Austerity and Private Debt

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ABSTRACT

Based on a panel of OECD countries, I provide empirical evidence that the costs of austerity crucially depend on the level of private indebtedness. In particular, fiscal consolidations lead to severe contractions when implemented in high private debt states. Contrary, fiscal consolidations have no significant effect on economic activity when private debt is low. These responses are mainly driven by household debt, whereas the effects do not differ with the level of corporate debt. Moreover, in high private debt states austerity induces a substantial fall in house prices. Both of these latter findings indicate that deterioration in household balance sheets are important to understand private debt-dependent effects of austerity. One possible implication of this paper is that the negative effects of large-scale fiscal consolidations undertaken by Southern European countries were likely to be amplified by the high private debt burdens in these economies.

JEL Codes: C23, E32, E62.

Keywords: Fiscal consolidation, Private debt, Local projection.

1 Introduction

This study shows that the effects of fiscal consolidations crucially depend on the level of private indebtedness. More specifically, I find that austerity leads to severe contractions in periods of private debt overhang. In contrast, fiscal consolidations have no significant impact on economic activity when private debt is low. These results shed light on the dismal growth performances especially in southern European countries which implemented large-scale fiscal consolidation programs while confronted with high private debt levels.

Recent contributions have pointed to the important role of private debt for the propagation and amplification of shocks and policy interventions. In their influential work, Mian and Sufi (2011, 2012) show that those US counties which experienced the largest increase in housing leverage before the financial crisis, suffered from more pronounced economic slack in the postcrisis period. The authors present evidence that deterioration in household balance sheets can explain the large drop in private demand and employment. Jordà, Schularick, and Taylor (2014) find that more mortgage-intensive expansions tend to be followed by deeper recessions and slower recoveries, while this effect is not present for non-mortgage credit booms. Moreover, Jordà, Schularick, and Taylor (2016) empirically investigate the linkage between private borrowing, public debt burdens and financial instability and find that private credit booms, not excessive public borrowing or the level of public debt, are the main precursors of financial turmoil.

Concerning the interrelation between fiscal policy and private debt, Eggertsson and Krugman (2012), Kaplan and Violante (2014) and Andrés, Boscá, and Ferri (2015) demonstrate in theoretical models, that the government spending multiplier increases with the level of private indebtedness. Within these models a significant share of households does not maximize lifetime utility due to borrowing constraints. Additionally, borrowing constrained households are characterized by a higher marginal propensity to consume out of income. Combined with price stickiness, Keynesian-type multipliers emerge if the share of these agents is large enough, which in turn depends on the level of indebtedness.

Another strand of literature investigates state-dependent costs of fiscal consolidations (Born, Müller, and Pfeifer, 2015; Jordà and Taylor, 2016). However, none of these studies allows the effects to differ according to the private debt level in the economy. This seems surprising given the above mentioned evidence which suggests that the responses to economic innovations are amplified by private debt overhang. Against this background, I provide empirical evidence that the economic consequences of austerity are significantly affected by the level of private indebtedness.

To investigate the effects of fiscal consolidations depending on the state of the economy, I estimate state-dependent impulse responses to exogenous changes in the government budget deficit using local projections as invented by Jordà (2005). The advantages compared to vector autoregressions (VARs) are that local projections are more robust to

model misspecification and offer a very convenient way to account for state dependence. Within the estimation approach, the state of the economy is allowed to vary according to the level of private debt overhang. High debt and low debt states are identified as periods when private debt-to-GDP ratios were respectively above and below trend. To identify fiscal consolidation periods, I use the narrative measure as proposed by Guajardo, Leigh, and Pescatori (2014). The dataset of my analysis covers 12 OECD countries on an annual frequency for the period 1978-2009.

The estimation results show that the responses to fiscal consolidations significantly differ according to the level of private indebtedness. Specifically, the results reveal a significant and severe decline in private consumption and GDP in high debt states. Contrary, in low debt states, private consumption and GDP show a marginal and insignificant reduction. The estimates imply that a one percent of GDP fiscal consolidation translates into a 2 percent lower GDP after five years when implemented in a period of private debt overhang. The drop in private consumption is even larger, resulting in a cumulative decline of more than 3 percent. The respective values for fiscal consolidations in low private debt states are 0.5 percent for GDP and 0.7 percent for consumption.

Concerning other important variables, I find that investment, imports and the employment rate significantly decrease in high private debt states, whereas these series do not show any significant effect when private leverage is low. Monetary policy reacts to fiscal consolidations by reducing the real interest rate by a similar magnitude irrespective of the private debt state. Interestingly, the sovereign default risk increases after consolidations implemented in a high private debt environment. This finding contradicts to the usual intention of austerity programs which lies in reducing the risk of sovereign default.[1]

My findings are robust for alternative definitions of debt overhang and the composition of fiscal consolidations. Moreover, the results prove to be robust when I condition on the state of the business cycle and government debt overhang.

Allowing the state of the business cycle to differ, I find that fiscal consolidations implemented in periods of high private debt induce economic activity to fall in recessions but also in booms. In expansions and recessions austerity has no significant effect on the economy when private debt is below average. Similar results emerge when controlling for the government debt level. Low and high government debt levels induce significant declines in economic activity when private leverage is high. Contrary, consolidations in low private debt states show insignificant effects irrespective of the public debt burden. To sum up, my findings suggest that the costs of austerity are mainly determined by the private debt level in the economy whereas the state of the business cycle and the level of public debt play only a minor role for the effectiveness of fiscal policy.

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[1]Complementary, Born, Müller, and Pfeifer (2015) show that austerity leads to an increase in the sovereign default premium in times of fiscal stress.

I highlight two additional results detecting changes in household balance sheets as a possible transmission channel through which my findings can be rationalized. First, by differencing between household and corporate debt, I show that most of the results are driven by household leveraging. While consolidations lead to a significant drop in GDP when households are highly indebted, GDP does not react significantly when corporate debt is above average. Therefore, private debt-dependent effects of fiscal policy seem to be caused by households' and not firms' borrowing decisions. Second, house prices significantly decline when fiscal consolidations are implemented in high private debt states, whereas they basically do not show any effect in low private debt states. Falling house prices typically reduce the value of home equity households can use as collateral to borrow against.[2]

The closest related work to this study is the paper by Bernardini and Peersman (2015). They find that the government spending multiplier is considerably larger in periods of private debt overhang. However, my paper departs from their study in two important dimensions. First, while Bernardini and Peersman (2015) focus on non-linear effects of government spending, I estimate private debt-dependent responses to fiscal consolidations which are a combination of tax-based and spending-based adjustments. It seems reasonable to assume that the effects of austerity measures differ from standard fiscal spending shocks, because fiscal consolidations are typically implemented under special circumstances or because they are particularly large (Born, Müller, and Pfeifer, 2015). Moreover, it is unclear that the effects of equally-sized expansion and tightening of fiscal policy should be symmetric, especially in the face of borrowing constraints. Second, my analysis is based on a panel dataset, whereas Bernardini and Peersman (2015) focus on the US economy. Thus, I provide multi-country evidence for private debt-dependent responses to fiscal policy.

The structure of the paper is organized as follows. In Section 2 the econometric method, database and the identification of private debt states is described. Section 3 presents results of the linear estimation, the benchmark estimation and an estimation with an alternative debt state identification. In Section 4 I check whether the results depend on the composition of the fiscal consolidation. Moreover, I detect state-dependent effects of other relevant variables. In Section 5 I further control for two prominent state variables: the business cycle and government debt overhang. Section 6 presents evidence that indicates the importance of the household balance sheet for understanding private debt-dependent effects of fiscal consolidations. Finally, section 7 concludes.

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[2]As shown by Mian, Rao, and Sufi (2013), highly leveraged households have a higher marginal propensity to consume out of housing wealth such that, ceteris paribus, the aggregate drop in private demand to falling house prices increases with the level of private debt overhang in the economy.

