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ARTICLE

Household debt and economic growth in Europe

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Abstract

We investigate the role and impact of household debt on the economic performance of European economies during the double-dip recession of 2008–2013. We use a loan-level data set of millions of residential mortgages originated between 2000 and 2013 to calculate regional indicators of household debt. The granular information allows us to construct a measure of interest rate mispricing during the housing boom that we use to identify the effect of a credit shock (CS) on household debt. Our analysis provides three main conclusions. First, in the period 2004–2006, the measure of CS was negative in most European regions which indicates that credit conditions were significantly relaxed relative to earlier years. Second, we find that regions in which household leverage increased more rapidly during the 2002–2007 period experienced a more severe decline in output and employment after 2008. Third, we find that the CS had the largest effect on increasing leverage for the low-income and the middle-income households, although the leverage of the high-income households represents a more powerful predictor of the decline in economic activity.

Keywords: Household debt; great recession; European economy; Monetary Union

1. Introduction

The Great Recession was a particularly extreme event for the European economy with a double-dip contraction between 2008 and 2013 that shed over 6 million jobs, two-thirds of which in the manufacturing sector. Since then, a growing literature has been trying to identify the forces that led the global economy to such an adverse economic outcome. Evidence for the USA indicates that the interaction of excessive borrowing by households in the early 2000s and the housing market could be the driving force for the decline in economic activity (Mian and Sufi (2010), Mian et al. (2013), and Mian et al. (2017)). According to this view, a *credit supply* shock (e.g., the relaxation of lending standards or optimistic expectations by lender as in Bordalo et al. (2021)) before the crisis led mortgage lenders to expand lending to segments of the population that normally were not able to obtain a mortgage, such as low-income and poor credit-quality borrowers. The credit supply shock had the effect of putting upward pressure on house prices, leading to the accumulation of economy-wide vulnerability. However, Ferreira and Gyourko (2015) and Adelino et al. (2016) find that the credit expansion affected all categories of borrowers, including the prime and high-income ones. Since these borrowers account for a significant share of mortgage origination, relative to sub-prime, the increase in lending contributed to put additional pressure on home prices and the subsequent increase in loan delinquencies and defaults.

The evidence on the relationship between private debt and subsequent economic growth in Europe is limited. Existing studies consider the analysis of a single European country or the aggregate Euro area, mostly due to the lack of individual and regional data over long periods of time

(e.g., Gambetti and Musso (2017), and Andersen et al. (2016), for household debt, and Bentolila et al. (2018), for firm debt).

The evidence in these papers suggests that many European countries experienced an increase in the level of household indebtedness relative to income in the years before the crisis. A possible explanation for the run-up in household debt points at the macroeconomic and financial impact of the European Monetary Union and the development of the Single Market in financial services. Both had the effect of reducing uncertainty and financing costs, thus increasing the desired spending levels of households (Alter et al. (2018)). Blanchard and Giavazzi (2002) suggest that the integration of goods and financial markets in Europe at the end of the 1990s lead to the reallocation of resources from capital-abundant, high-income, core countries to capital-scarce, low-income, peripheral ones. This reallocation had the effect of increasing the availability of capital to households that might have fuelled a bubble in the housing market. An additional factor that played a role in Europe was the loose monetary conditions as discussed in Maddaloni and Peydró (2011) and Jordà et al. (2015).

The goal of this paper is to investigate the dynamics of household debt and house prices in Europe and to understand their possible contribution to the deep contraction of economic activity that occurred after 2008. In addition, we aim to understand how the dynamics of indebtedness, house prices, and the decline in output and employment affected households across the income distribution. As discussed earlier, the lack of a consistent household finance data for European countries has severely limited the ability of researchers to conduct an European analysis and to draw general conclusions. To overcome this difficulty, we consider a novel data set on approximately 10 million residential mortgages originated in 8 European countries between 2000 and 2013. We follow the Eurostat Nomenclature of Territorial Units for Statistics (NUTS) classification and aggregate the data set at the NUTS3 regional level[1] to construct local measures of household debt and house prices, which we match to regional statistics on economic growth and employment. In our analysis, we focus on home-secured household debt alone, namely, on that part of household debt that is guaranteed by the value of the main residence as well as other real estate investments. This is an important component of debt given the high concentration of resources in the housing sector observed before the onset of the crisis in several European countries.

The first step of our analysis consists of evaluating whether the rise in household debt can be ascribed to a credit supply shock, such as the deregulation of financial markets that led to the relaxation of mortgage credit conditions, or rather to a demand shock, for instance, an income shock or inflated house price expectations that led borrowers to increase demand for credit. To this end, we exploit the fact that we observe loan-level data to construct a measure of interest rate mispricing during the housing boom. Specifically, we estimate a regression model for the loan interest rate that accounts for a number of observable loan and borrower characteristics that we assume determine the interest rate and calculate regional averages of the corresponding regression residuals that we call *credit shocks* (CSs). Deviation of the CS from zero indicates that, *ceteris paribus*, financial institutions are *mispricing* mortgage credit in that region relative to their earlier pricing strategy. Our first result is to show that most European regions experienced a credit supply expansion, which is similar for borrowers belonging to all income groups, although with consistent heterogeneity across regions and countries. This finding implies that Europe has witnessed a (relative) decline in the cost of credit which points toward the credit supply expansion as a possible explanation for the sudden rise in household debt observed during the years up to 2006.

In a second step, we adopt an instrumental variable (IV) approach and use the regional CS as instrument for the debt-to-income (DTI) ratio to evaluate the impact of the supply-driven leverage on the subsequent slowdown in output and employment. The second result of our analysis is that we find a significant relationship between household leverage and economic activity. In particular, the evidence indicates that regions hit by a relatively stronger credit supply shock in 2004–2006 are also the regions that experience the most severe decline in output and employment

indicators in the post-2008 period. We study separately the recessionary episode of 2008–2011 and the double-dip contractionary period of 2008–2013. We find that the recessionary effect of an increase in household leverage becomes significantly larger when considering the double-dip recession. This suggests that the same regions that experienced a decline in output and employment during the first recession were also hit by the second recession with further worsening of their economic conditions. The estimated effects of an increase in leverage are statistically significant: a unit increase of DTI is associated with a cumulative decline in real Gross Domestic Product (GDP) and total employment of 0.6% and 2.8%, respectively, during the first recessionary episode, and of 2.2% and 4.7% when considering the 2008–2013 period. In particular, the largest contractionary effect is consistently achieved by employment in the manufacturing sector rather than in the non-tradable one.

In a third step, we analyze the dynamics of leverage and its effect on economic activity across quartiles of the income distribution. We find that borrowers belonging to the bottom and middle of the income distribution are more sensitive to the credit supply shock as they increase their leverage significantly more relative to high-income borrowers. This is probably due to the fact that low- and middle-income borrowers are more likely to be credit constrained and increase their level of debt once lending standards are relaxed.

Overall, the evidence we provide seems to support the Blanchard and Giavazzi (2002) view that the liberalization of financial markets in the Euro area has fuelled an unsustainable rise in home-secured debt and house prices, which has eventually lead to the build up of the crisis and subsequent severe contraction. The remainder of the paper is structured as follows. Section 2 reviews the existing literature, while Section 3 describes the data set. Sections 4 and 5 introduce the statistical model and present our identification procedure, respectively. Section 6 comments on empirical results, and Section 7 concludes.

2. Background literature

Several studies, mostly focused on the USA, investigate the link between the increase in household debt and the economic performance during the Great Recession at the regional and country level. They find that excessive borrowing, coupled with housing market dynamics, might have driven the economic downturn. Among these, Mian and Sufi (2010) investigate the cross-sectional variation of household leverage at the onset of the 2007–2009 financial crisis for a set of counties in the USA. They find that, *ceteris paribus*, counties that experienced a large increase in DTI ratio before the financial crisis were also those that, during the crisis, suffered the sharpest decline in durable consumption and the largest rise in unemployment. To better understand how the combination of household debt and house price declines affected economic performance, Mian et al. (2013) explore variations in the housing net worth channel during the 2006-2009 housing collapse period. The authors find a large elasticity of consumption with respect to the drop in housing net worth. Additionally, they find that households with more significant decrease in housing net wealth are also those that experience a stronger reduction in credit limit and increased difficulty refinancing their mortgage at lower interest rates. A similar analysis is carried out by Mian and Sufi (2014), who find that housing net worth losses due to the financial crisis led to a significant contraction in employment within the non-tradable sector, that is, in those sectors, such as retail and wholesale, that rely heavily on the local demand.

