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Inequality and Crises Revisited

Salvatore Morelli and Anthony B. Atkinson

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University of Naples Federico II

University of Salerno

Bocconi University, Milan

CSEF - Centre for Studies in Economics and Finance
DEPARTMENT OF ECONOMICS – UNIVERSITY OF NAPLES
80126 NAPLES - ITALY
Tel. and fax +39 081 675372 – e-mail: csef@unisa.it

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Abstract

Recent debate has suggested that growing levels or high levels of inequality may be systematically associated with the occurrence of banking crises. Using the updated version of the Chartbook of Economic Inequality, this paper provides new empirical evidence on the `level' hypothesis and reassesses the empirical validity of the `growth' hypothesis. In line with previous work, the empirical analysis on the entire set of countries and years under investigation does not provide any conclusive and compelling statistical support to either of the hypotheses. However, the apparent statistical insignificance of the findings does not rule out the economic relevance of the question at hand, given that the hypotheses cannot be rejected for important crises and countries such as the US and the UK. Hence, the overall evidence is far from being conclusive and there are several reasons to shed further light on this important research topic.

JEL Classification: D31, D39

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* CSEF, University of Naples and Institute for Economic Modelling at the INET at Oxford. Contact: salvatore.morelli@gmail.com.

** Nuffeld College, University of Oxford and Institute for Economic Modelling at the INET at Oxford. Contact: tony.atkinson@nuffeld.ox.ac.uk.

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Introduction

Income inequality, broadly seen as a combination of stagnating average incomes at the middle and the bottom of the distribution and increasing average incomes at the top, has been singled out as one of the structural causes of the recent financial crisis, especially in the US.

But can inequality be adduced as a causal determinant of a banking crisis? We distinguish between two different hypotheses, the 'growth' and the 'level' hypothesis. The former assumes that it is growing inequality that may contribute to the instability of the financial system, while the latter assumes that it is the high level of inequality that generates macroeconomic instability.

The available empirical evidence provides fairly ambiguous answers to this question, as also described in a recent survey by Bazillier et al. (2014). On one hand, the nexus between growing inequality and the occurrence of a crisis is deemed not to be backed by significant statistical evidence across different countries and time periods (e.g. Atkinson & Morelli, 2010, 2011; Bordo & Meissner, 2012). On the other hand, other investigative works claim stronger support for the hypothesis that inequality may contribute to financial crises (e.g. Bellettini & Delbono, 2013 and Perugini et al., 2013).

The ambiguity of the findings is not entirely surprising, given that the complexity of the question under analysis. Inequality does not have a single dimension and a single indicator is usually the result of multiple levels of aggregation. Similarly, a financial crisis can also manifest in different forms and can have different and multiple triggering factors across different countries, while inequality never appears in official accounts of crisis determinants. Moreover, from an empirical point of view, one needs to acknowledge that we are facing what Angrist & Pischke (2008) call a 'fundamentally unidentified question'. We cannot simply carry out an experiment in which a country is endowed with different income distribution levels or dynamics in order to observe, other things being equal, the subsequent evolution of the stability within the financial sector. Therefore causality is very difficult, if not impossible, to establish.

One can nonetheless observe and analyse the historical evidence from a series of countries and assess where the evidence lies. Making use of the updated collection of historical data taken from the Chartbook of Economic Inequality, this paper provides novel empirical evidence on the 'level' hypothesis (generally neglected within the literature so far) and reassesses the empirical validity of the hypothesis that growing levels of inequality may be systematically associated with the occurrence of banking crises.

In particular, by restricting the analysis to the pre-crisis periods, we analyse whether inequality indicators were systematically on the rise or at a high level. However, we do not find systematic empirical support for either the growth or the level hypothesis once the changes and the levels of inequality indicators are assessed against a specific

critical threshold or compared to a country's own historical perspective and to the contemporaneous experience of other countries. The findings are also robust to different widths of the time window of observation and to different salience thresholds of inequality changes. Importantly, the analysis is robust to different inequality dimensions (income, earnings and wealth) combined with the use of different metrics (Gini, Top shares, poverty rates and P90/P50 ratio).

To summarise, pooling all available data together, our findings confirm the lack of compelling statistical evidence to consider either growing or high level of inequality as systematically linked to the occurrence of systemic banking crises.

However, the statistical 'insignificance' of the findings does not rule out entirely the economic 'significance' of the question at hand. This is particularly true in light of the fact that some of the most disruptive systemic banking crises in important countries like the US and the UK are still found to be preceded by rising or high levels of inequality.

The remainder of the paper is organised in four main sections. In the first section we briefly describe the current theoretical debate around the inequality and crisis nexus. In the second and third sections we explore the empirical evidence on the 'growth' and the 'level' hypotheses. The fourth section draws some conclusions.

1 Inequality and Crises: Review of the Current Theoretical Debate

Recent works within the literature have forcefully suggested that income inequality might have been one of the structural determinants of the onset of the recent crisis. All the arguments are essentially linking income inequality to the unsustainable surge in household indebtedness within the economy, which in turn has been singled out as one of the major predictor of banking crises (e.g. see Schularick & Taylor (2012)).[1]. In particular it has been pointed out that inequality may be contributing to:

(a) Reduce the aggregate demand and therefore economic performance in the economy. This argument follows from the distribution of the marginal propensity to consume across the income distribution, with rich individuals consuming substantially lower portions of their income.

(b) Increase the demand for credit of those individuals left behind in order to keep up with the rising living standard. With the conceptual support of the 'relative income hypothesis', the argument suggests that the increase in income inequality may have pushed households to work more, consume more and take on more debt in response to the shift of their income in comparison to richer households.