2   Econometric Method

To investigate the effects of fiscal consolidations depending on the state of the economy, I follow Auerbach and Gorodnichenko (2013), Ramey and Zubairy (2014) and Owyang, Ramey, and Zubairy (2013) in estimating state-dependent impulse responses to exogenous innovations in the government budget deficit using local projections as invented by Jordà (2005). Recently, this method has become a very popular tool to estimate non-linear effects. The main advantages compared to VARs are that local projections are more robust to model misspecifications and do not impose the implicit dynamic restrictions involved in VARs. Moreover, local projections offer a very convenient way to account for state dependence.

Let $Y_{i,t+h} - Y_{i,t-1}$ denote the cumulative response of a particular variable of interest from time $t-1$ to $t+h$ to an exogenous change in the government budget deficit at time t, where i indexes the countries in my sample. I estimate a set of regressions of $Y_{i,t+h} - Y_{i,t-1}$ on shocks to the government budget deficit $D_{i,t}$ and a set of control variables $X_{i,t}$:

$$
\begin{aligned}
Y_{i,t+h} - Y_{i,t-1} = & \ I_{i,t-1} \left[\psi_{A,h}(L) X_{i,t-1} + \beta_{A,h} D_{i,t} \right] \\
& + (1 - I_{i,t-1}) \left[\psi_{B,h}(L) X_{i,t-1} + \beta_{B,h} D_{i,t} \right] + \alpha_{i,h} + \eta_{t,h} + \epsilon_{i,t+h}.
\end{aligned}
\tag{1}
$$

Here, $\alpha_{i,h}$ are country-specific constants and $\eta_{t,h}$ captures time fixed effects to control for common macro shocks. $\epsilon_{i,t}$ denotes the error term which is assumed to have a zero mean and strictly positive variance. The dummy variable $I_{i,t}$ captures the state $\{A, B\}$ of the economy. $I_{i,t}$ takes the value of one when private debt is above a certain threshold and zero when it is below that threshold. I include a one-period lag of $I_{i,t}$ in the estimation to minimize the contemporaneous correlation between consolidation shocks and changes in private leverage. L represents the lag operator. The collection of $\beta_{A,h}$ and $\beta_{B,h}$ coefficients directly provide the state-dependent responses of variable $Y_{i,t+h} - Y_{i,t-1}$ at time $t + h$ to the shock at time t.

I prefer the specification of equation (1) to the propensity score matching method used in Jordà and Taylor (2016) because the former approach retains information about the size of fiscal consolidations, whereas the latter only allows the partition of fiscal consolidations into a binary dummy variable 0/1 indicating periods of fiscal consolidation and periods of no consolidation. By retaining information about the magnitude of fiscal consolidations, I am able to directly measure the size of fiscal consolidation across different private debt states.

The dataset of my analysis is of annual frequency over the period 1978-2008 for a balanced sample of 12 OECD countries.[3] In my baseline specification, the control variables

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[3] The included countries are Australia, Canada, Germany, Denmark, Spain, France, United Kingdom, Italy, Japan, the Netherlands, Sweden and the United States.

included in $X_{i,t}$ are the absolute changes in the cyclically adjusted primary balance relative to GDP (CAPB), the log differences of real GDP and the log differences of real personal consumption expenditures.[4] This choice closely mimics the VAR specification used in Guajardo, Leigh, and Pescatori (2014). The lag length is set to one year, although the results are robust to varying the lag length.

To identify fiscal consolidation shocks, I use the narrative measure as proposed by Guajardo, Leigh, and Pescatori (2014). This measure is constructed by examining contemporaneous policy documents. The main advantage of identifying fiscal consolidations via the narrative measure compared to changes in CAPB as suggested by Alesina and Ardagna (2010), is that the narrative measure is exogenous to current economic developments while changes in the CAPB are correlated to the business cycle. Guajardo, Leigh, and Pescatori (2014) show that there is a significant positive correlation between GDP forecast revisions and changes in the CAPB, whereas the null-hypothesis of no correlation between forecast revisions and the narrative measure cannot be rejected.

The definition of episodes of private debt overhang closely follows the approach by Bernardini and Peersman (2015). As an indicator for private debt, I use the private debt-to-GDP ratio, where data on private debt are taken from Schularick and Taylor (2012). To differentiate between high-debt and low-debt states, the debt-to-GDP ratios are filtered by country-specific smooth Hodrick-Prescott (HP) trends, where the smoothing parameter, λ, is set to $10,000$. The relatively high smoothing parameter ensures that the filter removes even the lowest frequency variations in the private debt-to-GDP series. High private debt states are defined as periods where there were positive deviations of the debt-to-GDP ratios from the trends, whereas low private debt states indicate periods when debt-to-GDP ratios were below its long-run trends. This procedure implies that out of the 372 periods included in the sample, 205 or 55% are detected as low private debt periods, while the remaining 167 episodes or 45% indicate periods of private debt overhang. In a separate exercise it is shown that the results are robust to an alternative definition of high/low private debt states.
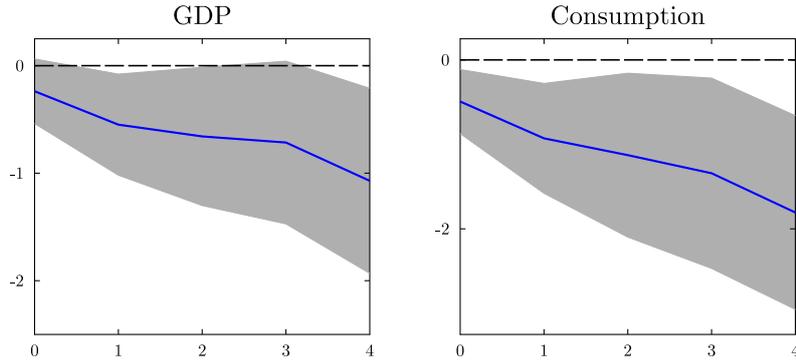
3 Results

3.1 Linear case

To gain a first insight into the real costs of fiscal consolidations, I present results of a linear estimation in which the state of the economy is not allowed to differ such that equation (1) becomes

$$Y_{i,t+h} - Y_{i,t-1} = \psi_h(L)X_{i,t-1} + \beta_h D_{i,t} + \alpha_{i,h} + \eta_{t,h} + \epsilon_{i,t+h}. \tag{2}$$

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[4]All data definitions and sources can be found in the appendix.

GDP   Consumption

Note: Cumulative changes (in per cent) in response to a shock of 1% of GDP to the cyclically-adjusted primary balance over $h = 0, 1, 2, 3, 4$ years. The shaded areas indicate 90% confidence bands based on robust standard errors clustered by country.

Figure 1 depicts the cumulative effects of GDP and private consumption (solid lines) from year 0 to year 4 in response to a fiscal consolidation shock, where 0 indicates the year in which the shock occurs. Shaded areas indicate 90% confidence bands based on robust standard errors clustered by country. The respective responses are normalized so that the CAPB rises by 1% of GDP in year 0.

The narrative shock leads to a persistent decline in GDP which accumulates to a loss of more than 1% four years after the policy implementation. However, the reaction of GDP is significant in just 2 out of the 5 periods considered. Private consumption significantly falls resulting in a cumulative drop of almost 2% after 5 years. The actual sizes of the cumulative effects are similar to those obtained by Guajardo, Leigh, and Pescatori (2014) based on a VAR analysis. The linear estimation reveals that the costs of fiscal consolidations are mild and, especially for GDP, just weakly significant. In the following, I demonstrate that the (on average) contractionary effects of austerity are mainly due to consolidations implemented when private leverage is high.

3.2 Baseline

Figure 2 presents the results of my baseline specification (equation (1)). The left column shows the cumulative responses to a fiscal consolidation implemented in a high private debt state, while the second column shows the respective changes to a fiscal consolidation undertaken in a low private debt state.

When private debt is below average GDP shows a mild an insignificant reduction which accumulates to less than 1% four years after the fiscal consolidation was implemented. Contrary, fiscal consolidations undertaken when private leverage is high lead to a significant decline in GDP which accumulates to almost 2% at the end of the forecast horizon.

