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Credit, crises and inequality

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Abstract

The global financial crisis was a stark illustration of the cost of financial instability at both the macroeconomic and individual level. Millions lost their jobs and, in many instances, incomes are yet to fully recover. In response, macroprudential regimes have been set up around the world, tasked with insuring against future crises. These regimes have been empowered with new tools to safeguard both lender and borrower resilience. Using those tools can have distributional costs, potentially limiting individual borrowing choices. But *not* using those tools can also have distributional consequences, in the event of an untamed crisis. Using a panel dataset of 26 advanced economies over five decades, we show that inequality – as measured by the Gini coefficient – rises following a financial crisis. We unpack this result with two novel contributions. First, we demonstrate that the inequality effects are driven by both a more severe spike in unemployment and a skewed impact on the income of those remaining in work. Second, we show that rapid credit growth in the run up to a downturn amplifies the increase in inequality that follows. These insights add a new dimension to macroprudential cost-benefit analysis, at the distributional level.

Key words:
***JEL* classification**:

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1 Introduction

The global financial crisis was a stark illustration of the cost of financial instability at both the macroeconomic and individual level. As the credit boom turned to bust, millions lost their jobs and, in many instances, incomes are yet to fully recover. In the US, for example, in the three years following 2007, GDP per capita fell 8.5% below a continuation of its pre-crisis trend and unemployment rose by over 7 million. The crisis also had heterogeneous impacts for those remaining in work, hitting those on low incomes the hardest. During the crisis, the average market income inequality across OECD countries increased by 1.4 percentage points (OECD, 2013).Taking these factors together, there were strong links between credit, crisis and inequality.

In the decade following the crisis, there has been an overhaul in financial regulation, seeking to ensure against the crisis dynamics that proved so costly. A key part of the institutional memory of the crisis has been the advent of macroprudential policy regimes, led by financial stability committees that now exist in over 40 countries around the world (Edge and Liang, 2017). These committees are tasked with addressing systemic risks that could cause the financial system to amplify, rather than absorb, the real economy impact of negative shocks. Macroprudential regimes have been empowered with new tools to address the fault lines in both lender and borrower resilience which drove the severity of the global financial crisis (Aikman, Bridges, Kashyap and Siegert ,2019; Bernanke 2018).

The implementation of macroprudential measures has both costs and benefits. The aim is to build resilience to – or lean against the development of – financial vulnerabilities that would otherwise amplify the economic fall-out of negative shocks. The benefit is therefore to reduce the size of macroeconomic tail events. Like any insurance policy, such interventions are likely to come with a premium. The cost of macroprudential insurance against the bad times is to introduce some "sand in the wheels" of finance in normal times. Establishing robust measures of these costs and benefits is essential in calibrating appropriate macroprudential reaction functions and will require a programme of research.

Macroprudential intervention – particularly with borrower-based tools – can have distributional effects, potentially limiting individual borrowing choices. While distributional outcomes are outside the macroeconomic realm of central banking, they are important to understand and may prove controversial (see for example Balls, Howat, and Stansbury 2016; Tucker, 2018).

It is equally important to understand the distributional consequences of an *absence* of macroprudentialism. In the event of untamed financial imbalances that lead to an amplified recession or, in the extreme, a financial crisis, what are the distributional consequences? This counterfactual is the focus of our paper. Without it, it is not possible to assess the distributional consequences of macroprudential intervention in context. We therefore begin

to facilitate a new dimension in macroprudential cost-benefit analysis, at the distributional level.

We investigate the impact of normal and financial recessions on income inequality and also the role of private sector credit in shaping the distributional effect. While a limited number of empirical studies have found that crises are related to income inequality few have incorporated the most recent global financial crisis in their dataset (Atkinson and Morelli 2011: De Haan and Sturm, 2017).

To understand the links between credit, crises and inequality we use a panel dataset of 26 advanced economies over five decades. Analysing around 100 recessions and crises in our sample, we show that income inequality – as measured by the Gini coefficient – rises in both normal recessions and, by more, in financial crises. The distributional effects are statistically significant and economically meaningful: the Gini coefficient rises by an average of 5% in the five years following a crisis in our sample.

We unpack this result with two novel contributions. First, we demonstrate that the inequality effects associated with recessions and crises are driven by both a spike in unemployment and a skewed impact on the income of those remaining in work. This second channel is consistent with aggregate income shocks loading most heavily on lower-income workers, perhaps reflecting their relative lack of bargaining power, a greater prevalence of variable hour contracts amongst the low paid and the greater effect of the unemployed or new labour market participants in depressing the wages of lower-skilled workers.

Second, we show that rapid credit growth in the three years running up to a downturn amplifies the increase in inequality that follows. We find that these amplification effects of credit growth are particularly strong in the lead up to a financial crisis. These amplification effects are consistent with the growing literature which links measures of the financial cycle – such as credit growth – with the severity of subsequent macroeconomic tail events (see for example Jordà, Schularick & Taylor, 2014; Bridges et al, 2017). To our knowledge, our paper is the first to extend those findings into distributional space.

These contributions provide a baseline for future macroprundential cost benefit analysis in distributional space. For example, in principle, they allow us to calculate the potential distributional benefits of, say, leaning on rapid credit growth in the late stages of a credit boom, were it to turn into a bust. These “tail event” benefits can then meaningfully be weighed against any distributional costs of implementing the policy in the first place.

2 Hypotheses

Financial crises are typically associated with more severe recessions, including lower GDP growth and higher unemployment, than normal recessions (Bordo et al., 2001; Schularick and

Taylor, 2012; Jorda, Schularick, and Taylor, 2013; Claessens, Kose and Terrones, 2014). There are two main mechanisms behind this. First, there is a financial accelerator effect whereby malfunctioning credit markets are not just a symptom of economic deteriorations but a key factor in amplifying their severity (Bernanke et al, 1999). Second, housing busts generate an aggregate demand externality as households restructure their balance sheets through reductions in consumption (as modelled for example, in Korinek and Simsek,2014; Eggertsson and Krugman, 2012 and demonstrated empirically in, for example, Dynan, 2012; Mian and Sufi, 2012).

Several recent papers find these two channels to central in explaining the severity of the macroeconomic fallout following the recent global financial crisis. For example, Aikman, Bridges, Kashyap and Siegert (2019) find these two channels explain a large proportion (four fifths) of the fall in GDP the US experienced during its crisis. Bernanke (2018) finds that the unusual severity of the US recession was due primarily to the impairment of the credit supply, caused by panic in the funding and securitisation markets. Gertler and Gilchrist (2018), meanwhile, find that if the US had not experienced the disruption to credit intermediation that it did in its banking sector, its recession would have been relatively mild, even if house prices had fallen by the same amount.

In this paper, we therefore begin by exploring whether the established link between financial crises and more severe macroeconomic downturns also has implications for income inequality. We build this hypothesis up as follows:

Hypothesis 1: Exploring the link between financial crises and inequality:
Hypothesis 1a. *Unemployment rises in both normal and financial recessions, but financial recessions are associated with more severe unemployment effects than normal recessions*.
Hypothesis 1b. *Income inequality rises in both normal and financial recessions. Within that, financial recessions are associated with larger increases in income inequality than normal recessions.*
Hypothesis 1c. *The impact of recessions – particularly financial recessions – on income inequality (1b) is larger than the effects on inequality attributable to higher unemployment (1a).*

Our starting point (Hypothesis 1a) is simply to confirm the link between financial crises and recession severity, with a focus on the unemployment rate as a measure of macroeconomic severity. [This is an uncontroversial starting point, though is useful to confirm given the typical focus on GDP losses as a metric of recession severity in previous studies, an exception being Claessens, Kose and Terrones (2014).