[1] A formalisation of this potential channel can be found in Iacoviello (2008) who links positive changes in earnings inequality (referred to as increased volatility of individual's earnings pattern) to the surge in household indebtedness (in order to smooth out consumption). Similarly, Kumhof & Ranciere (2010) and Ravenna & Vincent (2014) construct, within a conventional DSGE framework, a theoretical set-up in which a surge in inequality increases endogenously the leverage of households by increasing both demand and supply of credit

(c) Increase the supply of funds available in the economy as richer individuals search for new investments. Similarly, inequality may push governments to ease access to credit in order to face the mounting pressures for redistribution within the economy as well as the depressed aggregate demand.

Different versions of the arguments above were suggested by Milanovic (2009); Stiglitz (2009); Fitoussi & Saraceno (2010), Rajan (2010) among others.[2]

One should also recall, however, that the recent body of literature has also suggested that the correlation between income inequality and financial instability may have been driven by coincidental concurrent forces such as the right shift in political thinking which led to the liberalisation and the de-regulation of financial sector and other sectors of the economy (see Atkinson & Morelli, 2010, 2011, Krugman, 2010 and Acemoglu, 2011 for further discussion).

2 Description of the Data

In order to identify the occurrence of systemic banking shocks we have consulted some of the most authoritative databases of banking crises Bordo et al. (2001), Reinhart & Rogoff (2008, 2009), Reinhart (2010) and Laeven & Valencia (2008, 2010). In general the sources listed above do not always unequivocally identify crisis years, given differences in methods and judgements due to their reliance on both qualitative and quantitative measures. Thus, in order to assemble a list of systemic banking crises, we compared and summarised the information contained within those sources according to a 'majoritarian' criterion, as already done in Atkinson & Morelli (2011). The proposed summary measure, is a simple dummy variables taking value of 1 at the beginning year of a crisis and 0 otherwise.

Data on economic inequality are drawn from the Chartbook of Economic Inequality (Atkinson & Morelli, 2014), a collection of historical data assembled over the years from a variety of individual researchers as well as research institutions and statistical offices.[3] The database collects information on 5 different annual measures of 'inequality': a measure of top income shares (top 1% of gross personal income); an income (or consumption) based poverty measure (percentage of individuals living in households with income below 60% of average income within the economy); the Gini index on equivalised household disposable income; an earnings dispersion measure (the ratio between the 90th percentile and the median), and; a measure of top wealth share (top 1% of total net worth). The data cover a period of over 100 years, from 1900 to 2012,

[2]Some of these aspects were already surveyed in recent work by Atkinson & Morelli (2010, 2011) and more recently in Van Treeck (2013). The main ideas underlying the suggested links between inequality and crisis are, however, not new to the academic debate. For instance Brown (2004) has explicitly asked in his work the question of how rising income inequality can create "*the need for greater reliance on debt to sustain aggregate consumption expenditure*", formally analysing many aspects of the above mentioned conjectures about the inequality/crisis nexus well in advance of the 2007 crisis.

[3]The database and the working paper are downloadable from the web site www.chartbookofeconomicinequality.com.

for 25 different countries accounting for more than a third of the world population[4].

Much of the attention has focused on the US and the UK and Figure 1 describes the data available for these two countries during the ten years preceding the recent financial crisis, from 1998 to 2007. One can observe that the overall inequality measure (Gini) shows only a modest increase if any. The maximum increase is 1.3 percentage points in the US and 1.8 percentage points in the UK. The share of people living in poverty as well as the share of total net worth retained in the hand of the wealthiest 1% of the population appear to be relatively stable across the decade. The measures that show a larger proportionate increase are the top income shares and the upper earnings decile as a share of the median. In the US top 1% income share went from 15.2 to 18.3, and a very similar proportionate increase occurred in the UK, from 12.2 to 15.4. Similarly, earnings ratio increased by ten percentage points in both countries, albeit the extent of the earnings dispersion was substantially greater in the US to begin with. In 1998, top US earners (within the upper decile) had a salary equivalent to 2.2 times the median earner's, and this factor reached 2.3 by 2007. In the UK, the figure ranged from 1.9 in 1998 to 2 in 2007. Figure 1 shows that there is no "smoking gun" as far as overall inequality is concerned. This suggests that we need either to focus on the top of the distribution or to consider a wider range of countries and historical episodes. It is with the latter that we begin.

3 Empirical Evidence on the '*Growth*' Hypothesis

In this section we analyse more systematically whether inequality indicators were on the rise during pre-crisis periods, focusing only on the subset of countries and periods for which a banking crisis has been detected. This constitutes an instrumental investigation of the so called 'growth hypothesis'. The 'level hypothesis' will be investigated within the next section.

We begin by extending Atkinson and Morelli's original empirical investigation on the '*growth hypothesis*' (2010, 2011). In particular, the use of an updated version of the Chartbook of Economic Inequality, allows doubling of the number of observations, classifying an additional 21 banking crises.
Results are shown in Figure 2 where the changes in inequality before each detected banking crisis are tabulated. We categorise the distributional changes as follows:

- A Sign '+' or '-' is given to all positive and negative changes, within the 5 years preceding the onset of a banking crisis, which are greater than 1 percentage point (comparing T-1 to the average of T-4 to T-6, where T is the year of the crisis outbreak).

[4]The countries under investigation are: Argentina, Brazil, Australia, Canada, Finland, France, Germany, Iceland, India, Indonesia, Italy, Japan, Malaysia, Mauritius, Netherlands, New Zealand, Norway, Portugal, Singapore, South Africa, Spain, Sweden, Switzerland, the UK and the US

- Changes lower in magnitude or no changes are classified as '='.
- Missing observation are indicated with '#'.
- Special circumstances like major wars, civil wars and independence episodes are shown as '**S**'.