Figure 2: Baseline results
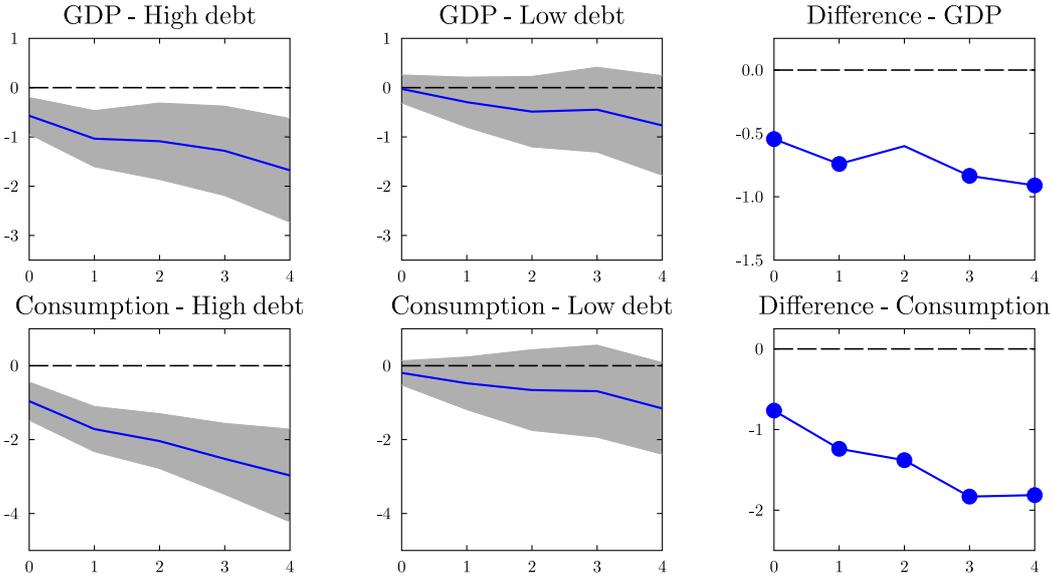
Note: The first two columns resport cumulative changes (in per cent) in response to a shock of 1% of GDP to the cyclically-adjusted primary balance over $h = 0, 1, 2, 3, 4$ years. The shaded areas indicate 90% confidence bands based on robust standard errors clustered by country. The last column shows the estimated difference between high debt and low debt responses. Dots indicate statistically significant differences at the 90% level.

A similar pattern can be observed for the respective consumption responses. Private consumption expenditures do not show a significant change in a low debt state. However, in a high private debt state consumption falls significantly such that expenditures are 3% lower after five years. The results indicate that a fiscal consolidation implemented when private debt is low leads to a small but insignificant reduction in economic activity, while fiscal consolidations in high private debt states induce a severe contraction in the economy.

Although the specific responses in Figure 2 give rise to different dynamics to fiscal consolidations in high and low private debt states, they do not imply whether these differences are significant, or in other words, whether the effects are significantly larger in high private debt states than in low debt states. To overcome this shortcoming, I test for every variable of interest and at each year of the forecast horizon the following hypothesis

$$H_0 : \beta_{A,h} < \beta_{B,h}. \tag{3}$$

This hypothesis can be tested with a simple one-sided t-test. A similar approach is applied by Ramey and Zubairy (2014) to test whether government spending multipliers statistically differ during times of economic slack.

The right column of Figure 2 shows the respective differences $\beta_{A,h} - \beta_{B,h}$ for GDP and consumption at each period of the forecast horizon. Thus, a negative value indicates

Figure 3: Alternative debt states definition (growth rate)
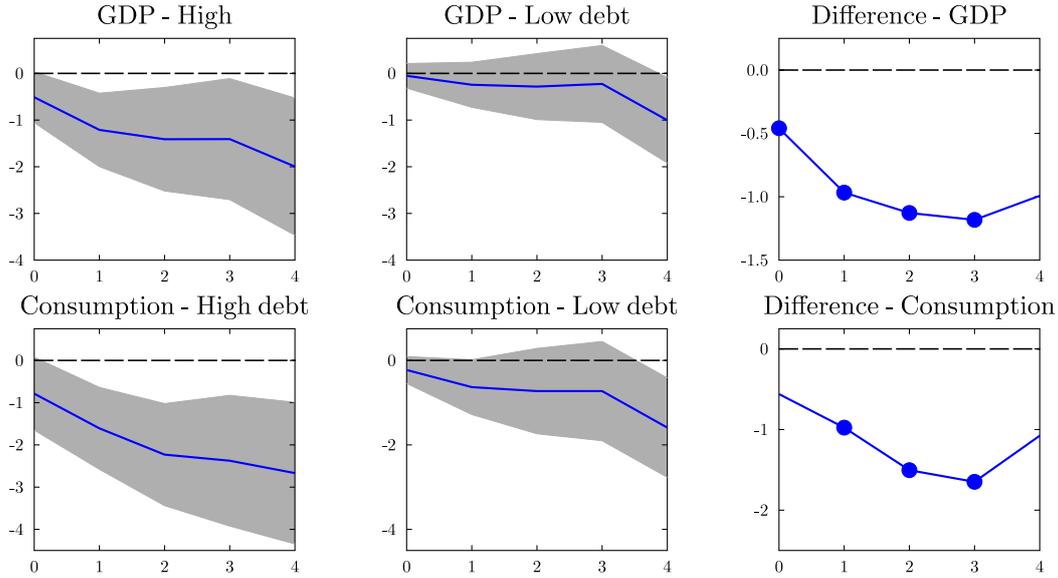
Note: The first two columns resport cumulative changes (in per cent) in response to a shock of 1% of GDP to the cyclically-adjusted primary balance over $h = 0, 1, 2, 3, 4$ years. The shaded areas indicate 90% confidence bands based on robust standard errors clustered by country. The last column shows the estimated difference between high debt and low debt responses. Dots indicate statistically significant differences at the 90% level.

that the response in high debt states is lower than in low private debt states. The dots indicate statistically significance at the 90% level.

The response differences in GDP and private consumption are statistically significant for almost all periods. For GDP the differences are significant for 4 out of the 5 years, while they are significant for all 5 periods when inspecting the changes in private consumption. Complementary to the fist two columns of Figure 2, the latter findings indicate that the negative effects of austerity are significantly larger when the policy is implemented in a period of private debt overhang.

3.3 Alternative low/high debt state definition

One possible concern with my baseline estimation could be that the results depend on the underlying definition of low and high private debt states. For this reason, I reestimate equation (1) by applying an alternative indicator of low and high private leverage periods. The alternative definition is based on Jordà, Schularick, and Taylor (2014) which define high (low) private debt states as periods when the growth rate of private debt was above (below) its country-specific average for two consecutive years.

Figure 3 presents the estimation results when using this alternative state definition. Obviously, the responses are similar to those of the benchmark specification. Fiscal con-

solidations in low debt states are followed by small and insignificant reductions in GDP and private consumption. However, when austerity is implemented in a period of high private leverage it translates into significant and substantial declines in GDP and private consumption expenditures. As the right column of Figure 3 shows, the differences in the respective GDP and consumption responses are statistically significant for most of the periods. Quantitatively, both state definitions lead to cumulative changes of similar magnitude.

This exercise reveals that my findings do not rely on the specific way to define low and high private debt states. The result of private debt-dependent costs of fiscal consolidations is robust to the definition of private debt overhang. In the following, I rely on the benchmark (HP-filter) definition of private debt states, because the alternative (Jordà, Schularick, and Taylor (2014)) definition implies a loss of information, due to its lag structure.

In the next section, I test whether the result of debt-dependent costs of austerity vary with the composition of the consolidation measure. Additionally, I show that the responses of other important macro variables also crucially depend on the private debt level when the consolidation is implemented.

4   Further insights

4.1   Spending and tax based consolidations

Guajardo, Leigh, and Pescatori (2014) and Alesina, Favero, and Giavazzi (2015) find that the costs of austerity differ with the composition of fiscal consolidations. Both studies show that tax-based consolidations lead to more severe contractions than spending-based adjustments. To allow the effects of consolidations to vary with its composition, I estimate equation (1) for spending-based and tax-based consolidations separately, where I make use of the composition definition stated by Guajardo, Leigh, and Pescatori (2014). The authors define fiscal policy changes as tax-based and spending-based if the budgetary impact of tax hikes and spending cuts, respectively, is greater than half the total impact.

