Austerity, Inequality, and Private Debt Overhang*

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Abstract

Using panel data of 17 OECD countries for 1980-2011, we find that the distributional consequences of fiscal consolidations depend significantly on the level of private indebtedness. Austerity leads to a strong and persistent increase in income inequality during periods of private debt overhang. In contrast, there are no discernible distributional effects when private debt is low. This result is robust to alternative identifications of fiscal consolidations, to different ways of defining periods of private debt overhang, and to controlling for the state of the business cycle and the level of government debt. We explore different channels through which our findings can be rationalized.

Keywords: austerity, fiscal policy, inequality, private debt, local projections

JEL classifications: E62, E64, D63

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1 Introduction

In the aftermath of the Global Financial Crisis, many governments implemented large-scale austerity programs in order to reduce budget deficits. While the long-run gains of lower government debt levels such as an increase in fiscal space and more balanced longer-term growth are widely acknowledged, debates among economists and policy makers are circling around potential threats to short-run economic stability and social equity. In this paper, we add to this debate by conducting an empirical investigation of how fiscal consolidations impact income inequality. In particular, we show that the level of private debt determines whether or not austerity affects income equality.

Rising income inequality may not only affect the welfare assessment of consolidation measures and undermine public support for it, it might also endanger the ultimate success of fiscal consolidations in improving fiscal sustainability through its potentially adverse consequences for economic performance and socio-political stability. While some papers find evidence that rising income inequality has negative consequences for economic growth (see, e.g., Alesina and Rodrik 1994 and Persson and Tabellini 1994), there is competing evidence of beneficial effects (see, e.g., Barro 2000 and Li and Zou 1998). Adverse consequences of rising inequality on socio-political stability, such as an increase in social unrest and a higher degree of political polarization, are documented by, e.g., Alesina and Perotti (1996) and Duca and Saving (2016). At the same time, Alesina and Tabellini (1990) and Azzimonti (2011) predict, based on political-economy models, that more polarized political systems produce higher public debt and lower economic growth.\footnote{Alt and Dreyer (2006) and Azzimonti (2018) provide empirical evidence supporting this view.}

Rising inequality is also linked to financial market instability and the likelihood of financial crisis, see Kumhof, Rancière, and Winant (2015) and Kirschenmann, Malinen, and Nyberg (2016). Moreover, a new stream of literature argues that the aggregate effects of policy interventions cannot be fully understood without considering its distributional consequences (see, e.g., Gornemann, Kuester, and Nakajima 2016, Auclert 2016, and Kaplan, Moll, and Violante 2016.}\footnote{Rising inequality is also linked to financial market instability and the likelihood of financial crisis, see Kumhof, Rancière, and Winant (2015) and Kirschenmann, Malinen, and Nyberg (2016). Moreover, a new stream of literature argues that the aggregate effects of policy interventions cannot be fully understood without considering its distributional consequences (see, e.g., Gornemann, Kuester, and Nakajima 2016, Auclert 2016, and Kaplan, Moll, and Violante 2016.}
suggests that if fiscal consolidations have significant adverse distributional consequences, the potential vicious cycle between rising inequality, political polarization and a worsening of public finances might be a threat to the ultimate success of fiscal consolidations.³

The question we address in this paper is whether or not austerity increases income inequality. The effect of austerity on inequality is a priori ambiguous because of the various channels through which fiscal consolidations may influence the income distribution. In the following, we describe four distinct theoretical channels through which austerity affects the income distribution and discuss why these channels are likely to be shaped by the level of private debt in the economy.⁴

The first channel is the earnings heterogeneity channel. This channel explains changes in income inequality through heterogeneous dynamics of labor earnings of high-income and low-income groups. Heathcote, Perri, and Violante (2010) show that labor earnings at the bottom of the income distribution are most negatively affected by economic downturns. This can be explained by the fact that employment losses fall disproportionately upon low-income groups, see, e.g., Jefferson (2008) and Carpenter and Rodgers (2004). Thus, the earnings heterogeneity channel predicts that austerity leads to an increase in inequality if fiscal consolidations have contractionary effects on the economy. Analyzing the interplay between fiscal policy and the private debt cycle, a recent stream of literature shows that the contractionary effects of fiscal retrenchments are amplified during periods of private debt overhang, see, e.g., Bernardini and Peersman (2018) and Klein (2017).⁵

One explanation for why private debt elevates the effects of fiscal policy is the existence

³An alternative mechanism through which rising inequality jeopardizes the effects of fiscal retrenchments is explored by Azzimonti, De Francisco, and Quadrini (2014). They lay out a multi-country politico-economic model where the incentives of governments to borrow increase when inequality rises if this is associated with higher income risk.

⁴In classifying these channels, we mainly follow Coibion, Gorodnichenko, Kueng, and Silvia (2017).

⁵Throughout the paper, private debt overhang describes periods in which the ratio of private debt to GDP is above trend.
of borrowing constrained households. Such households are characterized by a higher marginal propensity to consume out of income, compared to non-constrained households. If the share of these agents is large enough – which is positively related to the level of private indebtedness – Keynesian-type multiplier effects emerge (see, e.g., Eggertsson and Krugman 2012 and Andrés, Boscá, and Ferri 2015). Similar considerations may apply for borrowing-constrained firms, see Giroud and Mueller (2017). Taken together, this implies that the adverse distributional consequences of a short-run decline in economic activity in response to a fiscal consolidation are amplified if firms and households have a lot of debt.

The second channel is the income composition channel. While the earnings heterogeneity channel focuses on heterogeneous outcomes within one income source (labor income), the income composition channel explains changes in income inequality through heterogeneous dynamics across different sources of income (capital versus labor income). While, for most households, labor earnings are the primary source of income, others receive a larger share of their income from capital income. Low-income households typically rely on wage income, whereas high-income households tend to receive a relatively larger share of their income from capital income. When fiscal consolidations affect these different types of income heterogeneously, then the different household types experience different income outcomes. A private debt-dependence of this channel can be explained by evidence showing that the bargaining power of workers falls with economic activity, see, e.g., Morin (2017) and Aronsson, Löfgren, and Wikström (1993). Consequently, if the level of private indebtedness elevates the economic contraction after a fiscal consolidation (and it does according to the aforementioned literature), this will lower the share of income accruing to labor and lead to an increase in income inequality.
The third channel is the savings redistribution channel. This channel attributes changes in the income distribution to changes in real interest rates. An unexpected increase in real interest rates (through a rise in the nominal interest rate or a decrease in inflation) hurts borrowers and benefits savers. To the extent that borrowers are generally at the lower end of the income distribution, this tends to generate a more unequal income distribution. By studying nominal asset positions in the United States, Doepke and Schneider (2006) provide evidence for the importance of this savings redistribution channel. The response of real interest rates to fiscal consolidations is a priori ambiguous. Standard macroeconomic theory predicts a decrease in real interest rates when the fiscal deficit decreases. Notice, though, that recent empirical evidence suggests that U.S. deficit reductions are associated with rising real interest rates, see, e.g., Mountford and Uhlig (2009) and Ramey (2016). The response of real interest rates may also be private debt-dependent. Klein (2017) provides evidence that fiscal consolidations implemented in periods of high private debt lead to an increase in sovereign default probabilities which puts upward pressure on interest rates through an increase in risk premia. In sum, these considerations imply that it is more likely that austerity leads to an increase in real interest rates (and thus a rise in inequality via the savings redistribution channel) if firms and households have a lot of debt.

