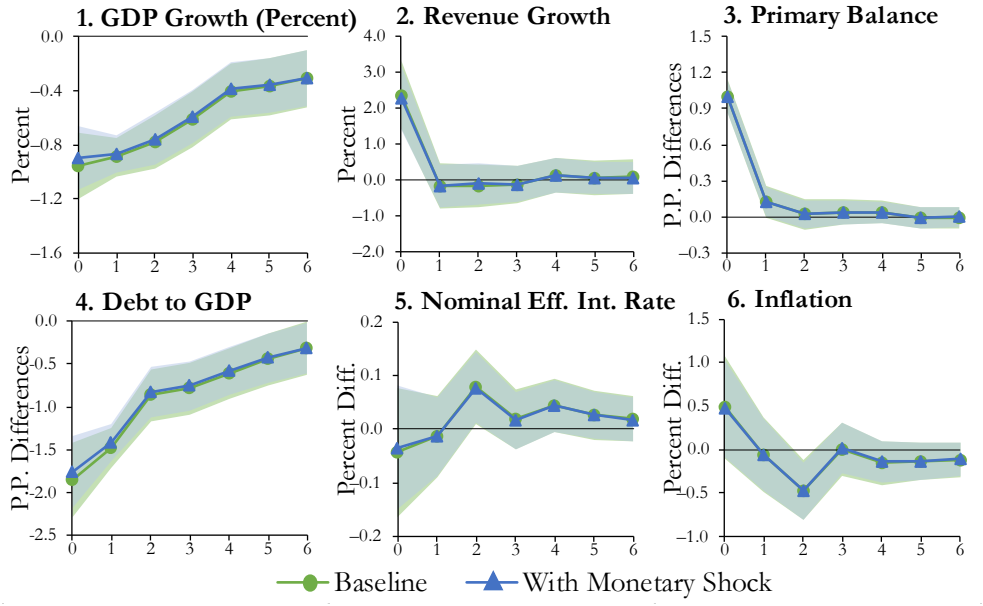
Panel A. Advanced economies: Successful fiscal consolidation shock



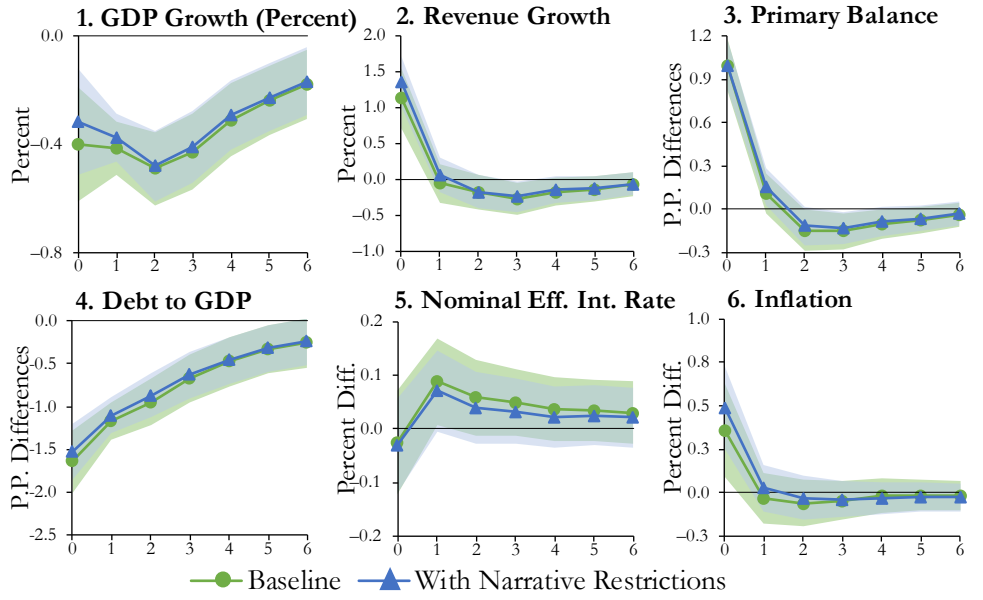
Panel B. Advanced economies: Unsuccessful fiscal consolidation shock



Panel C. Emerging markets: Successful fiscal consolidation shock



Panel D. Emerging markets: Unsuccessful fiscal consolidation shock



Notes: Impulse responses to successful and unsuccessful primary balance shocks identified via sign restrictions in Table 1, Panel B. Primary balance to GDP is scaled to one percentage point of GDP on impact on average. Displayed impulse responses are inverse variance weighted medians across countries from a Bayesian vector autoregression estimated country by country with 2 lags at annual frequency. Variables in panels 3-6 are in first differences to ensure stationarity. Shaded areas represent the 16th–84th percentile range of the posterior distribution. The sample includes 21 advanced economies (Panel A) and 37 emerging markets (Panel B).