Figure 4 shows the estimates for spending-based consolidations. Overall, the results coincide with the baseline estimation. GDP and private consumption do not change significantly when the austerity measure is implemented in a low private debt state. Indeed, GDP shows a mild increase when private debt is below average. The opposing picture emerges in high private debt states. GDP and private consumption are depressed significantly. The accumulated output loss after five years is 2%, whereas consumption expenditures drop by more than 4%.

In Figure 5, the results for tax-based consolidations are presented. Now, the differences between both debt states become even more visible. Tax-based consolidations

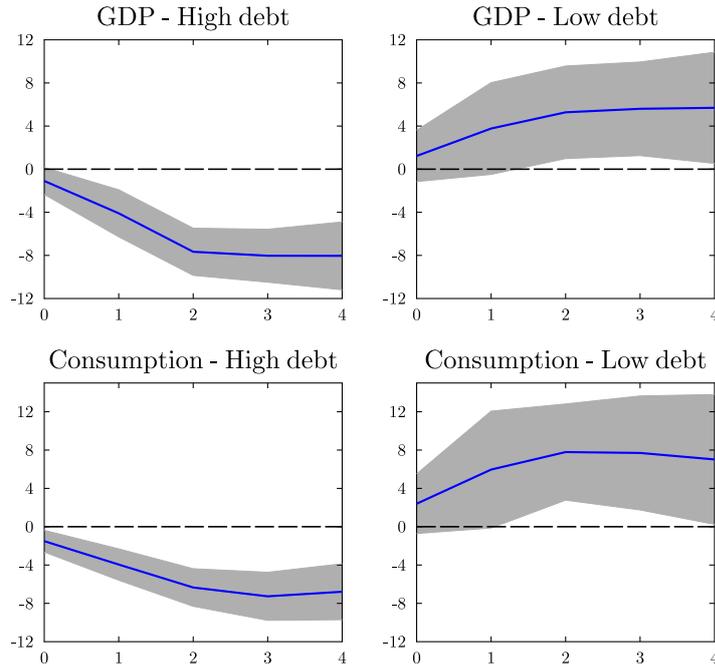**Figure 4: Spending-based consolidations**
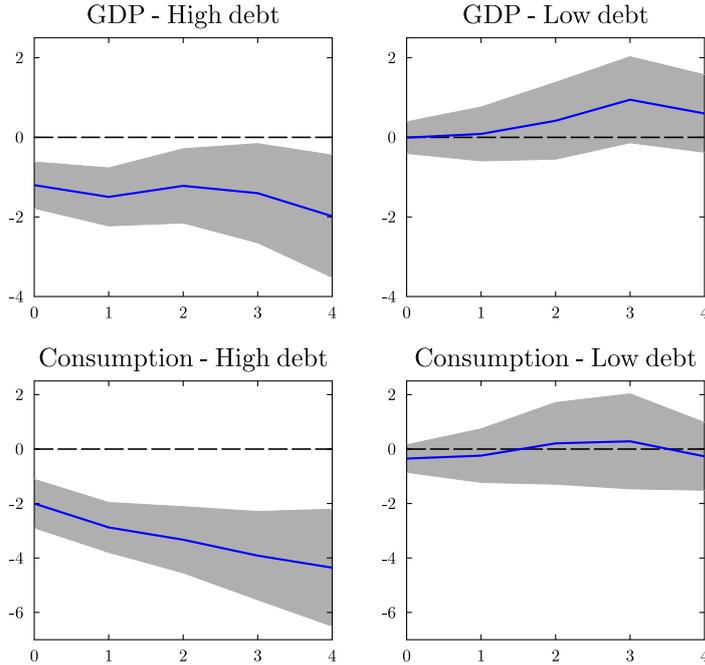
Note: Cumulative changes (in per cent) in response to a spending-based shock of 1% of GDP to the cyclically-adjusted primary balance over $h = 0, 1, 2, 3, 4$ years. The shaded areas indicate 90% confidence bands based on robust standard errors clustered by country.

implemented when private debt is low lead to persistent increases in GDP and private consumption. Both of these increases become statistically significant 2 years after the policy implementation. This finding is in line with the expansionary austerity hypothesis as proposed by Alesina and Ardagna (2010). In high private debt states, tax-based consolidations induce a large economic downturn. GDP (private consumption) is 8% (7%) lower four years after the consolidation was implemented. Nevertheless, the results on tax-based consolidations should be interpreted with cautious as the number of observations in my sample is limited. Out of the 52 tax-based consolidations considered, 38 (14) were implemented in a low (high) private debt state.

When controlling for the composition of fiscal consolidations, I find that spending-based and tax-based austerity programs are followed by severe contractions in GDP and private consumptions when private debt is high. However, when private leverage is low, both types of consolidations lead to increases in GDP. In line with Alesina and Ardagna (2010) and Guajardo, Leigh, and Pescatori (2014) I find that tax-based consolidations have stronger effects on economic activity than spending-based adjustments.

Figure 5: Tax-based consolidations

Note: Cumulative changes (in per cent) in response to a tax-based shock of 1% of GDP to the cyclically-adjusted primary balance over $h = 0, 1, 2, 3, 4$ years. The shaded areas indicate 90% confidence bands based on robust standard errors clustered by country.

4.2 Other variables of interest

So far, I have just considered the debt-depended responses of GDP and private consumption to fiscal consolidations. However, it seems worth studying whether also other important macro variables do react differently to fiscal consolidations in high and low private debt periods. In the following, I check for divergent responses in other components of GDP: private investment, imports and exports. Moreover, I test whether the effects on the labor market measured through the employment rate differ as well. It is shown that the central bank reduces its main policy rate by a similar magnitude, irrespective of the private debt state. Finally, I study how the sovereign default risk, indicated by the institutional investor ratings index (IIR), responses to consolidations in both private debt sates. At each horizon, I project these variables on fiscal consolidations and include their respective lags in the control vector $X_{i,t}$. While investment, imports and exports enter the estimation in log differences, the employment rate, interest rate and IIR are considered in absolute changes.

Figure 6 presents the responses of investment, imports and exports. Private investment increases slightly when the consolidation is undertaken in a period of low private debt. However, this increase is not statistically significant. In high private debt states, investment decreases significantly by more than 2% in the first two years. Afterwards,

the effect becomes insignificant as well. The mostly insignificant investment response relates to the empirical evidence presented by Mian, Sufi, and Verner (2015). They show that rises in household debt are closely tied to consumption and less related to business investment. Additionally, it can be interpreted as a first indicator that households', not firms', borrowing decisions are mainly responsible for private debt-dependent effect of austerity. However, below I will elaborate in more detail on the household balance sheet as a possible transmission channel to rationalize my findings.

Divergent responses can also be observed for imports. Imports decrease slightly but insignificantly in low private debt states. Contrary, imports are almost 5% lower after 5 years when the consolidation is undertaken in a high private debt period. The import response difference is significant for all periods.

In both debt states exports increase substantially. While this effect is statistically significant at the end of the forecast horizon when private debt is low, it is significant in the first three years when private leverage is high. As exports react rather similar in low and high debt states, the response difference is not statistically significant. Taking the effects on imports and exports together, in an additional exercise, I found that the current account significantly increases in high private debt sates, while it stays almost unchanged when private debt is low.

Figure 7 shows the results for the employment rate, interest rate and IIR. The employment rate increases steadily when private debt is below average. Nevertheless, only in the last year of the forecast horizon this reaction is significantly different from zero. Consolidations in high private debt states lead to a significant decline in the employment rate. The accumulated loss after four years is 1.5 percentage points. Additionally, as the right column shows, the employment rate response in high private debt states is significantly lower than the respective one in low private debt states. These findings indicate that the severe real costs of fiscal consolidations implemented when private debt is high also transfer to a deterioration in the labor market. This relation is also captured by the theoretical set-up of Andrés, Boscá, and Ferri (2015). In their model, the improvement in the labor market to a government spending shock positively depend on the equilibrium level of household debt.

