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The Long Run Evolution of Inequality and Macroeconomic Shocks

D.PHIL. THESIS IN ECONOMICS

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ABSTRACT

This thesis is concerned with two main questions. Do systemic banking crises substantially affect the income distribution in a country? Is income inequality a destabilising factor for the macro-economy? In order to answer the first question, this thesis examines a panel of 26 countries since 1900 and assembles a new database of crises, finding that the impact of major banking crises on the national income shares detained by the income groups within the richest decile is mostly small in magnitude. Indeed, the estimated impact is never bigger than a standard deviation of the specific top shares under investigation. Results are also confirmed in a separate analysis for the United States and are robust to a series of checks. These findings lend indirect support to the structuralist hypothesis that only substantial changes in government policies and institutional frameworks can bring about radical changes in income distribution. The analysis also highlights interesting heterogeneity across different income groups, country groups and time periods. The second question is addressed by making use of a newly assembled database on different dimensions of economic inequality. The new data helps to reject the statistical validity of the hypotheses that either growing inequality or a high level of inequality may systematically precede the onset of major banking crises. In addition, simulations based on the UK Family Expenditure Survey data find that even a full equalisation of income would increase the aggregate consumption by 3 percentage points at most. These findings, taken together, point out that an increase in income inequality may not concur to reduce the pressure on aggregate demand or be adduced as a structural factor of financial instability. Nonetheless, the evidence is not yet clear cut as the work further documents that periods of increasing income inequality in the UK were also associated with a reduction of the saving rates across the whole income distribution since 1968. The analysis contends that such evidence of under-saving behaviour may be consistent with the relative income hypothesis and some of its recent formulations such as the 'expenditure cascades' theory.

Dedicated to Valentina and Tito Luciano

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This Doctoral thesis presented constitutes the fruit of my five-year permanence at the University of Oxford, since October 2008. Nonetheless, a project like a thesis is certainly not the exclusive fruit of my own effort. The work has indeed benefited enormously -at different stages and to different extent- from the direct and indirect contributions of a wide number of people, the practical and monetary backing of several institutions as well as the invaluable daily support of special people which are part of my life. It is for this reason that I take the opportunity here to express my profound gratitude to these people and institutions.

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Of course, I should emphasise that none of these persons or institutions above are responsible for any errors or interpretation contained in the thesis. The views expressed in the work presented here are entirely my own.

Further Notes

A number of chapters in the thesis draw from or extend previous work done in collaboration with Anthony B. Atkinson and Paolo Lucchino. In particular, the database on banking crises and economic crises described in Chapter 1 was initially introduced in two joint works with Anthony B. Atkinson, namely the "Inequality and Banking Crisis : a First Look" report for the International Labour Organisation (2010) and the "Economic Crises and Inequality" Human Development Research Paper, 6 (2011). These works also constitute a building block for the analysis conducted in section 4.1 of the thesis, "Inequality and Crises: New Empirical Evidence".

Finally, Chapter 4 also includes some re-elaboration of empirical work conducted jointly with Paolo Lucchino. In particular, sections 4.3 and 4.4 re-expose and re-elaborate the content of a report prepared for the Resolution Foundation in March 2012 entitled "Inequality, debt and growth". I am very grateful to the Resolution Foundation and in particular to Paolo Lucchino for granting me the possibility to draw from our joint work in order to re-elaborate some of the content to propose it within a wider context. I should nonetheless emphasise that no-one apart from me should be held responsible for the views expressed here.

Word Count

The thesis is composed of approximately 75.000 words. This figure was obtained by multiplying the total number of pages of the thesis by the average number of words contained within a page full of text, a page with a graph and text, a page with table and a page with text and equations.

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Introduction

Background The discussion around income inequality has recently heated up around the globe. The recent 2007-2008 collapse of the global financial system and the subsequent economic downturn and debt crises that affected both the US and the Euro-zone naturally acted as a catalyst for growing concerns around the increasing dispersion of incomes within most of the advanced economies. On one hand, the acute loss of jobs (especially among the young educated), the credit crunch and the austerity measures implemented by governments to contain the sovereign debt crisis have put extra burden on the shoulders of the lower and middle classes. On the other hand, the public discourse has started to openly debate the economic implications as well as the legitimacy of increasingly powerful elites seizing a growing share of the national pie year after year. These concerns, led the Managing Director of the IMF, Christine Lagarde to indicate the need for "*addressing inequality and building inclusive growth*" as one of three 'milestones' of the future global economy, in her October 2012 Annual Meetings Speech in Tokyo. Interestingly, researchers and scholars have also began to single out inequality as one of the structural causes of the recent financial crisis especially in the US. The on-going debate to which this thesis is contributing is centered around different dimensions of inequality, discussing both equity and efficiency. This clearly breaks a recurrent classic dichotomy pervading conventional economic theory which led to the neglect of distributional issues.

Quoting the Nobel prize J. Stiglitz, "*For years, the dominant paradigm in macroeconomics, which assumed that income distribution did not matter, at least for macroeconomic behavior, ignored inequality both its role in causing crises and the effect of fluctuations in general, and crises in particular, on inequality. But the most recent financial crisis has shown the errors in this thinking, and these views are finally beginning to be questioned.*" (Stiglitz 2012).

The revival of interest around the inequality topic is in itself also linked to the relative neglect of the household sector within modern macroeconomic modelling frameworks. Indeed, despite recent progress[1], macroeconomic theory has largely neglected

[1]For instance, the so called representative agent models are no longer the unquestioned paradigm for business cycles and macroeconomic growth modelling and issues such as heterogeneity and aggregations are nowadays taken more seriously.

the role of household balance sheets in the macroeconomic modelling framework. To date, there is still no comprehensive model of macro-economic cycles that allows studying the impact of high or increased inequality.

Objective of the thesis The objective of this thesis is twofold, namely the investigation of the distributional effect of banking crises as well as the reverse direction of causality: the role of inequality in generating macroeconomic and financial instability. Both research objectives have already been the focus of investigative research in two papers written jointly with A.B. Atkinson (Atkinson and Morelli, 2010, and 2011). The latter works constitute the first systematical investigations of the inequality and crisis nexus with wide historical and geographical coverage. This thesis builds on these contributions and goes beyond the research already undertaken in several respects. This is certainly an ambitious goal given the relative neglect of the economic discipline for such topics as mentioned above.

It is also worth noting that at the time when my research began there was, to my knowledge, no systematic study exploring the nexus between inequality and crisis with wide historical and geographical scope. Therefore, I necessarily devoted part of my effort to building consistent empirical evidence in such a relatively unchartered territory. For example, my work has involved assembling two novel databases on a variety of macroeconomic shocks (described within Chapter 1) as well as on different measures of economic inequality. Both these databases, and particularly the Chartbook of Economic Inequality developed jointly with my thesis advisor, A.B Atkinson, have already been widely disseminated within the academic community.

My doctoral thesis, presented here, consists mainly of two parts.

Part I carries out an empirical investigation of the distributional effect of major financial crises since the beginning of the twentieth century. Are crises to be considered major turning points for income distribution? Is the latest crisis (and its alleged inefficiency-correcting market forces) able to invert the positive trend in income concentration we have observed over the past decades? The investigation, with particular reference to top income groups, consists in two different steps. As a first step, I investigate the United States given its relevance for the world economy. Moreover the extensive coverage and the good quality of US data on top income shares allows, on one hand, to fully investigate the three important US crises identified since 1900 (the 1929 Great Depression, the 1988 Savings&Loans crisis and the recent 2007 financial meltdown) and, on the other hand, to decompose the analysis by income sources and to include realised capital gains to the total income. In the second step, I then proceed to a panel investigation of a group of 27 countries highlighting the importance of the cross-country perspective as well as the evidence across different time periods. The use of the unique long-time series of the World Top Income Database (using top income shares as proxy variables for income inequality over time) allows to better ex-

ploit the time-series properties of the data and adopt some of the recent advances of macro-econometrics. The latter include the 'ex-post counterfactual analysis' recently discussed in Pesaran & Smith (2012) and panel models techniques more appropriate to deal with cross-sectional dependence. In practice the total effect of banking crises is estimated computing impulse response functions of the levels of top shares to the occurrence of the shock, an approach which is also consistent with an agnostic view of the duration of the banking crisis. The latter, is in fact a highly controversial matter within the literature. Taken together, the methodology constitutes an innovative contribution to the empirical literature on income distribution.

Part II Within the second part of the thesis I focus on two key areas:

i) On one hand, I reassess 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. This is be done by expanding and updating the empirical evidence of my previous works in collaboration with A. B. Atkinson[2]. More specifically, I distinguish the 'growth' hypothesis from the 'level' hypothesis. The former assumes that growing inequality may contribute to the instability of the financial system while the latter assumes that high level of inequality may generate macroeconomic instability. Similarly, the use of the Chartbook of Economic Inequality highlights the importance of looking a different segments of the income distribution spectrum represented by different inequality indicators. In addition, the Chartbook allows me to go beyond the use of top income shares and explore different dimensions of income distribution preserving a great deal of the historical coverage of the data.

ii) On the other hand, I explore the economic theoretical mechanisms of the hypothesis that inequality may be a factor contributing to macroeconomic and financial instability.

   A recurrent argument in the recent economic debate sees growing income inequality as a main driver of stagnating aggregate demand and private consumption. The lower pressure on demand coming from private consumption has then propped up easier credit access and lower interest rates. According to others the surge in inequality is directly responsible for increasing consumption desire and, consequently, higher demand for credit. In sum, either argument links income inequality to the unsustainable surge in household indebtedness and the personal sector leverage in the economy.

   The hypothesis above contains different lines of arguments and assessing their validity is quite a challenging task. Insofar as my thesis is concerned, I proceed as follows:

[2]See Atkinson & Morelli (2010, 2011).

1) First of all I explore and discuss the theoretical conditions under which we can observe the negative impact of an increasing dispersion of income on aggregate consumption in the economy. I then assess and discuss the empirical relevance of such conditions. This is done by estimating a consumption model using survey data on UK households and simulating how aggregate consumption changes when, other things being equal, income inequality is assumed to vary.
2) Secondly I review the theories that link household consumption and savings choices directly to income distribution. This happens when utility functions are interrelated and individuals value their consumption and welfare in relation to the other members of their reference group. In support of these theories, I provide evidence on the evolution of the saving rates across the UK income distribution from the 60s to 2010.

Structure of the thesis The thesis is composed of 4 main chapters. The first describes the main data on banking crises and macro-economic instability episodes for a group of 26 countries since 1900. The second chapter explores the short-term response of top income shares to the occurrence of systemic banking crises in the US. In a similar empirical exercise, the third chapter explores the distributional implications of crises for a panel of 26 countries since the beginning of the twentieth century. Finally, the last chapter tests the hypothesis that high levels or growing inequality were systematically preceding the occurrence of major banking crises within the sample of countries and years under investigation. Moreover, it explores the hypothesis that inequality affects both aggregate consumption and household consumption and saving choices.

Chapter 1

Identifying Shocks : a Database of Macroeconomic Crisis Episodes

Contents

Introduction

The study of the two-way relationship between income distribution and macro-economic crises, the objective of this thesis, presupposes the identification of such macroeconomic shocks of different nature. Although, there is no 'ready to use' comprehensive database for this purpose, the available historical information on different types of shocks is abundant. In this chapter I extensively draw on these available studies within the existing literature.

The objective of the chapter is threefold. Firstly, I assemble a database on systemic banking crises starting from the available list of crises across different sources. In particular, using simple rules I formulate a synthesis of existing databases on banking crises, selecting only those which are systemic in nature. Secondly, I assemble a new

database on 'economic' crises building on the extensive work by Barro & Ursúa (2008). More specifically, I collect information on real per-capita GDP and consumption crises, listing the beginning and the end of the episodes as well the relative severity of the crisis.

Finally, I consider the interconnectedness of crises of different sorts and underline the importance of studying more encompassing general 'macro-economic instability episodes' rather than single crises *per se*. Indeed, different crises tend to occur in clusters and are potentially endogenous to one other. For example, banking crises are usually associated with a reduction in the aggregate level of gross domestic product due to the disruption of credit markets and general reduction of the economic activity. Similarly, a currency crisis or a debt crisis can follow a banking crisis as the recent financial turmoil suggests. Thus, I also identify periods of general macroeconomic instability which, besides the banking shocks and economic crises episodes, include all sorts of different shocks, including currency crises, external and domestic debt crises, hyperinflation, major wars and independence episodes. This provides considerable additional information compared to isolated crisis events.

Generally speaking the crises are reported using a 0/1 dummy and where possible, information on the duration and the severity of the crisis is recorded as well. The information is collected over a long period that goes from 1900 to 2010 for 26 different countries[1]. The choice of the country list is dictated by the availability of distributional data as will become clear in Chapters 3 and 4. Moreover, the final list reflects a balanced mix between high income and middle-income countries.

1.1 Systemic Banking Crises

"*Identifying banking crises is the first step in all research on banking crises*" as Von Hagen and Ho (2007) recalled in their paper, proposing a new empirical method for crisis detection. However it turned out that the empirical identification of a banking crisis is not an easy task as realised during the investigation process and as witnessed by recent debates in the literature. I 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)) - for brevity hereinafter I refer respectively to BE, RR and LV. 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, I compare and summarise the information contained within those sources and assemble, according to specific rules, a list of banking shocks for a list of 26 countries from 1900 to 2009. The proposed summary measure is a simple dummy variables

[1]The countries covered are Argentina, Australia, Canada, China, Denmark, Finland, France, Germany, Iceland, India, Indonesia, Ireland, Italy, Japan, Malaysia, Netherlands, New Zealand, Norway, Portugal, Singapore, South Africa, Spain, Sweden, Switzerland, the UK and the US.

taking value of 1 at the beginning year of a crisis and 0 otherwise.

An Example An example may help to clarify. The three crisis databases at hand identify three systemic banking crises in the US since the beginning of twentieth century, namely the Great Depression, The Savings & Loans crisis and the recent Great Financial Meltdown[2]. The two most recent databases on crises identification agree in detecting the beginning of the latest financial meltdown in 2007. Different appears the case of Savings and Loans crisis, detected in 1984 by both BE and RR while LV consider the crisis as 'systemic' in 1988, considered to be the peak of the crisis following the stock market crash in 1987 [3]. Disagreement is found even for the worst US financial crisis in recorded history. RR points out the beginning of the 'calamity' in 1929 rather than 1930 as reported in Bordo et al. What is then a banking crisis?

Definition of Banking Crisis The multifaceted nature of the banking crisis episodes, especially over the long-period of time under analysis, requires a multidimensional approach, combining both quantitative and qualitative methods, as reflected in the methodologies applied by different scholars in defining a banking crisis episode fully described in Table 1.1. Indeed as clearly put in Bordo et al. (2001)'s Appendix, "*We date currency and banking crises using both qualitative and quantitative evidence. The use of qualitative evidence to date banking crises is standard in the literature. Because asymmetric information is intrinsic to bank intermediation, the value of non-performing loans becomes available only with a lag, and even then official estimates of loan losses understate the problem. Because of the existence of deposit insurance and lender-of-last-resort intervention, depositor runs do not necessarily accompany banking-sector problems, making the change in the value of deposits a poor measure of banking-sector distress. For all these reasons, any purely quantitative indicator of banking crises will be problematic.*"

Here I am concerned uniquely with systemic shocks, disregarding those events that affect isolated banks. The use of systemic shocks, indeed, may help mitigating the problem of disagreement over milder cases of banking distress. The identification of systemic crises is less problematic in RR (who identify explicitly systemic and non-systemic shocks) and in LV (who list uniquely systemic crises). However, no explicit description about the nature of banking crisis is found in BE at a first glance. Yet, further exploration of the source reveals that BE draw explicitly from the list of systemic banking crises in Caprio & Klingebiel (1996, 1999) for the post-1970 sub-sample. Similarly, the methodology adopted for the pre-1970 period is implicitly consistent with the detection of banking crises which are systemic in nature even for the period prior 1970. Indeed, as table 1.1 makes clear, BE identify crises when *"widespread bank failures"*, *"bank panic"* or *"the erosion of most or all of banking system collateral"* are observed.

[2]Other two banking crises occurred in US in 1907 and 1914, however they are both considered non-systemic and therefore dropped from the analysis.

[3]Caprio & Klingebiel (2003), whose authoritative source of banking crises chronology was used also by RR and LV, have indicated the Savings and Loans crisis with the entire period 1984-1991. LV confirm

Table 1.1: Definition of Banking Crisis

Sources	Banking crises identification
Bordo et al. (BE)	From Eichengreen & Bordo (2002): "*For an episode to qualify as a banking crisis, we must observe either bank runs, widespread bank failures and the suspension of convertibility of deposits into currency such that the latter circulates at a premium relative to deposits (a banking panic), or significant banking sector problems (including but not limited to bank failures) resulting in the erosion of most or all of banking system collateral that are resolved by a fiscally underwritten bank restructuring*".
Reinhart and Rogoff (RR)	Reinhart & Rogoff (2008, 2009), Reinhart (2010) they mark a banking crisis by two types of events: (1)"*bank runs that lead to the closure, merging, or takeover by the public sector of one or more financial institutions (as in Venezuela in 1993 or Argentina in 2001)"; and (2) "if there are no runs, the closure, merging, takeover, or large-scale government assistance of an important financial institution (or group of institutions), that marks the start of a string of similar outcomes for other financial institutions (as in Thailand 1996-97)*".
Laeven and Valencia (LV)	Laeven & Valencia (2008, 2010). The authors classify an event as a systemic banking crisis (excluding banking system distress events that affected isolated banks), "*when country's corporate and financial sectors experience a large number of defaults and financial institutions and corporations face great difficulties repaying contracts on time. As a result, non-performing loans increase sharply and all or most of the aggregate banking system capital is exhausted and this situation may be accompanied by depressed asset prices (such as equity and real estate prices)*".

1.1.1 Assembling a List of Banking Crises

In order to obtain a list of banking shocks, I have compared evidence from the three sources described above - BE, RR and LV -. Such databases span a long period of time from 1900-2009 (LV start the crisis identification in 1970 and BE end its coverage in 1998) and cover all the countries under analysis (BE does not cover China and India, Indonesia, Malaysia, New Zealand, Singapore and South Africa until 1972 and exclude entirely Iceland and Ireland). Similarly to what already done in Atkinson & Morelli (2011), this chapter adopts a so called 'majoritarian' criterion in order to deal with the presence of disagreements in the crisis identification across different sources. By doing this, 87 systemic banking crises[4] were detected in the sample of 26 countries under investigation from 1900 to 2010.

Methodology In particular, I proceed as follows. Where the 3 sources are available I identify a crisis in the banking sector only if at least 2 of the 3 sources available agree on the identification. This first rule automatically identify around 2/3 of the whole set of crises, namely 57 out of 87. On the other extreme, if only one source is available I proceed with the identification and this rule serves for the recording of additional 10

instead that the system crisis started in 1988 and ended in the same year.

[4] 8 of which are related to the latest global financial crisis in 2007.

crises[5].

Other 16 crises episodes are selected from those cases where a shock was identified in RR but not in BE. The decision was driven by the consideration that BE *"dropped crises for which there was insufficient data to estimate the years required to return to the pre-crisis rate of GDP growth (because of the intervention of a war or because of data problems)"* (Bordo et al. (2001), Web Appendix, page 3). BE use this information to estimate the duration of banking crises (as further discussed below). As I neglect this last issue and focus exclusively on the beginning of banking shocks I give priority to RR crisis identification. However, following further investigation I modify this decision in a few cases.

For instance, I eliminate the crises indicated for the US in 1907 and 1914, as they do not appear to be systemic crises based on the reading of the literature. In 1914 a larger shock had been avoided as The New York Stock Exchange and other important US exchange markets stopped operating from July to December 1914 in order to prevent a further crash started with massive selling operations of foreign securities holders (mainly European) which faced uncertainty as the war became more and more likely[6]. Similarly the US banking crisis in 1907 is dropped as considered not systemic. Furthermore, I include the single case (Spain 1924) where BE list a crisis which RR do not report. Finally, there are a handful of crisis episodes which are treated differently across databases, including notorious crises such as the Savings and Loans crisis and the Great Depression in the US. As a general rule, the information in RR is preferred to that in LV for the post-1970 period as RR tend on average to detect the crisis with a year in advance (As discussed below this might be a crucial issue). Only two exceptions are made to this rule, notably in the cases of the US S&L crisis and the Italian crisis in 2008, where I prefer the information on LV. Indeed, the Italian crisis was only considered 'border-line' (to systemic shock) by LV and I decided to drop it. Instead, the US S&L crisis (set to begin in 1984 according to RR and in 1988 according to LV) had a peculiar feature in its initial outbreak as it mostly involved savings institutions rather than commercial banks. For this reason I prefer indicating the beginning of the systemic banking crisis in 1988 as recorded in LV[7].

The resulting 87 cases are shown in Table1.3 under the column named '*Adopted here*' in comparison with the three sources of reference. The table shows a great deal of consistency with what identified in RR, at least in the 26 countries under investigation.

[5]Generally speaking, these are found to be cases where only Reinhart and Rogoff's data allow to identify crises given the total coverage of their database for the whole period and set of countries under investigation.

[6]Detailed accounts of those days are present in Sprague (1915) who argues: "*Sales of securities by foreign holders on the New York Stock Exchange began with the first intimation of trouble between Austria and Servia, increasing in volume day by day.*"

[7]Note that within Atkinson & Morelli (2010, 2011), where the list of banking crises presented here was used for the first time, the S&L crisis was dated at 1984.

Description of the Data The frequency distribution of banking crises over time is shown in figure 1.2 from which it appears clear that almost 70% of the identified crises fall in the pre second world war period and the remaining occur after 1975[8]. In other words, the figure shows clearly a well-known feature, namely that the Gold standard (1880 to 1913) and the interwar period (1913 to 1945) experience a great deal of instability of the banking sector compared to the Bretton-Woods period (1945 to 1971), in which only one crisis has been recorded[9](see Bordo et al. (2001) for further discussion about this). The frequency of banking crises is further decomposed by country groups and by individual country in figures 1.3 and 1.1 respectively.

For consistency with subsequent chapters, Figure 1.3 groups the country in four different country groups, namely Continental European, Western English Speaking, Nordic European and Developing Countries[10]. The evidence from the latter graph suggests that the incidence of banking crises is much lower in the post-1970 period for Continental European and Nordic European countries groups, whereas the evidence for Developing and Anglo-Saxon countries is not as clear cut (i.e. the number of crises occurring in the post-1970 compared to the pre-1970 period is respectively 11 and 12 for Developing countries and 4 and 6 for the Anglo-Saxon countries).

Few things are also worth noting from the decomposition of the crisis frequency by country. First of all, two countries in the list, namely New Zeland and South Africa, are crisis-free according to the consulted sources. Secondly, the distribution of crises across different countries, during the 112 years under investigation, is quite heterogeneous with a few countries like Argentina, India, Italy and Japan appearing particularly crisis-prone (Argentina experienced 7 major systemic shocks whereas 6 crises occurred in each of the other countries) and few others having experienced only one crisis over the course of the entire period. This is the case of Australia, Iceland, Ireland, Singapore and the UK. Finally, with the exception of Australia the crises in the latter list of countries fall entirely in the post-1970 period. Conversely there is a set of countries which experienced a banking shock only during the pre second world-war period like Australia, Canada, France, Portugal and Switzerland.

[8] The crises relating to the recent 2007-8 financial turmoil are Denmark 2008, Germany 2007, Iceland 2007, Netherlands 2008, Spain 2008, UK 2007 and US 2007.

[9] The crisis occurred in India in 1947 which is also coincident with the independence year of India and internal political upheavals.

[10] I group the countries in Nordic European (Denmark, Finland, Iceland, Norway and Sweden), Developing (Argentina, China, India, Indonesia, Malaysia, Mauritius, Singapore, South Africa and Tanzania), Western English speaking (Australia, Canada, Ireland, New Zealand, United Kingdom and United States), and Continental central European countries (France, Germany, Netherlands and Switzerland, together with Japan and the three southern European countries, namely Italy, Portugal and Spain). Southern European countries are included within the Continental group as distribution data for the former is limited as shown in Chapter 3.

1.1.2 Limitation of Data on Banking Crises

As explained before, the widely used methodology identifying crises described above mixes quantitative indicators with subjective judgments based on the observation of market events, such as forced bank closures, mergers, runs on financial institutions and government emerging measures. Generally, such widely used 'event method', it is necessary in order to analyze long-time horizons as quantitative data are not always available in earlier years of the twentieth century. However, it is worth noting that the methodology suffers from three main shortcomings which are particularly relevant for the objective of this thesis. First the methodology potentially detects crisis beginning with lag. Secondly, the lack of objective and common quantitative measures contributes to the lack of agreement on how to detect the end of the crisis. Thirdly, the detection of crises based on the 'event method' lacks comparable information about the severity of the crisis. I explore below these points in detail.

First of all, conditioning the detection of crises upon the observation of mitigation measures or data on banks balance sheets may lead to detect a crisis with considerable lag (This is also mentioned in Reinhart & Rogoff, 2008). Moreover, market interventions may occur not necessarily during crises periods and there is no clear objective agreement about how large the intervention should be in order to be associated with a crisis event. Similar considerations were raised in a recent IMF working paper where authors argue that most of the crises indicators that have been used in the literature are measures of "*lagged government responses to systemic bank shocks, rather than the occurrence of crises per se*" (Boyd et al., 2009) . This led the authors to argue that most of results in the empirical literature on banking crises should be revised. Furthermore, the so called 'events method' would detect principally the crises which required a strong mitigation intervention, raising compelling issues about selection bias given that the well-managed or less severe banking crises most probably would not require large scale emergency measures. Detecting banking crises which are systemic in nature - as I do here- would help taking care of such bias concerns. This is true on the assumption that every systemic crisis implies specific market events or require forms of intervention which are straightforwardly detected.

Secondly, the ongoing research on more sound crisis indicators has not yet come to end and a consensus on the best crisis indicator is not reached. Some scholars have tried to identify the length of the crisis but the approaches that have been adopted are, in my opinion, not entirely appropriate for the objective. For example Bordo et al. (2001, Appendix) define and calculate the recovery time of a crisis as "*the number of years until GDP growth returns to its pre-crisis trend, including the year when it returns to that trend*". Similarly in Laeven & Valencia (2010), the authors reported the end date for the crisis episodes. They define the end of a crisis as "*the year before two conditions hold: real GDP growth and real credit growth are positive for at least two consecutive years. In case the first two years record growth in real GDP and real credit, the crisis is dated to end the same year it starts*". Generally speaking, finding the end date of a banking cri-

sis remains a more controversial task than that of finding its starting point . Indeed, although the above mentioned methodologies are suitable to the identification of the ending date of the recession (likely stemming from the financial shock itself) they are not able to capture with precision when a banking crisis comes to an end. In this analysis I do not attempt to say anything about the ending date of a crisis and I focus instead on its starting year only.

Finally, the data are recorded based on a simple categorical variable do not allow to explore different intensity and depth of the crises, which can be crucial in an empirical investigation. This suggests the need for a continuous variable of financial instability which are not ready available, especially with a wide historical perspective[11].