Recent studies look at business dynamics in the OECD countries, using data at the country-level. Mian et al. (2017) perform a panel data regression analysis of 30 countries from 1960 to 2012 and find a negative relationship between the increase in the household debt-to-GDP ratio and GDP growth. The evidence suggests that this relationship is stronger for countries with less flexible exchange rate regimes. These conclusions are confirmed on a larger set of countries and time periods by Alter et al. (2018).

Despite ample evidence in the USA, there's been limited analysis of household debt in Europe and its effects on economic performance. Jappelli et al. (2013) study the differences in (aggregate) household indebtedness across 11 European countries, showing that higher indebtedness is associated with increased financial fragility, as measured by the sensitivity of household arrears and insolvencies to macroeconomic shocks. Ampudia et al. (2016) exploit data from the Household Finance and Consumption Survey in Europe to calculate a set of financial burden indicators for households. The authors calibrate their measures using country-level data on non-performing loan ratios and estimate a set of stress test elasticities in response to interest rate, income, and house price shocks. Cecchetti et al. (2011) study the conditions under which debt goes from good to bad, using data on 18 OECD countries from 1980 to 2010. They show that when household debt crosses a certain level, around 85% of GDP, debt is a drag on growth. Andersen et al. (2016) analyze the relationship between leverage and consumption based on microdata for Danish households. They find evidence that households used debt to increase spending pre-crisis and normalized their spending post-crisis.

Other studies assess the impact of pre-crisis conditions on the economic performance during the Great Recession in European countries. Mitze (2019) estimates a dynamic panel data model to study the impact of local labor market conditions prior to and during the global economic crisis on regional migration rates. The author shows that local labor market disparities significantly widened during the crisis and led to an orientation of migrants toward urban areas, away from regions with persistently high long-run unemployment rates. Crescenzi et al. (2016) provide a regional study on 254 NUTS2 regions from EU27 countries, exploring the role of both national level macroeconomic conditions as well as regional factors. The authors identify the current account surplus to be an important national level factor associated with stronger economic performance during the post-2008 recession, and human capital as the single most important positive variable as regional level resistance factor. The sharp increase in external imbalances across Europe during the pre-crisis period has been suggested as an important driver of the European crisis by various studies. Lane and Milesi-Ferretti (2011) observe that the variation in the size of recessions during 2008–2009 was significantly related to the size of outstanding current account imbalances (on this, see also Lane and Milesi-Ferretti (2012)). Lane and Pels (2012) find that the expansion in current account imbalances during 2002–2007 was associated with an increased optimism about future growth, which led to lower savings and higher construction investment, rather than investment in productive capital.

Most of the European studies discussed above focus on broad, country-level analyses, using survey data. In this paper we take a different approach by utilizing detailed administrative data to uncover the causal impact of household debt on the significant economic downturn post-2008.

3. Data

The European Datawarehouse (ED) collects information on loans for Euro area countries as part of the liquidity operations of the European Central Bank (ECB). The program, known as Asset-Backed Securities (ABS) loan-level initiative,[2] started in January 2013 and requires financial institutions to report information on the structure and performance of their securitized loan portfolios in a detailed and standardized format. The aim of the program is to increase transparency and to provide market participants with timely information on the underlying loans and their performance. The ABS portfolios include a variety of loans, ranging from residential mortgages, loans associated to credit card use, car purchases, and loans granted to small and medium enterprises. Information provided in the data set include the performance of each loan, updated at least on a quarterly basis. In addition, other variables are available at the origination of the loan, such as the total amount of loan and the gross income of the borrower.

For this study, we use data on loans for the purchase of a residential property, and consider information about the loan, the borrower, and the underlying property at the time of the loan origination. We consider loans that were originated as of January 2000. More precisely, loan-level information includes the amount of the loan at origination, the interest rate and type, and the loan term (in number of months). Borrower-level information includes gross annual income and the employment status (e.g., self-employed or unemployed). Finally, asset-level information contains data about the value of the property and the first digits of the postal code where the property is located. We only consider data for 8 countries, namely Belgium, Spain, France, Ireland, Italy, the Netherlands, Portugal, and the UK.[3] We clean the raw data as detailed in Appendix A and aggregate them at the regional level where the asset underlying each loan is located using the NUTS3 classification. The NUTS3 corresponds to the most granular regional aggregation available in ED and allows to study heterogeneous behavior across European regions, while exploiting the richness of information derived from the loan-level the data set. These aggregated data have been matched with regional data on real GDP, total and sectorial employment at the NUTS3 level obtained from the European Commission Joint Research Centre (JRC) Urban Data Platform.[4] By matching these data sources, we obtain a data set for 490 NUTS3 regions with information on household debt, interest rate, house prices, and local economic conditions observed between 2000 and 2013.

A relevant question to address is how representative our sample is for the financial situation of European households (Gaudêncio et al. (2019)). In Appendix B, we investigate the issue of the sample representativeness of the underlying population by comparing the key variables included in our analysis with the same variables constructed from consumer finance household surveys. There is an overall consistency for the main variables used in our analysis and the ones from survey data, with ED providing two significant advantages. First, we can model the within-country variability of the variables of interest by relying on ED regional information. Second, the availability of several thousand loans per region-year delivers more robustness to the analysis.

In our analysis we define household debt to include only home-secured debt, that is, debt that is collateralized by a real estate asset. Clearly, households also hold debt that is non-collateralized and is used for various purposes. While excluding non-home-secured debt may provide a biased representation of household debt, it is important to remark that collateralized debt accounts for the bulk of household debt in Europe. According to the Eurosystem Household Finance and Consumption Network (2013) survey, 82.8% of the total outstanding household balances in the Euro area in 2010–2011 is represented by mortgages collateralized on the household's main residence or other real estate properties owned by the household. Such percentage ranges between a minimum of 73.5% for Italy and a maximum of 92.1% for Portugal. We define DTI as the ratio between the total amount of new loans originated by a household in 1 year divided by its total annual gross income and then aggregate such ratio at the regional level by averaging. This ratio is often used in assessing affordability since it indicates the number of years required to repay the mortgage. Although this ratio has some drawbacks as it only accounts for home-secured debt and incorporates gross rather than net income, it does provide some useful insights into the financial risk a household faces. Households with high DTI are likely to be more sensitive to negative shocks to interest rate, income or house prices and therefore are more likely to default if these occur.

Fig. 1 reports the relationship between our key variable DTI in the pre-crisis period and a set of regional variables measuring economic performance over the years 2008–2013. As measures of performance we consider the growth in total employment, employment in manufacturing and non-tradable sector and GDP growth. For all variables we find a negative relation between these variables and the average DTI preceding the onset of the crisis. This suggests that regions characterized by higher household leverage pre-crisis were those that experienced a larger drop in employment and GDP during the double-dip recession. In the following section, we discuss a model that aims at assessing more formally this hypothesis.