While the previously discussed channels attribute changes in income inequality to the heterogeneous effects of movements in aggregate economic activity on different groups within society, the tax redistribution channel focuses on the direct distributional impacts of adjustments in the tax and transfer system implemented to improve the fiscal balance. The tax redistribution channel can affect inequality in both directions, depending on the chosen measures of the austerity program. Cuts in public transfer are likely to increase
net (after-tax, after-transfer) income inequality as households in the lower part of the income distribution receive a relatively larger share of their income from public transfers than households in the upper part of the income distribution. In contrast, increasing taxes on capital income, wealth, and inheritance or raising the progressivity of income taxes is likely to lower net income inequality. The composition of fiscal consolidations and thus their redistributive impact might as well depend on the level of private debt in the economy. This could be the case, for example, if a majority of voters is highly indebted and may thus favor austerity programs that rely more heavily on increases in wealth taxes. Likewise, measures like the elimination of tax deductibility of private debt will likely face a stronger opposition during periods in which a larger share of households has a lot of debt.

In short, these different channels imply that the effect of austerity on economic inequality is a priori ambiguous and is likely to depend on the state of the private debt cycle. As a result, we turn to the data to investigate the effects of fiscal consolidations depending on the level of private indebtedness. To do so, we estimate state-dependent impulse responses of income inequality to exogenous changes in the government budget deficit using local projections, as suggested by Jordà (2005). Income inequality is measured by the Gini coefficient. The estimated responses are allowed to vary according to the state of the private debt cycle, defined as fluctuations in the ratio of private debt to GDP around its long-run trend.\(^6\) High-debt states and low-debt states are identified as periods when the ratio of private debt to GDP was above or below trend, respectively. Identification of fiscal consolidation is achieved by using the narrative measure proposed by Devries, Guajardo, Leigh, and Pescatori (2011), available for 1980-2009, which we ex-

\(^6\)Throughout the paper, we use the terms “private debt cycle” and “credit cycle” interchangeably.
tend to include 2010 and 2011. The baseline dataset of our analysis covers a panel of 17 OECD countries from 1980 through 2011.

We find strong and statistically significant differences in the distributional consequences of austerity across private debt states. Austerity leads to a severe and significant increase in income inequality when firms and households have a lot of debt. A 1% of GDP reduction in the primary deficit translates into a rise in income inequality of around 2 Gini points in high private debt states. In contrast, when private debt is low, the inequality effects of fiscal consolidations are found to be small and statistically indistinguishable from zero. Thus, an estimation approach that abstracts from debt-dependence may well lead to wrong policy conclusions.

We conduct various robustness checks that confirm our findings. In particular, we take into account possible anticipation effects due to fiscal foresight, we consider alternative ways of defining periods of private debt overhang, and we restrict our sample to the period before the Global Financial Crisis. Moreover, we rule out that our results are driven by the state of the business cycle or the government debt level.

We also provide direct evidence on the debt-dependence of the channels underlying these distributional consequences of austerity. While we find strong evidence in favor of the debt-dependence of the earnings heterogeneity channel, the income composition channel and the savings redistribution channel are found to exhibit more muted debt-dependencies. In contrast, we find no evidence that the tax redistribution channel plays an important role in explaining our results.

Our paper is related to the literature that explores the distributional effects of monetary policy and fiscal policy, in general (see, e.g., Coibion, Gorodnichenko, Kueng, and Silvia 2017, Anderson, Inoue, and Rossi 2016, and Muntaz and Theophilopoulou 2017),
and fiscal consolidations, in particular (see, e.g., Agnello and Sousa 2014, Schaltegger and Weder 2014, and Ball, Furceri, Leigh, and Loungani 2013). However, none of these studies allows the effects to differ according to the state of the credit cycle. This is surprising given the aforementioned evidence suggesting that credit plays an important role in shaping the effects of fiscal policy interventions. In fact, we demonstrate that the inequality effects of fiscal policy vary considerably depending on the state of the credit cycle.

The remainder of the paper is organized as follows. Section 2 describes the data and the empirical strategy. Section 3 presents the main results and conducts various robustness checks. Section 4 tests the channels through which our results can be rationalized. The final section concludes.

2 Econometric Method and Data

We estimate state-dependent impulse responses to fiscal consolidations using local projections as proposed by Jordà (2005). This method is becoming an increasingly popular tool to estimate non-linear effects of policy interventions (see, for example, Auerbach and Gorodnichenko 2013, Ramey and Zubairy 2018 and Owyang, Ramey, and Zubairy 2013). The main advantages compared to VARs are that local projections are more robust to model misspecifications and the implicit dynamic restrictions involved in VARs are not imposed. Moreover, local projections offer a very convenient way to account for state dependence.\(^7\)

\(^7\)Note that the Jordà method does not uniformly dominate the standard VAR approach for calculating impulse responses. In particular, because it does not impose any restrictions that link the impulse responses across different horizons, the estimates are often erratic because of the loss of efficiency. Moreover, it sometimes displays oscillations at longer horizons. For a more detailed discussion, we refer to Ramey and Zubairy (2018).
For each horizon $k = 0, \ldots, 4$, we estimate the following regression model:

$$
Y_{i,t+k} - Y_{i,t-1} = I_{i,t-1} [\beta_{H,k} D_{i,t} + \psi_{H,k} X_{i,t-1}] \\
+ (1 - I_{i,t-1}) [\beta_{L,k} D_{i,t} + \psi_{L,k} X_{i,t-1}] + \alpha_{i,k} + \eta_{t,k} + \epsilon_{i,t+k},
$$

(1)

where $Y_{i,t+k} - Y_{i,t-1}$ is the change in income inequality at horizon $k$, $D_{i,t}$ is a fiscal consolidation shock, $\alpha_{i,k}$ are country fixed effects, $\eta_{t,k}$ capture time fixed effects, and $X_{i,t-1}$ is a vector of control variables. The dummy variable $I_{i,t-1}$ captures the state $\{H, L\}$ of private indebtedness prior to the shock, where $I_{i,t-1} = 1$ if private debt is high. We include a one-period lag of $I_{i,t}$ in the regressions to minimize contemporaneous correlations between fiscal shocks and the state of the economy. Given our specification, $\beta_{H,k}$ provides the response of $Y_{i,t+k} - Y_{i,t-1}$ to the consolidation shock at time $t$ in high private debt states, whereas $\beta_{L,k}$ provides the response in low private debt states. Note that the impulse responses incorporate the average transition of the economy from one state to another. In other words, if the fiscal consolidation shock affects the state of the debt cycle, this effect will be absorbed into the estimated coefficients $\beta_{H,k}$ and $\beta_{L,k}$.

