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journal homepage: www.elsevier.com/locate/jimfPrivate and public debt interlinkages in bad times [☆]Marco Bernardini ^a, Lorenzo Forni ^{b,*}^a Bank of Italy, DG Economics, Statistics and Research, Via Nazionale 91, 00184 Roma, Italy^b University of Padua, Department of Economics and Management, Via del Santo 33, 35122 Padova, Italy

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ABSTRACT

Drawing on a large sample of recession episodes, we document that those preceded by larger buildups in private debt tend to be followed by larger accumulations of public debt. Similarly to recessions preceded by a rapid run-up in public debt, these *ex-post* public debt buildups are associated with a more muted growth in government expenditures and a sharper rise in fiscal stress. The documented pattern becomes particularly intense in financial crises and emerges in both low and high public debt environments. These empirical regularities suggest that private sector indebtedness should be considered a relevant factor in the assessment of the soundness of the fiscal position.

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1. Introduction

The global financial crisis and its aftermath have shown that private and public debt positions can become strongly intertwined in bad times. The crisis originated in the United States after a prolonged period of debt accumulation in the private sector and required significant fiscal resources to be contained, leading to a large buildup of public debt (Fatás et al., 2019). While the experience of several advanced economies during this event suggests that the presence of excessive private debt accumulation at the start of a recession can be associated with large increases in public debt, evidence that this is a general pattern across a broader set of events remains limited.

To provide evidence on this issue, this paper reconsiders the role of both private and public debt accumulation as leading indicators of economic performance in recessions and recoveries. Our analysis relies on two ingredients. First, we use a large set of observations. Since downturns are infrequent events, we put together a large sample of more than 200 recession-recovery episodes by collecting data on GDP, private and public debt and on a number of fiscal and financial variables for a large set of advanced (AEs) and emerging market economies (EMEs) in the post-World War II era, that is, in the period 1950–2015. Second, we use Jordà's (2005) Local Projections (LPs) to assess the evolution of these variables during recession-recovery episodes conditionally on the rates of private and public debt accumulation observed in the years immediately before a business cycle peak. In this respect, recent studies have documented that the trajectory of debt is a relevant

[☆] All errors are ours; the views expressed in this paper are those of the authors and do not necessarily reflect those of the Bank of Italy.

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leading indicator of future economic and financial performance, not only in the case of private sector debt, but also in the case of government debt.¹

The main contribution of the paper is to show that recessions preceded by larger buildups in private credit tend to be systematically associated with larger increases of public debt.² Moreover, similarly to the case of larger buildups in public debt preceding recessions, these *ex-post* public debt buildups are accompanied by additional output losses and signs of a more constrained fiscal policy, that is, a more muted growth in government expenditures and a sharper rise in fiscal stress. These findings are robust to the exclusion of specific episodes. This is important because studies focusing on infrequent or even rare events, such as ours, require assembling an ample number of such cases across diverse countries over a long period of time and therefore accepting some degree of heterogeneity in the set of analyzed episodes.

We also study to what extent some of these patterns are specific to particular initial economic states, such as environments characterized by either disruptions in the financial sector or high public debt levels. First, we find that in financial recessions the documented emergence of *ex-post* public debt buildups following *ex-ante* private debt ones is even more pronounced and is accompanied by larger GDP losses and an intense debt deleveraging in the private sector, which implicitly results in a significant debt redistribution from the private to the public sector. Second, we investigate whether the initial level of public debt matters for our results. While our sample of recession–recovery episodes indicates that high public debt environments are on average characterized by a relatively worse economic performance and a more muted evolution of debt and government expenditures, we document that the evidence of a systematic interrelation between private and public debt holds in both high and low public debt environments.

Overall, these findings underlay the importance of considering developments in both private and public debt jointly. Analysing debt positions in silos – that is, assessing fiscal space in good times by only looking at public debt – might be a too limited approach. In particular, the presence of rapid debt buildups arising in the private sector should be recognized as a potential contingent liability of the public balance sheet and, therefore, considered a relevant factor in the assessment of the soundness of the fiscal position.

Related literature. On the importance of the links between private and public debt during recession–recovery episodes, the closest reference to our paper is [Jordà et al. \(2016\)](#). They work with a sample of 17 advanced economies from 1870 to 2011, in which 70 percent of the recessions and 80 percent of the banking crises occurred in the pre-WWII era. Their main finding regarding a contribution of public debt to the cost of recessions strongly depends on initial conditions: it arises only in financial crises preceded by both a private credit boom and an high starting level of public debt. Moreover, while they speculate that a potential reason for this finding has to do with the role of fiscal space in limiting the range of stabilization policies that the government can pursue, their historical sample does not allow them to inspect more directly the dynamics of fiscal variables such as government spending and fiscal stress as we do.

Other related contributions in this area are [Batini et al. \(2019\)](#) and [Mbaye et al. \(2018\)](#).³ The first paper empirically looks at the cyclical components of debt and output over time and shows that in the euro area private and public debt cycles are inversely related to that of future output. The effect of public debt is found to be significant when the level of debt is relatively high. The second study instead focuses on deleveraging episodes and shows that excessive private debt tends to translate into higher public debt, regardless of whether the credit boom resulted in a crisis or a more orderly deleveraging process.

Our study also touches on additional strands of the literature. First, it relates to a recent literature on the fiscal costs of banking crises. [Laeven and Valencia \(2013\)](#) document some of these costs. [Reinhart and Rogoff \(2013\)](#) look at the changes in public debt following banking crises and [Amaglobeli et al. \(2017\)](#) look at the conditions in which a country entered the crisis, including leverage.

Second, this study is also related to the vast literature on fiscal pro-cyclicality in EMEs. Focusing on the sub-sample of financial crises in EMEs, we offer a possible reinterpretation of the evidence that these countries have been on average prone to run pro-cyclical fiscal policies ([Kaminsky et al., 2004](#)). Our findings indeed suggest that the observed fiscal pro-cyclicality appears to be partly connected to the presence of excessive debt positions before crises and a tightening of financing constraints afterwards. In the absence of these conditions, real government spending appears at most to be a-cyclical in our sample of EMEs.

Lastly, our analysis speaks to the ongoing debate on fiscal space. In assessing the ability of a government to deal with future recessions and crises, the current state of private sector debt is generally not considered a relevant factor; fiscal space is mainly assessed by looking at the public balance sheet. [Romer and Romer \(2017\)](#) have proposed an analysis on several advanced economies arguing that entering a period of financial distress having policy space can make a difference in the way the ensuing recession–recovery phase plays out. Their analysis focuses on public debt without considering the dynamics of private debt in the years prior to a financial crisis. However, a large body of the literature has shown that financial crises are often preceded by private – not public – debt booms (i.e., [Jordà et al., 2011](#); [Jordà et al., 2016](#)). Our analysis suggests that a proper assessment of fiscal space should internalize the indirect and systematic weakening of public sector finances associated with excessive private credit positions.

¹ [Pescatori et al. \(2014\)](#) and [Chudik et al. \(2017\)](#) show that countries that increase public debt at a fast pace are found to grow relatively less in the future. Along the same vein, [Bassanetti et al. \(2019\)](#) show that a declining debt ratio is associated with a lower probability of debt distress and with a higher likelihood of recovering market access once access has been lost.

² In this paper we do not discuss whether the observed large fiscal interventions are justified from a welfare point of view. A large and prompt fiscal intervention might be indeed the optimal response to contain a banking crisis. For example, countries that in the aftermath of the 2008–09 crisis have used fiscal resources to fix their banking system early on have experienced faster recoveries ([International Monetary Fund, 2016](#)).

³ See also [Lo and Rogoff \(2015\)](#).

