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Credit, crises and inequality

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Abstract

Using a panel dataset of 26 advanced economies over the five decades preceding the Covid crisis, we show that inequality rises following recessions and that rapid credit growth in the run up to a downturn exacerbates that effect. A one standard deviation credit boom leads to a 40% amplification of the distributional fallout in the bust that follows. These links between inequality, credit and downturns are particularly significant for recessions associated with financial crises. We also find some evidence that low bank capital ahead of a downturn amplifies the inequality increase that follows. These insights add a new dimension to policy cost-benefit analysis, at the distributional level. Newly established macroprudential regimes have been empowered with tools to safeguard financial stability by bolstering both lender and borrower resilience. Using those tools may have distributional effects, potentially limiting individual borrowing choices. Our findings make clear, however, that *not* using those tools can lead to distributional costs, in the event of an untamed crisis.

Key words: Recessions, local projections, inequality, macroprudential policy.

JEL classification: G01, N10, D63.

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1 Introduction

Following the global financial crisis macroprudential tools were introduced in a number of countries to address fault lines in both lender and borrower resilience. While distributional outcomes are not the focus of these policies, they remain important to understand and may prove controversial (see for example Balls et al. (2016); Tucker (2018)). Discussion of and research on the distributional aspects of macroprudential policy tend to focus on one aspect of this issue - the first-round effects on the distribution of the allocation of credit. Some authors find, for instance, that lending restrictions affect lower income borrowers more than others (Peydró et al. (2020)). But these first round effects on credit are only one part of the distributional story. Relatively little is known about how such policies affect the income distribution via their role in preventing crises or mitigating their severity. This paper aims to help fill that gap.

To shed light on this issue we extend findings that link measures of the financial cycle – such as credit growth – with the probability and severity of macroeconomic tail events (Schularick and Taylor (2012); Jordà et al. (2013); Adrian et al. (2019); Adrian et al. (2018) and Aikman et al. (2019a)). In particular, we investigate whether rapid credit growth in the lead-up to a downturn is associated with an amplification of any subsequent impact on inequality. To our knowledge, our paper is the first to extend those findings into distributional space.

Using a cross-country data set of 26 advanced economies over five decades and approximately one hundred recessions, we show that income inequality – as measured by the Gini coefficient – rises relative to trend following both normal recessions and financial crises and that rapid credit growth in the three years running up to a downturn amplifies the increase in inequality that follows. These distributional effects are statistically significant and economically meaningful: a one standard deviation increase in credit growth in the run-up to a recession is associated with around a 40% amplification in the subsequent increase in inequality: the Gini coefficient rises by 3.9% rather than 2.8% over the next five years. We find that these amplification effects of credit growth are particularly significant in the lead up to a financial crisis.

We demonstrate that the primary mechanism through which this amplification occurs appears to be through the size of the recession. Credit fueled expansions tend to be followed by deeper recessions and a larger rise in unemployment (Jordà et al. (2013)). However, we also find evidence that not all of the inequality effect of recessions and crises can be explained by the direct effect of unemployment on inequality, suggesting that there is also 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 or a greater prevalence of variable hour contracts amongst the low paid.

In addition to rapid credit growth being an important amplifier of downturns, there is evidence that a more weakly capitalised banking system is associated with a deeper recession and slower recovery (Jordà et al. (2017)). We therefore extend our analysis to investigate whether this finding also extends into distributional space. Our preliminary evidence shows that low bank capital ahead of a downturn does tend to amplify the inequality fallout that follows. We find that a country entering a recession with a banking sector where the aggregate tangible common equity ratio is one standard deviation lower experiences around a 55% amplification of the rise in inequality that follows. This is consistent with channels whereby "resilience gaps" in the financial system can increase the likelihood and costs of macroeconomic tail events and demonstrates that these costs also include distributional effects. Our preliminary results also suggest that this may operate through the wage distribution of those remaining in work, rather than through the direct impact of unemployment on inequality.

The contributions in this paper provide potential insights for a holistic assessment of the distributional implications of various macroprudential policy options. Macroprudential intervention – particularly with borrower-based tools – may have distributional effects on application, potentially limiting individual borrowing choices.[1] However, our results suggest that it could materially reduce the rise in inequality accompanying a subsequent bust by moderating the size of a credit boom and/or building greater financial sector and real economy resilience in response to growing financial vulnerabilities.

Weighing up the overall distributional implications of macroprudential policy is beyond the scope of this paper. Instead, our findings highlight that when making such an assessment, it is 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.

This paper was written prior to the Covid-19 crisis. The unprecedented nature of the global Covid-19 shock, with economic characteristics unlike any other crisis we have witnessed over the past five decades (and beyond) make it difficult to compare to the crises in our sample. However, evidence published so far across several countries suggest that inequality increased sharply following the Covid-19 shock, especially if we do not take government interventions into account (Adams-Prassl et al. (2020); Carta and De Philippis (2021); Delaporte et al. (2020)). Our results therefore suggest:

i. To the extent that most countries did not enter the Covid-19 episode with a credit boom underway, the findings of this paper would suggest that any rise in income

[1] See for example Peydró et al. (2020).

inequality may be less than it would have been had pre-Covid credit growth been more rapid. The advent and exercise of macroprudential policy in the decade since the global financial crisis may have contributed to the moderation of pre-Covid credit growth.

ii. Any rise in income inequality associated with the Covid-19 shock may be smaller than in a situation where banking sector resilience had started from a lower level. Since the global financial crisis, significant micro- and macro-prudential policy reform has materially raised overall levels of bank capital.

iii. Relatedly, the implications of the Covid-19 shock for inequality would likely be worse had the shock also precipitated a systemic banking crisis.

However, all of these observations should be put in the context of the very much broader challenges associated with the Covid-19 shock, which is first and foremost a health crisis. At the time of writing, the impacts of the Covid-19 crisis are uncertain and wide-ranging. The unprecedented nature of the Covid shock and the required policy response will likely have many complex distributional implications. These go well beyond – and are likely to dominate – the channels we investigate in this paper. When data for the Covid-19 period become available, there will be much more to learn in future studies.

The rest of this paper is organised as follows: in Section 2 we outline the existing literature; in Section 3, we present our dataset and associated stylised facts; in Section 4 we give our methodology; and in Section 5 our headline results. Section 6 includes an extension and section 7 concludes.

2 Existing literature

Our starting point is to establish the link between recessions – our proxy for macroeconomic tail events – and the subsequent effects on inequality. In doing so we also document the rise in unemployment in the aftermath of recessions (and within that financial crises), given the close links between joblessness and inequality.

One obvious mechanism through which recessionary episodes could lead to an increase in inequality is via an increase in unemployment. This link is likely to be stronger to the extent that it is low income earners who are disproportionately likely to lose their jobs in a recession. The literature documents two channels that could lead the incidence of unemployment to fall most heavily on low income earners. First, low earners may tend to be less skilled and so be 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 and have less secure job contracts, so may be easier to lay off (Elsby et al. (2010)). The empirical literature suggests these channels may be material. In the UK, for example, Smith et al. (2019) document that downturns are indeed particularly bad for those on lower

incomes, who typically see large increases in unemployment. In the US, Feiveson et al. (2020) found that during the Great Recession, unemployment rates of minorities, the young and those with less education all rose substantially more than for the population overall.

These channels suggest a direct link between the rise in unemployment accompanying a recession and the knock-on effects on income inequality. Existing empirical evidence supports this link. For example, during the global financial crisis higher unemployment was found to be a significant driver of rising market income inequality in Europe and the US (Jenkins et al. (2012); Vacas-Soriano and Fernández-Macías (2017)).[2]

Direct effects from unemployment are not the only potential link between recessions and the distribution of income. *Wage* inequality (that is, the distribution of wages amongst those remaining employed) may rise due to a greater prevalence of variable hour contracts amongst the low paid, the greater effect of the unemployed or new labour market participants in depressing the wages of lower-skilled workers or due to their relative lack of bargaining power (Castaneda et al. (2003); Barlevy and Tsiddon (2006); Guvenen et al. (2014); Bell et al. (2021)). Using a panel dataset representative of 10 percent of all US working-age males from 1978 to 2011 Guvenen et al. (2014) find that pre-recession average earnings are a good predictor of changes in earnings during a recession. During the Great Recession workers in the 10th percentile of the earnings distribution experienced a fall in their earnings that was about 18 percent worse than that experienced by those in the 90th percentile. Bell et al. (2021) similarly find employees who are younger, male, lower-skilled, non-union, and working in smaller private sector firms show the largest earnings response to recessions. They also find a high degree of heterogeneity in the response of hours to aggregate shocks. During the most recent financial crisis, *wage* inequality increased in the US, Canada, Australia, New Zealand, Ireland and Scandinavian countries (Bonhomme and Hospido (2017); Jenkins et al. (2012); Perri and Steinberg (2012)).

Taking the direct and indirect channels which link recessions, unemployment and the wage distribution together, we would expect inequality to increase during recessions as those at the bottom of the distribution bear the brunt of the shock. Our analysis explores whether this is borne out in the data.

The impact of recessions on inequality will naturally depend on the underlying shocks that have caused or accompanied the downturn. For instance, a stock market crash, house price shock or currency crises may all be associated with a recession, but could have quite different transmissions through to the income distribution. Nevertheless, in this paper our approach is reduced form. In general, we do not distinguish between the impact of a recession from that of other contemporaneous shocks or macro-events associated with the initial shock. Instead we focus on the *total* short-run effect of the recession, with two main exceptions. First, we control for the direct effect of fiscal policy on the income distribution by focusing

[2]In the UK, the employment effect on income inequality was largely offset by falls in the earnings of those who remained in work and came from higher income households (Cribb et al. (2012)).

on market income inequality. This is discussed in more detail below. Second, we also experiment with controlling for the contemporaneous rise in unemployment to gauge the relative importance of the wage versus unemployment channels.

Having explored the link between recessionary episodes and income inequality, the focus of this paper is on the potential amplifiers of that link, associated with financial instability. Another strand of the literature has investigated the impact inequality may have on the frequency and severity of crises (see for example Kumhof et al. (2015); Paul (2017); Kohlscheen and Zakrajsek (2021)). However, we focus on the opposite direction: the implications of financial instability for inequality in the aftermath of crises.

First, we simply partition our sample to investigate whether the inequality repercussions of downturns are particularly acute when those downturns are associated with financial crises. A limited number of empirical studies have found that crises are related to increased inequality. For instance, Atkinson and Morelli (2011) consider the effect of a variety of macroeconomic shocks on inequality and find, in a sample of 25 countries over 100 years, that income inequality is likely to increase following systemic banking crises. De Haan and Sturm (2017) similarly find, using a wider sample of 121 countries, that banking crises increase market income inequality. Agnello and Sousa (2012) find that income inequality significantly increases at the onset of a banking crisis and declines afterwards. A greater impact on inequality in recessions associated with financial crises is perhaps to be expected, given the well-established finding that such recessions are typically deeper and more prolonged (see for example Jordà et al. (2013)).[3]

Our main contribution is to build on previous studies by investigating whether rapid credit growth in the lead-up to a downturn is associated with amplification of the subsequent distributional effects. This complements the established early-warning literature, which links indicators of the financial cycle (such as credit growth) to the subsequent probability of financial crises (see Kaminsky and Reinhart (1999) and Borio and Lowe (2002) for seminal contributions).[4] More recently, Schularick and Taylor (2012) and Jordà et al. (2013) have spearheaded a programme of research, which has established rapid credit growth as a key indicator of both the probability and severity of financial crises. A related – and fast-developing – literature applies quantile regression techniques to establish the link between financial indicators and the left tail of the GDP distribution (see Adrian et al. (2019), Adrian et al. (2018) and Aikman et al. (2019a)).