We use annual data of 17 OECD countries for 1980-2011. The beginning and the end of the sample are restricted by the availability of inequality data for some countries. We measure income inequality using Gini indices of market income (pre-tax, pre-transfer) and net income (post-tax, post-transfer) from the Standardized World Income Inequality Database (SWIID).\textsuperscript{8} The SWIID incorporates data from various international and national sources in order to increase comparability of available inequality data (for more details, see Jenkins 2015). Our vector of control variables $X_{i,t-1}$ includes real GDP growth and the change in the respective Gini coefficient.\textsuperscript{9}

\textsuperscript{8}A detailed description of the data and the data sources can be found in the Appendix.

\textsuperscript{9}It is well-known that OLS with fixed effects and a lagged dependent variable as regressor generally leads to the so-called Nickell-bias in the coefficient estimates. However, this bias decreases in the number
To measure fiscal consolidations, we use the narrative series proposed by Devries, Guajardo, Leigh, and Pescatori (2011), available for 1980-2009, which we extend through 2011. The series contains only those changes in the primary balance to GDP ratio that are motivated by a desire to reduce the budget deficit. The identified fiscal actions represent a response to past decisions and past economic conditions rather than to current and prospective conditions. Therefore, there should be no systematic correlation between the identified fiscal actions and other developments that affect economic activity in the short term. As a result, these fiscal actions are valid for estimating the short-term effects of fiscal consolidation on economic activity. In extending the narrative consolidation measure, we follow Dell’Erba, Mattina, and Roitman (2015) by using the following two OECD reports: *Restoring Public Finances, 2011* and *Restoring Public Finances, 2012 Update*. These reports outline the economic situation, fiscal consolidation strategy, and major consolidation measures for each OECD member country. The country notes in each report lay out each government’s rationale for pursuing fiscal adjustment and are used to identify consolidation periods that were motivated by a desire for deficit reduction.

As indicator for private indebtedness, we use the ratio of private debt to GDP. A similar indicator is used by Schularick and Taylor (2012), and Jordà, Schularick, and Taylor (2013) to study the role of credit in shaping the business cycle. Private debt data are taken from the Bank for International Settlements’s database on credit to the non-financial sector. To differentiate between high-debt and low-debt states, we filter the debt-to-GDP ratio by country-specific HP trends with smoothing parameter $\lambda = 100$, which corresponds to the usual value used for annual observations in the business cycle literature (Hodrick and Prescott 1997). This choice is justified by evidence found studying the characteristics of observations in the time dimension of the panel. Our dataset has a relatively large time dimension which implies that the bias is only small. Hence, we continue using OLS for our panel regressions.
the credit cycle. Using a private credit series covering several advanced economies for over 150 years, Jordà, Schularick, and Taylor (2016) find that the average duration of a credit cycle is similar to the average duration of a traditional business cycle. However, in a later exercise, we show that our results are robust when using a smoother HP-trend.

We define high private debt states as periods with positive deviations of debt-to-GDP ratios from trend. Periods in which the private debt-to-GDP ratios are below trend indicate low private debt states. As we calculate country-specific debt-to-GDP trends, the indicator variable varies across time for each country within our panel dataset. Our procedure implies that out of the 544 periods included in the sample, 279 or 51% are detected as low private debt periods, while the remaining 265 episodes or 49% indicate periods of private debt overhang.\textsuperscript{10} For the sake of illustration, Figure 1 shows the U.S. detrended private debt series as an example. The U.S. economy experienced two periods of private debt overhang, from the mid 1980s to the beginning of the 1990s and from the beginning of the 2000s to the end of the decade. The severe private de-leveraging process that followed the Global Financial crises lead to a massive reduction in outstanding private debt. Based on the narrative identification approach, the two largest U.S. consolidation packages were implemented in 1988 and 1994, respectively. The 1988 measure amounted to 0.85 percent of GDP and the 1994 consolidation amounted to 0.90 percent of GDP. While the first measure was implemented during a period of private debt overhang, the second consolidation occurred in an environment when private debt was below trend. Overall, our panel dataset includes 180 austerity measures of which 45% were implemented when private debt was high, whereas the remaining 55% occurred during periods of low private debt.

\textsuperscript{10}By construction, the average of the HP-filtered private debt-to-GDP ratio is zero which implies that half of the sample is classified as low and high private debt periods, respectively.
Notes: Detrended private debt to GDP ratio for the U.S. economy (HP-filter, $\lambda = 100$).

3 Results

This section presents our estimation results. First, we present evidence for private debt-dependent effects of fiscal consolidations on income equality, based on our baseline specification. Second, we discuss a series of robustness checks for our baseline results, including an alternative identification scheme that controls for fiscal foresight, alternative debt state definitions, and an alternative measure of income inequality. Moreover, we check whether the composition of the fiscal consolidation (spending-based or tax-based) is important for our results and we show that our results are robust when leaving out the Global Financial Crisis years. Finally, we demonstrate that our results are robust to controlling for the state of the business cycle and the level of government debt overhang.
3.1 Baseline Results

Figure 2 displays the change in income inequality after fiscal consolidations. The upper row presents responses for the Gini coefficient of market income whereas the lower row show estimates for the Gini coefficient of net income. To facilitate the interpretation of the results, we normalize responses so that the cyclically-adjusted primary balance rises by one percentage point on impact. For comparison, the left column shows responses based on a model with no state dependence. The middle and right column show results from our baseline nonlinear estimation. The middle column displays the change in income inequality during periods of private debt overhang, whereas the right column shows responses when private debt is low. The solid lines correspond to the point estimates and the shaded areas indicate 90% confidence intervals based on Driscoll and Kraay (1998) standard errors. These standard errors are robust with respect to heteroskedasticity as well as serial and cross-sectional correlation. Numbers on the horizontal axes denote years after the shock and the responses are expressed in percentage points.

We begin by considering the distributional consequences of fiscal consolidations in the model with no state dependence. The left column of Figure 2 displays a moderate increase in both Gini coefficients. The increase in market inequality is somewhat larger compared to the rise in net inequality. At horizon $k = 4$, the Gini coefficient based on market income increases by 0.65 Gini points whereas net inequality rises by 0.42 Gini points. While the response of market inequality is statistically significant for most periods of the forecast horizon, the increase in net inequality only becomes statistically significant after around three years following the consolidation shock.

The most interesting aspects are seen by comparing the responses across columns of Figure 2. It is evident that there are pronounced nonlinearities in the distributional con-
sequences of fiscal consolidations, in the sense that the effects differ substantially across states of the private debt cycle. During periods of high private debt, fiscal consolidations lead to a strong and long-lasting rise in income inequality. Four years after the consolidation, both Gini coefficients increase by around 2 percentage points. Thus, fiscal consolidations have a much larger adverse impact on market and net income inequality during periods of private debt overhang than is predicted by a model abstracting from state dependence. In contrast, when private debt is low, fiscal consolidations are followed by hardly any change in market and net income inequality. Note that the difference between the responses of income inequality, conditional on different debt states, is also statistically significant. Using a standard F-test, we can reject the null hypothesis of equal responses in high-debt states and low-debt states at the 5% level for horizons $k = 1$ and
$k = 4$. For the remaining horizons, the coefficients across debt states are estimated to be significantly different at the 10% level.