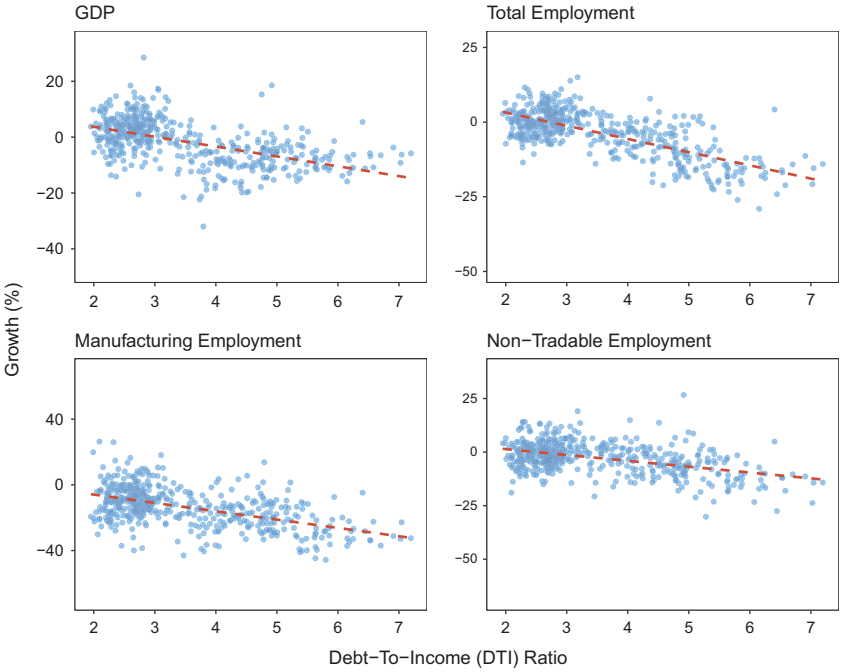

Figure 1. Scatter plot of the average DTI in 2002–2007 and the percentage change of over the period 2008–2013 for the selected macroeconomic variables at the NUTS2 level.

4. The model

The hypothesis that we test is whether household leverage has played a significant role in exacerbating business cycle fluctuations across regions in Europe. We adopt the CEPR chronology by assuming that the peak of the business cycle in the Euro area happened in the first quarter of 2008 and define the pre-crisis period between 2002 and 2007. Our empirical specification aims to explain the change in economic performance in the recessionary period with pre-crisis variables. For each region $g = 1, \ldots, G$, we consider the following equation:

$$\Delta_h y_{g,2008+h} = \beta DTI_{g,2002-07} + \lambda' \mathbf{W}_{g,2000-03} + \varepsilon_{g,2008+h}, \tag{1}$$

where $\Delta_h y_{g,2008+h}$ represents the growth rate of a macroeconomic variable for region g between 2008 and 2008+h, $DTI_{g,2002-07}$ measures the average DTI in region g during the 2002–2007 period, $\mathbf{W}_{g,2000-03}$ is a vector of control variables capturing the structural characteristics of region g in the years preceding the pre-crisis period, and $\varepsilon_{g,2008+h}$ is a Gaussian error term. We estimate the model in equation (1) at horizons $h = 3$ and 5, that is over the years 2008–2011 and 2008–2013, in order to capture the cumulative effect of the double-dip recession that occurred in EU countries. We are interested in estimating and interpreting the parameter β, which measures the effect of the pre-crisis household indebtedness on the economic performance after the crisis.

We estimate equation (1) using a number of alternative dependent variables as proxy for the economic performance of a region, $\Delta_h y_{g,2008+h}$. In particular, we consider 4 indicators of economic performance: real GDP, total employment, employment in the manufacturing sector and in the non-tradable sector. Following Mian et al. (2013), we include non-tradable employment, since this sector is found to be highly sensitive to local economic shocks in the USA. We construct the employment variable in the non-tradable sector by considering all activities belonging to wholesale and retail trade, accommodation, and food service sectors.[5]

Table 1. Descriptive statistics of the variables included in the analysis for the years 2008-2011 and 2008-2013. The growth rates are at the annual frequency. The sample is composed of 490 NUTS3 regions. Sources: ($^{+}$) ED data, (*) JRC Urban Data Platform, ($^{++}$) OECD data, (**) Eurostat

Period		Average	25th	Median	75th
	Variables measuring economic activity				
2008–2011	GDP growth*	0.017	−0.010	0.025	0.055
	Total employment growth*	−0.018	−0.044	−0.006	0.015
	Manufact. employment growth*	−0.043	−0.081	−0.038	0.004
	Non-tradable employment growth*	−0.012	−0.038	−0.003	0.021
2008–2013	GDP growth*	0.009	−0.039	0.024	0.069
	Total employment growth*	−0.030	−0.077	−0.014	0.021
	Manufact. employment growth*	−0.076	−0.137	−0.068	−0.004
	Non-tradable employment growth*	−0.026	−0.070	−0.011	0.027
	Control variables				
2002–2007	DTI^{+}	3.533	2.596	3.045	4.439
2000–2003	National debt/GDP^{++}	64.564	34.767	56.100	102.367
	% Manufact. empl.*	7.760	5.240	7.318	9.566
	% Non-tradable empl.*	10.698	8.033	9.940	12.655
2003	Population density*	0.419	0.055	0.101	0.260
2003	Population*	446.925	177.874	321.185	565.590
2003	% of urban regions**	21.335	0.000	0.000	0.000

The vector $\mathbf{W}_{g,2000-03}$ consists of a set of variables that capture both crisis at the international level, as well as regional factors, and that might be relevant in explaining the performance after the onset of the crisis (Dijkstra et al. (2015)). Following previous studies, we include as control variables the average national debt as a percentage of total GDP measured over the period from 2000 to 2003 for the country where region g is located. High leverage in the public sector, measured by a high level of the debt-to-GDP ratio, could contribute, in addition to household leverage, to explain the poor performance of some countries during the recession. We include in our regression the regional share of employment in the manufacturing and non-tradable sectors. Finally, we also consider the 2003 population density in region g as well as a dummy variable equal to 1 when the region is predominantly urban and zero otherwise, obtained from the urban–rural typology classification of Eurostat.

Table 1 presents the summary statistics of the outcome variables and the controls. Variables such as employment and GDP declined in the years after 2008, with a deeper drop considering the change up to 2013. For all these variables both the first quartile and the median are negative in the post-crisis periods. The drop hit hardly the manufacturing sector, which shows negative values across all quartiles. In the next section, we discuss the identification strategy for equation (1), while the regression results are discussed in Section 6.

5. Credit supply shock

Several factors can explain the negative relation between household leverage and future output and employment growth posited in equation (1). On the one hand, agents might expect higher future income and increase their current DTI by borrowing to purchase a home. On the other hand, an influx of foreign capital to the banking system and a relaxation of credit standards can contribute to the increase of residential lending by banks, including lending to more risky borrowers. In order to isolate the component of DTI that can be attributed to variation of credit supply,

we construct a measure of the *CS* by exploiting the loan-level information provided in the ED data set. Once we have separated the part of the leverage that is due to supply factors, we then analyze its relationship with future economic performance and evaluate its significance.[6]

We construct an instrument for household leverage that aims to directly measure the shock to credit markets that might be responsible for the variation of DTI. Identifying supply shocks using credit measures is a strategy followed by Mian et al. (2017) that use the sovereign spread of a country relative to the USA as their instrument for aggregate DTI. However, rather than using data about the country-level interest rate, we proxy the CS by measuring the difference between the observed interest rate on an individual loan and the predicted interest rate conditional on the loan and borrower characteristics. More precisely, we estimate a model of the interest rate on residential loans originated between 2000 and 2002, which we use to predict the loan's interest rate from 2003 onward. Then, we aggregate the difference between the realized and predicted interest rate at the regional level and refer to this measure as the CS, which we use to instrument household leverage. This is similar to the approach adopted by Justiniano et al. (2022) to analyze mortgage credit conditions in the USA between 2000 and 2007 and Hurst et al. (2016) to study the variation of the risk-adjusted interest rates with local economic conditions.