These studies focus on GDP losses as a measure for macroeconomic severity and link those losses to the state of the financial cycle. First, we complement those findings by establishing the implications for unemployment (rather than GDP) of credit amplifiers ahead

[3]Delis et al. (2020) also shed light on a potential direct channel between crises and inequality by showing how banks' credit decisions can widen the distribution of income five years later and that this effect can be stronger during crisis periods, given higher credit constraints.

[4]See Aikman et al. (2018) for a more detailed review of this literature.

of recessions and crises.[5] In a novel extension, we then examine whether credit booms have a role in amplifying the income inequality effects associated with the recessions that follow. To our knowledge, this is the first study that investigates this link between credit booms, the severity of downturns that follow and the implications for income inequality. We also investigate whether the primary mechanism through which this amplification occurs is the size of the recession (proxied by the change in unemployment) versus other channels.

Our final contribution is to examine whether low bank capital resilience also plays a role in amplifying the income inequality effects associated with recessions. Though preliminary, this complements existing literature which links "resilience gaps" in the financial system to macroeconomic tail risks. For example, Jordà et al. (2017) and Brooke et al. (2015) find some role for bank capital in affecting either the likelihood or severity of financial crises. Aikman et al. (2019a) also demonstrate a link between bank capital resilience and GDP tail risk in a quantile regression, advanced economy panel setting. More generally, a rich seam of literature establishes the importance of financial system vulnerabilities in amplifying shocks – see Bernanke (2018) and Aikman et al. (2019b) for recent applications to the severity of the financial crisis in the US. Nevertheless, we are not aware of any studies which link financial system resilience to the *distributional* effects which follow a macroeconomic shock. Our focus on inequality effects seeks to begin to fill that gap.

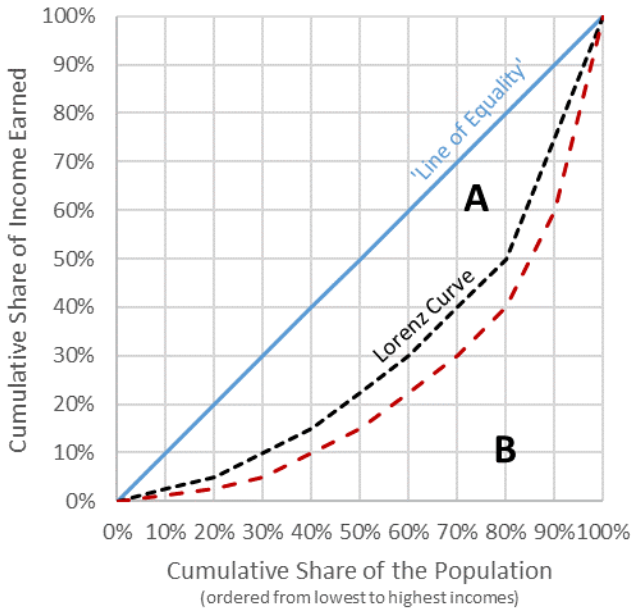
3 Data and stylised facts

3.1 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. The Gini coefficient is derived from the Lorenz curve, a graph of the cumulative share of income earned against the cumulative share of the population (Chart 1), developed by Lorenz (1905). The Gini coefficient is calculated by dividing area A by area (A + B) and captures the extent to which the Lorenz curve sags below the 45-degree line of 'perfect equality'. For each country in each year, coefficients range from 0 (perfect equality) to 100 (perfect inequality). As outlined above, we might expect the Lorenz curve to shift down – and the Gini coefficient to increase – during recessions, as those at the bottom of the distribution bear the brunt of the shock (illustrated by the red dotted line in Chart 1).

[5] In a cross-country study, 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. Focusing on the U.S., Kiley (2018) finds that rapid credit growth contributes to an elevated risk of large increases in unemployment.

Chart 1: Calculating the Gini coefficient



In this paper, our focus is on income, rather than wealth inequality. This enables us to draw on distributional data from a wide sample of recessions across 26 countries over five decades. Limitations in the availability of comparable cross-country wealth data over such a sample are significant. We therefore leave an exploration of the link between credit, recessions, asset prices and *wealth* inequality to future work. Our measure of market income does, however, include non-labour income, which includes returns from financial assets. Our analysis therefore does capture the impact of any change in earnings flows derived from financial wealth on the income distribution in a recession.

We also focus on Ginis based on market income inequality. Our focus on market income captures the effect of recessions on the income distribution before fiscal transfers. While such transfers may seek to offset distributional effects associated with recessions, we are interested in identifying the effect before these policies are put into place. Fiscal responses may vary across countries and time depending on the degree of fiscal space and the political context. A focus on market income therefore gives us the cleanest read of the link between recessionary forces and the income distribution. Though this approach does not control for the indirect effects of changes in fiscal policy on market income, such as extra public spending or regulatory changes, the use of a relatively short time horizon (5 years) should be sufficient to disentangle institutional effects from those exerted by market forces (Morelli (2018)).

Our income inequality data source is the Standardized World Income Inequality Database (SWIID) as its coverage far exceeds those of the alternatives (Ball et al. (2013); Solt (2015);

Jenkins (2015) and De Haan and Sturm (2017)).[6] Charts A1 and A2 in Annex A illustrate the variation in our Gini coefficient over time and across our sample of countries.

A possible weakness of our analysis is that it underestimates the contribution from the very top of the income distribution, who have been controlling a growing share of total income in many advanced economies. International data sources on income inequality suffer from under-coverage and under-reporting of top incomes (OECD (2018)). And recent evidence suggests that wage income at the very top is substantially cyclical (Parker and Vissing-Jorgensen (2010)). However, Morelli (2018) finds that the impact of banking crises on the US top income shares is mostly small in magnitude and short-term in nature, as top shares recover faster in the aftermath of a shock. Therefore, our paper, which investigates changes in the gini over the five years following the onset of recessions should not be too heavily impacted by this weakness in the data.

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 et al. (2013) in choosing recessions as our identification of such shocks.[7] Adverse macroeconomic shocks take many forms and this is, of course, only one of many possible approaches. We chose to focus on recessions as this is well established in the literature. Recessions, however, are reasonably rare events in macroeconomic history. We must therefore cast our net wide (26 countries) and deep (five decades) to capture sufficient episodes to make empirical analysis meaningful. While including emerging economies in our dataset would increase the number of recessions further, we restrict our sample to advanced economies. This is a balancing act. Expanding our sample too widely would increase the potential for cross-country heterogeneity in the ways in which the financial cycle, macroeconomic cycle and income distribution interact. 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 Annex A (Table A1).

[6]The SWIID 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, largely regarded as the highest quality data, is employed as the standard within the SWIID.

[7]An alternative approach would be to use the entire panel to make statements about the *average* effect of credit on inequality *through the cycle*. Our chosen approach helps us to disentangle the impact of economic upheavals on inequality from a separate, but related, question on how far inequality effects the probability of credit-driven recessions.

We identify a recession as two consecutive quarters of negative real GDP growth.[8] We 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 Laeven and Valencia (2012) - we denote it a "financial" recession. When there is no banking crisis, we denote these "normal" recessions.

As discussed in Section 2, we investigate whether rapid credit growth in the run-up to recessions has 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 non-financial 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.[9] We also adopt the macroeconomic controls used in Bridges et al. (2017), controlling for the output gap, inflation, policy rate and current account when establishing a link between recessionary amplifiers and inequality (see Section 4 for methodology). Annex A lists our data sources (Table A2) and gives accompanying summary statistics (Table A3).

In an extension, we also investigate the amplifying role of system-wide bank capital on the distributional effects of crises, using a ratio of banks' tangible common equity (TCE) to total assets. This draws on the dataset of Aikman et al. (2019a), which constructs a novel cross-country dataset for the TCE ratio. This is based on individual bank balance sheet data on firms' group level tangible common equity (defined as common equity minus preference shares and intangible assets) and total assets, obtained from Thomson Reuters Worldscope. These data are aggregated to the country-level using a chain-weighted approach, which accounts for the entry and exit of banks each period. These bank capital data are available at annual frequency and, at present, for a somewhat narrower sample of countries than in our baseline specification.

3.2 Summary statistics / stylised facts:

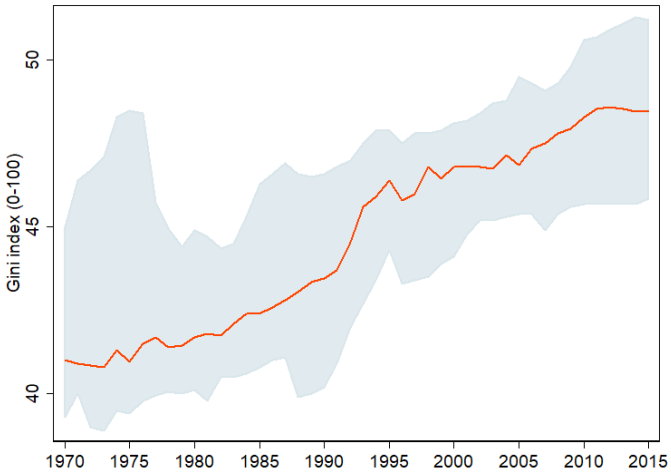
3.2.1 Inequality has trended up:

Since 1970, most advanced economies have experienced sizeable increases in inequality, as measured by the market Gini coefficient. In the mid-1970s our sample of 26 advanced economies had a median Gini of 41.0. By 2015, the median Gini coefficient had increased to 48.5 (Chart 2).

[8] In our robustness checks, we also restrict our recession sample to those with at least four quarters between consecutive peaks or consecutive troughs (following Harding and Pagan (2002)) to ensure that we do not identify small fluctuations within more significant recession episodes. Our robustness checks are discussed in Section 5.3 and set out in Annex D.

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

Chart 2: The path of market income inequality in our advanced economy sample



Source: Authors' calculations, based on SWIID data (see Annex A for details on data).

The upward trend in inequality across advanced economies has largely been driven by changes in the distribution of wages and salaries. It has been attributed, in part, to globalisation and skill-biased technological progress, coupled with stagnant wages and employment of unskilled labour (see, for example, Bourguignon (2016)). With a 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)).

Our focus is not, however, on the broad trends in inequality over the last fifty years. Instead, our focus is on the cyclical response of inequality to recessions, particularly those amplified by financial instability. As discussed in Section 4, we use a comprehensive set of controls to strip out longer-term trends in inequality from our analysis of the cyclical component of inequality. These controls include country fixed effects, a de-trended measure of the change in Gini following a recession and a control for slow-moving country-specific Gini developments in the ten years running up to each of our recession episodes.