Appendix 5: The Role of Consolidation Size

One limitation of our SVAR approach is that it does not allow for a full characterization of non-linearities such as differences in the impact of large vs small shocks and other time varying patterns within countries. That said, since the SVAR is estimated country by country, such differences can be documented and explored across countries.

Table A5 shows the median as well as 10^{th} and 90^{th} percentile of the shock size for the two fiscal consolidation shocks across countries in each of the two country groups. We leverage the significant heterogeneity evident in this table to split countries into two groups within each income group (AE vs EM) and shock category (successful vs unsuccessful) and compare the impulse responses in Figure A5.1 and Figure A5.2. For ease of comparison, the shock size is renormalized to a 1 percent of GDP increase in the primary balance to GDP ratio on impact.

The figures show that across the board, smaller shocks tend to have a somewhat (proportionally) larger impact on both GDP growth and debt ratios. One reason for this pattern could be that fiscal consolidations have a diminishing effect on growth and debt ratios as the size of the shock increases. On the other hand, unobserved country-level heterogeneity which leads countries to have large vs small consolidation shocks on average could also account for these patterns. The relative importance of these two sets of drivers behind the differences cannot be unmasked using the linear setup in our SVAR but would be a fruitful path to explore in future research via the use of non-linear and/or time varying models.

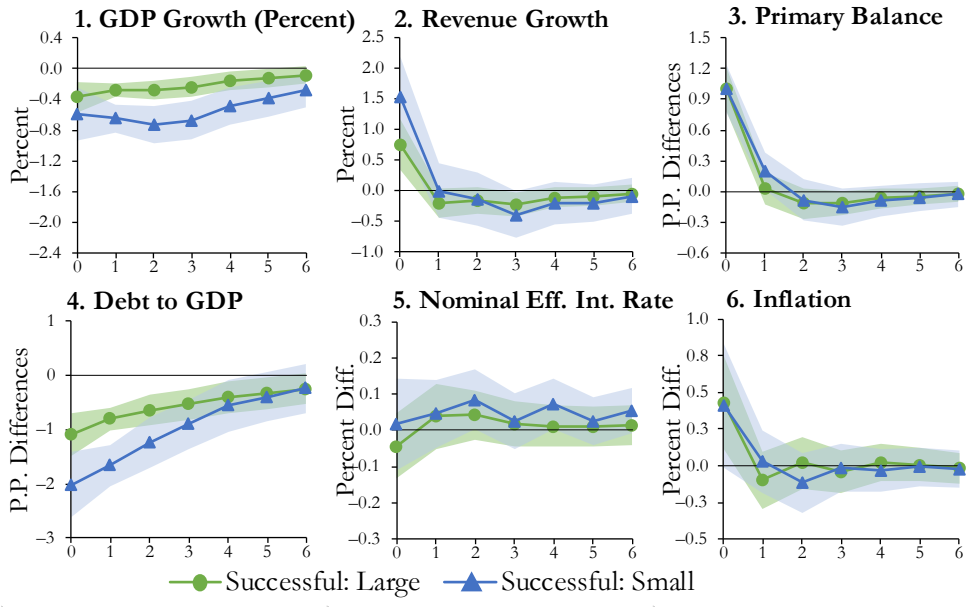
Table A5. Size of consolidation shocks

	Successful consolidation shock			Unsuccessful consolidation shock		
	Median	10th Percentile	90th Percentile	Median	10th Percentile	90th Percentile
AEs	0.4567	0.0910	1.1473	0.2931	0.0481	0.8796
EMs	0.4679	0.0860	1.6816	0.3541	0.0556	1.3575