Here the information on the Gini coefficient is preferred when the latter is available. Top income shares (or top wealth share and P90/P50 earnings ratio) are the second preferred measures followed by poverty rate indicators. Therefore Figure 2 combines the information available from different inequality indicators. The strongest evidence suggests that inequality appears rather stable in the years preceding the crises and the changes, when recorded, are not associated with any particular direction. In particular, we found the same number of crises preceded by salient increase or decrease in inequality in the 5 years window before a crisis (14 out of 43 classifiable cases and out of 84 identified crises)[5].

Results show a substantial agreement with what already described in Atkinson & Morelli (2010, 2011) despite the substantial increase in sample size. Indeed, using a similar approach we find no support for the hypothesis that sees increasing levels of inequality systematically associated to higher incidence of crises.

Note also that the recent 2007 systemic banking crisis identified in the US, according to classification in Figure 2, is preceded by 'stable' inequality and not by increasing inequality as suggested by the debate that sees inequality as one of the leading structural cause of the crises themselves. The lack of evidence of increasing inequality, however, may be due to the use of a misleading empirical 'specification'. For instance, 5 years may not be a sufficient time horizon in order to detect substantial changes in income distribution.

3.1 Expanding the time window

Indeed, extending the time window to medium-run (comparing T-1 to the average of T-9 to T-12), as shown in Figure 3 and Table 1, implies an increase in the number of crises preceded by growing inequality (these are now 16 over 39 classified episodes). For example, after expanding the time window, the pre-crisis change in inequality becomes (just) salient and positive also for the recent 2007 US financial meltdown.

3.2 Controlling for Different Salience Thresholds

In this section we check the validity of the findings above to changes in the value of salience threshold. In particular, to capture more substantial variation in inequality,

[5]Note that the number where inequality is found increasing before a crisis rises to 23 out of 43 if one does not use any threshold of salience for the classification of changes in inequality.

we raise the threshold to 3 percentage points.[6]. However, as minor changes would no longer be classified, the statistical support for the 'growth' hypothesis shrinks further as shown in table 1.

A 3 percentage point change in the Gini coefficient is also found to be almost equivalent to a 1 standard deviation for the two available Gini series in the case of the UK[7]. However, the same value is 3 times the average standard deviation in the case of Canada. This raises issues about whether the choice of a homogenous threshold can be optimal for all countries.

Hence, and using the UK observation as the benchmark, we use, in addition to the others, the criterion that a 1 standard deviation represents a salient change in the Gini coefficient for each single country. In line with previous findings, this procedure also shows little support for the growth hypothesis (see last two columns of Table 1).

However, it is worth noting that inequality is found to be strongly on the rise in important episodes such as the crises in Argentina in 1980, 1989 and 2001, Japan in 1992, the US in 1988, as well the recent crises in Germany and the UK in 2007. The case of US 2007 flips from being salient to non-salient again.

3.3 Controlling for Different Inequality Measures

Results so far are based on a joint analysis of different indicators of inequality (in the absence of Gini coefficients we relied on measures of concentration at the top of the income distribution -top shares- and the bottom of the income distribution -relative poverty indicators-). This was done in order to obtain the largest possible sample size and to cover the wide spectrum of the 'income parade'. Yet, in discussing the role of inequality in the run-up of the crisis, one needs to make clear *where* in the distribution inequality is rising or falling.

We therefore decompose the analysis by different dimensions of inequality. As mentioned above, we focus on three main measures of inequality of income: the Gini coefficient for the net-of-taxes and equivalised household income (a comprehensive measure of dispersion of income across all distribution); the top (gross) income share of the richest 1% or 0.1$ of the tax unit population (dispersion at the '*top*'), and; the head-count measure of households below 60% of the median income in the country (inequality of income between the '*bottom*' households and the median). Note also that a measure

[6] Atkinson (2003), argued, under specific assumptions, that the Gini coefficient could change by approximately 3 percentage points in response to a change in 5 percentage points in the income tax rate, a very difficult task for a policy maker (see also Atkinson & Marlier (2010, p. 112)). In particular, this is true assuming a constant marginal tax rate on all incomes and uniform tax credit. Atkinson (2003) also assumes that the Gini coefficient for disposable income amounts to 48 in case no distribution of income applies and that marginal tax rate is 20 % (p. 484, 2003).

[7] When there are multiple inequality series, in order to calculate the standard deviation of the series, we first calculate the standard deviation for each series. Subsequently we take the average of those as long as the estimation rests on more than 10 observations.

of top wealth shares or top earnings dispersion (ratio between the top decile and the median) is used to represent the top of the distribution when top income shares are not available.

Table 2 summarises the results disaggregated by inequality measures and different time horizons. In particular the 'growth' hypothesis is assessed using exclusively information on specific inequality indicators and then compared to the baseline case in which information about different inequality dimensions is combined (refer to column named '*overall*').

When the medium-run becomes the focus of the analysis, the number of crises preceded by rising Gini coefficients is the same as the number of crises preceded by declining or stable Gini (12). Table 3 provides further details for each country and crisis-year pairs. It is observed that, of the above mentioned 12 cases, all except the 1929 crisis in the US occur in the post-1980 period. This reflects the positive trend in income inequality experienced in many countries since the early 1980s. Furthermore, every crisis occurring in Argentina and the US are classified as having had salient rise in inequality in the ten years preceding the crash. Similarly, this is the case for other important and well known crises such as Japan 1992, Sweden 1991, Indonesia 1997 and the recent 2007 crises in the UK and Germany.

With the exception of the Argentina and US banking crises, this is not observed when focusing on measures of concentration at the top and the bottom of the income distribution or on different time horizons. In the latter cases, instead, the evidence is strongly against the validity of the 'growth' hypothesis, suggesting that it is the distribution of income as a whole that may matter most for the sake of the assessment of the hypothesis at hand.