Our next step (Hypothesis 1b) is to investigate the impact of recessions – and financial crisis-induced recessions in particular – on income inequality. This follows naturally as an extension to Hypothesis 1a, given unemployment effects are likely to translate directly into income

inequality effects, to the extent that unemployment and income inequality are typically positively correlated. This positive correlation would be consistent with a mechanism whereby increases in unemployment tend to worsen the relative position of low-income households.[1] Existing empirical evidence supports this link. For example, during the recent global financial crisis higher unemployment was a significant driver of rising market income inequality in the UK, in the rest of Europe and in the US (Jenkins et al, 2012; Eurofund, 2017).

The unemployment that recessions create – and that financial recessions exacerbate – could affect income inequality in a number of ways. First, and most directly, unemployment creates a group of people with zero market income. The effect this has on income inequality is in principle ambiguous, depending on where in the income distribution job losses occur most. If only high earners are made unemployed, inequality would likely reduce. In contrast, if unemployment affects both high and low earners equally, income inequality would be expected to rise because high earners typically have significant non-wage income sources to offset their lost labour income, while low earners have few if any (Metcalf, 1969). Moreover, it is typically low income earners who are most likely to lose their jobs in a recession for two reasons. First, they tend to be less skilled and so more likely to be employed in more cyclical (more recession-prone) industries (Hoynes et al, 2012). Second, low income earners are also more likely to be young with less secure job contracts, so easier to lay off (Elsby et al, 2010). These channels would suggest a direct link between the unemployment effects associated with financial recessions (hypothesis 1a) and knock-on effects on income inequality (hypothesis 1b).

Direct effects from unemployment are not the only potential link between financial recessions and the distribution of income. We explore the role played by channels other than unemployment on the link between crises and inequality in Hypothesis 1c. Theory suggests that, through a "wage Phillips curve" effect, high unemployment should lead to weaker bargaining power of workers, and lower wage growth. This is relevant for mean incomes, but has less to say about how the income distribution might change. There is evidence however, particularly from the Great Depression, that unemployment puts downward pressure on the wages of the lowest paid (Menderhausen, 1946). Other work suggests *wage* inequality (that is, the distribution of wages amongst those remaining employed) should rise during recessions due to work hours being reduced for low earners (Parker, 1999). Job search models meanwhile are able to predict higher income inequality for the continuously employed during recessions based on more able workers accumulating skills faster than less able ones (Barlevy and Tsiddon, 2006). During the most recent financial crisis wage inequality increased in the US, UK, Canada, Australia, New Zealand, Ireland and Scandinavian countries (Bonhomme and Hospido, 2012; Jenkins et al, 2012; Perri and Steinberg, 2012).

Looking at US data since 1945, Castaneda et al (1998) find that that the income share earned by the lowest income quintile is both the most volatile and the most procyclical, and that the

[1] The relationship with "disposable" income inequality, which takes into account government welfare payments, is more ambiguous. For instance in the UK in 2008 and 2009 the tax and benefit system played an important role in reducing disposable income inequality (IFS, 2017).

procyclicality of the income shares decrease monotonically until up until the top 5%. More recently, Guvenen, Ozkan and Song (2014) use a panel data set representative of 10 percent of all US working-age males from 1978 to 2011 and find that those with lower levels of prerecession earnings experienced larger falls in their earnings during recessions than that experienced by those with higher levels of prerecession earnings. Similar empirical patterns have been observed in other countries: in the UK (Nolan, 1986), Sweden (Bjorklund, 1991), the Philippines (Blejer and Guerrero, 1990), Brazil (Cardoso et al, 1995), and across a range of emerging market economies (Hacibedel et al, 2019). In principle, these patterns in pro-cyclicality could be driven by either skewed unemployment effects on the different income quintiles or by skewed impacts of an aggregate wage shock on the wages earned by those remaining employed in each income quintile. Hypothesis 1c seeks to unpack these two channels and to examine whether their relative importance differs in recessions associated with financial crises.

Our second hypothesis follows from the first and seeks to establish a novel result, which links financial conditions in the boom running up to a recession to the subsequent distributional effects. We structure this hypothesis as follows:

Hypothesis 2: Exploring whether financial conditions in the boom affect the distributional consequences in the recession that follows:
Hypothesis 2a. *Rapid credit growth in the run-up to both normal and financial recessions has an amplifying effect on the increase in unemployment that follows. This amplification is particularly severe in financial recessions.*
Hypothesis 2b. *Rapid credit growth in the run-up to both normal and financial recessions has an amplifying effect on the increase in income inequality that follows. This amplification is particularly severe in financial recessions.*
Hypothesis 2c. *The impact of rapid credit growth in amplifying income inequality (2b) is larger than the effects that can be attributed to an amplified unemployment effect (2a).*

Our second hypothesis is structured in an analogous way to the first. It seeks to examine the role that credit plays in the run-up to a recession in amplifying the busts that follow and to examine the knock-on implications for income inequality. A number of studies have documented the empirical links between indicators of loose credit conditions and the severity of subsequent recessions – see Aikman et al 2018 for a review. The growth rate of credit to households and non-financial companies, relative to GDP, in the boom is found to be a statistically robust and economically meaningful predictor of the severity of the subsequent bust (see for example Jordà, Schularick, and Taylor (2013)). These studies typically focus on GDP losses as a measure for macroeconomic severity. Our focus (hypothesis 2a) complements those findings with a focus on the implications for unemployment.[2] In a novel extension, we then examine whether credit booms have a role in amplifying the income inequality effects

[2] Bridges et al (2017) find that the impact of credit growth in amplifying losses in GDP per capita in subsequent recessions can be attributed to both an amplified unemployment effect and a reduction in labour productivity.

associated with the recessions that follow (hypothesis 2b). To our knowledge, this is the first study that investigates this link between credit booms, the severity of crises that follow and the implications for income inequality. Finally, we assess the extent to which any amplification of distributional effects from credit booms is driven by an amplified effect on unemployment or whether other channels are also at play (hypothesis 2c).

3 Data and stylised facts

Data sources and definitions:

Our data are annual in frequency and cover 26 advanced economies since the 1970s. Our key dependent variables of interest are unemployment and income inequality. Our unemployment data is from the OECD Database and the Global Financial Database. Our measure of income inequality is country Gini coefficients. We focus on Ginis based on market income inequality as we are interested in outcomes before welfare payments and subsidies are taken into account. For each country in each year, these coefficients are derived from the Lorenz curve calculations and range from 0 (perfect equality) to 100 (perfect inequality).[3] The data source is the Standardized World Income Inequality Database (Ball et al. 2013; Solt, 2017 and De Haan and Sturm, 2017). [EXPAND]. It incorporates data from the OECD Income Distribution Database, the Socio-Economic Database for Latin America and the Caribbean generated by CEDLAS and the World Bank, Eurostat, the World Bank's PovcalNet, the UN Economic Commission for Latin America and the Caribbean, national statistical offices around the world, and academic studies. The data collected by the Luxembourg Income Study is employed as the standard.

Our focus is on the behaviour of unemployment and income inequality in the years following adverse macroeconomic shocks in our sample, since we are interested in the distributional implications of these shocks and associated financial sector amplifiers. We follow the approach of Jordà, Schularick, and Taylor (2013) in choosing recessions as our identification of such shocks. Recessions, however, are reasonably rare events in macroeconomic history. We must therefore cast our net wide to capture sufficient episodes to make empirical analysis meaningful. As such, we have constructed a comprehensive cross-country panel dataset from a variety of sources, spanning 26 advanced economies since the 1970s. While including emerging economies in our dataset would increase the number of recessions, we restrict our sample to advanced economies to reduce the potential for more heterogeneous interaction across countries between financial and macroeconomic cycles. Although we include some countries that would have been categorised as newly-industrialised economies at the start of our sample, such as Hong Kong, Singapore and South Korea, the vast majority of recessions we identify in these countries occurred after the 1970s. [The full sample of countries used is listed in Section A at the end of this paper].