Private debt-dependent responses to fiscal consolidations could be explained by a different reaction of the monetary authority to austerity in low and high debt states. When the central bank reduces (increases) its interest rate less (more) strongly when austerity is realized in a high leverage period compared to a low debt state, then the more severe downtown could be caused by a debt-dependent interest rate change. Indeed, as the second row of Figure 7 demonstrates this hypothesis is not supported by the data. The central bank reduces the interest rate by a similar magnitude irrespective of the private debt state. The cumulative reduction is almost identical: -0.57 percentage points in low private debt states and -0.58 percentage points when private debt is high.

Figure 6: Investment, Imports, Exports
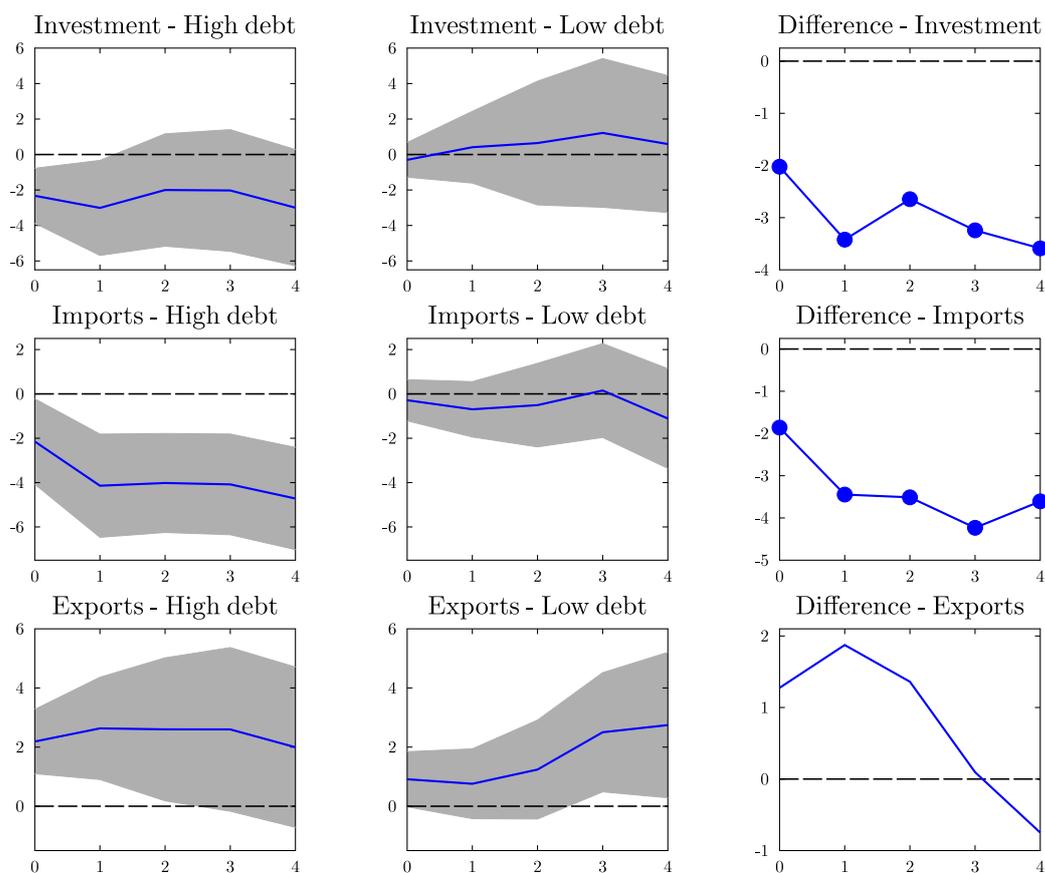
Note: The first two columns report cumulative changes (in per cent) in response to a shock of 1% of GDP to the cyclically-adjusted primary balance over $h = 0, 1, 2, 3, 4$ years. The shaded areas indicate 90% confidence bands based on robust standard errors clustered by country. The last column shows the estimated difference between high debt and low debt responses. Dots indicate statistically significant differences at the 90% level.

Overall, both interest rate responses are insignificant for most of the periods indicating a rather conservative expansionary monetary policy in reaction to fiscal consolidations. Not surprisingly, the response difference is statistically insignificant for all years of the forecast horizon.

Finally, I look at how the perceived risk of sovereign default measured by the IIR reacts in both states. The IIR is based on assessments of sovereign default risk by private sector analysts on a scale of zero to 100, with a rating of 100 assigned to the lowest perceived sovereign default probability. As the last row of Figure 7 shows the index falls when consolidations are implemented in a high private debt state, implying a higher probability of sovereign default. This result is important as austerity measures are normally undertaken to reduce the risk of sovereign default. Therefore, my findings indicate that fiscal consolidations have adverse effects when implemented in a high private debt environment. Interestingly, even in low debt states the IIR does not increase but mainly stays unchanged 4 years after the implementation took place. In three out of the five periods, the high debt IIR response is significantly lower than the low debt IIR response. To summarize, besides GDP and consumption, also imports, the employment rate and the sovereign default risk reacts differently to fiscal consolidations depending on the private debt level in the economy.

In the next section it is demonstrated that the result of private debt-dependent effects of austerity still prevails when I further condition on two other prominent state variables: the state of the business cycle and government debt overhang.

5 Additional state variables

5.1 Booms and recessions

Jordà and Taylor (2016) show that the costs of fiscal consolidations differ according to the state of the business cycle. They find that austerity leads to a significant drop in economic activity when implemented in recessions while there is no significant effect when consolidations are undertaken in a boom. Additionally, Auerbach and Gorodnichenko (2012) present empirical evidence that the government spending multiplier is larger in periods of economic slack. Contrary, Ramey and Zubairy (2014) do not find significant differences between spending multipliers in good and bad times. To check whether my findings are sensitive to the state of the business cycle, I further condition equation (1) on expansionary and recessionary states. In doing so, I calculate the cyclical component of GDP measured as deviations from a (country-specific) HP trend estimated with a smoothing parameter of $\lambda = 100$. Positive deviations from the resulting trend are defined as booms and negative deviations as recessions. Inspecting the obtained business cycle episodes, I find that the overlap between high debt and recessionary periods is far from complete. In

Figure 7: Employment, Interest Rate, Investors' Confidence
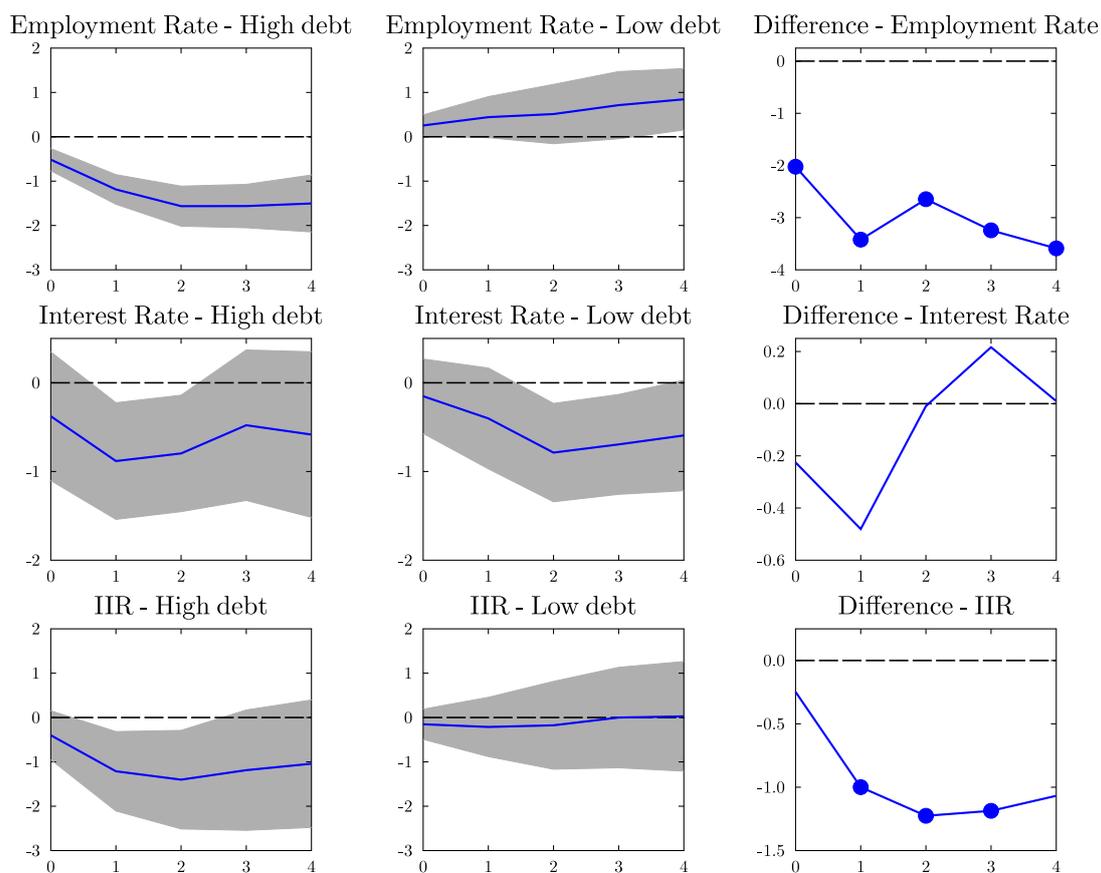
Note: The first two columns report cumulative changes (in percentage points) in response to a shock of 1% of GDP to the cyclically-adjusted primary balance over $h = 0, 1, 2, 3, 4$ years. The shaded areas indicate 90% confidence band based on robust standard errors clustered by country. The last column shows the estimated difference between high debt and low debt responses. Dots indicate statistically significant differences at the 90% level.