To construct the NUTS3 regional CS, we first estimate the following loan-level regression:

$$r_{i,g,t} = \alpha + \beta' \boldsymbol{X}_{i,g,t} + \epsilon_{i,g,t}, \tag{2}$$

where $r_{i,g,t}$ represents the interest rate on loan i in region g at time t. The vector $\boldsymbol{X}_{i,g,t}$ controls for a set of loan and borrower characteristics that include the LTV and DTI ratios, their respective squares, the logarithm of the loan amount, the logarithm of the borrower's gross income, the loan term (expressed in number of months), the interest rate type (i.e., floating, tracker, fixed for life, or fixed with periodic resets) and the LIBOR rate. In order to account for country-level heterogeneity, $\boldsymbol{X}_{i,g,t}$ also includes country dummy variables, as well as the interaction of the country dummies with LTV, LTV^2, DTI, DTI^2, income, loan term, and the interest rate type. In total we include 81 variables in the vector $\boldsymbol{X}_{i,g,t}$. We estimate equation (2) using all loans originated between 2000 and 2002 and then use the estimated parameters to predict the interest rate on loans originated from 2003 onward. The prediction error, denoted by $\hat{\epsilon}_{i,g,t}$, measures the CS for loan i, which we then average at the regional level as follows:

$$\epsilon^*_{g,t} = \frac{1}{N_{g,t}} \sum_{i=1}^{N_{g,t}} \left(r_{i,g,t} - \hat{\alpha} - \hat{\beta}' \boldsymbol{X}_{i,g,t} \right) = \frac{1}{N_{g,t}} \sum_{i=1}^{N_{g,t}} \hat{\epsilon}_{i,g,t}, \tag{3}$$

where $N_{g,t}$ is the number of loans in region g in year t, for $t \geq 2003$. If there are no shocks in the credit market after 2003, we expect the model prediction to provide an accurate pricing for the subsequent years and the average shock $\epsilon^*_{g,t}$ to be close to zero. The CS $\epsilon^*_{g,t}$ can arise both because of a demand or a supply shock that occurs in credit markets. In the presence of a credit supply expansion, lenders are willing to lend more or on cheaper terms, while a positive credit demand shock is characterized by households' willingness to borrow more or at higher interest rates. In this sense, we expect the predicted interest rate to be larger (smaller) than the observed interest rate when the economy is hit by a positive supply (demand) shock. The estimation results for equation (2) are provided in Table 6 of the Appendix. The results show that most variables are statistically significant at 5% and that the effects on the interest rate of the loan are heterogeneous across countries, in particular in the case of income, LTV, and DTI.

Fig. 2 shows the (average) predicted and realized interest rate by country and year. The predicted and realized rates are approximately at the same level in 2000–2002 by construction, whereas they tend to diverge in the following years. An example is Spain where the interest rate declined from over 5% in 2002 to 2.5% in 2005, followed by a rapid increase to 5% by 2008. However, the model in equation (2) predicts a considerably smaller reduction in the mortgage

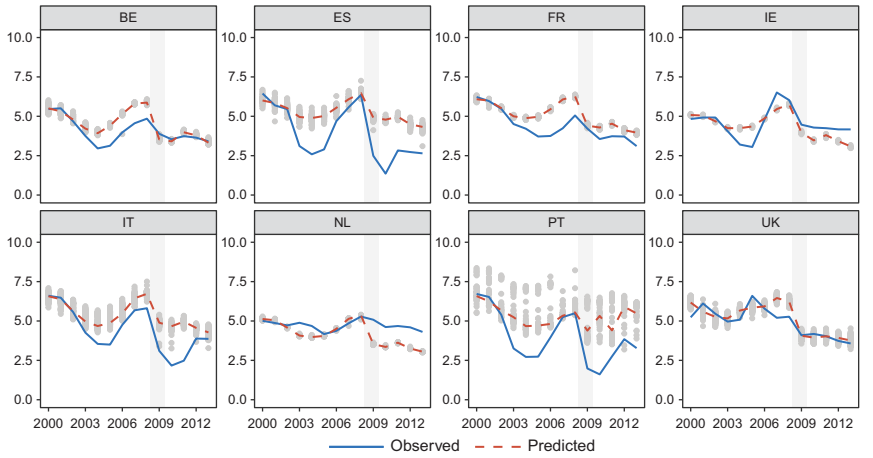

Figure 2. The predicted and observed (average) interest rate by country as in equation (2). The dots around the predicted line represent the regional predicted interest rates. The gray shadowed areas correspond to recessionary periods.

rate. This indicates that the changes in baseline interest rates and in loan and borrower characteristics did not vary enough to justify such a rapid decline in mortgage rates as documented in the Figure. This situation occurs, to different extents, also in Belgium, France, Ireland, Italy, and Portugal. The exceptions to this pattern are the Netherlands and the UK, where we obtain similar values for the predicted and realized (average) interest rates throughout the period. It is interesting to notice that the analysis by Justiniano et al. (2022) finds a similar pattern in the behavior of US mortgage rates in approximately the same period we consider. In the period following the 2008–2009 recession, the predicted rate tends to decline across all countries following the ECB decisions to lower rates from 1% in January 2009 to 0% in July 2012. In several countries, such as Italy, Portugal, and Spain, there is an indication of tightening of credit conditions with actual rates converging back toward their predicted values in the recovery between the two recessionary periods.

The model in equation (2) does not unequivocally identifies the nature of the shock since the negative value of $\epsilon^*_{g,t}$ could arise from a negative demand shock that reduces the household demand for residential mortgages, but also from a positive supply shock that increases the supply of credit. In our opinion, the evidence points in the direction of a credit supply shock as the main factor explaining the CS in Europe in the early to mid 2000s. A negative CS is consistent with the view that banks in these countries relaxed their lending standards due to the ample availability of capital. As we discussed earlier, the creation of the euro and the European Monetary Union, in addition to reforms to harmonize the financial sector, generated internal (and external) capital flows toward the capital-scarce European countries due to the elimination or currency risk and transaction costs (Blanchard and Giavazzi (2002)). While in some countries the capitals flowed to the purchase of government debt, a large portion was channeled to bank lending (in particular in Spain, Portugal, and Ireland). To evaluate more precisely this hypothesis, Fig. 3 compares the average CS in a country and its current account (as a percentage of GDP) between 2003 and 2006. The two variables are positively related suggesting that large and negative CS occurred in countries that run large current account deficits and vice versa for countries that had surpluses. This indicates that our loan-based CS measure proxies for the influx of capitals that some countries experienced in the years following the creation of the euro. The relationship in the Figure appears quite strong and supports the view of the supply nature of the CS. To further validate the nature of the credit supply shock, we consider its relationship with a measure of loan default. More specifically, for each region in our sample we calculate the default rate defined as the fraction of loans

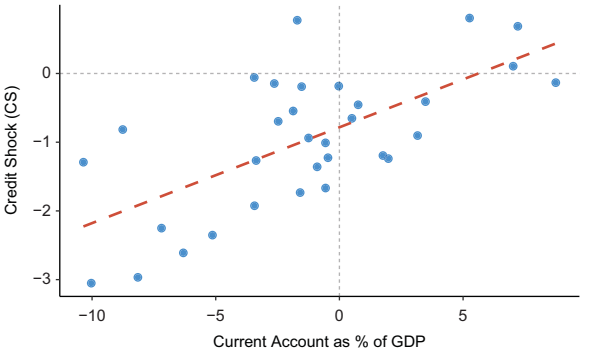

Figure 3. Scatter plot of the average credit shock (CS) in a country-year and the current account of the country for that year as a percentage of GDP. The years included in this graph are 2003–2006.

that are in arrears for more than 90 consecutive days. When averaging these two variables over the period 2000–2013, we find that the CS has a correlation coefficient of -0.45 with the default rate. This finding confirms that regions that experience large negative supply shocks are also those where the default rate has been higher relative to the other European regions.

The effect of a credit supply shock should also appear in significant changes of the distribution of borrower's characteristics after 2003.[7] The LTV ratio did not increase remarkably in most countries, except Ireland, as house prices and loan balances grew at similar rates.[8] On the other hand, the DTI increased in many countries for two reasons. The first is that high-income households borrowed more and the loan balances grew faster than their income. Second, more credit was extended to low-income household that are typically characterized by larger DTI levels. Overall, the combination of lower interest rates, longer loan terms, and higher DTI ratios seem to favor the view of a credit supply, rather than demand, shock. An alternative explanation is that financial institutions had optimistic beliefs about the housing market and thus lent to household at lower interest rates. This is certainly a possible effect which might have been triggered by the mechanism discussed earlier and reinforcing its effects. However, it seems unrealistic to be the main driver of the CS in the European case.

For all Euro area countries, the negative CS reduces significantly starting in 2006 and up to the Great Recession. We believe that an explanation for this change resides in the ECB decision to increase the marginal lending facility rate by 25 basis points to 3.25% on December 6, 2005. The interest rate increases continued until the meeting on July 9, 2008 when rates reached 5.25%, marking the end of the credit supply expansion in many European countries. Fig. 2 also reports the average predicted interest rates by region. In terms of within-country dispersion, we find that for some countries the predicted rate is quite similar across regions (see Belgium, France, Ireland, and the Netherlands), while for other countries there is a significant dispersion among regions.