We identify a recession as two consecutive quarters of negative real GDP growth, but to ensure that we do not identify small fluctuations within a more significant episode as a

[3] Gini coefficients typically range from 0 to 1. We have multiplied our coefficients by 100 to make interpretation easier.

separate event, as a robustness check we also require there must be at least four quarters between consecutive peaks or consecutive troughs (Harding and Pagan, 2002) [see Section B].

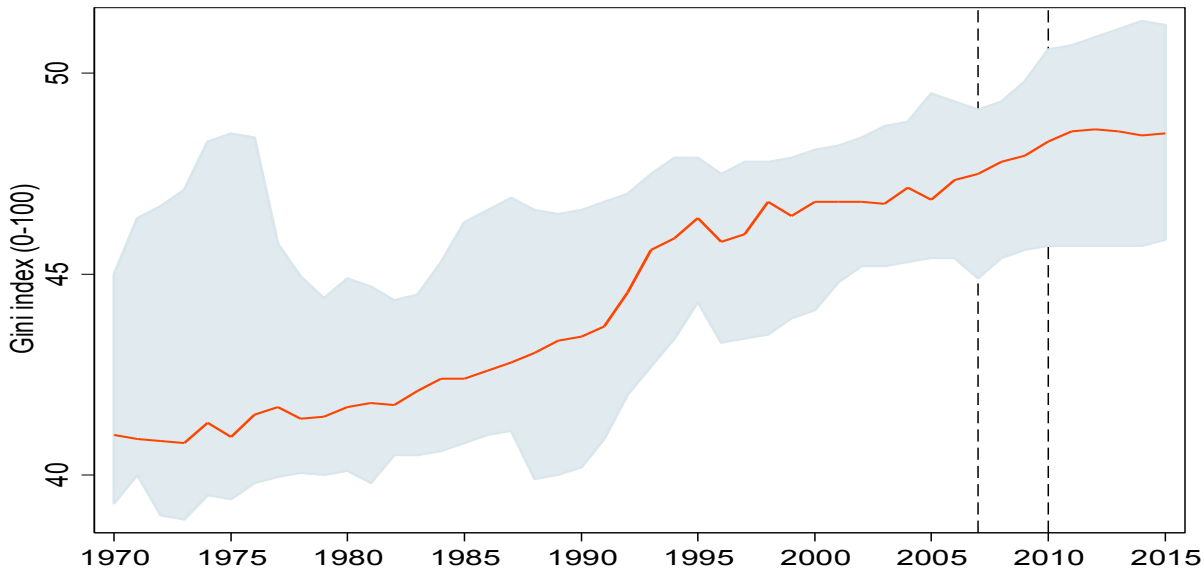
We are particularly interested in whether the distributional effects differ depending on whether a recession is associated with a financial crisis. We therefore split our sample of recessions: when a recession is accompanied by a banking crisis—defined as the recession being within one year of a systemic banking crisis classified by Valencia and Laeven (2012)—we denote it a "financial" recession. When there is no banking crisis, we denote these "normal" recessions.

As discussed in section 2, our second hypothesis is that rapid credit growth in the run-up to recessions may have an amplifying effect on the distributional effects that follow. To test this, we use the credit growth variable adopted by Bridges et al (2017) – that is the percentage point change in total private credit to GDP ratio in the three years running up to the start of the recession. This credit data originates from the Bank for International Settlements' (BIS) "Long series on total credit and domestic bank credit to the private non-financial sector" database[4].

For our control variables, we also draw on the dataset built by Bridges et al. (2017). [See Section A for a summary of variables and data sources]

Summary statistics / stylised facts:

Chart 1: The path of income inequality in our advanced economy sample



Source: Authors.

[4] http://www.bis.org/statistics/totcredit/credpriv_doc.pdf

Most advanced economies have experienced sizeable increases in inequality as measured by the market Gini. For some countries those increases came in the 1980s (United States, United Kingdom, Japan), whereas for others they came in the 1990s and early 2000s (Canada, Sweden, Finland, South Korea, Austria). Inequality trends in these countries can be thought of as following a J or U shape to varying degrees (Gottschalk and Smeeding, 2000). In Italy and France, inequality decreased in the 1980s but this was largely offset by later increases. Most advanced economies have experienced relatively small changes in inequality over the last ten or twenty years, but many have witnessed marked cyclical fluctuations. Relatively stable inequality in France and Italy, countries with the most unequal distribution in 1970 and rising inequality across other economies in our sample has produced some convergence in inequality levels in advanced economies. Compared with 1970, the interquartile range of the market Gini of these 26 advanced economies has become somewhat more compressed. The UK and Germany experienced some of the largest increases in inequality. In the mid-1970s this set of 26 rich countries had a median Gini index of 40.95 and an interquartile range of 9.1. By 2015 the median had increased to 48.5 and the interquartile range had narrowed to 5.3 (**Chart 1**).

The positive trends in inequality across advanced economies have largely been driven by changes in the distribution of wages and salaries. With few exceptions (e.g. France, Japan), the wages of the top decile of workers have risen relative to those of the bottom decile (OECD, 2011). This was due to both growing earnings' shares at the top and declining shares at the bottom, although top earners saw their incomes rise particularly rapidly (Atkinson, 2009).

Our focus is not on the broad trends in inequality over the last fifty years but on the cyclical response of inequality in the wake of recessions, particularly those amplified by financial instability. We therefore restrict our analysis to the five year windows around recessions which occur within our sample. Once the availability of data on control variables is taken into account, we identify 99 such recessionary episodes in our sample. The sample size compares favourably with related cross-country empirical studies of recessions, such as Jordà, Schularick, and Taylor (2013), and is fairly evenly split geographically (**Table 1**). Over time, our recession episodes are well represented across five decades, though there is a concentration in the 2000s, particularly for the financial recessions in our sample.

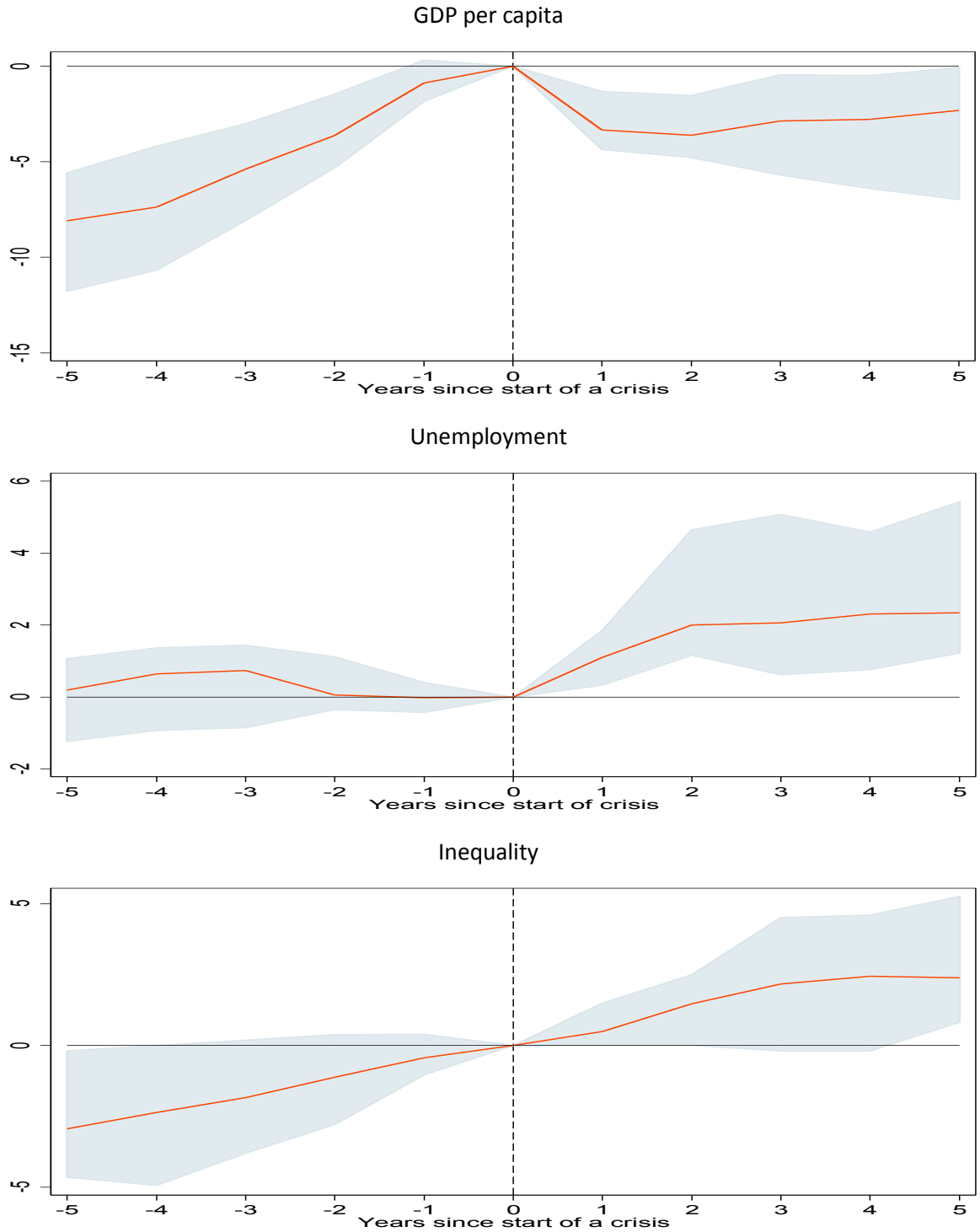
Table 1: Occurrence of recessions by region and decade