1.2 Economic Crises: Per-capita GDP and Consumption Collapses

Much of the attention of the thesis is on banking crises. However, I also identify real per-capita GDP and consumer expenditure[12] crises. Using the data by Barro & Ursúa (2008) (BU hereinafter) I implement the so called 'Peak to Trough' methodology (similarly to what done in BU[13]) and identify 'economic' crises as those where I observed a minimum 9.5% cumulative drop of GDP or consumption variables from peak to trough. Each crisis is assumed to start one year after the peak and ends at the trough year. The threshold is reduced to 5% from 1950 on in order to take into account the role of time trend and higher expectations as explained in the text below. Differently from the banking crisis data, here I am able to inform the reader about the length and the depth of each crisis episode. The methodology and the resulting database is explained in details below.

Assembling the Database: the Methodology The information on real per-capita GDP and Consumption crises is constructed using the BU data made available on the web[14] implementing independently what Barro and Ursúa call the 'Peak to Trough' methodology. Such data cover the entire sample of countries under investigation and all years until 2009 (1900-2009). I proceed describing the identification rules followed in the exercise in order to exclude the role of subjective assumptions in the selection

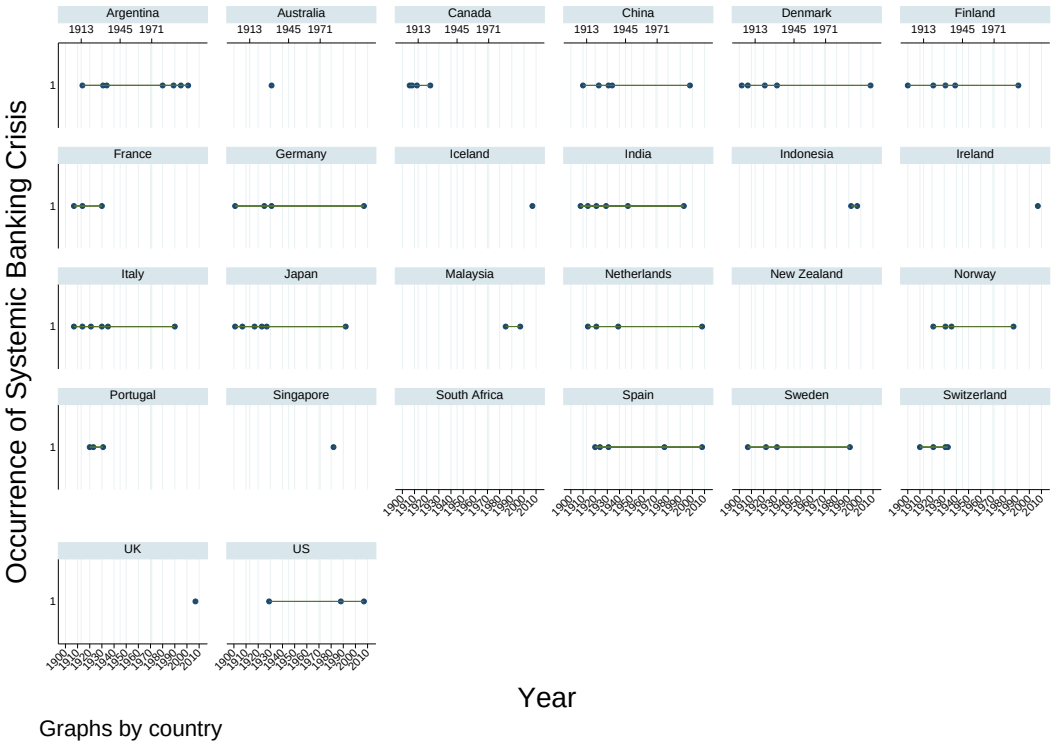
[11] In fact, for post-1970 period the database assembled by Laeven and Valencia has a wide set of information about the severity of each crisis. See Laeven & Valencia (2010) and their updates in 2012 for further details.

[12] Typically the data consider expenditure on both durables and non-durables goods.

[13] It is worth noting that Barro & Ursúa (2008) posit that "*The peak-to-trough method for assessing the size of contractions is reasonable if growth-rate shocks are i.i.d., so that level shocks are permanent. However, the method can be misleading when some shocks to levels are temporary*". In this work I abstract from the consideration of whether or not growth rate shocks are i.i.d.

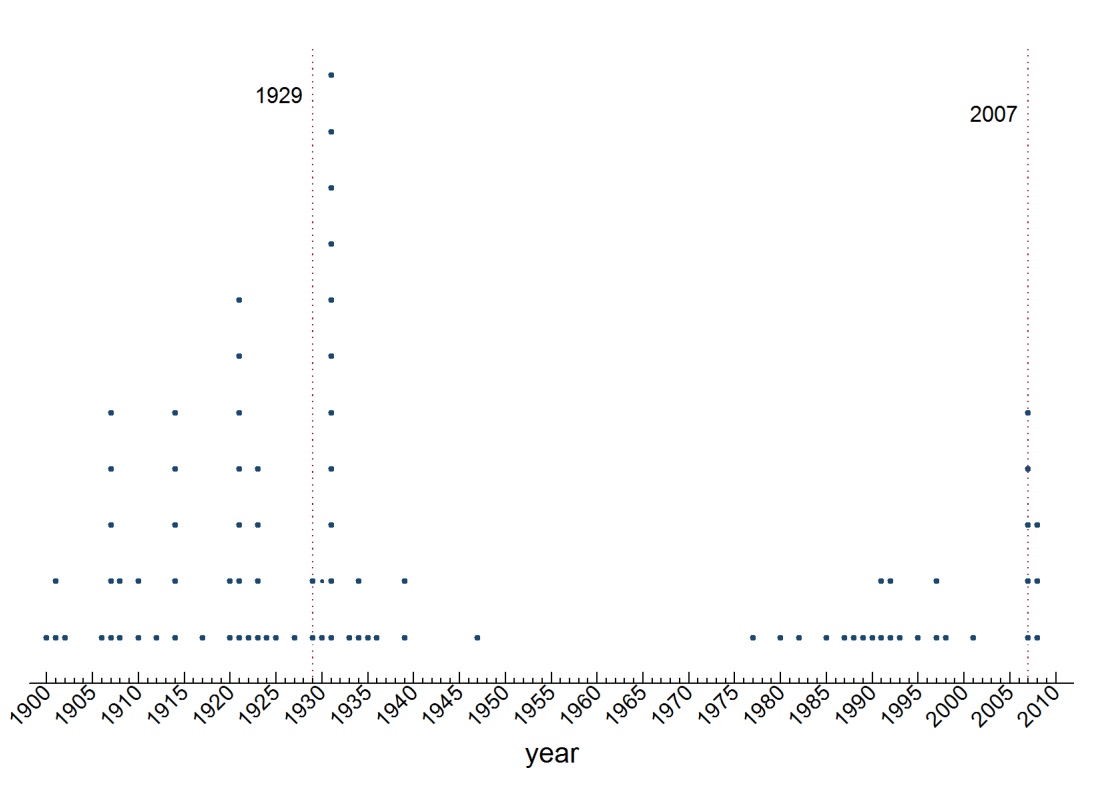
[14] $http://www.economics.harvard.edu/faculty/barro/files/MacroCrisesSince1870_80_614.xls$ accessed on September 2011.

Figure 1.1: The Occurrence of Systemic Banking Shocks by Countries



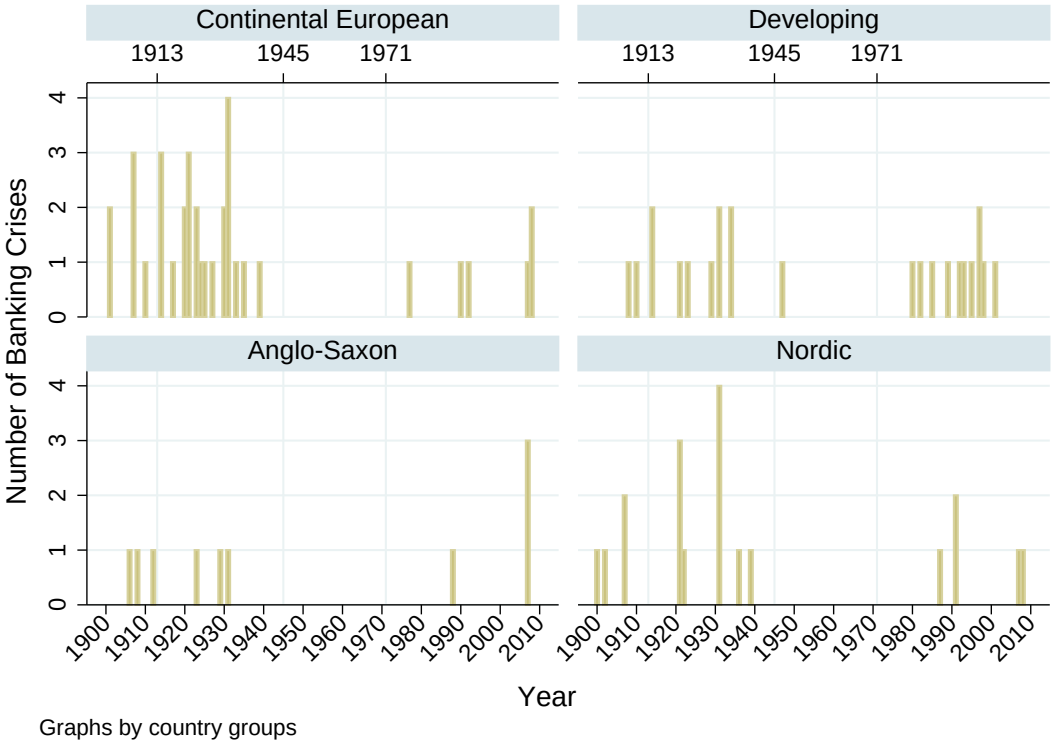
The graph shows the beginning year of each systemic banking crisis recorded in the sample. Every dot represents a single crisis for each country (as identified in the synthesis database described in the text). The years 1913, 1945 and 1971, marked on the upper X-axis, identify the beginning and the end of different international financial architecture regimes. The period 1880-1913 represents the Gold-Standard, whereas the years from 1913 to 1945 refer to the Inter-Wars period. Finally, the year 1971 marks the end of the Bretton-Woods system that lasted for 26 years since 1945.

Figure 1.2: Frequency of Identified Systemic Banking Shocks Over Time



The graph shows the frequency distribution of systemic banking crises recorded for every year in the sample. Every dot represents a single crisis as identified in the synthesis database described in the text.

Figure 1.3: The Occurrence of Systemic Banking Shocks by Country Groups



The graph shows the beginning year of each systemic banking crisis recorded in the sample. Every dot represents a single crisis for each country (as identified in the synthesis database described in the text). The years 1913, 1945 and 1971, marked on the upper X-axis, identify the beginning and the end of different international financial architecture regimes. The period 1880-1913 represents the Gold-Standard, whereas the years from 1913 to 1945 refer to the Inter-Wars period. Finally, the year 1971 marks the end of the Bretton-Woods system that lasted for 26 years since 1945. Countries are grouped in 4 different groups: Nordic European (Denmark, Finland, Iceland, Norway and Sweden), Developing (Argentina, China, India, Indonesia, Malaysia, Mauritius, Singapore, South Africa and Tanzania), Western English speaking (Australia, Canada, Ireland, New Zealand, United Kingdom and United States), and Continental central European countries (France, Germany, Netherlands and Switzerland, together with Japan and the three southern European countries, namely Italy, Portugal and Spain).

of crises.

First of all, the implementation of the peak to trough methodology rests on the arbitrary assumption on the threshold of cumulative percentage drop of the outcome variable. As mentioned above I use a threshold of 9.5% for the pre-1950 sub-period and of 5% for the subsequent years. The choice of the first threshold is driven by the willingness to replicate what has been done in the extensive work by Barro and Ursúa[15]. However, such threshold is halved for the post-1950 period based on the observation of the time trending patterns of GDP and consumption data as well as the role of the expectations of agents in the economy. In other words, a time invariant threshold for the detection of crisis does not seem appropriate in a context (the post-war period until recent years) in which the living-standards were generally continuously on the rise and expectations of agents were consistent with rising consumption and income per-capita. Indeed, a flat growth of real GDP is nowadays considered to be an economic failure. This may have not been the case in early years of the twentieth century.

Secondly, I assume that the period recorded as economic crisis or disaster must not reasonably include more than one year of positive growth of either GDP or consumption per-capita between the identified peak and trough. These two simple rules allow to identify around 116 real GDP per-capita crises and 109 real per-capita consumption crises.

Economic Crises Database: a Description The final dataset of GDP and consumption per-capita 'collapses' is fully described case by case in table 1.3. The latter table also contains information about the duration and the severity of each crisis. The length of the shock is the number of year elapsing from the beginning of the disaster to the trough year. The depth of the crisis is the cumulative percentage drop from peak to trough. The frequency distributions of crises length and depth for the subsample adopted here are not particularly distant from the ones calculated in Barro & Ursúa (2009), despite the (minor) differences in methodology (see above) and lower sample size. The average length of a crisis is 3.3 and 3.1 respectively for the 109 consumption disasters and the 116 GDP disasters identified here. Barro and Ursúa find slightly higher averages of 3.6 and 3.5 using a broader coverage of countries and years. Similarly the average cumulative drop within the crisis database presented here is respectively around 17% for both real per-capita GDP and Consumption, compared to an average downswing of around 21% recorded in their data[16].

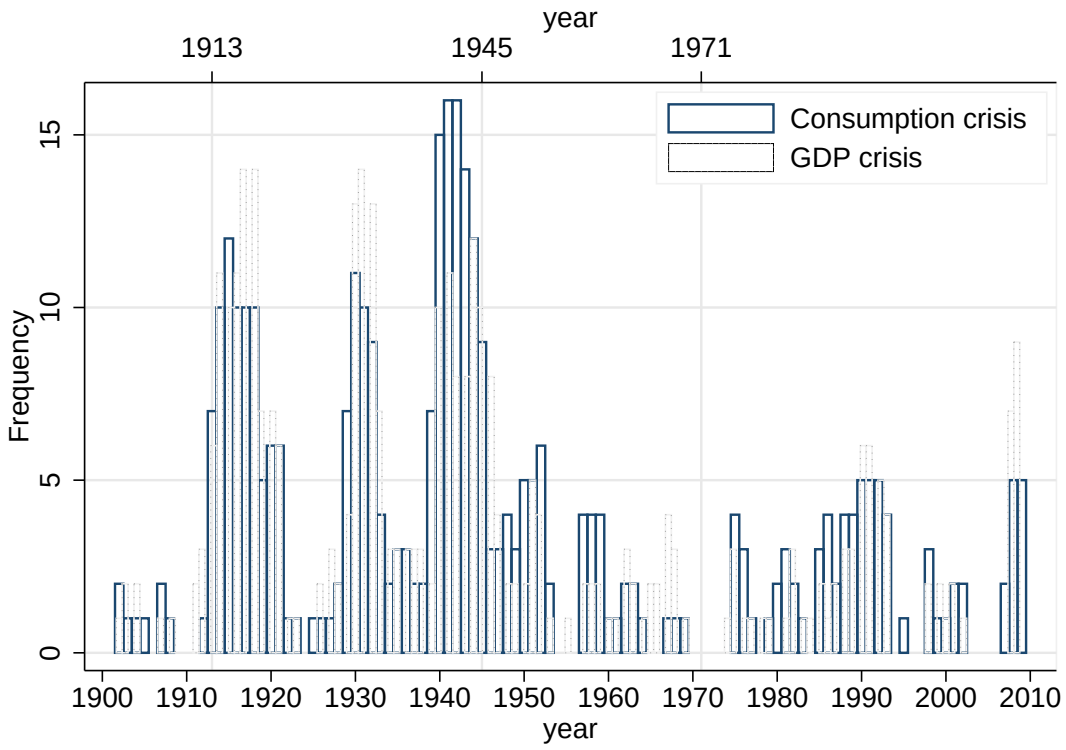
More than two-thirds (around 73%) of the countries under analysis are from the OECD group (or are High Income Countries according to the Atlas income classifica-

[15]The authors claim to use a 10% threshold. However, following more detailed investigation it was clearer that Barro and Ursúa have often used an effective threshold of 9.5%.

[16]Lower average crisis length and depth was indeed expected given the methodology adopted here.

tion of the World Bank) and the sub-sample of crises episodes I have identified represent a similar balance between OECD and non-OECD countries. Finally, it is worth noting that similarly to the case of banking crises the incidence of economic crises reduced dramatically over time. Indeed, almost 90% of total per-capita GDP collapses occur in the pre-1970 sub-sample. This share goes down to around 70% for the pre-1950 sub-period. The figures are slightly lower in the case of consumption crises with 65% of crises happening before 1950 and around 80% before 1970.

Figure 1.4: The Occurrence of Real Per-capita Consumption and GDP Shocks Across Countries

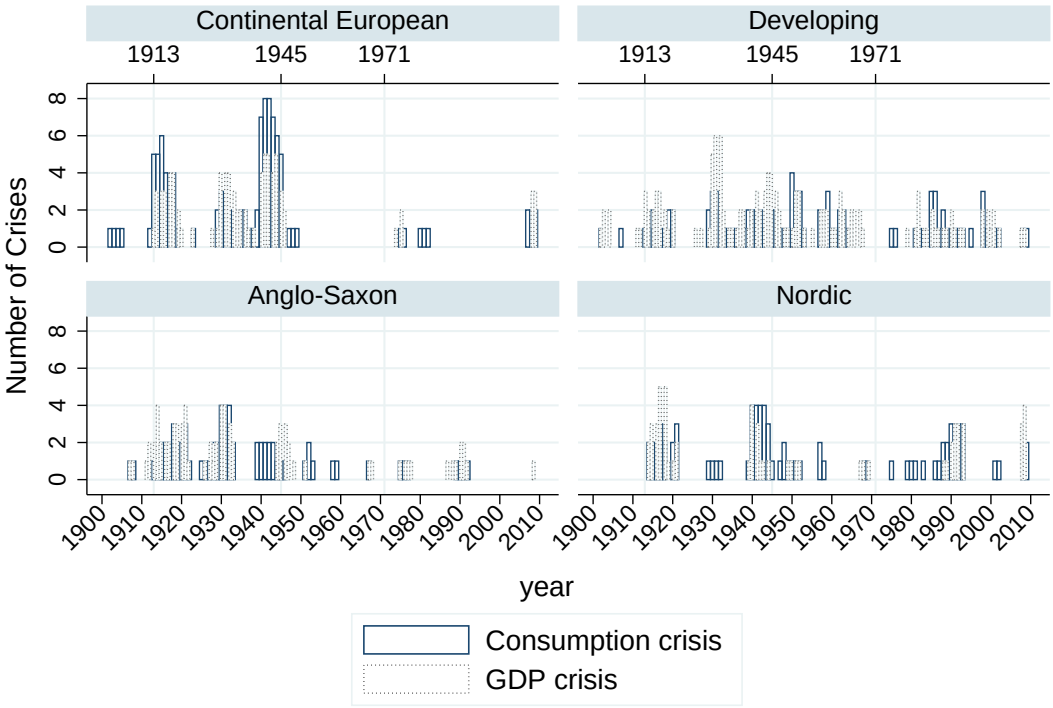


The graph shows the frequency of periods in which countries were undergoing consumption or GDP crisis. The years 1913, 1945 and 1971, marked on the upper X-axis, identify the beginning and the end of different international financial architecture regimes. The period 1880-1913 represents the Gold-Standard, whereas the years from 1913 to 1945 refer to the Inter-Wars period. Finally, the year 1971 marks the end of the Bretton-Woods system that lasted for 26 years since 1945.

1.2.1 GDP and Consumption crises

How far GDP crises are translated in consumption ones? Surprisingly, the degree of overlap between the consumption and GDP collapses years is lower than one would initially expect. The incidence of years in which I could record both an ongoing GDP

Figure 1.5: The Occurrence of Real Per-capita Consumption and GDP Shocks by Country Groups



The graph shows the frequency of periods in which countries were undergoing consumption or GDP crisis. The years 1913, 1945 and 1971, marked on the upper X-axis, identify the beginning and the end of different international financial architecture regimes. The period 1880-1913 represents the Gold-Standard, whereas the years from 1913 to 1945 refer to the Inter-Wars period. Finally, the year 1971 marks the end of the Bretton-Woods system that lasted for 26 years since 1945. Countries are grouped in 4 different groups: Nordic European (Denmark, Finland, Iceland, Norway and Sweden), Developing (Argentina, China, India, Indonesia, Malaysia, Mauritius, Singapore, South Africa and Tanzania), Western English speaking (Australia, Canada, Ireland, New Zealand, United Kingdom and United States), and Continental central European countries (France, Germany, Netherlands and Switzerland, together with Japan and the three southern European countries, namely Italy, Portugal and Spain).

and consumption crises is around 53% of the total years listed as a 'Consumption disaster' (57% of total years listed as 'GDP disasters'). However, by checking whether each single GDP crisis episode is contemporaneous to, preceded or followed by a per-capita consumption crisis and viceversa, one would learn that 65% of economic crises present some combination of consumption and GDP disruption. The frequency of both types of economic crises over time is shown in Figure . Its decomposition accross different country groups is instead represented in Figure 1.5. Furthermore, Table 1.3 refers to every economic crisis episodes in detail, identifying for each crisis-country pairs the duration of the crisis, its beginning and its severity.

Is it consumption crises that follow more often from GDP ones or it is the other way around? Observing the data I find that around 45% of consumption crises either occur contemporaneously to GDP crises or strictly follow them (in only 10% of total GDP collapses). Similarly one would like to know whether it is more common to observe GDP collapses with no consumption crisis in more recent decades. To check this I computed for each country the share of country-specific economic crises (consumption and GDP) that occurred in pre-1970 period. The evidence highlights that 50% of the 'high income' countries (equivalent to 10 countries, namely Australia, Canada, China, France, Germany, India, Japan, Switzerland, UK and US) in the sample experienced all their consumption disasters before the year 1970, whereas only 30% of the high income countries experienced all their GDP crises in the same period. This is suggestive that it might be more likely today to have 'income' shocks that are not followed by consumption collapses. Examples are the GDP crises in Finland (2009), Japan (2008), Sweden(2008) and UK(2009) which were not followed by a collapse of real per-capita consumption[17].

Besides potential measurement errors, there are different reasons why consumption collapses do not always follow GDP crises and may be less frequent in recent periods especially in developed countries. Standard economic theory predicts that consumption would not radically change as long as the change in income is transitory. In other words agents can smooth out consumption pattern through savings and/or access to the credit market. Recent income changes may have therefore been more transitory in nature compared to the past and this is incorporated in agents expectations formation[18]. However, it is worth noting that even in presence of transitory income shocks, agents may fail to smooth-out consumption as part of the asset can become illiquid during a downturn and households would have to reduce consumption (Kaplan & Violante, 2011). Similarly, if the shock to the economy has hit a large amount of individuals in the society, it can be difficult to smooth out even tempo-

[17] In the US the drop in per-capita GDP from 2007 to 2009 was 'only' 3%, too small a change to be considered as a collapse.

[18] For instance, it is interesting to notice that a consumption collapse was recorded in Iceland and Spain in 2008. Indeed, both countries are undergoing massive structural adjustment of the economy following the burst of the real estate and the financial sector bubbles, suggesting that income changes may be more permanent in nature.

rary reduction in income (Brugiavini & Weber, 2011). A further possible explanation lays in the relatively strong and wide welfare protection schemes typical of advanced countries. These can cushion the shocks in income levels, especially those of temporary nature, and this could help reducing the brunt on the consumption levels across short-term disequilibria. For example, as shown in a recent working paper, the incidence of transfers in the US personal disposable income distribution has increased markedly over the course of the twentieth century and was at a historical record following the recent financial meltdown (cfr. Fig. US5 in Atkinson & Morelli, 2010).

It should nonetheless be acknowledged that the relatively low (and reducing over time) incidence of consumption shocks in association to per-capita GDP crises may be due to the fact that data on per-capita GDP might not necessarily reflect precise information on the personal disposable income of households. Indeed, whether or not a reduction in per-capita GDP carries information about the dynamics of disposable and 'spendable' household income level remains a priori unclear. This is spelled out clearly in Jenkins et al. (2013) who write "*GDP measures the size of the economy in terms of the value of goods and services produced. As such, it differs from the revenues eventually available to resident households to sustain their living standards*". For instance, "*national income is divided among the 'institutional' sectors comprising the economy. Businesses may retain profits, which coincide with their share of disposable income in national accounts, to sustain investment plans, while government uses its income to provide for services in kind and collective goods. Thus, the same GDP fall may have rather different implications for current living standards between a country where the decline in income is buffered by the government through a rise in the public deficit, and a country where it is entirely transferred to household finances.*" (pag. 38). The National Accounts provide easy solution to the latter problems by allowing the separation of the information for the household sector from that regarding the business and government sectors. For instance, recent work by Atkinson (2013) highlights the relative stability of household income compared to GDP indicator over the current recession (started around 2007) within the Euro Area[19]. This clearly depends on the country-specific institutional characteristics, including the role of discretionary and automatic stabilizers in the economy. The work by Jenkins et al. (2013) also underlines the divergent patterns, over the latest recession, between the GDP and the 'Gross Household Disposable Income' (GHDI) in the EU area (17 countries)[20]. Moreover they further pointed out how the measure of Gross Household Adjusted Disposable Income (GHDI augmented by in kind government transfers) was even more stable during the latest recession.

Finally, it is also worth noting that even the National Accounts definition of income can substantially depart from what 'people in the street' may consider to be a more understandable definition of 'spendable' income. National Accounts defini-

[19]The work by Atkinson (2013) also shows that how within the Euro Area the ratio between household income (measured in the National Account) to per-capita GDP followed a medium-term downward trend since early 2000s.

[20]They also provide information about the US alone.

tion of income typically includes income of non-profit institutions serving the households. Moreover, and most importantly, the procedures followed within the National Accounts are not usually mirrored within the household surveys. Indeed, income definition within the Nation Accounts generally includes the "*imputation for the rent attributable to owner-occupiers for the services provided by their houses*", as well as the allowances "*for the change in households net equity in pension funds*" and "*for the value of individual services which households receive free of charge from the government, such as health, educational and cultural services*". "*The non-economist would acknowledge that they do indeed benefit from public services and from not having to pay rent, and that in the future they may benefit from the pension funds. However, these are not spendable income*" Atkinson, 2013, p. 6.

1.3 General Macro-Economic Instability Periods

With the help of the information on banking crises and economic shocks assembled above and the use of further details about other types of financial shocks one could identify general 'macro-instability' periods beginning with and featuring any of the type of crises under investigation. This would provide extra details about multi-faceted nature of macroeconomic-shocks which tend to occur in cluster.

Identification of Macro-Economic Instability Episode In order to assemble a new set of macro-economic instability episodes, besides the information on banking and economic crises described above, I collect information on additional financial and economic crises which were left out of the analysis. For instance, I collect information on major wars (including civil wars) and independence episodes, currency crises, external and domestic debt defaults and hyperinflation episodes. This information provides the base for the identification of general macro-economic instability episodes, defined as the period of time in which a country features at least one of the macro shocks listed above. More specifically, I assume that any identified 'crisis' (including banking shocks and per-capita GDP and consumption crises) can trigger the onset of a new macro-economic instability period as long as the preceding years (up to two years) are not featuring any other crisis.