Additional evidence on the supply nature of the shock is provided in Fig. 4 that shows the change in house prices and DTI (relative to year 2000) for regions in the first and last quartile of the CS in that year.[9] An interesting finding is that regions that experience in a certain year a negative $\epsilon^*_{g,t}$ (i.e., a credit supply expansion) are more likely to experience a larger increase in house prices and in household leverage relative to regions with positive shocks. In particular, the low CS group endured a rapid increase in leverage between 2000 and 2006, followed by a steep decline that, by 2013, had brought leverage back to its 2000-level. Instead, for the high-CS group, DTI started to increase after 2004 and declined moderately between 2011 and 2013.

In terms of house prices, while in the early 2000s both low and high-CS regions experienced a similar increase in house prices, they grew more rapidly starting from 2003 in the low group, while the price growth flattened out in high-CS regions. By 2013 house prices had increased by a similar

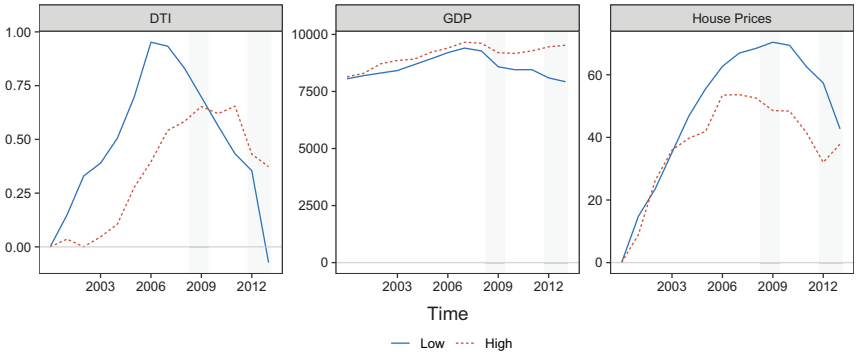

Figure 4. Change (relative to year 2000) of DTI and percentage growth of real GDP (in Euro) and house prices for the top and bottom quartiles of the distribution of the credit shock. The bottom quartile is denoted as *Low* and the top quartile is defined as *high*.

amount in both low- and high-CS regions. This evidence supports the view that an aggregate CS in Europe boosted household leverage and house prices, although with a different effect across regions. Fig. 4 also reports the median GDP level for the low- and high-CSs group which shows no relevant differences between the two groups until the first recessionary period and started diverging afterward as the low CS regions experienced a deeper decline in output relative to high-CS regions.

We adopt the proposed CS measure as an instrument to identify the component of household leverage, at the regional level, that can be attributed to credit supply shocks. This component of household leverage is then used as a predictor of future output and employment. In particular, we employ the average regional CS between 2003 and 2006, denoted by $\epsilon^*_{g,2003-2006}$, as an instrument for the average DTI ratio between 2002 and 2007 and denote this quantity by $DTI_{g,2002-07}$.

6. Regression results

Table 2 shows the results of the first-stage estimation of equation (1) when considering the CS as an instrument for household leverage between 2002–2007. The estimate of the CS coefficient is negative and indicates that, on average, large negative (positive) CS are expected to be associated with large (small) values of leverage, as measured by DTI. The negative sign of the coefficient is consistent with the credit supply hypothesis in the sense it predicts that the regions with larger DTI are those that experienced larger declines in interest rates (relative to the model's prediction). Specifically, a 1 percentage point[10] decline in the CS is associated with an average increase of the household leverage ratio by 1.484 points, *ceteris paribus*. The coefficients associated to the control variables (not shown in the Table), $\mathbf{W}_{g,2000-03}$ in equation (1), show comparable significant effects which give us some confidence to interpret the IV estimates.

Table 3 reports the OLS and two-stage least-square estimation results of equation (1). As outcome variables we consider the growth rate of GDP and several definitions of employment (total, manufacturing, and non-tradable) over the period 2008–2011 and 2008–2013. If we instrument the DTI in 2002–2007 using the CS, the expected effect of a point increase in household leverage decreases regional GDP growth by, on average, 0.6% at the 3-year horizon and 2.2% at the 5-year horizon. In addition, the effect of a point increase of leverage is associated to a decline of total employment of 2.8% and 4.7% at the 3- and 5-year horizons, respectively. When we consider separately manufacturing and non-tradable employment, our results suggest that leverage has a significantly larger effect on the former. Manufacturing employment declines by 4.1% and 7% at

Table 2. Estimation results of the first-stage regression in equation (1) for $DTI_{2002-2007}$ using the credit shock (CS) as the instrumental variable. Additional variables included in the regression are: public debt/GDP, share of manufacturing employment, share of non-tradable employment, population density, and an urban area dummy variable. Statistical significance is denoted by * at 10%, ** at 5%, and *** at 1%

Dependent variable: $DTI_{2002-2007}$	Estimate	SE
CS	−1.484***	0.061
Observations	490	
R^2	0.615	
F Statistic	128.521***	

Table 3. OLS and IV estimation results of the coefficient of $DTI_{g,2002-2007}$ in equation (1). The dependent variable $\Delta_h y_{g,2008+h}$ represents the (log) change of GDP, total, manufacturing, and non-tradable employment at the 3- and 5-year horizon. Statistical significance is denoted by * at 10%, ** at 5%, and *** at 1%

	GDP	Total employment	Manufacturing employment	Non-tradable employment
			2008–2011	
OLS	−0.011***	−0.028***	−0.036***	−0.016***
	(0.002)	(0.001)	(0.003)	(0.002)
IV (CS)	−0.006***	−0.028***	−0.041***	−0.015***
	(0.002)	(0.002)	(0.004)	(0.002)
R^2	0.119	0.529	0.287	0.208
			2008–2013	
OLS	−0.029***	−0.046***	−0.064***	−0.031***
	(0.002)	(0.002)	(0.003)	(0.002)
IV (CS)	−0.022***	−0.047***	−0.070***	−0.035***
	(0.003)	(0.003)	(0.004)	(0.003)
n	490	490	490	490
R^2	0.437	0.595	0.464	0.319

the two horizons considered, relative to a decline of non-tradable employment by 1.5% and 3.5%, respectively.

The finding that the credit supply-driven leverage has a larger impact on manufacturing relative to non-tradable employment is in contrast with the conclusion of Mian et al. (2013) for the USA, where the non-tradable sector is more sensitive to declines in local demand. A possible explanation is that banks reduced overall lending in response to losses on household loans during the financial crisis. This generalized contraction in lending affected, in particular, the manufacturing sector with the effect of reducing its employment significantly more relative to the non-tradable sector.

The first recessionary period in Europe was a synchronized contraction of output and employment that affected all countries in our sample, irrespective of the accumulation of household leverage in the previous years. However, the second recession developed quite differently since it affected mostly the regions and countries in which DTI had increased the most. The different nature of the two recessions contributes to explain the larger coefficient estimates that we find for the 2008–2013 relative to 2008–2011 period across all variables, and in particular for real GDP.

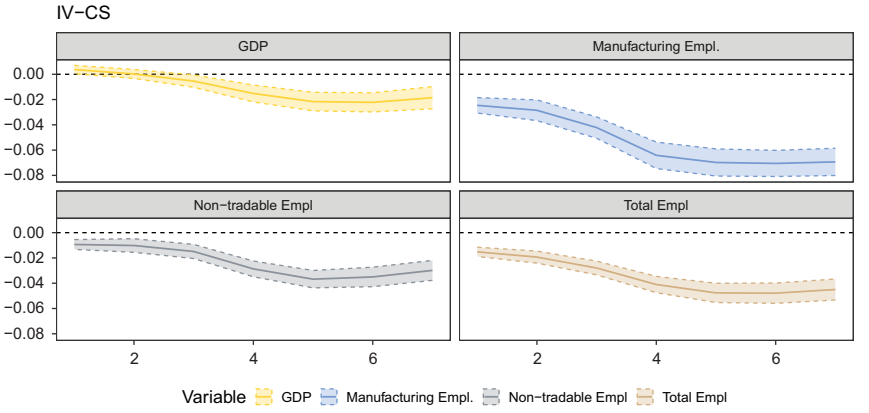

Figure 5. Impulse response function (IRF) with 95% (bootstrap) confidence bands of output and employment indicators to DTI using the IV estimation; the x-axis represents the horizon $h = 1, \ldots, 8$ and the y-axis represents the coefficient estimate in equation (1).