By region	Count	o/w financial	**By decade**	Count	o/w financial
Euro area core	20	6	**1970s**	11	0
Euro area periphery	22	7	**1980s**	15	0
Europe*	25	5	**1990s**	27	4
North America	8	1	**2000s**	42	16
Asia	14	3	**2010s**	4	2
Other	10	0			
Total	99	22		99	22

Notes: * Excluding euro area

What do these recession paths look like in practice? As an illustration **Chart 2** summarises the behaviour of our key variables of interest before and after the start of financial crises.

Chart 2: Summary of key variables before and after onset of a financial crises



Note: The solid line shows the median observation of the per cent of percentage point change of each variable relative to their level at the quarter before the start of a recession, and the shaded are shows the upper and lower quartile

Table 2: Summary statistics for key variables in the years following the onset of a recession and crisis

All recessions							Financial crises					
	Max	Min	p25	p75	Median	Mean	Max	Min	p25	p75	Median	Mean
	% change in real GDP						*% change in real GDP*					
Year 1	5.53	-6.43	-2.84	0.26	-1.22	-1.24	2.23	-6.43	-4.37	-1.32	-3.33	-2.98
Year 2	14.00	-10.34	-2.63	2.54	0.13	0.08	6.80	-10.34	-4.80	-1.53	-3.61	-3.24
Year 3	19.52	-11.13	-1.09	5.66	2.12	2.28	12.03	-11.13	-5.71	-0.45	-2.86	-2.13
Year 4	26.42	-17.69	-0.49	8.42	4.92	4.37	16.27	-17.69	-6.39	-0.49	-2.78	-1.90
Year 5	33.46	-23.48	0.53	10.68	6.47	6.27	24.22	-23.48	-6.98	-0.06	-2.32	-1.59
	% change in gini						*% change in gini*					
Year 1	4.56	-3.02	-0.22	1.14	0.22	0.45	3.29	-0.65	0.00	1.50	0.49	0.83
Year 2	7.34	-4.03	0.00	2.16	0.62	1.06	6.69	-0.73	0.00	2.50	1.48	1.68
Year 3	9.73	-5.94	-0.22	3.40	0.92	1.51	6.56	-1.71	-0.19	4.52	2.17	2.28
Year 4	10.33	-8.40	-0.19	4.08	1.01	1.73	8.50	-1.69	-0.19	4.61	2.44	2.52
Year 5	14.75	-10.66	-0.19	4.70	1.41	2.13	14.75	-0.61	0.82	5.26	2.39	3.38
	ppt change in unemployment						*ppt change in unemployment*					
Year 1	6.61	-0.70	0.15	1.43	0.80	0.97	6.61	-0.29	0.32	1.85	1.10	1.44
Year 2	8.61	-1.56	0.44	2.45	1.43	1.70	8.61	-0.49	1.16	4.65	2.00	2.81
Year 3	13.06	-1.89	0.13	2.60	1.43	1.80	13.06	-1.57	0.61	5.07	2.06	3.34
Year 4	13.54	-2.53	0.00	2.63	1.43	1.72	13.54	-2.04	0.76	4.58	2.31	3.84
Year 5	16.92	-3.58	-0.03	2.48	1.22	1.65	16.92	-2.18	1.22	5.42	2.35	4.13

Table 3: Summary facts for key variables in the years following the onset of a recession and crisis

	% of recession episodes where:			% of crises episodes where:		
	Real GDP fell	*Gini rose*	*Unemployment rose*	*Real GDP fell*	*Gini rose*	*Unemployment rose*
Year 1	71	61	86	91	68	91
Year 2	49	70	85	86	73	91
Year 3	32	70	76	77	73	86
Year 4	25	69	76	77	73	86
Year 5	23	73	73	77	82	86

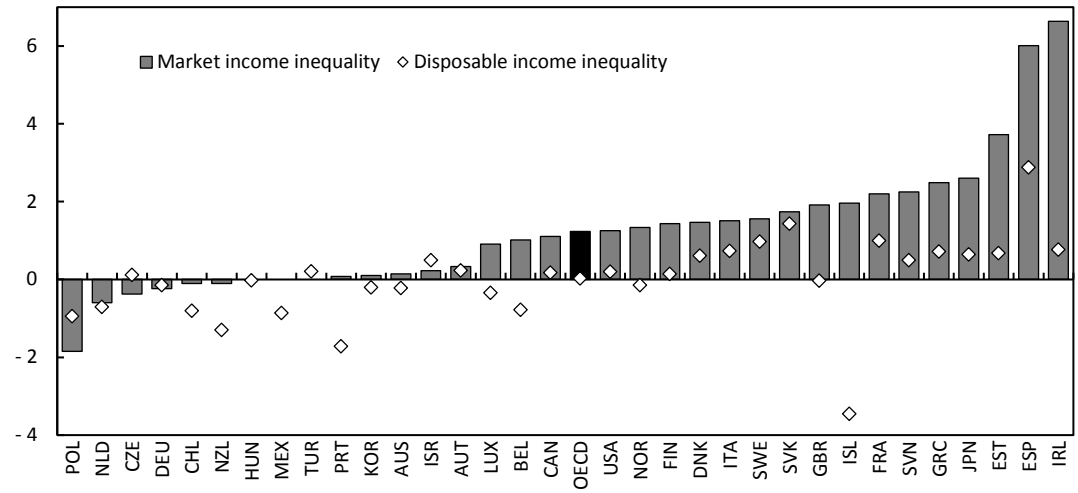
Economies in our sample have experienced a recession roughly once every ten years. On average, in these episodes GDP rises by around 6%, unemployment increases by 1.7ppts and the Gini increases by 2.1% after five years (**Table 2**). Recessions associated with banking crises tend to have larger effects on average: the mean fall in GDP is close to 2%, unemployment rises by 2.4ppts more and the Gini increases by 1.3% more than a normal one. This 3.4% rise corresponds to an increase in the Gini from 45 (for the average country) to 47 in the five years following a crisis. But within that there is substantial heterogeneity in the inequality effect of crises. For example, the interquartile range of the change in Gini five years into a crisis is 0.82% to 5.26%.