In other words, I allow a maximum of one year gap between the end and the beginning of two (or more) consecutive crises in order to be considered part of the same macro-instability episodes. The only exception to this rule is made to some cases involving one of the world wars. Due to the special circumstances I generally consider the beginning of the country participation to the world war as the beginning year of an additional and independent macro-economic turbulent period.

An example, would help clarifying. From 1923 to 1925, Germany (at the time the so called Weimar Republic) experienced a series of macroeconomic shocks. In 1923, together with an outbreak of hyperinflation, per-capita GDP and consumer expen-

diture dropped by more than 10% and a systemic banking crisis began in 1925. In 1929, following the Great Depression, Germany recorded an additional[21] period of macroeconomic turbulence, this time lasting for 25 years. The consumption and GDP disasters lasted until 1932 and a new banking shock hit the country in 1931. This was accompanied by currency crises in 1931 and 1934 and a restructuring of the external sovereign debt lasting until 1953. However, the outbreak of the Second World War in 1939 (accompanied by additional crises in per-capita GDP and consumption) led to consider two different macro-instability episodes, one beginning in 1929 and ending in 1939. The other one starting in 1939 and ending in 1953.

Sources of the Data Information on major wars, civil wars and independence episodes are drawn from the Center for Systemic Peace[22] and include cases like the Malaysian independence in 1957 as well as the Malayan revolution from 1958 to 1960; The 'Carnation' revolution in Portugal from 1974 to 1975; the Argentinean 'Dirty War' from 1976 to 1980; the Indian independence in 1947 and other episodes.

Information on external and domestic debt defaults and hyperinflation episodes are taken from 'This Time is Different Chartbook' by Reinhart (2010). Finally, information on currency crises is collected from Bordo et al. (2001) and from Laeven & Valencia (2010) concerning the period not covered by Bordo et al. (2001).

Description of the Macro-Instability Episodes The methodology described above allows to identify 237 different macro-instability episodes, of which 126 occurred before 1950 and 83 after 1970. Moreover, 71% of total episodes are identified in OECD countries. Note that differently from the banking crises, these data include information about the duration of each 'crisis'. The average duration of identified episodes is almost 4 years whereas the median duration is 3 years. Moreover, the database has the clear advantage to identify the multidimensional characteristics of the macroeconomic instability. Such dimensionality feature may well serve to proximate the degree of severity of the general instability episode. The recorded episodes range from complex cases where every crisis is recorded within the same episode (i.e. I record a major macro-instability episode in China beginning in 1921, lasting for 30 years and featuring any type of crisis dimension under investigation) to very simple episodes where only one crisis is recorded (i.e. in 1980 China experienced a currency crisis to which no other shock followed).

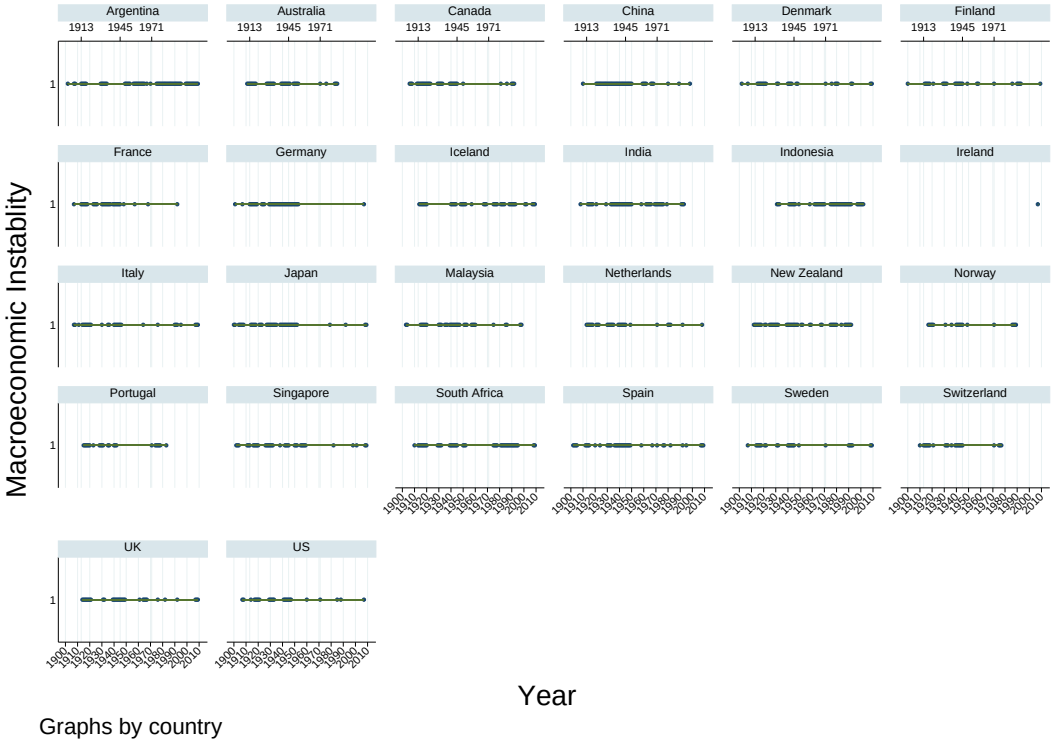
It is also worth noting that the beginning year of a general macro-instability episode is not necessarily coincident with a banking crisis or an economic crisis of the types described above. Similarly the total number of general instability episodes is different from the total number of banking crises to the extent that there are macro-instability

[21] Note that more than one year has passed between the end of the previous macro-instability period (1925) and the beginning of another one in 1929.

[22] Data accessed on the web at http://www.systemicpeace.org/warlist.htm.

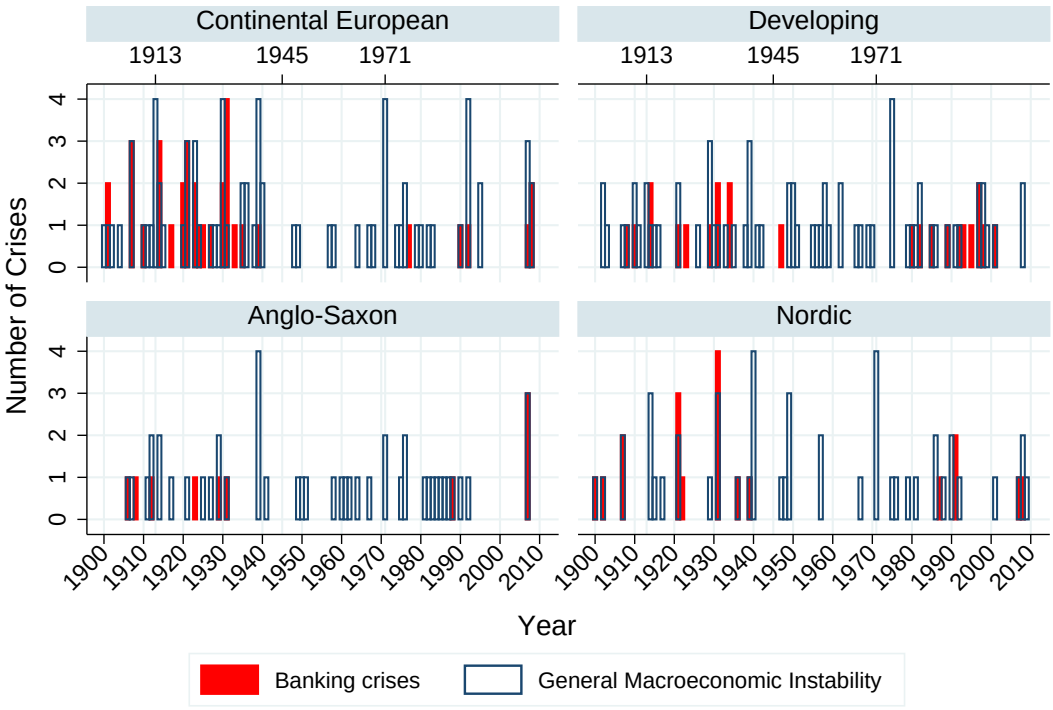
episodes which do not generate systemic crashes in the banking sector (both features are clearly shown in figure 1.7). In fact, around two third of the macro-instability episodes do not feature banking crises. Table 1.3 describes in details each identified instability episode, including the year of beginning, the duration and the types of crises involved.

Figure 1.6: Periods of General Macro-Economic Instability



The graph shows the entire duration of each macro-instability episode recorded in the sample. Every dot represents a year in which a country underwent 'macro-economic instability'. The latter is a period in which a country is experiencing at least one of the following event: systemic banking crisis, currency crisis, external or domestic debt crisis, hyperinflation, collapse of real per-capita GDP or consumption, major war, civil war or independence episode. It is to be noticed that, in the case of Ireland, I do not observe data for real per-capita GDP and consumption and therefore no 'economic crisis' is listed for this country. The years 1913, 1945 and 1971, marked on the upper X-axis, identify the beginning and the end of different international financial architecture regimes. The period 1880-1913 represents the Gold-Standard, whereas the years from 1913 to 1945 refer to the Inter-Wars period. Finally, the year 1971 marks the end of the Bretton-Woods system that lasted for 26 years since 1945.

Figure 1.7: Comparison of the Beginning Year of Banking Crises and Macro-Economic Instability: Across Country Groups



The graph shows the beginning year of systemic banking crises as well as the macro-instability episodes recorded in the sample. Every dot represents the beginning year of a single crisis only. I recall that a 'macro instability period' is a period in which a country is experiencing at least one of the following event: banking crisis, currency crisis, external or domestic debt crisis, hyperinflation, collapse of real per-capita GDP or consumption, major war, civil war or independence episode. The years 1913, 1945 and 1971, marked on the upper X-axis, identify the beginning and the end of different international financial architecture regimes. The period 1880-1913 represents the Gold-Standard, whereas the years from 1913 to 1945 refer to the Inter-Wars period. Finally, the year 1971 marks the end of the Bretton-Woods system that lasted for 26 years since 1945. Countries are grouped in 4 different groups: Nordic European (Denmark, Finland, Iceland, Norway and Sweden), Developing (Argentina, China, India, Indonesia, Malaysia, Mauritius, Singapore, South Africa and Tanzania), Western English speaking (Australia, Canada, Ireland, New Zealand, United Kingdom and United States), and Continental central European countries (France, Germany, Netherlands and Switzerland, together with Japan and the three southern European countries, namely Italy, Portugal and Spain).

Conclusion

The main goal of this chapter was to identify a set of systemic banking crises for a set of 26 countries over the entire twentieth century and until 2010. The chapter also identified a new database of economic crises (real per-capita GDP and consumption crises) as well as of general macro-economic instability episodes. These data were assembled from the most authoritative sources within the literature and this serves the empirical investigations that will follow in the next chapters.

Although the primary goal of this exercise was to collect data for the empirical investigation, it is worth mentioning that the new list of macro-economic shocks has highlighted an important set of issues:

First of all, banking crises are not isolated events but tend to occur in cluster with crises and shocks of other type. This has to be acknowledged within every empirical investigation on banking crises. Collecting data on different types of economic and financial crises I propose, as a starting point, a new indicator of macro-instability period. This approach can be taken as a first step to improve the multidimensional approach to the study of macro-economic shocks.

Moreover, available historical indicators of banking crises present several limitations which ought to be addressed in future research. In particular, there is a lack of continuous quantitative indicators on the instability of the banking sector and a lack of identification of the end point and the severity of each crisis. These are shortcomings that future investigation and research will need to address.

Data Appendix

Table 1.2: Comparison of Banking Crisis Identification across Sources

Country	Year	BE	RR	LV	Adopted here
Argentina	1914	0	1		1
Argentina	1931	1	1		1
Argentina	1934	1	1		1
Argentina	1980	1	1	1	1
Argentina	1981	0	0	1	0
Argentina	1982	0	0	1	0
Argentina	1985	1	0	0	0
Argentina	1989	1	1	1	1
Argentina	1990	0	0	1	0
Argentina	1991	0	0	1	0
Argentina	1995	1	1	1	1
Argentina	2001		1	1	1
Argentina	2002		0	1	0
Argentina	2003		0	1	0
Australia	1931	0	1		1
Australia	1989	1	0	0	0
Canada	1906	0	1		1
Canada	1908	0	1		1
Canada	1912	0	1		1
Canada	1923	1	1		1
China	1910		1		1
China	1923		1		1
China	1931		1		1
China	1934		1		1
China	1998	0	1	1	1
Denmark	1902	0	1		1
Denmark	1907	1	1		1
Denmark	1908	1	0		0
Denmark	1921	1	1		1
Denmark	1931	1	1		1
Denmark	1987	1	0	0	0
Denmark	2008		1	1	1
Denmark	2009		0	1	0
Finland	1900	1	1		1
Finland	1921	1	1		1
Finland	1931	1	1		1
Finland	1939	1	1		1
Finland	1991	1	1	1	1
Finland	1992	0	0	1	0

Table 1.2:continues on next page

Table 1.2:continues from previous page

Country	Year	BE	RR	LV	Adopted here
Finland	1993	0	0	1	0
Finland	1994	0	0	1	0
Finland	1995	0	0	1	0
France	1907	1	1		1
France	1914	0	1		1
France	1930	1	1		1
France	1931	1	0		0
France	1932	1	0		0
France	1994	1	0	0	0
France	2008		0	1	0
France	2009		0	1	0
Germany	1901	1	1		1
Germany	1925	0	1		1
Germany	1931	1	1		1
Germany	1977	1	0	0	0
Germany	2007		1	0	1
Germany	2008		0	1	0
Germany	2009		0	1	0
Iceland	2007		1	0	1
Iceland	2008		0	1	0
Iceland	2009		0	1	0
India	1908		1		1
India	1914		1		1
India	1921		1		1
India	1929		1		1
India	1947		1		1
India	1993	0	1	1	1
India	1994	1	0	0	0
Indonesia	1992	1	1	0	1
Indonesia	1997	1	1	1	1
Indonesia	1998	1	0	1	0
Indonesia	1999		0	1	0
Indonesia	2000		0	1	0
Indonesia	2001		0	1	0
Ireland	2007		1		1
Italy	1907	1	1		1
Italy	1914	0	1		1
Italy	1921	1	1		1
Italy	1930	1	1		1
Italy	1931	1	0		0

Table 1.2:continues on next page

Table 1.2:continues from previous page

Country	Year	BE	RR	LV	Adopted here
Italy	1935	1	1		1
Italy	1990	1	1	0	1
Italy	2008		1	0	0
Japan	1901	1	1		1
Japan	1907	1	1		1
Japan	1917	0	1		1
Japan	1923	0	1		1
Japan	1927	1	1		1
Japan	1992	1	1	0	1
Japan	1997	0	0	1	0
Japan	1998	0	0	1	0
Japan	1999		0	1	0
Japan	2000		0	1	0
Japan	2001		0	1	0
Malaysia	1985	1	1	0	1
Malaysia	1997	0	1	1	1
Malaysia	1998	1	0	1	0
Malaysia	1999		0	1	0
Netherlands	1914	0	1		1
Netherlands	1921	1	1		1
Netherlands	1939	1	1		1
Netherlands	2008		1	1	1
Netherlands	2009		0	1	0
New Zealand	1979	1	0	0	0
New Zealand	1987	1	0	0	0
Norway	1921	1	1		1
Norway	1922	1	0		0
Norway	1923	1	0		0
Norway	1931	1	1		1
Norway	1936	0	1		1
Norway	1987	1	1	0	1
Norway	1991	0	0	1	0
Norway	1992	0	0	1	0
Norway	1993	0	0	1	0
Portugal	1920	1	1		1
Portugal	1923	1	1		1
Portugal	1925	1	0		0
Portugal	1931	1	1		1
Portugal	1932	1	0		0
Portugal	2008		0	1	0

Table 1.2:continues on next page

Table 1.2:continues from previous page

Country	Year	BE	RR	LV	Adopted here
Portugal	2009		0	1	0
Singapore	1982	1	1	0	1
South Africa	1977	1	0	0	0
South Africa	1985	1	0	0	0
Spain	1920	1	1		1
Spain	1924	1	0		1
Spain	1925	1	0		0
Spain	1931	1	1		1
Spain	1977	1	1	1	1
Spain	1978	0	0	1	0
Spain	1979	0	0	1	0
Spain	1980	0	0	1	0
Spain	1981	0	0	1	0
Spain	2008		1	1	1
Spain	2009		0	1	0
Sweden	1907	1	1		1
Sweden	1922	0	1		1
Sweden	1931	1	1		1
Sweden	1932	1	0		0
Sweden	1991	1	1	1	1
Sweden	1992	0	0	1	0
Sweden	1993	0	0	1	0
Sweden	1994	0	0	1	0
Sweden	1995	0	0	1	0
Sweden	2008		0	1	0
Sweden	2009		0	1	0
Switzerland	1910	0	1		1
Switzerland	1921	0	1		1
Switzerland	1931	1	1		1
Switzerland	1933	1	1		1
Switzerland	2008		0	1	0
Switzerland	2009		0	1	0
UK	2007		1	1	1
UK	2008		0	1	0
UK	2009		0	1	0
US	1907	1	1		0
US	1914	0	1		0
US	1929	0	1		1
US	1930	1	0		0
US	1931	1	0		0

Table 1.2:continues on next page

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Country	Year	BE	RR	LV	Adopted here
US	1932	1	0		0
US	1933	1	0		0
US	1984	1	0	0	0
US	1988	0	0	1	1
US	2007		1	1	1
US	2008		0	1	0
US	2009		0	1	0

Table 1.2:complete

Table 1.3: The list of identified 'Economic' Crises

country	year	Consumption 'disasters'			GDP 'disasters'		
		Start year	Duration	Total loss	Start year	Duration	Total loss
Argentina	1902	1	1	.1265692	0		
Argentina	1907	1	1	.1230704	0		
Argentina	1913	1	5	.1718845	1	5	.2888532
Argentina	1929	1	4	.1893069	0		
Argentina	1930	0			1	3	.1948358
Argentina	1949	0			1	4	.0989381
Argentina	1950	1	4	.1431803	0		
Argentina	1959	1	1	.1009669	1	1	.0008137
Argentina	1962	1	2	.0882787	1	2	.0698697
Argentina	1975	1	2	.0895333	0		
Argentina	1981	1	2	.1041235	1	2	.1114505
Argentina	1985	1	1	.0008627	1	1	.0008342
Argentina	1988	1	3	.160221	1	3	.1414776
Argentina	1995	1	1	.0544261	0		
Argentina	1999	1	4	.2490815	1	4	.2195656
Australia	1911	0			1	8	.118
Australia	1914	1	5	.2379723	0		
Australia	1927	0			1	5	.2210995
Australia	1928	1	5	.2343915	0		
Australia	1939	1	6	.3014074	0		
Australia	1944	0			1	3	.1453131
Australia	1951	1	3	.0751995	0		
Canada	1907	1	2	.1207762	0		
Canada	1913	1	3	.1302862	0		

Table 1.3:continues on next page

Table 1.3:continues from previous page

country	year	Consumption 'disasters'			GDP 'disasters'		
		Start year	Duration	Total loss	Start year	Duration	Total loss
Canada	1914	0			1	1	.0947836
Canada	1918	0			1	4	.3007075
Canada	1919	1	3	.1960391	0		
Canada	1929	0			1	5	.3482843
Canada	1930	1	4	.2300891	0		
Canada	1990	0			1	3	.0500186
China	1930				1	5	.1089178
China	1937				1	10	.4982476
China	1959	1	4	.1919729	1	4	.2532738
China	1967				1	2	.1448918
Denmark	1915				1	4	.160133
Denmark	1920	1	2	.2409765			
Denmark	1940	1	4	.1979116	1	2	.2385586
Denmark	1947	1	2	.1438599			
Denmark	1979	1	3	.062866			
Denmark	2008	1	2	.0617816	1	2	.0729642
Finland	1914	1	5	.3595474	1	5	.3525126
Finland	1929	1	4	.2480361	0		
Finland	1939	1	6	.3128021	1	2	.1039852
Finland	1957	1	2	.0629582	0		
Finland	1990	1	4	.1403819	1	4	.1237644
Finland	2009	0			1	1	.0821014
France	1913	1	3	.2145548	1	6	.2891468
France	1930	0			1	6	.1870338
France	1939	1	5	.5800982	0		
France	1940	0			1	5	.4137538
Germany	1913	1	6	.4249523	0		
Germany	1914	0			1	6	.3566661
Germany	1923	1	1	.1267054	1	1	.1369008
Germany	1929	1	4	.1213509	1	4	.2799239
Germany	1940	1	6	.4122022	0		
Germany	1944	0			1	3	.7363946
Iceland	1914				1	7	.2400614
Iceland	1948	1	5	.2495389	0		
Iceland	1949	0			1	4	.1387702
Iceland	1957	1	1	.0703209	0		
Iceland	1967	0			1	3	.0760634
Iceland	1968	1	2	.1184494	0		

Table 1.3:continues on next page

Table 1.3:continues from previous page

country	year	Consumption 'disasters'			GDP 'disasters'		
		Start year	Duration	Total loss	Start year	Duration	Total loss
Iceland	1975	1	1	.1071759	0		
Iceland	1983	1	1	.0678625	0		
Iceland	1988	1	6	.1762426	1	6	.0702869
Iceland	2001	1	2	.0700647	0		
Iceland	2008	1	2	.2484295	1	2	.0875958
India	1917				1	2	.1455207
India	1933	1	10	.2172073	0		
India	1944	1	3	.1302409	1	5	.1169007
India	1948	1	3	.177056	0		
India	1965	0			1	2	.0697005
India	1979	0			1	1	.0007711
Indonesia	1931				1	3	.1136427
Indonesia	1941				1	5	.5454178
Indonesia	1958				1	1	.0773425
Indonesia	1962	0			1	6	.1132094
Indonesia	1963	1	2	.0861615	0		
Indonesia	1982	0			1	1	.0005673
Indonesia	1986	1	3	.0971586	0		
Indonesia	1998	1	1	.0753279	1	2	.157828
Italy	1919	0			1	2	.2205094
Italy	1940	1	6	.2861759	1	6	.413271
Italy	2007	1	3	.0522549	0		
Italy	2008	0			1	2	.0743867
Japan	1929	1	7	.1173688	0		
Japan	1938	1	8	.6391707	0		
Japan	1941	0			1	6	.5034749
Japan	2008	0			1	2	.0571091
Malaysia	1903	0			1	2	.099531
Malaysia	1915	1	2	.0959364	0		
Malaysia	1918	1	3	.425431	0		
Malaysia	1930	1	3	.2575329	1	3	.1731186
Malaysia	1935	0			1	3	.1533625
Malaysia	1939	1	9	.3356894	0		
Malaysia	1940				1	2	.2354434
Malaysia	1943				1	5	.3608522
Malaysia	1951	0			1	3	.0783528
Malaysia	1952	1	1	.1184351	0		
Malaysia	1957	1	2	.0890025	1	2	.0631242

Table 1.3:continues on next page

Table 1.3:continues from previous page

country	year	Consumption 'disasters'			GDP 'disasters'		
		Start year	Duration	Total loss	Start year	Duration	Total loss
Malaysia	1985	1	2	.1446411	0		
Malaysia	1998	1	1	.1241322	1	1	.0009488
Netherlands	1913	1	6	.4397726	0		
Netherlands	1914	0			1	5	.2584019
Netherlands	1930	0			1	5	.1290712
Netherlands	1940	1	5	.5450704	1	5	.5254962
Netherlands	1980	1	3	.0653574	0		
New Zealand	1912	0			1	7	.1074692
New Zealand	1921	1	2	.2110122	1	2	.1453378
New Zealand	1925	1	8	.2117331	0		
New Zealand	1926	0			1	2	.1173168
New Zealand	1930	0			1	3	.1799252
New Zealand	1945	1	2	.1667714	0		
New Zealand	1948	0			1	1	.1192544
New Zealand	1951	0			1	1	.0007561
New Zealand	1952	1	1	.1036623	0		
New Zealand	1958	1	2	.08115	0		
New Zealand	1967	1	1	.057977	1	2	.0238547
New Zealand	1975	1	3	.0996297	1	4	.0826269
New Zealand	1987	0			1	5	.0672082
New Zealand	1989	1	4	.0548138	0		
Norway	1917	1	2	.1686184	1	2	.147903
Norway	1920	1	2	.1607234	0		
Norway	1921	0			1	1	.1095579
Norway	1940	1	5	.0995852	1	5	.1933692
Norway	1986	1	4	.0083717	0		
Portugal	1915	1	5	.2152026	0		
Portugal	1928	0			1	1	.1089357
Portugal	1935	1	2	.1208796	1	2	.1481225
Portugal	1940	1	3	.1042338	0		
Portugal	1974	0			1	2	.0845752
Portugal	1975	1	2	.097894	0		
Singapore	1902	0			1	3	.2141013
Singapore	1911	0			1	3	.3373438
Singapore	1916	0			1	1	.1732555
Singapore	1918	0			1	3	.2361633
Singapore	1919	1	2	.1264586	0		
Singapore	1926	0			1	2	.389618

Table 1.3:continues on next page

Table 1.3:continues from previous page

country	year	Consumption 'disasters'			GDP 'disasters'		
		Start year	Duration	Total loss	Start year	Duration	Total loss
Singapore	1929	1	3	.1040918	0		
Singapore	1930	0			1	3	.4117939
Singapore	1938	0			1	1	.1521037
Singapore	1950	1	2	.1586846			
Singapore	1951	0			1	2	.3447171
Singapore	1955	0			1	1	.0008013
Singapore	1957	1	3	.1171213	1	1	.1127746
Singapore	1998	1	1	.0008004	0		
Singapore	2001	0			1	1	.0005224
Singapore	2008	0			1	2	.0702439
South Africa	1913				1	5	.2292311
South Africa	1920				1	1	.2390188
South Africa	1929				1	4	.1182544
South Africa	1950	1	3	.0704213	0		
South Africa	1982	0			1	6	.1133357
South Africa	1985	1	2	.0837824	0		
South Africa	1990	0			1	4	.10234
South Africa	1991	1	3	.0626848	0		
South Africa	2008	1	2	.054697	0		
Spain	1902	1	4	.0958966	0		
Spain	1912	1	4	.1423492	0		
Spain	1930	1	1	.1008402	1	4	.0955683
Spain	1936	1	2	.4609177	1	3	.3129101
Spain	1941	1	5	.1449891	0		
Spain	1947	1	3	.1308683	0		
Spain	2007	1	3	.0872116	0		
Spain	2008	0			1	2	.0513105
Sweden	1914	1	4	.1147456	0		
Sweden	1917	0			1	2	.1504824
Sweden	1921	1	1	.1322849	1	1	.1075892
Sweden	1940	1	6	.1819743	1	2	
Sweden	1990	1	4	.0689911	0		
Sweden	1991	0			1	3	.0611088
Sweden	2008	0			1	2	.0567609
Switzerland	1913	1	6	.1079899	0		
Switzerland	1917	0			1	2	.1739245
Switzerland	1940	1	6	.1727083	1	3	.1260854

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country	year	Consumption 'disasters'			GDP 'disasters'		
		Start year	Duration	Total loss	Start year	Duration	Total loss
Switzerland	1975	0			1	1	.0005837
UK	1916	1	3	.167442	0		
UK	1919	0			1	3	.1923541
UK	1939	1	5	.1692796	0		
UK	1944	0			1	4	.1477896
UK	2009	0			1	1	.0559249
US	1907	0			1	2	.1054872
US	1914	0			1	1	.0951907
US	1918	1	4	.1641762	0		
US	1919	0			1	3	.1183431
US	1930	1	4	.2083068	1	4	.289852
US	1945	0			1	3	.1651076

