Debt Shift, Financial Development and Income Inequality in Europe

Bezemer, Dirk; Samarina, Anna

university of groningen

faculty of economics and business

16020-GEM

Debt Shift, Financial Development and Income Inequality in Europe

Dirk Bezemer
Anna Samarina

SOM is the research institute of the Faculty of Economics & Business at the University of Groningen. SOM has six programmes:
- Economics, Econometrics and Finance
- Global Economics & Management
- Human Resource Management & Organizational Behaviour
- Innovation & Organization
- Marketing
- Operations Management & Operations Research

Research Institute SOM
Faculty of Economics & Business
University of Groningen

Visiting address:
Nettelbosje 2
9747 AE Groningen
The Netherlands

Postal address:
P.O. Box 800
9700 AV Groningen
The Netherlands

T +31 50 363 9090/3815

www.rug.nl/feb/research

Debt Shift, Financial Development and Income Inequality in Europe

Dirk Bezemer
University of Groningen, Faculty of Economics and Business, Department of Global Economics and Management
d.j.bezemer@rug.nl

Anna Samarina
University of Groningen, Faculty of Economics and Business, Department of Global Economics and Management

Debt Shift, Financial Development and Income Inequality in Europe

Dirk Bezemer* Anna Samarina

University of Groningen

This version: October 5, 2016

Abstract

Does financial development increase income inequality? Ambiguous answers to this question to date may be due to over-aggregation. In data over 1990–2012 for 26 EU economies, we study the effects on income inequality of different components of financial development. We find that bank credit to real estate and financial asset markets, which increases the wage share of the Finance, Insurance and Real Estate (FIRE) sector, increases income inequality. Credit to non-financial business and for household consumption supports broader income formation, decreasing income inequality. There was a large shift of bank credit allocation since the 1990s, away from supporting investments by non-financial firms and towards financing capital gains in real estate and financial asset markets. Combined with our new findings, this 'debt shift' helps to understand the growth of inequality.

Keywords: income inequality, financial development, debt shift, Europe

JEL Classification: E51, G21, I30

*Corresponding author: Faculty of Economics and Business, University of Groningen, PO Box 800, 9700 AV Groningen, The Netherlands. Email: d.j.bezemer@rug.nl.

1 Introduction

Since the late 1980s, levels of income inequality have risen substantially in most OECD countries (Piketty, 2014; OECD, 2015; Milanovic, 2016). After the 2008 crisis, research attention to a possible connection with the growth of finance has increased. Does financial development increase income inequality? In this paper we show that the answer depends on the kind of financial development. We adopt bank credit as a measure for financial development, and find that credit to real estate and financial asset markets increases income inequality, but credit to non-financial business and household consumer credit decrease income inequality. This finding helps to explain the rise in income inequality in recent decades: since the 1990s, bank credit allocation has shifted away from non-financial business and towards real estate and financial asset markets.

We construct measures for two components of financial development for 26 EU economies from 1990 (or 1995) to 2010 and 2012 (depending on the inequality measure we use) and report results with and without the post-2007 crisis years. By using such recent data we account for the changing relation between finance and inequality since the 1990s due to structural changes such as the funding innovations, bank internationalization, the credit boom of the early 2000s and the 2007 crisis and its aftermath.

In panel fixed-effects regressions, we analyze impacts on different measures for income inequality. While we see no significant effects of a total-credit measure of financial development on Gini income inequality, once we distinguish between the two types of credit, we observe robust, opposite effects. Bank credit to the business and consumer sector decreases income inequality, while credit to real estate and financial asset market increases income inequality. These results suggest that debt shift matters to the explanation of income inequality trends in Europe. We argue that this is due to capital gains and the growth of income in the finance, insurance and real estate (FIRE) sector that accompanies capital gains. The shift in the allocation of bank debt ('debt shift', for short) increased FIRE-sector incomes relative to other incomes, pushing up income inequality.

The new findings add to a literature which is still scant. The finance-inequality nexus is 'under-investigated' (Gimet and Lagoarde-Segot, 2011, p.1698) and this is especially true for developed economies; in particular, Bertola (2010) notes that there is little research on inequality issues in the European Economic and Monetary Union. By studying EU economies, we remove some of the heterogeneity in other studies, which may hide significant relations within clusters of economies. Another feature of our paper is that we observe different impacts on total-income Gini coefficients and on Theil indices for pay inequality, which are sensitive to regionally concentrated income dynamics related to real estate capital gains and financial-sector development. By varying factors that condition the finance-inequality nexus — wage shares and housing markets, trade and investment — we are able to shed some light on the conditional relation between financial development and inequality. We find that the effect of lending to non-financial business is weaker in labor markets that already foster more equality, with stronger trade unions or higher wage shares. It is also weaker in economies which are more open, and in which investment constraints are smaller . We also find evidence on regional effects: in economies where the FIRE sector's value-added share is larger, or where real house prices are higher, lending to real estate and financial markets increases regional pay inequality more.

There are differences between pre-crisis and post-crisis effects. Growth in bank credit to non-financial business clearly reduced total-income inequality in the full sample and weakly in a sample excluding the crisis years. Growth in credit to the FIRE sector increased income inequality in both time samples, but the pre-crisis coefficient is double the size of the coefficient for the sample including the crisis years. Again, these differences are not observed for a total-credit measure of financial development.

The paper is structured as follows. In the next section, we discuss how shifts in the allocation of bank credit may change the relation between connecting financial development and income inequality. In section 3 we present the data and variables. In sections 4 and 5 we discuss the methodology and present our findings, respectively.

Section 6 concludes with a summary and discussion of this paper's limitations and further work.

2 Debt Shift and the Finance-Inequality Nexus

The impact of financial development on inequality is theoretically ambiguous. Financial development may ameliorate income inequality due to decreasing barriers to investment and risk insurance for the poor, and increasing returns (Greenwood and Jovanovic, 1990; Galor and Zeira, 1993; Banerjee and Newman, 1993). This was empirically borne out in studies using data on developing countries since the 1960s (Clarke et al., 2006; Beck et al., 2007). Beck et al. (2007, p.27) report that "financial development disproportionately boosts incomes of the poorest quintile and reduces income inequality". Other measures than credit volumes yield similar results. Mookerjee and Kalipioni (2010) find in a sample of developed and developing countries that greater access to bank branches robustly reduces income inequality, while barriers to bank access significantly increase income inequality.

Results for advanced economies are mixed.[1] Beck et al. (2007) report that financial development reduced inequality in the U.S. But Van Arnum and Naples (2013) find that the growth of the U.S. financial sector has contributed to the exacerbation of inequality in recent decades. Likewise, Denk and Cournéde (2015) find that financial expansion has held back income growth of low- and middle-income households in OECD economies.

One reason for these mixed findings may be that 'total credit to the private sector' is often used as the proxy measure for financial development. The composition of the stock of bank credit has, however, changed dramatically in recent decades. Bezemer et al. (2016) report that the large rise in total bank debt in a balanced panel of 14 countries from 1990 to 2011 was mainly due to the growth in credit to real estate and

[1] See Demirgüc-Kunt and Levine (2009) for a survey of literature on financial development and inequality.

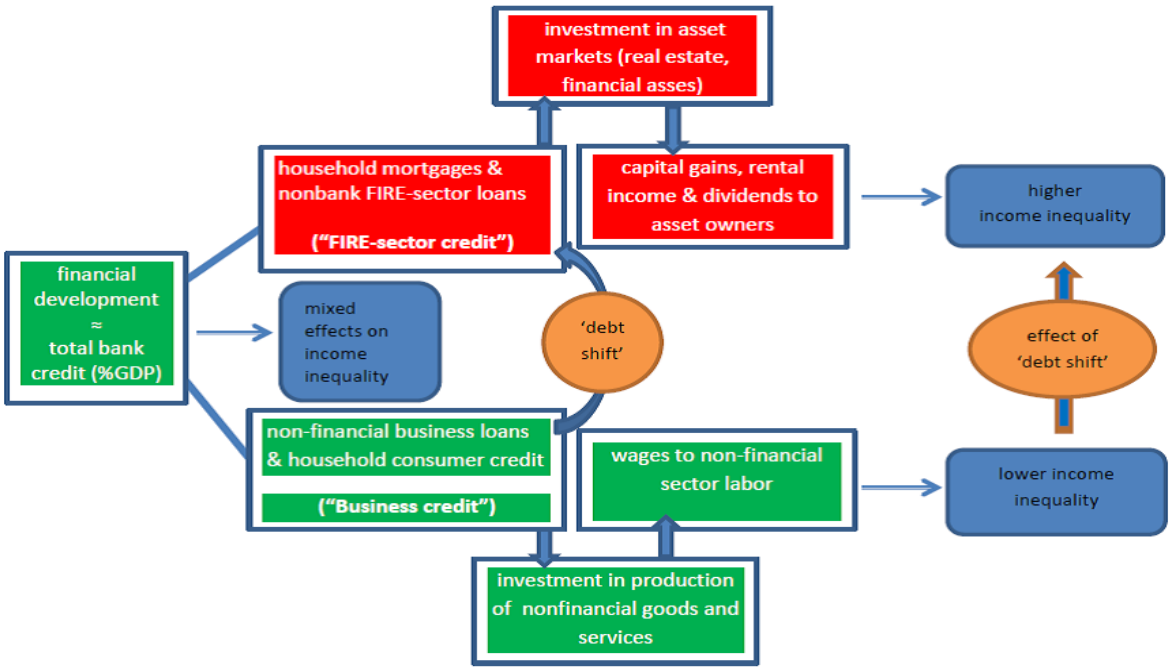
financial asset markets, from 30% to 66% of GDP on average. In the same sample, bank credit to non-financial business was about stable, from 41% of GDP in 1995 to 46% of GDP in 2008. Similarly, Jorda et al. (2016) report an increase from 30% to 60% in household mortgage credit as share of GDP since 1900 in a sample of 17 countries, with most of that increase since the 1980s.

The 'sea change' in the composition (rather than only the level) of bank credit has so far not registered in the inequality literature. Yet it should matter to the theoretical channels from financial development to inequality. The traditional arguments for inequality-decreasing effects of financial development include decreasing investment barriers and risk, with increasing opportunities for consumption smoothing. These arguments are relevant to non-financial business loans and consumer credit. Credit supporting investment and demand in the real sector has the potential to generate employment and higher wages and thereby a more equal income distribution. There are important qualifiers to this effect, including labor market institutions, the economy's wage share, industrial structure, and degree of openness. But given the right conditions in each of these areas, real-sector investment supported by domestic financial development can be a powerful income equalizer.

For credit to asset markets, another set of arguments comes into play, which rationalizes inequality-increasing effects of financial development. Piketty (2014) identifies redistribution between wage earners and owners of capital as a key reason for rising income inequality — where 'capital' includes real estate and financial assets. Bank credit to real estate markets drives up house prices (Favara and Imbs, 2015) and generate capital gains. Capital gains due to rising prices of bonds, stocks and real estate will increase incomes in the forms of dividends, interest, rental incomes, and financial fees in the Finance, Insurance and Real Estate (FIRE) sector, where incomes are typically already high. This is why credit to asset markets tends to increase income inequality.

Indeed the 'Great Mortgaging' (Jorda et al., 2016) after the 1980s was a time of large income growth for the FIRE-sector, which expanded rapidly (Greenwood and Scharf-

Figure 1: **Debt shift and its impact on income inequality**



stein, 2013). For 26 EU economies analyzed in the present paper, the value-added share of the FIRE sector doubled or tripled between 1990 and 2012. One of the causes of the growth in FIRE-sector income shares was the shift in the allocation of bank debt towards real estate and financial asset markets — which we labeled 'debt shift'. And one of the consequences of debt shift, we argue, was increased income inequality. Figure 1 illustrates debt shift and its impact on income inequality.

In the interest of brevity, from here on we will label mortgages and loans to financial business jointly as *FIRECredit* and bank credit to non-financial business and for household consumption will be denoted *BusinessCredit* (a more accurate, but also more cumbersome name would be 'credit supporting demand and investment in goods-and-non-financial-services markets'). We choose this delineation as a proxy distinction between financial-development effects that run through markets for goods and services, as distinct from financial-development effects that run through asset markets. On the one hand, consumer credit supports demand for goods and services provided by non-

financial businesses, and loans to non-financial business mainly (but not exclusively) support their supply. On the other hand, household mortgages and loans to financial business mainly (but not exclusively) support demand for real estate and financial assets, respectively. The production and sale of goods and services – directly linked to wage formation for most of the labor force — has very different effects on income distribution than do rising prices in real estate and financial markets, which generates capital gains, dividends, interest income and rental income for owners of real estate and financial assets. Some of these incomes flow to homeowner households. But on average income from assets falls disproportionately to the high-income population segments working in the FIRE-sector, in contrast to the more widely distributed wages generated in goods and services markets. Adam and Tzamourani (2015) study effects on wealth (not income) inequality. They note that in the euro area, equity price capital gains are concentrated among the households at the top end of the wealth distribution and house price gains benefit the median households (except in Germany which has a low ownership rate). We conjecture that similar distributional effects may hold for income. Mortgages are less available to lower-income, more credit-constrained households. Indeed Denk and Cazenave-Lacroutz (2015) find that in most EMU countries, credit to households (mostly mortgages) is more unequally distributed than household disposable income: the top 40% of households hold 65% of households credit, while the top 20% hold 40%. Since credit shares rise along income distribution, reducing household credit would lower inequality.