3.2.2 Some stylised facts on the behaviour of inequality following recessions

We restrict our analysis to the five-year windows around the recessions in our sample. Once the availability of data on control variables is taken into account, we identify 99 such recessionary episodes in our sample, which are 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.

What do these recession paths look like in practice? Table 2 draws out the key points, with further charts and summary statistics provided in Annex B. The top panel of Table 2 provides context for our sample of 99 recessions by first looking across the entire panel of data. As outlined above inequality has tended to rise on average across our panel. This

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

trend has amounted to around a 0.3% increase in the market income Gini coefficient each year, cumulating to around 1.6% over a typical five-year period. At the same time, real GDP per capita growth has averaged around 2% per year (or around 10% cumulatively over five years) and on average the unemployment rate has drifted up somewhat.

The third panel of Table 2 restricts attention to the 99 recession events in our dataset. As expected, this shows that GDP growth typically fell in the first year of these episodes and unemployment rose. In year 2, on average, growth did not return to trend. Over this two-year period the rise in the Gini coefficient was, on average, 1% - around double that accounted for by the full-sample trend. Through years three to five, GDP growth in these recession episodes typically recovered to trend but did not catch up lost ground, with the increase in unemployment persisting. Likewise, the rise in Gini coefficient remained above its trend path throughout the average five-year recessionary period.

The fourth panel of Table 2 splits the sample of 99 recessions in two and focuses on those which were preceded by above average credit growth. Perhaps most strikingly, these episodes are, on average, substantially more persistent. Accompanying that, the increase in income inequality, as measured by the five-year percentage change in the Gini coefficient, was substantially larger for recessions preceded by a credit boom.

It could be that rapid credit growth *lessens* inequality in the boom years running up to a recession and so the apparent amplifying effect on inequality observed in the aftermath of a recession is simply an unwinding of this effect. However, this does not appear to be the case: we find that inequality also tended to rise during the credit boom which preceded the bust. For example, in the five-years *preceding* a recession in instances where credit growth was above average, the Gini coefficient grew by 1.8% on average (Appendix B, Table B2). This is somewhat *faster* than the full sample average. This suggests that the net effect of a credit boom followed by a recession is to push up inequality relative to trend.

Panel five of Table 2 splits the set of 99 recessions according to the level of bank capital

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

Year	1	2	3	4	5
Full panel (all episodes)					
Cumulative GDP growth (%)	2.1	4.2	6.3	8.3	10.4
Change in Unemployment rate (pp)	0.1	0.2	0.4	0.5	0.7
% Change in Gini	0.3	0.6	0.9	1.3	1.6
Non recession episodes					
Cumulative GDP growth (%)	3.1	6.5	9.9	13.1	16.3
Change in Unemployment rate (pp)	-0.2	-0.4	-0.6	-0.8	-1.0
% Change in Gini	0.2	0.5	0.8	1.0	1.3
All recession episodes					
Cumulative GDP growth (%)	-1.3	0.0	2.1	4.0	5.7
Change in Unemployment rate (pp)	1.0	1.7	1.8	1.7	1.6
% Change in Gini	0.4	1.0	1.5	1.7	2.0
Recession episodes with above average credit growth preceding them					
Cumulative GDP growth (%)	-1.9	-2.0	-1.0	-0.1	1.0
Change in Unemployment rate (pp)	1.1	2.2	2.7	2.9	2.9
% Change in Gini	0.5	1.4	1.9	2.2	2.8
Recession episodes with below average bank capital preceding them					
Cumulative GDP growth (%)	-1.5	-1.3	0.2	1.7	2.7
Change in Unemployment rate (pp)	0.9	1.8	2.0	2.0	2.0
% Change in Gini	0.7	1.7	2.2	2.6	3.2
Financial recession episodes					
Cumulative GDP growth (%)	-3.0	-3.4	-2.3	-2.2	-2.1
Change in Unemployment rate (pp)	1.4	2.8	3.3	3.8	4.1
% Change in Gini	0.8	1.6	2.2	2.4	3.3

Note: mean statistics given at each horizon. First panel covers the full panel across five decades. Panels 3-5 cover the 99 recessionary episodes documented in Table 1 and panel 6 the 22 financial crises.

ahead of the downturn and focuses on the half where financial sector resilience was below average. These episodes are also, on average, more severe in GDP and unemployment space than the full sample of recessions, though the difference is less marked than for the credit boom partition. Interestingly, however, the inequality fallout is particularly severe amongst this set of "low resilience" recessions.

Finally, panel six confirms that the macroeconomic fallout following recessions associated with financial crises is particularly severe. This split also reveals that the increase in inequality associated with these crisis episodes is more severe than in average recessions and over double that accounted for by the long-term upward trend in the Gini coefficient.

3.2.3 Some unconditional correlations between credit, crises and inequality:

Building on the stylised facts in Table 2 – which were based on a partitioned sample – we next explore the extent to which the distributional effects of recessions are correlated with financial vulnerabilities observable before the event. While such correlations are unconditional and necessarily reduced form, we use them to motivate our subsequent empirical strategy, which seeks to more rigorously control for other observable factors.

Charts 3 and 4 present the correlation between the pace of credit growth relative to GDP in the three years running up to a recession and the unemployment and Gini coefficient changes in the 5 years following the onset of recession. The positive correlations in these charts suggest that a more rapid build-up of credit ahead of a recession is associated with bigger subsequent increases in both unemployment and income inequality. The slopes are statistically significant at the 1% level and suggest an economically meaningful link. An additional 10 percentage point increase in the credit-to-GDP ratio in the three years leading up to a recession is associated with a 1.2pp extra increase in unemployment and an extra 0.8% rise in the Gini index in the five years that follow.[10] It is interesting to note that although the highest credit growth is in the run-up to financial crises, there is also a positive correlation between credit growth and the Gini coefficient for normal recessions.

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.[11] The same reduced form relationship emerges. Those states that experienced a more rapid pre-crisis build-up in household credit saw the largest increases in both unemployment (Chart 5) and inequality (Chart 6).[12] As with the country-level analysis, these correlations are statistically significant and economically meaningful.[13] The strong link between credit growth and the Gini coefficient at the state level is a reassuring corroboration of the international correlations described above, given the diminished scope for omitted variables when focusing on one country and one episode.

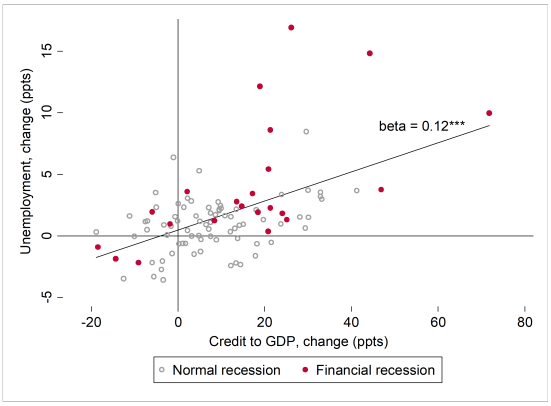
[10]For reference, a one standard deviation three-year increase in the credit-to-GDP ratio across our sample is equivalent to a 15pp increase. A one standard deviation five-year increase in the unemployment rate and Gini index are equivalent to a 3.3pp and 3.7% increase respectively.

[11]This analysis builds on Figure 8 in Aikman et al. (2019c) by incorporating state level inequality data into the analysis.

[12]Note here that *household* credit relative to GDP is used at the state level, rather than total private non-financial sector credit to GDP, given data availability.

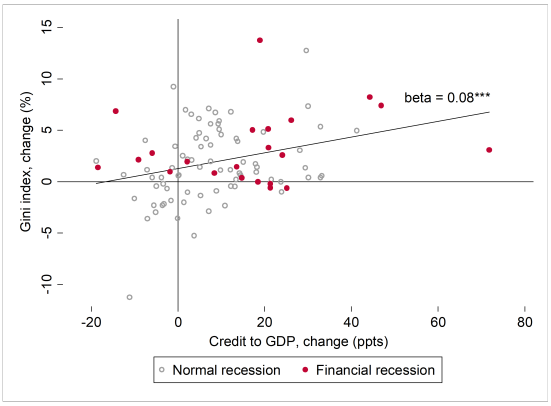
[13]Note that the slope coefficients are not directly comparable, since the state-level exercise focuses on household credit.

Chart 3: Unemployment and the change in pre-crisis credit to GDP



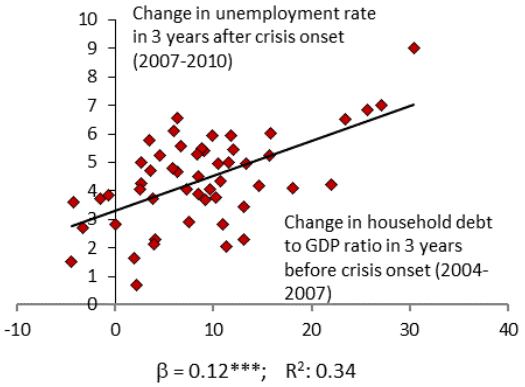
Note: X-axis shows the cumulative percentage point change in the total private non-financial sector credit to GDP ratio in the three years running up to the recession. Y-axis shows the pp change in the unemployment rate in the five years following the onset of the recession.

Chart 4: Income inequality (Gini index) and the change in pre-crisis credit to GDP



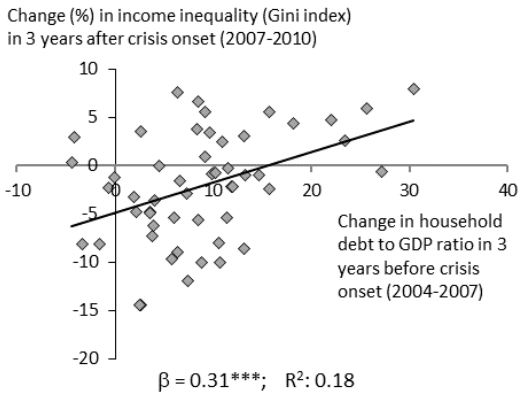
Note: X-axis shows the cumulative percentage point change in the total private non-financial sector credit to GDP ratio in the three years running up to the recession. Y-axis shows the cumulative % change in the market income Gini coefficient in the five years following the onset of the recession.

Chart 5: Unemployment and the change in pre-crisis household credit to GDP for US states during the global financial crisis



Source: Authors' calculations. State level household debt statistics from Federal Reserve Bank of New York; GDP data from Bureau of Economic Analysis; unemployment data from Bureau of Labour Statistics.