Table 1.3:complete

Table 1.4: The List of the Identified Macro-Instability Episodes

Country	Year	Duration of Macro Instability	Occurrence of Specific Crisis				
			Banking Crisis	Currency Crisis	Economic Crisis	'Wars'	Debt Crisis
Argentina	1902	1			Yes		
Argentina	1907	2		Yes	Yes		
Argentina	1913	5	Yes		Yes		
Argentina	1929	6	Yes	Yes	Yes		
Argentina	1949	4	Yes	Yes	Yes		Yes
Argentina	1956	10	Yes	Yes	Yes		Yes
Argentina	1967	1		Yes			
Argentina	1970	1		Yes			
Argentina	1975	21	Yes	Yes	Yes		Yes
Argentina	1999	11	Yes	Yes	Yes		Yes
Australia	1911	8			Yes	Yes	
Australia	1927	7	Yes	Yes	Yes		
Australia	1939	8		Yes	Yes	Yes	
Australia	1949	5		Yes	Yes		
Australia	1971	1		Yes			
Australia	1976	1		Yes			
Australia	1983	3		Yes			

Table 1.4:continues on next page

Table 1.4:continues from previous page

Country	Year	Duration of Macro Instability	Occurrence of Specific Crisis				
			Banking Crisis	Currency Crisis	Economic Crisis	'Wars'	Debt Crisis
Canada	1906	3	Yes		Yes		
Canada	1912	12	Yes	Yes	Yes	Yes	
Canada	1929	5		Yes	Yes		
Canada	1939	7				Yes	
Canada	1950	1		Yes			
Canada	1962	1		Yes			
Canada	1981	1		Yes			
Canada	1986	1		Yes			
Canada	1990	3			Yes		
China	1910	1	Yes				
China	1921	30	Yes	Yes	Yes	Yes	Yes
China	1959	4			Yes		
China	1966	10			Yes	Yes	
China	1980	1		Yes			
China	1989	1		Yes			
China	1998	1	Yes				
Denmark	1902	1	Yes				
Denmark	1907	1	Yes				
Denmark	1915	8	Yes	Yes	Yes		
Denmark	1931	2	Yes	Yes			
Denmark	1940	4			Yes		
Denmark	1947	2			Yes		
Denmark	1971	1		Yes			
Denmark	1976	1		Yes			
Denmark	1979	3			Yes		
Denmark	1992	2			Yes		
Denmark	2008	2	Yes		Yes		
Finland	1900	1	Yes				
Finland	1914	5			Yes	Yes	
Finland	1921	1	Yes	Yes			
Finland	1929	4	Yes	Yes	Yes		
Finland	1939	7	Yes		Yes	Yes	
Finland	1949	1		Yes			
Finland	1957	2			Yes		
Finland	1971	1		Yes			
Finland	1986	1		Yes			
Finland	1990	4	Yes	Yes	Yes		

Table 1.4:continues on next page

Table 1.4:continues from previous page

Country	Year	Duration of Macro Instability	Occurrence of Specific Crisis				
			Banking Crisis	Currency Crisis	Economic Crisis	'Wars'	Debt Crisis
Finland	2009	1			Yes		
France	1907	1	Yes				
France	1913	6	Yes		Yes	Yes	
France	1923	4		Yes			
France	1930	8	Yes	Yes	Yes		
France	1939	7			Yes	Yes	
France	1948	1		Yes			
France	1957	1		Yes			
France	1968	1		Yes			
France	1992	1		Yes			
Germany	1901	1	Yes				
Germany	1907	1		Yes			
Germany	1913	7			Yes	Yes	
Germany	1923	3	Yes		Yes		
Germany	1929	10	Yes	Yes	Yes		Yes
Germany	1939	15		Yes	Yes	Yes	Yes
Germany	2007	1	Yes				
Iceland	1914	7			Yes		
Iceland	1940	5				Yes	
Iceland	1948	5			Yes		
Iceland	1957	1			Yes		
Iceland	1967	3			Yes		
Iceland	1975	4		Yes	Yes		
Iceland	1981	4		Yes	Yes		
Iceland	1988	6			Yes		
Iceland	2001	2			Yes		
Iceland	2007	3	Yes		Yes		Yes
India	1908	1	Yes				
India	1914	5	Yes		Yes	Yes	
India	1921	1	Yes				
India	1929	1	Yes				
India	1933	6			Yes		
India	1939	12	Yes		Yes	Yes	Yes
India	1958	1		Yes			
India	1962	5			Yes	Yes	
India	1969	8					Yes
India	1979	1			Yes		

Table 1.4:continues on next page

Table 1.4:continues from previous page

Country	Year	Duration of Macro Instability	Occurrence of Specific Crisis				
			Banking Crisis	Currency Crisis	Economic Crisis	'Wars'	Debt Crisis
India	1991	3	Yes	Yes			
Indonesia	1931	3			Yes		
Indonesia	1941	6			Yes	Yes	
Indonesia	1949	1					Yes
Indonesia	1958	1			Yes		
Indonesia	1962	9			Yes	Yes	Yes
Indonesia	1975	7		Yes		Yes	
Indonesia	1982	4		Yes	Yes	Yes	
Indonesia	1986	6	Yes	Yes	Yes		
Indonesia	1992	1	Yes			Yes	
Indonesia	1997	6	Yes	Yes	Yes		Yes
Ireland	2007	1	Yes				
Italy	1907	2	Yes	Yes			
Italy	1911	1				Yes	
Italy	1914	8	Yes		Yes	Yes	
Italy	1930	1	Yes				
Italy	1935	2	Yes	Yes			
Italy	1940	7			Yes	Yes	Yes
Italy	1964	1		Yes			
Italy	1976	1		Yes			
Italy	1990	3	Yes	Yes			
Italy	1995	1		Yes			
Italy	2007	3			Yes		
Japan	1900	2	Yes	Yes			
Japan	1904	5	Yes	Yes			
Japan	1914	5	Yes			Yes	
Japan	1921	3	Yes	Yes			
Japan	1927	9	Yes	Yes	Yes		
Japan	1938	15			Yes	Yes	Yes
Japan	1979	1		Yes			
Japan	1992	1	Yes				
Japan	2008	2			Yes		
Malaysia	1903	2			Yes		
Malaysia	1915	6			Yes		
Malaysia	1930	3			Yes		
Malaysia	1935	3			Yes		
Malaysia	1939	9			Yes	Yes	
Malaysia	1951	3			Yes		

Table 1.4:continues on next page

Table 1.4:continues from previous page

Country	Year	Duration of Macro Instability	Occurrence of Specific Crisis				
			Banking Crisis	Currency Crisis	Economic Crisis	'Wars'	Debt Crisis
Malaysia	1957	4			Yes	Yes	
Malaysia	1975	1		Yes			
Malaysia	1985	2	Yes		Yes		
Malaysia	1997	2	Yes	Yes	Yes		
Netherlands	1913	6	Yes		Yes		
Netherlands	1921	3	Yes	Yes			
Netherlands	1930	6		Yes	Yes		
Netherlands	1939	7	Yes		Yes	Yes	
Netherlands	1949	1		Yes			
Netherlands	1971	1		Yes			
Netherlands	1980	3			Yes		
Netherlands	1992	1		Yes			
Netherlands	2008	1	Yes				
New Zealand	1912	7			Yes	Yes	
New Zealand	1921	2			Yes		
New Zealand	1925	8			Yes		
New Zealand	1939	10			Yes	Yes	
New Zealand	1951	2			Yes		
New Zealand	1958	2			Yes		
New Zealand	1967	2			Yes		
New Zealand	1975	6		Yes	Yes		
New Zealand	1984	1		Yes			
New Zealand	1987	6		Yes	Yes		
Norway	1917	5	Yes		Yes		
Norway	1931	1	Yes		Yes		
Norway	1936	1	Yes				
Norway	1940	6			Yes	Yes	
Norway	1949	1		Yes			
Norway	1971	1		Yes			
Norway	1986	4	Yes	Yes	Yes		
Portugal	1915	6	Yes		Yes	Yes	
Portugal	1923	1	Yes				
Portugal	1928	4	Yes	Yes	Yes		
Portugal	1935	2			Yes		
Portugal	1940	3			Yes		
Portugal	1971	1		Yes			
Portugal	1974	5		Yes	Yes	Yes	

Table 1.4:continues on next page

Table 1.4:continues from previous page

Country	Year	Duration of Macro Instability	Occurrence of Specific Crisis				
			Banking Crisis	Currency Crisis	Economic Crisis	'Wars'	Debt Crisis
Portugal	1983	1		Yes			
Singapore	1902	3			Yes		
Singapore	1911	3			Yes		
Singapore	1916	5			Yes		
Singapore	1926	7			Yes		
Singapore	1938	1			Yes		
Singapore	1942	4				Yes	
Singapore	1950	3			Yes		
Singapore	1955	5			Yes		
Singapore	1982	1	Yes				
Singapore	1998	1		Yes	Yes		
Singapore	2001	1			Yes		
Singapore	2008	2			Yes		
South Africa	1910	1					Yes
South Africa	1913	8			Yes	Yes	
South Africa	1929	4			Yes		
South Africa	1939	7				Yes	
South Africa	1950	3			Yes		
South Africa	1975	4		Yes			
South Africa	1981	15		Yes	Yes		Yes
South Africa	2008	2			Yes		
Spain	1902	4			Yes		
Spain	1912	4			Yes		
Spain	1920	1	Yes				
Spain	1924	1	Yes				
Spain	1930	4	Yes		Yes		
Spain	1936	14			Yes	Yes	Yes
Spain	1958	1		Yes			
Spain	1967	1		Yes			
Spain	1971	1		Yes			
Spain	1976	2	Yes	Yes			
Spain	1982	1		Yes			
Spain	1992	1		Yes			
Spain	1995	1		Yes			
Spain	2007	3	Yes		Yes		
Sweden	1907	1	Yes				
Sweden	1914	5			Yes		
Sweden	1921	2	Yes		Yes		

Table 1.4:continues on next page

Table 1.4:continues from previous page

Country	Year	Duration of Macro Instability	Occurrence of Specific Crisis				
			Banking Crisis	Currency Crisis	Economic Crisis	'Wars'	Debt Crisis
Sweden	1931	2	Yes		Yes		
Sweden	1940	6			Yes		
Sweden	1949	1		Yes			
Sweden	1971	1		Yes			
Sweden	1990	4	Yes	Yes	Yes		
Sweden	2008	2			Yes		
Switzerland	1910	1	Yes				
Switzerland	1913	6			Yes		
Switzerland	1921	1	Yes				
Switzerland	1931	3	Yes				
Switzerland	1936	1		Yes			
Switzerland	1939	7			Yes		
Switzerland	1971	1		Yes			
Switzerland	1975	3			Yes		
UK	1914	8			Yes	Yes	
UK	1931	2		Yes			Yes
UK	1939	11		Yes	Yes	Yes	
UK	1961	1		Yes			
UK	1964	4		Yes			
UK	1976	1		Yes			
UK	1982	1		Yes			
UK	1992	1		Yes			
UK	2007	3	Yes		Yes		
US	1907	2			Yes		
US	1914	1		Yes			
US	1917	5			Yes	Yes	
US	1929	5	Yes	Yes	Yes		Yes
US	1941	7			Yes	Yes	
US	1960	1		Yes			
US	1971	1		Yes			
US	1985	1		Yes			
US	1988	1	Yes				
US	2007	1	Yes				

Table 1.4:complete

Chapter 2

Banking Crises in the US: the Response of Top Shares in a Historical Perspective

Contents

Introduction

The 2007-2008 financial collapse and the subsequent economic recession brought the distributional impact of macroeconomic shocks back on the research agenda. Banking crises as other macroeconomic shocks, create 'winners' and 'losers' within the affected economy. Making use of the identified list of systemic banking shocks in the previous Chapter, I investigate the distributional impact of the three systemic banking shocks detected in the US since the beginning of the twentieth century. Given the very long time horizon under investigation, I will confine my analysis to the study of the share in national income accruing to the top of the distribution. Indeed, the data series on the so called top income shares (taken from the World Top Income Database, WTID) date back to 1913 and provide unique annual observations estimated continuously from the same institutional source. The data also allow, among other things, to decompose income by different sources and to add realised capital gains to total income for the entire period under investigation. These important features would not be replicable for such a long period by any other available data on US income distribution.

After discussing the nature of the data used for the analysis, the empirical investigation begins with a so called 'window study'. Using a window of 5 years, the data on top shares is examined graphically around crises episodes, without any adjustment. However, describing the temporal association between the crisis and the dynamics of the top tail of the income distribution is only the first step of the empirical investigation. The following steps specify the formal econometric models. The investigation starts investigating whether, following a banking shock, the growth rate of top shares series deviates from the forecasted pattern given the past behaviour. This can be considered as a first step towards comparing actual values with some row measure of counterfactuals. Results are based on two different multi-period forecasting techniques.

As a second step, an Autoregressive Distributed Lags (ADL) model is estimated, where the dynamic series of growth rate of top shares are assumed to be exposed to impulses (banking shocks). This allows to estimate the dynamic impact of banking turmoil on the behaviour of the levels of top shares and recover the *total* effect of crisis on the shares. Such an approach is more common in the analysis of macroeconomics perturbations but constitutes one of the first applications of this sort in the study of distributional consequences of macro shocks. Estimates of dynamic multipliers can be accompanied by standard errors which in turn are useful to gauge the statistical significance of the impact of the shocks on *levels* of top shares as well as their *growth* rates.

Existing literature Surprisingly, very few studies have tried to answer the complex pressing question on how gains and losses of banking crises are borne across different groups of individuals within a country's economy. In contrast, the distribu-

tional consequences of general aggregate fluctuations and business cycles have been more widely investigated in the US, especially in past decades. Notable examples are Beach (1976, 1977), Blinder & Esaki (1978), Blank & Blinder (1985), Blank (1989) and more recently Parker & Vissing-Jorgensen (2009) and Thompson & Smeeding (2013)[1]. Such studies are important points of reference in the literature, especially in order to identify the role of aggregate fluctuations, including unemployment and inflation, for changes in the size of income distribution. If common business cycles have systematic distributional impacts so do banking crises-led recessions which have been shown to be generally more severe than usual economic downturns. However it is worth recalling that banking crises and economic recessions or other financial crises are different in nature and so could be their distributional consequences.

Structure of the Chapter The chapter is composed of 7 main sections. The first section describes the problem at hand whereas the second highlights the advantages and the limitations of the data used. A first look at the raw data on top shares around the crisis episodes is given within the third section. The fourth section represents the core of the empirical investigation where two counterfactual analyses are carried out: one based on forecasting techniques and the other based on macro-econometrics and the calculation of Impulse Response Functions (IRFs). In other words, section 4 investigates the hypothetical scenarios in which no crises materialise and compares them to the actual data estimating the average total impact of a crisis on different top shares. The fifth section briefly discusses the role of reverse causality and what can be done to mitigate the concerns of mis-pecification and endogeneity. The last core section, finally, discusses the robustness of the findings to a variety of different model specifications.

2.1 Unravelling the Complexity

Usually banking crises are associated with a series of events. Sizeable crashes in stock and real estate markets are often temporally associated with banking crises and the recent great financial meltdown of the early 21st century is clearly not an exception. Such events can largely depress financial and real household wealth holdings as well as different sources of income (e.g. dividends payments, capital gains and remuneration schemes linked to stock market performance). Massive failures or restructuring of financial institutions can also increase layoffs in the financial sector as well as other sectors in the economy. Similarly, one would expect a drop in average earnings level as hours worked per worker and productivity drop (e.g. one would expect the bonus and the stock-option components of executives' salaries to be reduced due to their higher correlation with shares performance).

[1] For studies on the response of inequality indicators to general macro-economic conditions in the UK see Nolan (1986, 1987) and Jäntti & Jenkins (2010) .

Furthermore, banks are commonly seen as a source of systemic risk given that the potential loss in output of a bank failure exceeds the specific losses of the claim holders linked to the insolvent or failing bank. A recent study (Haugh et al., 2009) has analyzed the output losses following the 6 worst banking crises[2] in OECD countries of last the decades excluding the recent one. Findings indicate that losses are around 2-3 times higher than other downturns[3]. Preliminary evidence suggests even higher costs for the recent financial meltdown[4]. Output losses bring about a rise in unemployment[5] and this might have strong distributional impact, ceteris paribus depending on the effectiveness of automatic stabilisers[6] such as social security schemes and on the population groups eventually harmed the most by the job-loss.

On the other hand, banking crises are often followed by large government interventions, including increase in specific types of social transfers (i.e. unemployment benefits), nationalization of distressed financial institutions and other bank bailout schemes[7]. Such policy interventions are financed by fiscal policy which inevitably implies an immediate or future transfer from taxpayers to main beneficiaries of such policies[8]. However, such fiscal policy may also severely undermine the stability of public finances, depending on the severity of the crisis and this might call for future additional fiscal imposition (i.e. the case of European sovereign debt crisis serves here as a clear example). In order to address this, taxes can be disproportionately levied on those who benefited most from bailout and rescue schemes or simply on groups with higher fiscal capacity (as currently debated following the great financial collapse of 2007-2009). Alternatively or contemporaneously general spending cuts may be applied to governmental services and welfare provision. Policy intervention in the aftermath of a crisis might also tighten the regulation of financial markets, curbing the possibility of future high returns for the financial sector (e.g. credit market regulation,

[2]The 6 banking crises refer to 1977-1985 crisis in Spain, to the Sweden, Norway and Finland crises in early 1990s, to the Japanese crisis in 1990s and to the US Savings and Loan crisis in the 1980s.

[3]Output losses are measured by the cumulative loss in GDP relative to potential GDP.

[4]Laeven & Valencia (2010), using a wide sample of banking crises from 1970 to 2009, estimated that the cumulative percent difference between the actual GDP from the trend over 4 years following a crisis (included) was around 30% for the recent meltdown versus an average of 25% for previous crises.

[5]Each of three banking crisis cases under analysis in this paper, has been associated to economic downturn and rise in unemployment rate. The National Bureau of Economic Research indicates 1929(III)-1933(I), 1990(III)-1991(I) and 2007(IV)-2009(II) as the beginning and the end years(quarters) of official US recessions. Unemployment rose dramatically during recessions. Estimates indicate a stunning surge from 2.08 to 25.2% from 1929 to 1932. From 1988 to 1992 unemployment rate went from 5.3 to 7.4, while it almost doubled (from 5 to 9.6%) from 2007 to 2010.

[6]In a recent paper Dolls et al. (2012) found that 34% of an unemployment shock is absorbed by automatic stabilisers in US.

[7]Rescue packages account on average for 12% of GDP (gross fiscal costs) according to Laeven & Valencia (2008) for a series of 42 systemic banking crises. New estimates for the recent crisis started in 2007-2008 suggest that fiscal costs are around three times smaller given the sizeable monetary policy intervention in the market. For US the total cost over 2007 and 2009 was around 5% of GDP (Laeven & Valencia, 2010).

[8]For example following the analysis of Curry & Shibut (2000), $124 out of $146 billion total estimated costs of the S&L crisis have been borne by the U.S. taxpayers. Only a small share of cost was therefore borne by the thrift industry.

remuneration caps and change in regulation for market concentration). Figure 2.1 summarises the channels through which a financial meltdown can influence income and wealth distribution.

To conclude, understanding the overall distributional consequences of macroeconomic shocks is an extremely challenging and complex task. First of all, such shocks hardly affect the size of income distribution in a systematic and unique fashion as every crisis has its own features, causes and consequences. Ideally one needs to carefully analyze a range of behavioral responses to the shock, namely individual labour supply decision following the drop in wealth, the dynamics of portfolio investments of different group of individuals and corporate decisions in terms of number of recruitment and layoffs, dividends distribution, as well as salary and compensation of CEOs and employees. Similarly, government interventions through bailout measures, regulatory interventions and welfare and fiscal policies also ought to be taken into account. Such analysis, however, presupposes the use of a wide range of detailed micro-data which includes post-tax income data, unfortunately not available over a long period of time.

Given the wide number of perspectives one could adopt in order to analyse the distributional impact of banking crises I confine my-self to a specific observation angle. Namely, as mentioned above, I focus the attention on countrys richest quantiles shares in US gross income distributions. In my opinion and given the objective of the chapter, the choice is considered to be a particularly appropriate. There are a number of reasons why this might be an informative and unique exercise, namely:

1. Data on top income shares represents a unique opportunity to analyse an extraordinary long time horizon covering most of twentieth century and the beginning of the twenty-first century. No other comprehensive measure of US income distribution would allow studying such a long time horizon continuously over time. The long annual series also allow exploiting the time-series properties of the data better.

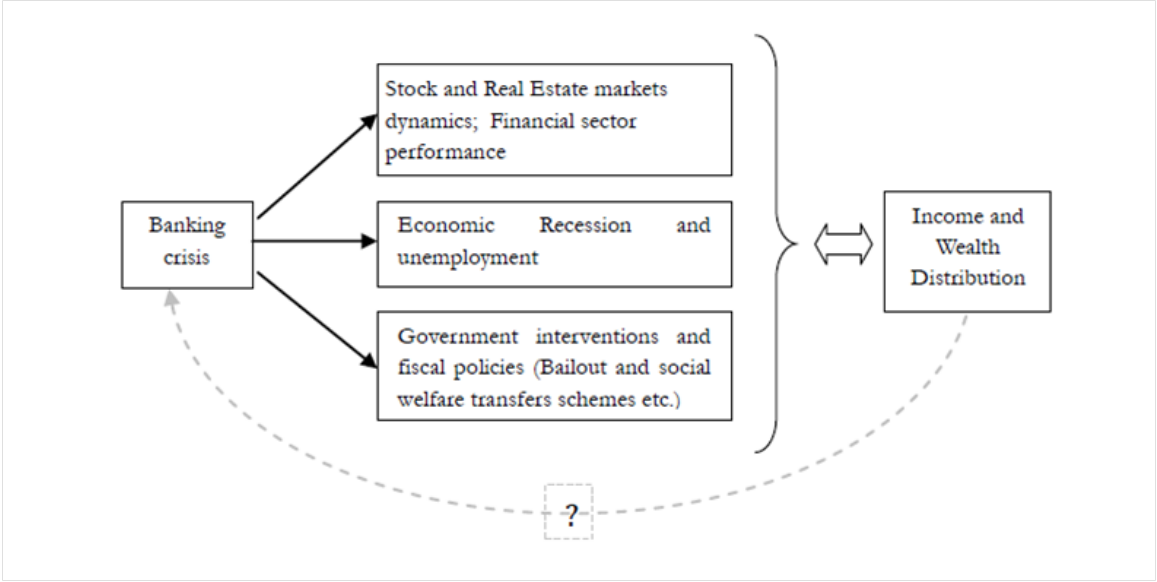
2. The financial sector, likely to be harmed during a banking turmoil, is increasingly populated by wealthy and rich individuals. Moreover, the composition of income at the right tail of the distribution is such to make the link with the financial meltdown more plausible.

3. The use of data based on gross income appears of help in order to untangle the direct effect of government intervention through fiscal policies, contemporaneous to the occurrence of a banking crisis.

4. The use of top shares allows including realized capital gains to the total market income accruing to the top US income brackets. Such a source of income has a sizeable incidence in the total income at the top and it is particularly affected by the occurrence of financial shocks.

5. Data on US top income shares are decomposable by income sources for the entire period under observation which would help to interpret the findings of the work.

Figure 2.1: Unraveling the Complexity



2.2 Data

This section describes the data I use for income distribution in the US. As for the identification of the systemic banking crises I address the reader to the detailed discussion within Chapter 1. It suffices to know that, for the case of the US, only three systemic banking crises are identified since the beginning of the twentieth century: 1929/1930, late 80's and 2007 and these three crises are be the focus of this chapter.

2.2.1 Data on the US Top-Income Shares

As for data on US top income shares, I draw extensively on the detailed database estimated and assembled by Piketty & Saez (2003) (PS hereinafter[9]). With information gathered from 1913 to 2011, this database is a valuable source to describe the long-run trend of the relative income and wages accrued at the top tax units[10] of the US income

[9]The updated estimates to 2011 can be downloaded from Emmanuel Saez's web page. Moreover, data on the US top income shares are now included in the World Top Income Database which now coverage a variety of different countries (see Alvaredo et al. (2013)).

[10]A tax unit in the U.S. tax code is either a married couple or a single individuals. Dependents are also included.

distribution[11]. Overall, PS present a set of annual series of shares of total income accruing to a number of top fractiles above the 90th percentile.

At a first glance, this may seem just a tiny portion of the overall population. Nonetheless, US is a populous nation with a total 153 million tax units in 2008 (37.7 in 1913) meaning that I am effectively analysing around 15.3 million tax units (3.7 million). Furthermore, enormous differences in income level characterise the subgroups within top decile. In 2006 the minimum non-capital gains income in order for a tax unit to be counted above the P90, P95, P99, P99.5, P99.9 and P99.99 percentiles was respectively 111.772, 156.773, 392.922, 616.387, 1.883.501 and 8.568.365 US-2008 dollars[12]. PS database also presents the data on tax reported income[13] broken down to market income sources such as wages, business income, and capital income. For the purpose of this analysis, I make use of data on top fractile income shares in total income both including and excluding capital gains[14].

In their 2003 paper Piketty and Saez maintain that *"Realized capital gains are not an annual flow of income (in general, capital gains are realized by individuals in a lumpy way) and form a very volatile component of income with large aggregate variations from year to year de pending on stock price variations"*. For this reason they exclude capital gains and include only dividends, rents, interest rates and royalties within their main representation of capital income. Although I acknowledge their argument as compelling and reasonable, I have also conduct the analyses by including capital gains in the definition of capital income.

I justify the choice on different grounds.

First of all, I have recalculated the incidence of different sources of income within total income accruing at the top tax brackets. The calculations, represented in Figure 2.2 show that the share of capital capital income (including capital gains) is still the biggest source of income for the two richest fractiles even in recent periods and that it increases almost linearly across top fractiles above the 90th percentile. In 2007, at the onset of the recent crisis, figures go from a minimum of 9% for P90-95 quantile to 47% for the top percentile [15] whereas these figures were almost double as much in 1929.

[11]Data updated to 2011 have been downloaded from the World Top Income Database website http://topincomes.g-mond.parisschoolofeconomics.eu/

[12]Moreover, the 2006 ratios between the average incomes of independent fractiles within top decile (P90-P95, P95-P99, P99-P99.5,P99.5-P99.9, P99.9-P99.99 and P99.99-P100) and the above stated thresholds are respectively 1.17,1.39, 1.21, 1.61, 1.83 and 2.55.

[13]Tax reported income could very likely differ from real gross income due mainly to tax evasion and avoidance. PS use a gross definition of income before deductions, individual income taxes and payroll taxes. In addition, used income definition excludes all government transfers such as Social Security (retirement and disability benefits) and health benefits (Medicare and Medicaid), compensation schemes for unemployment and all cash and in-kind welfare schemes.

[14]In both cases income fractiles are defined by ranking income excluding capital gains.

[15]Conversely, by excluding capital gains from the calculation brings down these figure respectively to 5% and 33%. Data are downloadable at "http://elsa.berkeley.edu/ saez/".