Because of the different channels between credit and income inequality, credit supporting the FIRE sector will have different impacts than credit supporting non-financial business investment and consumer demand. For research purposes, it is then problematic to lump these credit categories together in one credit-to-GDP measure of financial development, without distinction between credit types. This is likely to yield mixed findings on the finance-inequality nexus. Depending on the extent of 'debt shift' (the shift in credit allocation towards supporting FIRE-sector incomes), the finance-

inequality nexus could be either positive or negative. In cross-country regression analysis, these opposing effects could well cancel out so that the average effect is small and statistically insignificant. But underneath the aggregate, the two credit categories we distinguish in this paper may have significant, but opposite effects on income inequality. To test these effects is the aim of this paper. Disaggregating total bank credit into two credit types is a prerequisite to better observe the impact of financial development on income inequality.

There is some, but not much research supporting this approach to the finance-inequality nexus. Kus (2012) examines variables related to capital gains (e.g. stock market valuations). Controlling for labor market institutions, unemployment, globalization and social spending, he reports a positive association of capital gain measures with income inequality for OECD economies over 1995–2007. Roine and Waldenström (2012) show for Sweden that capital gains explain most of the increase in inequality since the 1980s.

The role of capital gains implies a distinction between phases of the business cycle. Roine and Waldenström (2014) find for a sample of developed economies that top income shares which are driven by capital gains rise faster in periods of above-average growth. In our analysis we will control for the output gap and distinguish the post-2007 years from the full 1990-2012 sample. The mortgage-fueled house price and financial market boom until 2007 (which may have increased income inequality) turned into a housing market and equity market crises with capital losses, negative equity, and rising unemployment. FIRE-sector credit effects on inequality are likely to have been different in two periods.

Our paper connects to literature which shows that credit to non-financial firms has fundamentally different impacts than does credit to asset markets, as mortgage credit to households or as loans to non-bank financial firms (Werner, 1997, 2012). Economies with more household credit (most of which are mortgages) experience slower income growth (Jappelli et al., 2013; Büyükkarabacak and Valev, 2010; Beck et al., 2012; Beze-

mer et al., 2016; Jorda et al., 2016), larger external imbalances (Büyükkarabacak and Krause, 2009) and higher probabilities of crisis, with longer post-crisis recessions (Rose and Spiegel, 2011; Frankel and Saravelos, 2012; Sutherland et al., 2012; IMF, 2012; Babecky et al., 2013). We add to this literature that growth in mortgages and in credit to financial asset markets tends to increase income inequality by concentrating income growth more in the FIRE sector.

3 Data

3.1 Data and variables description

We use annual observations of income and pay inequality measures for 26 EU countries over the period 1990–2012, with the time period determined by data availability. Table A.1 in Appendix A describes the construction and data sources for all inequality variables. We use the Gini income inequality index for 1990–2012, taken from the Standardized World Income Inequality Database (SWIID). We choose a Gini net index based on disposable incomes (post-tax, post-transfers).[2],[3]

Credit to the FIRE sector supports generation of wages plus significant non-wage incomes as dividends, interest and rental incomes; credit to non-financial business is more directly linked to non-financial-sector wages incomes. This suggests that inequality measures need to be sensitive to wage and total-income differences. In order to observe effects on wage income inequality and total-income inequality, we will also use the industrial pay inequality measure *payineq100* constructed in the University of Texas Inequality Project (UTIP) from UNIDO Industrial Statistics, available from 1990 until 2008. This isolates wage inequality dynamics rather than total-income inequality,

[2]Our results are robust to using a Gini market index instead (before taxes and transfers).

[3]We are aware that Gini index might not reflect inequality well as it does not vary much over time. Therefore, as a robustness check, we measured income inequality by the ratio between 90th and 10th percentile of income distribution, and between 80th and 20th percentiles, which show higher variation. The data for these ratios, from EU-SILC dataset, were available only for half of our sample. The estimation results (available on request) for the percentile ratios were similar to Gini net in our main analysis.

as in the Gini. Industrial pay inequality is defined as the between-industry component of a Theil's T statistic. We refer to the Appendix for details.

A striking feature of FIRE-sector income growth is its regional concentration, linked to real estate dynamics and financial-sector employment. Von Ehrlich and Seidel (2015) show that increasing financial access for non-financial business reduces inequality between regions by spreading investment opportunities more equally over space. But in a house price boom due to rising mortgaging lending (Favara and Imbs, 2015), price increases tend to be strongly spatially concentrated. And to the extent that FIRE sector employment is regionally concentrated — typically, in the capital or other major cities — its relative income growth will increase regional income inequality. Therefore, in addition to the *payineq100* Theil index, we will also use a within-region Theil index (*TW*), a between-region Theil index (*TB*), and overall regional Theil index (*TO*). The overall Theil inequality index (*TO*) is the sum of a country's between-region and within-region Theil components. Theil indices are available from 1995 to 2010. Note that *TO* is different from industrial pay inequality *payineq100*, which does not reflect regional variation in between-industry pay inequality.[4]

The data for bank credit were collected from the consolidated balance sheets of Monetary Financial Institutions in central bank statistics, separately for each country. We distinguish four types of domestic bank credit: bank credit to non-financial business, bank credit to non-bank financial business (insurance companies, pension funds, and other non-bank financial institutions), household consumption credit, and mortgages to households, all reported as percentages of GDP. A detailed description of the credit dataset is provided in Bezemer et al. (016b).

One challenge we face in the analysis is that we do not have a sufficiently long panel, especially since we must use annual observations. There is a risk of reflecting short-term business cycles movement rather than the underlying finance-inequality

[4]The regional pay inequality Theil indices *TO, TW* and *TB* are based on data on employment and wages in six sectors and all NUTS2 regions, for each country of the European Union. We recomputed *TO, TW* and *TB* indices from the Europe-wide basis used in UTIP to country-based data. We refer to the Appendix B for details.

relation. We address this problem in two ways. First, by including in the control variables the output gap as a proxy for the business cycle. And second, by also running the analysis using 3-year averages for all variables.

We will consider a wide range of control variables. Some are common in the inequality literature, including income levels, income growth, inflation, unemployment, levels of education, government expenditures and trade openness. In addition we included other plausible covariates of income inequality: wage shares, labor union strength, the economy's industrial structure, population growth, financial deregulation, asset prices, and capital flows.

Income levels and growth influence inequality depending on the distribution of growth over income levels (Dollar and Kraay, 2002). Inflation may lead to pressure for rising nominal wages, with that pressure unevenly distributed over income levels, and depending on labor union strength (Kus, 2012). Rising unemployment typically hurts lower income groups disproportionally and increases inequality. It also creates downward pressure on wages for those employed, which may create additional effects on the distributions of income and pay (Van Arnum and Naples, 2013). More education may widen income gaps, depending on the educational system and the income premium on a year of schooling (Van Arnum and Naples, 2013; Dabla-Norris et al., 2015).

Redistributive fiscal policy through higher government expenditures may reduce income inequality (Heshmati and Kim, 2014). Trade openness raises wages more in tradable sectors and so increases income inequality, depending on the sectoral income distributions and skill premia across sectors (Lakner and Milanovic, 2015; Milanovic, 2016). Economies with high wage shares tend to be less unequal, and so are those with minimum wages. Industrial structure, measured by the shares of manufacturing and services in GDP, captures changes in inequality due to income dynamics which are industry-specific. Table A.2 in Appendix A provides details on construction and sources for all variables. Descriptive statistics are reported in Table A.3.

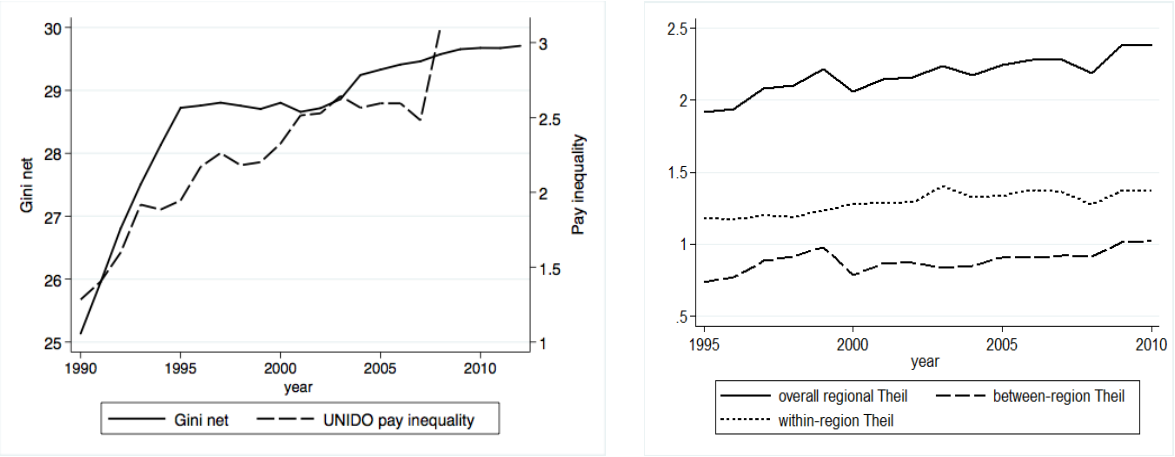
Any study on finance and inequality has to consider reverse causality and endogeneity. Causality might run from inequality to financial development, or both may be caused by an unobserved third factor. Larger household indebtedness and higher income inequality may be jointly caused by governments providing cheap credit to low-income households (Rajan, 2010). Inequality, once rising, may be self-reinforcing if it constraints effective demand (Carroll et al., 2014). Rising income inequality may cause poorer households to borrow more in order to sustain their consumption levels (Kumhof et al., 2015). There is evidence from the U.S. (where median incomes have long been stagnant but top incomes have raced away) for a 'keeping up with the Joneses' effect as a driving force in the growth of mortgage and consumer lending and increasing household indebtedness (Onaran et al., 2011; Coibion et al., 2014). Previous studies (e.g., Clarke et al., 2006; Kunieda et al., 2014) instrument financial development with legal origin or other institutional factors. These cannot be used as instruments for disaggregated credit categories. We will use lagged credit variables and also GMM specifications.

3.2 Trends in Income Inequality and Financial Development

Figure 2 shows the development of income and pay inequality for EU countries over 1990–2012. We show the unweighted average over 26 countries. The Gini index increased mildly after 1995, but pay inequality rose fast in most of the time period, with temporary stability in the late 1990s and mid 2000s. Within-region pay inequality rose steadily until 2003 and was about flat afterward, until 2010. The between-region Theil index of pay inequality rose over 1995-1998 and then shows a remarkable drop over 1998-2000, possibly related to the start of EMU phase 3 (euro introduction). From 2000-2010, between-region pay inequality rose again, less steeply than before 2000.

In Figure 2 we present trends in disaggregated bank credit over 1990–2012, as unweighted averages over an (unbalanced) panel of 26 countries each year. Although the unbalanced nature of the panel distorts the trends somewhat, they are qualitatively

Figure 2: **Income and (regional) pay inequality in Europe**

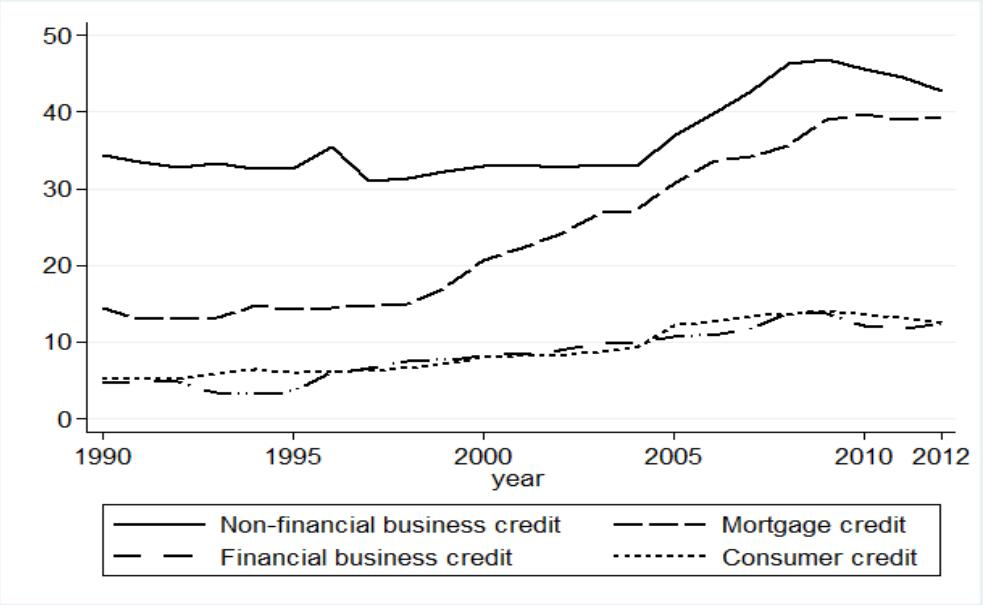


Sources: SWIID; University of Texas Inequality Project based on UNIDO Industrial Statistics; authors' calculations

similar to those reported in Jorda et al. (2016) and Bezemer et al. (2016). We observe a strong increase in household mortgage credit, almost tripling from 15% to 40% of GDP on average from the late 1990s until 2010. We see proportionally similar increases in consumer credit and bank credit to non-bank financials, each rising from 5% to 14% of GDP over 1990–2012. Bank credit to non-financial business was stagnant as a share of GDP from 1990 to 2004, but then increased from 32% to 46% until the 2007 crisis, after which it fell back to 42%. Further exploration showed that this remarkable rise after 2004 is driven by steep rises in six countries (Bulgaria, Denmark, Estonia, Ireland, Lithuania and Spain).