Structure of the paper. In the following section we present the econometric framework and the dataset. In Section 3 we analyze the paths of a set of real and financial variables during recession-recovery episodes conditionally on the rates of private and public debt accumulation observed in the years immediately before a business cycle peak. In Section 4, we analyze the case of financial recessions, that is, episodes of negative growth that are characterized by disruptions in the financial sector. In Section 5, we assess to what extent the starting level of public debt matters for the documented results. Finally, Section 6 concludes the paper.

2. Methodology and data

2.1. Methodology

To investigate the economic performance of a country entering a recession with a steeper debt trajectory, we follow Jordà et al. (2016) and use Jordà's (2005) Local Projections (LPs) to condition the dynamics of a variable of interest in recession-recovery episodes on predetermined characteristics. The conditional path is estimated directly, by running a sequence of regressions for different horizons, rather than indirectly extrapolating it from a given model, as it is the case with Vector AutoRegressions (VARs). This avoids the imposition of implicit dynamic restrictions and easily allows to accommodate panel structures and, as we do in Sections 4 and 5, non-linearities.

Specifically, our baseline findings build on the following LP model:

$$\frac{z_{i,p+h} - z_{i,p}}{y_{i,p}} = \theta^h + \beta_{PR}^h \frac{d_{i,p}^{PR} - d_{i,p-5}^{PR}}{y_{i,p-5}} + \beta_{PU}^h \frac{d_{i,p}^{PU} - d_{i,p-5}^{PU}}{y_{i,p-5}} + \gamma^h \frac{X_{i,p} - X_{i,p-5}}{y_{i,p-5}} + \alpha_i^h + u_{i,p+h}^h \quad (1)$$

for $h = 1, \dots, 5$. The term on the left hand side is the change in a generic variable of interest z in country i from a peak year p , the year before a recession occurs, to year $p+h$ – that is, 1 to 5 years later – scaled by the pre-recession GDP level $y_{i,p}$. Notice that model (1) focuses on recession-recovery episodes, in the sense that each observation in the estimation process is associated with a specific business cycle peak p , which is identified using the Bry and Boschan (1971) algorithm. Formally, a generic year t is a peak year p if the level of real per capita GDP grows in year t and drops in year $t+1$.

On the right hand side of Eq. (1) we include an intercept θ^h and a set of regressors that are predetermined with respect to the start of the recession. These are defined as changes over the five years preceding the downturn, expressed as a ratio of the starting GDP level $y_{i,p-5}$. $d_{i,p}^{PR}$ and $d_{i,p}^{PU}$ denote private and public debt while $X_{i,p}$ is a vector of controls that contains the set of analyzed variables z other than the d ones. α_i^h is a country level fixed effect, and $u_{i,p+h}^h$ is the residual. Standard errors are clustered at the country-level as a conservative fix for the leftover serial correlation typical of LPs.

The variables z analyzed in this paper are GDP, private debt, public debt, government expenditures and IMF credit, all expressed in real per capita terms.⁴ The analysis of GDP and debt is a natural step to take: the first provides direct information about the intensity of the contraction and the speed of the recovery, while the second allows us to keep track of potential debt interrelations. The other two variables, instead, allow to investigate more closely the economic and financial performance of the public sector in bad times. Government expenditures provide information on the fiscal policy stance. Since the automatic impact on fiscal accounts works mostly through revenues, the literature typically identifies this variable as a proxy indicator to assess the fiscal policy stance since it is the fiscal aggregate that is relatively less affected by GDP fluctuations (Kaminsky et al., 2004).⁵ The use of IMF credit, instead, provides information on the tightness of public borrowing constraints. An increase in the net outstanding debt with the IMF can indeed be seen as a signal that a lender of last resort is the only way to secure financing either because financial market stress has become unbearable or the country has lost market access (Gavin and Perotti, 1997).⁶

To allow a meaningful interpretation of the intercept θ^h , all the regressors d and X are expressed in differences from their pooled sample means and the set of country-dummies is sum-normalized to zero.⁷ In the spirit of Jordà et al. (2016), we then use the estimated parameters to construct two scenarios: an *average scenario* and a *rapid debt buildup scenario*. The average scenario is provided by the collection of the $\hat{\theta}^h$ s for $h = 1, \dots, 5$ and reflects the path of a variable of interest z during a recession-recovery episode when all the regressors are at their average value. The rapid debt buildups scenarios, instead, are given by a linear combination of the $\hat{\theta}^h$ s and the $\hat{\beta}^h$ s and reflect the path of z when the recession is preceded by a debt accumulation that is one standard deviation larger than the average debt accumulation and all the other regressors are at their average.⁸ Deviations

⁴ We deflate these variables using the same price index, that is, the GDP deflator. Covering the post WWII era for a large number of countries, including many EMEs, puts constraints on data availability. For example, the share of debt in foreign currency, sovereign spreads and data on monetary policy interest rates are often only available for the most recent recession-recovery episodes.

⁵ We focus on total expenditures. We however checked that using primary expenditures, for which the coverage is smaller, yields very similar results.

⁶ One way to measure fiscal stress is to look at the spread between the long-term government bonds in the country of interest relative to those in another "safe" country. Since for many countries long-term bonds were introduced only in the 1980s, this metrics is not available for most of our recession-recovery episodes.

⁷ To avoid multicollinearity we arbitrarily drop the last country-dummy. The zero-sum normalization of the country dummies, which we impose by subtracting the inverse of the number of countries to each dummy variable, guarantees that the estimated value of the intercept θ^h is not affected by this choice.

⁸ Formally, the rapid debt buildup scenarios are given by the following linear combinations of parameters: $\hat{\theta}^h + sd_{PR} \hat{\beta}_{PR}^h$ for private debt and $\hat{\theta}^h + sd_{PU} \hat{\beta}_{PU}^h$ for public debt. Standard deviations are computed over the full sample and kept fixed for consistency over different horizons h and response variables z ($sd_{PR} = 24.6$ and $sd_{PU} = 18.5$; see Table A2 in the Appendix A).

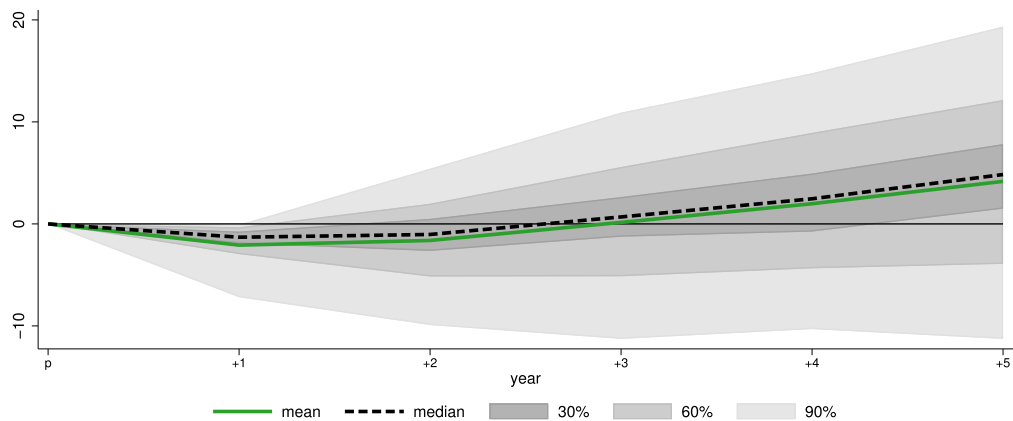


Fig. 1. Economic performance in recession-recovery episodes. Empirical distribution of GDP in the first five years following a business cycle peak (p) as defined in Eq. (1). The solid line is the sample mean. The dashed line is the median. The bands show different percentile intervals: 35th–65th (30%), 20th–80th (60%), 5th–95th (90%).

from the average scenario thus provide a measure of the differential economic performance that is associated with entering a recession after a more rapid run-up in debt.⁹

2.2. Data and descriptive analysis

We analyze a set of more than 200 recession-recovery episodes in the post-WWII era in both advanced (AEs) and emerging market economies (EMEs), extracted from a large international dataset based on several data sources: Penn World Tables (PWT), Public Finances in Modern History (PFMH), Historical Public Debt (HPD), International Financial Statistics (IFS), and World Economic Outlook (WEO).¹⁰

Data on population and real GDP are from the PWT. Fiscal variables data are from the PFMH database compiled by Mauro et al. (2015), which includes an unbalanced panel of 55 countries over the period 1800–2011. Whenever possible, we impute missing values using comparable data from the WEO and, for the fiscal variables, also the HPD database compiled by Abbas et al. (2010, 2013 update). Data on IMF credit are from the IFS database.