Figure 8: Booms and Recessions - High private debt
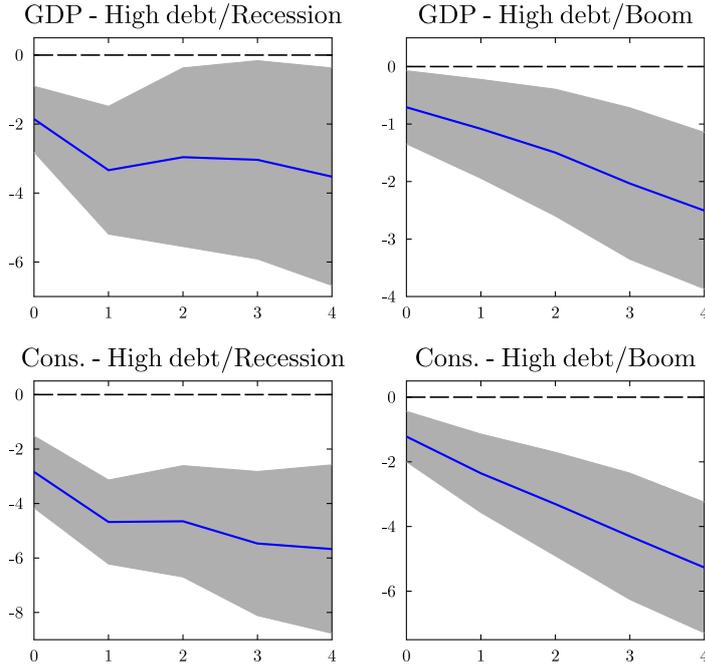
GDP - High debt/Recession   GDP - High debt/Boom

Cons. - High debt/Recession   Cons. - High debt/Boom

Note: Cumulative changes (in per cent) in response to a shock of 1% of GDP to the cyclically-adjusted primary balance over $h = 0, 1, 2, 3, 4$ years. The shaded areas indicate 90% confidence bands based on robust standard errors clustered by country.

particular, the correlation of the respective indicator variables is only moderate (0.089). Therefore, my results are not driven by identifying periods of economic downtown rather than episodes of high private debt.

I reestimate equation (1) separately for low and high private debt states, where the variable I_t now indicates periods with high (low) private debt that are also characterized as recessions. Thus, $1 - I_t$ measures expansionary states that coincide with periods of high (low) private debt.

The results for high private debt states are shown in Figure 8. The respective responses reveal that my findings are robust to the state of the business cycle. Significant reductions in GDP and private consumption emerge for recessions but also for expansions. In line with Jordà and Taylor (2016), the effects are stronger in recessions. In booms characterized also as high private debt states, GDP and private consumption are 2.5% and 5.3%, respectively, lower four years after the implementation. In recessions that coincide with periods of high private debt, the respective numbers are 3.5% and 5.7%.

Figure 9 presents the business cycle-dependent responses to consolidations implemented in low private debt periods. Although the effects are somewhat larger in recessions, statistically significant responses are not present for most of the periods. Indeed, GDP does not react significantly to fiscal consolidations in a low private debt state, neither in

Figure 9: Booms and Recessions - Low private debt
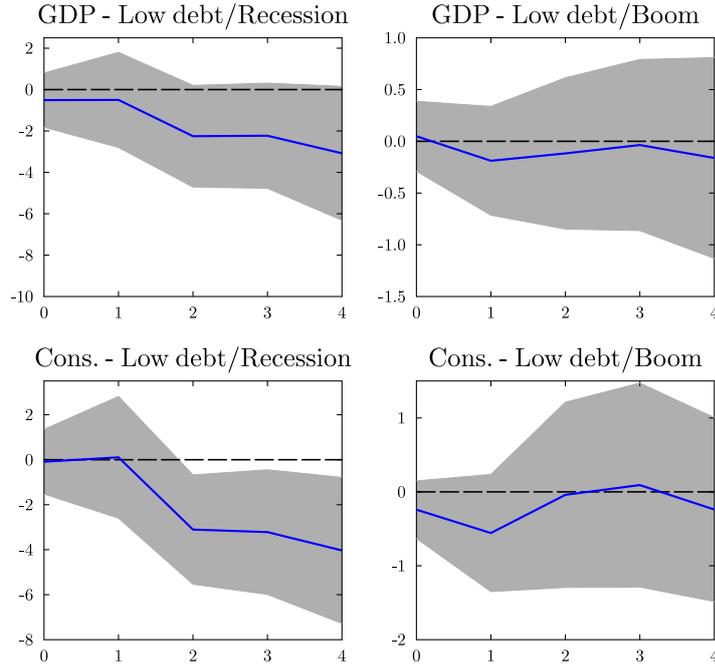
Note: Cumulative changes (in per cent) in response to a shock of 1% of GDP to the cyclically-adjusted primary balance over $h = 0, 1, 2, 3, 4$ years. The shaded areas indicate 90% confidence bands based on robust standard errors clustered by country.

expansions nor in recessions. In booms, the accumulated GDP and private consumption responses are close zero.

5.2 Government debt

In addition to the state of the business cycle, the effects of fiscal policy were found to vary with the level of public debt in the economy. Perotti (1999) shows that an increase in government consumption leads to higher private consumption expenditures when government debt is low, whereas consumption declines when public debt-to-GDP levels are high. Similar, Ilzetzki, Mendoza, and Végh (2013) provide evidence that the government spending multiplier negatively depend on the public debt level. To check whether the result of private debt-dependent costs of fiscal consolidations still holds when controlling for the public debt level, I condition equation (1) on private debt overhang. This is done by estimating equation (1) for high and low private debt states separately, where I_t indicates periods of high (low) private debt that coincide with periods of low public debt. $1 - I_t$ measures periods of high (low) private debt that are also characterized by high public debt burdens. Periods of high (low) public debt are defined as positive (negative) deviations of the government debt-to-GDP ratio from a country-specific smooth HP trend ($\lambda = 10,000$). Data on the government debt-to-GDP ratio are taken from Jordà,

Schularick, and Taylor (2016). The obtained correlation between both indicator variables (high private debt, low government debt) is just weak (0.262).

Figure 10 presents the cumulative responses for high private debt states. GDP and private consumption decline significantly irrespective of the public debt level when the consolidation is implemented. In line with the findings by Perotti (1999) and Ilzetzki, Mendoza, and Végh (2013), the effects are larger in periods of low public debt. When government debt is low, GDP (consumption) is almost 5% (7%) lower four years after the implementation. In high government debt states, the accumulated loss is 2% for GDP and 4% for consumption.