In Table 1 we explore correlations over time and between countries of inequality and financial development. The Gini index and countrywide pay inequality measures are both negatively correlated to credit expansion of all types. The strongest negative correlations of pay inequality are with the non-financial business credit share of GDP; for the Gini, all correlations are much weaker, consistent with the small variation in these data. The Theil regional indices present a diverse picture. Only consumer credit is significantly and positively correlated to within-region wage inequality. For between-regions and overall regional inequality, we find again strongly negative correlations with non-financial business and financial business credits, and much smaller negative correlations with consumer and mortgage credit.

Figure 3: **Disaggregated bank credit over 1990–2012**



Sources: central banks' statistics; authors' calculations

Table 1: **Correlations of inequality measures with credit variables**

	Gini	Pay ineq	Theil overall	Theil between	Theil within
Total credit	−0.14***	−0.48***	−0.05	−0.11*	0.08
BUSINESS credit (1+2)	−0.13***	−0.43***	−0.18***	−0.32***	0.15 ***
1. Non-financial business credit	−0.12***	−0.41***	−0.25***	−0.37***	0.07
2. Hhs consumer credit	−0.08	−0.33***	−0.08	−0.09	0.34 ***
FIRECredit (3+4)	−0.16***	−0.40***	0.05	0.08	−0.02
3. Financial business credit	−0.10*	−0.27***	0.19***	0.25***	−0.001
4. Hhs mortgage credit	−0.15***	−0.42***	−0.03	−0.02	−0.03

Note: The table reports pairwise correlation coefficients. ***p<0.001, **p<0.05, *p<0.1.

These explorations suggest that it is especially the non-financial business credit component of financial development which drives any impact on inequality; and that regional effects are mostly between-regions, not within-regions effects. Below we test this impression.

4 Methodology

We analyze the relation between bank credit and different measures of income and pay inequality in panel fixed-effects regressions using annual data, controlling for a

number of covariates[5] The baseline model specification is:

$$INEQ_{it} = \alpha + \beta CRED_{it-1} + \gamma CTRL_{it} + \mu_i + \epsilon_{it}, \;\; i = 1,...,N; t = 1,...,T, \qquad (1)$$

where $INEQ_{it}$ is the Gini or Theil index for income or pay inequality in country i and year t; $CRED_{it-1}$ is a matrix of bank credit to private sector, including either total bank credit, as in the finance-and-inequality literature to date; or the two categories of credit denoted *BusinessCredit* and *FIRECredit*. *BusinessCredit* is measured by the stock of bank loans to non-financial business credit plus household consumer credit, scaled by GDP. *FIRECredit* is measured by the stock of bank loans to nonbank financial institutions plus household mortgage credit, scaled by GDP.

Further, β is a vector of estimated parameters for credit variables. All categories of credit are included in the model with a one period lag, to account somewhat for reverse causality; below we will also use 3-year lags and instrumented variables to do this more thoroughly. $CTRL_{it}$ is a matrix of control variables, described in Section 3.1. μ_i are country fixed effects; ϵ_{it} is an independently and identically distributed white noise error term with mean 0. Standard errors are clustered per country to account for heteroscedasticity and autocorrelation in the error term.

5 Estimation Results

In Table 2 we start with a total-credit specification of financial development. As control variables we include those most widely used (income levels and growth, inflation, unemployment and education) plus the output gap, wage shares and industrial structure.[6] We observe that higher inflation and lower output gaps (both signifying a

[5] As a robustness check, we also estimated equations for three-year non-overlapping averages of annual data. This accounts for low variability of inequality measures and decreases sensitivity of outcomes to short-term variations.

[6] Many other variables could in theory be argued to affect income inequality. We base model selection on the literature review, but also probed the results for robustness to including other variables. In Appendix A we report results with additional control variables, most of which do not enter with significant coefficient and none of which would change the results presented here, had they been included in the regression.

business cycle upswing) tend to increase total-income inequality. Controlling for this, for 26 EU countries over 1990–2012 we do not find evidence of a significant correlation of lagged financial development to total-income inequality. But we do find that lagged financial development negatively correlates to between-regions pay inequality, and (weakly) to overall pay inequality.

Table 2: **Total bank credit and inequality**

	Gini12′	Gini07′	Pay inequality	Theil overall	Theil between	Theil within
Total bank credit$_{t-1}$	−0.004	−0.004	−0.004	−0.006 *	−0.005 ***	−0.001
	(0.009)	(0.017)	(0.005)	(0.003)	(0.001)	(0.002)
GDP per capita	3.300	4.449	1.050	0.784	1.099 **	−0.314
	(2.429)	(2.670)	(0.622)	(0.853)	(0.491)	(0.543)
Income growth	0.080 *	0.107	0.006	0.006	0.024	−0.018 *
	(0.047)	(0.072)	(0.022)	(0.020)	(0.016)	(0.010)
Output gap	−0.212 ***	−0.220 **	−0.036	−0.019	−0.024 *	0.005
	(0.059)	(0.085)	(0.039)	(0.027)	(0.013)	(0.023)
Wage share (as % GDP)	0.039	−0.012	−0.021	0.016	0.039	−0.023
	(0.089)	(0.127)	(0.027)	(0.038)	(0.029)	(0.018)
VA share of manufacturing	0.084	0.076	0.050	−0.003	−0.066	0.064
	(0.113)	(0.137)	(0.047)	(0.080)	(0.051)	(0.040)
Inflation	3.752 **	6.078 ***	2.002 ***	−7.130	−3.707 *	−3.422
	(1.577)	(1.860)	(0.608)	(4.484)	(2.061)	(2.922)
Unemployment	−0.113	0.021	0.066 **	−0.028	−0.011	−0.017
	(0.108)	(0.109)	(0.027)	(0.025)	(0.013)	(0.017)
Schooling years	0.203	0.015	0.357 **	0.195	0.039	0.155
	(0.258)	(0.300)	(0.142)	(0.123)	(0.040)	(0.106)
Observations	382	255	244	292	292	292
Countries	26	24	25	25	25	25
R-squared	0.15	0.15	0.24	0.14	0.26	0.12

Notes: The dependent variables are: the Gini net income inequality index for 1990–2012 and 1990–2007; the UTIP-UNIDO industrial pay inequality index (×100) for 1990–2008, and the overall Theil regional pay inequality index (the sum of within and between Theil components); the Theil between-region index; and the Theil within-region index for 1995–2010. Credit variables are one-year lagged. The Table reports coefficient estimates with robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1. Constant term and country-fixed effects are included (not shown).

In Table 3 we turn to the separate effects of credit aggregates. Consistent with the framework developed in section 2, lagged credit to the FIRE section correlates positively and significantly to Gini income inequality. The coefficient before 2008 is double the size of the coefficient including the post–2007 crisis years. This suggests that the inequality-increasing effect of *FIRECredit* was linked to the credit boom and strong income growth before 2008. The effect is also apparent for pay inequality, where the

Table 3: **Business/FIRE credit and income/pay inequality**

	Gini12′	Gini07′	Pay inequality	Theil overall	Theil between	Theil within
$FIRECredit_{t-1}$	0.016 **	0.033 **	0.010 **	0.004	0.001	0.002
(fin. bus. & real estate)	(0.008)	(0.015)	(0.005)	(0.004)	(0.004)	(0.003)
$BusinessCredit_{t-1}$	−0.036 **	−0.042 *	−0.008	−0.015 **	−0.011 **	−0.003
(non-fin. bus. & hh cons.)	(0.014)	(0.024)	(0.010)	(0.006)	(0.005)	(0.003)
GDP per capita	2.309	3.738	0.650	0.564	0.759	−0.194
	(2.288)	(2.503)	(0.580)	(0.780)	(0.457)	(0.562)
Income growth	0.088 **	0.183 ***	0.002	0.002	0.020	−0.018 **
	(0.043)	(0.048)	(0.028)	(0.018)	(0.015)	(0.009)
Output gap	−0.175 ***	−0.258 ***	−0.039	−0.020	−0.019	−0.001
	(0.059)	(0.082)	(0.044)	(0.029)	(0.014)	(0.024)
Wage share (as % GDP)	0.051	0.095	0.025	0.030	0.050	−0.019
	(0.088)	(0.133)	(0.031)	(0.036)	(0.032)	(0.015)
VA share of manufacturing	0.035	0.190	0.183 ***	0.015	−0.067	0.083 *
	(0.081)	(0.131)	(0.039)	(0.087)	(0.048)	(0.048)
Inflation	4.975	6.016	−5.060	−2.185	−1.642	−0.543
	(6.758)	(6.488)	(4.012)	(1.860)	(2.019)	(1.081)
Unemployment	−0.030	0.051	0.059 **	−0.025	−0.009	−0.017
	(0.092)	(0.080)	(0.024)	(0.025)	(0.013)	(0.019)
Schooling years	0.074	0.082	0.423 ***	0.179	0.036	0.143
	(0.196)	(0.256)	(0.128)	(0.118)	(0.043)	(0.104)
Observations	355	233	218	271	271	271
Countries	25	23	24	24	24	24
R-squared	0.17	0.30	0.36	0.14	0.30	0.13

Notes: The dependent variables are: the Gini net income inequality index for 1990–2012 and 1990–2007; the UTIP-UNIDO industrial pay inequality index (×100) for 1990–2008, and the Theil regional pay inequality index (the sum of within and between Theil components); the Theil between-region index; and the Theil within-region index for 1995–2010. Credit variables are one-year lagged. The Table reports coefficient estimates with robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1. Constant term and country-fixed effects are included (not shown).

data run until 2008. We do not observe significant correlations with the regional Theil measures for pay inequality.

In contrast, *BusinessCredit* (which is mostly credit to non-financial firms) reduces total-income Gini inequality, albeit the coefficient is only weakly significant before the crisis. Countries with more *BusinessCredit* saw larger reductions or smaller increases in income inequality. There is no significant result for inter-industry pay inequality, which suggests that the Gini results are not driven by between-industry dynamics, but reflect falling income inequality across all industries. The reduction in inequality that *BusinessCredit* causes has a clear regional dimension. It significantly reduces between-region pay inequality (TB), which translates into a significant negative coefficient also for overall Theil (TO). As before, higher income growth and lower output

gaps are linked to higher total-income inequality. Between-industry pay inequality increases with unemployment, education levels (presumably due to skill premiums) and manufacturing shares, perhaps reflecting the income equalizing influence of a growing services sector.

The relation between financial development and income inequality may be hump-shaped (Greenwood and Jovanovic, 1990). That is, at low levels of financial development, more credit may increase inequality since not all benefit from it, but as more people gain access to finance, this reduces inequality (Kim and Lin, 2011). To check whether there is a nonlinear relation between credit categories and inequality, we add quadratic terms of credit types. Since the quadratic term of *FIREcredit* is insignificant, we report in Table 4 only the results when quadratic term of *Businesscredit* is included.

Table 4: **Non-linear relationships: credit and inequality**

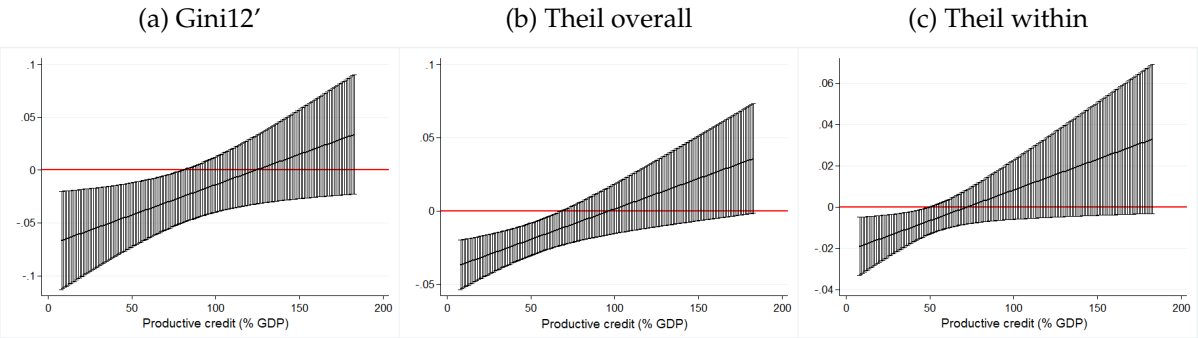
	Gini12′	Gini07′	Pay inequality	Theil overall	Theil between	Theil within
$FIRECredit_{t-1}$	0.012	0.032 *	0.010 **	0.001	0.001	0.0001
	(0.008)	(0.016)	(0.005)	(0.003)	(0.004)	(0.003)
$BusinessCredit_{t-1}$	−0.071 **	−0.046	−0.001	−0.040 ***	−0.019 ***	−0.021 **
	(0.025)	(0.060)	(0.025)	(0.009)	(0.005)	(0.008)
$BusinessCredit^2_{t-1}$	0.0003**	0.0001	−0.0001	0.0002***	0.0001	0.0002**
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	355	233	218	271	271	271
R-squared	0.19	0.30	0.36	0.19	0.31	0.18

Notes: The dependent variables are: the Gini net income inequality index for 1990–2012 and 1990–2007; the UTIP-UNIDO industrial pay inequality index (×100) for 1990–2008, and the Theil regional pay inequality index (the sum of within and between Theil components); the Theil between-region index; and the Theil within-region index for 1995–2010. Credit variables are one-year lagged. The Table reports coefficient estimates with robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1. Constant term, control variables, and country-fixed effects are included (not shown).

The results show that at levels of *BusinessCredit* below 88% of GDP (96% of all observations), lagged *BusinessCredit* significantly reduces Gini inequality, with this effect diminishing as credit levels rise. Only at very high levels of credit (above 123% GDP), the effect of *BusinessCredit* is positive but statistically insignificant. Similarly, lagged *BusinessCredit* has negative, significant effects on the Theil overall index and the Theil within-region index below 70% and 47%, respectively, which comprises 60% of the sample. We conclude that nonlinear effects are present for regional pay inequality but

not for overall income inequality. The income-reducing effect of *BusinessCredit* is robust to accounting for the nonlinear effects.