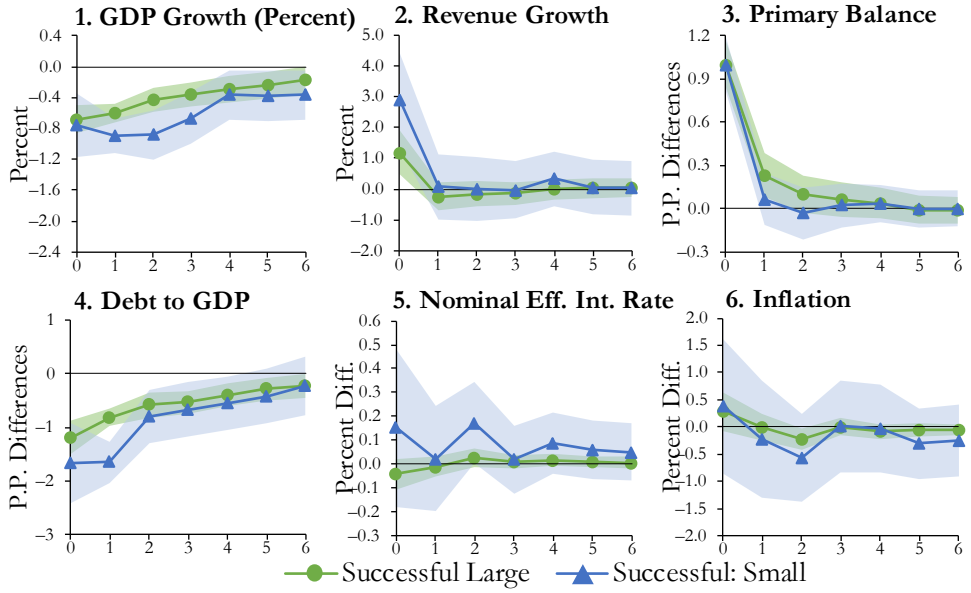
Notes: Size of the shock measures as the impact response of the primary balance to GDP ratio