To get further insights on the estimated effects, one can interpret equation (1) in the spirit of the local projection approach of Jordà (2005). By estimating the model at different horizons h, we can obtain the impulse response function (IRF) for the effect of a unit change in $DTI_{2002-2007}$ on the outcome variable. Fig. 5 shows the IRF when the model is estimated by IV at horizons $h = 1, \ldots, 8$. The graph shows the increasingly negative effect of household leverage on output and employment as the horizon increases. The estimates are between 0 and -3% at the short horizons that include only the first recession, while they more than double as the horizon expands to include the second recessionary period.

6.1 Analysis by income group

The aggregate analysis discussed so far hides the fact that the credit supply shock might have had different effects based on the income level of the borrower. In this section, we look at the role of income, which is a key factor to determine the borrower's quality and her ability to repay the loan.

We divide our data set into two household income groups: the high-income group is composed of households in the top 25% of the income distribution (per region-year), while the low-income group represents the bottom 25% of the distribution. The top graph of Fig. 6 shows the growth (relative to year 2002) in the total debt by income group, region (denoted by dots), and origination year. The graph shows that in the years between 2002 and 2006 all countries, except France and Portugal, experienced a significant increase of loan origination by the low-income group at the same time that the share of origination by the high-income group declined.[11] Another interesting fact is provided by the bottom graph of Fig. 6 that shows the change in DTI (relative to year 2002) for the two income groups. For Belgium, Spain, Ireland, and Italy, we find that low-income households increased significantly their leverage in the pre-crisis period relative to high-income households that experienced only modest or no increases. These countries also experienced a rapid deleveraging phase after the ECB tightened credit conditions in 2006 and 2007. For the remaining countries, the results show that leverage increased similarly for the two groups.

What was the effect of these credit conditions on house prices? The top graph of Fig. 7 shows the percentage growth of house prices (relative to 2002) for the low- and high-income groups and across regions. For regions in Belgium, Spain, Italy, and the UK, the graphs show that house prices increased significantly for both income groups, although at a faster rate for the first income quartile. Only in the case of Portugal the evidence suggests a faster increase of house prices for

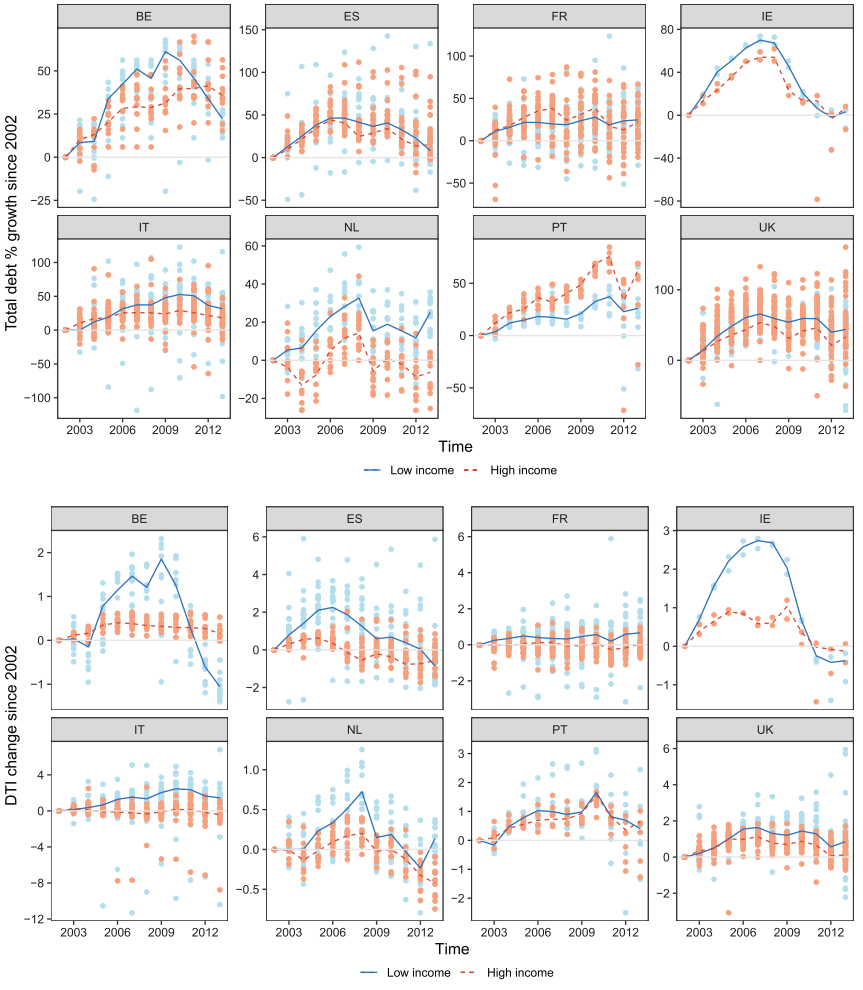

Figure 6. Percentage growth (relative to 2002) of the total debt owned by the bottom and top income quartiles (top) and change in DTI for the same groups (bottom) in the 2002–2013 period. The dots around the lines represent the regional individual observations: low-income households are reported in blue, high-income households in red.

the high-income households. Overall, these results suggest that the availability of capital to the banking system was channeled to expand loan origination to all income groups, although it had the largest effect on increasing leverage and house prices for the low-income households in most European countries. Looking at the variation in the mortgage interest rate in the bottom graph of Fig. 7, the drop observed in the years between 2003 and 2006 was generalized across income groups, although there are some differences. In most countries, except Belgium and Portugal, the average interest rate paid by the high-income households is lower relative to the low-income group. This evidence indicates that, while the CS had the effect of significantly increasing lending and leverage of the low-income households, it also encouraged more borrowing by high-income households through attractive loan terms, in particular the interest rate on the loan.

Motivated by this descriptive analysis we next construct measures of the CS and DTI based on quartiles of the income distribution in the region. Fig. 8 shows the average CS for the bottom and top income quartile in each country together with the regional values by income group. The earlier finding that the high-income borrowers experienced (relatively) lower interest rates on their