Chart 6: Income inequality (Gini index) and the change in pre-crisis household credit to GDP for US states during the global financial crisis

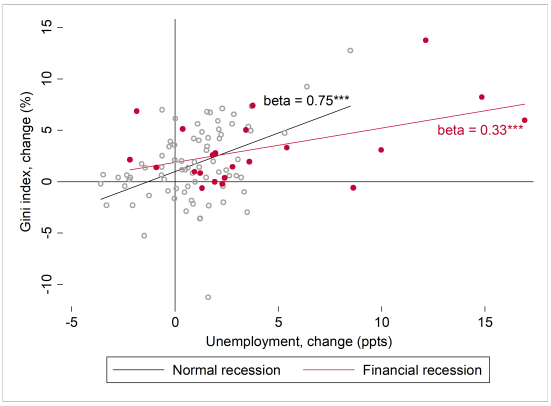


Source: State level household debt statistics from Federal Reserve Bank of New York; income inequality data from Mark W. Frank's panel of annual state-level income inequality measures. Notes: Income is market income

The relationship between credit growth and the subsequent increase in both unemployment and the Gini coefficient gives an example of the more general positive *contemporaneous* correlation between changes in unemployment and changes in income inequality. Indeed, looking across our sample of recessions, we find a clear positive correlation between the

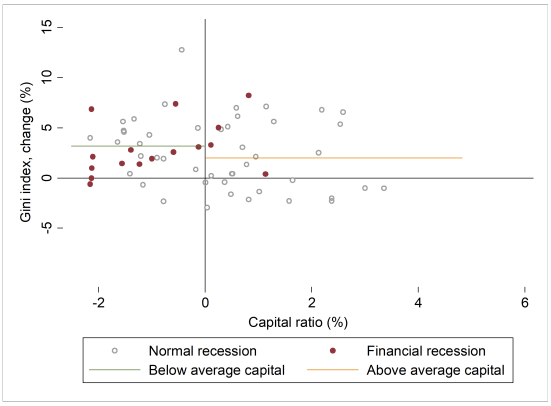
size of the unemployment effect five years after the onset of the downturn and the scale of the increase in the Gini coefficient (Chart 7). That positive correlation applies to both the sub-sample of recessions associated with financial crises and the broader set of "normal" recessions. In fact, the correlation coefficient is strongest for these non-financial recessions, suggesting that each 1pp increase in the unemployment rate in the five years following a recession is associated with a 0.75% increase in the Gini coefficient over the same period. For the financial crises in our sample, this slope is shallower at 0.33%. The relatively strong contemporaneous correlation between unemployment and inequality during our recession episodes suggests – as expected – that transmission channels relating to unemployment are significant drivers of the links between credit, crises and inequality.

Chart 7: Income inequality (Gini index) and the change in unemployment 5 years after recessions and crises



Source: Authors' calculations. See data sources listed in Annex Table A2. Notes: Income is market income

Chart 8: Income inequality (Gini index) and the pre-crisis capital ratio during recessions



Source: Authors' calculations. See data sources listed in Annex Table A2. Notes: Income is market income. Capital ratio is globally demeaned.

Finally, we examine the correlation between the aggregate banking sector capital ratio at the onset of our recession episodes and the subsequent increase in inequality. We do not find evidence of a continuous correlation between pre-recession bank capital and subsequent increases in inequality.[14] We do however note (consistent with Table 2) that recessions entered into with below average bank capital are associated with more severe inequality episodes than those with above average bank capital (Chart 8). It is also notable that the majority of financial recessions in our sample were preceded by below-average levels of bank capital.

Clearly, these reduced form, unconditional correlations are, at most, indicative of an economically meaningful link between pre-recession financial vulnerabilities and the unemployment and inequality increases that accompany the subsequent downturn. Stronger or different links may of course be masked by other factors that are not controlled for. Next,

[14] We explore this relationship further in Section 6, by controlling for other potentially confounding factors.

we therefore 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 primary objective is to determine whether rapid credit growth in the run up to a recession helps to predict the change in income inequality that comes afterwards. To investigate this, we employ 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 to 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 level $y_{t(r)}$, where $t(r)$ denotes the year before the onset of the r$^{\text{th}}$ 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 cumulative percentage change in the Gini coefficient in the five years after a recession starting in period t in country j. We do this for each recession in our sample of 26 countries $j = \{1, \ldots, 26\}$ and for each yearly impulse horizon h out to five years after the recession began $h = \{1, \ldots, 5\}$.

As documented in Section 3, there has been a long-run trend in the Gini coefficient across our full sample. Before conditioning on a recession episode, we would not, therefore, expect our dependent variables to be flat over any given five-year period. We wish to focus on the cyclical dynamics of credit, crises and inequality and so to adjust for this trend. To do so, we calculate – consistent with the top panel of Table 2 – the cumulative trend growth rate of the Gini coefficient at horizon h across our *full panel* of countries (across countries and years).[15] We denote this $Y_{trend,h}$. For example, reading directly from Table 2, $Y_{trend,5} = 1.6\%$. We then define the cyclical component of our dependent variable as:

$$\tilde{Y}_{t(r)+h,j} = Y_{t(r)+h,j} - Y_{trend,h}$$

Because we de-trend the Gini using the average trend over the full panel, including recession periods, some of the upward trend that we purge will reflect the cyclical effects that we are

[15]For completeness, we also make this adjustment for the trend in unemployment across our full sample, for our regressions where unemployment is the dependent variable. The trend in unemployment is, however, much smaller than that for the Gini coefficient.

trying to uncover. This is therefore a conservative approach, which will act to attenuate the size of any cyclical effects that we estimate.

Our generic specification is then to estimate the following, at each horizon h, in order to construct a full impulse response:

$$\tilde{Y}_{t(r)+h,j} = \bar{\alpha}_R^h + \sum_{j=1}^{J-1} \alpha_j^h + \beta_R^h \cdot Credit\ growth_{j,t} + \zeta^h trend_{j,t} + \theta^h controls_{j,t} + \epsilon_{j,t}\ \forall h = 1, \ldots, 5 \tag{1}$$

The average impact of a recession on the change in de-trended inequality is captured by $\bar{\alpha}_R^h$. The credit growth term is given by the cumulative percentage point change in the total private non-financial sector credit to GDP ratio in the three years prior to the pre-recession peak. Our coefficient of interest for the role of credit growth in amplifying the distributional effects of recessions at horizon h is β_R^h. In our final section, we also include the bank capital ratio $TCE\ ratio_{j,t}$ on the right hand side of our specification. This allows us to investigate whether a lack of banking sector resilience can also act as an amplifier of the inequality effects of downturns.

We include a number of additional controls. Country fixed 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 response of inequality in recessions. Our approach to detrending is comprehensive. We de-trend our dependent variable directly, subtracting the *full panel* global trend. Alongside that, we also control for any country- and time-specific slow-moving trends in our dependent variable. In particular, we include the 10-year country-level trend ($"trend_{j,t}"$) in unemployment and inequality running up to each recession in our sample. This allows us to absorb any slow-moving effects driven, for example, by different structural changes in a given country in a given decade.[16]

Following Bridges et al. (2017), we also control for the domestic macro environment in the period before each recession, including inflation, the size of the current account, the central bank policy 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. We remove the global mean across countries and time for each of our variables, such that – were all financial and macro indicators at their average levels – the mean recession path would be recovered in $\bar{\alpha}_R^h$.

Finally, we also introduce a split in our specification to distinguish between our results for

[16]As a robustness check, we also exclude the 10-year trend and instead use Hamilton (2017)'s robust approach to detrending, regressing our dependent variable at time $t + h$ on the two most recent values as of time t, as recommended for annual data. Our robustness checks are discussed in Section 5.3 and set out in Annex D.

recessions associated with financial crises and those associated with "normal" recessions:

$$\tilde{Y}_{t(r)+h,j} = \bar{\alpha}_N^h N + \bar{\alpha}_F^h F + \sum_{j=1}^{J-1} \alpha_j^h + \beta_N^h N \cdot Credit\ growth_{j,t} + \beta_F^h F \cdot Credit\ growth_{j,t} + \zeta^h trend_{j,t} + \theta^h controls_{j,t} + \epsilon_{j,t}\ \forall h = 1, \ldots, 5 \quad (2)$$

In this variant, the 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 our dependent variable is captured by, $\bar{\alpha}_N^h$ and $\bar{\alpha}_F^h$ respectively. We also interact our credit growth variable with the N and F dummies to ascertain whether credit amplification is particularly strong in the event of a financial versus normal recession episode.

5 Results: credit, crises and inequality

5.1 Exploring the link between recessions, unemployment and inequality:

We first assess the increase in unemployment and income inequality associated with the recessions in our sample, formalising the stylised facts from Section 3, before considering the role of amplifying factors. All regressions reported (unless otherwise stated) are of the de-meaned dependent variables described in Section 4 and include country fixed effects, macro control variables and also control for the country- and time- specific slow moving trend.[17]

Table 3 summarises our baseline results. The top row shows that a typical recession in our sample is associated with a significant cyclical increase in unemployment, which peaks at around 2.4pp in year 2. The second row illustrates that, despite controlling for trend and other explanatory factors, the recessions in our sample are associated with a statistically and economically meaningful increase in the cyclical component of the Gini coefficient three to five years out, rising to 2.7% after five years. Charts 9 and 10 illustrate these baseline results.

Turning to the third and fourth panels of Table 3, we allow for differential effects of recessions associated with financial crises. These estimates reveal that the financial recessions in our sample are typically associated with larger cyclical effects on both unemployment and inequality. For unemployment, the year 2 peak rises to 3.3pp (compared to 2.1pp for

[17] In the interests of space, coefficients on control variables are not reported but are available upon request. As we discuss in our robustness Section 5.3 and set out in Annex D, our main findings are robust to the exclusion of macroeconomic controls, country fixed effects and trend inequality.

Table 3: Impact of recessions on unemployment and income inequality

	Year 1	Year 2	Year 3	Year 4	Year 5
Specification 1	Change in unemployment (ppts) after onset of recession				
All recessions	1.324***	2.381***	1.873***	1.258	1.602*
	(0.212)	(0.429)	(0.671)	(0.804)	(0.897)
	Change in Gini (%) after onset of recession				
All recessions	0.420	0.728	1.421**	1.455**	2.705***
	(0.339)	(0.502)	(0.529)	(0.683)	(0.790)
Specification 2	Change in unemployment (ppts) after onset of recession				
Normal recessions	1.205 ***	2.130***	1.562**	0.865	1.167
	(0.221)	(0.440)	(0.736)	(0.878)	(0.988)
Financial recessions	1.742***	3.261***	2.967**	2.638*	3.129**
	(0.288)	(0.681)	(1.078)	(1.299)	(1.394)
	Change in Gini (%) after onset of recession				
Normal recessions	0.328	0.619	1.280**	1.280*	2.417**
	(0.349)	(0.533)	(0.557)	(0.724)	(0.872)
Financial recessions	0.774	1.142*	1.961**	2.124**	3.801***
	(0.494)	(0.634)	(0.810)	(0.858)	(0.913)
Observations	99	99	99	99	99

Robust standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
Includes controls for country-fixed effects, macroeconomic variables and trend 10-year trend

normal recessions). This effect on jobs is also much more persistent, with the year 5 effect remaining as high as 3.1pp, compared to a smaller – and statistically insignificant – year 5 effect for normal recessions of 1.2pp. The precision with which we can estimate the differential paths associated with financial recessions is limited by the relatively small number of crises in our sample. Even so, the estimated impulse response of unemployment to financial recessions lies close to two standard deviations above the comparable coefficient estimates for normal recessions (Chart 11). An F-test reveals that the difference is significant in years 1 and 2 at the 10% level.