It is important to mention that austerity increases market and net income inequality rather equally within a certain private debt state. As seen in Figure 2, the difference between both inequality measures, reflecting redistribution through the government tax and transfer system, is small. We will come back to this issue when we investigate the role of the tax redistribution channel for understanding the state-dependent distributional consequences of austerity.

Overall, our main findings reveal that the distributional consequences of fiscal consolidations vary considerably with the level of private debt; debt carried by firms and households. This implies that an estimation approach ignoring debt-dependence may well lead to wrong policy conclusions.

3.2 Robustness and Additional Results

We now re-specify our baseline empirical approach in order to check the robustness of our main result that the distributional consequences of fiscal consolidations vary considerably over the credit cycle.

For brevity, we focus on net income inequality and report responses for horizon $k = 1$ in tabular form (our main results are robust across alternative forecast horizons and to using market income inequality). The first line of Table 1 repeats our baseline results. Columns 2 and 3 display the estimated change in the Gini coefficient for net income one year after the fiscal consolidation for high-debt states and low-debt states, respectively. Column 4 reports the estimated difference across states.\footnote{The 16% level is chosen as lower threshold because 16-84% confidence bands are widely used in the empirical macro literature (see, for example, Castelnuovo and Surico 2010 and Hofmann, Peersman, and Straub 2012)}
Table 1: Robustness (Effect on Net Income Inequality in Year $k = 1$).

<table>
<thead>
<tr>
<th></th>
<th>High Debt</th>
<th>Low Debt</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>0.748***</td>
<td>−0.078</td>
<td>0.826***</td>
</tr>
<tr>
<td></td>
<td>(0.353)</td>
<td>(0.092)</td>
<td></td>
</tr>
<tr>
<td>Alternative Identification</td>
<td>1.131***</td>
<td>−0.076</td>
<td>1.207***</td>
</tr>
<tr>
<td></td>
<td>(0.559)</td>
<td>(0.101)</td>
<td></td>
</tr>
</tbody>
</table>
| Alternative Debt States Definitions
| $\lambda = 1000$            | 0.232**   | −0.096   | 0.328**    |
|                              | (0.129)   | (0.159)  |            |
| Country-specific $\lambda$   | 0.677***  | −0.081   | 0.758***   |
|                              | (0.335)   | (0.091)  |            |
| Smooth Transition            | 0.865**   | −0.119   | 0.983***   |
|                              | (0.486)   | (0.121)  |            |
| High/low debt countries      | 0.753***  | 0.138    | 0.783**    |
|                              | (0.256)   | (0.301)  |            |
| Differentiating between Private Debt
| Household Debt               | 0.318**   | −0.025   | 0.342*     |
|                              | (0.184)   | (0.115)  |            |
| Corporate Debt               | 0.365***  | −0.025   | 0.391*     |
|                              | (0.176)   | (0.166)  |            |
| Alternative Gini index (UTIP-EHII) | 0.293*** | −0.090   | 0.383***   |
|                              | (0.097)   | (0.159)  |            |
| Leaving out GFC              | 0.367**   | −0.007   | 0.373*     |
|                              | (0.215)   | (0.206)  |            |

Notes: The table reports point estimates and Driscoll-Kraay standard errors in parentheses. In each case the shocks are normalized so that the cyclically-adjusted primary balance rises by 1% of GDP in year $k = 0$. *Significant at 16%; **significant at 10%; ***significant at 5%.

**Alternative Identification.** Jordà and Taylor (2016) argue that the narrative measure has a predictable component and, therefore, results could be biased due to fiscal foresight.

To account for possible anticipation effects, we combine the approach suggested by Jordà and Taylor (2016) with the forecast error-approach proposed by Auerbach and Gorodnichenko (2012).\footnote{Auerbach and Gorodnichenko (2012) use the unpredictable component of government spending as proxy for exogenous variations in fiscal expenditures.} The procedure consists of two steps. First, we regress the narrative consolidation measure, $D_{i,t}$, on a set of control variables that might include informa-
tion that helps to predict the outcome variable (real GDP growth, change in cyclically-adjusted primary balance, CPI inflation). The residuals of this regression measure the unpredictable component of fiscal consolidations. In a second step, the residuals are used as proxy for exogenous austerity innovations in the estimation of Equation (1).

The second row of Table 1 shows that we also find strong and significant differences in the distributional consequences of fiscal consolidations across the private debt cycle under this alternative identification scheme. Fiscal consolidations lead to a severe and significant increase in income inequality when private debt is high. In contrast, austerity is not associated with significant distributional consequences when private debt is low. Compared to our baseline specification, the difference between debt states is estimated to be larger when applying this alternative identification approach.13 This exercise shows that the finding of private debt-dependent distributional effects of fiscal consolidation is robust to alternative ways of identifying fiscal consolidation episodes.

Alternative Debt States Definitions. We define high (low) private debt states as positive (negative) deviations of private debt-to-GDP ratios from (country-specific) HP trends. For our benchmark estimation, we set the smoothing parameter $\lambda$ equal to 100, motivated by recent evidence showing that the average duration of the credit cycle is similar to the average duration of the business cycle (Jordà, Schularick, and Taylor 2016). In contrast to this evidence, Borio (2014) and Drehmann, Borio, and Tsatsaronis (2012) argue that the credit cycle is significantly longer and has a much greater amplitude than the standard business cycle. Therefore, Drehmann, Borio, and Tsatsaronis (2011) propose using a smooth HP-trend in order to capture the low frequency of credit cycles. To account for the possible longer duration of the credit cycle, we re-estimate Equation (1) but set

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13This is consistent with Jordà and Taylor (2016), who find that the effects of fiscal consolidations on macroeconomic aggregates are amplified once they control for possible anticipation effects in the narrative measure.
\( \lambda = 1000 \), which implies a relatively smooth HP-trend. Table 1 shows the results of this exercise. Our results are robust when allowing for a smoother trend. We again find significant differences in the distributional consequences of fiscal consolidations over the credit cycle. In periods of private debt overhang, income inequality increases significantly after fiscal consolidations, whereas income inequality is barely affected when private debt is low.

Thus far, we assumed that the smoothing parameter of the HP-filter is constant across all countries. However, fixing the smoothing parameter across countries may be inappropriate if there are important cross-country differences in the smoothness of the underlying trend component.\(^{14}\) Therefore, in the following we test whether our results are robust to using country-specific smoothing parameters. To estimate these individual smoothing parameters, we rely on the approach suggested by Choudhary, Hanif, and Iqbal (2014). The basic idea of this method is to exclude a single data point at a time and then find a smoothing parameter that provides a spline series that best replicates the missing data point. As Table 1 shows, our results are robust when allowing for country-specific smoothing parameters. Once again, we find significantly larger distributional effects of fiscal consolidations during periods of private debt overhang.

In our previous analysis, we defined any positive (negative) deviation from trend as a period of high (low) private debt. This definition of debt states does not take into account the scope of private debt overhang or the amplitude of the credit cycle. Figure 3 shows results of an alternative definition of debt states in which we distinguish between periods with excessive debt overhang (defined as those debt to GDP deviations from trend that are larger than the country-specific mean of positive deviations from trend) and periods with lower debt. In periods of excessive debt overhang, we again find evidence

\(^{14}\)Thanks are due to an anonymous referee for pointing out this possibility.
Figure 3: Effects of Fiscal Consolidation on Income Inequality, Excessive Debt Overhang.