Figure 4: The effect of *BusinessCredit* on inequality conditional on credit level



Notes: Solid lines show marginal effects of *BusinessCredit* on inequality at different levels of credit; vertical boundaries indicate 95% confidence interval. The marginal effects are significant when solid lines and confidence intervals are above (below) zero.

5.1 FIRE-sector credit effects on inequality: conditioning factors

So far, we have tested a reduced form of the causal chain depicted in Figure 1. In this section we tease out evidence on the intervening steps by examining factors that could condition the impact of financial development on income inequality if the Figure 1 causal chain operates.

First, it was suggested that a rising share of FIRE sector income is the transmission channel from FIRE-sector credit to financial development. This implies that in economies with larger FIRE sectors, the effect of FIRE-sector credit on income inequality will be larger. Also, since FIRE-sector incomes rise due to growing asset prices, in economies with higher asset prices the effect of FIRE-sector credit on income inequality will be larger. To test this transmission channel, we will interact *FIRECredit* with the FIRE-sector size and house prices (proxy for asset prices).

In Table 5, panel 5.1. we find that the higher the value-added share of the FIRE sector, the bigger is the positive impact of *FIRECredit* on overall and between-regions pay inequality. The effect is significant for value-added shares larger than 17% of total value-added, accounting for 25-45% of all observations. And in Table 5, panel 5.2.

Table 5: **The effect of *FIRECredit* on inequality conditional on the FIRE sector size and house prices**

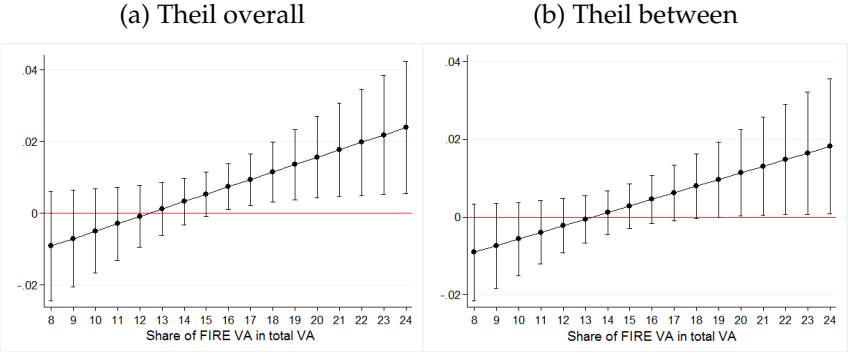
	Gini12′	Gini07′	Pay inequality	Theil overall	Theil between	Theil within
5.1. FIRE sector size						
$FIRECredit_{t-1}$	0.008	0.051	−0.025	−0.026 *	−0.023 *	−0.003
	(0.042)	(0.079)	(0.029)	(0.015)	(0.013)	(0.009)
Share of FIRE VA	0.027	0.293	−0.242 *	−0.065	−0.050	−0.015
	(0.212)	(0.307)	(0.128)	(0.070)	(0.056)	(0.050)
$FIRECredit_{t-1}\times$	0.0001	−0.002	0.002	0.002 **	0.002 *	0.0001
Share of FIRE VA	(0.003)	(0.006)	(0.002)	(0.001)	(0.001)	(0.001)
$BusinessCredit_{t-1}$	−0.043 ***	−0.063 ***	−0.004	−0.016 ***	−0.013 ***	−0.003
	(0.014)	(0.020)	(0.009)	(0.005)	(0.004)	(0.003)
Observations	347	225	214	271	271	271
R-squared	0.18	0.34	0.42	0.17	0.34	0.13
5.2. Real house prices						
$FIRECredit_{t-1}$	−0.013	−0.022	−0.026	−0.017	0.001 *	−0.018 *
	(0.021)	(0.047)	(0.020)	(0.012)	(0.009)	(0.010)
Real house price	0.004	−0.021	−0.017 ***	−0.009	−0.003	−0.006
	(0.012)	(0.016)	(0.006)	(0.006)	(0.003)	(0.004)
$FIRECredit_{t-1}\times$	0.0001	0.0001	0.0003**	0.0002*	0.0001	0.0002**
real house price	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$BusinessCredit_{t-1}$	−0.0363**	−0.034	−0.020 **	−0.012 *	−0.010 *	−0.002
	(0.015)	(0.023)	(0.008)	(0.007)	(0.006)	(0.004)
Observations	317	196	182	244	244	244
R-squared	0.22	0.30	0.532	0.16	0.32	0.20

Notes: The dependent variables are: the Gini net income inequality index for 1990–2012 and 1990–2007; the UTIP-UNIDO industrial pay inequality index (×100) for 1990–2008, and the Theil regional pay inequality index (the sum of within and between Theil components); the Theil between-region index; and the Theil within-region index for 1995–2010. Credit variables are one-year lagged. The Table reports coefficient estimates with robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1. Constant term, control variables, and country-fixed effects are included (not shown).

we find that *FIRECredit* increases both *payineq100* and overall regional pay inequality more when real house prices are higher for real house price index values above 107. This is true for 60% of all observations with house price data. For TW (within-region, between-industry) inequality, the total marginal effect is significant for real house price index values above 123 (49% of observations), this suggest that FIRE-sector credit affects the regional wage distribution, but not total incomes.

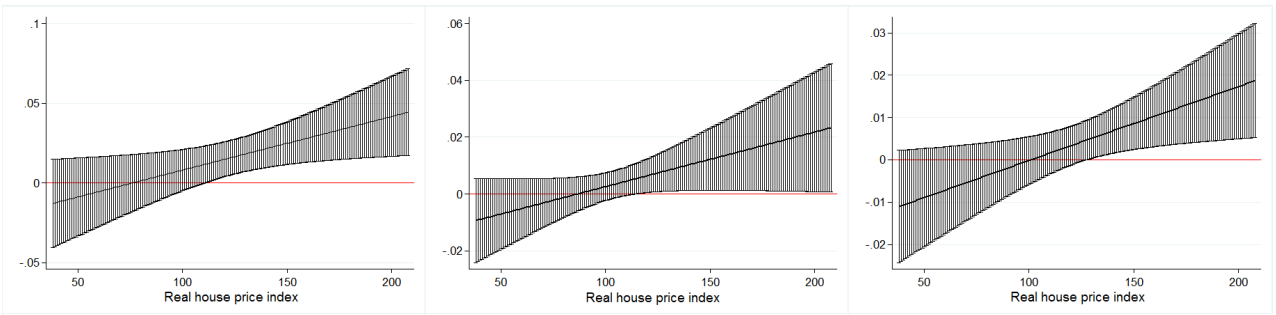
The results on these two conditioning factors (house price and FIRE-sector size) support the view that a rising share of FIRE sector income is a transmission channel from FIRE-sector credit to financial development.

Figure 5: The effect of *FIRECredit* on inequality conditional on the FIRE sector size



Notes: Solid lines show marginal effects of *FIRECredit* on regional inequality at different levels of VA share of FIRE sector; vertical boundaries indicate 95% confidence interval. The marginal effects are significant when solid lines and confidence intervals are above (below) zero.

Figure 6: The effect of *FIRECredit* on inequality conditional on real house prices



Notes: Solid lines show marginal effects of *FIRECredit* on pay and regional inequality at different real house prices; vertical boundaries indicate 95% confidence interval. The marginal effects are significant when solid lines and confidence intervals are above (below) zero.

5.2 Business Credit effects on inequality: conditioning factors

Second, we examine factors that condition the impact of *BusinessCredit* on income inequality. The suggested channel is that *BusinessCredit* loosens financing constraints on investment, leading to a relative rise in employment and incomes in lower-income sectors, which reduces income disparities. A first implication of this is that the investment effect of business credit will be larger for larger financing constraints. We cannot observe financing constraints on investment directly, but we proxy them by non-residential investment, assuming that the more investment relative to GDP there is in an economy, the smaller are financing constraints. In country-years where the financing constraint is more binding (where non-residential investment shares are lower),

BusinessCredit reduces income inequality more.

In Table 6, panel 6.1. we interact *BusinessCredit* with non-residential investment. Above a threshold for the investment share of 16% GDP, which includes 75% of the sample, we find that the interaction term is indeed negative and significant in a regression on Gini index, using the full sample until 2012. Also in a regression on inter-industry pay inequality the interaction term is negative, albeit only for low values of the investment share (below 16%). There are no regional inequality effects for *BusinessCredit*, and no pre-crisis effects (possibly due to the smaller sample). The results suggest that credit to business and consumers reduces income inequality by stimulating investment.

The degree to which investment leads to more domestic employment and wages may depend on trade openness. This degree is likely to be smaller when effects of business credit leak away via trade, influencing foreign income distribution rather than domestic one. Also, in more open economies, credit is more likely to go to vibrant export sectors with relatively high wages. The regression results in Table 6, panel 6.2. show that for trade openness up to a level of imports plus exports of 87% GDP, or for 46% of all observations, the effect of *BusinessCredit* on pay inequality is negative but diminishing as openness increases. However, openness almost never reverses the effect. It is only above a threshold of 146% (amounting to just 15% of all observations) that the *BusinessCredit* effects on pay inequality is significantly positive. There is no significant interaction effect on the total-income Gini index, suggesting that redistribution (the difference between Gini and Theil indices) counters the effect of trade openness.

Further, the degree to which investment leads to more employment and wages depends also on how much wage shares can rise. In economies where wage shares are already high, for instance due to strong trade unions or for structural reasons, business credit cannot make much of a difference to the wage distribution. In Table 6, panel 6.3. we find that when wage shares are below 57-58% GDP (72% of all observations), *BusinessCredit* reduces Gini income inequality (both until 2012 and until 2007) as well as

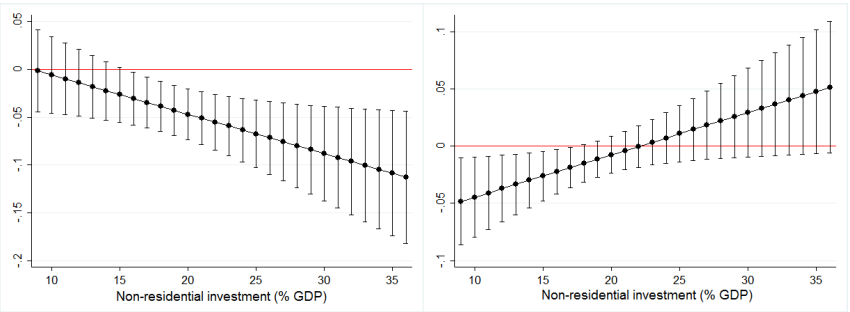
Table 6: **The effect of business credit conditional on investment, openness, wages**

	Gini12′	Gini07′	Pay inequality	Theil overall	Theil between	Theil within
6.1. Non-residential investment						
$FIRECredit_{t-1}$	0.011	0.030	0.014 ***	0.004	0.002	0.003
	(0.009)	(0.018)	(0.005)	(0.004)	(0.004)	(0.003)
$BusinessCredit_{t-1}$	0.035	−0.003	−0.082 **	−0.029	−0.020	−0.009
	(0.037)	(0.092)	(0.034)	(0.017)	(0.014)	(0.010)
Non-residential investment	0.190 **	0.004	−0.157 *	−0.115 **	−0.052	−0.063
	(0.090)	(0.106)	(0.081)	(0.055)	(0.044)	(0.038)
$BusinessCredit_{t-1}\times$	−0.004 **	−0.002	0.004 **	0.001	0.001	0.000
non-residential investment	(0.002)	(0.004)	(0.002)	(0.001)	(0.001)	(0.000)
Observations	355	233	218	271	271	271
R-squared	0.21	0.30	0.42	0.19	0.32	0.16
6.2. Trade openness						
$FIRECredit_{t-1}$	0.017 **	0.031 *	0.010 *	0.003	0.001	0.003
	(0.008)	(0.016)	(0.005)	(0.004)	(0.004)	(0.003)
$BusinessCredit_{t-1}$	−0.029	−0.052	−0.049 ***	−0.024 **	−0.013 *	−0.012 *
	(0.024)	(0.050)	(0.009)	(0.010)	(0.007)	(0.006)
Trade openness	0.001	0.007	−0.024 **	−0.006	0.002	−0.008 **
	(0.022)	(0.020)	(0.011)	(0.004)	(0.003)	(0.003)
$BusinessCredit_{t-1}\times$	−0.0001	0.000	0.0005***	0.000	0.000	0.000
trade openness	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	355	233	218	271	271	271
R-squared	0.17	0.30	0.43	0.15	0.30	0.15
6.3. Wage share in GDP						
$FIRECredit_{t-1}$	0.012 *	0.032 ***	0.010 *	0.003	0.001	0.002
	(0.006)	(0.010)	(0.005)	(0.003)	(0.004)	(0.003)
$BusinessCredit_{t-1}$	−0.330 ***	−0.404 **	0.051	−0.080 **	−0.050 **	−0.030
	(0.097)	(0.154)	(0.086)	(0.034)	(0.019)	(0.028)
Wage share as % GDP	−0.147	−0.149	0.062	−0.017	0.022	−0.039
	(0.112)	(0.173)	(0.062)	(0.051)	(0.043)	(0.027)
$BusinessCredit_{t-1}\times$	0.005 ***	0.007 **	−0.001	0.001 *	0.001 *	0.000
wage share	(0.002)	(0.003)	(0.002)	(0.001)	(0.000)	(0.001)
Observations	355	233	218	271	271	271
R-squared	0.23	0.37	0.37	0.16	0.31	0.14

Notes: The dependent variables are: the Gini net income inequality index for 1990–2012 and 1990–2007; the UTIP-UNIDO industrial pay inequality index (×100) for 1990–2008, and the Theil regional pay inequality index (the sum of within and between Theil components); the Theil between-region index; and the Theil within-region index for 1995–2010. Credit variables are one-year lagged. The Table reports coefficient estimates with robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1. Constant term, control variables, and country-fixed effects are included (not shown).