4 The Investigation of the '*Level*' Hypothesis

The work by Atkinson & Morelli (2011) did not investigate whether inequality levels were relatively higher before identified macroeconomic shocks and this led them to conclude that " *the level hypothesis cannot be ruled out at this stage*". The latter requires a careful definition of the comparator to which the inequality measure can be evaluated against. Inequality at a point in time can be 'high' in relation to the country's historical standard or in relation to the contemporaneous experience of other countries. As a matter of fact, the Gini coefficient in Sweden went up by ten percentage points from 1978 to 2010, going from 22.5 to 32.5. This is an enormous increase in income dispersion across Swedish households over time, but Sweden remains a relatively egalitarian country if compared to other countries in the world[8]. Therefore, based on a time dimension the risk of a crisis may seem significantly enhanced, but this is not the

[8]Using the wave VI of Luxembourg Income Study data - a dataset containing inequality data comparable across countries - one observes that Sweden - in the year 2004 - has the third lowest Gini coefficient in the whole set of countries.

case observing the cross-country dimension.

Whereas the investigation of the level hypothesis with a cross-country comparator has already been investigated in Bellettini & Delbono (2013)[9], no attempts have been carried out in the literature to investigate the level hypothesis using a time comparator as well.

We therefore follow two main approaches here, each of which has a set of advantages and disadvantages. On the one hand, each measure of inequality is compared to the country's own historical evidence. On the other hand, the average level of inequality across countries can be used as main comparator. Both approaches are valid under specific assumptions. The use of a time comparator assumes that the inequality series are comparable over time and that the empirical distribution of data is sufficiently close to the 'real' distribution of values for a specific measure of income inequality and for the period under investigation. On the contrary, in order to have meaningful estimates using a space comparator, one has to assume cross-country comparability of data and obtain external comparable information on the average 'world' inequality to which the country-observations are compared. These issues are further discussed below.

The Chartbook of Economic Inequality, as discussed above, is purposely assembled in order to preserve the comparability of inequality series over time and it is used for the time-dimension approach. Instead, we draw information from the Luxembourg Income Study (LIS) in order to adjust the country series and construct a cross-country comparator. Details are discussed below.

4.1 The Level Hypothesis: Time Dimension

In investigating whether the high level of inequality had a role in different crisis episodes it is crucial to ask what is the basis of comparison. In this subsection we make exclusive use of the time-series observations for each single country. Inequality is deemed to be high only in relation to what can be observed over time. In particular, we draw on the historical experience of countries, for which we have constructed time-comparable inequality series, in order to estimate an empirical distribution of the main inequality indicators. We then compare these empirical distributions on different inequality measures to the observations that we have at the eve of each crisis (e.g. we give priority to the observation on the average of inequality during the three years preceding the eve of the crisis). The level of inequality is then recorded as being relatively 'high' or 'exceptional' compared to historical standards only if the observation lies above the 90th and/or the 80th percentiles of its respective country-specific distribution.

This exercise is conducted for both the Gini coefficients and the measure of dispersion at the top (typically the top income share of the richest 1% of the tax units)

[9]The work by Bellettini & Delbono (2013) constitutes the first attempt to assess the validity of the 'level' hypothesis with cross-section information.

separately. The information of the two different measures is then combined with a similar 'lexicographic' criterion used before, according to which the information about the Gini coefficient is given full priority over the measures of income dispersion at the top.

This approach has important advantages. First of all, less structure is required from the database. In other words, all one needs to have is enough historical observations to compute the empirical distribution (observations do not have to be continuous over time) and, in the worst case scenario, one single observation in the 4 years preceding the crisis event. Indeed, the test for level hypothesis based on a time comparator allows to exploit the highest sample size (51 of the 84 crises are now classifiable). Secondly and given the nature of the database at hand, relying on observations over time guarantees more compelling results than a cross-country comparison due to issues in data comparability across panel units (see below).

The exercise, however, also presents some caveats. In particular, the estimation of distribution of inequality data based on the available data points can be biased in case the sample does not cover the entire time horizon under investigation. As a matter of fact, although the estimation of the empirical distribution can be conducted even with few data points, this does not guarantee the unbiased estimation of the 'true' centile we are interested in. In order to acknowledge this important shortcoming we discard all the estimates coming from the use of fewer than 20 observations[10]. Moreover, if different results based on different inequality measures lend mixed support to the validity of the level hypothesis, we would prefer the information obtained using the biggest sample.

Aggregated results for this form of 'level' hypothesis in comparison with the 'growth' hypothesis are found in Table 4. The table shows that the level hypothesis based on a time comparator does not find greater support in the data compared to other tested hypotheses. For instance, in 21 out of 51 classified cases (41% of the cases) inequality was found to be above the country-specific 80th percentile in the years preceding the crisis. In comparison, the highest support for the growth hypothesis (found using medium-run time window and the baseline salience threshold) counts 16 cases out 39 classified crises, representing 41% of cases too.).

A few things are worth noting. This methodology allows to classify crises which were otherwise unclassifiable due to lack of continuous information over time. Table 5 classifies the two Japanese crises in the early twentieth century (1901 and 1907), the Italian crises in 1914 and 1935, the 1923 crisis in Canada, the 1921 crisis in Finland, the 1931 crises in Australia and Norway, the 1934 Argentinian crisis and the Indian crisis in 1929. Furthermore, new information became available for already classified crises episodes. For instance, both the 1929 and 2007 crises in the US are now considered to

[10]For instance, by doing this we exclude entirely the data on Iceland for which we only have 19 observations

be preceded by systematically 'high' inequality. Conversely, this is not true in the case of the Savings&Loans crisis, contrasting with the evidence from the 'growth' hypothesis where inequality was considered to have had a salient increase. Similarly, in the case of Japan, the 1992 crisis is found to be preceded by growing levels of inequality but not by a high level of inequality by historical standards. Further detailed information is found in Table 5.