As a proxy for private debt, we use IFS data on banks' claims on the private sector (line 22d), which cover a larger set of countries and time periods than the widely-used Bank for International Settlements (BIS) debt data. Claims include loans and some relatively minor items such as securities and shares, financial derivatives and trade credit advances. With the exception of shares, these other items are part of private sector debt. However, the difference between claims and loans is generally small. Loans account, on average, for 96 percent of bank claims in countries reporting to the IFS Standardized Reporting Forms in 2015 (for which a decomposition between loans and other items is available).

Fig. 1 summarizes the variation in economic growth during the first five years after a business cycle peak. The solid and dashed lines track the average economic performance in downturns, while the grey shades measure different percentile ranges, that is, 30 percent, 60 percent and 90 percent. The main message from this graph is that “bad times are not all equally bad”. Some recessions are very intense and the economy takes a long time to recover. Other recessions are short-lived and the subsequent economic recovery is very rapid. In other words, while the average recession lasts one year and the economy tends to recover fully within three years, average values mask considerable variation.

Fig. 2 summarizes the variation in the rates of private and public debt accumulation in the five years up to the peak prior to recessions, as defined in Eq. (1). Again, the data show considerable heterogeneity. While on average debt has moderately increased in both sectors before recessions (as shown by the vertical lines), at times it has strongly deviated from the average. For instance, there are cases where debt rose more rapidly than average prior to recessions, and others where it decreased instead of increasing. We exploit the substantial variation in our data to estimate model (1).

3. Private and public debt interlinkages

Fig. 3 reports the dynamics of the analyzed variables from the year preceding a recession to five years later under different scenarios. The solid lines refer to the average scenario; that is, the typical dynamics during recession and ensuing recoveries. At times of falling economic activity, with real per capita GDP going down by construction in year one, the other variables are

⁹ Although the debt buildups are not exogenously determined, implying that we cannot make causal claims, notice that they are predetermined, meaning that we can reasonably rule-out the presence of direct feedback mechanisms running from economic performance to debt buildups (i.e., in the absence of anticipation on the severity of an incoming recession).

¹⁰ We consider countries that are covered by the PFMH database and for which we observe at least 30 years of data. Table A1 in the Appendix A lists all the analyzed episodes by country-group and types of recessions.

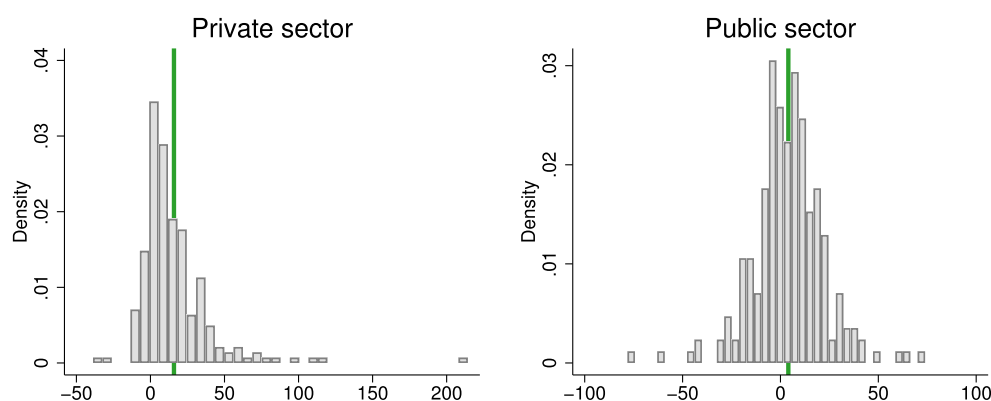


Fig. 2. Sample distributions of debt buildups at the business cycle peak. Empirical distributions of accumulations of private and public debt in the five years preceding a business cycle peak (p) as defined in Eq. (1).

characterized by counter-cyclical dynamics: private and public debt increase, the government spends more and fiscal stress – proxied by the evolution in IMF credit – rises. As the recovery unfolds, starting in year two, all the variables remain on an upward trend.

How do these patterns differ when a recession is preceded by a larger than average accumulation of public debt? The dashed lines in the bottom row of Fig. 3 illustrate this scenario. In this case the recovery tends to be slower, generating economically significant output losses. After five years, despite achieving a full recovery with respect to the pre-recession level, economic activity remains about two percentage points lower than in the average case. As expected, in the case of a rapid public debt buildup, we find also that government expenditures grow less and fiscal stress, proxied by access to IMF credit, tends to be higher. Overall, these dynamics suggest that in bad times public spending is more likely to be constrained in countries that have entered the recession with a faster rate of public debt accumulation. Conversely, a lower accumulation of public debt prior to a downturn is generally associated with a less severe recession and a more rapid recovery. These results point to the importance of maintaining *ex-ante* fiscal space to allow policymakers to run counter-cyclical fiscal policies in bad times. But is the availability of fiscal space a sufficient macro-financial condition to address future recessions?

The dashed lines in the top row of Fig. 3 show the case of a country entering a recession after a rapid accumulation of private – not public – debt. Also in this scenario we find that a more fragile private debt position at the start of an economic recession is followed by poorer economic performance in bad times. The recession lasts one additional year and the economic recovery is completed only in year four. It is striking that in a rapid private debt buildup scenario fiscal policy appears to be similarly constrained: government expenditures end up growing less than average, and fiscal stress spikes. Why should this be the case? The main difference is the behavior of private, and especially, public debt. In particular, we find that recession-recovery episodes preceded by more rapid debt buildups in the private sector are characterized by private sector deleveraging and a rapidly accelerating accumulation of public debt. While our framework does not allow us to identify the underlying mechanism, this is evidence that excessive private debt positions prior to a recession tend to put additional weight on the public balance sheet afterwards. This amplification works through both indirect and direct channels, such as the automatic impact of economic activity on fiscal deficits and “below the line” fiscal operations (that is, outlays made to purchase financial assets from the private and financial sectors). In this context, the presence of private debt deleveraging is likely to act as a further drag, exacerbating these effects.

To sum-up, we document three main patterns. First, recessions preceded by larger debt accumulations – either private or public – tend to be characterized by additional output losses, which translate in deeper contractions and longer recoveries. Second, a more rapid accumulation of private debt in the years preceding a recession is typically followed by a sharper deterioration of the public balance sheet. Third, similarly to *ex-ante* run-ups in public debt, these *ex-post* public debt buildups are accompanied by signs of a more constrained fiscal policy.

Overall, these findings suggest that an excessive accumulation of private debt tends to give rise to contingent liabilities in the public balance sheet and underlay the importance of considering developments in both private and public debt jointly and not in silos.