Secondly, I consider net capital gains from asset ownership as a form of capital income ('unearned' income) with a considerable increasing relevance for richest households.

Thirdly, the lumpiness of gains realization can be strictly connected with the occurrence of a banking crisis (for example data clearly show the steep growth of the incidence of capital gains on total income accruing at the top especially in the years preceding banking crises). Excluding capital gains, could therefore be informationally costly for the sake of the present analysis.

Finally, distributed dividends and income under the form of realised capital gains might be seen as substitute forms of capital income, especially for upper income groups. In other words shareholders with different preferences and different tax regimes choose to hold shares which adopt their preferred dividend policy. As a consequence, individuals within top tax brackets may prefer to hold stocks which guarantee relatively low payout ratios as tax regimes discriminate against dividends and favors capital gains sources of income.[16]. This is known as the 'clientele effect'[17]. For instance, in order to provide a crude illustration of such an argument I construct a simple measure of 'fiscal convenience' of capital gains by taking the difference between the top marginal tax rate on dividends and that on long-term capital gains. Then I plot the 5-years moving average of the latter measure together with the dynamics of capital gains and dividends incidence in total income, accruing to the richest top001% (this representation can be found in Figure 2.3). The graph shows some correlation[18] between the share of capital gains and their relative fiscal convenience although with some lag and only starting from late 60's.

2.3 Preliminary results

Having described the data I now move to a preliminary empirical investigation of the data.

2.3.1 Data analysis

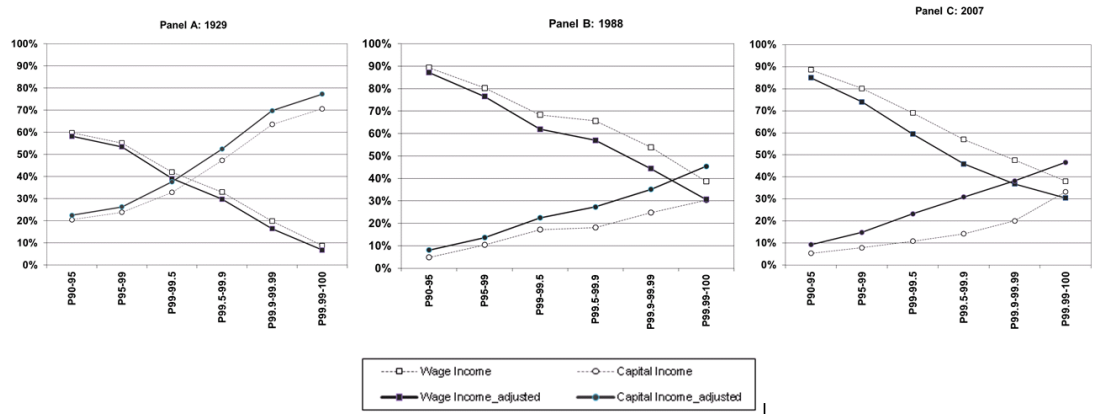
Plotting data on a 5 years window diagram, without making any adjustment but data normalization, provides an initial evidence of the fact that top shares may potentially

[16]Moreover it can be argued that the effective tax rates on capital gains may be even lower than the official ones. Indeed, taxes on capital gains could be entirely avoidable simply deciding not to sell the assets over the entire life-time. Taxes on capital gains are also easier to postpone and reduce as only net capital gains (in excess of capital losses) are subject to taxation.

[17]More complete discussion on 'clientele effect' is found in Miller & Modigliani (1961), Elton & Gruber (1970).

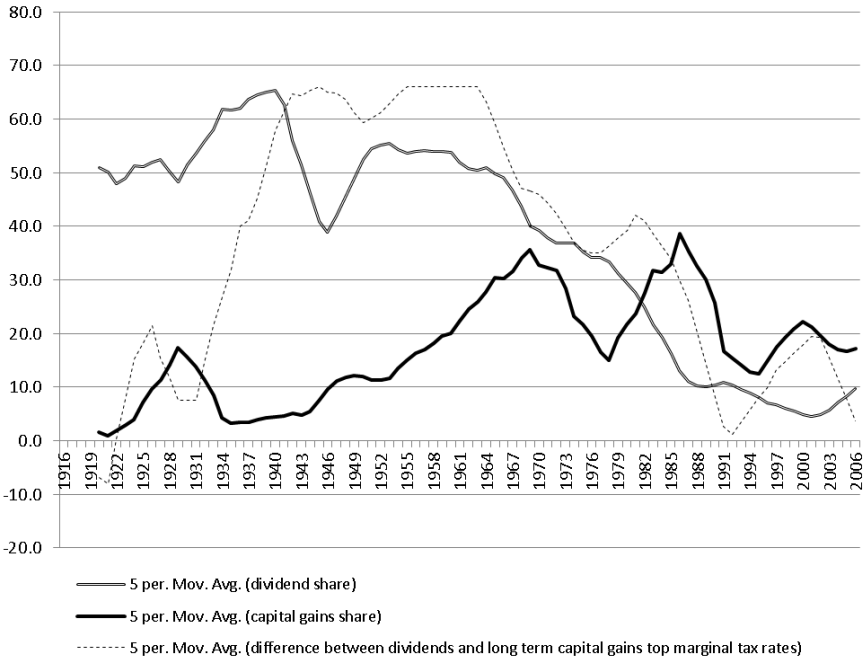
[18]Beyond this simple exercise, more compelling evidence requires the use of more appropriate micro-data.

Figure 2.2: Role of Capital Gains across Income Groups and over Time: Recalculating Capital and Wage Income Share



The adjusted series are calculated by including capital gains income in the definition of capital income. However, capital gains were not considered for the definition and calculation of the fractiles. Share of business income is not represented in the graph. Source: Piketty & Saez (2003) and Saez (2012) data updates and author's own calculations.

Figure 2.3: Dividends vs Capital Gains in Top001

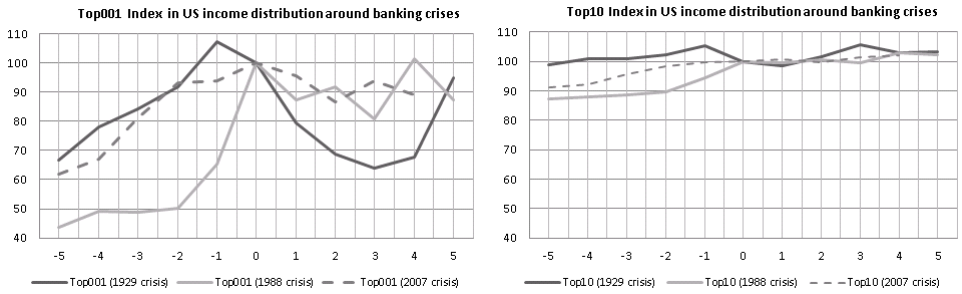


Note: Y-axis represents percentage points. The graph shows the 5 years moving average of the share of dividends and capital-gains within total income. Dashed line represents the relative 'fiscal convenience' of long term capital gains for highest income groups. 'Fiscal convenience' is calculated as the difference between the highest marginal tax rate on dividends and that on capital gains. Sources: Piketty & Saez (2003) , data updates from Saez (2012) and author's own calculations). Sialm (2009).

decrease or slow down their growth following a systemic banking crisis. I summarise the evidence with the use of standardised level of top shares and their share growth rates around the crises episodes.

In particular, I set top shares to take value of 100 at the crisis year (period 0). Figure 2.4 shows the behavior of the top hundredth percentile (what it is labeled as top001[19]) as well as the top decile share (labeled as top10[20]) in the US income distribution around crises episodes (figures exclude capital gains). The Top001 share appears to have a cyclical or inverted V-shaped pattern while the top decile seems not to be particularly affected by the occurrence of a systemic banking shock and it generally shows little changes.

Figure 2.4: Top001 and Top10 Standardised around Crises Episodes: Excluding Capital Gains



Source:Piketty & Saez (2003) , data updates from Saez (2012) and author's own calculations.

The cyclical pattern of the share of the richest group in the US income distribution has been recently thoroughly documented in Parker & Vissing-Jorgensen (2010) and does not strike as a new finding. More interesting, however, appears the behavior of the top decile share. This demands further investigation as well as raising all sorts of interesting questions.

What drives the dynamics of top shares? To what extent are banking crises responsible for such pattern? Is the impact of crises different over time? As I proceed in the paper I will attempt to provide some answers which, although incomplete and non-definitive, are considered to be a step toward the understanding of such complex issues.

[19]The top001 share is, in other words, the share in total income of the upper income bracket above the 99.99th percentile (P99.99).

[20]Using the same terminology as before the top decile is the upper income bracket above the 90th percentile (P90)

It is worth mentioning, however, that a mere analysis of the temporal association between the shares dynamics and the occurrence of the crises does not take into account the fact that top shares may be influenced by trending patterns and structural changes of any sort[21]. For instance, Figure 2.4 suggests, at a first glance, that recent banking crises had milder impact on the richest shares in US income distribution compared to the impact of the 1929 Great Depression. However, if one assumes that a positive growth of top shares preceding a crisis is entirely or partially due to a time trend, then the decrease of top shares following the shock may be underestimated during the recent crises episodes. In other words, the pattern around crisis episodes has to be rotated clockwise.

This and other issues concerning the non-stationarity of the series are spelled out more clearly in the following subsections.

2.3.2 The dynamics of an income share

Before describing the empirical specification of the analysis is worth discussing what drives the growth rates of top income shares. If one defines the top income share as $s_i = y_i/Y$, the explicit form of the growth rate of top shares is the proportional difference between the growth of income within a specific top income group i (y_i) and the total income of the remaining households at the bottom of the economy with the exclusion of group i (Y_{-i}). Where the scaling parameter s_i is the share in total income of income group i.

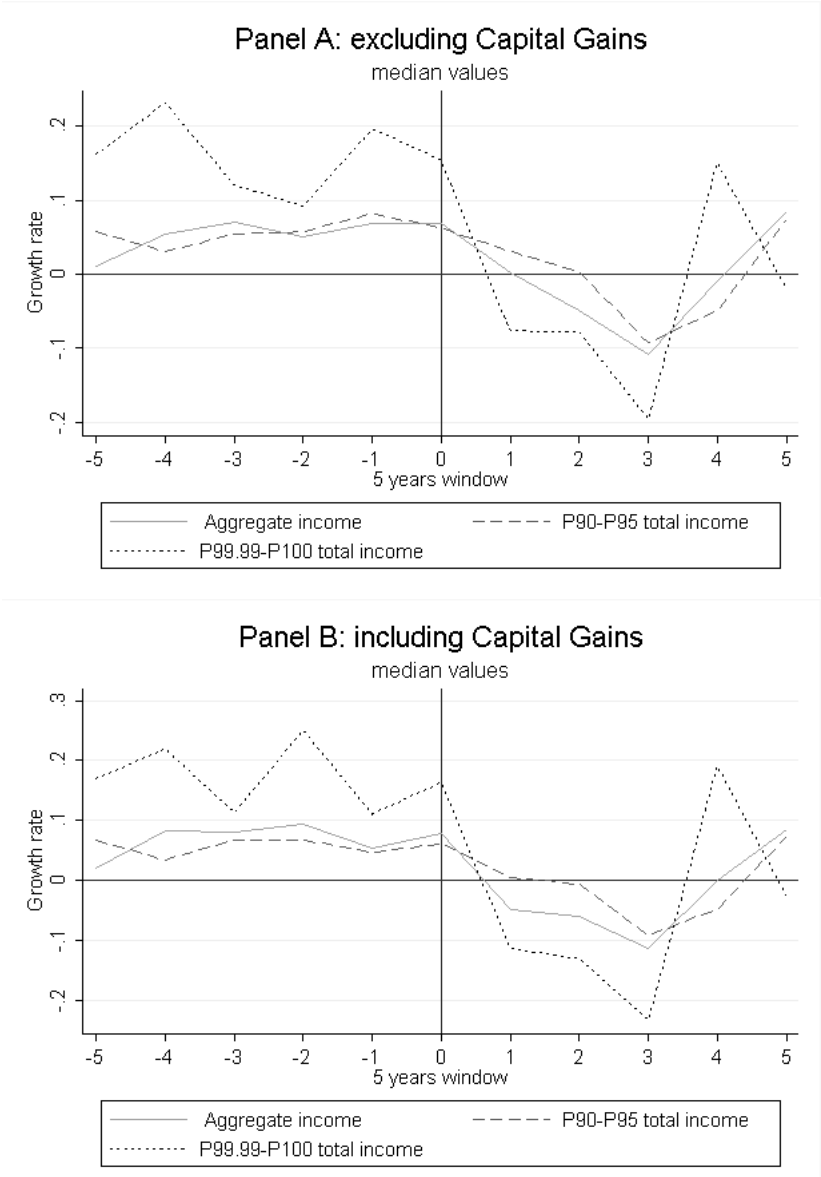
$$\frac{ds_i}{s_i} = \frac{dy_i}{y_i} - \frac{dY}{Y} = (1 - s_i)[\frac{dy_i}{y_i} - \frac{dY_{-i}}{Y_{-i}}]. \tag{2.1}$$

noting that $Y = s_i y_i + (1 - s_i)Y_{-i}$

Equation (2.1) highlights how the growth rate of upper groups' income (numerator) automatically influences the growth rate of total income in the economy (denominator). Therefore, other things being equal, the bigger the relative share in total income (s_i) of the upper group, the lower the growth rate of the share itself (in absolute value). On the other hand, Equation (2.1) also shows the role of relative cyclicality

[21] For example I warn the reader that changes in taxation regimes are not taken into account at this stage. A clear illustration is the US Tax Reform Act of 1986 (TRA86) which, among other things, brought the top marginal tax rate on personal income from 50% to 28% in 1988 (the top rate was reduced to 38.5% in 1987). TRA86 also reduced the tax rate on corporate income from 46% to 34%, to a level higher then top tax marginal rate. This might have incentivised income shifting from corporate income to personal income (Slemrod (1996), Slemrod (2000)) and reduced tax evasion at the top. Both could have impacted strongly on the short-term level of top income shares. Indeed the highest fractile share in total US income (top001) grew by 30% from 1986 to 1987 (a year of stock market crash) and by 53% from 1987 to 1988 (when a banking crisis hit). Moreover, a growth rate of 53% is the second highest growth rate recorded from 1913 to 2008. Such behavioral response to TRA86 changes in taxation has also been discussed in Piketty & Saez (2003).

Figure 2.5: Median Growth Rates of Total Income around Crises Episodes



Each data point represents the median value of income growth rate. In particular, the growth of total income in the economy is compared to that of total income accruing to different top groups (top 0.01 and top10-top5) around the three crises episodes under investigation. The period 0 represents the onset of the crisis and I observe the dynamics of the variables in a symmetric 5-years time window. Source: Piketty & Saez (2003) , data updates from Saez (2012) and author's own calculations.

of top groups' income compared to the rest of the population. This factor is indeed very relevant.

In Figures 2.5 I compare the aggregate income (P0-P100) growth rate to that of specific income groups, showing that income is cyclical for every upper group for median values around crises episodes. However income is most cyclical for the richest groups (as shown also in Parker & Vissing-Jorgensen, 2010 for the post-1980 period). Therefore the shares of richer fractiles decline (or rise) when their average incomes decline (or rise). For poorer fractiles within the top decile this is not necessarily the case, especially during crisis years.

Importantly, the described features of top shares volatility are also consistent with the observation made in Parker & Vissing-Jorgensen (2009). Namely, the authors refer to the fact that growth rates of top income in Piketty and Saez's database are likely to be a downward biased representation of the effective growth rates of the total income of a given group of upper tax units. This happens as they do not track the same households over time. Hence, to say it with their words, "*If high-income households are more exposed to aggregate fluctuations, some of them will fall into lower percentile groups when aggregates fall and will rise up the distribution when aggregates rise. This composition could actually bias down the relative exposure of high-income groups.*" Such data feature is less relevant for the present study which does not intend to track same tax units over time, but rather the yearly snapshot of share of total income held by upper groups. Yet it provides a possible explanation of the average stability or rise in top decile share in post-crisis years. Also, note that in the case of richest percentile (top001), a likely bias is constrained, as by construction new tax units can 'enter' the fractile only from the bottom and no tax unit could 'leave' the top group because of higher income level.

The Growth Rates of Top Shares and Financial Crises Figure 2.6 summarises the evidence for the Great Crash, Savings & Loans crisis and the recent Financial Meltdown, showing broadly that top shares in total income (including and excluding capital gains) experienced sustained positive median growth rates during the five years preceding a systemic banking crisis[22]. On the contrary, the median growth rates drop to negative values for the three years following the financial shock. However, this is a general description which applies only to richer top income groups. Indeed, the results show that richer fractiles (above P99) and 'poorer' ones within top decile (below P99) seem to form two distinct groups whose shares in total income are negatively and significatively correlated especially during the period surrounding the financial shocks[23].

[22] I prefer to summarise the evidence for the three US systemic banking crises with median rather than mean values as the former can smooth out excess variability due to potential outliers in small sample. In any case, mean values have been calculated and they match pretty closely the median ones.

[23] The correlation is particularly highly significant for the series including capital gains and it appears robust to the use of different time windows. Moreover, the correlations before crisis appear slightly stronger than the period after the crisis.

For example, the top decile share net of the top5 (called hereinafter top10-top5[24]), grew on average 4 percent after a banking crisis (excluding capital gains), while it had a negative average growth of around 1 percent in the years preceding the crisis. Instead, the richest fractile share in total income (top001) grew on average around 13 percent preceding banking turmoil and then it dropped by 9 percent. Such changes around banking crises episodes are all statistically significant mostly at 1 percent significance level, except the case of top decile as a whole.
It is also worth noting that I focus the attention on non-overlapping fractional percentiles within the top decile. This avoids artificial positive correlation of growth rates, driven by the direct interdependence of top fractile groups [25].

Given the importance of the discussion above and in order to ease the discussion, the analysis will hereinafter focus exclusively on the top10-top5 and top001 fractiles. These two groups, as described above can act, with no loss of generality, as representative groups of respectively the 'poorer' and the 'richer' fractiles within the top decile. To complement the analysis, results are also reported for the top decile as a whole. This will highlight that focusing on different top shares is indeed important and failing to take that into account can lead to misleading conclusions.

[24]The top10-top5 share is the share of the upper income group included between the 90th percentile and the 95th percentile, also called P90-P95.

[25]Indeed, as an example, all tax units within Top001 share are in turn fully contained in Top01 income group. Tax units populating the latter are then contained in Top1 which in turn forms part of Top10 group.

Box A: Comparison with Stock Market Crashes For a brief comparison one can do a similar analysis in the case of general stock market crashes. I use the dates listed in Mishkin & White (2003) where the two authors, taking 1929 and 1987 as a benchmark, identify stock market crashes when an overall nominal decline of minimum 20% in the stock market index is recorded. The recent 2007 crash also fully qualifies as a market crash according to this criteria.[a].

Having dropped the stock market crashes that coincide with systemic banking shocks (1929,1987 and 2007), I observe that the share in total income (excluding capital gains) of the top hundredth percentile dropped on average by 4 percent during the three years following the crash, after gaining only a maigre 0.5 percent in the preceding years on average.[b]. On the other hand, the dynamics for 'poorer fractiles' within the top decile no longer appears statistically significant and the overall top decile shows a significant average drop of 1 percent following the crash. Hence richer and poorer fractiles within the richest 10 percent group of US households no longer seem negatively correlated around stock market crisis periods. Interestingly and differently from the cases of systemic banking shocks, the richer fractiles don't seem, on average, to earn disproportionate income prior a general stock market crash, while the top decile as a whole looses ground in the three years after the shock.

I argue that the difference observed in the behavior of top shares in the aftermath of the two different financial shocks could be potentially due to the role of unemployment dynamics. Indeed, in the sample used here I do not systematically observe large rises in unemployment and large drops in total reported income following general crashes in stock markets. Conversely this was the case for each of three systemic banking shocks under investigation[c]. However, unemployment cannot explain also the different dynamics prior the occurrence of the two types of shocks. The latter may be due to the role of financial bubbles generating disproportionate gains accruing to the top of the distribution or, more controversially as suggested within recent literature (and explored in detail within Chapter 4, can reflect the role of rising inequality in leading to banking crash.

[a] Crashes identification varies depending on the index used (DowJones, S&P500 or NASDAQ) and depending on the time window used to record a decline in shares price. Using weekly data for Dow Jones only 1929 and 1987 are identified as crashes. Using a three months window crashes are identified in 1907, 1930-1932 and 1987 with DowJones whilst S&P500 identifies also 1929 and NASDAQ 1987 among others. Using a year window and the DowJones one could identify among others,1904,1914, 1915, 1930-33 and 1988. S&P500 identifies 1907, 1917, 1930-33. With the use of NASDAQ one can also add 1984 as a crash year. Even though the analysis of Mishkin and White stops in early 2000, it is easy to check that the 12 months window would certainly list the year 2008 as a "crash" year. DowJones went down more than 20% from the peak of October 2007 to July 2008 and by more than 50% until March 2009.

[b] The difference is significative at 10 percent significance level comparing the three years preceding a crisis, including the crisis year itself, to the three years following a crisis. Differences have been tested statistically also accounting for potential change in variance. In addition, the figures are almost exactly the same for the shares including income from realised capital gains.

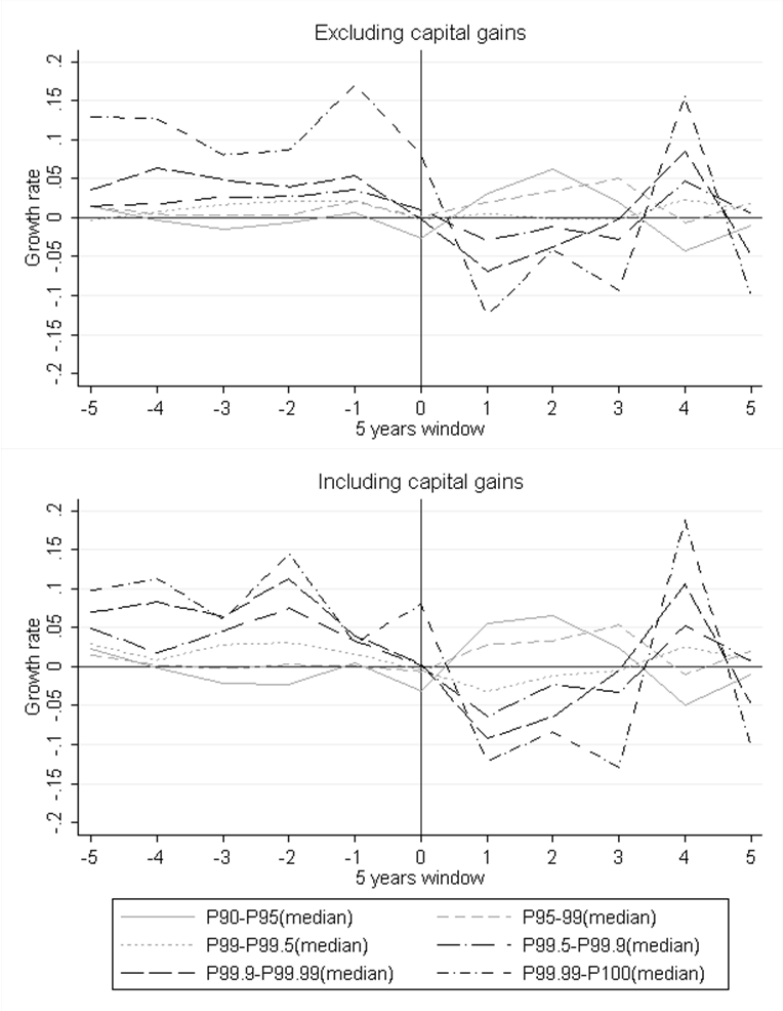
[c] I would provide further evidence for such observation in the following sections.

2.4 Counterfactual Analysis

To what extent one can ascribe the change in top income share to the occurrence of a systemic banking shock? In fact, a drop in the top shares can be simply part of the cyclical behavior of the series and have nothing to do with the financial turmoil. Similarly, as discussed above, the time trend should be accounted for in attempting to answer such questions.

One can exploit historical variation of the series in order to forecast the pattern of the top series from the perspective of the crisis year. This would helps to visualise what the shares would have been had the crisis never occurred. It would be more precise talking about pseudo-forecast given that I forecast something whose actual value

Figure 2.6: Median Growth Rates of Different Top Fractiles Share of Aggregate Income around Crises Episodes



Each data point represents the median value of the growth rate of total income accruing to different non-overlapping upper groups around the three crises episodes under investigation. The period 0 represents the onset of the crisis and I observe the dynamics of the variables in a symmetric 5-years time window.
Source: Piketty & Saez (2003) , data updates from Saez (2012) and author's own calculations

is already known, for comparison needs. Therefore no out of sample forecast is performed. I therefore attribute to the term forecast a more general meaning.
In a following step I then try to gauge the statistical significance of the findings.

The main conceptual idea of the empirical specification is similar to that adopted in Romer & Romer (1989) who have attempted to gauge the implications of exogenous monetary policy shocks on unemployment rate and industrial output.[26]

It should be stressed however that the results presented in the section below, do not carry any causal interpretation which is very difficult to establish given the nature of the data. The purpose is to present the empirical evidence in the clearest possible way.

Counterfactual Analysis Using Forecasting

The objective of this section is to investigate whether the top shares series deviate from their forecast pattern following a banking shock and given their past behavior. This can be considered as a first step towards comparing actual values with some row measure of counterfactuals.

However, a forecast model performs well if based on stationary series and this imposes a constraint on our model specification. Stationarity implies that past observations of the series are informative about its future dynamics. Indeed, in stationary series the future is equal to the past in probabilistic terms. Standard causes of non-stationarity are the presence of a trend (deterministic or stochastic) or any structural break.

Data on top-shares in level have a clear non-linear trend, the presence of structural breaks can be detected through standard techniques[27] and one cannot rule out the presence of stochastic trend (unit root)[28].

This leads me to exclude a model specification based on the levels of the shares in favor of one based on their growth rates. As a matter of fact, the growth rate series

[26]Recent work by Cerra & Saxena (2008) used a similar methodology to explore the role of a set of macro shocks (among others banking crises) on economic performance for a panel of countries. A more detailed discussion about a similar methodology is found in Pesaran & Smith (2012) who describe it as 'ex-post' counterfactual analysis. Next chapter deals with this issue in more details.