4.2 The Level Hypothesis: Cross-Country Dimension

A complete investigation of the 'level' hypothesis has to include the space dimension as well. In other words, the high level of inequality before the onset of a crisis has to be assessed with respect to the experience of other countries as well. This is what we attempt to do in the following section.

Nonetheless, the data at hand now impose stronger constraints on the empirical investigation of this type of 'level' hypothesis. Indeed, in order to obtain meaningful outcomes, one has to work with data which are comparable across countries. This, for example means that one could not implement this test for measures of income dispersion at the top as they are not usually available across countries on a comparable scale. One can however investigate the Gini coefficients within the post 1980 sub-period (no comparable Gini are available for earlier years in sufficient number). Unfortunately, the Chartbook of Economic Inequality is not directly designed to serve this purpose and other available databases providing Gini coefficients that are comparable across countries do not have enough continuous information over time for each country or, in some cases, have a single data point (typically in the latest years). The Luxembourg Income Study (LIS), for example, provides this type of information for the set of countries under investigation[11].

In order to overcome the problems mentioned above we proceed as follows. First of all, we take the observations available in LIS in 2004 (or the nearest available year) and we adjust the available series in the Chartbook. More precisely we link (with proportional adjustment) the Chartbook Gini series to the 2004 (or nearest) LIS observation. By doing this we reshape the Gini series in the database at hand to be also comparable across countries.[12] This is true under the assumption that the adjustment is valid back

[11] The LIS data are the most closely comparable across countries, but only provide observations at intervals. There are 'waves' every 5 years approximately, but not annual data (Waves we (around 1980), II (around 1985), III (around 1990), IV (around 1995), V (around 2000) and VI (around 2004)). For example the US data are for the following years: 1969, 1974, 1979, 1986, 1991, 1994, 1997, 2000, 2004, 2007 and 2010.

[12] As an example consider the case of the UK where the data on Gini estimated in the Chartbook in 2004 is very close to the correspondent value in the LIS database. The values are 34 and 34.4 respectively. The methodology above consists in adjusting the available value in the Chartbook (34) with a proportional factor (34.4/34). This proportional adjustment is kept constant for other years so to obtain a new adjusted Gini series.

to the 1980, the beginning year of the investigation.

Once obtained a set of Gini observations which are comparable across countries (under the assumptions above) one needs to construct a comparator against which to evaluate the levels of Gini in different countries and years. For this we make use of the average of available Gini in *all* countries covered by the LIS for each decade starting from the 1980s. This procedure allows us to compare the inequality level for a specific country and year to the average '*world*' Gini level in the specific decade.

If the Gini in the years preceding the crisis (typically the average of the three years preceding the crisis) is higher than the 'world' average, we consider this as an observation in support of the cross-country 'level' hypothesis. The main results of this exercise are found in a compact version in Table 4 and in an expanded and detailed format in Table 5. The latter reveals interesting details worth noting. The 'level' hypothesis, for instance, is now supported in the case of the S&L crisis in the US whilst it was rejected in the time version of the 'level' hypothesis testing procedure. Conversely, the case of Italy also appears worth noting as inequality preceding the eve of the 1990 crisis is found to be relatively high in relation to other countries, but not based on its historical evidence. Similarly the Italian crisis rejected the validity of the growth hypothesis in the previous section. Overall, out of 24 classifiable cases 10 episodes could not be assessed as data were missing, while 8 and 6 cases were found respectively in support and not in support of the 'level' hypothesis. Overall, these findings suggest that even the level hypothesis, evaluated with a cross-country comparator, is not unequivocally supported in the data.

Similar results were found in Bellettini & Delbono (2013), who were able to classify 14 crises and found evidence supporting the level hypothesis in 9 cases.[13] The authors suggest, however, that "*although the sample of banking crisis we succeed to classify is fairly small, the association does not look negligible at all*". Despite the latter statement, we believe this is too small a difference to infer any meaningful conclusion as both empirical findings are only weakly supporting the level hypothesis by means of any statistical standard.

Conclusions

Using the Chartbook of Economic Inequality (Atkinson & Morelli, 2014), we assessed the empirical validity of the hypothesis that both growing levels and high levels of inequality may be systematically associated with the occurrence of banking crises (the 'growth' hypothesis and the 'level' hypothesis). On one hand, and insofar as the 'growth hypothesis is concerned, this is done by reassessing the empirical evidence of our pre-

[13]The work by Bellettini & Delbono (2013) makes use of a combination of data from the Chartbook of Economic Inequality, the OECD, the LIS and the WIID (UNU-WIDER, 2008) databases and compare the average Gini in the 10 years preceding each crisis to the OECD Gini average relevant in the period (from both the OECD and the LIS database)

vious 2010 and 2011 works. On the other hand, we also provided new evidence on the 'level' hypothesis by comparing different measures of inequality before the crisis to a country's own historical evidence (e.g. 'time comparator') and to the average experience of other countries (e.g 'cross-country comparator'). This constitutes, to the best of our knowledge, the first attempt to assess the validity of the 'level' hypothesis across different dimensions (over time and across-countries).

The overall aggregate empirical evidence, however, does not provide any convincing statistical support for either of the hypotheses and the findings are in line with the analysis already carried out in Atkinson & Morelli (2010, 2011).

Nevertheless, it is also worth recalling that statistical insignificance does not rule out the economic relevance of the question at hand.

First of all, as recalled in Bellettini & Delbono (2013)[14], crises can be spread from one country or region to others and do not necessarily generate within the national boundaries, especially in a context of high financial and economic integration. Hence, the change in inequality in 'crisis-originator' countries (e.g. the US and the UK) acquires substantial additional importance compared to that occurring in 'crisis-receiving' countries. This means that the approach followed so far may be mis-specified, to the extent that the growth and level hypotheses are assessed in all countries, irrespectively of their role in originating a crisis.