Notes: Changes in net income inequality 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 Driscoll-Kraay standard errors.

for strong and significant distributional consequences of fiscal consolidations. Compared to our baseline specification, the point estimates are even more pronounced, but also more uncertain. Four years after the consolidation, the Gini coefficient increases by 3 (instead of 2) percentage points. Thus, the higher the level of private debt overhang, the more severe inequality is affected by fiscal consolidations. In low-debt states, though, austerity does not affect income inequality.

Thus far, our indicator variable $I_{i,t}$ was computed as a dummy variable, with observations 0 and 1. To account for a gradual regime change, we calculate a continuous indicator function based on the smooth-transition approach applied by several contributions studying state-dependent effects of policy interventions, see, e.g., Auerbach and Gorodnichenko (2013), Caggiano, Castelnuovo, Colombo, and Nodari (2015), and Tenreyro and Thwaites (2016). Table 1 shows the results of this exercise.\textsuperscript{15} As it turns out, the estimates are pretty similar to our baseline case. Consolidations implemented when private debt is high lead to a significant increase in income inequality, whereas austerity undertaken when private debt is low has no significant effect on inequality. In line with our benchmark

\textsuperscript{15}Details on the calculation of the indicator function are presented in the Appendix.
results, the state-dependent coefficients are also estimated to be significantly different when relying on a smooth transition approach.

Our preferred way to differentiate between high and low private debt states is based on the debt level relative to a country-specific average. As an alternative, debt states could be defined relative to the overall country average. In particular, countries with an average private debt level above the sample average could be classified as high private debt countries whereas countries with a below average private debt level could represent low private debt countries. As Table 1 shows, our results are also robust when applying this alternative state definition. Countries with structurally high private debt levels experience stronger increases in inequality in response to fiscal consolidations compared to countries with structurally lower private debt levels.

In sum, these exercises reveal that our findings do not rely on the specific method of defining low and high private debt states.

**Differentiating between Household and Corporate Debt.** The private debt series used so far measures the sum of debt held by private household and firms. To analyze whether our results are primarily driven by a specific source of private debt, we now differentiate between household debt and corporate debt. Series on corporate debt and household debt are taken from the Bank for International Settlements, where, due to data limitations, the panel includes only 13 out of the 17 countries of our baseline sample. As before, low/high corporate debt and low/high household debt periods are identified as deviations from a smooth country-specific trend (HP-filter with $\lambda = 100$). Table 1 presents responses of the Gini coefficient for net income in low/high household and low/high corporate debt states. Equation 1 is separately estimated for both types of

---

\[ ^{16} \text{Note that, for our preferred state definition, all countries experience high and low private debt periods, whereas this alternative definition splits the sample between high and low private debt countries.} \]
private debt. We find that income inequality rises significantly in periods of high household and high corporate debt. In contrast, when household or corporate debt is below trend, inequality does not respond significantly to austerity. Moreover, the difference between high and low debt responses is estimated to be significant for both types of private debt. This exercise reveals that the finding of private debt-dependent inequality effects of fiscal consolidations is not primarily driven by one specific source of private debt but is a common feature of the household and corporate credit cycle.

**Alternative Gini Index.** So far, our results rely on the Gini index provided by the SWIID database. Although the SWIID database offers data for most countries and for a substantial period of time, there are some concerns about its data comparability (see, e.g., Jenkins 2015). For this reason, we test whether our findings are robust when using an alternative time series for the Gini index. More specifically, we use the Gini index of the Estimated Household Income Inequality (EHII) Data Set built by the University of Texas Inequality Project (UTIP). Unfortunately, this dataset is only available for the period 1980-2005 and just covers 15 out of the 17 countries of our baseline sample. Keeping this loss of information in mind, the second last row of Table 1 shows the results when using the UTIP-EHII Gini index as dependent variable. As seen in the table, our finding of private debt-dependent distributional effects of fiscal consolidations holds true also when using this inequality measure.

**Changes in the Sample.** The results presented so far are based on a sample that includes the Global Financial Crisis (GFC) period and its aftermath in which large-scale austerity programs were undertaken. Thus, the question arises of whether our findings are mainly driven by the GFC and its aftermath. To check, we remove observations from the GFC and its aftermath and then re-estimate our model on a sample ending in 2006. The
last row of Table 1 shows that our main result remains intact. Austerity raises inequality when private debt is high, whereas we do not find discernible distributional consequences when private is low.

In an additional exercise, we investigate whether the results are driven by any key country in the sample. To do so, we have re-estimated Equation (1) by sequentially dropping one country at a time. We find that the baseline result is not driven by any key player in the sample.\footnote{Results of these estimations are available upon request.}

**Composition.** Guajardo, Leigh, and Pescatori (2014) find that the aggregate costs of austerity differ with the composition of fiscal consolidations. To analyze whether the finding of debt-dependent distributional consequences of consolidations depends on the composition, we re-estimate equation (1), where we 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 that both spending-based and tax-based consolidations tend to have adverse distributional consequences during periods of high private debt, whereas there is no evidence of rising income inequality during periods of low private debt. While the effects of spending-based consolidations in high-debt states are estimated very precisely, the effects of tax-based consolidations on inequality are more uncertain (the estimates are significant only when 68\% confidence bands are considered). This is presumably due to the limited number of tax-based consolidations representing only 1/3 of all consolidations in our sample.
Notes: Changes in net income inequality 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 Driscoll-Kraay standard errors.

3.3 Controlling for Additional State Variables

In this section, we demonstrate that the result of private debt-dependent inequality effects of austerity still prevails when we further condition on two other prominent state variables: the state of the business cycle and government debt overhang.

The State of the Business Cycle. This paper emphasizes the credit-cycle dependency of the distributional consequences of austerity. Jordà and Taylor (2016) and Agnello and Sousa (2014) find that the aggregate and distributional effects of fiscal consolidations are amplified in periods of economic slack, respectively. Given this, it is possible that our
emphasis on nonlinear effects across the credit cycle is simply a relabeling of nonlinear
effects across the business cycle. This, however, is not the case as we show in the following.

To investigate the role of the business cycle for our results, we now differentiate between
booms \((B)\) and slumps \((S)\) and estimate the following specification separately for low \((L)\) and high \((H)\) private debt states:

\[
Y_{i,t+k} - Y_{i,t-1} = I_{S,i,t-1}^j \left[ \psi_{S,k}^j X_{i,t-1} + \beta_{S,k}^j D_{i,t} \right] \\
+ I_{B,i,t-1}^j \left[ \psi_{B,k}^j X_{i,t-1} + \beta_{B,k}^j D_{i,t} \right] \\
+ I_{O,i,t-1}^j \left[ \psi_{O,k}^j X_{i,t-1} + \beta_{O,k}^j D_{i,t} \right] \\
+ \alpha_{i,k}^j + \eta_{i,k}^j + \epsilon_{i,t+k}, \quad \text{for } j \in \{L, H\}. \tag{2}
\]

\(I_{S,i,t}^j\) and \(I_{B,i,t}^j\) now indicate the state of the business cycle within the private debt state
\(j \in \{L, H\}\). In the estimation for high private debt states, \(I_{S,i,t}^H\) measures periods of high
private debt that coincide with periods of economic contractions, whereas \(I_{B,i,t}^H\) indicates
periods of high private debt that are also characterized by economic expansions. \(I_{O,i,t}^H\) is
then a dummy variable for being in the opposing private debt state (which is the low-
debt regime) irrespective of the state of the business cycle. \(\beta_{S,k}^H\) and \(\beta_{B,k}^H\) then provide the
state-dependent responses in slumps and booms within the high-debt regime, respectively.