[27]For example assuming that breakpoint is unknown, the estimation of Quandt's breakpoint statistic helps detecting at least one break for every top share under analysis. For more details and precise estimation of the structural breaks in top income shares series see Roine & Waldenström (2011)

[28]Although there is not much discussion around this issue, some scholars have argued that unit root hypothesis testing on bounded shares present some logical flaws. Indeed, a share (bounded between 0 and 1) cannot have an infinite variance as a 'random walk' would instead formally require. See Jäntti & Jenkins (2010) for further discussion about unit root tests on inequality variables. Even though one is not willing to accept this argument, it remains true that standard unit root testing procedures are not appropriate for bounded series and this issue was largely neglected in the literature. See also the useful discussion in Cavaliere (2005), Granger (2010) and Cavaliere & Xu (2013)

of top shares do not present any structural break[29] and present a straightforward linear time trend. Once controlling for a linear time trend[30] the series would therefore become trend-stationary[31]. Furthermore, the exercise based on growth rates would carry out straightforward interpretation and can be also useful to estimate the unforeseeable impact of each banking crisis on the levels of top shares, our ultimate interest. Indeed, this can be easily done by cumulating forecast errors estimated on growth rates.[32]

Forecast Model Following the study by Romer & Romer (1989), I adopt a pure time series approach estimating an autoregressive model over the entire period of reference (1913-2011). Estimated parameters are used to calculate forecast value of the rates of growth of top shares ahead in time. The forecast model includes 2 lags[33] and a deterministic trend component T and, as explained above, it is estimated on the growth rates of top shares (not on their levels):

$$g_{i,t} = \alpha_i + \sum_{j=1}^{2} \beta_{i,j} g_{i,t-j} \; + \gamma_i T_{i,t} + \epsilon_{i,t}. \tag{2.2}$$

The estimations are carried out using Newey-West estimators which allow for heteroschedaticity and autocorrelation of error terms.[34]

I make use of both the multi-periods forecast model and the iterated autoregressive method; the results obtained are very similar.

With the multi-periods forecast approach any s-steps ahead forecast requires the estimation of an autoregressive model which include the lags of forecast variable up to $t - s$, with $s \geq 1$. Conditioning on the information set at time $t - s$, the forecast

[29] Indeed, the Quandt's score does not detect any structural break

[30] For instance it is straightforward to show that if y follows an AR(p) model with a quadratic trend, its first difference would be still linearly dependent on time.

[31] It should be noted more precisely that the presence of a volatility clustering over time (changing variance over time) provide an additional source of non-stationarity. However this problem can be easily handled using standard Heteroskedasticity consistent definition of Var-Cov matrix in the model estimation.

[32] An alternative approach to the use of growth rate with linear time trend, would consist in using detrended observations of top shares. For example, the Hodrick-Prescott (HP) filtering technique (Hodrick & Prescott, 1997), like other time series filters, isolates a time-variant trend component $\tau_{i,t}$ and subtracts it from the series $y_{i,t}$ in order to obtain a cyclical component or de-trended high frequency series $d_{i,t}$. Detrending the top shares of income is an interesting exercise but requires an arbitrary choice of parameters and does not carry out straightforward interpretation.

[33] The number of lags has been chosen following the indication of the two standard information criteria. Bayesian Information Criteria and Akaike Information Criteria have been compared over the estimation of autoregressive models from 1 up to 6 lags. Indeed using 2 lags was coincident to a minimum for both BIC and AIC values.

[34] Truncation parameter has been selected using the standard rule $m = 0.75 * T * 1/3$, where T is the number of observations in the specification Andrews (1991). This rule suggests to use 3 lags ($m = 3$) in every estimation. The models appear also correctly specified as the assumption of autocorrelation in the residuals is rejected with very high confidence using conventional portmanteaus Q-tests.

model (which in my case contains only two lags as above stated) takes the following general form:

$$g_{i,t/I_{t-s}} = \alpha_{i,s} + \sum_{j=0}^{1} \beta_{i,j,s} g_{i,s,t-s-j} + \gamma_i T_{i,t} + \epsilon_{i,s,t}. \tag{2.3}$$

The parameter estimates vary for different s, which explains the presence of the subscripts in above equation. Note also that with *s=1* (2.2) and (2.3) are the same. At any time t then the s-steps ahead forecast takes the following form:

$$\widehat{g}_{t+s/I_t} = \widehat{\alpha}_s + \sum_{j=0}^{1} \widehat{\beta}_{j,s} g_{s,t-s-j} + \widehat{\gamma}_i T_{i,t}. \tag{2.4}$$

The variables and parameters are now stacked on the number of different income groups i.

The iterated forecast method instead simply iterates the single-period forecast in (2.2). For example the 2 steps ahead forecast at time t are obtained by iterating the single-period forecast using the forecast value of g_{t+1} estimated in t.

Evidence on the Growth Rates Equation (2.4) has been estimated with both forecasting methods for every fractile for the 1913-2008 period. Then I calculate dynamic forecasts of the growth rates of the top shares. This is done for every top group and for the four years following each of the three systemic banking shocks under investigation. Results for the richest fractile share of non capital-gains income (top 001 percent of the population) are illustrated in Figure 2.7, whereas results for the poorer group within the top decile (top10-top5) and the top decile as a whole (top10) are represented in Figure 2.8 and Figure 2.9. In both charts the forecast of future values of the growth rates of the shares under investigation are compared to actual values of top001 and top10-top5 growth rates, respectively for the three crises under investigation. Few things are worth noting.

First of all, the evidence from the two different forecast methods is almost identical[35], suggesting that the results are not driven by the different methodology adopted. Moreover, on one hand, the graph clearly shows that the growth rate of the richest fractile has been over-forecast and the growth of the top10-top5 has been under-forecast on average. On the other hand, the evidence is rather mixed insofar as the top10 growth rate is concerned and no clear pattern seems to prevail for this specific upper income group. To be more precise, the findings suggest that the actual post-crisis growth rate for the top001 tends to be lower than what expected based on the trending features and the mean-reverting property of the series. In particular, the actual values of the top001 growth rate lay systematically below its forecast value. This

[35]The only exceptions are the 1991 and 1992 forecast of top10-top5 growth rates, in which case the two different methodologies diverge quite substantially with their estimates.

also happens following the latest 2007 crisis with the exception of the third post-crisis year, when the actual growth rate value is slightly bigger then its forecast value. Note also that a great deal of the drop in growth rate for top001 which occurred in 1989, was easily foreseeable given the past dynamic of the series (mean-reversion) and, thus, cannot be directly attributed to the crisis. This is a valid example of the reason why I have adopted such methodology. The dynamics of the growth rate of top10-top5 is instead found to be higher than what forecast (see Figure 2.8) while the top10 growth rate is neither systematically under-forecast nor systematically over-forecast (see Figure 2.9).

Evidence on the Levels But what can one say about the level of the top shares? Indeed, ultimately one is interested in estimating the unforeseeable impact of each banking crisis on the top shares themselves. This can be easily done by cumulating forecast errors[36] at every year as represented in Figure 2.10. As shown in the latter figure, every systemic banking shock in US led to a similar drop in top001 which was not expected on the basis of past dynamic behavior of the series. Three years after the Great Crash in 1929, the top001 income share was around 30 percent lower than forecast value before beginning a partial recovery. Top shares followed a similar dynamics during the Savings and Loans crisis. However, the drop up to the third year from the shock appeared slightly higher, accounting for around 35 percent deviation from the forecasted pattern. Finally, the richest share is found around 25% below its forecasted value in 2010, three years from the onset of the most recent crisis and, differently from other episodes, there appear to be no sign of recovery in 2011[37]. It should also be noted that if I had estimated equations (2.2) to (2.4) without using the time trend I would have incorrectly obtained a very high impact for the Great Depression while the drop for recent crises on top shares would be almost halved. The perception that recent crises might have milder impact on top shares could have therefore been driven by the mis-specification of the model.[38].

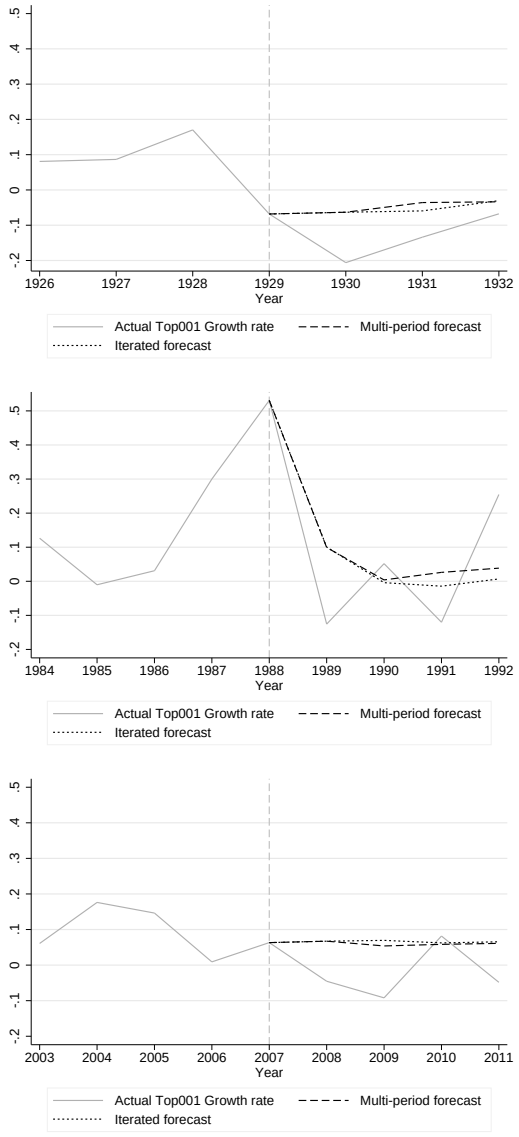
On the other hand, the share in total income for the P90-P95 income group was somehow under-forecasted by the model. This is consistent with the data account within the section of the preliminary results, in which I described the two shares of the bottom and the upper part of the top decile as negatively correlated around the crisis episodes. As a result, not much action is recorded in the top10 as a whole. What discussed above underlines again the importance of a disaggregated investigation of the data across different upper income groups.

[36] Note that the use of cumulated errors slightly accentuates the very small differences in forecast estimates obtained with the two different methods. The difference is however negligible and I prefer to make use of iterated method in order to carry on the forecasts exercise with a greater number of observations.

[37] It is important to note that the new data on the US top income share for the year 2012 were released few weeks after the submission of this thesis. In fact, the 2012 figures show a strong recovery of the US richest top shares. This would mirror what happened during other crises with a year lag.

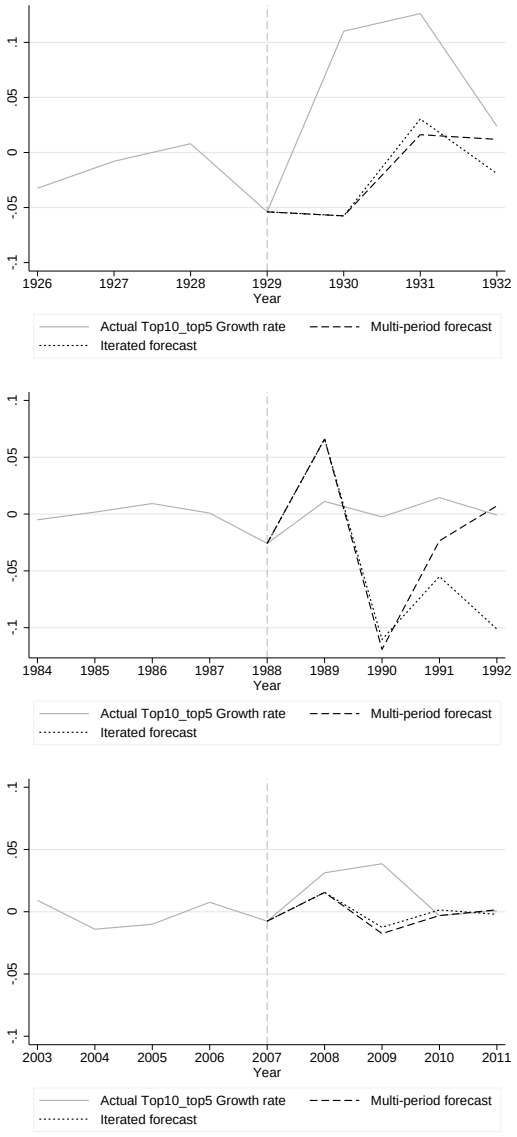
[38] Results are not tabulated but available upon request.

Figure 2.7: Actual vs. Forecasted Growth Rates of Top001 Income Share



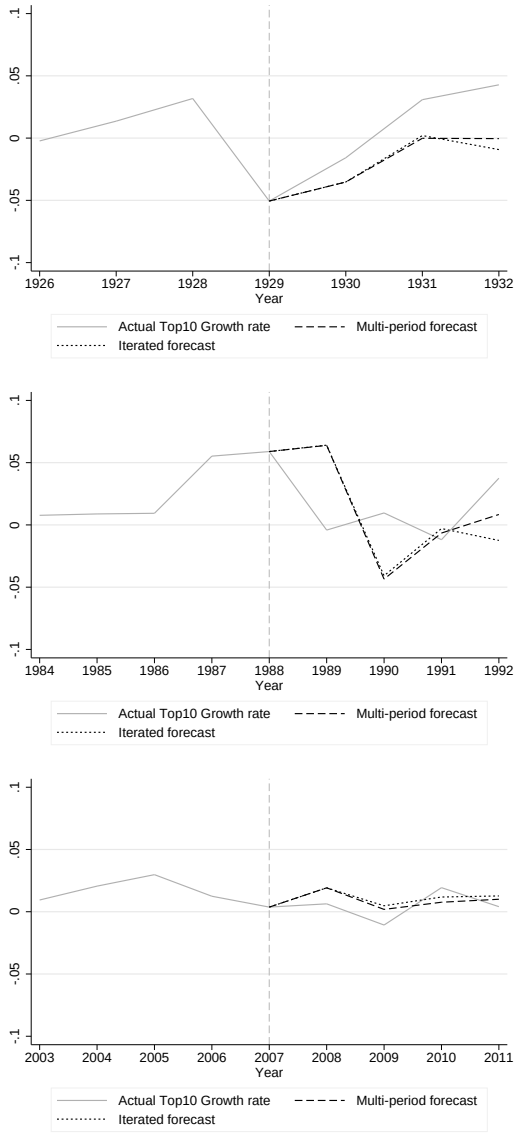
The graph shows the dynamics of the growth rate of top001 around the three crisis periods under investigation (beginning respectively in 1929, 1988, and 2007) compared to the forecast value estimated at t based on two forecast methodologies, namely the 'iterated' and the 'multi-periods' methods described in the text.

Figure 2.8: Actual vs. Forecasted Growth Rates of Top10-Top5 Income Share



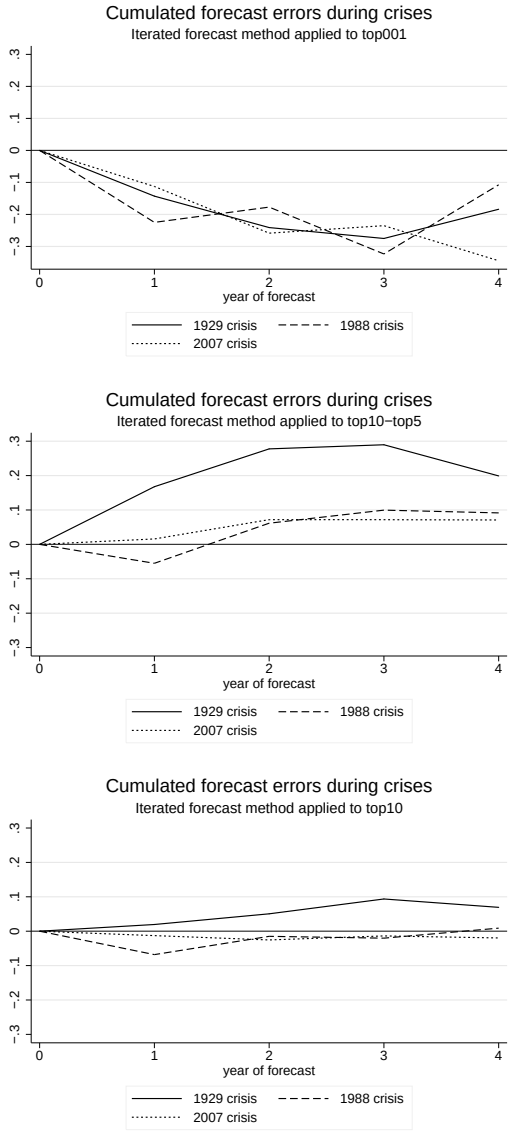
The graph shows the dynamics of the growth rate of top10-top5 around the three crisis periods under investigation (beginning respectively in 1929, 1988, and 2007) compared to the forecast value estimated at t based on two forecast methodologies, namely the 'iterated' and the 'multi-periods' methods described in the text.

Figure 2.9: Actual vs. Forecasted Growth Rates of Top10 Income Share



The graph shows the dynamics of the growth rate of top10 around the three crisis periods under investigation (beginning respectively in 1929, 1988, and 2007) compared to the forecast value estimated at t based on two forecast methodologies, namely the 'iterated' and the 'multi-periods' methods described in the text.

Figure 2.10: Cumulated Forecast Errors: Top001, Top10-Top5 and Top10 Income Shares



Each single charts represent the cumulative forecast errors in the 4 years following each US banking crisis, The forecast error at any point in time is computed as the difference between forecast value and actual value as represented in Figures 2.7,2.8 and 2.9. The data represents the cumulative forecast error based on the 'iterated' method described in the text.

Counterfactual Analysis Using Macro-Econometrics

Loosely speaking, I now try to associate a confidence band around the cumulated forecast error lines presented in Figure 2.10. In order to do that I estimate a bivariate autoregressive distributed lags model ADL(1,4), essentially an augmented version of the forecast model[39]:

$$g_{i,t} = \alpha_i + \theta_i g_{i,t-1} + \sum_{j=0}^{4} \phi_{i,j} BC_{t-j} + \gamma_i T_{i,t} + \nu_{i,t}. \tag{2.5}$$

$g_{i,t}$ is the growth rate of income accruing at group i in period t. BC_t is a dummy variable taking value of 1 at the beginning year of a systemic banking shock. The estimation of the ADL model (2.5) is done under the assumption of exogeneity of crisis event with respect to contemporaneous and past observations of the growth rates of top shares.[40]. Moreover, I am abstracting here from the influence of any other events, other than the occurrence of the banking shock, on top shares. Essentially I am attributing the entire post-shock dynamics of the shares to the financial shock itself.

Such an approach is certainly less informative about the direct and indirect impact of crises on top shares. However, it is not necessarily misspecified, in the case in which every subsequent relevant macroeconomic event (e.g. raise in unemployment, economic crisis, policy interventions and stock market swings) has been directly caused by the banking shock, or it is assumed to be so [41]. This argument has also been eloquently described in a recent paper about the so called 'ex-post' counterfactual approach in macro-econometrics by Pesaran & Smith (2012).

The model (2.5) was estimated individually for each income group using least squares regressions. The standard errors are computed using the Newey-West formula. As shown in table 2.1 the coefficients for Top001 of the baseline ADL model are negative for the three years following the crisis and indicate a recovery in the 4th year after the shock occurred. For instance, the growth rate of the top001 is reduced by around 18 percentage points one year after the onset of the crisis. The opposite happens to the growth rate of the share of P90-95 share. Indeed, the latter growth rate gains around 6 percentage points in the years after the crisis. This is true, though with greater magnitude, even looking a the series including capital gains, represented in the table 2.1 in the last three columns.

[39]Note that I now make use of only one lag of the dependent variable. This would ease the derivation of the impulse response functions as shown in the next section.

[40]The potential problem of endogeneity of the crisis dummy with respect to the growth rates of top shares is further analysed below.

[41]The beginning of the S&L crisis as I set it in 1988 was preceded by the 1987 stock market crash. However, the origin of the crisis as noted in the literature (see Reinhart & Rogoff, 2009 for instance) traces the origin of the banking turmoil in 1984, well before the stock market crash. In addition the stock market crash is not using annual observation of stock market indexes as recalled in Box A.

The estimated parameters of the ADL model can be now used to estimate the total effect of crisis on the growth rates as well as the levels of the top shares. This is done by calculating impulse response functions as further explained below.

Table 2.1: ADL Model Estimated for BC and Selected Top Shares (Including and Excluding Capital Gains)

	(1)	(2)	(3)	(4)	(5)	(6)
	Excluding capital gains			Including capital gains		
	top10	top001	top10_top5	top10	top001	top10_top5
BC	-0.004	0.130	-0.031*	0.001	0.150	-0.032***
	(0.024)	(0.136)	(0.012)	(0.028)	(0.097)	(0.008)
L.BC	-0.008	-0.175***	0.056+	-0.041***	-0.269**	0.083*
	(0.005)	(0.044)	(0.029)	(0.009)	(0.080)	(0.036)
L2.BC	0.007	-0.057	0.044	-0.012	-0.245***	0.050+
	(0.014)	(0.044)	(0.028)	(0.018)	(0.066)	(0.027)
L3.BC	0.012	-0.047	0.001	0.016	-0.089	0.001
	(0.015)	(0.055)	(0.011)	(0.016)	(0.090)	(0.015)
L4.BC	-0.002	0.071	-0.031	-0.001	0.067	-0.033
	(0.017)	(0.090)	(0.026)	(0.012)	(0.090)	(0.029)
L.Gtop10	0.161			0.047		
	(0.219)			(0.184)		
L.Gtop001		0.172			-0.137	
		(0.114)			(0.123)	
L.Gtop10_top5			0.190			0.176
			(0.179)			(0.166)
Observations	93	95	93	93	95	93

Newey-West Standard errors in parentheses
The table shows the coefficients of the estimation of the ADL model (2.5) on the growth rate of the top shares. Linear time trend and constant are suppressed from the table
$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Estimating Impulse Response Functions. The impact of a perturbation in the dummy variable D at time t (taking value of 1 if shock occurs and zero otherwise) is straightforward and is represented by the coefficient of the dummy variable at time t. Future dynamic multipliers are clearly dependent on the feedback effect due to the presence of lagged variables of the top share growth rates. Given the stationary nature of the series (growth rates), every impulse to the dynamic process would automatically decay over time and this approach becomes informative about the depth and duration of a change in top shares brought about by banking shocks. Defining ψ the vector of parameters ($\psi = \theta, \phi_1, \phi_2, \phi_3, \phi_4$), one can define the impulse response function realizations as $I^G_{i,j}(\psi, t)$ for the growth rate of top share (of top group i) evaluated at $j = 0, 1, 2, 3, 4, 5$ years following the onset of the banking shock at time T. The superscript G indicates that the estimates are related to the growth rates of top shares. As an example I derive below the first three realizations of the impulse response function

on the growth rates:

$$I^G_{i,0} = \phi_{i,0} \tag{2.6}$$

$$I^G_{i,1} = \phi_{i,0}\theta_i + \phi_{i,1} \tag{2.7}$$

$$I^G_{i,2} = \phi_{i,2} + \theta_i(\phi_{i,0}\theta_i + \phi_{i,1}) \tag{2.8}$$

By cumulating those responses over time one obtains the dynamic cumulated impact on the level of top shares for every income group i, indicated as $I^L_{i,j}(\psi, t)$.

$$I^L_{i,0} = I^G_{i,0} \tag{2.9}$$

$$I^L_{i,1} = I^L_{i,0} + I^G_{i,1} \tag{2.10}$$

$$I^L_{i,2} = I^L_{i,1} + I^G_{i,2} \tag{2.11}$$

It is worth noting that every realization of the IRF is a non-linear combination of the parameters of the ADL model, like the ones reported in Table 2.1.

The tabulations of the estimated version of the impulse response functions for both the growth rates and the levels ($I^G_{i,j}(\widehat{\psi}, t)$ and $I^L_{i,j}(\widehat{\psi}, t)$) for selected income groups are instead reported in Tables 2.2 and 2.3.

Table 2.2: Impulse response function of selected top shares to BC : excluding capital gains

	(1) top10_G	(2) top10_L	(3) top001_G	(4) top001_L	(5) top10_top5_G	(6) top10_top5_L
I.0	-0.004	-0.004	0.130	0.130	-0.031*	-0.031*
	(0.024)	(0.024)	(0.136)	(0.136)	(0.012)	(0.012)
I.1	-0.009*	-0.014	-0.152***	-0.022	0.050+	0.019
	(0.005)	(0.025)	(0.032)	(0.140)	(0.027)	(0.022)
I.2	0.006	-0.008	-0.083+	-0.105	0.053+	0.073
	(0.014)	(0.025)	(0.043)	(0.161)	(0.032)	(0.051)
I.3	0.013	0.005	-0.061	-0.166	0.011	0.084
	(0.016)	(0.031)	(0.048)	(0.154)	(0.008)	(0.056)
I.4	0.000	0.005	0.061	-0.105	-0.029	0.055
	(0.015)	(0.028)	(0.087)	(0.174)	(0.026)	(0.053)
I.5	0.000	0.005	0.010	-0.095	-0.006	0.050
	(0.002)	(0.028)	(0.015)	(0.179)	(0.007)	(0.054)
Observations	93	93	95	95	93	93

Standard errors in parentheses
+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

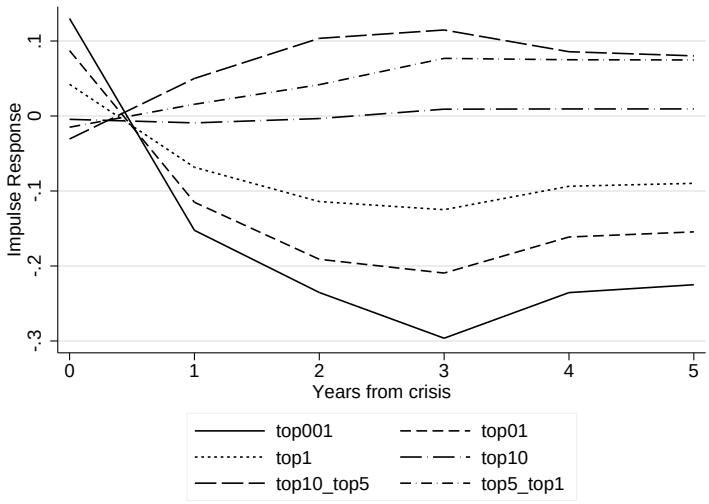
Results are also shown graphically in Figure 2.11 for the levels of top shares across different upper groups. In addition, the individual impulse response functions for all selected top income groups, for both levels and growth rates as well as for both series including and excluding capital gains, are fully represented in Figures 2.12 and 2.13, including a 1 standard-error confidence band.