Real GDP fell one year after the onset of a recession in 71% of cases and in 91% of cases for financial crises (**Table 3**). Unemployment rose after one year in 86% of recessions and in 91% of crises. The Gini rose after five years in 73% of recessions and 83% of crisis.

Looking at the most recent financial crisis, most OECD countries saw income inequality (before tax and government transfers) increase (**Chart 3**). For instance, in the UK market income inequality increased by 2 percentage points between 2007 and 2010. France, Italy, Sweden and Greece experienced similar increases. The largest increase was in Ireland, where market Gini increased by 7 percentage points over the crisis.

Chart 3: Market and disposable income inequality in OECD countries, 2010 vs 2007

Percentage point change in gini index

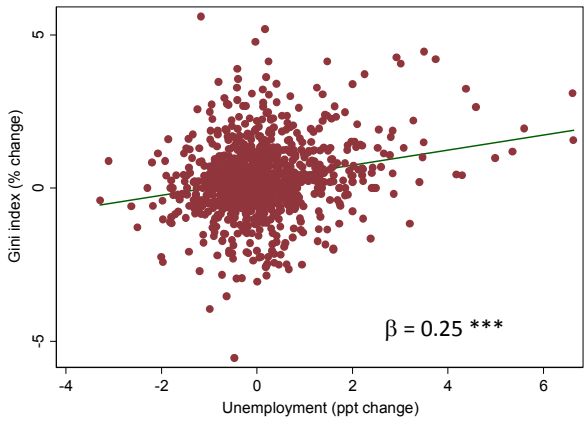


Source: OECD.

Some unconditional correlations:

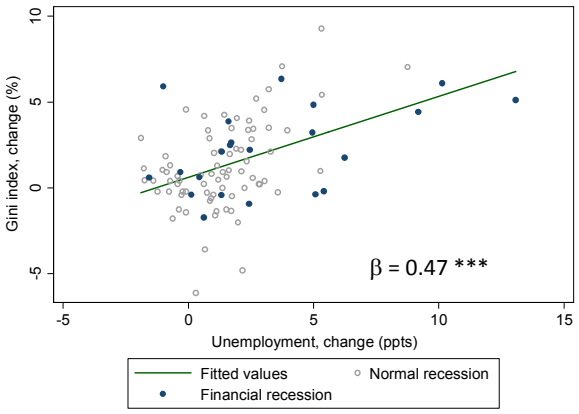
As set out in Section 2, our hypotheses seek to explore the extent to which distributional effects in recessions are driven directly by unemployment effects and the extent to which other factors may be in play. We find a positive correlation between unemployment and inequality over the full panel (β =0.25 significant at the 1% level) and a stronger positive correlation during recessions in our sample (β =0.47 significant at the 1% level), which suggests that unemployment is a significant driver of the increase in inequality following a recession (**Charts 4 and 5**).

Chart 4: Income inequality (Gini index) and the change in unemployment during recessions and normal periods



Source: Authors. Notes: Income is market income

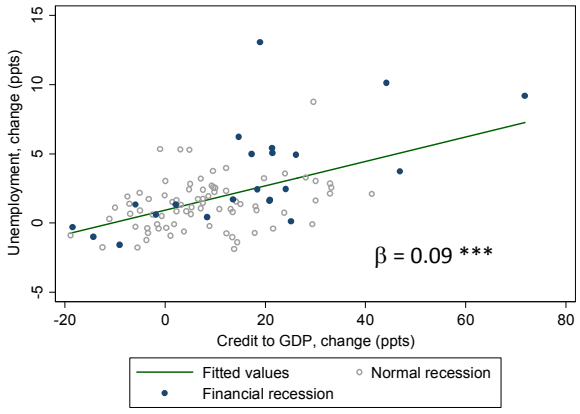
Chart 5: Income inequality (Gini index) and the change in unemployment during recessions



Source: Authors. Notes: Income is market income

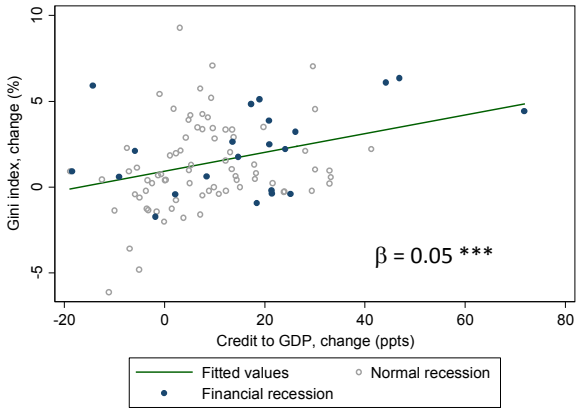
As discussed in Section 2, our second hypothesis seeks to unpack the role that rapid credit growth in the run up to a recession plays in amplifying the distributional impact that follows. Simple unconditional correlations suggest that a more rapid build-up of credit ahead of both normal and financial recessions is correlated with bigger impacts on both unemployment (**Chart 6**) and income inequality (**Chart 7**) in the three years following the recession's onset. For instance, an additional percentage point of credit growth in the 3 years leading up to a recession is associated with a 0.1ppt increase in unemployment and 0.05% rise in the Gini index.

Chart 6: Unemployment and the change in pre-crisis credit to GDP during recessions



Source: Authors.

Chart 7: Income inequality (Gini index) and the change in pre-crisis credit to GDP during recessions

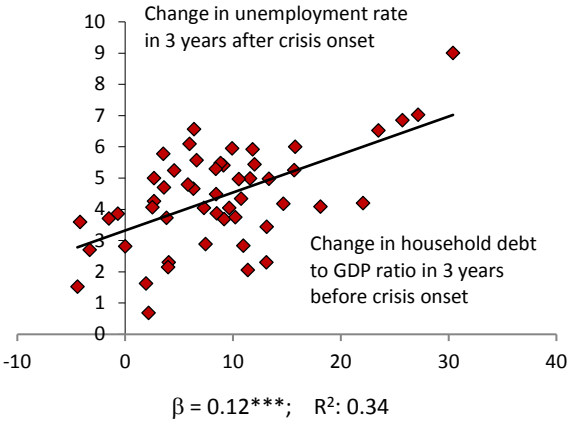


Source: Authors. Notes: Income is market income

A similar correlation between credit growth, unemployment and inequality can be assessed within-country, for the United States, by looking at how each metric changed in each US state around the recent global financial crisis. Those states that experienced a more rapid pre-crisis build-up in household credit saw the largest increases in both unemployment (**Chart 8**) and inequality (**Chart 9**). The correlations are more pronounced than the average country

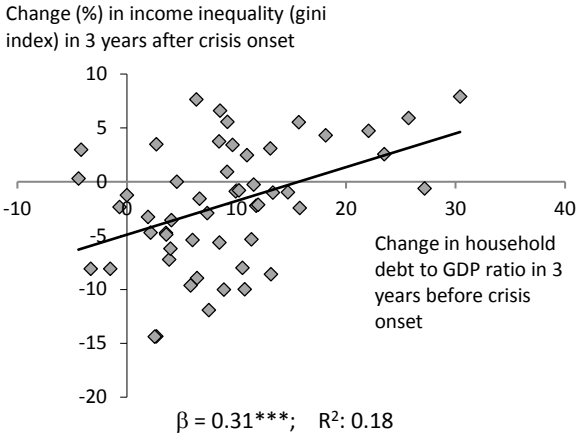
experience in the past. This is because among advanced economies, the US experienced a particularly big unemployment response to the global financial crisis (OECD, 2010), with layoffs affecting low skilled workers especially hard (Charles, Hurst and Notowidigdo, 2016).

Chart 8: Unemployment and the change in pre-crisis credit to GDP for US states during the global financial crisis (2007-2010)



Source: Authors.