More generally, it is important to recognise that the inequality-crisis nexus can apply independently to specific cases or country and that, if existent, it might not be an iron law. Indeed, as recently argued by Dani Rodrik "*economics is a science that can claim to have uncovered few, if any, universal truths. Like almost everything else in social life, the relationship between equality and economic performance is likely to be contingent rather than fixed, depending on the deeper causes of inequality and many mediating factors.*"[15]

Finally, an interesting stream of literature is exploring the potential mechanisms that may relate income inequality to household 'over-consumption', under-saving and over-indebtedness behaviours (e.g. the works by Frank et al., 2010, De Giorgi et al., 2012, Bertrand & Morse, 2013, Georgarakos et al., 2012 and Gorodnichenko et al., 2012 represent very interesting examples). In particular, the hypothesis that income dispersion can endogenously impact on household indebtedness decisions is particularly relevant to understand the potential contribution of income inequality to macroeconomic

[14] In the conclusions to their paper, Bellettini & Delbono claim that "*as long as high income inequality is associated to banking crises in 'big' countries, then such inequality should be of some concern for the whole system, given the interdependency of financial markets and the resulting contagion outside national boundaries*".

[15] The quotation is taken from the article "Good and bad inequality" appeared on Project Syndicate's web site on the 11th of December 2014.

instability, which may not necessarily lead to a crisis. Yet this hypothesis has not been yet fully explored (Zinman, 2014). Many hypotheses have been put forward which need rigourous testing and formalisation and more research is warranted in this relatively understudied field.

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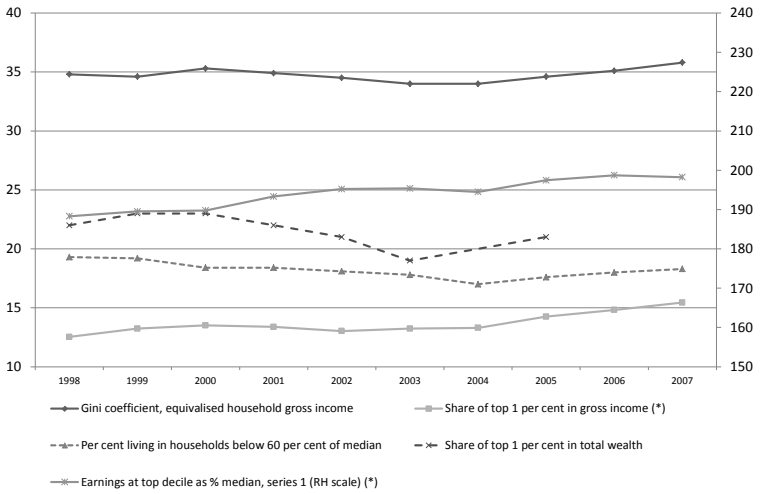
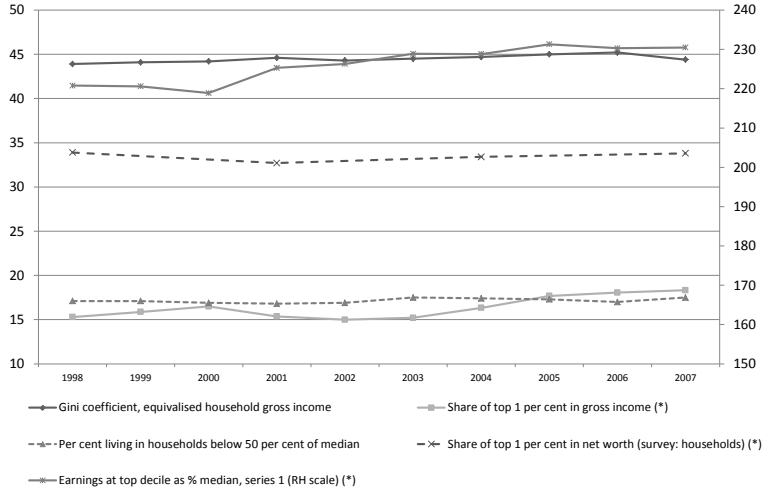
Appendix A

Graphs and Tables

Figure 1: Evolution of economic inequality in the UK and the US: 1998 - 2007



(a) United Kingdom



(b) United States

Source: Data taken from the Chartbook of Economic Inequality (2014).

Figure 2: Inequality Before Systemic Banking Crises: Short-run

Short- run		List of crises		Total
Pre-crisis change in income inequality	+	Argentina 1980; Argentina 1989; Argentina 2001 Brazil 1990 Germany 2007 India 1929 Iceland 2007	Indonesia 1997 Japan 1923; Netherlands 1939 Netherlands 2008 Sweden 1907 Switzerland 1931 US 1929; US 1988	14
	=	Canada 1923 Finland 1931; Finland 1991 Germany 1931 Indonesia 1992 Japan 1927; Japan 1992 Malaysia 1997	Norway 1987 Singapore 1982 Spain 2008 Sweden 1991 UK 2007 US 2007	14
	-	Argentina 1995 Australia 1931 Brazil 1994 Finland 1939 France 1914 France 1930	Germany 1925 India 1993 Italy 1990 Malaysia 1985 Netherlands 1921 Sweden 1922 Switzerland 1921	13
	#	Argentina 1914 ; Argentina 1931; Argentina 1934 ; Brazil 1900; Brazil 1914; Brazil 1923; Brazil 1926; Brazil 1929 Brazil 1963; Canada 1906 Canada 1908; Canada 1912; Denmark 1902; Denmark 1907; Finland 1900; Finland 1921 France 1907; Germany 1901	India 1908; India 1914 ; India 1921; Italy 1907; Italy 1914; Italy 1921; Italy 1930; Italy 1935 Netherlands 1914 Norway 1921; Norway 1931; Norway 1936; Portugal 1920; Portugal 1923; Portugal 1931 Spain 1920; Spain 1924; Spain 1931; Spain 1977 Sweden 1931; Switzerland 1910; Switzerland 1933	41
	S	India 1947 Japan 1917		2

Author's update and re-elaboration of results in Atkinson & Morelli (2010, 2011). Absolute changes (5-year window) in inequality lower than 1 percentage points are classified as no changes (=). Positive changes (> 1 pt)are classified with a '+'. Negative (< -1 pt) are classified with '-'. Crisis occurred during special historical events like world wars are classified with a 'S'. All missing information are represented with a '#'.