Sensitivity: clusters of episodes by peak year and by country. Studies that focus on recessions require accepting some degree of heterogeneity in the set of analyzed events. Since these episodes are infrequent, researchers look at historical records or use a broad set of countries in order to assemble an ample number of events. For instance, Jordà et al. (2016) extend the sample along the time dimension, including recession-recovery episodes related to the pre-World War II era, while we consider a larger set of countries over a shorter period of time. In addition, retrieved data typically have different coverage over time and across countries. Notwithstanding this limitation, in this section we show that our results hold when we re-estimate the model in Eq. (1) excluding one peak year or one country at a time.¹¹

¹¹ For ease of comparison, we calibrate the rapid debt buildup scenarios as in Fig. 3 (see footnote 8).

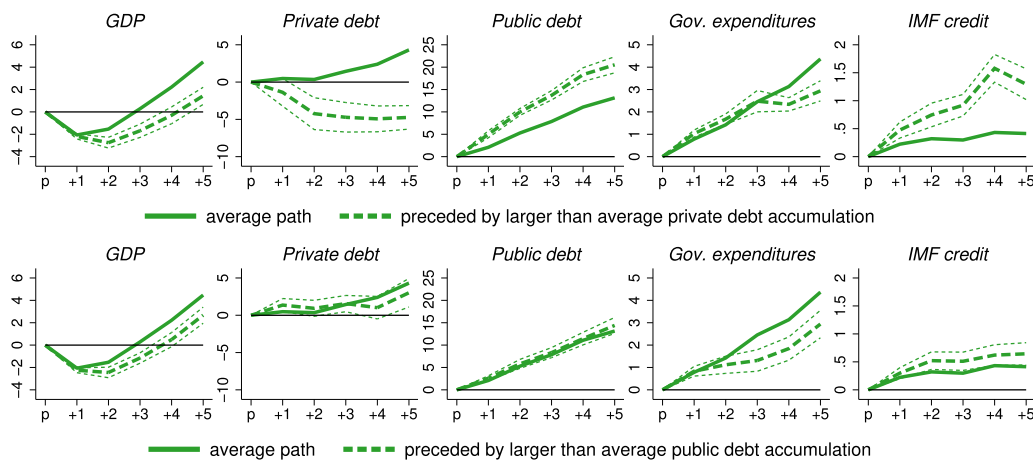


Fig. 3. Recessions and recoveries preceded by rapid debt buildups. Dynamics of real per capita GDP, private debt, public debt, government expenditures, and IMF credit, from the year before a recession takes place (p) to five years later ($p+5$), scaled by the pre-recession GDP level $y_{i,p}$. The solid line shows the average path of the variable, while the dashed line refers to the path when the recession is preceded by a rapid accumulation of private or public debt (top and bottom rows, respectively). Bands denote one-standard deviation confidence intervals.

The lines in Panel (a) of Fig. 4 show how the deviations from the average paths look like when we exclude one peak year at a time. We find that the inclusion of the group of recession-recovery episodes starting in 2008 (i.e., with the business cycle peaking in 2007) tends to strengthen the amplifications associated with an *ex-ante* private debt buildup, especially on the dynamics of private debt. This underscores the international dimension and the intensity of the global financial crisis that was characterized by a number of major banking crises preceded by significant private debt accumulations. Despite this difference, our main result that public debt tends to build more rapidly if preceded by a rapid private debt buildup still holds. Also the conditional effects on the other variables turn out to be quite robust.

Panel (b) in Fig. 4 shows that the estimated effects also hold if we exclude observations by country. The only (and minor) exception relates to the boom-bust cycle in private debt that is slightly less intense when Iceland is excluded from the sample. In this respect, notice that Iceland entered the financial recession in 2008 with a massive buildup in private debt, the largest in our sample.¹² However, in this case also, the directions of the estimated amplifications tend to hold after the removal of such an extreme event.

4. Debt interlinkages during banking crises

The literature on credit booms highlights that rapid accumulations of private debt in good times can be particularly damaging if the ensuing recession is characterized by the presence of a financial sector crisis. First, it can be at the root of the downturn (Boissay et al., 2016). Some recent research shows that a rapid accumulation of private debt is a leading indicator of banking crises, which usually are followed by extremely acute downturns (Gourinchas and Obstfeld, 2012; Jordà et al., 2011; Reinhart and Rogoff, 2009). Second, in the presence of financial sector disruptions, the empirical association between debt service and borrowing constraints (Johnson and Li, 2010) is likely to be amplified. In addition, the recent history of banking crises shows that financial sector intervention policies, such as bank recapitalizations and asset purchases, often require significant additional fiscal resources, contributing to the deterioration of the public balance sheet (Laeven and Valencia, 2013). In exploring the presence of debt interlinkages in bad times, banking crises are therefore natural episodes to consider.

To isolate the predictive association between debt buildups before banking crises and economic performance afterwards, we allow for a state-dependent relation. Specifically, following Jordà et al. (2016), the LP model becomes:

$$\frac{z_{i,p+h} - z_{i,p}}{y_{i,p}} = \theta_N^h (1 - F_{i,p}) + \theta_P^h F_{i,p} + \beta_{NPR}^h (1 - F_{i,p}) \frac{d_{i,p}^{PR} - d_{i,p-5}^{PR}}{y_{i,p-5}} + \beta_{FPR}^h F_{i,p} \frac{d_{i,p}^{PR} - d_{i,p-5}^{PR}}{y_{i,p-5}} + \beta_{NPU}^h (1 - F_{i,p}) \frac{d_{i,p}^{PU} - d_{i,p-5}^{PU}}{y_{i,p-5}} + \beta_{FPU}^h F_{i,p} \frac{d_{i,p}^{PU} - d_{i,p-5}^{PU}}{y_{i,p-5}} + \gamma^h \frac{X_{i,p} - X_{i,p-5}}{y_{i,p-5}} + \alpha_i^h + u_{i,p+h}^h \quad (2)$$

for $h = 1, \dots, 5$. The state-dependent model in Eq. (2) is similar to the baseline model (1), the only difference being that each parameter of interest is interacted with a discrete indicator $F_{i,p}$, and its complement $(1 - F_{i,p})$, which takes the value 1 if the analyzed recession episode is characterized by the presence of a banking crisis at the peak of the business cycle or at the start of the recession.¹³ Regarding the model in Eq. (2), the new specification now requires centering all of the regressors in relation

¹² This is the most extreme value on the right hand side of the histogram shown in the left panel of Fig. 2.

¹³ The use of a small window to define a recession as financial minimizes the risk of erroneously identifying a non-financial recession as financial, especially in highly volatile economies.