Turning to income inequality, the cyclical response of the Gini coefficient following a financial recession builds to 3.8% by year 5, nearly 60% larger than the 2.4% associated with non-financial recessions. Chart 12 illustrates these differential effects on inequality across point estimates for normal versus financial recessions, though an F-test cannot reject equality, given the relatively small sample of financial recessions.

Chart 9: Cumulative change in de-trended unemployment (ppts) following average recession

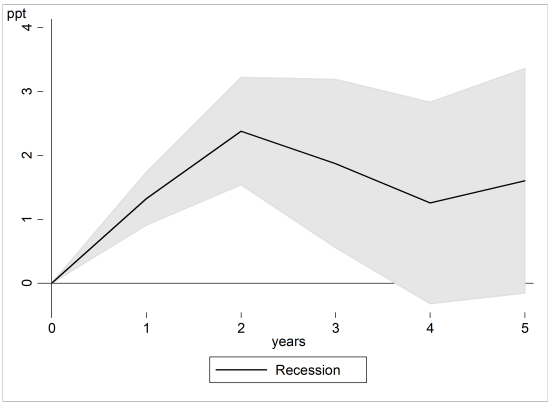
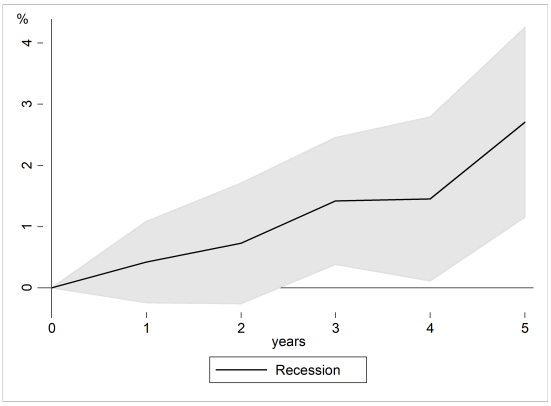


Chart 10: Cumulative change in de-trended Gini index (%) following average recession



Notes: Based on Table 3 results. Average cyclical responses of unemployment and the Gini coefficient to a recession. Shaded areas represent 95% confidence intervals around the mean.

Chart 11: Cumulative change in de-trended unemployment (ppts) following the onset of financial and normal recessions

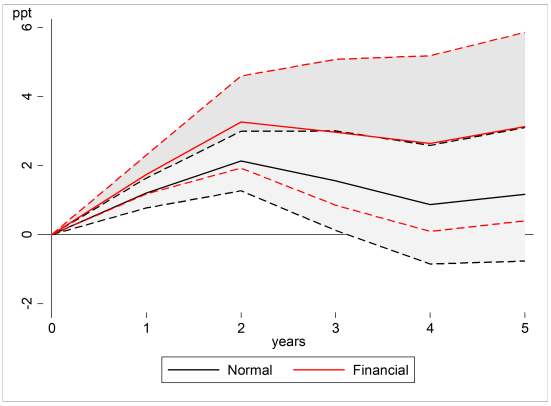
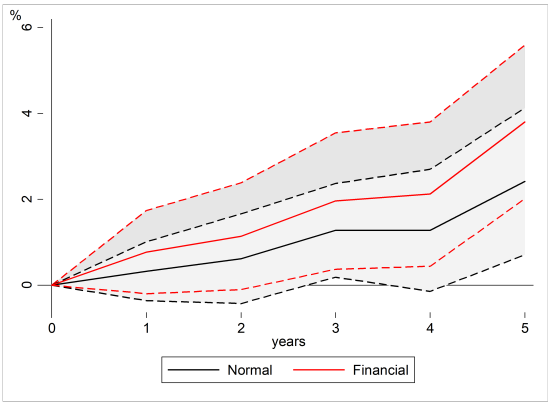


Chart 12: Cumulative change in de-trended Gini index (%) following the onset of financial and normal recessions



Notes: Based on Table 3 results. Average cyclical responses of unemployment and the Gini coefficient to a recession. Shaded areas represent 95% confidence intervals around the mean. Paths for "financial" and "normal" recessions reported separately.

The role of unemployment vs other channels in accounting for the rise in inequality during recessions:

Clearly, an important driver of the increased income inequality associated with recessions is likely to be the associated increase in unemployment. However, this is unlikely to be the only channel. There are several other potential mechanisms, which may affect the wage distribution for those remaining in work (see Section 2). In order to gauge the relative importance of the unemployment channel in driving the overall link between recessions and income inequality, we can adapt our empirical strategy to control for the *contemporaneous* move in unemployment. In particular, we can estimate the following:

$$\widetilde{Gini}_{t(r)+h,j} = \bar{\alpha}_R^h + \sum_{j=1}^{J-1} \alpha_j^h + \beta_R^h \cdot Credit\ growth_{j,t} + \zeta^h trend_{j,t}$$
$$+ \theta^h controls_{j,t} + \widetilde{ue}_{t(r)+h,j} + \epsilon_{j,t}\ \forall h = 1, \ldots, 5 \quad (3)$$

It is important to note that this specification moves away from our baseline local projection approach, which is careful only to include explanatory variables observable at period t – that is, the peak quarter preceding the onset of each recession. In this extension, we relax this approach by controlling also for contemporary changes in unemployment during the recessionary period itself (spanning the years t to $t + h$). Here, we do not claim causality, but focus instead on reduced form accounting for the change in Gini coefficient during recessionary episodes. Of course, there could be omitted variables that impact both the change in unemployment and the change in Gini coefficient during the recession. It could also be that changes in inequality in the five years following the onset of recession themselves affect the contemporaneous change in unemployment. Our claim, however, is that the much more likely mechanisms run in the other direction: from increased unemployment to increased inequality, over the horizon of interest. As such, our approach helps us to disentangle the extent to which the rise in inequality estimated during recessions can be accounted for simply by the unemployment channel.

Table 4 reports the results of this extension – it is the corollary of our baseline results, reported in Table 3. Three observations stand out:

i. First, the increase in unemployment during a recession is well correlated with the increase in inequality observed in that episode. This corroborates the reduced form correlation depicted in Chart 7. This contemporaneous relationship is statistically significant in both specifications and at all horizons from one to five years.

ii. Second, in the first two years following the onset of recession, the estimated constant in our revised specification is close to zero and statistically insignificant. That is, having controlled for the observed increase in unemployment during the early stages of recession and the impact that has on inequality, there is no evidence of additional mechanisms pushing inequality up further during the first two years of the downturn.

iii. Third, however, there is evidence of a sizeable cyclical increase in inequality 3-5 years into recessionary episodes over and above that which can be directly accounted for by the contemporaneous increase in unemployment. This suggests that other mechanisms – aside from the direct increase in unemployment – play an economically meaningful role by the five-year horizon. For example, from Table 3, we know that unemployment is typically around 1.6pp higher by year 5 of an average recession in our sample. According to our estimate for the contemporaneous impact of unemployment

on inequality, that can account for around a 0.7% (1.602*0.467) increase in the Gini coefficient. That compares to our estimate of an *additional* 2.3% increase in the Gini coefficient by year 5 of the recession, having controlled for the impact of the contemporaneous rise in unemployment. In other words, around three-quarters of the overall rise in the Gini coefficient by year 5 cannot be accounted for directly by the increase in unemployment observed by that point.

Table 4: Impact of recessions on income inequality controlling for contemporaneous impact on unemployment

	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Specification 3	Change in Gini (%) after onset of recession				
Unemployment - contemporaneous	0.441**	0.418**	0.379**	0.427**	0.467**
	(0.169)	(0.185)	(0.140)	(0.153)	(0.185)
All recessions - constant	-0.136	-0.168	0.887	1.227*	2.337**
	(0.438)	(0.674)	(0.576)	(0.707)	(0.846)
Specification 4	Change in Gini (%) after onset of recession				
Unemployment - contemporaneous	0.413*	0.418**	0.374**	0.428**	0.456**
	(0.203)	(0.193)	(0.141)	(0.159)	(0.182)
Normal recessions	-0.143	-0.168	0.875	1.234	2.280**
	(0.445)	(0.681)	(0.607)	(0.776)	(0.893)
Financial recessions	0.0586	-0.163	0.967	1.194	2.601**
	(0.728)	(0.822)	(0.797)	(0.856)	(0.987)
Observations	99	99	99	99	99

Robust standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
Includes controls for country-fixed effects, macroeconomic variables and trend 10-year trend

Broadly similar findings hold in our second specification, which splits normal and financial recessions: by year 5, a significant role is estimated for channels additional to the direct unemployment effect in explaining the increase in the Gini coefficient.[18]

These results are indicative of important channels affecting income inequality during recessions over and above the rise in unemployment. As discussed in Section 2, this is consistent with greater *wage* inequality resulting from aggregate income shocks. This may reflect,

[18]The relative role of the direct unemployment channel on inequality is somewhat larger for financial recessions, given that we find unemployment rises considerably further and more persistently in the aftermath of financial recessions (Table 3). Even so, the estimated constant coefficient of 2.601 for financial recessions by year 5 suggests that well over half of the total rise in inequality in such episodes cannot be accounted for directly by the contemporaneous increase in unemployment.

for example, low earners being disproportionately affected by reduced working hours or diminished bargaining power.

5.2 Do credit booms amplify the impact of recessions on unemployment and inequality?

We next introduce our credit growth variable, in order to investigate whether rapid credit growth in the run up to recessions has an amplifying effect on the increase in unemployment and inequality that follows. The evidence strongly supports an amplifying role for credit across both measures.

The first panel of Table 5 suggests that a 1pp increase in the credit to GDP ratio in the three years running up to an average recession in our sample is associated with a 0.09pp additional increase in unemployment in the downturn that follows. This is a sizeable effect. To put it into context, a one standard deviation increase in our credit growth variable constitutes a 15pp change (over three years). Our estimates suggest that a credit boom of this size would be associated with a 1.3pp amplification of the rise in unemployment during the recession, doubling the average unemployment increase after five years.

Turning to the second panel of Table 5, we also find a significant and sizeable effect of credit growth on the rise in the Gini coefficient in an average recession. To our knowledge, we are the first study to document this effect. Our estimates suggest that a 1pp increase in the credit to GDP ratio is associated with a 0.07% cumulative increase in the Gini coefficient over the subsequent five-year recessionary episode. A one standard deviation credit boom would therefore amount to a 1.1% additional increase in income inequality over and above the average 2.8% increase after five years. That is, a 40% amplification.

The third and fourth panels of Table 5 illustrate that this role for credit growth as an amplifier is strongest (and most statistically significant) for recessions associated with financial crises. That is particularly the case for the unemployment effects, where the credit interaction term for financial recessions is two to three times the magnitude estimated for the total sample of recessions. For the credit amplification effects on the Gini coefficient, in contrast, the size of the coefficient for financial recessions is not materially larger, though it is more precisely estimated.

Charts 13 and 14 illustrate the average path for cyclical unemployment and the de-trended Gini coefficient over a financial recession and illustrate the significant amplification of that path associated with a one standard deviation credit boom.