Figure 7: The effect of business credit on inequality conditional on investment

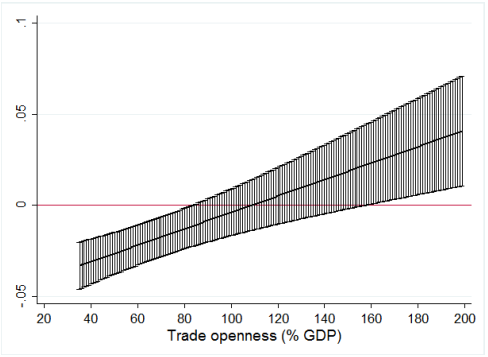
(a) Gini12′ (b) Pay inequality



Notes: Solid lines show marginal effects of *BusinessCredit* on inequality at different levels of non-residential investment; vertical boundaries indicate 95% confidence interval. The marginal effects are significant when solid lines and confidence intervals are above (below) zero.

Figure 8: The effect of business credit on inequality conditional on trade openness

(a) Pay inequality



Notes: The solid line shows the marginal effect of *BusinessCredit* on pay inequality at different levels of trade openness; vertical boundaries indicate 95% confidence interval. The marginal effect is significant when solid lines and confidence intervals are above (below) zero.

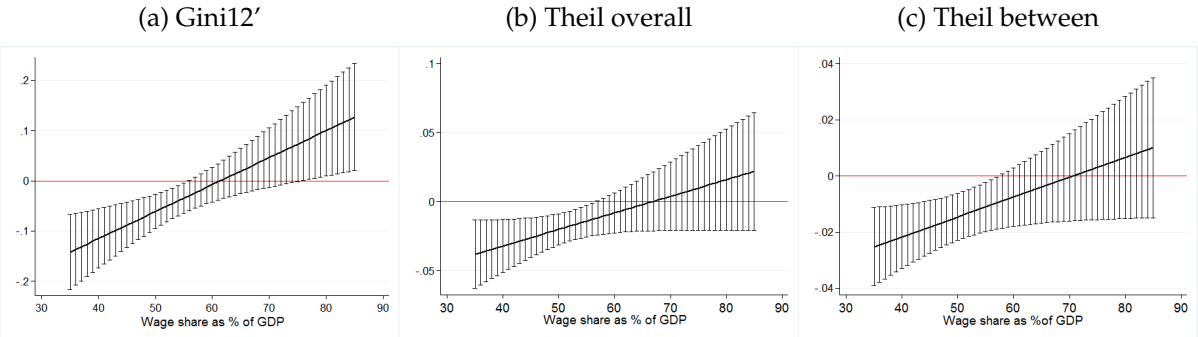
regional pay inequality measured by Theil overall and Theil between-region. The effect diminishes as the wage share increases.

These results constitute additional evidence consistent with the steps in the Figure 1 causal chain.

6 Robustness checks

We conducted extensive sensitivity analyses to check the robustness of our results to modifications in methodology and to model specifications and additional variables. Most of these results are presented in Appendix A.

Figure 9: The effect of business credit on inequality conditional on wage share



Notes: The solid line shows the marginal effect of *BusinessCredit* on income/pay inequality at different levels of wage share; vertical boundaries indicate 95% confidence interval. The marginal effect is significant when solid lines and confidence intervals are above (below) zero.

First, we re-estimated all models including a more extensive set of control variables. The results are reported in Table A.4. The findings for credit categories are comparable to the benchmark results, while most of the additional controls were either insignificant and did not affect the outcomes. The noteworthy result is that government expenditures increase Gini income inequality, but reduce pay inequality. This might be due to higher subsidies to non-financial firms, which could stimulate investment and employment.

Second, we re-estimated all models using a random-effects regression instead of fixed-effects. The Hausman test in several cases pointed towards using a random effects model, while in other cases the fixed-effects regression was indicated. The estimation results from a RE models (see Table A.5) are weaker than for FE models, although generally they are qualitatively comparable. In the RE specification, *FIREcredit* no longer significantly affects pay inequality and *BusinessCredit* no longer impacts Gini inequality in the pre-crisis period.

Third, we address the potential endogeneity problem, noted in section 2. Previous studies (e.g., Clarke et al., 2006; Kunieda et al., 2014) instrument financial development with legal origin or other institutional factors. However, it is unclear what variables could serve as suitable instruments for disaggregated credit categories. Therefore, we instrument credit variables with their lags, using IV-GMM as well as fixed-effects IV

regressions. All the instruments in IV-GMM were dropped, with test statistics suggesting that instrumented credit variables are exogenous. The outcomes of the fixed-effects IV regressions are similar to our main results, both in terms of significance and magnitude of estimates. Table A.6 reports the estimates of IV fixed-effects regressions with the 2nd and 3rd lags of credit categories used as instruments (we also estimated longer lag windows up to 6 lags, which did not alter the results).

Another concern was that given that inequality measures do not vary much over time, we might not observe enough variation in the annual data. This motivates our next robustness check where we conduct the analysis using 3-year non-overlapping averages of annual data over 1990-2012. The results are reported in Table A.7. The findings here are qualitatively similar to the estimations based on annual observations.

To control for time fixed effects we included year or period (for 3-year data) dummies. The results were not affected and time dummies were jointly insignificant. Therefore, we did not include them in the benchmark analysis.

We also controlled for alternative measures of government expenditures, using the cyclical component of expenditure of general government and cyclically adjusted total expenditure of general government. The former was insignificant, while the latter had a similar impact as did the non-adjusted government expenditure.

Last, since we study EU countries, we include EMU dummy to test whether becoming an EMU member influenced countries' income and pay inequality. We find a significant effect only for Theil between-regions inter-industry wage inequality measures: EMU membership contributed to reducing between-region pay inequality.[7] This result, which does not affect the outcomes for credit categories, is relevant to the discussion of the impact of EMU membership on regional disparities.

[7]This result goes in contrast with Bouvet (2010) who finds that euro adoption worsened regional inequality in poorer EU states, but had negligible effect on regional inequality in advanced EU states.

7 Conclusion

In this paper we revisited the question whether financial development decreases income inequality, with a new focus. We discussed how ambiguous answers in the literature to date may be due to over-aggregation. The indicator for financial development is typically bank credit stocks to the private sector, without distinction of the use of credit. We disaggregate bank credit into credit to real estate and financial asset markets, which increases the income share of the Finance, Insurance and Real Estate (FIRE) sector and, we expect, increases income inequality. The other category is credit to non-financial business and for household consumption, which more broadly supports investment, demand, employment and wages, and is expected to decrease income inequality.

We find evidence for the different effects of these two credit aggregates in data over 1990–2012 for 26 EU economies. We also aim to register differences in effects on total-income versus pay inequality, and within pay inequality on regional versus country-wide level. Among other findings, we find that credit to non-financial business and consumers tends to smooth both Gini total-income and regional pay inequality, whereas FIRE sector credit has the opposite effect.

The literature documents a large shift of bank credit allocation since the 1990s, away from supporting investments by firms in the real economy sector and towards financing capital gains in real estate and financial asset markets. Combined with our new findings, this 'debt shift' helps to understand the growth of inequality.

We then probe the conditions for financial development to decrease or increase income inequality. The inequality-reducing effect of non-financial business plus consumer bank credit varies with levels of investment, trade openness and wage shares. The inequality-increasing effect of 'FIRE sector' credit varies with the FIRE sector's share in the economy and with house prices.

The findings on the opposite effect of credit to the FIRE-sector on one hand and to non-financial business or consumers on the other hand are remarkably consistent. This invites more work to extent the analysis to other countries. Also the transmission

channels from credit to inequality should be studied in more detail, using sector-level and firm-level data. By moving from broad credit aggregates to distinction of credit by its uses, we will gain a more detailed understanding of the impacts not only on inequality, but also on other macroeconomic outcomes such as stability and growth.

The disaggregation applied in this paper is one possibility, and it is only an imperfect way to separate effects running through asset markets from effects running through goods-and-services markets. The same reasoning would suggest other disaggregations if the focus of analysis is different. For instance, within credit to nonfinancial business, there is much that is not necessarily financing output growth and wage formation, but rather commercial real estate, mergers and takeover, or share buyback programs. These uses of credit will effect inequality (and other outcomes) through different channels, perhaps more akin to the capital-gain channels we have described for FIRE-sector. With more detailed data, this sort of effects can be studied better.

A policy implication of our work is that, since financial-sector dynamics matters so clearly to income inequality, financial-sector policies should be formulated not only in pursuit of financial-sector efficiency and stability, but also consistent with income distribution objectives.

Acknowledgments

We thank seminar participants in Bilbao (July 2016) for helpful comments. Dirk Bezemer wishes to thank for their generous support the Equilibrio Foundation and the Institute for New Economic Thinking (grant INO11-00053). All errors are our own.

References

Adam, K. and P. Tzamourani (2015). Distributional consequences of asset price inflation in the euro area. CEPR Discussion Papers 10897, Centre for Economic Policy Research.

Babecky, J., T. Havranek, J. Mateju, M. Rusnak, K. Smidkova, and B. Vasicek (2013). Leading indicators of crisis incidence: Evidence from developed countries. *Journal of International Money and Finance 35*(C), 1–19.

Banerjee, A. and A. Newman (1993). Occupational choice and the process of development. *Journal of Political Economy 101*(2), 274–298.

Barro, R. J. and J. W. Lee (2013). A new data set of educational attainment in the world, 1950–2010. *Journal of Development Economics 104*, 184–198.

Beck, T., B. Büyükkarabacak, F. K. Rioja, and N. Valev (2012). Who gets the credit? And does it matter? Household vs. firm lending across countries. *The B.E. Journal of Macroeconomics 12*(1), 1–46.

Beck, T., A. Demirgüc-Kunt, and R. Levine (2007). Finance, inequality and the poor. *Journal of Economic Growth 12*(1), 27–49.

Bertola, G. (2010). Inequality, integration, and policy: issues and evidence from EMU. *Journal of Economic Inequality 8*, 345–365.

Bezemer, D., M. Grydaki, and L. Zhang (2016). More mortgages, lower growth? *Economic Inquiry*, forthcoming.

Bezemer, D., A. Samarina, and L. Zhang (2016b). A new data set on differentiated credit. Mimeo, University of Groningen.

Bouvet, F. (2010). EMU and the dynamics of regional per capita income inequality in Europe. *Journal of Economic Inequality 8*, 323–344.

Büyükkarabacak, B. and S. Krause (2009). Studying the effects of household and firm credit on the trade balance: The composition of funds matters. *Economic Inquiry 47*(4), 653–666.

Büyükkarabacak, B. and N. T. Valev (2010). The role of household and business credit in banking crises. *Journal of Banking and Finance 34*(6), 1247–1256.

Carroll, C., J. Slacalek, and K. Tokuoka (2014). The distribution of wealth and the marginal propensity to consume. ECB Working Paper Series 1655, European Central Bank.

Clarke, G., L. C. Xu, and H. Zou (2006). Finance and income inequality: What do the data tell us? *Southern Economic Journal 72*(3), 578–596.

Coibion, O., Y. Gorodnichenko, M. Kudlyak, and J. Mondragon (2014). Does greater inequality lead to more household borrowing? new evidence from household data. NBER Working Paper 19850, National Bureau of Economic Research.

Dabla-Norris, E., K. Kochhar, N. Suphaphiphat, F. Ricka, and E. Tsounta (2015). Causes and consequences of income inequality : A global perspective. IMF Staff discussion note 15/13, International Monetary Fund.

Demirgüc-Kunt, A. and R. Levine (2009). Finance and inequality: Theory and evidence. NBER Working Paper 15275, National Bureau of Economic Research.

Denk, O. and A. Cazenave-Lacroutz (2015). Household finance and income inequality in the euro area. Economics Department Working Papers 1226, OECD.

Denk, O. and B. Cournéde (2015). Finance and income inequality in OECD countries. Economics Department Working Papers 1224, OECD.

Dollar, D. and A. Kraay (2002). Growth is good for the poor. *Journal of Economic Growth 7*(3), 195–225.

Favara, G. and J. Imbs (2015). Credit supply and the price of housing. *American Economic Review 105*(3), 958–992.

Frankel, J. and G. Saravelos (2012). Can leading indicators assess country vulnerability? Evidence from the 200809 global financial crisis. *Journal of International Economics 87*(2), 216–231.

Galbraith, J. K., J. Choi, B. Halbach, A. Malinowska, and W. Zhang (2015). A comparison of major world inequality data sets: LIS, OECD, SILC, WDI and EHII. UTIP Working Paper 69, The University of Texas at Austin.

Galbraith, J. K. and J. E. Garcilazo (2008). Inequalities, employment and income convergence in Europe: Evidence from regional data. UTIP Working Paper 52, The University of Texas at Austin.

Galor, O. and J. Zeira (1993). Income distribution and macroeconomics. *Review of Economic Studies 60*(1), 35–52.

Gimet, C. and T. Lagoarde-Segot (2011). A closer look at financial development and income distribution. *Journal of Banking & Finance 35*(7), 1698–1713.

Greenwood, J. and B. Jovanovic (1990). Financial development, growth, and the distribution of income. *Journal of Political Economy 98*(5), 1076–1107.

Greenwood, R. and D. Scharfstein (2013). The growth of finance. *Journal of Economic Perspectives 27(2): 32*.