Analogously, in the estimation for low private debt states, \(I_{S,i,t}^L\) \((I_{B,i,t}^L)\) measures periods of
low private debt that coincide with periods of economic slumps (booms) and \(I_{O,i,t}^L\) is the
dummy variable for being in the opposing private debt state (which is now the high-debt
regime). \(\beta_{S,k}^L\) and \(\beta_{B,k}^L\) then provide the state-dependent responses in slumps and booms
within the low-debt regime, respectively.

We define booms and slumps in two ways. First, we consider the output gap as an
indicator of the state of the business cycle. More precisely, we follow Jordà and Taylor
(2016) and define booms (slumps) as positive (negative) deviations of log real GDP from
country-specific HP trends, where we use a smoothing parameter of $\lambda = 100$. Second, similar to Ramey and Zubairy (2018) we use the detrended unemployment rate as an indicator of economic slack.\footnote{We again compute country-specific HP trends with a smoothing parameter $\lambda = 100$.}

Figure 5 shows that our results appear in both business cycle states. Due to the limited observations of each of the four regimes (high debt/slump, high debt/boom, low debt/slump, low debt/boom), Figure 5 presents 68\% (one standard error) confidence bands. If private debt is high, inequality increases significantly, irrespective of the state of the business cycle (see the left column of Figure 5). Likewise, if private debt is low, consolidations do not significantly impact income inequality, neither during booms nor during slumps (see the right column of Figure 5). This holds irrespective of whether we identify booms and slumps via the output gap, see Figure 5(a), or via the detrended unemployment rate, see Figure 5(b).\footnote{This finding is also robust to using country-specific smoothing parameters estimated by the Choudhary, Hanif, and Iqbal (2014) method. Results of this exercise are available from the authors upon request.}

Figure 5 also makes clear that economic slumps amplify the adverse distributional consequences of fiscal austerity during \emph{high} private debt states, compared to periods in which economic activity is booming. This is particularly evident if economic slumps are identified using the unemployment rate. Four years after the consolidation, the Gini coefficient increases by 4 (instead of around 1) percentage points, see the left column of Figure 5(b). In contrast, economic slumps do not amplify the distributional consequences of austerity during \emph{low} private debt states. Interestingly, when private debt is low, the point estimates associated with economic expansions are even larger than the respective slump-estimates, although the coefficients are not statistically different from zero. But
Figure 5: Controlling for the Business Cycle.

(a) Output gap

Notes: Changes in net income inequality 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 68% confidence bands based on Driscoll-Kraay standard errors.
what is most important to note is that austerity does not affect income inequality if private
de debt is low, irrespective of whether the economy is experiencing a boom or a slump.

**Government Debt Overhang.** In addition to the state of the business cycle, previous
literature find that the aggregate effects of fiscal policy 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-to-GDP levels
are low, whereas consumption declines when public debt-to-GDP levels are high. Likewise, Ilzetzki, Mendoza, and Vegh (2013) provide evidence that the government spending
multiplier depends negatively on the level of public debt.

Given this, it is possible that our emphasis on nonlinear effects across the private
credit cycle is a relabeling of nonlinear effects across the government debt cycle if the
level of private debt and the level of government debt are interdependent. This could well
be the case, for example because high government debt overhang may induce households
to increase savings to finance future tax payments, thereby lowering the level of private
indebtedness.

To check whether the result of private debt-dependent inequality effects of fiscal consol-
idations still holds when controlling for the public debt level, we re-estimate equation (2),
where $I_{S,i,t}^h$ and $I_{B,i,t}^h$ now indicate the state of the government debt level within the pri-
ivate debt state $j \in \{L, H\}$. In the estimation for high private debt states, $I_{S,i,t}^H$ measures
periods of high private debt that coincide with periods of low government debt, whereas
$I_{B,i,t}^H$ indicates periods of high private debt that are also characterized by a high level
of government debt. $I_{O,i,t}^H$ is then a dummy variable for being in the opposing private
debt state (which is the low private debt regime) irrespective of the level of government
Figure 6: Controlling for the Level of Government Debt.

Notes: Changes in net income inequality 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 68% confidence bands based on Driscoll-Kraay standard errors.

debt.\textsuperscript{20} Periods of high (low) public debt are defined as positive (negative) deviations of the government debt-to-GDP ratio from a country-specific HP trend ($\lambda = 100$).

Figure 6 demonstrates that our main results hold irrespective of the level of government debt. When private debt is high, fiscal consolidations lead to a significant increase in income inequality, irrespective of the level of government debt. In contrast, austerity has no discernible adverse distributional consequences during low private debt states.\textsuperscript{21} In a situation of low private and high government debt, fiscal consolidations even lead to a mild decrease in inequality. The figure also shows that the adverse distributional consequences of fiscal austerity are amplified during periods of low government debt, compared to periods in which government debt is high.

\textsuperscript{20}Analogously, in the estimation for low private debt states, $I_{L,i,t}^L$ ($I_{L,i,t}^H$) measures periods of low private debt that coincide with periods of low (high) government debt and $I_{L,i,t}^L$ is the dummy variable for being in the opposing private debt state (which is now the high private debt regime).

\textsuperscript{21}Again, this is also robust to using country-specific smoothing parameters estimated by the Choudhary, Hanif, and Iqbal (2014) method. Results of this exercise are available from the authors upon request.
In sum, our results suggest that the distributional consequences of austerity are mainly determined by the level of private indebtedness in the economy, whereas the state of the business cycle and the level of public debt seem to play a minor role for whether or not austerity increases inequality.

4 Investigating the Channels

The evidence shown in the previous sections suggests that the distributional consequences of fiscal consolidations crucially depend on the state of the credit cycle. We now provide evidence on the channels underlying these distributional consequences of austerity. Specifically, we explore the debt-dependence of the earnings heterogeneity channel, the income composition channel, the savings redistribution channel, and the tax redistribution channel.

Tax Redistribution Channel. Reducing government budget deficits through transfer cuts, tax increases, or a combination of both affects directly the degree of redistribution through the tax and transfer system. Whether it increases or decrease inequality depends on the specific policy mix chosen. A cut in transfers is likely to increase net income inequality, since the income of households at the lower end of the income distribution relies disproportionately on public transfers. An increase in capital income taxes or a rise in the progressivity of the tax system is likely to lower income inequality.