Figure A5.1. Large vs small successful Consolidations: Cross-Country Differences

Panel A: Advanced economies



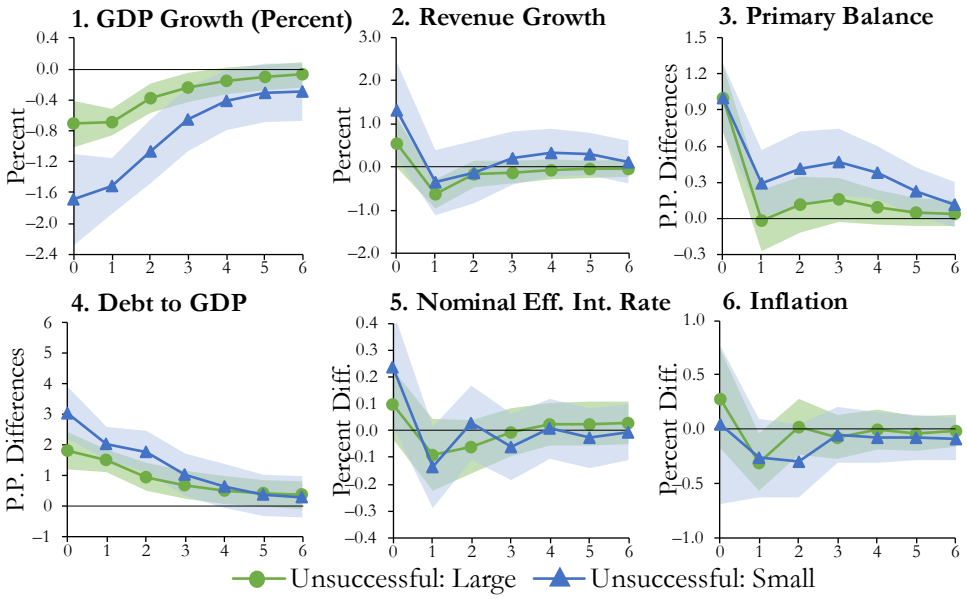
Panel B: Emerging markets



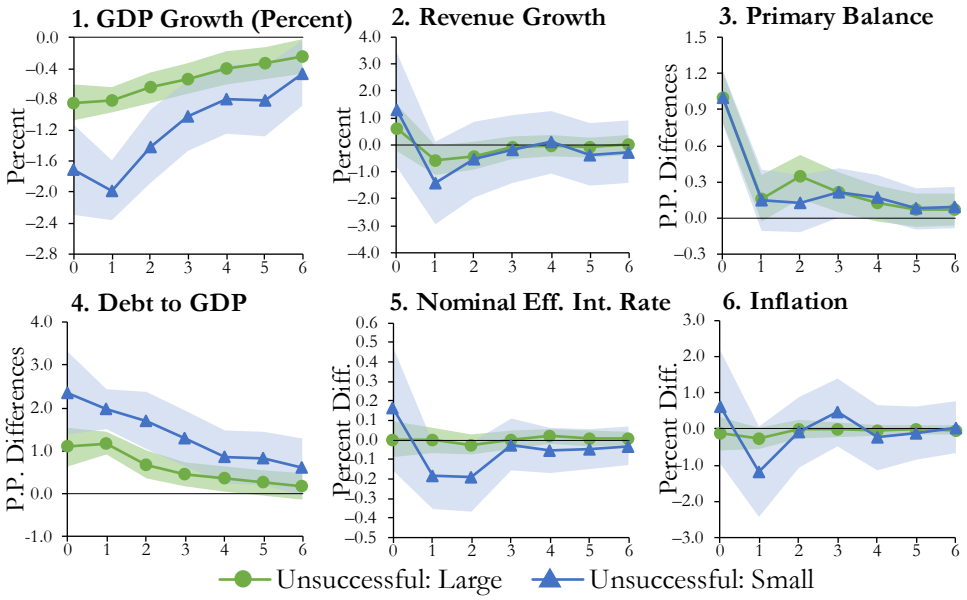
Note: Primary balance shock is scaled to one percentage point of GDP on impact on average. Displayed impulse responses are inverse variance weighted medians across countries from a Bayesian vector autoregression estimated country by country with 2 lags at annual frequency. Variables in panels 3-6 are in first differences to ensure stationarity. Shaded areas represent the 16th–84th percentile range of the posterior distribution. The sample is split by above and below median shock size based on Table A5.

Figure A5.2. Large vs small unsuccessful Consolidations: Cross-Country Differences

Panel A: Advanced economies



Panel B: Emerging markets



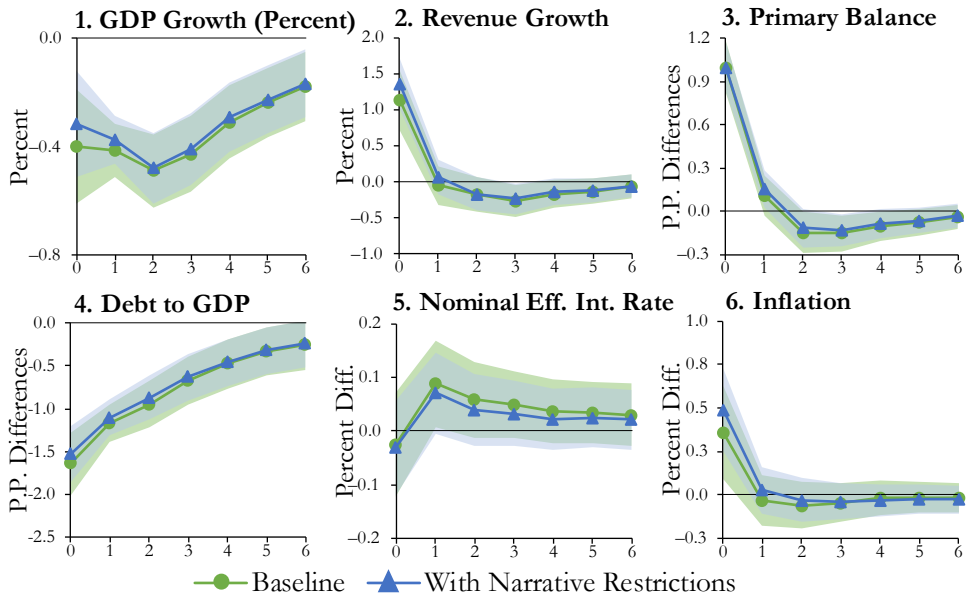
Sources: Canova and Ferroni (2022); IMF World Economic Outlook; IMF, Historical Public Finance Dataset (Mauro and others 2013); and IMF staff calculations.

Note: Primary balance shock is scaled to one percentage point of GDP on impact on average. Displayed impulse responses are inverse variance weighted medians across countries from a Bayesian vector autoregression estimated country by country with 2 lags at annual frequency. Variables in panels 3-6 are in first differences to ensure stationarity. Shaded areas represent the 16th–84th percentile range of the posterior distribution. The sample is split by above and below median shock size based on Table A5.