Chart 9: Income inequality (Gini index) and the change in pre-crisis credit to GDP for US states during the global financial crisis (2007-2010)



Source: Authors. Notes: Income is market income

Clearly these reduced form, unconditional correlations are, at most, indicative of there being an economically meaningful link. Next we set out our empirical strategy to assess the robustness of these relationships when appropriate macroeconomic, time trend and country-specific controls are taken into account

4 Empirical strategy

Our objective is to determine whether the nature of recessions, in our sample, and rapid credit growth in the run up to a recession helps to predict the change in income inequality that comes afterwards. We do this employing the local projections method developed by Jordà (2005) in which impulse responses are arrived at by estimating separate regressions for each forecast horizon *t + h*, conditional on a given set of variables at time *t*.

A key feature of this method is that it is more robust to model misspecification than a conventional vector autoregression model and also allows non-linear impulse responses (such as interaction terms) to be estimated more flexibly. The dependent variable leads explanatory variables which helps address endogeneity concerns.

We define our dependent variable $Y_{t(r)+h,j}$ as either the percentage point deviation in unemployment or the percentage deviation in the inequality measure, *y* from its pre-recession peak level $y_{t(r)}$, where *t(r)* denotes the year before the onset of the r^{th} recession. As set out in Section 3, our baseline inequality measure is the market income Gini coefficient. Therefore, for example, $Y_{t(r)+5,j}$, would denote the percentage change in the Gini coefficient five years ater a recession starting in period t in country j. We do this for each recession in our sample of 26

countries *j* = {1,..., 26} and for each yearly impulse horizon h out to five years after the recession began *h* = {1,…,5}. Our generic specification is then to estimate the following, at each horizon h, in order to construct a full impulse response:

$$Y_{t(r)+h,j} = \bar{\alpha}_N^h N + \bar{\alpha}_F^h F + \sum_{j=1}^{J-1} \alpha_j^h + \beta_N^h . N . Credit\ growth_{j,t} + \beta_F^h . F . Credit\ growth_{j,t} + \zeta^h trend_{j,t} + \theta^h controls_{j,t} + \varepsilon_{j,t} \quad \forall \mathrm{h} = 1 \dots 5 \quad (1)$$

N and F are dummy variables which take the value of 1 for a recession classified a "normal" and "financial" respectively. As discussed in Section 3, financial recessions in the sample are those associated with a banking crisis as identified by Laeven and Valencia (2012). The average impact of normal and financial recessions on the change in inequality is captured by, $\bar{\alpha}_N^h$ and $\bar{\alpha}_F^h$ respectively. Credit growth terms are included to capture the role of credit in amplifying the impact of recessions. These are interacted with the N and F dummies to ascertain whether credit amplification is particularly strong in the event of financial versus normal recession episodes. Fixed country effects, α_j^h are included to control for any bias in our estimates caused by unobserved time invariant variables across countries, which may affect the responses of inequality in recessions.

We include a number of controls. We control for the long-run (10-year) trend in unemployment and inequality. On average, there has been a negative trend in unemployment and a positive trend in income inequality among high-income countries. This positive trend in inequality can be partly accounted for by globalisation and skill-biased technological progress coupled with stagnant wages and employment of unskilled labour (Bourguignon, 2016). Controlling for these slow-moving structural developments in unemployment and inequality with a 10-year trend ensures that our estimates pick up the cyclical response of inequality in our sample of recessions, which span five decades.

Following Bridges et al (2017), we also control for the domestic macro environment, including inflation, the size of the current account, central bank rate and the output gap. This is to avoid omitted variable bias in our β estimates, given these factors may be correlated with the rate of credit growth prior to the recession as well as our dependent variable.

5 Results

Hypothesis 1: Exploring the link between financial crises and inequality:

We address the set of hypotheses in Section 2 in turn, all regressions reported (unless otherwise stated) include country fixed effects, macro control variables and a slow moving

trend.[5] Starting with Hypothesis 1a, our baseline results (**Table 4)** suggest that unemployment rose in both the normal and financial recessions in our sample and that financial recessions were associated with more severe unemployment effects than normal recessions. On average unemployment is 3.5 percentage points higher two years following the onset of a financial crisis and 2.4 percentage points higher following a normal recession. The effects for financial recessions are still significant by year 5 but are not following a normal recession. The effects for financial recessions are statistically different (in paired t-tests) from those for normal recessions at all horizons.

Table 4: Baseline results unemployment

	Year 1	Year 2	Year 3	Year 4	Year 5
	Change in unemployment (ppts) after onset of crisis				
Normal recession	1.324***	2.380***	1.952**	1.403	1.841*
	(0.221)	(0.440)	(0.736)	(0.878)	(0.988)
Financial recession	1.862***	3.510***	3.357***	3.176**	3.803**
	(0.288)	(0.681)	(1.078)	(1.299)	(1.394)
Observations	99	99	99	99	99
R-squared	0.821	0.822	0.706	0.656	0.626
Adjusted R-squared	0.448	0.448	0.448	0.448	0.448
RMSE	2.752	2.752	2.752	2.752	2.752

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Includes controls for country-fixed effects, macroeconomic variables and trend unemployment

Hypothesis 1b asserts that income inequality rises in the years following both normal and financial recessions and rises by more following financial recessions. Our results (**Table 5**) suggest that recessions are indeed associated with a statistically and economically significant increase in income inequality and that financial crises are followed by a bigger increase in income inequality than normal recessions. Five years following the onset of a financial crisis the Gini coefficient is on average 5.4% higher, relative to 4% higher following a normal recession. The effects are significant at the 1 per cent level in years 3 to 5. And again, the effects for financial recessions are statistically different from those for normal recessions at all horizons.

[5] In the interests of space coefficients on control variables are not reported but are available upon request.

Table 5: Baseline results Gini index

	Year 1	Year 2	Year 3	Year 4	Year 5
	Change in Gini (%) after onset of crisis				
Normal recession	0.618*	1.212**	2.198***	2.532***	4.024***
	(0.349)	(0.533)	(0.557)	(0.724)	(0.872)
Financial recession	1.064**	1.735**	2.880***	3.376***	5.408***
	(0.494)	(0.634)	(0.810)	(0.858)	(0.913)
Observations	99	99	99	99	99
R-squared	0.443	0.545	0.621	0.591	0.597
Adjusted R-squared	0.405	0.405	0.405	0.405	0.405
RMSE	3.22	3.22	3.22	3.22	3.22

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Includes controls for country-fixed effects, macroeconomic variables and trend Gini

We next conduct some rule of thumb calculations to gauge whether there might be an effect on income inequality over and above the one through unemployment (Hypothesis 1c).[6] Based on our coefficients when unemployment is at its peak, two years after the onset of a normal recession it accounts for only around a third of the effect (2.4*0.25 = 0.6) of normal recessions on income inequality (1.8). Two years after the onset of a financial recession unemployment accounts for only around half of the effect (3.5*0.25 = 0.9) of crises on income inequality (1.9). Effects of crises on inequality, over those transmitting via higher unemployment, may be explained by a few factors. First, low earners are likely to include those on an hourly rate and their hours may be reduced in a downturn causing a reduction in income. Second, some less skilled individuals may experience more anaemic wage growth rather than unemployment. Low earning cohorts include a larger proportion of self-employed individuals who are typically more vulnerable to negative shocks to the broader economy than those who are salary-employed. Third, increases in part-time participation in response to a downturn may also increase the tail of low income earners.