To analyze whether changes in the tax and transfer system can help to understand the debt-dependent distributional consequences of austerity, we investigate the effect of fiscal consolidations on redistribution, allowing again for different responses in high-debt and low-debt regimes. To measure the degree of redistribution through the tax and transfer system, we calculate the difference between market and net income inequality (labeled for
brevity redistribution in the following). A rise in this redistribution measure thus implies that net income inequality increases by less than market income inequality in response to fiscal consolidations. We do so by regressing, for each horizon, \( k = 0, \ldots, 4 \), the change in redistribution on our measure of fiscal consolidations and include lags of the change in redistribution and output growth in the control vector \( X_{i,t-1} \).

As the first row of Figure 7 shows, redistribution tends to increase in both debt states with the response of redistribution being stronger in high private debt states. This is not surprising, given the contractionary effects of austerity and the fact that, in general, redistribution rises in economic downturns. The latter reflects the significant role played by automatic stabilizers implicit in the government tax and transfers system, see, e.g., Krueger, Perri, Pistaferri, and Violante (2010). This automatic response of redistribution renders it difficult to identify the importance of discretionary changes in the tax and transfer system for the changes in income inequality after fiscal consolidations as the counterfactual – how inequality would have behaved in a non-austerity induced downturn – cannot be directly observed. However, what we can clearly conclude from inspecting the figure is that there is no evidence that the tax redistribution channel plays an important role in explaining our main result that fiscal consolidations lead to a significantly stronger increase in net income inequality if firms and households have a lot of debt, compared to if they have little debt.

**Earnings Heterogeneity Channel.** As employment losses fall disproportionately upon low income groups, labor earnings at the bottom of the distribution may be disproportionately affected by fiscal consolidations. To analyze whether employment dynamics can help to understand the debt-dependent distributional consequences, we investigate the effect of fiscal consolidations on aggregate employment, allowing again for different
responses in high-debt and low-debt regimes. We do so by regressing, for each horizon, \( k = 0, \ldots, 4 \), the change in the aggregate employment rate on our measure of fiscal consolidations and include lags of the change in the employment rate and output growth in the control vector \( X_{i,t-1} \). If we find that the response of employment to fiscal consolidations differ across the credit cycle, the earnings heterogeneity channel offers an explanation for private debt-dependent inequality effects to austerity.

The results are shown in the second row of Figure 7. Notably, we only observe a significant fall in employment when private debt is high. At the end of the forecast horizon, the employment rate declines by more than 1 percentage point. The evidence described above suggests that this is associated with a disproportionate decline in employment for low-income groups that, in turn, translates into a rise in income inequality. In contrast, when private debt is low, the employment rate shows hardly any change in response to fiscal consolidations. Four years after the implementation of the consolidation, the effect on the employment rate is almost zero. This may explain why we do not observe an increase in income inequality in periods when private debt is below trend.

**Income composition channel.** The income composition channel attributes changes in income inequality to heterogeneous dynamics across different sources of income (capital versus labor income). Low-income households typically rely on wage income, whereas high-income households tend to receive a relatively larger share of their income from capital income. When fiscal consolidations affect these different types of income heterogeneously, then the different household types experience different income outcomes. According to the income composition channel, a rise in the capital income share in response to austerity benefits high-income households relatively more strongly, which ultimately leads to an increase in income inequality.
Figure 7: Redistribution, Employment Rate, Capital Income Share, and Real Interest Rate.

Notes: Changes in the respective variable 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 Driscoll-Kraay standard errors.
To analyze whether different types of incomes are affected heterogeneously, we investigate the response of the capital income share to fiscal consolidation shocks. We do so by re-estimating the regression model (1) but considering the change in the capital income share as the dependent variable. Thereby, the obtained estimation results allow us to detect the possible debt-dependent effects of austerity on the capital income share. We include lags of the change in the capital income share together with real GDP growth in the control vector $X_{i,t-1}$.

As the third row of Figure 7 shows, fiscal consolidations affect different types of income in a heterogeneous manner. After fiscal consolidations, the capital income share increases.\(^{22}\) As mentioned before, the relative rise in capital income primarily benefits households in the upper part of the income distribution, generating a mechanism through which fiscal consolidations influence inequality. Turning to the role of private indebtedness, we see that the rise in the capital income share tends to be stronger when austerity is implemented during a period when private debt is high. The capital income share rises by more than 0.5 percentage points four years after the consolidation was implemented. When private debt is low, we only observe small and mostly insignificant changes in the capital share of income. At the end of the forecast horizon, the response of the capital income share in low-debt states is less than half as strong as the response in high-debt states. Although the response of the capital income share displays a more muted debt-dependence, the income composition channel offers a further explanation for the debt-dependent inequality responses to fiscal consolidations.

**Savings redistribution channel.** An unexpected increase in real interest rates (through a rise in the nominal interest rate or a decrease in inflation) redistributes resources from

\(^{22}\)This response of the capital share stands in contrast to the general procyclical behavior documented by, e.g., Shao and Silos (2014).
borrowers to savers. Since borrowers are generally at the lower part of the income distribution, this generates a rise in income inequality.

The last row of Figure 7 highlights the role of the savings redistribution channel for understanding our results. The figure shows results of an estimation exercise where we regress the change in the real interest rate on fiscal consolidation shocks, again adding the lag of the dependent variable to the vector of control variables. Due to data limitations, the panels includes only 9 out of the 17 countries of our baseline sample. As seen in the figure, the real interest rate increases significantly when consolidations are implemented during high private debt periods. While, at first, counter-intuitive, the rise in the real interest rate accords with recent empirical evidence. First, Mountford and Uhlig (2009) and Ramey (2016) show that U.S. fiscal expansions are associated with falling real interest rates. Second, Klein (2017) finds that fiscal consolidations implemented in periods of high private debt lead to an increase in the government debt level and the sovereign default probability. The latter raises risk premia and puts upward pressure on interest rates.

The increase in the real interest rate induces a rise in debt repayments that, according to the savings redistribution channel, positively affect income received by richer households. In contrast, when private debt is low, the real interest rate changes significantly only on impact, while for the remaining forecast horizons there is no statistically significant effect.

To summarize, we presented evidence that strongly supports the earnings heterogeneity channel for understanding private debt-dependent distributional consequences of fiscal consolidations. The income composition channel and the savings redistribution channel display more muted debt-dependencies. We find no evidence that the tax redistribution channel offers a mechanism through which our main results can be rationalized.
5 Conclusion

This paper reveals important private debt-dependent effects of austerity. Estimating state-dependent local projections for a panel of OECD countries, we provide evidence that the distributional consequences of fiscal consolidations vary considerably over the credit cycle. Fiscal consolidations lead to a strong and persistent increase in income inequality during periods of private debt overhang. By contrast, there are no discernible distributional effects when private debt is low. This finding is robust to taking into account possible anticipation effects, to different definitions of private debt overhang, to varying the sample period, and to controlling for the state of the business cycle and the level of government debt. Private debt-dependent dynamics in aggregate employment, in the composition of income, and in real interest rates can help to understand our findings. In contrast, we find no evidence that changes in the government tax and transfer system implemented to improve the fiscal balance explain why the inequality effects of austerity depend on the private debt cycle.

Our results have important policy implications. The optimal timing of consolidation is a highly complex decision, depending on many economic and socio-political aspects. Empirical evidence on the nonlinear effects of fiscal consolidations enables policy makers to make informed decisions about the optimal timing of fiscal consolidations. Our study adds to the debate about when is the right time for austerity by shedding light on the debt-dependent distributional consequences of austerity. Our results suggest that the state of the private debt cycle is one of the relevant factors at play, in particular for policy makers concerned about inequality.