Heshmati, A. and J. Kim (2014). A survey of the role of fiscal policy in addressing income inequality, poverty reduction and inclusive growth. IZA Discussion Papers 8119, Institute for the Study of Labor (IZA).

IMF (2012). *World Economic Outlook*, Chapter 3. Dealing with Household Debt, pp. 89–124. International Monetary Fund.

Jappelli, T., M. Pagano, and M. di Maggio (2013). Households' indebtedness and financial fragility. *Journal of Financial Management, Markets and Institutions 1*(1), 26–35.

Jorda, O., M. Schularick, and A. M. Taylor (2016). The great mortgaging: Housing finance, crises and business cycles. *Economic Policy 31*(85), 107–152.

Kim, D. and S. Lin (2011). Nonlinearity in the financial development-income inequality nexus. *Journal of Comparative Economics 39*(3), 310–325.

Kumhof, M., R. Ranciére, and P. Winant (2015). Inequality, leverage, and crises. *American Economic Review 105*(3), 1217–1245.

Kunieda, T., K. Okada, and A. Shibata (2014). Finance and inequality: How does globalization change their relationship? *Macroeconomic Dynamics 18*(5), 10911128.

Kus, B. (2012). Financialisation and income inequality in OECD nations: 1995-2007. *Economic and Social Review 43*(4), 477–495.

Lakner, A. and B. Milanovic (2015). Global income distribution: from the fall of the Berlin Wall to the Great Recession. *World Bank Economic Review 30*(2), 203–232.

Milanovic, B. (2016). *Global Inequality: A New Approach for the Age of Globalization*. Harvard University Press.

Mookerjee, R. and P. Kalipioni (2010). Availability of financial services and income inequality: The evidence from many countries. *Emerging Markets Review 11*(4), 404–408.

OECD (2015). *In It Together: Why Less Inequality Benefits All*. Paris: OECD.

Onaran, O., E. Stockhammer, and L. Grafl (2011). Financialization, income distribution, and aggregate demand in the US. *Cambridge Journal of Economics 35*(4), 637–666.

Piketty, T. (2014). *Capital in the 21st Century*. Harvard University Press.

Rajan, R. G. (2010). *Fault Lines: How Hidden Fractures Still Threaten the World Economy*. Princeton, NJ: Princeton University Press.

Roine, J. and D. Waldenström (2012). On the role of capital gains in Swedish income inequality. *Review of Income and Wealth 58*(3), 569–587.

Roine, J. and D. Waldenström (2014). Long-run trends in the distribution of income and wealth. IZA Discussion Paper 8157, The Institute for the Study of Labor (IZA).

Rose, A. and M. M. Spiegel (2011). Cross-country causes and consequences of the crises: an update. *European Economic Review 55*(3), 309–324.

Sutherland, D., P. Hoeller, R. Merola, and V. Ziemann (2012). Debt and macroeconomic stability. OECD Economics Department Working Papers 1003, OECD.

Van Arnum, B. and M. Naples (2013). Financialization and income inequality in the United States, 1967–2010. *American Journal of Economics and Sociology 72*(5), 11581182.

Von Ehrlich, M. and T. Seidel (2015). Regional implications of financial market development: Industry location and income inequality. *European Economic Review 73*, 85–102.

Werner, R. A. (1997). Towards a new monetary paradigm: a quantity theorem of disaggregated credit, with evidence from Japan. *Kredit und Kapital 30*, 276–309.

Werner, R. A. (2012). Towards a new research programme on 'banking and the economy' – Implications of the Quantity Theory of Credit for the prevention and resolution of banking and debt crises. *International Review of Financial Analysis 25*, 1–17.

Appendix A

Table A.1: **Description of inequality measures and their data sources**

Variable	Description	Data sources
Gini income inequality index	Gini index is measured as the area between the Lorenz curve and the equality diagonal. A Lorenz curve plots the cumulative percentages of total income received against the cumulative number of recipients, starting with the poorest individual/household. Gini index ranges from 0 (perfect equality) to 100 (perfect inequality).	SWIID
Industrial pay-inequality	Defined as the dispersion of pay in manufacturing. It is measured by the between-group components of Theil's T statistics calculated across industries, based on the UNIDO Industrial Statistics (see Galbraith et al. (2015)).	UTIP-UNIDO
Between-region inequality	Measures interpersonal pay inequality between regions of a country. The between-region component is the sum of Theil elements for all regions of a country, where Theil elements are derived using the employment and wages of each region (see Galbraith and Garcilazo (2008)).	UTIP
Within-region inequality	Measures interpersonal pay inequality within regions of a country. The within-region component is the weighted average of the between-sector within-region Theil inequality index for each region of a country; the weights are wages weights (see Galbraith and Garcilazo (2008)).	UTIP
Overall Theil inequality	Sum of the between-region component and the within-region component	UTIP

Table A.2: **Description of explanatory variables and their data sources**

Variable	Description	Data sources
Financial development	Measured by: 1) total bank credit to private sector; 2) *BusinessCredit* – sum of credit to non-financial business and household consumer credit; 3) *FIRECredit* – sum of credit to financial business and household mortgage credit. All credit variables in % nominal GDP.	Central banks' statistics
Income level	GDP per capita (ln), in 2005 U.S. dollars	WDI World Bank
Income growth	Annual growth rate of GDP per capita.	WDI World Bank
Output gap	Gap between actual and potential GDP at 2010 reference levels (in % of potential GDP at constant prices).	AMECO database
Wage share	Adjusted wage share: total economy: as % of GDP at current prices.	AMECO database
VA share of manufacturing	Share of Gross VA of manufacturing in total VA branches (in %, from current prices).	AMECO database
Inflation	Measured as $\frac{\pi/100}{1+\pi/100}$, where π denotes the annual CPI inflation rate	WDI World Bank
Unemployment	Unemployed as a share (in %) of labor force	WDI World Bank
Schooling years	Educational Attainment for Population Aged >25 (average years of schooling)	Barro and Lee (2013)
Government expenditure	General government final consumption expenditure in % of GDP	WDI World Bank, IFS IMF
Population growth	Annual growth rate (in %)	WDI World Bank
Financial deregulation	Credit market deregulation index. Consists of 3 components: ownership of banks, extension of credit, and presence of interest rate controls/negative interest rates. The credit deregulation index is an average of the components; it takes values from 1 to 10.	Fraser Institute's Economic Freedom Indicators
Trade openness	Sum of export and import of goods and services as % of GDP	IFS IMF
Capital inflows	Total inflows (sum of FDI, portfolio and other investment loans) in % nominal GDP.	IMF BoP
Real stock price	Annual stock market index (deflated by CPI)	OECD
Real house price	Annual house price index (deflated by CPI)	BIS
Labor union strength	Trade union density, measured as the ratio of earners that are trade union members, divided by the total number of earners.	OECD
VA share of FIRE	Share of FIRE Value Added in total Value Added of the economy.	Eurostat, OECD
Non-residential investment	Nonresidential investment (total gross fixed capital formation minus dwellings) in % GDP.	Ameco, Eurostat

Table A.3: **Descriptive statistics over 1990–2012**

Variable	No obs.	Mean	Sd	Min	Max
Inequality measures					
Gini net	588	28.63	4.39	17.96	36.72
Pay inequality (×100)	433	2.21	1.43	0.28	7.37
Theil between-region inequality (×100)	359	0.89	1.37	0.00	7.24
Theil within-region inequality (×100)	359	1.30	0.83	0.00	5.47
Theil overall regional inequality (×100)	359	2.19	1.82	0.00	10.18
Credit variables					
Total bank credit	423	84.23	49.51	9.12	272.69
BusinessCredit (1+2)	414	48.08	25.75	8.48	184.49
1. Non-financial business credit	423	37.77	19.30	8.08	126.91
2. Consumer credit	414	10.15	8.44	0.17	61.03
FIRECredit (3+4)	389	38.81	31.04	0.34	143.44
3. Financial business credit	397	9.62	12.04	0.03	69.27
4. Mortgage credit	414	27.66	22.73	0.06	101.59
Control variables					
GDP per capita (ln)	595	9.75	0.80	7.81	10.88
Income growth	574	2.10	4.03	−21.17	13.08
Output gap	521	0.11	3.09	−12.88	14.83
Wage share in GDP	559	54.10	5.84	35.23	85.34
VA share of manufacturing	561	18.69	4.74	5.05	33.82
Inflation (transformed)	590	0.07	0.14	−0.05	0.91
Unemployment	587	8.98	4.18	0.60	24.80
Schooling years	598	9.93	1.55	5.25	13.16
Government expenditure	595	19.56	3.51	5.69	28.06
Population growth	598	0.19	0.75	−2.57	2.89
Financial deregulation	583	7.89	2.36	0.00	10.00
Trade openness	595	96.46	39.63	35.29	199.01
Total capital inflows	535	18.26	49.12	−101.35	636.46
Real stock price	530	102.12	62.42	10.29	491.40
Real house price	417	88.67	26.87	38.50	208.33
Labor union strength	442	34.77	21.00	0.00	83.86
VA share of FIRE	510	13.66	2.52	8.056	24.10
Non-residential investment	546	18.16	4.15	9.54	35.26

Table A.4: **Robustness check: full specification of controls**

	Gini12′	Gini07′	Pay inequality	Theil overall	Theil between	Theil within
$FIRECredit_{t-1}$	0.007	0.031 **	0.009 **	0.001	0.005	−0.004
	(0.008)	(0.012)	(0.004)	(0.004)	(0.004)	(0.004)
$BusinessCredit_{t-1}$	−0.046 **	−0.043 **	−0.006	−0.013 **	−0.011 **	−0.002
	(0.017)	(0.017)	(0.004)	(0.007)	(0.005)	(0.002)
GDP per capita	2.207	−4.698	−0.243	2.437	2.179 *	0.257
	(3.319)	(4.284)	(0.881)	(1.718)	(1.071)	(0.891)
Income growth	0.082	0.130 ***	0.010	0.024	0.033 *	−0.009
	(0.049)	(0.041)	(0.014)	(0.025)	(0.019)	(0.010)
Output gap	−0.109	−0.046	−0.026	−0.021	−0.021	0.001
	(0.082)	(0.070)	(0.029)	(0.035)	(0.016)	(0.027)
Wage share (as % GDP)	0.173	0.260 ***	0.132 ***	0.087	0.108 **	−0.021
	(0.112)	(0.070)	(0.031)	(0.051)	(0.049)	(0.016)
VA share of manufacturing	0.142	0.209	0.090 **	−0.014	−0.077	0.063
	(0.104)	(0.137)	(0.038)	(0.085)	(0.053)	(0.039)
Inflation	−6.848	−26.165 *	0.026	−0.668	0.634	−1.301
	(10.053)	(12.609)	(2.472)	(2.470)	(1.564)	(1.587)
Unemployment	0.121	0.199 **	0.048 **	−0.005	−0.013	0.007
	(0.072)	(0.078)	(0.022)	(0.033)	(0.020)	(0.026)
Schooling years	0.160	−0.112	0.362 ***	0.137	0.032	0.105
	(0.205)	(0.170)	(0.091)	(0.108)	(0.048)	(0.085)
Government expenditures	0.234 *	0.353 ***	−0.217 ***	−0.049	−0.058	0.009
	(0.114)	(0.104)	(0.046)	(0.091)	(0.055)	(0.078)
Population growth	−0.183	0.703	−0.099	0.039	0.018	0.021
	(0.372)	(0.533)	(0.113)	(0.242)	(0.115)	(0.164)
Financial deregulation	0.383 **	0.340	−0.022	−0.058	−0.073 *	0.014
	(0.137)	(0.198)	(0.040)	(0.051)	(0.040)	(0.033)
Trade openness	−0.004	0.032	0.014 *	0.003	−0.0001	0.004
	(0.018)	(0.020)	(0.008)	(0.007)	(0.004)	(0.005)
Labor union strength	−0.054	−0.214 ***	−0.039 ***	−0.004	0.013 *	−0.017
	(0.060)	(0.045)	(0.007)	(0.016)	(0.007)	(0.014)
Total capital inflows	0.002	−0.008	0.004 **	0.002	−0.001	0.003 **
	(0.005)	(0.007)	(0.002)	(0.002)	(0.001)	(0.001)
Real house price	0.017 **	0.015	−0.001	−0.004	−0.005	0.001
	(0.007)	(0.012)	(0.003)	(0.005)	(0.003)	(0.003)
Real stock price	−0.0001	−0.001	−0.003 ***	−0.001	0.001	−0.002 **
	(0.003)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	271	171	156	212	212	212
Countries	20	20	20	20	20	20
R-squared	0.36	0.65	0.72	0.23	0.47	0.23

Notes: The dependent variables are: the Gini net income inequality index for 1990–2012 and 1990–2007; the UTIP-UNIDO industrial pay inequality index (×100) for 1990–2008, and the Theil regional pay inequality index (the sum of within and between Theil components); the Theil between-region index; and the Theil within-region index for 1995–2010. Credit variables are one-year lagged. The Table reports coefficient estimates with robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1. Constant term and country-fixed effects are included (not shown).