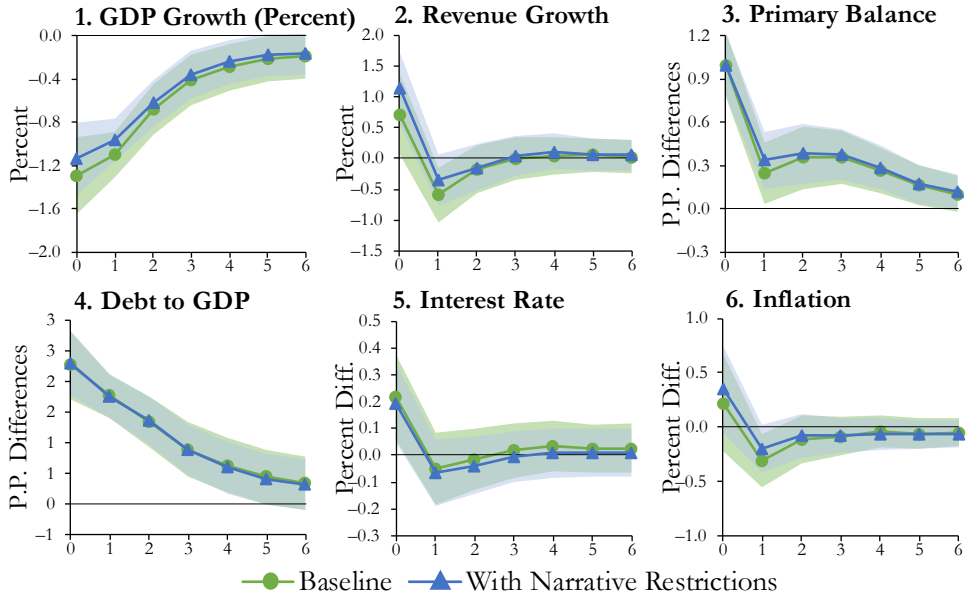
Appendix 6: Impulse responses with narrative restrictions

Figure A6.1. Impulse responses of debt to GDP to a primary balance shock, successful and unsuccessful fiscal consolidations in advanced economies, with and without narrative restrictions

Panel A. Successful consolidation



Panel B. Unsuccessful consolidation

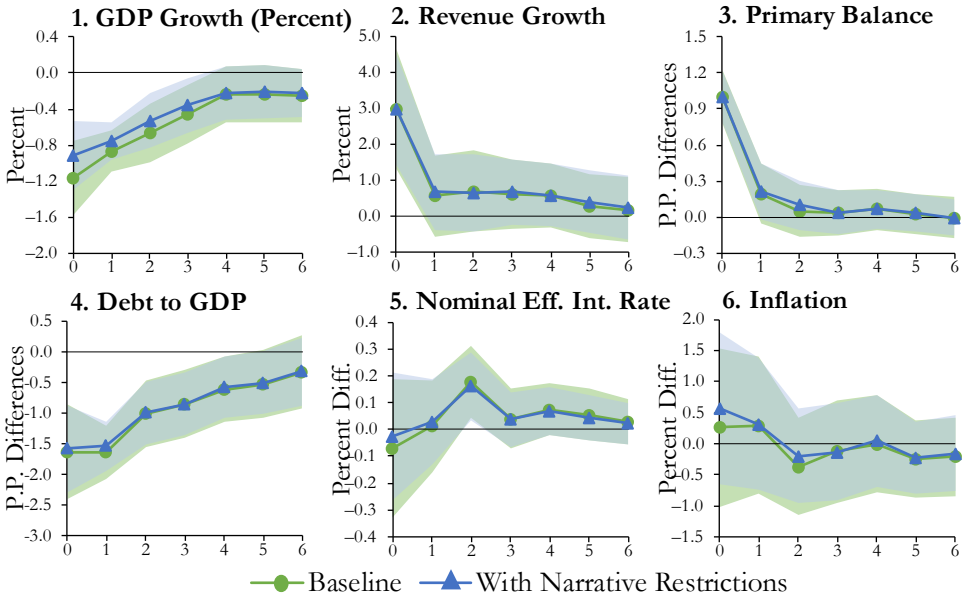


Note: Primary balance shock is scaled to one percentage point of GDP on impact on average. Displayed impulse responses are inverse variance weighted medians across countries from a Bayesian vector autoregression estimated country by country with 2 lags at annual frequency. Variables in panels 3-6 are in first differences to ensure stationarity. Shaded areas represent the 16th–84th percentile range of the posterior distribution. The sample includes