The documented distributional consequences of austerity may also jeopardize the ultimate goal of austerity to improve fiscal sustainability. This will happen if rising inequality
increases public debt and lowers economic growth via political-economy channels such as an increase in socio-political instability. In fact, Klein (2017) shows that fiscal consolidations implemented in periods of high private indebtedness are “unsuccessful” in the sense that they lead to an increase in public debt and sovereign risk premia. A deeper investigation of the potential vicious cycle between rising inequality, political instability, and fiscal sustainability might be a promising area for future research.

Our contribution also provides guidance for theoretical models that seek to study aggregate and distributional consequences of policy interventions. We show that private debt matters for the inequality effects of fiscal policy. Thus, the growing macroeconomic literature that integrates heterogeneous agents and distributional changes into New Keynesian models should elaborate on private indebtedness when studying the implications of fiscal policy interventions. Moreover, our results may help to differentiate between competing classes of heterogeneous agent models. Finally, the heterogeneity in income responses across households and the channels through which we try to explain the baseline findings may help to provide a better understanding of the transmission mechanism of fiscal policy.

References


Appendix

A1 Data Definitions and Sources

The baseline sample covers the period 1980-2011 and the countries Australia, Austria, Belgium, Canada, Germany, Denmark, Ireland, Spain, Portugal, France, Finland, United Kingdom, Italy, Japan, the Netherlands, Sweden and the United States.

The sample of the robustness exercises in which we differentiate between household and corporate debt covers the period 1980-2011 and the countries Australia, Belgium, Canada, Germany, Spain, Portugal, France, Finland, United Kingdom, Italy, Japan, Sweden and the United States.

The sample of the robustness exercises in which we use the Gini index of the University of Texas Inequality Project covers the period 1980-2005 and the countries Austria, Belgium, Canada, Germany, Denmark, Ireland, Spain, Portugal, France, Finland, United Kingdom, Italy, Japan, the Netherlands and the United States.

The sample of the estimates on the real interest rate covers the period 1980-2011 and the countries Australia, Belgium, Canada, Germany, Spain, France, United Kingdom, Italy and the United States.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
<th>Source</th>
</tr>
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<tbody>
<tr>
<td>GDP, real</td>
<td>Gross domestic product, constant prices, OECD base year</td>
<td>OECD</td>
</tr>
<tr>
<td>GDP, nominal</td>
<td>Gross domestic product, current prices, current PPPs, in US Dollar</td>
<td>OECD</td>
</tr>
<tr>
<td>CAPB</td>
<td>Cyclically-adjusted primary balance relative to GDP</td>
<td>Alesina and Ardagna (2010), for 2010, 2011 OECD series used</td>
</tr>
<tr>
<td>Narrative fiscal consoli-</td>
<td>Changes in fiscal policy motivated by a desire to reduce the budget deficit</td>
<td>Devries, Guajardo, Leigh, and Pescatori (2011) and extended for the</td>
</tr>
<tr>
<td>dation measure</td>
<td>and not by responding to prospective economic conditions</td>
<td>years 2010, 2011</td>
</tr>
<tr>
<td>Income inequality</td>
<td>Gini coefficients for net and market income</td>
<td>Standardized World Income Inequality Database</td>
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<tr>
<td>(SWIID)</td>
<td></td>
<td></td>
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<td>Income inequality (EHII)</td>
<td>Gini coefficient gross household income</td>
<td>University of Texas Inequality Project</td>
</tr>
<tr>
<td>Employment rate</td>
<td>Civilian employment as % population (15-64 years old)</td>
<td>OECD</td>
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<td>GDP deflator</td>
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<td>Total credit to private</td>
<td>End-of-year credit to private non-financial sector from all sectors,</td>
<td>Bank for International Settlements</td>
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<td>sector</td>
<td>market value, in US Dollar, Adjusted for breaks</td>
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<tr>
<td>Private debt-to-GDP ratio</td>
<td>Total credit to private sector divided by GDP, nominal</td>
<td>Own calculation</td>
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<td>1-labor income share, real unit cots, total economy</td>
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<td>Unemployment rate as % of civilian labor force</td>
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<td>Interest rate</td>
<td>Short-term interest rate, per cent per annum</td>
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<td>Real interest rate</td>
<td>Interest rate minus log difference of GDP deflator</td>
<td>Own calculation</td>
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<tr>
<td>Government debt-to-GDP</td>
<td>General government debt (percent of GDP)</td>
<td>IMF Global Debt Database</td>
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</table>
**A2 Extension of the Narrative Measure**

In extending the narrative consolidation measure, we follow Dell’ Erba, Mattina, and Roitman (2015), who provide data for the consolidation measure of 2010 and 2011. The extension of the dataset is based on the following two OECD reports: *Restoring Public Finances, 2011* and *Restoring Public Finances, 2012 Update*. These reports outline the economic situation, fiscal consolidation strategy, and major consolidation measures for each OECD member country. The country notes in each report lay out each government’s rationale for pursuing fiscal adjustment and are used to identify consolidation periods that were motivated by a desire for deficit reduction.

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<thead>
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<th>2011</th>
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<td>2.20</td>
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<tr>
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A3 Smooth Transition

The smooth transition results presented in Section 3.2 are obtained by estimating the following equation:

\[ Y_{i,t+k} - Y_{i,t-1} = F(z_{i,t-1}) \left[ \beta_{H,k} D_{i,t} + \psi_{H,k} X_{i,t-1} \right] \\
+ (1 - F(z_{i,t-1})) \left[ \beta_{L,k} D_{i,t} + \psi_{L,k} X_{i,t-1} \right] + \alpha_{i,k} + \eta_{t,k} + \epsilon_{i,t+k}, \]

where \( F(z_{i,t}) \) is a smooth increasing function of an indicator of the state of the credit cycle. Following Tenreyro and Thwaites (2016), Auerbach and Gorodnichenko (2013) and Caggiano, Castelnuovo, Colombo, and Nodari (2015), we employ the logistic function

\[ F(z_{i,t}) = \frac{\exp\left(\theta \frac{(z_{i,t} - c)}{\sigma_z}\right)}{1 + \exp\left(\theta \frac{(z_{i,t} - c)}{\sigma_z}\right)}, \]

where \( c \) is a parameter that controls what proportion of the sample the economy spends in either private debt state and \( \sigma_z \) measures the standard deviation of the state variable \( z \). \( \theta \) determines how violently the economy switches from a high-debt to a low-debt state when \( z_t \) changes.

Given the mentioned evidence showing that the credit cycle has similar characteristics as the traditional business cycle (Jordà, Schularick, and Taylor 2016), we define \( z_{i,t} \) following the approach of Tenreyro and Thwaites (2016), who study business cycle-dependent effects of monetary policy shocks. Thus, \( z_{i,t} \) is defined as a two year moving average in the change of the private debt-to-GDP ratio. Moreover, \( \theta \) and \( c \) are set as in Tenreyro and Thwaites (2016) (\( \theta = 3, \ c = 20 \)).