Table A.5: **Robustness check: Random effects regression**

	Gini12′	Gini07′	Pay inequality	Theil overall	Theil between	Theil within
$FIRECredit_{t-1}$	0.013 *	0.028 *	0.005	0.004	0.002	0.0003
	(0.008)	(0.016)	(0.004)	(0.004)	(0.004)	(0.002)
$BusinessCredit_{t-1}$	−0.030 **	−0.038	−0.008	−0.014 **	−0.012 **	−0.0002
	(0.015)	(0.024)	(0.006)	(0.006)	(0.005)	(0.005)
GDP per capita	0.734	1.193	−0.671	0.247	0.478	−0.222
	(1.650)	(1.659)	(0.434)	(0.536)	(0.339)	(0.301)
Income growth	0.080 **	0.193 ***	0.0001	−0.0001	0.016	−0.012 *
	(0.040)	(0.058)	(0.042)	(0.017)	(0.014)	(0.007)
Output gap	−0.138 **	−0.172 **	0.006	−0.013	−0.013	0.001
	(0.061)	(0.074)	(0.055)	(0.024)	(0.013)	(0.019)
Wage share (as % GDP)	−0.0004	0.031	0.002	0.028	0.049	−0.023
	(0.082)	(0.121)	(0.022)	(0.037)	(0.033)	(0.017)
VA share of manufacturing	−0.053	0.009	0.043	0.003	−0.065	0.039
	(0.079)	(0.113)	(0.034)	(0.082)	(0.047)	(0.039)
Inflation	4.010	3.015	−6.314	−2.300	−1.761	−0.475
	(6.703)	(7.052)	(4.613)	(1.925)	(2.103)	(1.092)
Unemployment	−0.026	0.052	0.041	−0.026	−0.009	−0.018
	(0.098)	(0.089)	(0.034)	(0.026)	(0.014)	(0.021)
Schooling years	0.048	−0.036	0.257	0.180	0.061	0.062
	(0.168)	(0.238)	(0.160)	(0.116)	(0.046)	(0.103)
Observations	355	233	218	271	271	271
Countries	25	23	24	24	24	24
R-squared	0.15	0.26	0.27	0.14	0.30	0.11

Notes: The dependent variables are: the Gini net income inequality index for 1990–2012 and 1990–2007; the UTIP-UNIDO industrial pay inequality index (×100) for 1990–2008, and the Theil regional pay inequality index (the sum of within and between Theil components); the Theil between-region index; and the Theil within-region index for 1995–2010. Credit variables are one-year lagged. The Table reports coefficient estimates with robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1. Constant term and country-fixed effects are included (not shown).

Table A.6: **Robustness check: IV fixed-effects regressions**

	Gini12′	Gini07′	Pay inequality	Theil overall	Theil between	Theil within
$FIRECredit_{t-1}$	0.017 **	0.037 **	0.009 *	0.002	−0.0001	0.002
	(0.008)	(0.015)	(0.005)	(0.004)	(0.003)	(0.002)
$BusinessCredit_{t-1}$	−0.040 ***	−0.056 **	−0.009	−0.016 ***	−0.011 **	−0.005 *
	(0.012)	(0.022)	(0.009)	(0.006)	(0.005)	(0.003)
GDP per capita	1.936	3.545	0.827	0.672	0.823 *	−0.150
	(2.192)	(2.403)	(0.679)	(0.761)	(0.486)	(0.510)
Income growth	0.080 **	0.198 ***	−0.006	0.008	0.021	−0.014
	(0.037)	(0.042)	(0.030)	(0.019)	(0.016)	(0.008)
Output gap	−0.196 ***	−0.254 ***	−0.034	−0.017	−0.026 **	0.0091
	(0.054)	(0.064)	(0.041)	(0.024)	(0.013)	(0.019)
Wage share (as % GDP)	0.005	0.032	0.035	0.022	0.040	−0.017
	(0.092)	(0.132)	(0.042)	(0.039)	(0.035)	(0.014)
VA share of manufacturing	0.078	0.208	0.208 ***	−0.023	−0.084	0.061
	(0.076)	(0.145)	(0.049)	(0.091)	(0.057)	(0.042)
Inflation	7.870	9.840	−10.173 ***	−2.249	−1.371	−0.878
	(6.149)	(6.318)	(3.498)	(2.169)	(2.289)	(0.977)
Unemployment	−0.067	0.010	0.057 **	−0.029	−0.015	−0.014
	(0.095)	(0.073)	(0.028)	(0.026)	(0.013)	(0.018)
Schooling years	0.133	0.024	0.442 ***	0.145	0.021	0.124
	(0.179)	(0.259)	(0.132)	(0.132)	(0.049)	(0.115)
Observations	309	191	179	242	242	242
Countries	24	22	23	24	24	24
R-squared	0.20	0.34	0.48	0.16	0.28	0.15

Notes: The dependent variables are: the Gini net income inequality index for 1990–2012 and 1990–2007; the UTIP-UNIDO industrial pay inequality index (×100) for 1990–2008, and the Theil regional pay inequality index (the sum of within and between Theil components); the Theil between-region index; and the Theil within-region index for 1995–2010. Credit variables are one-year lagged. The Table reports coefficient estimates with robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1. Constant term and country-fixed effects are included (not shown).

Table A.7: **Robustness check: 3-year data**

	Gini12′	Gini07′	Pay inequality	Theil overall	Theil between	Theil within
$FIRECredit_{t-1}$	0.004	0.030 *	0.014 ***	0.0004	−0.003	0.003
	(0.009)	(0.017)	(0.005)	(0.005)	(0.004)	(0.003)
$BusinessCredit_{t-1}$	−0.037 **	−0.058 **	−0.014	−0.019 **	−0.015 **	−0.005
	(0.015)	(0.022)	(0.013)	(0.007)	(0.006)	(0.004)
GDP per capita0	2.635	4.430	−1.115 **	0.479	0.812	−0.332
	(1.979)	(2.878)	(0.517)	(0.830)	(0.544)	(0.574)
Income growth	0.230 ***	0.375 ***	−0.009	0.045	0.055	−0.010
	(0.076)	(0.109)	(0.021)	(0.048)	(0.039)	(0.027)
Output gap	−0.299 ***	−0.394 ***	0.0001	−0.056	−0.0676**	0.011
	(0.066)	(0.103)	(0.030)	(0.038)	(0.032)	(0.033)
Wage share (as % GDP)	0.017	−0.031	0.046	0.010	0.032	−0.022
	(0.112)	(0.153)	(0.031)	(0.045)	(0.038)	(0.016)
VA share of manufacturing	−0.030	0.091	0.196 ***	−0.039	−0.123	0.084
	(0.095)	(0.150)	(0.055)	(0.119)	(0.086)	(0.052)
Inflation	14.447 *	20.448 **	−16.583 ***	0.068	−0.496	0.564
	(7.326)	(9.545)	(2.334)	(4.347)	(3.842)	(2.019)
Unemployment	−0.033	0.085	0.035	−0.028	−0.031	0.003
	(0.106)	(0.079)	(0.031)	(0.035)	(0.025)	(0.022)
Schooling years	0.136	0.102	0.495 **	0.236	0.025	0.211
	(0.203)	(0.338)	(0.198)	(0.157)	(0.070)	(0.161)
Observations	118	69	70	91	91	91
Countries	25	22	24	24	24	24
R-squared	0.23	0.44	0.75	0.24	0.37	0.23

Notes: The dependent variables are: the Gini net income inequality index for 1990–2012 and 1990–2007; the UTIP-UNIDO industrial pay inequality index (×100) for 1990–2008, and the Theil regional pay inequality index (the sum of within and between Theil components); the Theil between-region index; and the Theil within-region index for 1995–2010. Credit variables are one-year lagged. The Table reports coefficient estimates with robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1. Constant term and country-fixed effects are included (not shown).

Appendix B: Construction of country-base regional Theil indexes[8]

In the regional inequality indexes in the UTIP dataset, the reference is EU-wide inequality. Inequality of a region is compared to the average inequality in all other regions in the EU, using the population weight and wage weights of the region in the EU population and wage. In this paper we are interested in explaining regional inequality relative to other regions in the same country, not relative to the EU. Therefore we constructed Theil indexes by re-calculating the UTIP Theil indices which have the whole EU as their reference. Appendix B describes the calculation. Since industrial and regional pay inequality variables are measured on a scale from 0 to 10, we pre-multiplied them by 100 for easier presentation and interpretation.

The between-region component of Theil pay inequality index for the EU is the sum of regional Theil elements and is expressed in UTIP as:

$$T_{EU}^{B} = \sum_{j=1}^{m} \left(\frac{P_j}{P} \frac{\bar{Y}_j}{\bar{Y}} log? \left(\frac{\bar{Y}_j}{\bar{Y}} \right) \right) \tag{A.1}$$

where $\bar{Y}_j = \frac{Y_j}{P_j}$ is the average wage income of region j; Y_j is the wage income of region j; P_j is the number of individuals employed in all sectors of region j; P is the total number of employed in all regions in the EU; $\frac{P_j}{P}$ is the population weight of region j in the EU; $\bar{Y} = \frac{Y}{P}$, with Y being the total income of all regions of all countries in the EU.

Thus, the **Theil regional element for EU** for region j, TEL_{jEU} is expressed as:

$$TEL_{jEU} = \frac{P_j}{P} \frac{\bar{Y}_j}{\bar{Y}} log? \left(\frac{\bar{Y}_j}{\bar{Y}} \right) = \frac{P_j}{P} \left(\frac{Y_j}{P_j} \div \frac{Y}{P} \right) log? \left(\frac{\bar{Y}_j}{\bar{Y}} \right) = \frac{Y_j}{Y} log \left(\frac{\bar{Y}_j}{\bar{Y}} \right) \tag{A.2}$$

where $\frac{Y_j}{Y}$ is the regional income weight for EU (the share of income of region j in the total income of all regions of all countries in EU.

To construct regional Theil inequality indexes with a country base, we need to recalculate regional income weights and regional Theil elements for each country rather than for the whole EU.

Regional income weights in a country income are computed as follows:

1. Sum up regional income weights for all regions of each country: $\sum_{j=1}^{N_c} \frac{Y_j}{Y} = \frac{Y_c}{Y}$, where N_c is the number of regions in country c, $\frac{Y_c}{Y}$ is the income weight of country c in total income of EU.
2. Divide regional income weights for EU by country income weight for EU to get **regional income weights in a country's income**: $\frac{Y_j}{Y_c} = \frac{Y_j}{Y} \div \frac{Y_c}{Y}$.

In analogy to computing regional Theil elements for the EU base (see equation (A.2)), **regional Theil elements for a country base** can be calculated as:

[8]We thank Jamie Galbraith and Wenjie Chen for making the data available and answering our queries.

$$TEL_{jc} = \frac{Y_j}{Y_c} log\left(\frac{\bar{Y_j}}{\bar{Y_c}}\right) = \frac{Y_j}{Y_c} log\left(\frac{Y_j}{P_j} \div \frac{Y_c}{P_c}\right) = \frac{Y_j}{Y_c} log\left(\frac{Y_j}{Y_c} \div \frac{P_j}{P_c}\right) \tag{A.3}$$

where $\frac{Y_j}{Y_c}$ is an income weight of region j in total income of country c, $\frac{P_j}{P_c}$ is employment share of region j in total employment of country c.

The employment shares with a country base are derived as follows:

1. Re-write equation A.2: $TEL_{jEU} = \frac{Y_j}{Y} log\left(\frac{Y_j}{P_j} \div \frac{Y}{P}\right) = \frac{Y_j}{Y} log\left(\frac{Y_j}{Y}\frac{P}{P_j}\right)? = \frac{Y_j}{Y} log\frac{Y_j}{Y} + \frac{Y_j}{Y} log\frac{P}{P_j}$. First, calculate $\frac{Y_j}{Y} log\frac{Y_j}{Y}$.
2. Calculate $X = \frac{Y_j}{Y} log\frac{P}{P_j} = TEL_{jEU} - \frac{Y_j}{Y} log\frac{Y_j}{Y}$. Compute $\frac{P}{P_j} = \exp(X \div \frac{Y_j}{Y})$.
3. Calculate employment shares for EU base as $\frac{P_j}{P}$.
4. Sum up regional employment shares for all regions of each country: $\sum_{j=1}^{N_c} \frac{P_j}{P} = \frac{P_c}{P}$, where $\frac{P_c}{P}$ is the employment share of country c in total employment of EU.
5. Divide regional employment share for EU by country employment share for EU to get **regional employment shares in a country's employment**, $\frac{P_j}{P_c} = \frac{P_j}{P} \div \frac{P_c}{P}$.
6. Calculate **regional Theil elements for country base**, using regional income weights in country income and regional employment shares in country employment:

$$TEL_{jc} = \frac{Y_j}{Y_c} log\left(\frac{Y_j}{Y_c} \div \frac{P_j}{P_c}\right) \tag{A.4}$$

The **between-region Theil inequality index** for country base is the sum of regional Theil elements:

$$T_c^B = \sum_{j=1}^{N_c} TEL_{jc} \tag{A.5}$$

The within-region component of Theil Inequality Index for EU is calculated as:

$$T_{EU}^W = \sum_{j=1}^{m} \left(\frac{Y_j}{Y} T_j^{'}\right) \tag{A.6}$$

where $T_j^{'}$ is the between-sector within-region Theil inequality index for region j (see UTIP documentation). $T_j^{'}$ is not dependent on EU base, so we do not have to change it.