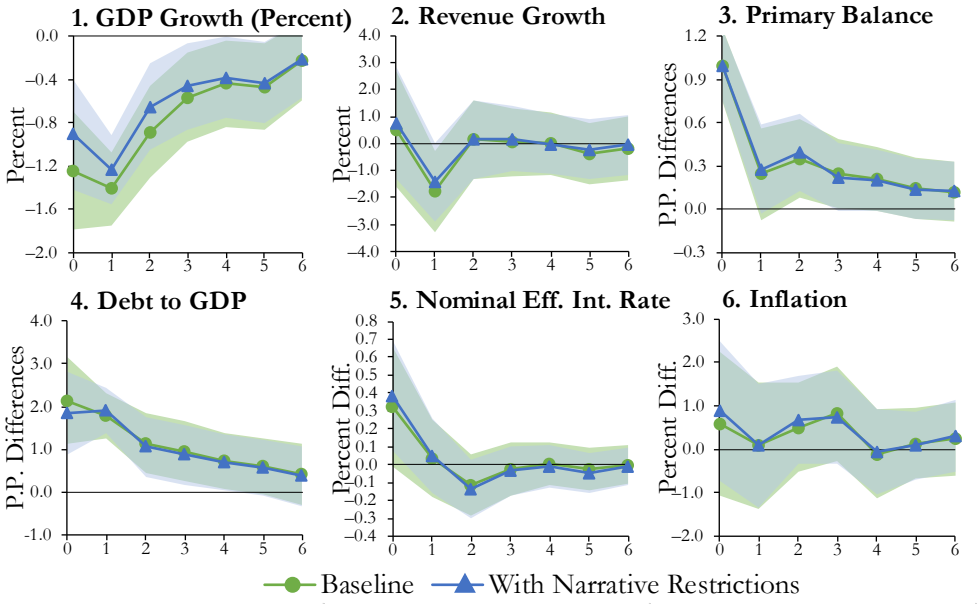
17 advanced economies from 1981 to 2019. Narrative sign restrictions are imposed on the sum of the successful and unsuccessful shocks in the first year of a narrative consolidation episode.

Figure A6.2. Impulse responses of debt to GDP to a primary balance shock, successful and unsuccessful fiscal consolidations in emerging markets, with and without narrative restrictions

Panel A. Successful consolidation



Panel B. Unsuccessful consolidation



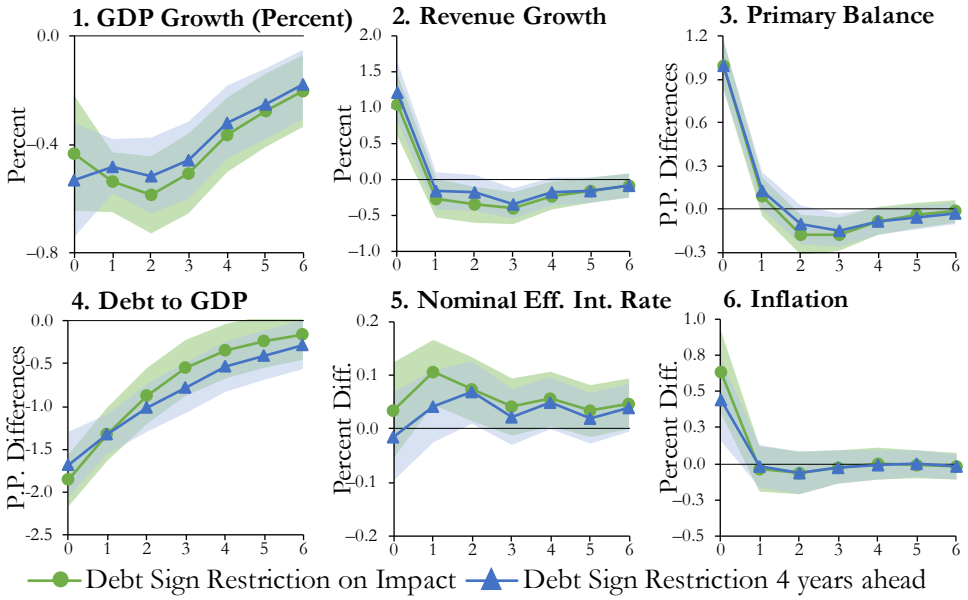
Sources: Canova and Ferroni (2022); IMF World Economic Outlook; IMF, Historical Public Finance Dataset (Mauro and others 2013); and IMF staff calculations.
Note: Primary balance shock is scaled to one percentage point of GDP on impact on average. Displayed impulse responses are inverse variance weighted medians across countries from a Bayesian vector autoregression estimated