Figure 3: Inequality Before Systemic Banking Crises: Medium-run

Medium-run		List of crises		Total
Pre-crisis change in income inequality	+	Argentina 1980; Argentina 1989; Argentina 1995; Argentina 2001 Brazil 1990; Brazil 1994 Germany 2007 Iceland 2007 Indonesia 1997; Netherlands 1914	Japan 1923; Japan 1992 Sweden 1991 Switzerland 1931 UK 2007 US 1929; US 1988; US 2007	16
	=	Finland 1991 India 1993 Italy 1921 Japan 1927 Malaysia 1997	Netherlands 2008 Norway 1987 Spain 2008 Sweden 1931	9
	-	Australia 1931 Finland 1931; Finland 1939 France 1930 Germany 1925; Germany 1931 Indonesia 1992	Italy 1990 Malaysia 1985 Netherlands 1939 Singapore 1982 Sweden 1922	12
	#	Argentina 1914 ; Argentina 1931; Argentina 1934 ; Brazil 1900; Brazil 1914; Brazil 1923; Brazil 1926; Brazil 1929 Brazil 1963; Canada 1906; Canada 1908; Canada 1912; Canada 1923 Denmark 1902; Denmark 1907; Finland 1900; Finland 1921; France 1907; France 1914; Germany 1901	India 1908; India 1914 ; India 1921; India 1929; Italy 1907; Italy 1914; Italy 1921; Italy 1930; Italy 1935; Netherlands 1914; Netherlands 1921; Norway 1921; Norway 1931; Norway 1936; Portugal 1920; Portugal 1923; Portugal 1931 Spain 1920; Spain 1924; Spain 1931; Spain 1977; Sweden 1907 Sweden 1931; Switzerland 1910; Switzerland 1921; Switzerland 1933	45
	S	India 1947 Japan 1917		2

Author's update and re-elaboration of results in Atkinson & Morelli (2010, 2011). Absolute changes (10-year window) in inequality lower than 1 percentage points are classified as no changes ('='). Positive changes (> 1 pt)are classified with a '+'. Negative (< -1 pt) are classified with '-'. Crisis occurred during special historical events like world wars are classified with a 'S'. All missing information are represented with a '#'.

Table 1: Growth Hypothesis: Is inequality growing substantially before a banking crisis? Short and Medium-Run and Different Salience Thresholds

	Homogeneous threshold				Country-specific threshold	
	1pt		3pt		1 StDev	
Valid hypothesis?	Short-run	Medium-run	Short-run	Medium-run	Short-run	Medium-run
YES	14	16	4	9	3	9
NO	27	21	27	28	33	24
S	2	2	2	2	2	2
Missing	41	45	41	45	33	49
Total	84	84	84	84	84	84

Notes: The table checks the validity of the 'growth' hypothesis under different time horizon and salience thresholds. On one hand we compare the short-run (approx. 5 years) to the medium-run (approx. 10 years). On the other hand, we check the hypothesis across two country-homogeneous salience thresholds and a country specific threshold. More specifically a crisis is considered to support the hypothesis (YES) if the absolute recorded pre-crisis change in inequality is positive and higher than 1 percentage point, 3 percentage points or 1 standard deviation, depending on different specifications.
The signs 'S' and 'Missing' respectively refer to special circumstances (like wars) and missing observations.

Table 2: Growth Hypothesis: Aggregate Evidence by Different Inequality Measures

	Short-Run				Medium-Run			
		By inequality measures				By inequality measures		
Valid hypothesis?	Overall	Gini	Top	Poverty	Overall	Gini	Top	Poverty
YES	14	8	14	2	16	12	11	6
NO	27	15	24	17	21	12	19	10
S	2	0	0	0	2	0	2	0
Missing	41	61	46	65	45	60	52	68
Total	84	84	84	84	84	84	84	84

Notes: The table checks the validity of the 'growth' hypothesis under different inequality indicators and time horizons. On one hand we compare the short-run (approx. 5 years) to the medium-run (approx. 10 years). On the other hand, we check the hypothesis across different inequality measures representing the whole spectrum of the income distribution: Gini indicator ('Gini'), top1% income share ('Top'), and relative poverty measure ('Poverty'). The column 'Overall' refers to the baseline summary measure giving priority to information on the Gini coefficient. Note also that when we lack information on top income shares, top wealth shares or P90/P50 earnings ratio are used instead if available.
A crisis is considered to support the growth hypothesis (YES) if the absolute recorded pre-crisis change in inequality is positive and higher than the baseline salience threshold (1 percentage point). The signs 'S' and 'Missing' respectively refer to special circumstances (like wars) and missing observations.