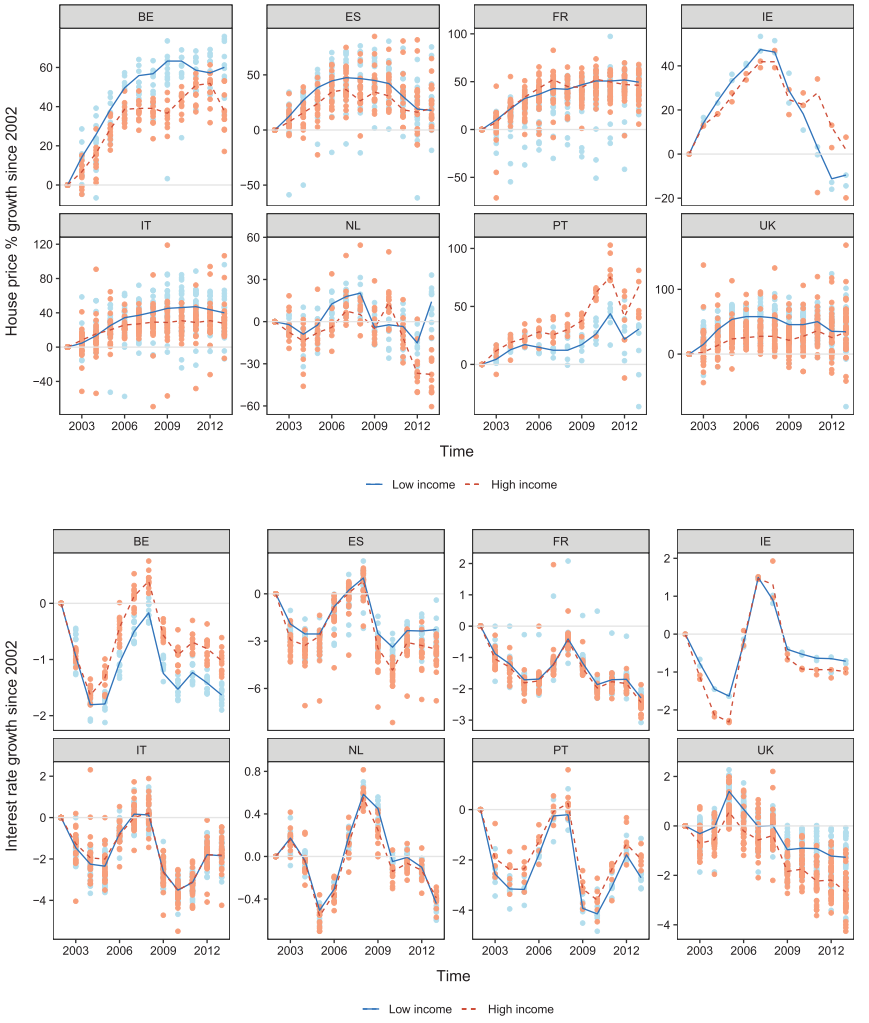

Figure 7. Percentage growth (relative to 2002) of the average house price for the bottom and top income quartiles (top) and change in interest rate for the same groups (bottom) in the 2002–2013 period. The dots around the lines represent the regional observations: low-income households are reported in blue, high-income households in red.

loans means that the group has experienced a smaller CS. This is clear from the Figure, in particular for Spain, Ireland, and the UK.[12] This confirm that the CS operated via two main channels. Banks increased lending to low-income households relative to earlier years which contributed to a significant increase of leverage and house prices. On the other hand, they also increased lending to medium- and high-income households through low interest rates. Although leverage for this group of borrowers did not increase significantly, there was an effect on house prices.

In Table 4, we provide estimation results for equation (1) using the DTI and CS variables constructed based on four income quartiles. In the first stage, we regress the DTI of an income group on the CS for that group (plus controls as in the earlier application). We then use the predicted DTI for the income group to forecast regional GDP growth and the employment change during the 2008–2011 and 2008–2013 period. The first-stage results reported in the Table show that the effect of the CS on household leverage was larger for low-income households relative to high-income ones. In particular, the findings indicate that we expect an average increase of DTI by

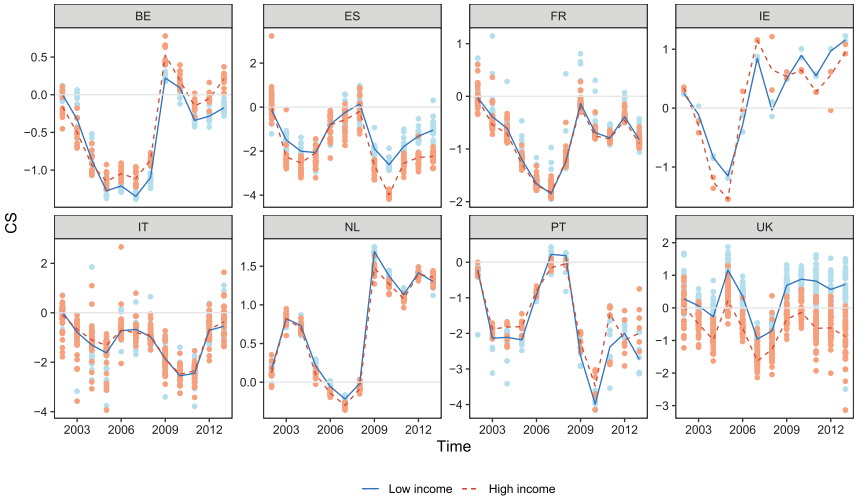

Figure 8. The graphs show the average CS by country for the bottom and top quartile households. The dots around the lines represent the regional individual observations: low-income households are reported in blue, high-income households in red.

0.827 points for a percentage point decline in CS, while at the top income quantile the effect is only 0.256. In addition, the coefficient estimate declines significantly, with the effect at the highest quartile representing about a third of the effect at the lowest quartile. Although the credit supply shock contributed to the increase of leverage at all income levels, it had a relatively larger effect on the low-income households. This is consistent with the earlier discussion of the distributional differences of DTI for these two groups. While DTI increased only marginally for the high-income group during the period 2002–2007, it expanded significantly in many regions for the low-income group as shown in Fig. 6. The larger (in absolute value) slope of the first-stage regression captures the fact that a 1% decline in CS is associated to a larger increase in DTI for the low-income group relative to the high-income households.

The results for the second stage also show significant differences across income groups. For both horizons and all variables, we find that the decline in output and employment post-2008 occurs more rapidly in response to the increase in leverage of the high-income households relative to the low-income households. We believe this effect is related to the characteristic of the high-income borrowers experiencing a larger (negative) CS and a moderate increase of leverage (relative to the low-income borrowers) which requires a larger multiplier to produce a significant decline in output and employment. Overall, we find that the distributional properties of the CS and DTI, in particular, play an important role in explaining the impact and the heterogeneity of the CS and DTI on the outcome variables.[13]

7. Concluding remarks

There is substantial evidence for the USA that household debt plays an important role in intensifying business cycle fluctuations (see Mian and Sufi (2010), among many others). In this paper, we provide evidence that this mechanism was also a determining factor in the double-dip recession that occurred in Europe between 2008 and 2013. We exploit a novel loan-level data set of residential mortgages in 8 European countries to proxy household debt levels from 2000 to 2013 at the NUTS3 regional level: in particular, we are interested in estimating whether the household leverage levels before the Great Recession can explain the severity of the subsequent economic

Table 4. IV estimation using the 2003 regional credit shock for different income groups of borrowers as instrument for 2002–2007 DTI. The first column provides the estimation results for the first-stage regression while the remaining columns indicate the dependent variable. Statistical significance is denoted by * at 10%, ** at 5%, and *** at 1%

Income quartile	First stage	GDP	Total employment	Manufacturing employment	Non-tradable employment
			2008-2011		
1st	−0.827***	−0.011***	−0.050***	−0.070***	−0.026***
	(0.048)	(0.004)	(0.004)	(0.008)	(0.005)
2nd	−0.715***	−0.010*	−0.055***	−0.081***	−0.029***
	(0.046)	(0.005)	(0.005)	(0.009)	(0.005)
3rd	−0.579***	−0.012**	−0.066***	−0.098***	−0.035***
	(0.045)	(0.005)	(0.006)	(0.010)	(0.006)
4th	−0.256***	−0.046***	−0.165***	−0.241***	−0.096***
	(0.041)	(0.012)	(0.025)	(0.039)	(0.019)
			2008–2013		
1st		−0.041***	−0.088***	−0.125***	−0.064***
		(0.006)	(0.007)	(0.010)	(0.007)
2nd		−0.043***	−0.094***	−0.136***	−0.070***
		(0.006)	(0.007)	(0.011)	(0.008)
3rd		−0.051***	−0.115***	−0.167***	−0.086***
		(0.008)	(0.010)	(0.014)	(0.010)
4th		−0.139***	−0.277***	−0.414***	−0.210***
		(0.025)	(0.044)	(0.063)	(0.038)

slowdown. For all regions in our data set, we propose an instrument for household leverage represented by the CS, based on a loan-level model of interest rates.

Our findings confirm that the European regions where household leverage increased relatively more in the first half of the 2000s were also the regions that were more affected by the subsequent decline in economic activity. We estimate that a point increase in the DTI ratio in the pre-recessionary period predicts a decline by 2.2% of regional GDP between 2008 and 2013 and even larger effects on the employment measures. These estimates indicate the potentially large effects on the local economic activity of excessive household debt. We believe that the most likely explanation for the significant increase in household leverage are supply-side factors, also referred to as *credit supply* shock. In the early 2000s, most European countries experienced a decline in mortgage rates driven by the post-euro convergence of rates across Europe. This created capital flows from capital-abundant regions toward other regions that, coupled with the liberalization of financial markets, sparked rapid increases in house prices and in household leverage, in particular for households in the lowest quartiles of the income distribution. The housing market played a major role in this mechanism by transmitting the credit supply shocks from the financial sector to the real economy through households balance sheets. In addition, we find that the credit supply shock had a stronger impact on low- and middle-income borrowers that increased significantly their leverage before the crisis, although the decline in regional economic activity seems to have responded more markedly to the increase of credit supply leverage by high-income households.