country by country with 2 lags at annual frequency. Variables in panels 3-6 are in first differences to ensure stationarity. Shaded areas represent the 16th–84th percentile range of the posterior distribution. The sample includes 14 emerging markets from 1990 to 2019. Narrative sign restrictions are imposed on the sum of the successful and unsuccessful shocks in the first year of a narrative consolidation episode.

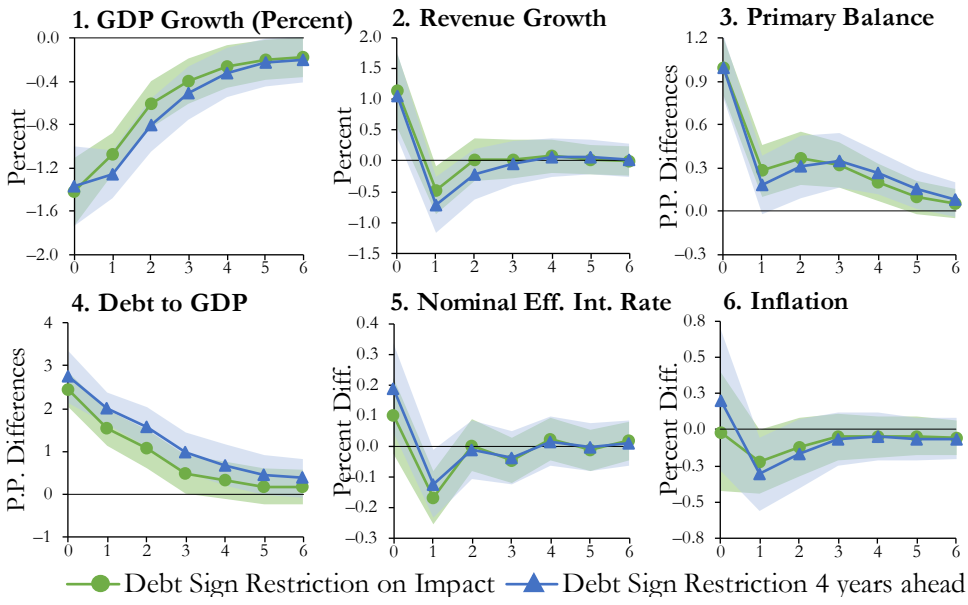
Appendix 7: Sign restrictions at alternative horizons

Figure A7.1. Impulse responses of debt to GDP to a primary balance shock, successful and unsuccessful fiscal consolidations in advanced economies, contemporaneous and 4-period ahead sign restriction on debt to GDP ratio