Table 3: Growth Hypothesis: Detailed Evidence Using Different Inequality Measures

		Short-Run				Medium-Run			
			By inequality measures				By inequality measures		
Country	Year	Overall	Gini	Top	Poverty	Overall	Gini	Top	Poverty
Argentina	1980	+	+		=	+	+		
Argentina	1989	+	+		+	+	+		+
Argentina	1995	-	-		-	+	+		+
Argentina	2001	+	+	+	+	+	+		+
Australia	1931	-		-		-		-	
Canada	1923	=		=					
Finland	1931	=	=	=		-	-	-	
Finland	1939	-	-	=		-	-	=	
Finland	1991	=	=	=	-	=	=	=	-
France	1914	-		-					
France	1930	-		-		-		-	
Germany	1925	-		-		-		-	
Germany	1931	=		=		-		-	
Germany	2007	+	+	+	=	+	+	=	+
Iceland	2007	+	+	+	=	+		+	
India	1929	+		+					
India	1947	S		S		S		S	
India	1993	=	=	-	-	=	=	+	-
Indonesia	1992	=	=		-	-	-		-
Indonesia	1997	+	+	=	-	+	+		-
Italy	1921					=	=		
Italy	1990	-	-	=	-	-	-	+	-
Japan	1917	S		S		S			
Japan	1923	+		+		+		+	
Japan	1927	=		=		=		=	
Japan	1992	=	=	=		+	+	=	
Malaysia	1985	-	-		=	-	-	-	+
Malaysia	1997	=	=	=	=	=	=	=	=
Netherlands	1914					+		+	
Netherlands	1921	-		-					
Netherlands	1939	+		+		-		-	
Netherlands	2008	+	+	+	=	=	+		
Norway	1987	=		=	-	=		=	-
Singapore	1982	=	=	=		-	-	=	
Spain	2008	=	=	=		=	-	-	=
Sweden	1907	+		+					
Sweden	1922	-		-		-		-	
Sweden	1931					=		=	
Sweden	1991	=	=	=		+	+	=	
Switzerland	1921	-		-					
Switzerland	1931	+		+		+		+	
UK	2007	=	=	+	=	+	+	+	-
US	1929	+		+		+	+	+	
US	1988	+	+	+	=	+	+	+	+
US	2007	=	=	+	=	+	+	+	=

Notes: extended version of Table 2
The table includes only the events for which distributional information exist.

Table 4: The 'Growth' vs 'Level' Hypothesis: Aggregated Evidence

	'Growth' hypothesis (*Medium Run only*)			'Level' hypothesis		
	Homogenoeus salience threshold		Country-specific salience threshold	Time dimension		Cross-country dimension *Gini and post-1980 only*
Valid hypothesis?	1pt	3pt	1 StDev	P80	P90	
YES	16	9	9	21	12	8
NO	21	28	24	28	37	6
S	2	2	2	2	2	-
Missing	45	45	49	33	33	10
Total	84	84	84	84	84	24

The table compares the evidence in support of both the growth and the level hypotheses. Note that only the results based on the medium-run are tabulated for the growth hypothesis.

Table 5: 'Growth' vs 'Level' Hypothesis: Detailed Evidence

		'Growth' hypothesis (Medium-run only)			'Level' hypothesis		
		Homogenous salience threshold		Country-specific salience threshold	Time dimension		Cross-country dimension
Country	Year	1pt	3pt	1 St.Dev.	P80	P90	(Only Gini and post-1980)
Argentina	1934				NO	NO	na
Argentina	1980	YES	YES	YES	NO	NO	
Argentina	1989	YES	YES	YES	NO	NO	
Argentina	1995	YES	NO	NO	NO	NO	
Argentina	2001	YES	YES	NO	YES	NO	
Australia	1931	NO	NO	NO	YES	NO	na
Brazil	1990				YES	YES	YES
Brazil	1994				NO	NO	YES
Canada	1923				YES	NO	na
Finland	1921				YES	YES	na
Finland	1931	NO	NO	NO	NO	NO	na
Finland	1939	NO	NO	NO	NO	NO	na
Finland	1991	NO	NO	NO	NO	NO	NO
France	1930	NO	NO	NO	YES	NO	na
Germany	1925	NO	NO		NO	NO	na
Germany	1931	NO	NO		NO	NO	na
Germany	2007	YES	YES	YES	YES	YES	NO
Iceland	2007	YES	YES	YES			
India	1929				NO	NO	na
India	1947	S	S	S	NO	NO	na
India	1993	NO	NO	NO	NO	NO	YES
Indonesia	1992	NO	NO	NO	NO	NO	
Indonesia	1997	YES	YES	YES	NO	NO	
Italy	1914				YES	YES	na
Italy	1921	NO	NO	NO	YES	YES	na
Italy	1930						na
Italy	1935				YES	NO	na
Italy	1990	NO	NO	NO	NO	NO	YES
Japan	1901				NO	NO	na
Japan	1907				NO	NO	na
Japan	1917	S	S	S	YES	YES	na
Japan	1923	YES	NO	NO	YES	NO	na
Japan	1927	NO	NO	NO	YES	YES	na
Japan	1992	YES	NO	YES	NO	NO	YES
Malaysia	1985	NO	NO		NO	NO	
Malaysia	1997	NO	NO	NO	NO	NO	
Netherlands	1914	YES	NO	NO	YES	YES	na
Netherlands	1921				YES	YES	na
Netherlands	1939	NO	NO	NO	NO	NO	na
Netherlands	2008	NO	NO	NO	NO	NO	NO
Norway	1931				YES	NO	na
Norway	1987	NO	NO	NO	NO	NO	NO
Singapore	1982	NO	NO	NO	NO	NO	
Spain	2008	NO	NO	NO	NO	NO	NO
Sweden	1922	NO	NO	NO	YES	YES	na
Sweden	1931	NO	NO	NO	YES	YES	na
Sweden	1991	YES	NO	NO	NO	NO	NO
Switzerland	1931	YES	YES	YES	YES	NO	na
Switzerland	1933				NO	NO	na
UK	2007	YES	NO	NO	YES	NO	YES
US	1929	YES	YES	YES	YES	YES	na
US	1988	YES	YES	YES	NO	NO	YES
US	2007	YES	NO	NO	YES	NO	YES

Notes: extended version of Table 4.
The table includes only the events for which distributional information exist.