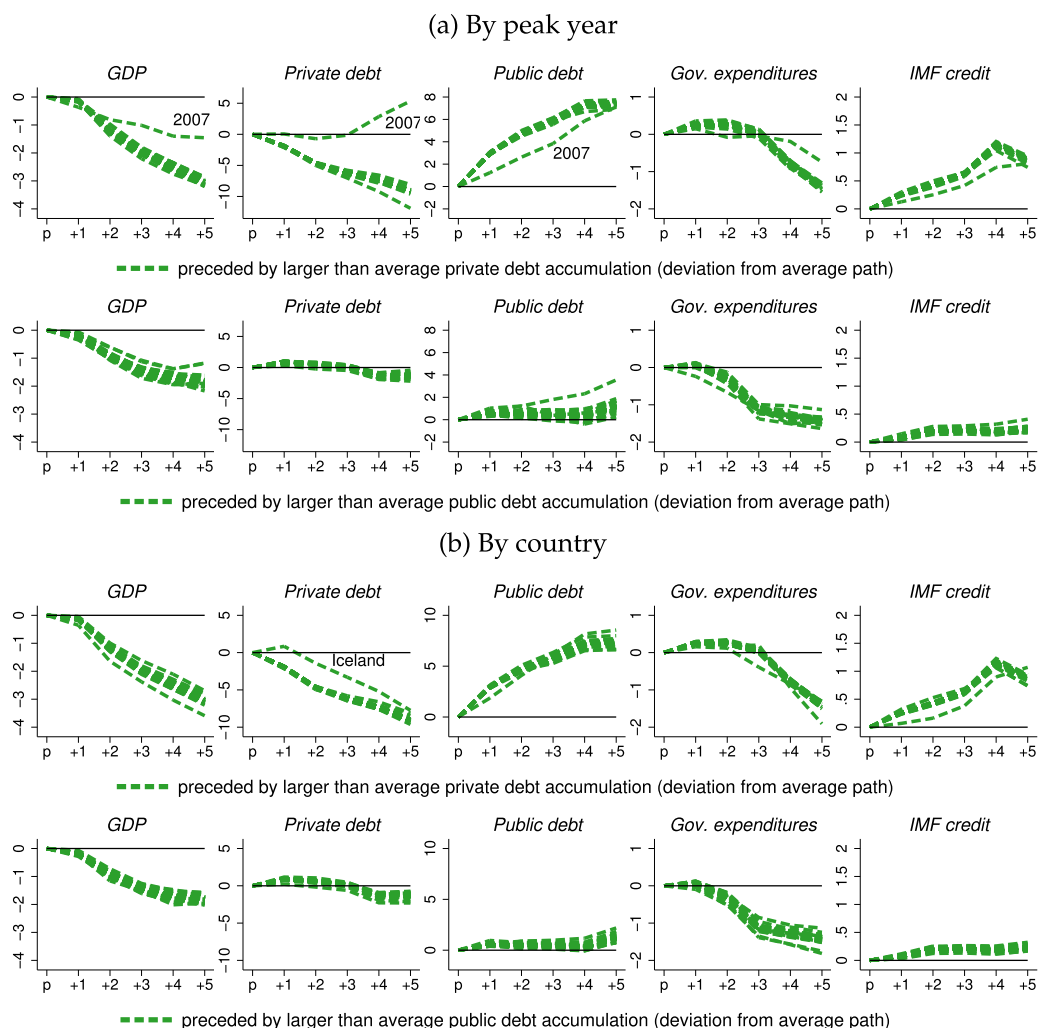


Fig. 4. Excluding one group of observations at a time. Dynamics of real per capita GDP, private debt, public debt, government expenditures, and IMF credit, from the year before a recession takes place (p) to five years later ($p+5$), scaled by the pre-recession GDP level $y_{i,p}$. The dashed line refers to the deviation from the average path when the recession is preceded by larger than average debt accumulation and a group of observations are excluded from the estimation (by peak year or by country). Bands denote one-standard deviation confidence intervals.

to their means in the non-financial and financial recession bins, respectively. Similarly, the rapid debt buildup scenarios are now calibrated using their respective standard deviations in non-financial and financial recession bins.¹⁴ Financial crisis episodes are identified using data from Laeven and Valencia (2013), Reinhart and Rogoff (2009), and Jordà et al. (2016).¹⁵

Fig. 5 reports the evolution of the analyzed variables from the year preceding either a non-financial or a financial recession to five years later under different scenarios. The solid lines refer to the average paths. Financial recessions are associated with a considerably larger GDP decrease than non-financial recessions. After five years, the economic recovery is not yet complete. The resulting output loss, visually represented by the area between the solid line and the horizontal axis in Panel (b) of Fig. 5, is substantial. This amplification is typically the result of a reinforcing mechanism triggered by the private debt deleveraging process that, as shown in the figure, tends to differentiate financial recessions from non-financial ones. The attempt to create room to cut private debt reduces aggregate demand, making the recession deeper and longer (Claessens

¹⁴ This is meant to capture the fact that financial recessions are typically preceded by more rapid accumulations of private debt than non-financial ones (Table A2). See also Jordà et al. (2013, 2016) on this. The rapid debt buildup scenarios are now given by the following linear combinations of parameters: $\hat{\theta}_{NPR}^p + sd_{NPR} \hat{\beta}_{NPR}^p$ for private debt in non-financial recessions, $\hat{\theta}_{NPU}^p + sd_{NPU} \hat{\beta}_{NPU}^p$ for public debt in non-financial recessions, $\hat{\theta}_F^p + sd_{FPR} \hat{\beta}_{FPR}^p$ for private debt in financial recessions, and $\hat{\theta}_F^p + sd_{FPU} \hat{\beta}_{FPU}^p$ for public debt in financial recessions ($sd_{NPR} = 16.3$, $sd_{NPU} = 18.2$, $sd_{FPR} = 39.6$, and $sd_{FPU} = 19.8$; see Table A2 in the Appendix A).

¹⁵ Concerning crisis dates, since these datasets cover different time periods and different sets of countries, we merge them using the following criteria: if at least one source documents the presence of a banking crisis, we include it. If alternative sources document a banking crisis start year that differs by one year, we use the earlier year.