Next we consider the extent to which the amplifying effect of credit booms on the rise in inequality in the busts that follow can be explained by the direct unemployment channel. To do this, we mimic the exercise in Table 4 in Section 5.1, by controlling for the *contemporaneous* increase in unemployment when examining the rise in the Gini coefficient following a

Table 5: Credit interaction: impact of credit growth prior to a recession on the subsequent path of unemployment and income inequality in the recession

	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Specification 5	Change in unemployment (ppts) after onset of recession				
All recessions	1.306***	2.241***	1.600***	0.953	1.296*
	(0.214)	(0.335)	(0.505)	(0.616)	(0.737)
Recessions* credit growth	0.00524	0.0410**	0.0803***	0.0897***	0.0899***
	(0.00725)	(0.0157)	(0.0230)	(0.0268)	(0.0269)
	Change in Gini (%) after onset of recession				
All recessions	0.431	0.795	1.518**	1.577**	2.849***
	(0.357)	(0.560)	(0.564)	(0.746)	(0.823)
Recessions* credit growth	0.00521	0.0337	0.0490**	0.0620*	0.0733*
	(0.0128)	(0.0212)	(0.0219)	(0.0309)	(0.0358)
Specification 6	Change in unemployment (ppts) after onset of recession				
Normal recessions	1.070***	1.675***	0.929	0.135	0.391
	(0.222)	(0.300)	(0.554)	(0.712)	(0.863)
Financial recessions	1.525***	2.559***	2.025**	1.546	1.962*
	(0.269)	(0.486)	(0.766)	(0.950)	(1.053)
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)
	Change in Gini (%) after onset of recession				
Normal recessions	0.194	0.598	1.226**	1.366*	2.566**
	(0.412)	(0.631)	(0.588)	(0.778)	(0.921)
Financial recessions	0.527	0.959	1.656**	1.999**	3.736***
	(0.486)	(0.633)	(0.725)	(0.801)	(0.908)
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

Robust standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
Includes controls for country-fixed effects, macroeconomic variables and trend 10-year trend

Chart 13: Cumulative change in unemployment (ppts) following the onset of a financial recession and the amplifying impact of a 1SD credit boom beforehand

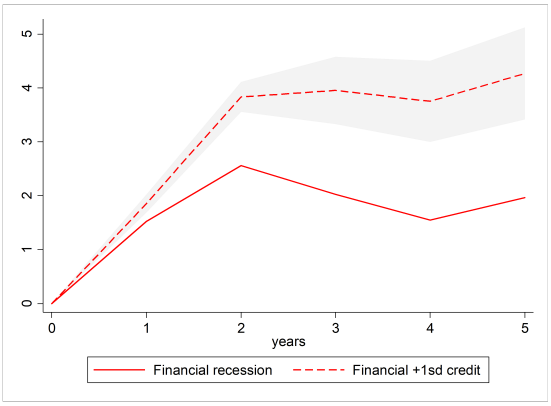
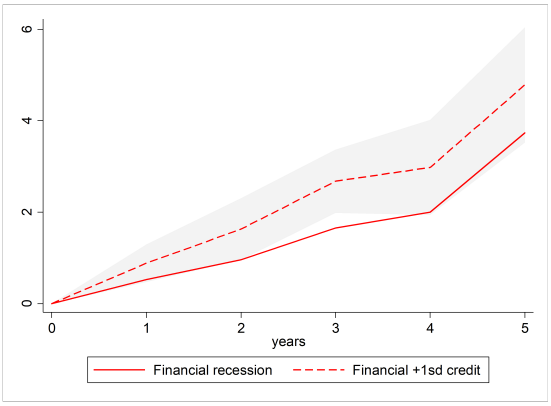


Chart 14: Cumulative change in de-trended Gini index (%) following the onset of financial recession and the amplifying impact of a 1SD credit boom beforehand



Notes: Based on Table 5 results. Unemployment and Gini coefficient responses to a financial recession. Solid red lines give the mean response of unemployment and the Gini coefficient to a financial recession. The dotted line shows the amplified effect on each variable if the financial recession was preceded by a one standard deviation (15pp) increase in the change in the credit to GDP ratio in the 3 years prior to the crisis. The shaded areas gives the 95% confidence intervals around the estimated interaction effect of the 1SD credit boom.

recession. The results of this exercise are given in Table C1 in Annex C. Again, this reveals that the increase in unemployment and the Gini coefficient are well correlated following a recession. Moreover, as discussed in the previous section, we continue to uncover a statistically and economically significant role for additional channels – beyond the direct unemployment effect – in driving the overall increase in the Gini coefficient in years 3-5 following the onset of recession.

There is, however, no evidence that rapid credit growth in the build up to a recession can account for any *additional* increase in inequality during the recession over and above the amplifying effect it has on the rise in unemployment. When explaining the rise in inequality during a recession, the coefficient on pre-recession credit growth is not significantly different from zero once the contemporaneous rise in unemployment is also controlled for. That is certainly not to say that credit booms do not have consequences for inequality during the busts that follow. As set out above, a one standard deviation credit boom in the run up to recession is found to approximately double the rise in unemployment that follows. Our estimates for the strong contemporaneous link between unemployment and inequality during a recession therefore corroborate our earlier finding that inequality typically rises by more in recessions that follow credit booms. This extension illustrates that the primary mechanism through which this occurs appears to be through the amplified impact on unemployment.

5.3 Robustness

We have shown that i) both normal and financial recessions are associated with statistically and economically meaningful increases in both unemployment and inequality; ii) those increases are materially larger in financial versus normal recessions; and iii) rapid credit growth in the lead up to a recession materially amplifies the unemployment and inequality effects that follow. Our findings that income inequality rises in the five years following a recession and that this effect is larger in recessions preceded by credit booms is robust to a variety of alternative specifications. The full results of our robustness tests are set out in Annex D.

6 Extension: the role of bank capital resilience

In this section, we investigate whether low banking sector capitalisation amplifies the impact of recessions on unemployment and inequality. This enquiry builds on the novel dataset of Aikman et al. (2019a), which the authors use to establish an empirical link between low bank capital and larger tail risks to GDP (so-called "GDP-at-risk"). At present, the measure of bank capital used in this study (the aggregate tangible common equity (TCE) ratio described in Section 3) is available for a subset of 16 of our 26 advanced economy sample. Taking this narrower sample, we conduct a preliminary investigation of whether the level of bank capital across a country's banking sector on the eve of a recession has any impact on the magnitude of the inequality effects that follows in the downturn.

The full results are included in E1.1 in Annex E. In summary:

i. The level of pre-recession bank capital does not have a significant effect on the path of unemployment that follows whereas it does have a significant effect on the Gini coefficient. In particular, *weak* bank capital on the eve of a downturn typically amplifies the inequality effect that follows.

ii. This finding suggests that the associated transmission channels may operate through the *wage* distribution of those remaining in work, rather than through the direct impact of unemployment on income inequality.

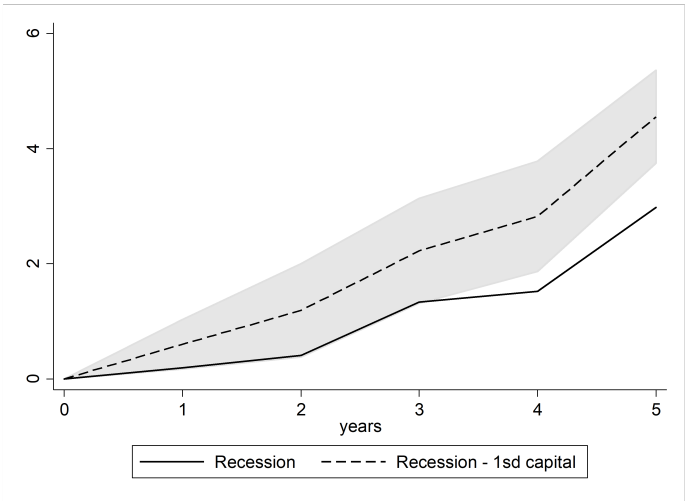
iii. The inclusion of the credit growth interaction does not meaningfully affect the coefficients on the bank capital interaction. This suggests that these two pre-recession financial vulnerabilities (rapid credit growth and weak bank capital) amplify the rise in inequality in recessions through different channels.[19]

Chart 15 illustrates the impact of a one standard deviation weakening in bank capital (which amounts to 1.4pp reduction in the TCE ratio) on the inequality effect that accompanies

[19]This is consistent with our finding in Section 5.2 that the credit amplification effect can be largely explained via its impact on unemployment, whereas the bank capital channel discussed in this section appears not to operate via the unemployment effect.

an average recession. The effect is sizeable, leading to an amplification of around 55% in the total cyclical inequality effect by year 5. To give a sense of scale, the UK TCE ratio was around 2% in 2008, nearly two standard deviations below the mean. Our results suggest that this represented a significant vulnerability which could amplify not only the macroeconomic consequences of the severe shock that was to come, but also the associated distributional effects.

Chart 15: Cumulative change in de-trended Gini (%) following a recession and the amplifying impact of a 1SD weaker aggregate bank capital ratio on the eve of the recession



Notes: Based on Table E1.1 results. Solid line shows the mean cyclical response of the Gini coefficient in the five years following a recession. The dotted line shows the amplified effect on income inequality if banking sector capital was one standard deviation (1.4pp) lower prior to the recession. The shaded area gives the 95% confidence interval around the estimated bank capital interaction effect. Note that we do not separate "normal" and "financial" recessions in this exercise, given the more limited sample size where bank capital data are available.

7 Conclusions

In our sample of 99 recessions, across 26 advanced economies, over five decades, we show that income inequality – as measured by the Gini coefficient – rises relative to trend in the five years following a downturn. We show that this applies to both normal recessions and those associated with financial crises, but that the inequality increase is around 60% larger in financial recessions.

This cyclical rise in inequality during recessions accompanies an increase in unemployment. Indeed, the rise in unemployment can account for some of the distributional consequences: we find a strongly significant contemporaneous link between the path of unemployment and income inequality following a recession. However, our findings suggest that three to five years after the onset of a recession, the majority of the cyclical rise in inequality cannot be directly accounted for by higher unemployment alone. This is consistent with other

important channels operating that give rise to a skewed impact on the income of those remaining in work.

We demonstrate that rapid credit growth in the run-up to a recession – whether financial or normal in nature – significantly amplifies the unemployment and income inequality effects that follow. A one standard deviation credit boom is associated with a doubling of the average unemployment effect by year 5 of our sample of recessions. Consistent with the more severe path for unemployment, we estimate that a one standard deviation credit boom is also associated with a 40% amplification of the cyclical rise in inequality. This amplifying role for credit appears particularly strong in conjunction with financial recessions.

Finally, we present initial findings that suggest that weak banking sector capital can also amplify the distributional effects of downturns. These results tentatively indicate a 55% amplification in the cyclical response of income inequality to a recession, if a country enters the recession with bank capital ratios one standard deviation lower than average.

Taken together, these results suggest an important link between credit, crises and inequality. They demonstrate that tail events for the macroeconomy also represent distributional shocks. Our findings suggest that financial vulnerabilities – the rapid accumulation of debt, weakening of bank capital, and an increased risk of a recession becoming a financial crisis – can all contribute to more severe distributional consequences when a shock hits. In the decade since the financial crisis, macroprudential policy has been tasked with addressing such financial vulnerabilities. The introduction of such policies may create costs as well as benefits, at both the macroeconomic and the distributional level. Our study provides important context when assessing such costs and benefits. In particular, it illustrates that *not* using macroprudential tools to address building financial vulnerabilities can lead to materially amplified effects – both macroeconomic and distributional – in the event of an adverse shock.