Turning to the low private debt responses as reported in Figure 11, I find insignificant effects for periods with low and high public debt burdens. The effects are imprecisely estimated resulting in relatively large confidence bands. In accordance to Figure 10, the point estimates for GDP and consumption are larger when the government debt level is low.

To sum up, the last two exercises demonstrate that fiscal consolidations implemented in high private debt states are always a drag on private economic activity, irrespective of the state of the business cycle or the government debt level. Contrary, austerity measures undertaken in low private debt periods do not have a significant effect on the economy in booms and recessions, when government debt is high or low. This result gives rise to the interpretation that effectiveness of fiscal policy does not vary with the business cycle or the public debt burden but rather with the level of private leverage. Whether this reasoning also contributes to the controversial debate of state-dependent government spending multipliers (see for example Auerbach and Gorodnichenko (2012), Ramey and Zubairy (2014)) could be an interesting agenda of future research.

6   Household balance sheet

What is the underlying transmission channel through which my results can be rationalized? In the following, I present evidence indicating that deterioration in household balance sheets as proposed by Mian and Sufi (2011, 2012) is of central importance for understanding private debt-dependent responses to fiscal consolidations. Mian and Sufi (2011, 2012) stress that the large drop in private demand during the Great Recession were mainly caused by a worsening in housing net worth of highly leveraged households. Moreover, U.S. counties with a larger decline in housing net worth are found to experience a larger decline in employment. In a recent paper Mian, Sufi, and Verner (2015) empirically show that an increase in private debt is associated with lower output growth in the future. This result only holds for increases in household debt, while for rises in corporate debt the authors do not find significant future output effects. In a more theoretical framework, Andrés, Boscá, and Ferri (2015) show that the spending multiplier

Figure 10: Low/high Government debt - High private debt
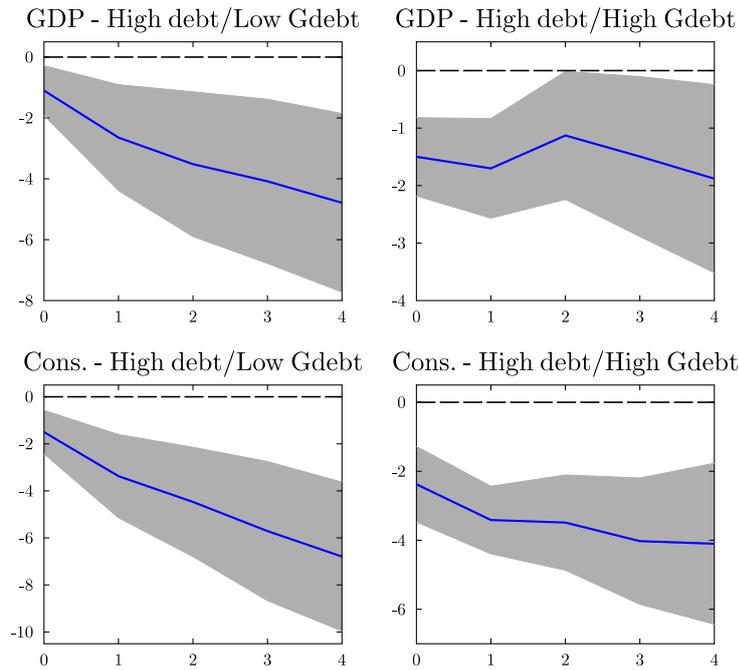
Note: Cumulative changes (in per cent) in response to a shock of 1% of GDP the cyclically-adjusted primary balance over $h = 0, 1, 2, 3, 4$ years. The shaded areas indicate 90% confidence bands based on robust standard errors clustered by country.

Figure 11: Low/high Government debt - Low private debt
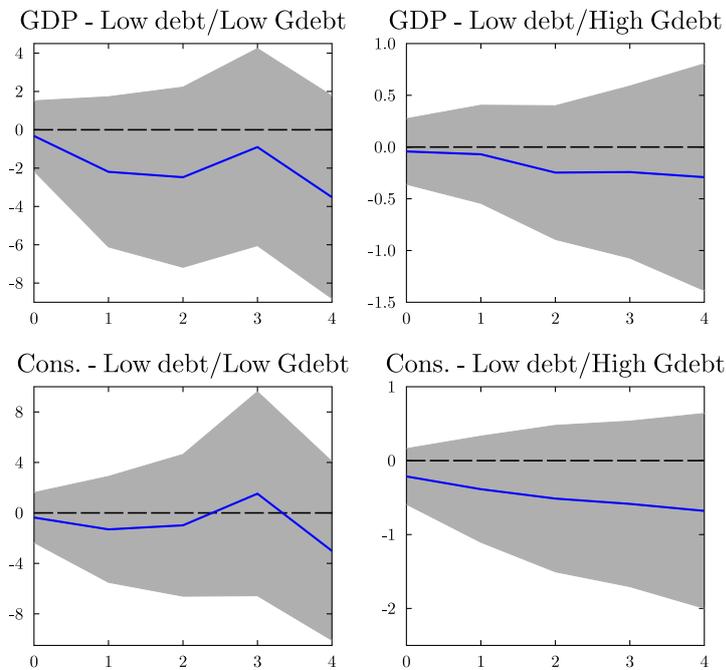
Note: Cumulative changes (in per cent) in response to a shock of 1% of GDP to the cyclically-adjusted primary balance over $h = 0, 1, 2, 3, 4$ years. The shaded areas indicate 90% confidence bands based on robust standard errors clustered by country.

increases with the level of households' indebtedness. Their model economy is populated by two types of households, lenders and borrowers. Borrowing households face a collateral constraint which limits the maximum loans that an individual can get to a fraction of the liquidation value of the amount of housing held by the household, the loan-to-value ratio. By assuming that the collateral constraint holds with equality in equilibrium, it can be shown that borrowing households discount the future more heavily than lending households. This model feature is backed by the empirical finding that indebted households have a higher marginal propensity to consume out of housing wealth (Mian, Rao, and Sufi, 2013). In a simulation exercise, Andrés, Boscá, and Ferri (2015) show that the size of the spending multiplier positively depend on the share of borrowers in the economy and the loan-to-value ratio, which in turn depends on the level of indebtedness. Taking together, all these studies find that a high level of households indebtedness amplifies the effects to economic shocks.

The central determinant of housing net worth are real estate prices. Mian and Sufi (2011, 2012) demonstrate that changes in house prices crucially effect private consumption expenditures. Falling house prices led to a deterioration in households balance sheets which, through the housing net worth channel, resulted in the large reduction in economic activity observed during the Great Recession. Andrés, Boscá, and Ferri (2015) model house prices as one variable of the liquidation value households can use as collateral to borrow against.

Given this considerations, my results are tested in two additional dimensions. First, I split private debt into household debt and corporate debt and check whether my findings depend on the specific type of private leveraging. Second, I show how house prices respond to fiscal consolidations in high and low private debt states.

Figure 12 presents the different GDP responses in low/high corporate debt and low/high household debt states. Moreover, the third column shows whether the respective high debt responses are significantly larger than the respective low debt responses. Equation (1) is separately estimated for both types of private debt. Series on corporate debt and household debt to GDP are taken from the Bank for International Settlements, where, due to data limitations, the panel is now restricted to the period 1980-2008 and the countries Australia, Canada, Germany, Spain, France, United Kingdom, Italy, Japan, Sweden and the United States. As before, low/high corporate debt and household debt periods are identified as deviations from a smooth trend (HP-filter with $\lambda = 10,000$).