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Notes

1 The NUTS3 level corresponds to a highly granular standardized representation of European regions. More information is available at https://ec.europa.eu/eurostat/web/nuts/background.
2 More details at https://www.ecb.europa.eu/paym/coll/loanlevel/html/index.en.html.
3 The set of countries included in the analysis was dictated by data availability in ED. For some countries, such as Belgium, Spain, France, Ireland, Italy, the Netherlands, Portugal, and the UK, we have large samples of loans in each region. However, for Germany and the Scandinavian countries, the data availability is significantly reduced with some regions in these countries with no loans.
4 For more information see https://urban.jrc.ec.europa.eu/#/en/download.
5 These are sectors G and I according to the NACE Rev.2 classification.
6 In Appendix C we follow the strategy proposed by Mian et al. (2013) of using the housing supply elasticity (Saiz (2010)) to proxy for credit supply variations. We construct the measure for the European regions in our sample and discuss the several limitations of the approach.
7 See Appendix D for a detailed discussion.
8 Adelino et al. (2020) provides evidence for the USA that the distribution of LTV did not significantly change between 1996 and 2015, although the private sector substituted government agencies in the origination of high LTV loans.
9 Since we form the quartiles at the annual frequency, the regions included in each quartile might be different over time.
10 A percentage point change corresponds to slightly more than the 0.92 estimated standard deviation of the CS.
11 While the share of origination of the high-income group declined (relative to the low-income group) it is still the case that the share of loans is significantly larger. Between 2003 and 2007, loan origination by the low-income group amounted to 37.7 billion euro in our sample while lending to household in the highest income quartile reached 64.9 billion euro across all European regions.
12 We also calculated the credit shock spread for the high-income relative to the low-income households in the same region, that is, $\epsilon^*_{g,t,high} - \epsilon^*_{g,t,low}$. Considering the period between 2003 and 2006, we find that the average spread is -0.11% and for 65.96% of the regions the CS is smaller for the high-income relative to low-income households.
13 This result seems to be consistent with the findings of Adelino et al. (2016) for the USA. They identify a sharp increase in delinquencies for high-income borrowers during the crisis relative to earlier years. While we do not have information on the default of these borrowers, we observe that their increase in debt is strongly associated to the regional economic slump.

References

Adelino, M., A. Schoar and F. Severino (2016) Loan originations and defaults in the mortgage crisis: The role of the middle class. *The Review of Financial Studies* 29(7), 1635–1670.
Adelino, M., W. B. McCartney and A. Schoar (2020) The role of government and private institutions in credit cycles in the us mortgage market. Tech. rep., National Bureau of Economic Research.
Alter, A., A. X. Feng and N. Valckx (2018) Understanding the macro-financial effects of household debt: A global perspective. International Monetary Fund.
Ampudia, M., H. van Vlokhoven and D. Żochowski (2016) Financial fragility of euro area households. *Journal of Financial Stability* 27, 250–262.
Andersen, A. L., C. Duus and T. L. Jensen (2016) Household debt and spending during the financial crisis: Evidence from danish micro data. *European Economic Review* 89, 96–115.
Bentolila, S., M. Jansen and G. Jiménez (2018) When credit dries up: Job losses in the great recession. *Journal of the European Economic Association* 16(3), 650–695.
Blanchard, O. and F. Giavazzi (2002) Current account deficits in the euro area: The end of the Feldstein-Horioka puzzle? *Brookings Papers on Economic Activity* 2(2), 147–186.
Bordalo, P., N. Gennaioli, A. Shleifer and S. J. Terry (2021). Real credit cycles. Tech. rep., National Bureau of Economic Research.
Cecchetti, S. G., M. S. Mohanty and F. Zampolli (2011). The real effects of debt. BIS Working Paper: No. 352.
Crescenzi, D., D. Luca and S. Milio (2016) The geography of the economic crisis in Europe: National macroeconomic conditions, regional structural factors and short-term economic performance. *Cambridge Journal of Regions, Economy and Society* 9(1), 13–32.
Davidoff, T. (2016) Supply constraints are not valid instrumental variables for home prices because they are correlated with many demand factors. *Critical Finance Review* 5(2), 177–206.

Dijkstra, L., E. Garcilazo and P. McCann (2015) The effects of the global financial crisis on European regions and cities. *Journal of Economic Geography* 15(5), 935–949.
Ferreira, F. V. and J. E. Gyourko (2015). A new look at the US foreclosure crisis: Panel data evidence of prime and subprime borrowers from 1997 to 2012. NBER Working Paper.
Finance, E. H. and C. Network (2013) The Eurosystem household finance and consumption survey, results from the first wave. Tech. rep.
Gambetti, L. and A. Musso (2017) Loan supply shocks and the business cycle. *Journal of Applied Econometrics* 32(4), 764–782.
Gaudêncio, J., A. Mazany and C. Schwarz (2019) The impact of lending standards on default rates of residential real-estate loans. ECB Occasional Paper.
Hurst, E., B. J. Keys, A. Seru and J. Vavra (2016) Regional redistribution through the US mortgage market. *American Economic Review* 106(10), 2982–3028.
Jappelli, T., M. Pagano and M. Di Maggio (2013) Households' indebtedness and financial fragility. *Journal of Financial Management, Markets and Institutions* 1(1), 23–46.
Jordà, Ò. (2005) Estimation and inference of impulse responses by local projections. *American Economic Review* 95(1), 161–182.
Jordà, Ò., M. Schularick and A. M. Taylor (2015) Betting the house. *Journal of International Economics* 96, S2–S18.
Justiniano, A., G. E. Primiceri and A. Tambalotti (2022) The mortgage rate conundrum. *Journal of Political Economy* 130(1), 121–156.
Lane, P. and B. Pels (2012). Current account imbalances in europe. Institute for International Integration Studies Discussion Paper Series.
Lane, P. R. and G. M. Milesi-Ferretti (2011) The cross-country incidence of the global crisis. *IMF Economic Review* 59(1), 77–110.
Lane, P. R. and G. M. Milesi-Ferretti (2012) External adjustment and the global crisis. *Journal of International Economics* 88(2), 252–265.
Maddaloni, A. and J.-L. Peydró (2011) Bank risk-taking, securitization, supervision, and low interest rates: Evidence from the euro-area and the US lending standards. *Review of Financial Studies* 24(6), 2121–2165.
Mian, A. and A. Sufi (2010) Household leverage and the recession of 2007-09. *IMF Economic Review* 58(1), 74–117.
Mian, A. and A. Sufi (2014) What explains the 2007-2009 drop in employment? *Econometrica* 82(6), 2197–2223.
Mian, A. and A. Sufi (2017) Fraudulent income overstatement on mortgage applications during the credit expansion of 2002 to 2005. *The Review of Financial Studies* 30(6), 1832–1864.
Mian, A., A. Sufi and E. Verner (2017) Household debt and business cycles worldwide. *The Quarterly Journal of Economics* 132(4), 1755–1817.
Mian, A., K. Rao and A. Sufi (2013) Household balance sheets, consumption, and the economic slump. *The Quarterly Journal of Economics* 128(4), 1687–1726.
Mitze, T. (2019) The migration response to local labour market shocks: Evidence from EU regions during the global economic crisis. *Oxford Bulletin of Economics and Statistics* 81(2), 271–298.
Saiz, A. (2010) The geographic determinants of housing supply. *The Quarterly Journal of Economics* 125(3), 1253–1296.
Vermeulen, W. and J. Rouwendal (2007). Housing supply and land use regulation in the Netherlands.
Voigtländer, M. (2009) Why is the German homeownership rate so low? *Housing Studies* 24(3), 355–372.

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