Panel A. Successful consolidation



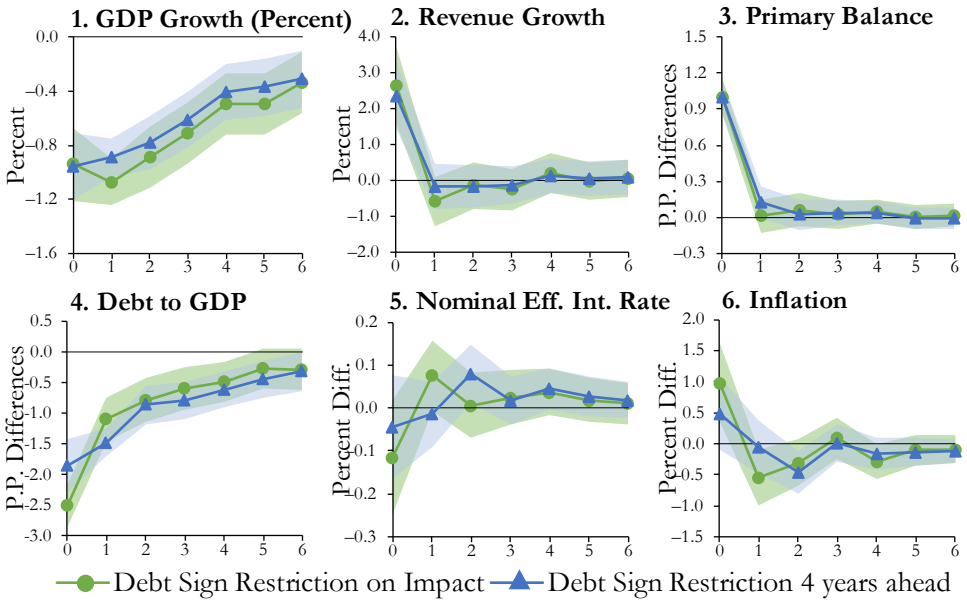
Panel B. Unsuccessful consolidation



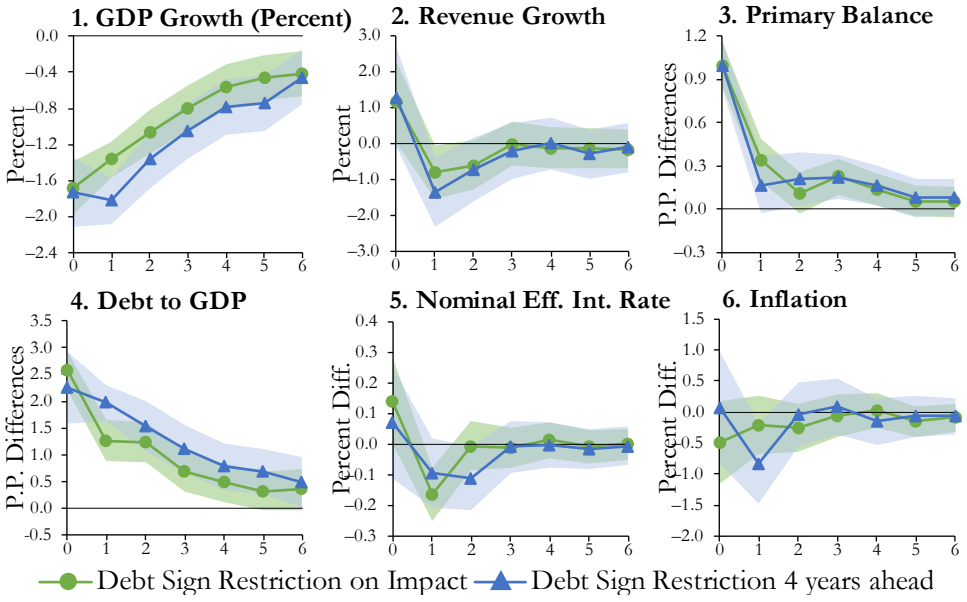
Sources: Canova and Ferroni (2022); IMF World Economic Outlook; IMF, Historical Public Finance Dataset (Mauro and others 2013); and IMF staff calculations.
Note: Primary balance shock is scaled to one percentage point of GDP on impact on average. Displayed impulse responses are inverse variance weighted medians across countries from a Bayesian vector autoregression estimated country by country with 2 lags at annual frequency. Variables in panels 3-6 are in first differences to ensure stationarity. Shaded areas represent the 16th–84th percentile range of the posterior distribution. The sample includes 21 advanced economies from 1990 to 2019.

Figure A7.2. Impulse responses of debt to GDP to a primary balance shock, successful and unsuccessful fiscal consolidations in emerging markets, contemporaneous and 4-period ahead sign restriction on debt to GDP ratio

Panel A. Successful consolidation



Panel B. Unsuccessful consolidation



Sources: Canova and Ferroni (2022); IMF World Economic Outlook; IMF, Historical Public Finance Dataset (Mauro and others 2013); and IMF staff calculations.
Note: Primary balance shock is scaled to one percentage point of GDP on impact on average. Displayed impulse responses are inverse variance weighted medians across countries from a Bayesian vector autoregression estimated country by country with 2 lags at annual frequency. Variables in panels 3-6 are in first differences to ensure stationarity. Shaded areas represent the 16th–84th percentile range of the posterior distribution. The sample includes 37 emerging markets from 1990 to 2019.