Table 2.3: Impulse response function of selected top shares to BC : including capital gains

	(1) top10_G	(2) top10_L	(3) top001_G	(4) top001_L	(5) top10_top5_G	(6) top10_top5_L
I_0	0.001	0.001	0.150	0.150	-0.032***	-0.032***
	(0.028)	(0.028)	(0.097)	(0.097)	(0.008)	(0.008)
I_1	-0.041***	-0.040	-0.290***	-0.139	0.077*	0.044
	(0.010)	(0.037)	(0.066)	(0.140)	(0.036)	(0.036)
I_2	-0.014	-0.054	-0.206***	-0.345*	0.064*	0.108+
	(0.016)	(0.039)	(0.054)	(0.171)	(0.030)	(0.063)
I_3	0.015	-0.038	-0.061	-0.406*	0.013	0.121+
	(0.016)	(0.040)	(0.091)	(0.169)	(0.013)	(0.068)
I_4	0.000	-0.038	0.076	-0.331+	-0.031	0.089
	(0.011)	(0.041)	(0.096)	(0.184)	(0.028)	(0.067)
I_5	0.000	-0.038	-0.010	-0.341+	-0.005	0.084
	(0.001)	(0.041)	(0.015)	(0.177)	(0.007)	(0.067)
Observations	93	93	95	95	93	93

Standard errors in parentheses
+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 2.11: The Impulse Response to Crisis on the Levels of Selected Top Groups



The IRFs are estimated using the parameters of the baseline ADL model reported in Table 2.1

Figure 2.12: The Impulse Response to Banking Crisis on the Growth Rates of the Shares of Selected Top Groups

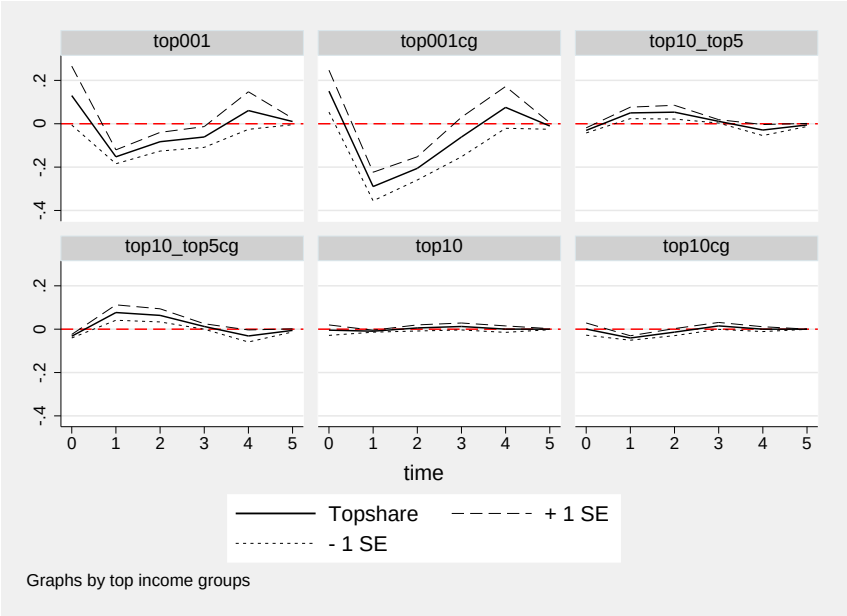
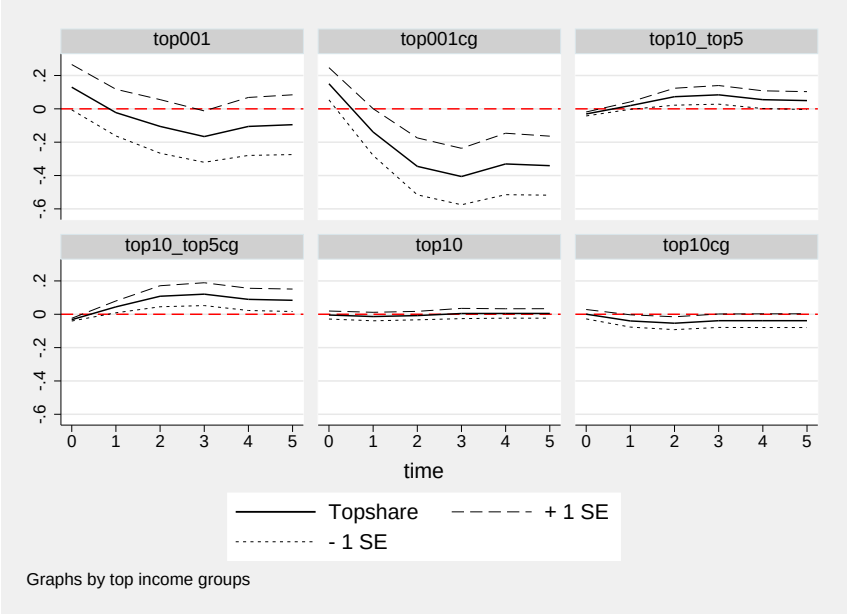


Figure 2.13: The Impulse Response to Banking Crisis on the Levels of the Shares of Selected Top Groups



Estimation of Standard Errors Given the nonlinear combination of estimated parameters, the estimation of SEs are obtained with the *Delta method* through asymptotic results [42].

Main Results The empirical evidence using above methodology suggests that the impact of US banking crises so far has been negative at the very top, positive at the bottom of the decile and, as a consequence, 'neutral' for the entire top decile share. Thus, the use of different top income share in the analysis matters as can provide contrasting evidence, marking the importance of the decomposition of income groups at the top. Information on Top10 solely would lead to conclude that crises have no impact on the 'rich' share of total income. It is also worth noting that the growth rates of the shares of the two independent subgroups under investigation (top001 and top10-top5) are significantly affected in the two years following a banking shock. Negatively in one case (for the top001) and positively in the other (for the top10-top5). This implies, on one hand, that the level of the richest top share is found to be, on average, lower that what it would have been predicted in the absence of crisis, based on previous dynamics of the series and including trend patterns. On the other hand, the bottom group within the top decile (P90-P95) gained in relative terms in the years following a systemic shock. Moreover, due to the substantial shock to the growth rates, the effect on the levels is not entirely re-absorbed in the medium-run. Indeed, the top hundredth percentile share in total non capital gains income is found to be 2 percent lower (with respect to the counterfactual) during the first year following the crisis and it is still 10 percent lower after five years (table 2.2, column (4)). These figures drop respectively to -14 and -34 percent if I include capital gains in the definition of income (table 2.3, column (4)). These figures, translated in top001 units, imply that the share is found, after 5 years from the crisis and on average, to be 0.14 percentage points lower than the counterfactual value in the case of the share excluding capital gains. This is equivalent to almost a sixth of a standard deviation[43]. If one includes capital gains, the recorded drop in top001 is almost three times as big and equivalent to 1.1 percentage points, accounting for almost 3/5 of one standard deviation[44].

In other words, the estimated effect of crises on the shares is not substantial in magnitude but appears relatively long-lasting. However, it is worth stressing that, although the clear signs of recovery of top shares at the 4th year following the shock are not sufficient to bring the levels of the shares back to the no-crisis 'equilibrium' path, such qualitative feature of the results may not be very robust to changes in the specification, controlling for other variables. This becomes clearer in the robustness section.

[42] The asymptotic variance-covariance matrix is effectively estimated through the command 'nlcom' in Stata 12 routine, following the estimation of each model.

[43] These figures are calculated by noting that the average value of top001 is 1.4 and its standard deviation is .97 over the entire period.

[44] The average value of top001 including capital gains is 2.3 and its standard deviation is 1.3 over the entire period.

The evidence for the top10-top5 share is almost specular to that of the top001 but the magnitude of changes are only at a first glance smaller. Indeed, two years after the shock the level of the share in total income of the P90-P95 upper group is on average around 7 percent higher than the no-crisis scenario. The series remains at around 5 percent above the counterfactual even 5 years following the shock, respectively for the series excluding capital gains (figures for the series including capital gains raise to respectively 10 an 8 percent). This is equivalent to say that the share is found to be 0.6 (1.1) percentage points below the counterfactual measure at the 5th year from the crisis if one considers the series excluding (including) capital gains. This is equivalent to approximately 1 standard deviation.[45]

2.5 Reverse 'Causality'

The consistency of the estimated parameters in the ADL model (2.5) rests on the assumption of exogeneity of the crisis dummy variable with respect to the growth rates of top income shares. Up to now, I have systematically assumed away any feedback effect going from inequality to occurrence of crisis and I have assumed that crisis has a contemporaneous effect on the growth rate of top shares. Nevertheless, a growing body of research is now focusing on whether increasing income dispersion (or high levels of dispersion[46]) could increase the likelihood of a crisis to occur.

A simple way to control for this potential endogeneity problem is to assume that crisis and top shares growth rates are contemporaneously uncorrelated so that changes in $g_{i,t}$ at the year of the onset of the crisis would be entirely attributed to innovations to the growth rate process and not to the crisis itself (the assumption $\phi_{i,0} = 0$ turns the crisis variable into a predetermined variable)[47].

As shown in the data in Figure 2.6, top income shares were generally on the rise before and during the onset of the major US banking crises, meaning that it was im-

[45]The average values for top10-top5 shares are 11.45 and 11.24 respectively for the series excluding and including capital gains. The relative standard deviation values are 0.87 and 0.84.

[46]The distinction between the 'growth' hypothesis from the 'level' hypothesis is indeed a crucial one as I discuss in Chapter 4.

[47]The assumption that crisis may be caused by increasing top income shares may seem a peculiar suggestion. As discussed more thoroughly within Chapter 4, the available empirical evidence linking the growth rate of income inequality to the occurrence of financial crisis does not yet provide any convincing evidence that such a nexus between the growth of inequality and the occurrence of banking crisis exists. This conclusion was also reached by Atkinson & Morelli (2010, 2011) and Bordo & Meissner (2012). The latter study tested explicitly whether the growth rate of top income shares were increasing the probability of the occurrence of banking crisis. Similarly I tested a probit model linking the growth rates of top shares to the crisis variables and its lags (results are not shown in the chapter but do not suggest any strong relationship between the two variables). However, as it is also made clear in the Chapters 4, the empirical evidence is not conclusive yet and new theoretical and empirical works indicate divergent results. For this reason, the estimates controlling for crisis endogeneity, at this stage, are preferred to the baseline ones throughout the chapter. In ay case, even ruling out the possibility that growing inequality may be one of the causal factor of a crisis, the assumption $\phi_{i,0} = 0$ would simply allow a lagged impact of crises on top shares. The latter is not an unreasonable assumption.

plicitly assumed so far that such a positive change in top shares was brought about by the crisis itself. This was true especially for the richest top shares as the top10-top5 share had median pre-crisis growth close to zero. By assuming $\phi_{i,0} = 0$, instead, I allow the possibility for such a positive change in top income shares to be the 'cause' of the crisis. Given that the impact of crises on richest top shares for the subsequent year is negative, this suggests that the estimated IRFs described in the previous section were conservative estimates of the total impact of crises on richest top shares (e.g. the distributed lag model carries out the positive impact in year 0 to following years).

Results, are shown in Figure 2.14 and highlight that the magnitude of the IRFs realization for each period following the crisis is indeed bigger for the richest top shares (top001) and substantially unvaried for the top10-top5 share, irrespectively of whether one includes or excludes capital gains. The peak of the drop in top001 (excluding capital gains) now reached approximately 40% in the third year from the onset of crisis[48] (this is equivalent to a drop of the share by approximately 0.5 percentage points[49]. Instead and consistently with the evidence discussed above, the percentage impact on the top10-top5 is found substantially unvaried and it is approximately only 1 percentage point bigger compared to the baseline case (again this is clear comparing Figure 2.14 to Figure 2.13. This is equivalent to an additional 0.1 percentage points variation in the share.

2.6 Robustness

In this section I check that the consistency of the main results by changing the econometric specification and after a series of robustness checks.

2.6.1 Omitted Variables

As mentioned above, banking crises are usually accompanied by a series of policy interventions, shocks to the economy, the labour market and the financial markets. These variables might play a crucial role in driving the top shares and so far variables other than time trend, crisis dummy and top shares lags, entered the specification of the baseline model (2.5). However, as discussed within the counterfactual analysis section, the estimated counterfactual (the estimated value of top share in the absence of a crisis) is not valid if one conditions the model on variables which are directly affected by the crisis itself[50].

I control below for two additional variables[51], namely the change in marginal tax

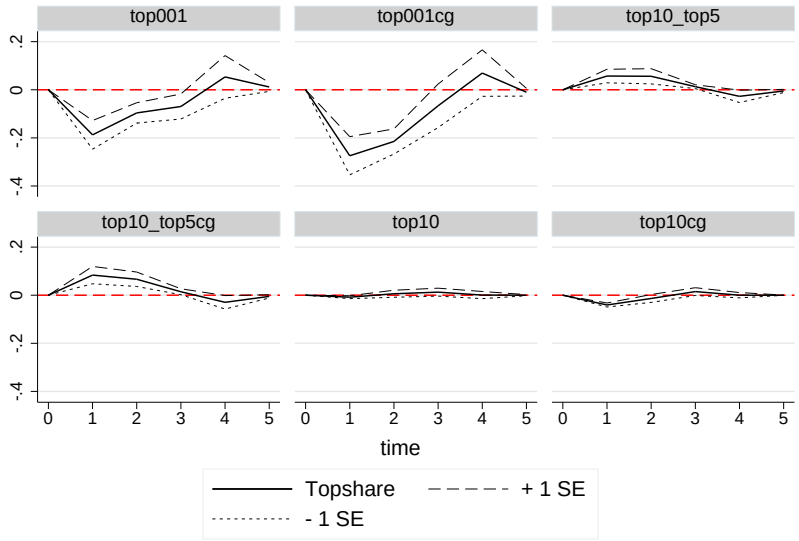
[48]The drop in top001 share is approximately 20 percentage points lower using the baseline specification described before (see Figure 2.13).

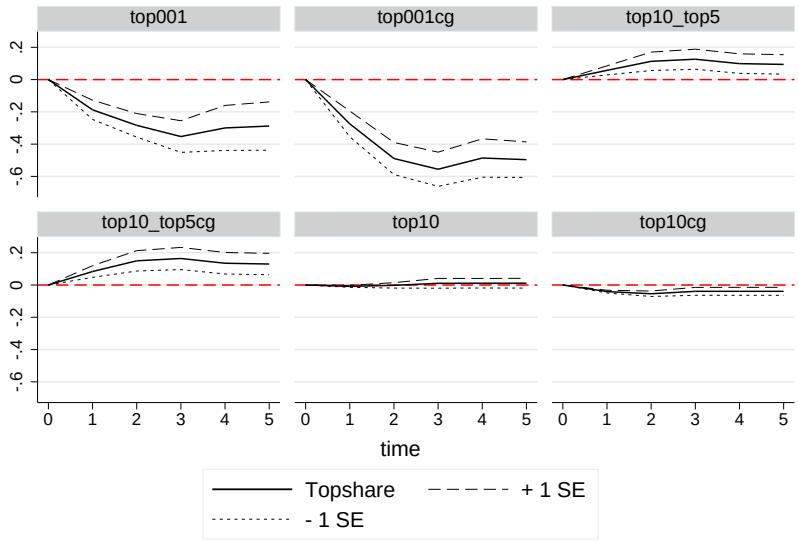
[49]This is, for instance, almost the actual drop in top001 from 2007 to 2009.

[50]This aspect is detailed also within next chapter.

[51]Under the assumption that the short-run changes in the variables listed above are not directly ascribed to the banking crisis.

Figure 2.14: Controlling for Crisis 'Endogeneity': the Impulse Response to US Banking Crises on the Growth Rates and the Levels of the Shares of Selected Top Groups.





rates[52] and the change in the average real GDP per-capita[53] observed in the 26 countries analysed within these thesis (to proxy the global economic activity[54]. I consider both controls as particularly relevant for the reasons exposed below.

On the one hand, controlling for general economic activity in countries other than the US prevents to capture the changes in top shares that are linked to a general depression effect, involving other countries and affecting the US above and beyond the total effect of the banking crisis. Indeed, top shares are strongly correlated across countries (as it is made clearer in the next chapter). On the other hand and as mentioned in the introduction, the use of taxation-based data makes the households' reported income particularly sensitive to changes in taxation as individuals attempt to minimise their tax liabilities. The role of tax avoidance (lawful re-timing of income reporting and income shifting) and behavioral responses to change in taxation can affect the short-term as well as the long-run levels of top shares[55] as detailed in Atkinson et al. (2011), Saez et al. (2012) and Piketty et al. (2011).

I therefore expand the baseline model (2.5) accordingly in order to have better estimates of the parameters and, consequently, of the impulse response functions. Table 2.4 tabulates the results for the augmented ADL model whereas figure 2.15 shows the resulting IRF for selected top groups.

The use of additional covariates particularly affects the bottom and the upper groups within the top decile changing the qualitative feature of the results. More specifically, the dynamic impact of banking shocks on the top shares appears now less persistent and mainly temporary in nature[56]. This is shown in Table 2.4 and pictured in Figure 2.15. At the fifth year from crisis, indeed, the impact of the crisis seems to be almost entirely re-absorbed. This suggests that most of the negative impact on top shares originally found from the 4th year, may be due to changes in taxation and

[52]Data on top marginal tax rates are taken from Sialm (2009) and all the observations are updated to 2011. For income group at the bottom of the top decile (top10top5) I make use of the marginal tax rate for income ranging from 100k to 250k (2008 US dollars). The marginal tax rate for income higher than 250k is associated to the top decile as a whole (which contains also richer households). Top marginal tax rate is associated to the richer fractile (top001). In order to be more precise, one could associate different marginal tax rates to different tax units using micro data and the TAXSIM simulator elaborated by the National Bureau of Economic Research. This however could be done only from 1960 on and using micro data (see Saez, 2004).

[53]Data are taken from Barro & Ursúa, 2009

[54]I recall that the 26 countries under investigation accounts for more than a third of the total world population.

[55]In 1929 top marginal tax rate on income was reduced to 24% from 25%. It increased back to 25% for two years until 1932 when there has been a substantial increase in marginal rate, reaching 63%. Three years following the S&L shock in 1990, top marginal income tax rate rose from 28 to 31% and then again to 39.6% in 1992. Once controlling for such taxation regime shifts it seems evident that part of the drop in the top shares following banking shocks might be due to a behavioral response in reporting income for tax purposes.

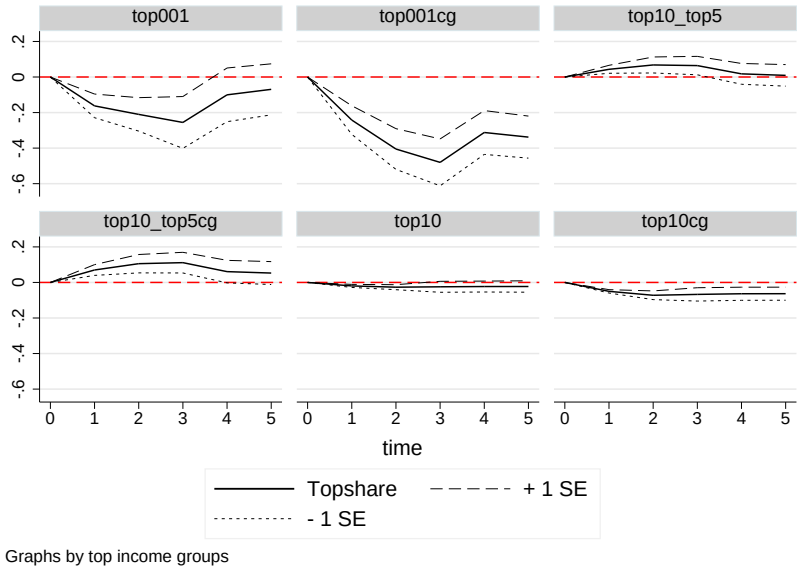
[56]A more persistent impact of banking shocks is preserved only for the share in total income of the richest group, once capital gains are included.

Table 2.4: Augmented ADL Model Estimated for BC and Selected Top Shares

	(1)	(2)	(3)	(4)	(5)	(6)
	Excluding capital gains			Including capital gains		
	top10	top001	top10_top5	top10	top001	top10_top5
L.BC	-0.019*	-0.162*	0.043+	-0.050***	-0.242**	0.070*
	(0.009)	(0.067)	(0.022)	(0.010)	(0.081)	(0.030)
L2.BC	-0.003	-0.016	0.017	-0.017	-0.200**	0.024
	(0.014)	(0.043)	(0.022)	(0.017)	(0.070)	(0.021)
L3.BC	0.004	-0.036	-0.008	0.007	-0.100	0.000
	(0.024)	(0.087)	(0.017)	(0.026)	(0.093)	(0.017)
L4.BC	0.001	0.164**	-0.046	0.003	0.156***	-0.051+
	(0.023)	(0.062)	(0.028)	(0.016)	(0.037)	(0.029)
Changes in marginal tax rates	0.207**	0.074	0.396*	0.207**	0.142*	0.354+
	(0.064)	(0.059)	(0.172)	(0.077)	(0.070)	(0.189)
average 'world' growth in GDP per-capita	-0.277*	0.824	-0.568+	-0.210	1.051	-0.555+
	(0.121)	(0.528)	(0.287)	(0.188)	(1.038)	(0.306)
L.Gtop10	0.198			0.095		
	(0.194)			(0.188)		
L.Gtop001		0.199			-0.155	
		(0.121)			(0.153)	
L.Gtop10_top5			0.181+			0.161
			(0.102)			(0.099)
Observations	91	93	91	91	93	91

Standard errors in parentheses
The table shows the coefficients of the estimation of the augmented ADL model including average real GDP per-capita and marginal tax rates.
We assumed contemporaneous uncorrelation between crisis and top shares
Linear time trend and constant are suppressed from the table
$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 2.15: Controlling for Tax Rates and 'World' Average per-Capita GDP: the Impulse Response to US Banking Crises on the Levels of the Shares of Selected Top Groups.



to general crisis spill-over effects as top shares in one country may be substantially affected by top shares dynamic in other countries (not necessarily depending on the geographic proximity).

It is also worth noting that most of the 'dampening effect' on the IRF is due to the inclusion of cross-country average growth of per-capita GDP to signify that spill-over effects from and to other countries can be strong in magnitude. The latter information is clear by looking at Figure 2.16[57].

Caveats It is important to mention that the inclusion of average growth of per-capita GDP as an additional control variable might be controversial for two main reason:

First of all, the new variable might be in turn affected by the US top income share. In other words the additional covariate might be endogenous so that the estimated parameter becomes biased. However, this is probably too strong a concern as it seems implausible that what happens to the rich tail of the US income distribution have a strong impact on the world average per-capita GDP growth rate.

Secondly, as recalled above, the estimated counterfactual (the estimated value of top share in the absence of a crisis) is not valid if one conditions the model on variables which are directly affected by the crisis itself. This becomes problematic to the extent that one is not ready to believe that the average world per-capita GDP is unaffected

[57]See also next Chapter which discusses the spill-overs feature more broadly by analysing the impact of systemic banking shocks on top shares across different country groups.

by the occurrence of a systemic banking crisis in the US.[58] In the latter case a correct derivation of the IRF would also require the estimation of the dynamic of the average world GDP per-capita in the absence of a crisis[59]. This is a very difficult task and I do not attempt to solve this issue within the paper. However and in order to downplay the latter concern, it is worth noting that the inclusion of the additional covariate in the model specification captures the general and average interrelation between world per-capita GDP growth and the US top income shares growth over the entire time period under analysis. Not just across crisis or recession periods.

2.6.2 Different Specifications

I continue to check the robustness of the results by changing the baseline empirical specification in model (2.5).

In particular, I first consider different lag structure of the banking crisis dummy variables up to 8 lags. Indeed, autoregressive distributed lag models may be sensitive to such change in specification.

Secondly and most importantly, I consider a situation in which the banking crisis lasts for 5 years and not only one year as assumed in the baseline estimation of the impulse response functions. In other words this can be taken into account by simply assuming that the crisis dummy variable takes value equal to 1 for the 5 years following the beginning of the crisis. As discussed in the section of the derivation of the IRF, this would give an 'upper-bound' measure of the size of the impact on top income shares.

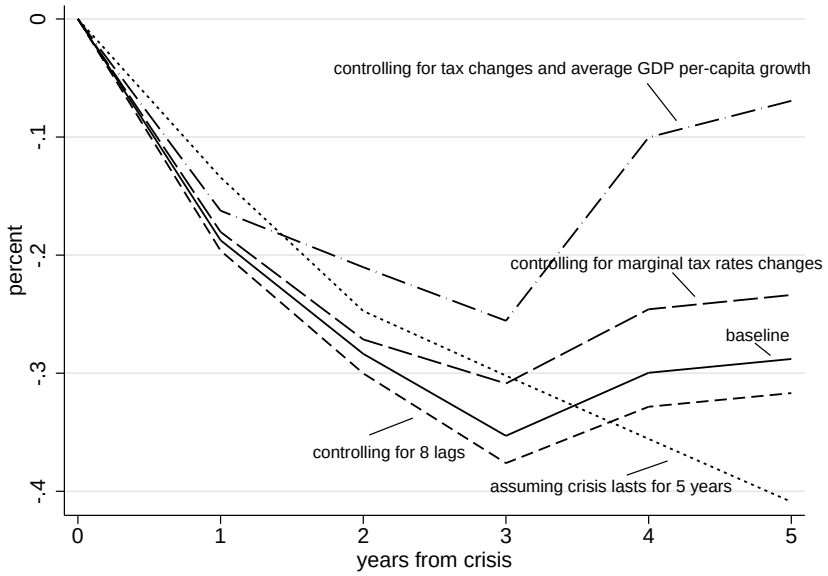
Results suggest that extending the specification to 8 lags barely affects the estimation of the total impact of the crisis on all upper income groups. However, this is not the case if one extends, by assumption, the duration of each crisis to 5 years. Indeed the size of the impact of systemic banking shocks on richest top shares during the first three years following the crisis is slightly reduced. On the contrary, from the fourth year the richest top shares continue to loose ground with respect to the estimated counterfactual, showing no signs of recovery. diverging from the rest of the results presented above. The results discussed in this section compared to the others discussed before can be observed in a single chart in Figure 2.16. The latter shows, for the top001 only (excluding capital gains)[60], how the impact of banking crises changes across different specifications discussed so far. Note also that the model controlling for a 5-years long banking crisis can only be meaningfully compared to the baseline

[58] Especially during the post-Second World War period, the United States it has been the leading economic power of the world economy and it is possible that a US crisis has a direct impact on other countries' national income.

[59] This problem is formally derived and explained within the appendix of the next Chapter.

[60] Results are also available for the other income groups and including capital gains but are not shown in the text.

Figure 2.16: Comparing the Impact of Banking Crisis on Top001 across Different Model Specifications



The baseline model represents the original ADL model in which one assumes contemporaneous uncorrelation between crisis and the growth rates of top shares. The IRFs are computed using income shares without capital gains.

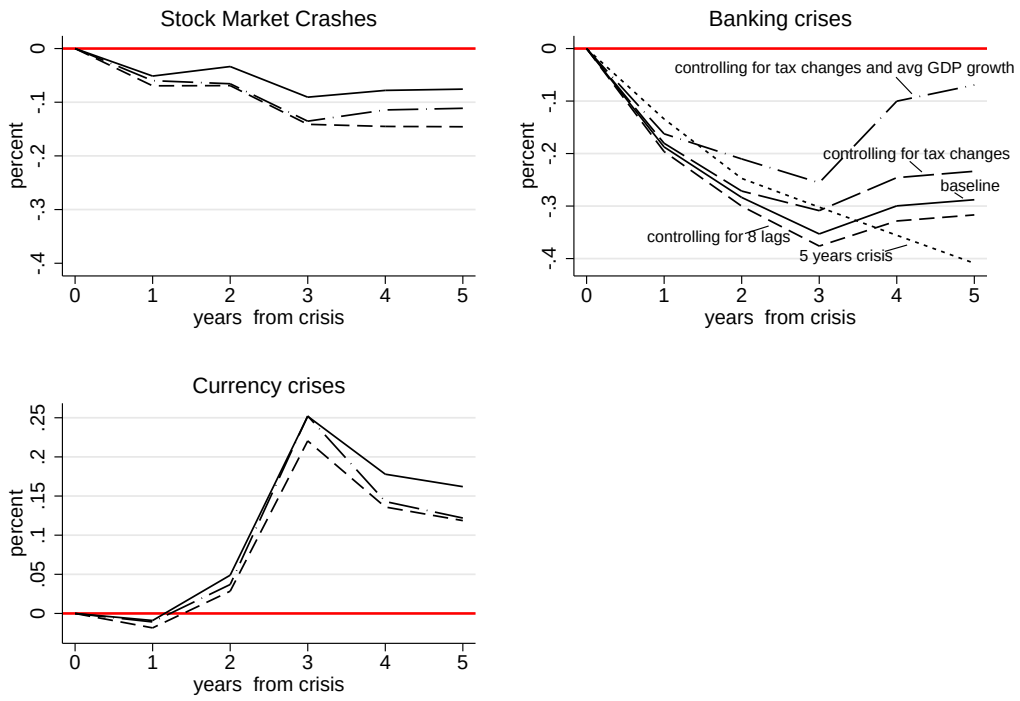
case in which the crisis is assumed to last for 1 year.