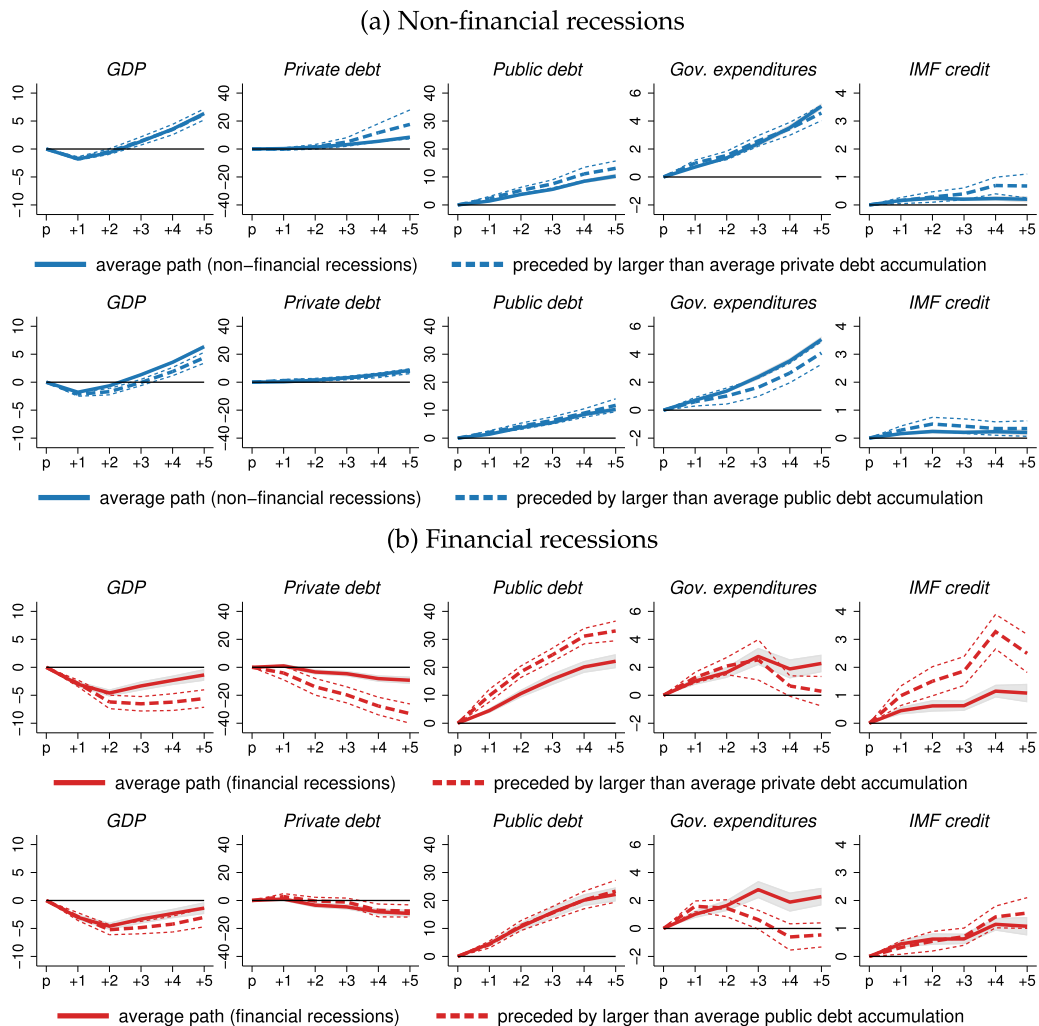


Fig. 5. Effects depending on the presence of a banking crisis. Dynamics of real per capita GDP, private debt, public debt, government expenditures, and IMF credit, from the year before a non-financial or financial recession takes place (p) to five years later ($p+5$), scaled by the pre-recession GDP level $y_{i,p}$. The solid line shows the average path of the variable, while the dashed line refers to the path when the recession is preceded by larger than average debt accumulation. Bands denote one-standard deviation confidence intervals.

et al., 2014). In addition, in our sample of financial recessions the deleveraging process in the private sector is accompanied by substantial increases in public debt and fiscal stress (use of IMF credit), which further testify the intensity of these events.

The most interesting results for our purposes are however related to the conditional effects predicted by a rapid private debt buildup in the years preceding a financial crisis, visually represented by the dashed lines in the top row of Fig. 5(b). While an *ex-ante* rapid accumulation of public debt appears to explain variation in economic performance in both non-financial and financial recessions, rapid run-ups in private leverage play as expected a prominent role at the onset of a banking crisis. In particular, they further amplify financial recessions with the result that five years after the business cycle peak there is no evidence of a sustained recovery in output. In this context, the documented emergence of *ex-post* public debt buildups following *ex-ante* private debt ones is even more pronounced. Specifically, following a rapid accumulation of private debt in the years preceding a financial crisis we find an even larger increase in public debt, accompanied by a more intense private debt deleveraging, a more muted growth in government expenditures and a higher IMF credit spike.

Extension: banking crises in advanced and emerging economies. Following Claessens et al. (2012), we look at both AEs and EMEs jointly. There are however a number of reasons why debt amplifications in financial crises might be associated with different effects in EMEs. First, these countries are historically more vulnerable than advanced economies to rapid debt buildups. On one hand, they often suffer from “original sin”, that is, they borrow in foreign currencies abroad because institutional weaknesses prevent them from borrowing in their own currency (Eichengreen et al., 2005). Clearly, this makes them more vulnerable to sudden stops in credit. On the other hand, Reinhart et al. (2003) argue that a country’s record of repeated

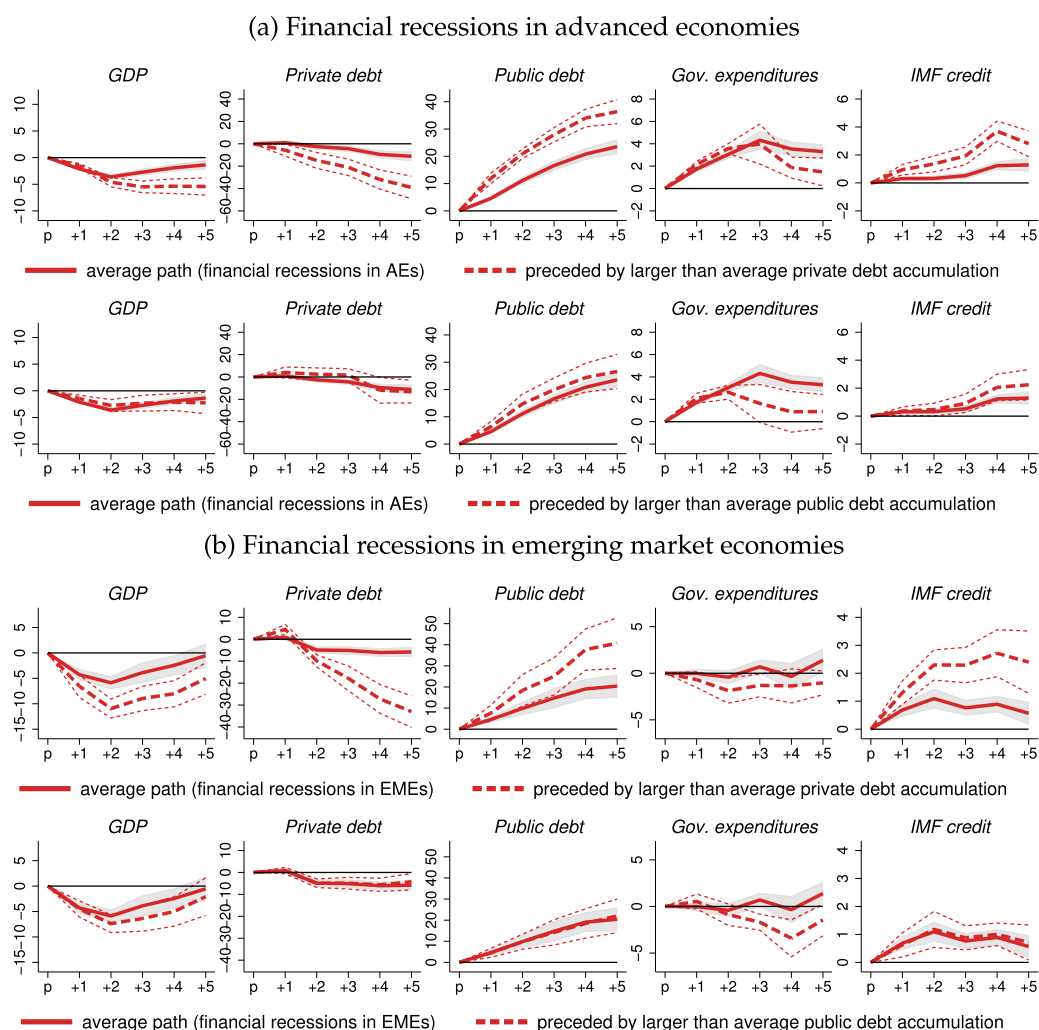


Fig. 6. Financial recessions by country group. Dynamics of real per capita GDP, private debt, public debt, government expenditures, and IMF credit in AEs and EMEs, from the year before a financial recession takes place (p) to five years later ($p+5$), scaled by the pre-recession GDP level $y_{t,p}$. The solid line shows the average path of the variable, while the dashed line refers to the path when the financial recession is preceded by larger than average debt accumulation. Bands denote one-standard deviation confidence intervals.

crises and defaults, a condition that typically characterizes a number of EMEs' history, makes its institutions more "debt-intolerant", that is, less capable to sustain apparently moderate debt burdens. Moreover, EMEs are generally characterized by less developed or tested financial systems, a structural difference that may potentially alter the transmission mechanism through which debt interacts with the real economy. To check to what extent financial recessions in EMEs are different, we re-estimate model (2) by splitting the sample by country-groups.¹⁶

Notwithstanding the limited number of episodes on which this exercise is based, Fig. 6 shows that the patterns characterizing financial recessions in both AEs and EMEs are comparable. First, in both groups of countries financial recessions and ensuing recoveries on average last five years or more. Second, the documented amplifications linked to an *ex-ante* rapid private debt buildup appear to be strikingly similar across AEs and EMEs. In both country-groups we indeed observe the emergence of an *ex-post* public debt buildup and an acceleration in the rate of private debt deleveraging. This implicit redistribution is also associated with a more muted growth in government expenditures and a more rapid increase in IMF credit.