The **within-region Theil inequality index** for country base, is calculated analogically, just replacing income weights for EU with weights for country:

$$T_c^W = \sum_{j=1}^{N_c} \left(\frac{Y_j}{Y_c} T_j^{'}\right) \tag{A.7}$$

Overall Theil inequality index sums between- and within-region components:

$$T_c = T_c^B + T_c^W \tag{A.8}$$

List of research reports

12001-HRM&OB: Veltrop, D.B., C.L.M. Hermes, T.J.B.M. Postma and J. de Haan, A Tale of Two Factions: Exploring the Relationship between Factional Faultlines and Conflict Management in Pension Fund Boards

12002-EEF: Angelini, V. and J.O. Mierau, Social and Economic Aspects of Childhood Health: Evidence from Western-Europe

12003-Other: Valkenhoef, G.H.M. van, T. Tervonen, E.O. de Brock and H. Hillege, Clinical trials information in drug development and regulation: existing systems and standards

12004-EEF: Toolsema, L.A. and M.A. Allers, Welfare financing: Grant allocation and efficiency

12005-EEF: Boonman, T.M., J.P.A.M. Jacobs and G.H. Kuper, The Global Financial Crisis and currency crises in Latin America

12006-EEF: Kuper, G.H. and E. Sterken, Participation and Performance at the London 2012 Olympics

12007-Other: Zhao, J., G.H.M. van Valkenhoef, E.O. de Brock and H. Hillege, ADDIS: an automated way to do network meta-analysis

12008-GEM: Hoorn, A.A.J. van, Individualism and the cultural roots of management practices

12009-EEF: Dungey, M., J.P.A.M. Jacobs, J. Tian and S. van Norden, On trend-cycle decomposition and data revision

12010-EEF: Jong-A-Pin, R., J-E. Sturm and J. de Haan, Using real-time data to test for political budget cycles

12011-EEF: Samarina, A., Monetary targeting and financial system characteristics: An empirical analysis

12012-EEF: Alessie, R., V. Angelini and P. van Santen, Pension wealth and household savings in Europe: Evidence from SHARELIFE

13001-EEF: Kuper, G.H. and M. Mulder, Cross-border infrastructure constraints, regulatory measures and economic integration of the Dutch – German gas market

13002-EEF: Klein Goldewijk, G.M. and J.P.A.M. Jacobs, The relation between stature and long bone length in the Roman Empire

13003-EEF: Mulder, M. and L. Schoonbeek, Decomposing changes in competition in the Dutch electricity market through the Residual Supply Index

13004-EEF: Kuper, G.H. and M. Mulder, Cross-border constraints, institutional changes and integration of the Dutch – German gas market

13005-EEF: Wiese, R., Do political or economic factors drive healthcare financing privatisations? Empirical evidence from OECD countries

13006-EEF: Elhorst, J.P., P. Heijnen, A. Samarina and J.P.A.M. Jacobs, State transfers at different moments in time: A spatial probit approach

13007-EEF: Mierau, J.O., The activity and lethality of militant groups: Ideology, capacity, and environment

13008-EEF: Dijkstra, P.T., M.A. Haan and M. Mulder, The effect of industry structure and yardstick design on strategic behavior with yardstick competition: an experimental study

13009-GEM: Hoorn, A.A.J. van, Values of financial services professionals and the global financial crisis as a crisis of ethics

13010-EEF: Boonman, T.M., Sovereign defaults, business cycles and economic growth in Latin America, 1870-2012

13011-EEF: He, X., J.P.A.M Jacobs, G.H. Kuper and J.E. Ligthart, On the impact of the global financial crisis on the euro area

13012-GEM: Hoorn, A.A.J. van, Generational shifts in managerial values and the coming of a global business culture

13013-EEF: Samarina, A. and J.E. Sturm, Factors leading to inflation targeting – The impact of adoption

13014-EEF: Allers, M.A. and E. Merkus, Soft budget constraint but no moral hazard? The Dutch local government bailout puzzle

13015-GEM: Hoorn, A.A.J. van, Trust and management: Explaining cross-national differences in work autonomy

13016-EEF: Boonman, T.M., J.P.A.M. Jacobs and G.H. Kuper, Sovereign debt crises in Latin America: A market pressure approach

13017-GEM: Oosterhaven, J., M.C. Bouwmeester and M. Nozaki, The impact of production and infrastructure shocks: A non-linear input-output programming approach, tested on an hypothetical economy

13018-EEF: Cavapozzi, D., W. Han and R. Miniaci, Alternative weighting structures for multidimensional poverty assessment

14001-OPERA: Germs, R. and N.D. van Foreest, Optimal control of production-inventory systems with constant and compound poisson demand

14002-EEF: Bao, T. and J. Duffy, Adaptive vs. eductive learning: Theory and evidence

14003-OPERA: Syntetos, A.A. and R.H. Teunter, On the calculation of safety stocks

14004-EEF: Bouwmeester, M.C., J. Oosterhaven and J.M. Rueda-Cantuche, Measuring the EU value added embodied in EU foreign exports by consolidating 27 national supply and use tables for 2000-2007

14005-OPERA: Prak, D.R.J., R.H. Teunter and J. Riezebos, Periodic review and continuous ordering

14006-EEF: Reijnders, L.S.M., The college gender gap reversal: Insights from a life-cycle perspective

14007-EEF: Reijnders, L.S.M., Child care subsidies with endogenous education and fertility

14008-EEF: Otter, P.W., J.P.A.M. Jacobs and A.H.J. den Reijer, A criterion for the number of factors in a data-rich environment

14009-EEF: Mierau, J.O. and E. Suari Andreu, Fiscal rules and government size in the European Union

14010-EEF: Dijkstra, P.T., M.A. Haan and M. Mulder, Industry structure and collusion with uniform yardstick competition: theory and experiments

14011-EEF: Huizingh, E. and M. Mulder, Effectiveness of regulatory interventions on firm behavior: a randomized field experiment with e-commerce firms

14012-GEM: Bressand, A., Proving the old spell wrong: New African hydrocarbon producers and the 'resource curse'

14013-EEF: Dijkstra P.T., Price leadership and unequal market sharing: Collusion in experimental markets

14014-EEF: Angelini, V., M. Bertoni, and L. Corazzini, Unpacking the determinants of life satisfaction: A survey experiment

14015-EEF: Heijdra, B.J., J.O. Mierau, and T. Trimborn, Stimulating annuity markets

14016-GEM: Bezemer, D., M. Grydaki, and L. Zhang, Is financial development bad for growth?

14017-EEF: De Cao, E. and C. Lutz, Sensitive survey questions: measuring attitudes regarding female circumcision through a list experiment

14018-EEF: De Cao, E., The height production function from birth to maturity

14019-EEF: Allers, M.A. and J.B. Geertsema, The effects of local government amalgamation on public spending and service levels. Evidence from 15 years of municipal boundary reform

14020-EEF: Kuper, G.H. and J.H. Veurink, Central bank independence and political pressure in the Greenspan era

14021-GEM: Samarina, A. and D. Bezemer, Do Capital Flows Change Domestic Credit Allocation?

14022-EEF: Soetevent, A.R. and L. Zhou, Loss Modification Incentives for Insurers Under ExpectedUtility and Loss Aversion

14023-EEF: Allers, M.A. and W. Vermeulen, Fiscal Equalization, Capitalization and the Flypaper Effect.

14024-GEM: Hoorn, A.A.J. van, Trust, Workplace Organization, and Comparative Economic Development.

14025-GEM: Bezemer, D., and L. Zhang, From Boom to Bust in de Credit Cycle: The Role of Mortgage Credit.

14026-GEM: Zhang, L., and D. Bezemer, How the Credit Cycle Affects Growth: The Role of Bank Balance Sheets.

14027-EEF: Bružikas, T., and A.R. Soetevent, Detailed Data and Changes in Market Structure: The Move to Unmanned Gasoline Service Stations.

14028-EEF: Bouwmeester, M.C., and B. Scholtens, Cross-border Spillovers from European Gas Infrastructure Investments.

14029-EEF: Lestano, and G.H. Kuper, Correlation Dynamics in East Asian Financial Markets.

14030-GEM: Bezemer, D.J., and M. Grydaki, Nonfinancial Sectors Debt and the U.S. Great Moderation.

14031-EEF: Hermes, N., and R. Lensink, Financial Liberalization and Capital Flight: Evidence from the African Continent.

14032-OPERA: Blok, C. de, A. Seepma, I. Roukema, D.P. van Donk, B. Keulen, and R. Otte, Digitalisering in Strafrechtketens: Ervaringen in Denemarken, Engeland, Oostenrijk en Estland vanuit een Supply Chain Perspectief.

14033-OPERA: Olde Keizer, M.C.A., and R.H. Teunter, Opportunistic condition-based maintenance and aperiodic inspections for a two-unit series system.

14034-EEF: Kuper, G.H., G. Sierksma, and F.C.R. Spieksma, Using Tennis Rankings to Predict Performance in Upcoming Tournaments

15001-EEF: Bao, T., X. Tian, X. Yu, Dictator Game with Indivisibility of Money

15002-GEM: Chen, Q., E. Dietzenbacher, and B. Los, The Effects of Ageing and Urbanization on China's Future Population and Labor Force

15003-EEF: Allers, M., B. van Ommeren, and B. Geertsema, Does intermunicipal cooperation create inefficiency? A comparison of interest rates paid by intermunicipal organizations, amalgamated municipalities and not recently amalgamated municipalities

15004-EEF: Dijkstra, P.T., M.A. Haan, and M. Mulder, Design of Yardstick Competition and Consumer Prices: Experimental Evidence

15005-EEF: Dijkstra, P.T., Price Leadership and Unequal Market Sharing: Collusion in Experimental Markets

15006-EEF: Anufriev, M., T. Bao, A. Sutin, and J. Tuinstra, Fee Structure, Return Chasing and Mutual Fund Choice: An Experiment

15007-EEF: Lamers, M., Depositor Discipline and Bank Failures in Local Markets During the Financial Crisis

15008-EEF: Oosterhaven, J., On de Doubtful Usability of the Inoperability IO Model

15009-GEM: Zhang, L. and D. Bezemer, A Global House of Debt Effect? Mortgages and Post-Crisis Recessions in Fifty Economies

15010-I&O: Hooghiemstra, R., N. Hermes, L. Oxelheim, and T. Randøy, The Impact of Board Internationalization on Earnings Management

15011-EEF: Haan, M.A., and W.H. Siekman, Winning Back the Unfaithful while Exploiting the Loyal: Retention Offers and Heterogeneous Switching Costs

15012-EEF: Haan, M.A., J.L. Moraga-González, and V. Petrikaite, Price and Match-Value Advertising with Directed Consumer Search

15013-EEF: Wiese, R., and S. Eriksen, Do Healthcare Financing Privatisations Curb Total Healthcare Expenditures? Evidence from OECD Countries

15014-EEF: Siekman, W.H., Directed Consumer Search

15015-GEM: Hoorn, A.A.J. van, Organizational Culture in the Financial Sector: Evidence from a Cross-Industry Analysis of Employee Personal Values and Career Success

15016-EEF: Te Bao, and C. Hommes, When Speculators Meet Constructors: Positive and Negative Feedback in Experimental Housing Markets

15017-EEF: Te Bao, and Xiaohua Yu, Memory and Discounting: Theory and Evidence

15018-EEF: Suari-Andreu, E., The Effect of House Price Changes on Household Saving Behaviour: A Theoretical and Empirical Study of the Dutch Case

15019-EEF: Bijlsma, M., J. Boone, and G. Zwart, Community Rating in Health Insurance: Trade-off between Coverage and Selection

15020-EEF: Mulder, M., and B. Scholtens, A Plant-level Analysis of the Spill-over Effects of the German *Energiewende*

15021-GEM: Samarina, A., L. Zhang, and D. Bezemer, Mortgages and Credit Cycle Divergence in Eurozone Economies

16001-GEM: Hoorn, A. van, How Are Migrant Employees Manages? An Integrated Analysis

16002-EEF: Soetevent, A.R., Te Bao, A.L. Schippers, A Commercial Gift for Charity

16003-GEM: Bouwmeerster, M.C., and J. Oosterhaven, Economic Impacts of Natural Gas Flow Disruptions

16004-MARK: Holtrop, N., J.E. Wieringa, M.J. Gijsenberg, and P. Stern, Competitive Reactions to Personal Selling: The Difference between Strategic and Tactical Actions

16005-EEF: Plantinga, A. and B. Scholtens, The Financial Impact of Divestment from Fossil Fuels

16006-GEM: Hoorn, A. van, Trust and Signals in Workplace Organization: Evidence from Job Autonomy Differentials between Immigrant Groups

16007-EEF: Willems, B. and G. Zwart, Regulatory Holidays and Optimal Network Expansion

16008-GEF: Hoorn, A. van, Reliability and Validity of the Happiness Approach to Measuring Preferences

16009-EEF: Hinloopen, J., and A.R. Soetevent, (Non-)Insurance Markets, Loss Size Manipulation and Competition: Experimental Evidence

16010-EEF: Bekker, P.A., A Generalized Dynamic Arbitrage Free Yield Model

16011-EEF: Mierau, J.A., and M. Mink, A Descriptive Model of Banking and Aggregate Demand

16012-EEF: Mulder, M. and B. Willems, Competition in Retail Electricity Markets: An Assessment of Ten Year Dutch Experience

16013-GEM: Rozite, K., D.J. Bezemer, and J.P.A.M. Jacobs, Towards a Financial Cycle for the US, 1873-2014

16014-EEF: Neuteleers, S., M. Mulder, and F. Hindriks, Assessing Fairness of Dynamic Grid Tariffs

16015-EEF: Soetevent, A.R., and T. Bružikas, Risk and Loss Aversion, Price Uncertainty and the Implications for Consumer Search

16016-HRM&OB: Meer, P.H. van der, and R. Wielers, Happiness, Unemployment and Self-esteem

16017-EEF: Mulder, M., and M. Pangan, Influence of Environmental Policy and Market Forces on Coal-fired Power Plants: Evidence on the Dutch Market over 2006-2014

16018-EEF: Zeng,Y., and M. Mulder, Exploring Interaction Effects of Climate Policies: A Model Analysis of the Power Market

16019-EEF: Ma, Yiqun, Demand Response Potential of Electricity End-users Facing Real Time Pricing

16020-GEM: Bezemer, D., and A. Samarina, Debt Shift, Financial Development and Income Inequality in Europe

www.rug.nl/feb