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Annexes

Annex A: Data Coverage

Table A1: Summary of countries in sample:

Country		
Australia	Greece	Portugal
Austria	Hong Kong	Singapore
Belgium	Ireland	South Korea
Canada	Israel	Spain
Czech Republic	Italy	Sweden
Denmark	Japan	Switzerland
Finland	Netherlands	United Kingdom
France	New Zealand	United States
Germany	Norway	

Chart A1: Income inequality (Gini index) in advanced economies since 1970

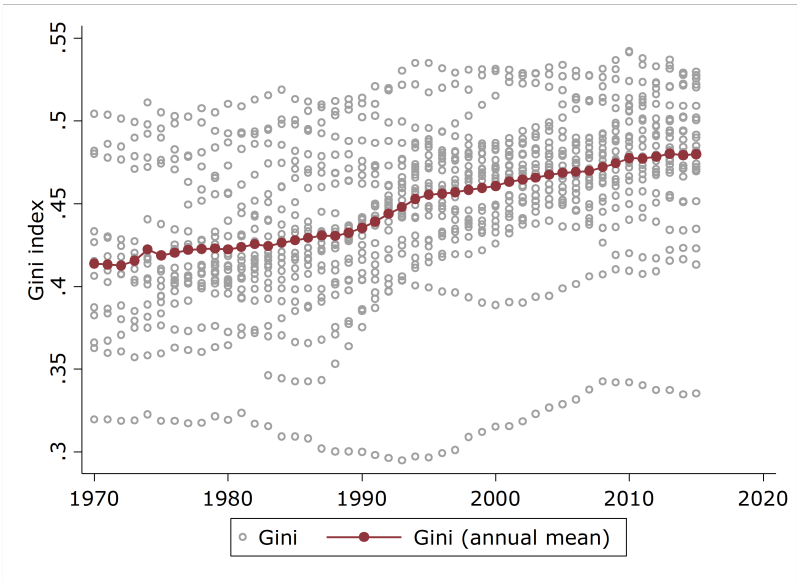


Chart A2: Variation in income inequality (Gini) in advanced economies since 1970, by country

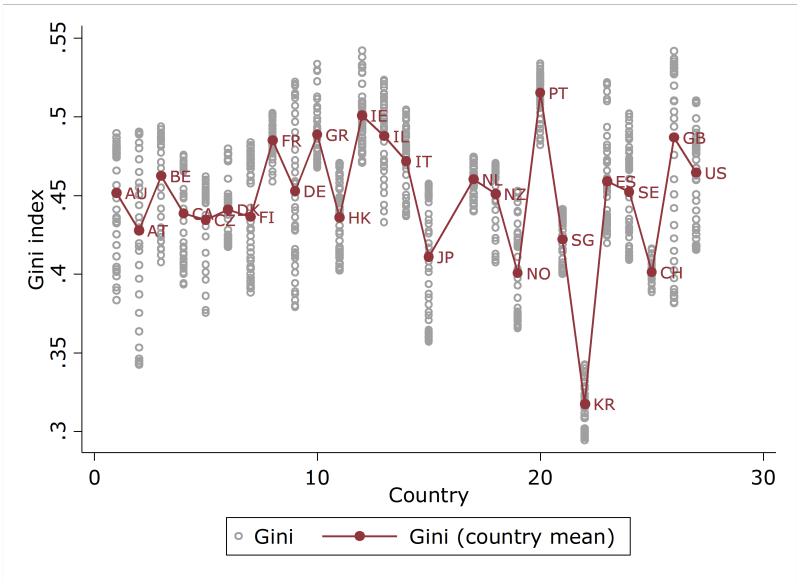


Table A2: Summary of data sources

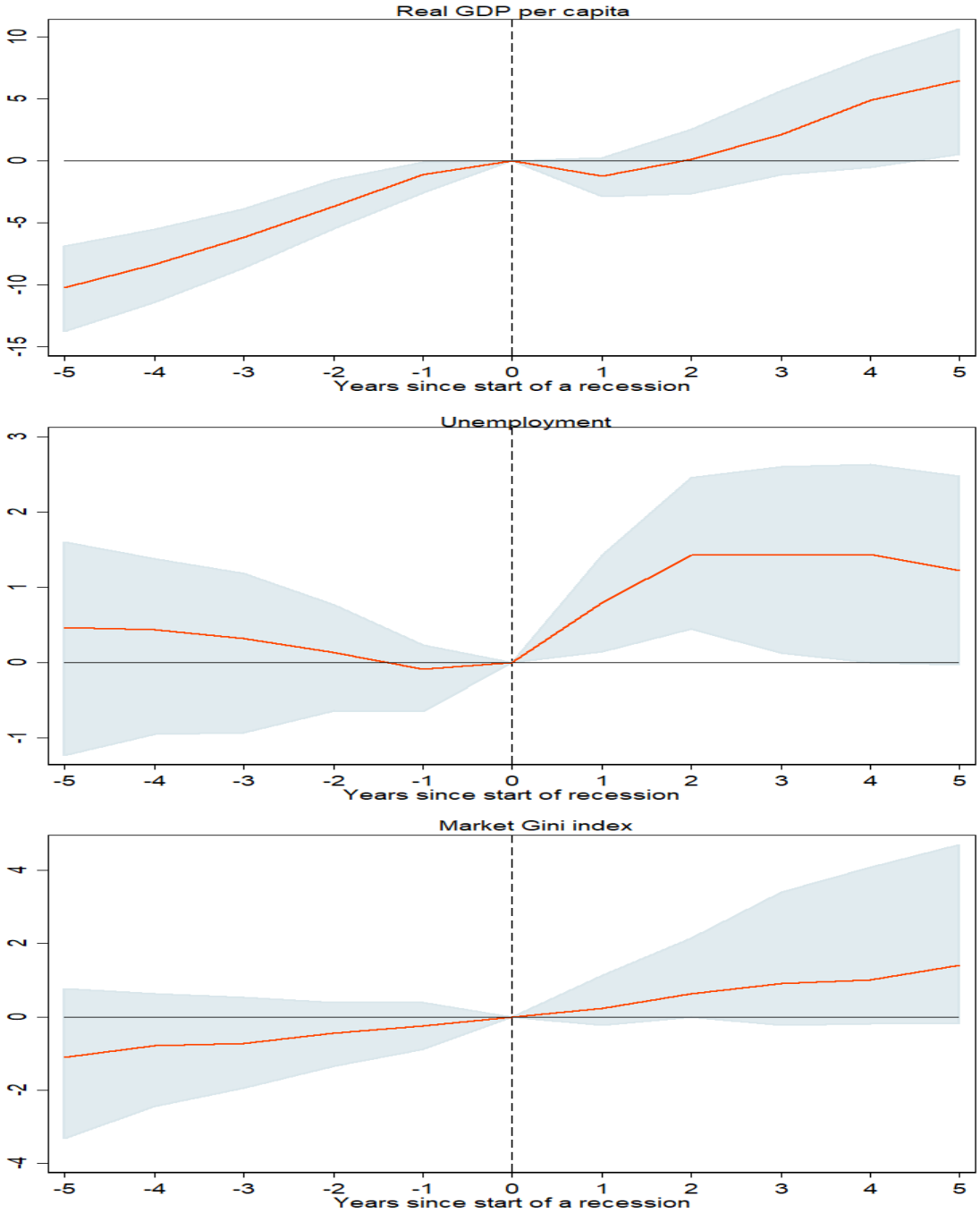
Variable	Data sources	Notes
Market Gini index	Standardized World Income Inequality Database (SWIID)	
Real GDP per capita	OECD and national statistics websites	Older data for Germany, Greece and Hong Kong use the OECD's expenditure components.
Population	World Bank and National Statistics	Annual data are interpolated cubicly to generate quarterly data.
Unemployment	OECD and Global Financial Database (GFD)	
Private sector credit	Bank for International Settlements (BIS)	"Long series on total credit and domestic bank credit to the private non-financial sector" database
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.
TCE ratio	Aikman et al. (2019a)	Based on individual bank balance sheet data on firms group level tangible common equity (common equity minus preference shares and intangible assets) and total assets, obtained from Thomson Reuters Worldscope.

Table A3: 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
Bank capital	62	3.9	1.4	4.0	1.8	7.3
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

Annex B: Additional information on behaviour of key variables around recession episodes:

Chart B1: Median and interquartile range path of key variables during recessions



Notes: 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 area shows the upper and lower quartile

Table B1: Further 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	5.4	-6.6	-2.9	0.3	-1.2	-1.3	2.2	-6.6	-4.5	-1.3	-3.4	-3.0
Year 2	13.1	-10.9	-2.7	2.5	0.1	0.0	6.6	-10.9	-4.9	-1.5	-3.7	-3.4
Year 3	17.8	-11.8	-1.1	5.5	2.1	2.1	11.4	-11.8	-5.9	-0.4	-2.9	-2.3
Year 4	23.4	-19.5	-0.5	8.1	4.8	4.0	15.1	-19.5	-6.6	-0.5	-2.8	-2.2
Year 5	28.9	-26.8	0.5	10.1	6.3	5.7	21.7	-26.8	-7.2	-0.1	-2.3	-2.1
% change in Gini							**% change in Gini**					
Year 1	4.5	-3.1	-0.2	1.1	0.2	0.4	3.2	-0.7	0.0	1.5	0.5	0.8
Year 2	7.1	-4.1	0.0	2.1	0.6	1.0	6.5	-0.7	0.0	2.5	1.5	1.6
Year 3	9.3	-6.1	-0.2	3.3	0.9	1.5	6.4	-1.7	-0.2	4.4	2.1	2.2
Year 4	9.8	-8.8	-0.2	4.0	1.0	1.7	8.2	-1.7	-0.2	4.5	2.4	2.4
Year 5	13.8	-11.3	-0.2	4.6	1.4	2.0	13.8	-0.6	0.8	5.1	2.4	3.3
ppt change in unemployment							**ppt change in unemployment**					
Year 1	6.6	-0.7	0.2	1.4	0.8	1.0	6.6	-0.3	0.3	1.9	1.1	1.4
Year 2	8.6	-1.6	0.4	2.5	1.4	1.7	8.6	-0.5	1.2	4.7	2.0	2.8
Year 3	13.1	-1.9	0.1	2.6	1.4	1.8	13.1	-1.6	0.6	5.1	2.1	3.3
Year 4	13.5	-2.5	0.0	2.6	1.4	1.7	13.5	-2.0	0.8	4.6	2.3	3.8
Year 5	16.9	-3.6	0.0	2.5	1.2	1.6	16.9	-2.2	1.2	5.4	2.3	4.1

Table B2: Summary statistics for key variables in the years prior to the onset of a recession