It turns out that my major finding of private debt-dependent effects of fiscal consolidations is mainly driven by households' leveraging position and not corporate debt overhang. In low and high corporate debt states, GDP does not response significantly in the years after the fiscal consolidation. Although, the effect in high corporate debt states is somewhat larger, the difference between both responses is not statistically significant in any period of the forecast horizon. A different picture emerges for household debt. When

Figure 12: Corporate Debt vs. Household Debt
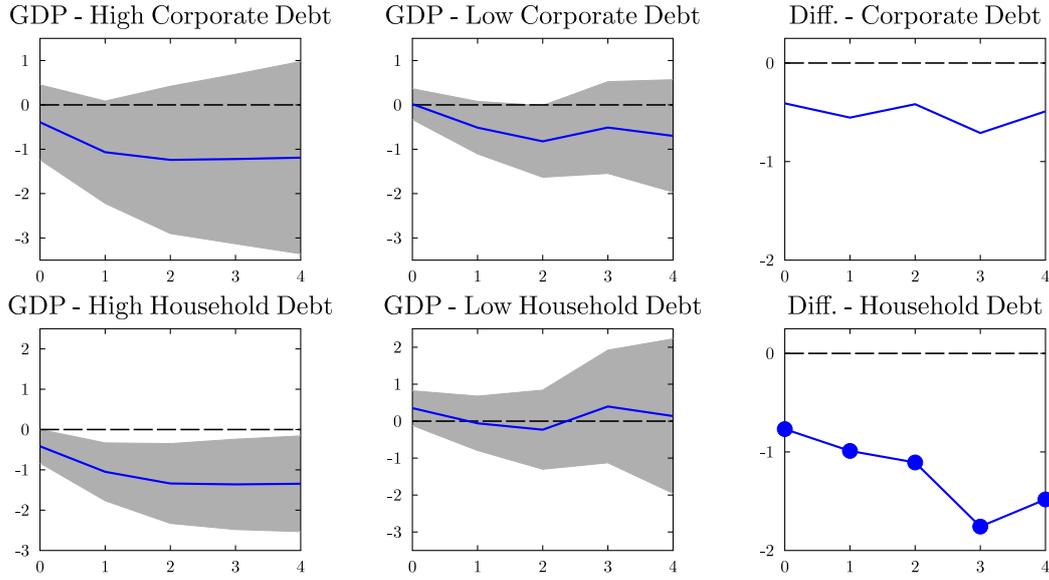
Note: Cumulative changes (in per cent) in response to a shock of 1% of GDP to the cyclically-adjusted primary balance over $h = 0, 1, 2, 3, 4$, years. The shaded areas indicate 90% confidence bands based on robust standard errors clustered by country.

household debt is low, GDP does not react significantly and the cumulative effect after five years is almost zero. Contrary in high household debt states, GDP significantly drops which accumulates to a loss of 1.5% at the end of the horizon. Moreover, the response difference between high and low household debt states is statistically significant for all 5 years considered. In line with the findings by Mian and Sufi (2011, 2012) and Andrés, Boscá, and Ferri (2015), the results in Figure 12 point to the important role of household leveraging for the economic dynamics to fiscal interventions. Corporate debt levels seem to play a minor role in understanding private debt-dependent effects of fiscal policy.

Given that significantly diverging responses can only be observed for different household debt states, it seems natural to investigate how the central driver of housing wealth, house prices, react to fiscal consolidations in low/high private debt periods. As mentioned earlier, house prices are one key ingredient of households' optimal consumption decision. Falling house prices reduce the home equity value that serves a collateral to borrow against which ultimately results in lower consumption expenditures by constrained agents (Mian and Sufi (2011, 2012)). To test whether this transmission channel also applies to my findings, Figure 13 shows the response of house prices to fiscal consolidations implemented in low and high private debt states. House price data are taken from the Federal Reserve Bank of Dallas (Mack and Martínez-García (2011)). At each horizon, house prices are projected on fiscal consolidations and their respective lag is included in the vector of control variables $X_{i,t}$. House prices enter the estimation in log differences.

Figure 13: House Prices

Note: Cumulative changes (in per cent) in response to a shock of 1% of GDP to the cyclically-adjusted primary balance over $h = 0, 1, 2, 3, 4$ years. The shaded areas indicate 90% confidence bands based on robust standard errors clustered by country.

Figure 13 shows that the response of house prices crucially depend on the private debt level when the fiscal consolidation is undertaken. House prices do not react significantly when private leverage is low. However, in a high private debt state, house prices significant fall with a accumulated decline of almost 10% after five years. As the last column of Figure 13 demonstrates the difference between the respective responses is statistically significant for al five periods.

Although causal interpretations should be taken with cautious at this stage, the evidence shown in the last two Figures indicates that private debt-dependent costs of fiscal consolidations can be rationalized through deterioration in household balance sheets. Theories should therefore elaborate on the housing net worth channel (Mian and Sufi (2011, 2012)) when studying the consequences of fiscal policy interventions.

7 Conclusion

This paper has shown that the level of private indebtedness significantly determines the costs of fiscal consolidations. Based on a panel of 12 OECD countries, I have used local projection methods which allow responses to differ between low debt and high debt states.

I find that austerity implemented in a low private debt state do not induce significant changes in GDP and private consumption. In contrast, fiscal consolidations lead to severe contractions in GDP and private consumption when private debt is high. This result is robust to alternative definitions of low/high private debt states, the composition of fiscal consolidations, condition on the state of the business cycle and government debt overhang. Investment, imports and employment fall significantly when private leverage is high, while they do not show any significant effect when private debt is low.

Two additional findings highlight the importance of the housing net worth channel (Mian and Sufi (2011, 2012)) for understanding my results. First, the private debt-dependent responses to fiscal consolidations are mainly driven by household debt and

not corporate debt. Second, I show that house prices significantly decline when consolidations are implemented in a period of private debt overhang. Both of these latter observations indicate that deterioration in household balance sheets represents a possible channel through which my results can be explained.

My findings reveal important implications. They confirm predictions of theoretical models as the ones by Eggertsson and Krugman (2012) and Andrés, Boscá, and Ferri (2015) which point out the impact of fiscal policy interventions to be larger in periods of private debt overhang. Moreover, high private debt levels in Southern European countries may have amplified the negative effects of large-scale fiscal consolidations. Contrary to its objective of reducing sovereign default risk, austerity measures could have even increased solvency problems. More generally speaking, the level of private debt and especially of household debt seems to matter for the effects of fiscal policy.

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Appendix: Data definitions and sources

The baseline sample covers the period 1978-2008 and the countries Australia, Canada, Germany, Denmark, Spain, France, United Kingdom, Italy, Japan, the Netherlands, Sweden and the United States.

Data definitions and sources

Variable	Definition	Source
GDP	Gross domestic product, constant prices, OECD base year	OECD
Consumption	Final consumption expenditures, households and non-profit institutions serving households, constant prices, OECD base year	OECD
CAPB	Cyclically-adjusted primary balance	Alesina and Ardagna (2010)
Private debt	End-of-year amount of outstanding domestic currency lending by domestic banks to domestic households and nonfinancial corporations (excluding lending within the financial system)	Schularick and Taylor (2012)
Fiscal consolidation	Changes in fiscal policy motivated by a desire to reduce the budget deficit and not by responding th prospective economic conditions	Guajardo, Leigh, and Pescatori (2014)
Investment	Gross fixed capital formation, constant prices, OECD base year	OECD
Imports	Imports of goods and services, constant prices, OECD base year	OECD
Exports	Exports of goods and services, constant prices, OECD base year	OECD
Employment rate	Civilian employment as % population (15-64 years old)	OECD
Interest rate	Main central bank policy interest rate	Guajardo, Leigh, and Pescatori (2014)
Institutional Investors Rating Index	Assessments of sovereign risk by private sector analysts on a scale to 100, with a rating of 100 assigned to the lowest perceived sovereign default probability	Guajardo, Leigh, and Pescatori (2014)
Household debt	End-of-year credit to households and NPISHs from all sectors, market value, percentage of GDP, adjusted for breaks	Bank for International Settlements; sample restricted to 1980-2008, no data for Denmark and Netherlands
Corporate debt	End-of-year credit to non-financial corporations from all sectors, market value, percentage of GDP, adjusted for breaks	Bank for International Settlements; sample restricted to 1980-2008, no data for Denmark and Netherlands
House prices	Real house prices index (four-quarter average)	Federal Reserve Bank of Dallas (Mack and Martínez-García (2011))
Public debt to GDP	Face value of total general government debt outstanding to GDP	Jordà, Schularick, and Taylor (2016)