Hypothesis 2: Exploring whether financial conditions in the boom affect the distributional consequences in the recession that follows:

Our results (**Table 6**) also suggest that rapid credit growth in the run up to recessions, has an amplifying effect on the increase in unemployment that follows (Hypothesis 2a). The effect is particularly strong for financial ones (**Table 7, Chart 9)**. The coefficient on the interaction between credit *growth* and financial recessions is positive and statistically significant at the 1 % level in years 2 to 5 and is at least 3 times greater than that for normal recessions. The effects are statistically and economically meaningful. For example, a 1.s.d increase in our credit growth variable in our sample constitutes an 20.7 ppts increase in the credit to GDP ratio in the three years running up to a crisis. Each additional standard deviation increase in pre-crisis

[6] The relationship between unemployment and the Gini is stronger during recession periods (compare charts 4 and 5). We use the coefficient from the full panel regression as during recessions the relationship is likely to be more endogenous.

credit growth above the cross-country mean therefore amplifies the effect of a crisis on unemployment by [20.7*0.17] 3.5ppts, five years into a recession.

Table 6: Baseline results unemployment with credit interactions for all recessions

	Year 1	Year 2	Year 3	Year 4	Year 5
	Change in unemployment (ppts) after onset of crisis				
Recession	1.373***	2.084***	1.192*	0.600	1.077
	(0.242)	(0.360)	(0.610)	(0.733)	(0.838)
Recession* credit growth	0.00524	0.0410**	0.0803***	0.0897***	0.0899***
	(0.00725)	(0.0157)	(0.0230)	(0.0268)	(0.0269)
Observations	99	99	99	99	99
R-squared	0.808	0.828	0.755	0.700	0.658
Adjusted R-squared	0.495	0.495	0.495	0.495	0.495
RMSE	2.633	2.633	2.633	2.633	2.633

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 7: Baseline results unemployment with credit interactions and normal versus financial recession split

	Year 1	Year 2	Year 3	Year 4	Year 5
	Change in unemployment (ppts) after onset of crisis				
Normal recession	1.237***	1.788***	0.836	0.153	0.582
	(0.245)	(0.337)	(0.628)	(0.755)	(0.870)
Financial recession	1.409***	1.899***	1.038	0.510	0.989
	(0.335)	(0.588)	(0.865)	(1.069)	(1.174)
Normal recession* credit growth	-0.00486	0.0137	0.0487**	0.0523*	0.0486
	(0.00605)	(0.0102)	(0.0228)	(0.0275)	(0.0312)
Financial recession* credit growth	0.0237	0.0916***	0.139***	0.159***	0.166***
	(0.0174)	(0.0229)	(0.0277)	(0.0387)	(0.0439)
Observations	99	99	99	99	99
R-squared	0.835	0.881	0.804	0.760	0.720
Adjusted R-squared	0.573	0.573	0.573	0.573	0.573
RMSE	2.421	2.421	2.421	2.421	2.421

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Includes controls for country-fixed effects, macroeconomic variables and trend unemployment

We've shown that credit growth matters for the unemployment effect of downturns. But does it also matter for income inequality? Our results (**Table 8**) suggest that rapid credit growth in the run up to recessions is also a strong predictor of the magnitude of the inequality effect (Hypothesis 2b). When we split the sample into normal and financial recessions the interaction term is only statistically significant for financial ones (**Table 9, Chart 10)**. The higher credit growth is in the three years prior to a crisis, the larger the increase in income inequality following the crises' onset (**Chart 11**). The coefficient on the interaction between credit *growth*

and financial recessions is statistically significant in years 2 to 5. For instance, each additional standard deviation increase in pre-crisis credit growth above the cross-country mean therefore amplifies the effect of a crisis on the Gini by 20.7*0.08 = 1.7% five years into a recession.

Our main findings are robust to a number of checks including, omitting consecutive crises and the exclusion of country fixed effects, macroeconomic controls, trend inequality growth. This suggests that credit *growth* not only matters for the subsequent severity of downturns and crises but also for the distributional consequences.

Table 8: Baseline results Gini with credit interactions for all recessions

	Year 1	Year 2	Year 3	Year 4	Year 5
	Change in Gini (%) after onset of crisis				
Recession	0.669*	1.053*	1.950***	2.214**	3.728***
	(0.339)	(0.577)	(0.616)	(0.805)	(0.980)
Recession* credit growth	0.00521	0.0337	0.0490**	0.0620*	0.0733*
	(0.0128)	(0.0212)	(0.0219)	(0.0309)	(0.0358)
Observations	99	99	99	99	99
R-squared	0.434	0.568	0.651	0.626	0.626
Adjusted R-squared	0.447	0.447	0.447	0.447	0.447
RMSE	3.106	3.106	3.106	3.106	3.106

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 9: Baseline results Gini with credit interactions and normal versus financial recessions

	Year 1	Year 2	Year 3	Year 4	Year 5
	Change in Gini (%) after onset of crisis				
Normal recession	0.575	0.962	1.831**	2.079**	3.499***
	(0.362)	(0.629)	(0.663)	(0.876)	(1.066)
Financial recession	0.564	1.074	1.844**	2.552***	4.596***
	(0.519)	(0.715)	(0.742)	(0.805)	(1.006)
Normal recession* credit growth	-0.00919	0.0230	0.0315	0.0542	0.0678
	(0.0151)	(0.0247)	(0.0254)	(0.0380)	(0.0461)
Financial recession* credit growth	0.0256	0.0481*	0.0735***	0.0704***	0.0753**
	(0.0170)	(0.0240)	(0.0211)	(0.0249)	(0.0300)
Observations	99	99	99	99	99
R-squared	0.466	0.576	0.662	0.631	0.634
Adjusted R-squared	0.443	0.443	0.443	0.443	0.443
RMSE	3.116	3.116	3.116	3.116	3.116

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Includes controls for country-fixed effects, macroeconomic variables and trend Gini

Chart 10: Cumulative change in unemployment (ppts) following the onset of financial and normal recessions

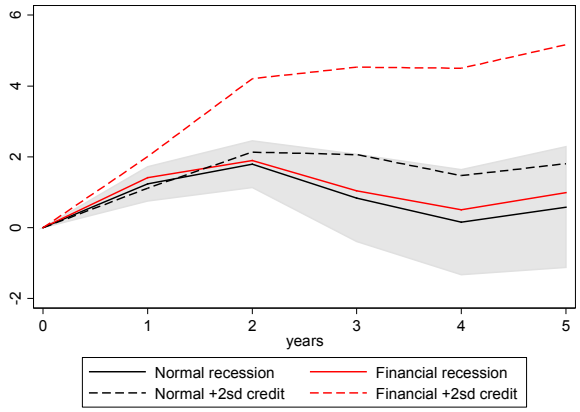
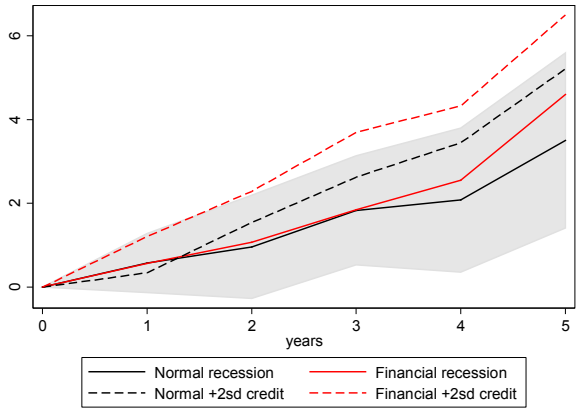


Chart 11: Cumulative change in Gini index (%) following the onset of financial and normal recessions



Having established that financial crises have an effect on income inequality through higher unemployment and that this is amplified by rapid pre-crisis credit growth we now investigate whether there is an impact on income inequality over and above that explained by higher unemployment (Hypothesis 2c). Based on our coefficients 5 years after the onset of a financial recession the credit growth amplified unemployment effect accounts for only around half of the effect (0.17*0.25 = 0.04) of crises on income inequality (0.08).

6 Conclusions

Across our sample of 99 recessions over five decades, we show that income inequality – as measured by the Gini coefficient – rises in both normal recessions and, by more, in financial crises. The distributional effects are statistically significant and economically meaningful: the Gini coefficient rises by an average of 4% in the five years following a recession and 5% in the five years following a crisis in our sample.