Year	**-5**	**-4**	**-3**	**-2**	**-1**
All recession episodes					
Cumulative GDP growth (%)	11.3	9	6.5	3.9	1.4
Change in Unemployment rate (pp)	-0.1	-0.1	-0.1	0	0.2
% Change in Gini	1.2	0.9	0.7	0.5	0.4
Recession episodes with above average credit growth preceding them					
Cumulative GDP growth (%)	11.7	9.2	6.5	3.9	1.5
Change in Unemployment rate (pp)	-0.8	-0.6	-0.5	-0.1	0.1
% Change in Gini	1.8	1.5	1.3	0.9	0.6

Annex C: Credit amplification, controlling for contemporaneous impact on unemployment

Table C1: Impact on inequality controlling for contemporaneous impact on unemployment

	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Specification 1	Change in Gini (%) after onset of recession				
Unemployment - contemporaneous	0.445**	0.341*	0.299*	0.364*	0.414*
	(0.208)	(0.194)	(0.170)	(0.181)	(0.226)
All recessions - constant	-0.144	0.0309	1.047*	1.305*	2.425***
	(0.496)	(0.693)	(0.571)	(0.723)	(0.858)
Recessions* credit growth	-0.00107	0.0170	0.0238	0.0228	0.0233
	(0.0146)	(0.0215)	(0.0242)	(0.0330)	(0.0420)
Specification 2	Change in Gini (%) after onset of recession				
Unemployment - contemporaneous	0.356	0.338	0.263	0.395*	0.443*
	(0.276)	(0.234)	(0.206)	(0.213)	(0.243)
Normal recessions	-0.179	0.0309	0.985	1.405*	2.534***
	(0.474)	(0.700)	(0.596)	(0.774)	(0.882)
Financial recessions	-0.0131	0.0916	1.128	1.462	2.974***
	(0.682)	(0.839)	(0.852)	(0.899)	(0.995)
Normal recession* credit growth	-0.00969	0.0176	0.0193	0.0304	0.0379
	(0.0139)	(0.0230)	(0.0270)	(0.0366)	(0.0455)
Financial recession* credit growth	0.0145	0.0162	0.0377	0.00218	-0.0106
	(0.0263)	(0.0343)	(0.0359)	(0.0451)	(0.0518)
Observations	99	99	99	99	99

Robust standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
Includes controls for country-fixed effects, macroeconomic variables and trend 10-year trend

Annex D: Robustness to alternative specifications:

D1: Hamilton (2017) approach to de-trending the Gini Coefficient:

As a robustness test we drop our baseline approach of controlling for any country- and time-specific slow-moving trends by including a 10-year country-level trend in our dependent variable. Instead, we follow Hamilton (2017) and include the two most recent lagged changes in our dependent variable as of time t in our specification, as recommended for annual data. The size and significance of the increase in the Gini coefficient following recessions and the credit interaction effects are very similar to our baseline results reported in Tables 3 and 5 respectively.

Table D1.1: Gini, without trend and with two most recent lags as of date t for annual data

	Year 1	Year 2	Year 3	Year 4	Year 5
	Change in Gini (%) after onset of recession				
Recession	1.625***	0.781	1.671**	0.442	2.935***
	(0.549)	(0.525)	(0.721)	(0.310)	(0.759)
Observations	99	99	99	99	99
R-squared	0.524	0.470	0.489	0.386	0.486
Adjusted R-squared	0.241	0.241	0.241	0.241	0.241
RMSE	3.195	3.195	3.195	3.195	3.195
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

Table D1.2: Gini with credit growth interactions, without trend and with two most recent lags as of date t for annual data

	Year 1	Year 2	Year 3	Year 4	Year 5
	Change in Gini (%) after onset of recession				
Recession	0.838	1.714***	1.780**	0.449	3.064***
	(0.528)	(0.505)	(0.700)	(0.320)	(0.712)
Recession*credit growth	0.0315	0.0491**	0.0606**	0.00427	0.0713**
	(0.0190)	(0.0186)	(0.0274)	(0.0126)	(0.0327)
Observations	99	99	99	99	99
R-squared	0.500	0.570	0.540	0.387	0.535
Adjusted R-squared	0.302	0.302	0.302	0.302	0.302
RMSE	3.064	3.064	3.064	3.064	3.064
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

D2: Dropping recessions without at least a year between consecutive peaks or troughs

Next we limit our sample by dropping overlapping recession episodes, where GDP peaks or troughs occur in quick succession. The size and significance of the increase in the Gini coefficient following recessions is similar to our baseline results. The credit interaction effect is no longer significant at the 10 percent level for all recessions. But it is significant for financial recessions in years 3 and 4 when we split our sample.

Table D2.1: Gini index dropping consecutive recessions

	Year 1	Year 2	Year 3	Year 4	Year 5
	Change in Gini (%) after onset of recession				
Recession	0.424	0.793	1.484**	1.505**	2.808***
	(0.348)	(0.529)	(0.537)	(0.681)	(0.740)
Observations	90	90	90	90	90
R-squared	0.455	0.454	0.545	0.475	0.481
Adjusted R-squared	0.209	0.209	0.209	0.209	0.209
RMSE	3.218	3.218	3.218	3.218	3.218
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 D2.2: 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 recession				
Recession	0.424	0.853	1.569**	1.618**	2.940***
	(0.355)	(0.585)	(0.580)	(0.750)	(0.785)
Recession*credit growth	0.000131	0.0286	0.0408	0.0539	0.0633
	(0.0117)	(0.0214)	(0.0239)	(0.0318)	(0.0376)
Observations	90	90	90	90	90
R-squared	0.455	0.481	0.578	0.516	0.520
Adjusted R-squared	0.255	0.255	0.255	0.255	0.255
RMSE	3.123	3.123	3.123	3.123	3.123
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

D3: Different specifications

Finally, we build up to our baseline results (column iv matches Tables 3 and 5 respectively). In the preceding columns, we show the impact of including country fixed effects, the time- and country- specific slow-moving trend in the Gini and our raft of macroeconomic controls. Country fixed effects are required to uncover the cyclical rise in inequality following recessions. Our inclusion of the slow-moving trend and macroeconomic controls reduces the size of our estimated coefficient somewhat, though each estimate remains significant at the 1% level. Strikingly, the size and significance of our estimated credit interaction effect remains very stable to the exclusion of fixed effects, trend and controls.

Table D3.1: 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 recession			
Recession	0.438	4.183***	3.685***	2.705***
	(0.413)	(0)	(0.233)	(0.790)
10-year trend			0.184**	0.198**
			(0.0925)	(0.0949)
Inflation				-0.355*
				(0.189)
Current account				-0.361**
				(0.162)
Output gap				-0.177
				(0.335)
Policy rate				0.252
				(0.162)
Fixed effects	No	Yes	Yes	Yes
Observations	99	99	99	99
R-squared	0.014	0.274	0.345	0.463
Adjusted R-squared	0.00418	0.0156	0.0999	0.218
RMSE	3.660	3.639	3.480	3.244
Residual degrees of freedom	25	25	25	25

Robust standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table D3.2: 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 recession			
Recession	0.438	4.508***	4.046***	2.849***
	(0.406)	(0.133)	(0.202)	(0.823)
Recession*credit growth	0.0766**	0.0873**	0.0781**	0.0733*
	(0.0293)	(0.0357)	(0.0308)	(0.0358)
10-year trend			0.154*	0.170**
			(0.0803)	(0.0828)
Inflation				-0.365**
				(0.175)
Current account				-0.272
				(0.175)
Output gap				-0.0897
				(0.328)
Policy rate				0.346**
				(0.166)
Fixed effects	No	Yes	Yes	Yes
Observations	99	99	99	99
R-squared	0.110	0.365	0.417	0.515
Adjusted R-squared	0.0919	0.127	0.187	0.283
RMSE	3.495	3.427	3.308	3.106
Residual degrees of freedom	25	25	25	25

Robust standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Annex E: Extension: the role of bank capital resilience

The top two panels of Table E1.1 augment our baseline specification with a bank capital interaction. The top panel indicates that the level of pre-recession bank capital does not have a significant effect on the path of unemployment that follows.[20] In contrast, in the second panel, the estimated coefficients on income inequality are negative and significant. This suggests that high bank capital resilience ahead of a recession has typically been associated with a less severe subsequent rise in inequality. Put differently, *weak* bank capital on the eve of a downturn typically amplifies the inequality effect that follows.[21]

It is interesting that pre-recession bank capital seems to have a significant effect on the subsequent path of income inequality but not on the path of unemployment. This finding suggests that the associated transmission channels may operate through the *wage* distribution of those remaining in work, rather than through the direct impact of unemployment on income inequality. For example, these findings would be consistent with the wages of the low paid being hit particularly hard (relative to higher income deciles) in recessions that were preceded by weakly capitalised banking sectors.

The final panel of Table E1.1 includes both the bank capital interaction and the credit growth interaction described in Section 5.2. It is notable that the inclusion of the credit growth interaction does not meaningfully affect the coefficients on the bank capital interaction.

Likewise, the coefficients on the credit growth interaction remain very similar to those discussed in Table 5 – they continue to suggest rapid pre-recession credit growth is an important inequality amplifier. This suggests that these two pre-recession financial vulnerabilities (rapid credit growth and weak bank capital) amplify the rise in inequality in recessions through different channels.[22]

[20] While the estimated coefficients are negative – suggesting that higher bank capital resilience may reduce the subsequent rise in unemployment – these coefficients are not statistically different from zero.

[21] This result also holds if bank capital is de-meaned at the country level, rather than by the full-panel average.

[22] This is consistent with our finding in Section 5.2 that the credit amplification effect can be largely explained via its impact on unemployment, whereas the bank capital channel discussed in this section appears not to operate via the unemployment effect.

Table E1.1: Bank capital interaction: impact of aggregate banking sector capital prior to recession on the subsequent path of unemployment and income inequality in the recession

	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Specification 7	Change in unemployment (pp) after onset of recession				
All recessions	1.410***	3.643***	3.293***	2.511*	2.109
	(0.269)	(0.634)	(1.103)	(1.337)	(1.410)
Recessions* capital	-0.0350	-0.117	-0.151	-0.213	-0.274
	(0.0924)	(0.121)	(0.300)	(0.346)	(0.350)
Specification 8	Change in Gini (%) after onset of recession				
All recessions	0.191	0.405	1.331	1.519	2.976**
	(0.688)	(0.845)	(1.012)	(1.224)	(1.330)
Recessions* capital	-0.303*	-0.579*	-0.660*	-0.964**	-1.167***
	(0.162)	(0.306)	(0.345)	(0.361)	(0.305)
Specification 9	Change in Gini (%) after onset of recession				
All recessions	0.152	0.0957	0.827	0.949	2.339*
	(0.729)	(0.951)	(0.951)	(1.083)	(1.186)
Recessions* capital	-0.300*	-0.560**	-0.628**	-0.928***	-1.127***
	(0.154)	(0.232)	(0.239)	(0.243)	(0.305)
Recessions* credit growth	0.00445	0.0354**	0.0577***	0.0652***	0.0728***
	(0.0109)	(0.0143)	(0.0129)	(0.0128)	(0.0184)
Observations	62	62	62	62	62

Robust standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
Includes controls for country-fixed effects, macroeconomic variables and trend 10-year trend
Note: Capital ratio is globally demeaned as are all macroeconomic variables, in line with the baseline specification.