One notable and relevant difference, however, is that in EMEs financial crises preceded by rapid accumulations of debt are associated with an absolute reduction of government expenditures. This suggests that the well-documented presence of fiscal pro-cyclicality in EMEs (Kaminsky et al., 2004) might be linked to the presence of excessive debt positions before a financial

¹⁶ For ease of comparison, we calibrate the rapid debt buildup scenarios as in Fig. 5 (see footnote 14).

crisis and a tightening of financing constraints afterwards, especially in the case of a rapid private debt buildup. In the absence of these conditions, the average fiscal stance in our sample of EMEs appears a-cyclical; that is, real expenditures on average remain stable over the analyzed horizon. This provides a complementary explanation of fiscal policy procyclicality in EMEs to those that focus on structural characteristics such as the quality of institutions or political economy considerations (Ilzetzki, 2011; Frankel et al., 2013).

5. Heterogeneity in public debt levels

While the literature agrees that a more rapid accumulation of private debt in good times is a leading indicator of lower economic performance in recession-recovery episodes, work on public debt and economic activity has suggested that both a high level of debt and a steep debt trajectory may signal the presence of vulnerabilities.

There are four reasons why our baseline specification considers public debt changes, instead of levels. First, the impact of the level of public debt on economic growth is complex to uncover, since the underlying relation significantly differs across countries and hardly follows a common pattern (Eberhardt and Presbitero, 2015). This is likely linked to the fact that countries differ in their debt tolerance, depending on their institutions and past history. Second, the debt-growth relation might also differ across time periods, since financial sector innovations in the form of new products, processes or technologies can

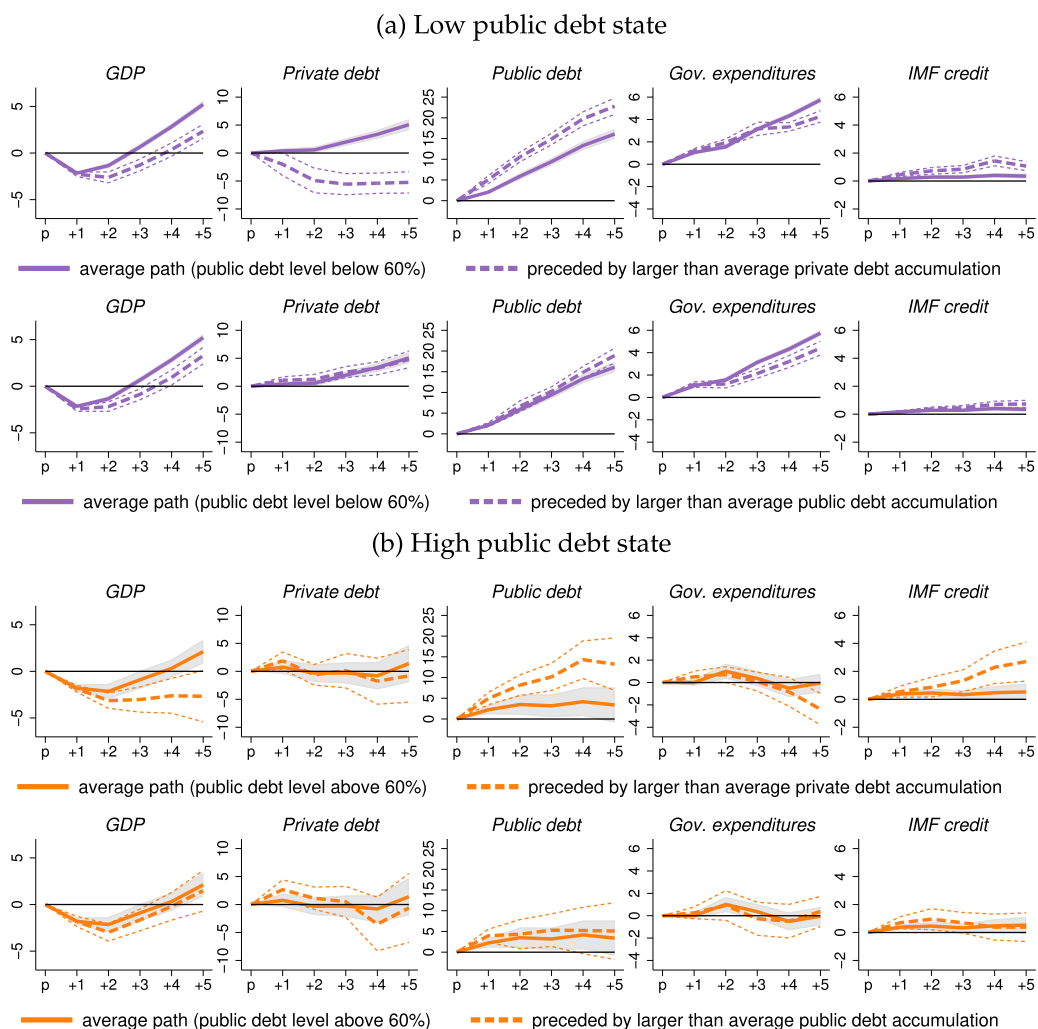


Fig. 7. Effects depending on the initial level of public debt. Dynamics of real per capita GDP, private debt, public debt, government expenditures, and IMF credit, from the year before a recession takes place (p), in a low or in a high public debt environment, to five years later ($p+5$), scaled by the pre-recession GDP level $y_{t,p}$. The solid line shows the average path of the variable, while the dashed line refers to the path when the recession is preceded by larger than average debt accumulation. Bands denote one-standard deviation confidence intervals.

allow the debt level to increase over time without necessarily compromising its sustainability. Third, different countries use different definitions of public debt. For some countries only central government data are available, while others compile general government data. Even for countries that use the same definition, the perimeter of what is included and what is not might be different (for example regarding the debt of state owned enterprises). Since we analyze infrequent events that are related to different time periods and countries, we posit that debt changes should provide a less noisy and more timely signal. Lastly, looking at changes in both private and public debt facilitates the comparisons of the results related to the two debt types.

It might however be argued that entering a recession with a level of public debt that is already high can constrain the fiscal response and therefore have an impact on the documented results. In this section we therefore assess whether the conditional responses that we have identified in the previous sections depend on the level of public debt at the peak, just before the recession begins. To do so, we adopt the state-dependent model introduced in the previous section. In this case the discrete indicator $F_{i,p}$ takes value one when the level of public debt-to-GDP at the peak is above 60%, a level close to the 75th percentile in our sample (i.e., 58.6% across the analyzed events). This approach allows the debt threshold to be relatively high while at the same time having a sufficient number of observations above the threshold.¹⁷

Results are shown in Fig. 7, where the upper panel refers to the low public debt state, while the lower panel refers to the high debt state. A few interesting indications emerge. First, in the high public debt state recessions tend to be longer, the increase in public debt is more contained and government expenditures remain at their peak level. Overall, these patterns indeed suggest that both the level and trajectory of public debt are relevant *ex-ante* dimensions that can signal the presence of fiscal vulnerabilities and play a role in constraining the fiscal policy response in bad times. Second, in both environments a more rapid accumulation of private debt ahead of recession tends to be followed by a more pronounced *ex-post* accumulation of public debt and signs of a more constrained fiscal policy.

Overall, these results suggest that, regardless of the starting level of public debt, a rapid run-up in private debt in good times can mask additional fiscal vulnerabilities.

6. Conclusions

Drawing on a large sample of recession-recovery episodes that occurred after WWII in both advanced and emerging economies, we first document that downturns preceded by rapid accumulations of debt, either in the private or the public sector, are systematically associated with additional GDP losses. On the fiscal side, this result points to the importance of keeping the powder dry in good times to better address future recessions and crises.