We unpack this result with two novel contributions. First, we demonstrate that the inequality effects associated with recessions and crises are driven by both a spike in unemployment and a skewed impact on the income of those remaining in work. On average unemployment is 3.5 percentage points higher two years following the onset of a financial crisis and 2.4 percentage points higher following a normal recession. Based on some rule of thumb calculations the change in unemployment accounts for only around a third of the effect of normal recessions on income inequality and around half of the effect of crises on income inequality.

Second, we show that rapid credit growth in the three years running up to a downturn amplifies the increase in inequality that follows. We find that these amplification effects of credit growth are particularly strong in the lead up to a financial crisis. Each additional standard deviation increase in pre-crisis credit growth above the cross-country mean amplifies the effect of a crisis on unemployment by 3.5ppts and on the Gini coefficient by 2% after five years. This finding is consistent with the growing literature which links measures of the

financial cycle – such as credit growth – with the severity of subsequent macroeconomic tail events. To our knowledge, our paper is the first to extend those findings into distributional space.

These contributions provide a baseline for future macroprundential cost benefit analysis in distributional space. For example, in principle, they allow us to calculate the potential distributional benefits of, say, leaning on rapid credit growth in the late stages of a credit boom, were it to turn into a bust. These "tail event" benefits can then meaningfully be weighed against any distributional costs of implementing the policy in the first place.

Annexes

A. Data coverage

Table A1: Summary statistics of explanatory variables at peak in real GDP

Variable	Obs	Mean	SD	Median	Min	Max
3-year change in total private credit to GDP ratio	99	9.9	14.9	8.4	-18.9	71.8
Inflation	99	5.5	5.3	3.2	-2.6	22.9
Current account	99	-0.2	5.2	-0.2	-14.9	13.8
Output gap	99	-0.1	1.1	-0.1	-3.3	2.9
Policy rate	99	4.8	4.8	5.4	0.1	20.5

Table A2: Summary of countries in sample and averages of credit growth at peak in real GDP

Country	3-year change in credit to GDP ratio
Australia	6.2
Austria	10.9
Belgium	21.6
Canada	14.8
Czech Republic	9.9
Denmark	23.3
Finland	8.8
France	12.2
Germany	4.4
Greece	8.3
Hong Kong	4.5
Ireland	34.2
Israel	8
Italy	3.7
Japan	-3
Netherlands	2.1
New Zealand	16.4
Norway	7.2
Portugal	18.9
Singapore	4.6
South Korea	14
Spain	20.7
Sweden	15.6
Switzerland	2.5
United Kingdom	12.4
United States	6.4
Total	9.9

Table A3: Summary of data sources

Variable	Data sources	Notes
Market Gini index	SWIID	
Real GDP	OECD and national statistics websites	Older data for Germany, Greece and Hong Kong use the OECD's expenditure components.
Population	World Bank and National Statistics	Annual data are interpolated cubicly to generate quarterly data.
Unemployment	OECD and Global Financial Database (GFD)	
Private sector credit	Bank for International Settlements (BIS)	
Central bank policy rates	GFD	Market overnight interest rates are used where data on policy rates are unavailable for inappropriate
Current account	OECD, Datastream, World Bank and International Historical Statistics	The latest data are drawn from the OECD and datastream. Where data become unavailable, annual
Inflation	GFD	Consumer price indices
Banking crises	Laeven and Valencia (2012)	Quarterly data are generated by interpolating these annual data.

B. Robustness

i. Consecutive crises

Table B1: Gini index dropping consecutive crises

	Year 1	Year 2	Year 3	Year 4	Year 5
	Change in Gini (%) after onset of crisis				
Normal recession	0.677*	1.361**	2.362***	2.668***	4.193***
	(0.370)	(0.584)	(0.565)	(0.748)	(0.842)
Financial recession	0.838*	1.470**	2.537***	3.053***	5.145***
	(0.435)	(0.565)	(0.758)	(0.816)	(0.921)
Observations	90	90	90	90	90
R-squared	0.496	0.545	0.641	0.587	0.602
Adjusted R-squared	0.383	0.383	0.383	0.383	0.383
RMSE	3.223	3.223	3.223	3.223	3.223
Residual degrees of freedom	25	25	25	25	25

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Includes controls for country-fixed effects, macroeconomic variables and trend Gini

Table B2: Gini index with credit growth interaction dropping consecutive crises

	Year 1	Year 2	Year 3	Year 4	Year 5
	Change in Gini (%) after onset of crisis				
Normal recession	0.653	1.122	2.006***	2.242**	3.700***
	(0.387)	(0.705)	(0.693)	(0.920)	(1.055)
Financial recession	0.585	1.111	1.856**	2.630**	4.728***
	(0.557)	(0.779)	(0.834)	(0.986)	(1.222)
Normal*credit growth	-0.00744	0.0249	0.0304	0.0544	0.0661

	(0.0167)	(0.0277)	(0.0295)	(0.0443)	(0.0537)
Financial*credit growth	0.0137	0.0352	0.0593**	0.0527*	0.0576
	(0.0138)	(0.0259)	(0.0220)	(0.0264)	(0.0364)
Observations	90	90	90	90	90
R-squared	0.505	0.568	0.671	0.620	0.632
Adjusted R-squared	0.409	0.409	0.409	0.409	0.409
RMSE	3.154	3.154	3.154	3.154	3.154
Residual degrees of freedom	25	25	25	25	25

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Includes controls for country-fixed effects, macroeconomic variables and trend Gini

ii. Different specifications

Table B3: Gini index results exclusion of country fixed effects, trend inequality growth and macroeconomic controls

	(i)	(ii)	(iii)	(iv)
	Change in Gini (%) 5 years after onset of crisis			
Normal recession	1.696***	5.790	5.327***	4.024***
	(0.412)		(0.219)	(0.872)
Financial recession	3.264***	7.554***	6.781***	5.408***
	(0.772)	(1.314)	(1.105)	(0.913)
10-year trend			18.39**	11.56
			(8.707)	(9.560)
Inflation				-0.326*
				(0.182)
Current account				-0.361**
				(0.153)
Output gap				-0.211
				(0.356)
Policy rate				0.294*
				(0.163)
Fixed effects	No	Yes	Yes	Yes
Observations	99	99	99	99
R-squared	0.264	0.465	0.512	0.597
Adjusted R-squared	0.249	0.264	0.319	0.405
RMSE	3.620	3.582	3.446	3.222
Residual degrees of freedom	97	25	25	25

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table B4: Gini index results with credit growth interactions, exclusion of country fixed effects, trend inequality growth and macroeconomic controls

	(i)	(ii)	(iii)	(iv)
	Change in Gini (%) 5 years after onset of crisis			
Normal recession	0.918*	5.154***	4.870***	3.499***

	(0.474)	(0.296)	(0.335)	(1.066)
Financial recession	2.671***	7.074***	6.259***	4.596***
	(0.961)	(1.530)	(1.515)	(1.006)
Normal*credit growth	0.0972***	0.102**	0.0858*	0.0678
	(0.0325)	(0.0477)	(0.0467)	(0.0461)
Financial*credit growth	0.0356	0.0422	0.0511	0.0753**
	(0.0366)	(0.0422)	(0.0439)	(0.0300)
10-year trend			15.40*	9.117
			(8.301)	(8.749)
Inflation				-0.342*
				(0.174)
Current account				-0.272
				(0.162)
Output gap				-0.119
				(0.350)
Policy rate				0.382**
				(0.174)
Fixed effects	No	Yes	Yes	Yes
Observations	99	99	99	99
R-squared	0.333	0.528	0.559	0.634
Adjusted R-squared	0.305	0.333	0.368	0.443
RMSE	3.481	3.411	3.321	3.116
Residual degrees of freedom	95	25	25	25

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

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