However, our analysis also suggests that maintaining *ex-ante* fiscal space might not be a sufficient condition to have room for policy maneuvering *ex-post*. This is because fiscal space can be eroded rapidly if debt is excessive in other sectors of the economy at the time the recession hits. Indeed, we document that a more rapid accumulation of private debt in the years preceding a recession is typically followed by a sharper weakening of public sector finances. That is, countries entering recessions after a rapid accumulation of private – not public – debt soon find themselves operating in a faster-growing public debt environment, and experience a subdued evolution of government expenditures and increased fiscal stress. We document that this pattern is even more pronounced in financial recessions – that is, downturns characterized by the presence of disruptions in the banking sector – and holds in both low and high public debt environments.

These stylized facts have important policy implications. Debt buildups arising in the private sector are generally not perceived as liabilities in the public balance sheet. Our findings suggest, however, that private sector indebtedness should be considered a relevant factor in the assessment of the soundness of the fiscal position. In bad times, the difference between private and public debt might become blurred. This makes it difficult for policymakers to assess *ex-ante* a debt position by looking only at one specific economic sector.

Our study is a first step toward a better understanding of the interconnections between public and private debt in bad times. In particular, we shed light on a number of empirical regularities that arise during infrequent or even rare events such as recessions and financial crises. Although we have shown that an empirical predictive association exists between debt buildups, emergence of fiscal stress and reduction in government expenditures, we do not propose a structural rationalization of the mechanisms that drive these stylized facts. For example, the prediction of lower government expenditures in recessions preceded by rapidly growing debt positions might be due to the emergence of borrowing constraints during crises but might possibly be due to reduced fiscal sustainability as a result of lower growth prospects, leading to fiscal restraints, or to a combination of these two. More analyses will be needed to reveal the structural drivers of these dynamics; this is left to future research.

Appendix A

See Tables A1 and A2.

¹⁷ The rapid debt buildup scenarios are now constructed using the following standard deviations: $sd_{NPR} = 26.0$, $sd_{NPU} = 16.1$, $sd_{FPR} = 18.9$, and $sd_{FPU} = 20.0$; see Table A2 in the Appendix A.

Table A1
List of business cycle peaks.

Argentina	EME	1974, 1977, 1979*, 1984, 1987‡, 1994*, 1998, 2008, 2011	Mexico	EME	1981*, 1985, 1992, 1994*, 2000, 2007
Australia	AE	1976, 1981, 1989*, 2007	Netherlands	AE	2001, 2008*, 2011‡
Austria	AE	1974, 1977, 1980, 1992, 2008*‡, 2012‡	New Zealand	AE	1974, 1976, 1987*‡, 1997, 2007
Belgium	AE	1974, 1980‡, 1992‡, 2008*‡, 2011‡	Norway	AE	1981, 1987*
Brazil	EME	1980, 2002‡, 2008‡	Pakistan	EME	1970, 2000‡, 2007, 2009
Canada	AE	1956, 1981, 1989‡, 2008‡	Panama	EME	1957, 1973, 1982‡, 1987*‡, 1994‡, 2000‡, 2008
Chile	EME	1971, 1981*, 1998, 2008	Paraguay	EME	1981, 1985, 1990‡, 1995*, 1997, 2008, 2011
Colombia	EME	1980, 1997*	Peru	EME	1975, 1981, 1984, 1987, 1991, 1997, 2000, 2008
Costa Rica	EME	1974, 1979, 1984‡, 1990‡, 1995, 1999, 2008	Philippines	EME	1982*, 1990, 1997*, 2008
Denmark	AE	1973, 1979, 1987*‡, 1992‡, 2007*, 2011	Portugal	AE	1973, 1982, 1992, 2002, 2007*‡, 2010‡
Dominican Republic	EME	1977, 1981, 1983, 1989‡, 2002*, 2008	South Africa	EME	1971, 1974, 1981, 1984, 1989*, 1997, 2008
Finland	AE	1976, 1990*, 2008, 2011	Spain	AE	1974, 1978, 1980, 1992, 2007*
France	AE	1974, 1992, 2007*‡, 2011‡	Sweden	AE	1976, 1990*, 2007*, 2011
Germany	AE	1966, 1974, 1981, 1992, 2002‡, 2008*‡	Switzerland	AE	1974, 1981, 1990*, 1994, 2001‡, 2008*, 2011
Greece	AE	1973, 1979, 1986, 1989, 1991*‡, 2007*‡	Thailand	EME	1996*, 2008
Iceland	AE	1956, 1960, 1966, 1974, 1982, 1987, 1990, 1994, 2001, 2007*	Turkey	EME	1977, 1988, 1990*, 1993*, 1998, 2000*, 2007
India	EME	1969, 1973, 1975, 1978, 1990	United Kingdom	AE	1957‡, 1968‡, 1973*, 1979, 1990*, 2007*
Iran	EME	1992, 1996, 2007, 2011	United States	AE	1957, 1969, 1973, 1979, 1981, 1990‡, 2000, 2007*‡
Ireland	AE	1965, 1974, 1982‡, 2007*, 2011‡	Uruguay	EME	1981*, 1987‡, 1994, 1998
Israel	AE	2000‡, 2008‡	Venezuela	EME	1977*, 1988, 1992*‡, 1995‡, 1997, 2001, 2008, 2012
Italy	AE	1974, 1992‡, 2001‡, 2007*‡, 2011‡			
Japan	AE	1973, 1992*‡, 1997*‡, 2007‡, 2010‡			
Korea	AE	1979, 1997*			

Note. The list shows the 224 peaks ($t = p$) that are used, at least once, for the estimation of the local projection models (1) and (2). A generic country i at time p is included only if (a) all the corresponding LHS and RHS observations are available, and (b) it has experienced at least two recessions in the available sample. The symbol * indicates peaks preceding financial recessions (as defined in Section 4) while the symbol ‡ indicates peaks preceding high public debt recessions (as defined in Section 5).

Table A2
Summary statistics of the debt accumulations prior to recessions.

		All countries		Advanced		Emerging	
		Private	Public	Private	Public	Private	Public
All peaks	obs	224	224	120	120	104	104
	mean	15.9	4.0	21.6	6.7	9.3	1.0
	sd	24.6	18.5	28.4	15.6	17.3	21.1
Non-financial	obs	176	176	91	91	85	85
	mean	11.6	4.6	15.1	7.0	7.8	2.1
	sd	16.3	18.2	18.3	15.8	12.9	20.2
Financial	obs	48	48	29	29	19	19
	mean	31.5	1.8	41.8	5.6	16.0	-4.0
	sd	39.6	19.8	42.4	15.2	29.6	24.6
Low public debt	obs	172	172	83	83	89	89
	mean	17.4	0.1	24.9	2.4	10.5	-2.2
	sd	26.0	16.1	31.5	12.3	17.0	18.8
High public debt	obs	52	52	37	37	15	15
	mean	10.8	17.1	14.2	16.1	2.4	19.7
	sd	18.9	20.0	18.3	18.0	18.2	24.6

Note. The table shows summary statistics of the private and public debt buildups used for the estimation of the local projection models (1) and (2). These are defined as changes over the five years preceding a downturn, expressed as a ratio of the starting GDP level, that is $(d_{i,p} - d_{i,p-5})/y_{i,p-5}$. We report the number of observations, means and standard deviations for the full sample and across country-groups (advanced and emerging) and types of recessions (non-financial and financial; low and high public debt states).

Appendix B. Supplementary material

A supplementary appendix associated with this article can be found, in the online version, at <https://doi.org/10.1016/j.jimonfin.2020.102239>.

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