2.6.3 Different Financial Crises

The last step in the empirical investigation explores whether the impact of systemic banking shock on top shares is actually different from other types of crisis. This would help discerning whether what I captured in the outcome of the investigation is a generic crisis effect which would have occurred in any other type of crisis. To investigate this issue I collect data on US stock market crashes since the beginning of the century (as described before in Box A) as well as information on currency crises[61]. Results are shown for the case of top001 in figure 2.17. The latter provides comparable information for the three different financial shocks and the empirical specifications I have described above. The impulse response functions are calculated only for those episodes which are not coincident to a systemic banking crisis (i.e. 2007 stock market crash is not part of the estimation). Results show that the US stock market crashes had, on average, a milder impact on the richest top shares compared to banking crisis (the impact is more than halved). Instead, the currency crises seem to have the opposite effect on inequality at the top, namely are associated with a mild permanent

[61] Data on currency crises are taken from and Bordo et al. (2001) until 1970 and from Laeven & Valencia (2010) after 1970.

Figure 2.17: Comparing the Impact of Banking, Stock Market and Currency Crises on Top001 across Different Model Specifications



The baseline model represents the original ADL model in which one assumes contemporaneous uncorrelation between crisis and the growth rates of top shares. The IRFs are computed using income shares without capital gains. The estimated model specifications are the same for every crisis analysed with the exception of the specification controlling for 5 years length crisis which is specific to the analysis on banking crisis.

(over the short run) increase in the richest top share. The Figure also reports the IRFs controlling for a different specification of the ADL model including 8 lags and for the tax rate changes as well as the average 'world' GDP growth (as done for the case of banking crises discussed before). In particular, it is worth noting that the latter control did not affect the results substantially as done in the case of banking crises.

2.7 Interpretation

Measuring what top incomes are composed of is key to understand the dynamics of such shares over time as well as around banking crises episodes. Piketty & Saez (2003, 2006) extensively discussed about the sharp change in composition of income sources at the top of the US income distribution over the twentieth century. According to their estimates, capital income (excluding capital gains) and especially dividend income

gradually left place to an increasing share of wage, business income and realised capital gains[62]. I have shown earlier in Figure 2.2 how the incidence of wage income within the top001 group went from 7% of total income in 1929 to 31% in 2007 (the incidence of capital income on total income, including capital gains, decreased from 77 to 47% over the same time period). As for the the top10-top5 income group, the incidence of wage income over the total went from 48% in 1929 to 85% in 2007, and that of capital income (including capital gains) went from 22% to 9% respectively.

This phenomenon is mainly interpreted by Piketty and Saez as a gradual replacement of 'rentier' class by the so called 'working rich', especially in latest decades[63]. Yet, such a drastic composition change at the top of the income distribution, whether it really occurred or not[64], might have not reduced the correlation of top income shares with stock market and financial sector performance. This may have also happened as other sources of income became very sensitive to macroeconomic performance, such as top remunerations, bonuses and stock options. This suggests that financial shocks hit shareholders harder in the early twentieth Century, mainly through a change in dividend income and change in realised capital gains and losses[65]. In contrast, more recent crises episodes also require the investigation of more classic job market channels.

The formalization of a theoretical model that links the occurrence of banking crisis to the response of top shares, which goes beyond the scope of this chapter, would ideally begin from the decomposition of the total income, accruing to the richest households, by different income sources.

[62]However, as the two authors show in their work, dividends incidence on the corporate income sector was remarkably stable over time and it has been slightly rising since early 80s. Conversely capital income share in the personal income sector had been almost always increasing since the end of WWII, and this is consistent with a considerable redistribution of wealth within US population over time.

[63]The first estimation published by PS were updated to the year 1998, when top capital income share was at its historical minimum. Subsequent years witnessed a revival of capital income as Atkinson et al. (2011) clarify. I have also shown in early paragraph that the role of capital income in top income brackets is considerably higher once capital gains are taken into account.

[64]Other scholars did not find convincing evidence about the 'rentier class' being overtaken by a rich 'working class'. The main reason being that the measure for capital income used in Piketty and Saez might have underestimated the true incidence of 'unearned' income over total income. For example Wolff & Zacharias (2009), after adjusting the wealth income in order to better "*reflect the advantage from asset ownership or the disadvantage from liabilities*", conclude that 'working rich' and 'rentier' classes appears to co-habitate the top end of US economic ladder in recent decades. See also the discussion about the role of capital gains within capital income.

[65]There was also less interventionism in the market and troubled banks, firms etc. were usually not bailed out.

2.7.1 Income Decomposition

As an illustrative example one might decompose the top income into three main sources (Wage, Capital[66] and Business income[67]) so that $y_i = W_i + C_i + B_i$. By totally differentiating y_i and using simple algebra, one obtains:

$$\frac{dy_i}{y_i} = \frac{dW_i}{W_i}\alpha_i^W + \frac{dC_i}{C_i}\alpha_i^C + \frac{dB_i}{B_i}\alpha_i^B. \tag{2.12}$$

From (2.12) one can calculate k_i^π, the contribution[68] of each single income source to the growth rate of total income of group i (y_i), where $\pi = \{W, C, B\}$. Every k_i^π depends on the growth rate specific to the income source and on the relevance of each specific income source over the total income of group i. Moreover, the sum of all income source contributions is equal to 1 at any time t.

$$\sum \frac{\frac{d\pi_i}{\pi_i}\alpha_i^\pi}{\frac{dy_i}{y_i}} = \sum \kappa_i^\pi = 1. \tag{2.13}$$

I could easily estimate the average value of income sources contribution to the top income growth by considering a discrete-time version of (2.13) and estimate the following equations individually:

$$\begin{cases} \frac{\triangle W_{i,t}}{y_{i,t-1}} = \frac{\triangle W_{i,t}}{W_{i,t-1}}\alpha_{i,t-1}^W = a_{i,t}^W + b_{i,t}^W \frac{\triangle y_{i,t}}{y_{i,t-1}} + \varepsilon_{i,t}^W \\ \frac{\triangle C_{i,t}}{y_{i,t-1}} = \frac{\triangle C_{i,t}}{C_{i,t-1}}\alpha_{i,t-1}^C = a_{i,t}^C + b_{i,t}^C \frac{\triangle y_{i,t}}{y_{i,t-1}} + \varepsilon_{i,t}^C \\ \frac{\triangle B_{i,t}}{y_{i,t-1}} = \frac{\triangle B_{i,t}}{B_{i,t-1}}\alpha_{i,t-1}^B = a_{i,t}^B + b_{i,t}^B \frac{\triangle y_{i,t}}{y_{i,t-1}} + \varepsilon_{i,t}^B \end{cases} \tag{2.14}$$

Least squares estimates [69] of b_i^π are obtained through regressing one by one the equations in the system[70] (2.14). Findings using the observations around crises only (5 years window) are shown in Table 2.7.2. It indicates that the role of capital sources of income is the predominant driver of the income growth in richer fractiles within the top decile, whilst the growth of the total income of poorer quantiles depends to a

[66] I can in turn decompose capital income into realised capital gains, dividend and other forms of income (rental and interest income). Therefore I am focusing here on income including capital gains only.

[67] Business income represents profits from S-Corporations (entities whose profits are taxed only at the individual level) plus profits from Partnerships and sole proprietorship businesses (Schedule C income).

[68] Ideally one would like to understand the role of marginal distributions of each source of income as well as their joint distribution for the dynamic of the right tail of income distribution. This is discussed in Atkinson et al. (2011) and Alvaredo et al. (ming) for two sources of income, namely wage and capital.

[69] Standard errors are robust to heteroskedasticity. Newey-West standard errors are even smaller and are not tabulated.

[70] System estimation such as Seemingly Unrelated Regression can only be carried out on all equations but one as, by construction, the variance covariance matrix of estimated coefficients would be singular.

greater extent on wage type of income.[71]

The above results can be now complemented with the information about the cyclicality of different sources of income at the top. To present this, I regress the growth rate of each single income source accruing to a specific upper income group against the growth rate of total income in the economy (including capital gains). The slope coefficients are represented graphically across income groups in Figure 2.18 after further decomposing capital income into capital gains, dividends and other types of income[72]. Findings indicate that the elasticity to total income of every source of income is higher than 1 only for richer groups. Capital type of income is instead the only source of income to be highly cyclical across all groups. As I have seen before, capital income is also the most relevant source of income growth for the richer upper groups, while wage type of income is a-cyclical and accounts for most of the income dynamics for 'poorer' groups within the top decile.

Summary and Further Discussions Results from the investigation of different sources of income at the top of US income distribution reveals that capital and wage income are nowadays the most important sources of income for the richest group (see Figure 2.2). Moreover, even if both sources of income are highly cyclical, (meaning that their growth rates elasticity to that of total income in the economy is higher than 1), capital income (including capital gains) appears to drive most of the growth of total income for the richest fractile around crises episodes. Conversely, wage income appears to be the most important source of income, as well as the main driver of total income growth, for the P90-P95 group. However, wage income is not very cyclical for this income group meaning that its growth rate elasticity to that of total income in the economy is lower than 1.

Such quantitative findings require nonetheless a qualitative justification and some tentative explanations which constitute the objective of the following subsections. In particular I focus the attention on the two most important sources of income, wages and capital and explore how different factors such as unemployment, top remunerations, the role of financial sector as well as that of stock holdings can help justify the main features of the findings of the empirical investigation described above.

It is also important to underline that the documented changes in income are not necessarily exogenous, as they could reflect optimal endogenous response of agents. On one hand, individuals might lose their job and consequently their source of wage

[71] The role of wage types of income at the bottom of the top decile is reduced if one considers only the observations around stock market crashes episodes (3 years window), whereas it remains substantially unvaried for the richest tax unit. This is another piece of evidence supporting the fact that bottom groups within top decile are particularly sensitive to the aggregate economic conditions. For example the group could be relatively more shielded against higher unemployment rates. This issue is further discussed below.

[72] Interest income plus rental income plus royalties

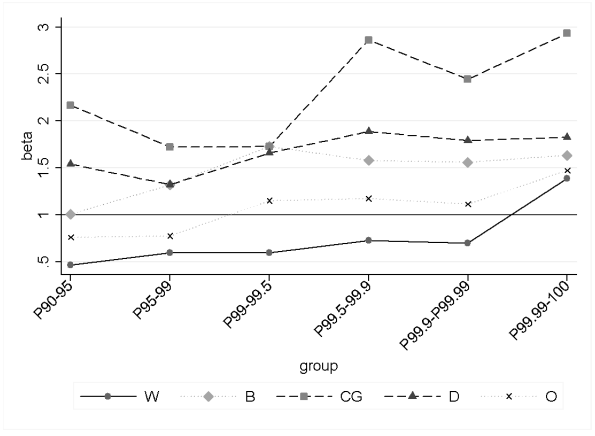
Table 2.5: The Contribution of Different Sources to the Top Income Growth During Banking Crises Episodes

	(1) P90-95	(2) P99.99-100	(3) P90-95(B)	(4) P99.99-100(B)
Wage	0.564***	0.210***	0.479***	0.209***
	(0.095)	(0.059)	(0.077)	(0.047)
Business	0.158*	0.146***	0.270***	0.154***
	(0.079)	(0.042)	(0.047)	(0.034)
Capital	0.276***	0.641***	0.2485***	0.627***
	(0.0346)	(0.079)	(0.041)	(0.063)
N	29	29	62	64

Least square regression with robust standard errors. Capital income includes realised net capital gains. Columns (1) and (2) use sample restricted to the 5-years period around the three crises episodes. Columns (3) and (4), instead, provide estimates restricted to the three years around stock market crashes episodes.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

income or dividend distribution may be reduced by the corporate management. On the other hand, individuals could independently decide not to realise their capital gains and not to exercise their stock options and this clearly happens especially during turbulence periods. This would not modify the qualitative feature of the empirical findings. Nevertheless, it would considerably change the underlying economic models one could use to interpret those results.

Figure 2.18: Elasticity of different sources of income to total income across top groups



Beta represents the elasticity of sources of income to total income Estimation sample refers exclusively to years around crises (5 years window) W:Wage B:Business CG:Capital Gains D: Dividends O:Other

2.7.2 Explaining the Relative Gain in Top10-Top5 Share

As discussed within the data description section, tax units belonging to the P90-P95th income bracket have a total market income between 110.000 and 160.000 US 2007 dollars. Assuming that a tax unit is composed of two individuals, this is suggesting that total individual annual income belonging to this income bracket is between 55.000 and 80.000 US 2007 dollars, consistent with upper middle class workers income. Moreover, as explained above, the great majority of this income takes the form of wage income (around 85%) but this source appears not very cyclical for this specific income group. In what follows I contend that this is suggestive of the fact that the group may be particularly protected against unemployment and this can explain why, following a banking crisis, I found that top10-top5 share to be above the predicted path of the series in the absence of the crisis.[73]

Although this statement cannot be proven using the data at hand, the hypothesis is somewhat consistent with both theoretical and empirical considerations. On the theoretical side, economic theories based on non-competitive markets suggest that labour mobility is higher for less skilled workers[74]. Under the assumption that low skilled individuals also have lower remunerations on average, this suggests that the rise in layoffs and unemployment rates during economic downturn disproportionately affect the bottom of the income distribution (say the bottom 90%).

On the empirical side, there are two main findings that support the statement above: First, I have shown within the text that top10-top5 share does not tend to rise following standard stock market crashes which are not associated to systemic banking crises. Second, wage income accounts for approximately 60% of total income growth for top10-top5 share during banking crises and this figure drops by 10 percentage points during general stock market crashes as shown in Table . Both points are relevant as substantial surge in unemployment rate was only found following US systemic banking crises and not following general stock market crashes[75].

[73] I recall also that this explanation has to be complemented with the rather mechanic explanation given within the section 'The dynamics of an income share'. In this section I explained that movements in top10-top5 share can be also driven by composition change of the fractiles during crises. Data on top income shares do not track the same individuals over time.

[74] Efficiency wage theories and search theories provide a clear support for these conjectures as argued in Furman & Stiglitz (1998). The two authors, for instance, show in a simplified model of efficiency wages with two agents (low productivity and high productivity) that as the demand for labour falls during a recession, the agents on the low-productivity efficiency wage curve are '*rationed out of the market*'.

[75] Each of three banking crisis cases under analysis in this paper, has been associated to economic downturn and substantial rise in unemployment rate. The National Bureau of Economic Research indicates 1929(III)-1933(I), 1990(III)-1991(I) and 2007(IV)-2009(II) as the beginning and the end years(quarters) of official US recessions. Unemployment rose dramatically during recessions. Estimates indicate a stunning surge from 2.08 to 25.2% from 1929 to 1932. From 1988 to 1992 unemployment rate went from 5.3 to 7.4, while it almost doubled (from 5 to 9.6%) from 2007 to 2010.

2.7.3 Explaining the Relative Loss in Top001 Share

As discussed within the data description section, the 15.000 tax units belonging to the P99.99-P100th income bracket (what I called top001) have a minimum total market income of 8.5 million US dollars. Differently from the P90-P95 case, we are dealing here with the richest individuals within the US. Indeed, CEOs and top executives in non financial and financial industries represent a sizeable portion of upper income groups (up to 13% of top tax AGI brackets or higher according to estimates in Kaplan & Rauh, 2010).

It is also important to recall that capital income and not just wage income plays a crucial role for the dynamic of the income of this group. In what follows I provide a tentative explanation about how capital income and wage income can negatively affect the top001 share around crisis episodes.

The Role of Capital Income

I have shown before that capital income appears to be the main driver of income growth at the very top of the US income distribution, especially during banking crises. In this section I discuss the theoretical explanations underlying the changes, around crisis episodes, in the two of the main sources of capital income, dividends and capital gains. The latter sources of income are both clearly linked to stock holdings and portfolio choices which are the focus of the discussion below.

It is important to recognise that the stream of income from stock holding activity could not only be influenced exogenously. In fact, endogenous responses of investors to swings in the market could also play a crucial role. For instance, changes in dividend income may be the result of exogenous or endogenous response to the banking shock. Given the holding of share, on one hand, a company may decide not to distribute dividends or to reduce their payment ratio during downturn (exogenous change). On the other hand, shareholders may independently decide to liquidate the share during a market downswing, receiving as a consequence, zero future income from dividends of the specific share (endogenous change). Both decisions to sell or not to sell stocks can also influence the stream of income from capital gains. Firstly, in case the shareholders are liquidating their risky positions, it is possible to obtain positive or negative realised net capital gain depending on the values of the liquidated shares versus the original purchase price. Secondly, the stream of income coming from the realised net capital gains can be also influenced by the decision of not selling stocks during downswings (i.e. postponing the realisation of the capital gains to better times). The relevance of these arguments, however, cannot be checked against the data and I further explore the issues below with the help of evidence in the literature.

The Role of Stock Holding Simple theory can be of guidance in order to explain why changes in stock holdings are linked to the swings in share values, and ultimately to financial shocks. In order to do so, one should ideally model the way portfolio decisions vary around upswings and downswings in the market conditionally on the choice to participate on the stock market. Indeed, a financial shock may lead some investors out of the stock market and some others to simply liquidate their riskier positions conditioned on their participation.

For instance, a conventional simple dynamic model of portfolio choice, with constant relative risk aversion utility function and participation costs, predicts that a shock in wealth would optimally drive out some investors from the stock market. The remaining invest a constant share α in risky assets[76]

Other theoretical models of household portfolio choice with background income risk (see, e.g., Haliassos & Bertaut, 1995, Heaton & Lucas, 2000, Viceira, 2001, Haliassos & Michaelides, 2003, Gomes & Michaelides, 2005) imply that households should adjust their stockholding participation status or portfolio shares of risky assets in response to household-specific changes (e.g., in wealth, income or age) or to changes in the market environment (e.g., expected returns or volatility)[77]

However, despite the clear theoretical predictions of different models, conditional and unconditional stock holding together with stock trading behavior, are topics which are not well understood and studied in the empirical literature. Brunnermeier & Nagel (2008) find little evidence of participation fluctuating together with wealth. Similarly Bilias et al. (2010) show that there is tendency of the vast majority of households to exhibit the same participation status over time (using the same PSID data). Results suggest that stock market downturns mainly discourage nonparticipants from entering rather than encouraging a mass exodus from the stock market. Households with lower resources, however, are found to have higher probability of exit during downswings. Nevertheless, it should be mentioned that one cannot be sure that the same results would apply to extreme events such as systemic banking shocks and more evidence is needed.

Along these lines, changes in stock holdings (conditional on participating) in response to the financial shock seem worth investigating. Examples of 'flight to security' or 'flight to quality' are commonly found within the accounts of financial down-

[76]This type of model usually solves the following problem: $maxE_t \sum_{\tau=0}^{\infty} \delta^{\tau} \frac{(C_{t+\tau})^{1-\gamma}}{1-\gamma}$ subject to $W_{t+1} = (1 + R_{p,t+1})(W_t - C_t)$ where $R_{p,t+1} \equiv \alpha_t(R_i - R_f) + R_f$.

[77]In alternative, if one is willing to assume that ups and downs in the market are linked to swings in investors' risk aversion, then a simple Arrow two-assets model of portfolio choice justifies the increase in the optimal share of risky assets during boom times. A further example is represented by a model of portfolio with consumption habit which effectively allows the RRA to change with wealth fluctuations (mostly used in asset pricing and macroeconomics). In other words the proportion of wealth invested in risky asset could vary with wealth: $maxE_t \sum_{\tau=0}^{\infty} \delta^{\tau} \frac{(C_{t+\tau}-X)^{1-\gamma}}{1-\gamma}$. Within such a model, the agents should make sure to have enough financial resources to ensure that future consumption is above the habit level. The consumption path with $C \leq X$ with nonzero probability are assigned infinitely negative utility.

swings. Habit models described above predict a positive correlation between shares of risky assets within portfolios and the amount of net wealth. Generally, using PSID data, both studies by Brunnermeier & Nagel (2008) and by Bilias et al. (2010) find that "*a vast majority of households do not trade*". However, evidence in the latter study suggests that more education, higher income or higher net financial wealth encourages trading especially following the downswing. In addition, using SCF data, the study finds that households with brokerage accounts (especially those who are very wealthy) trade frequently, both during upswings and downswings. This observation is consistent with Fisher's claim that during every market downswings ('Bear Market') there could be rallies (lasting from several days to months and sometimes years) which can produce "*gains for investors or traders who make careful and educated choices, while constantly monitoring their positions*" (1930).

The Role of Distributed Dividends It is generally recognised that shareholders may dislike changes in dividend policy for different reasons. First dividend payment is a secure income source for shareholders compared to volatile gain in the value of the share due to investments financed by profit plough-back (i.e. market may somehow undervalue investments). Secondly, dividends provide important signals to the market which in turn influence shareholder's expectation on future firms' profits (i.e. a firm that can sustain dividend through tough times is considered to be a solid one). Third, sudden changes in dividend policies might cause costs to shareholders 'clientele' which no longer recognises the firm's dividend policy as its preferred (see Wood, 1975).

One may therefore argue that because dividends policy is usually smooth across small short-term disequilibria, most of the observed change in dividend income at the top of the distribution must come from the 'flight to quality' or the 'flight to safety' operations described above (i.e. assets liquidation).

However, it is worth noting that although one could define a banking crisis as a short term disequilibrium, there might be good reasons why a smooth dividend policy is not to be considered optimal throughout a systemic banking crises. Dividends, especially in a credit crisis, might be seen as a crucial form of available capital for underpriced companies that face strong liquidity crisis (not necessarily insolvent). It can be easily theorised that in such cases shareholders might be better off with a zero dividend or a dividend cut that might save their companies from bankruptcy. Evidence from the Great Depression period is provided in Baker (1939), who has analyzed how companies listed in the New York Exchange distributed their earnings respectively to executives and to shareholders (dividends) over the period 1928-1936[78]. In his analysis, total dividends for biggest corporations raised initially from 1928 to 1930

[78]It is worth noting that executives compensations share in total earnings in largest companies was on average 5% for 1928-1936 period. Conversely dividends accounted for 71% of total earnings. These figures become respectively 25% and 62% for smaller corporations. The authors select 51 out of 84 largest industrial corporations (with asset worth more than 100 millions 1929$) and 53 out of more than 200

by 38% and subsequently plummeted cumulatively by 87% up to 1933, when dividends started raising again (distributed dividends were up by 25% from 1928 to 1929 in smaller companies and down to zero in 1932 and 1933). Evidence for the US 2007 crisis shows that the number of S&P500 listed companies that increased their dividends outnumbered those who decreased their dividends in 2007 and 2008. However in 2008 and 2009 the drop in total dividends was far higher than the total increase.

Summary The discussion above might suggests that most of the observed cyclicality of capital income around crisis episodes might be driven by endogenous behavioural response of investors to market conditions. Indeed, it appears more likely for rich investors, compared to their poorer counterparts, to actively trade stocks during market swings. Moreover, investors might liquidate their risky assets during downswings and re-purchase assets once the market prospects are improving. This would justify part of the cyclical movements of the shares. However, very little is known in practice about these mechanisms and their effective validity. Shedding more light on these important issues seem however an important avenue for future research.

The Role of Top Wage incomes

Remuneration at the top also matter for the dynamics of the top shares. Indeed, the remuneration structure at the top end of the income distribution increasingly comprehends incentive schemes, including stock options as well as short-term and long term bonuses linked to corporate shares performance[79]. Consistently, Frydman & Saks (2010), analysing a representative sample of the largest 200-300 public-traded US firms, documented that an increasing share of executive compensation is linked to market or firm performance through stock option schemes[80] and other forms of incentive pays since the 1950s[81]. However, the authors argue that the correlation between the stock market index and the pay of publicly-traded firms executives has been strong only starting from 1980. The fraction of executives receiving an option has increased over time reaching 82 percent by the 1990s (it was only 16 percent throughout the 1950s). Moreover, the median value of options award has steadily increased over

smaller corporations (assets worth less than 10 millions 1936$) listed in New York Exchange.

[79]This does not seem surprising as managers' remuneration schemes have been increasingly designed to be 'aligned' with the shareholders' interest in order to cope with classical agency problem (at least in theory). Note also that under efficient incentive contract design, the remuneration can be optimally set to be relative to general stock market or sector performance rather than corporate performance alone.

[80]They don't include gains from exercised options but the value of stock option grants only. This would set the compensation value independent from firms shares' swings in valuation and from executives' endogenous choices about when to exercise the options.

[81]It should be noted that restricted stock option were introduced in 1950. These types of options were subject to a special fiscal regime which allowed them to be taxed as capital gains and not as labour income. Hence, the marginal tax rate on restricted options was only 25 percent rather than a considerably higher tax rate for high income earners (the maximum tax rate on labour income was 91 percent from 1954 to 1963). This reasonably constituted an enormous fiscal advantage which incentivised the new executive pay schemes.

time passing from around 15 percent of total compensation in the mid-1950s to around 37 percent in the late 1990s (it was around 15-30 percent in mid '80s)[82].

Summary The discussion above suggests that the structure of the remuneration at the top of US income distribution creates cyclical fluctuations (down in bad times and up in good times) in 'wage' type of income for the top income brackets pushing the top income shares to be pro-cyclical[83]. Moreover, the role of the top remunerations, bonuses and stock options can also contribute to explain why the richest share in total US income may recover fast after the recent post-1980 banking shocks.

Conclusion

In this chapter I have shown that the level of the richest top share is found to be, on average, lower than what it would have been predicted in the absence of crisis, based on previous dynamics of the series, including trend patterns. On the other hand, the bottom group within the top decile (P90-P95) gained in relative terms in the years following a systemic shock. 'Inequality' at the top of the US distribution, thus, tends to shrink following a systemic banking crisis. This also implies that the overall effect on the entire top decile share is mostly insignificant. Thus, the use of different top income shares in the analysis matters as it can provide contrasting evidence, marking the importance of the decomposition of income groups at the top. Top income groups are heterogeneous in nature and their relative response to systemic banking shocks appears to be different. Information on Top10 solely would lead to conclude that crises have no impact on the 'rich' share of total income.

However, despite the interesting heterogeneity of results across income groups, the magnitude of the estimated changes in top shares is always lower than 1 standard deviation so that it appears that banking crises are followed by relatively mild changes in top shares.

More specifically, using the baseline empirical specification, the investigation founds that the top hundredth percentile share in total non capital gains income is 22 percent

[82]Similar results were already found in Hall & Liebman (1998), using data from large U.S. corporations from 1980 to 1994. The authors found that CEO pay has become much more sensitive to corporate performance than it once was. And they credit stock options for this change. ("*The responsiveness of CEO compensation to firm value more than tripled from 1980 to 1994, rising from 1.2 to 3.9*",but(...) "*the elasticity of salary-plus-bonus (with stock and options excluded) to firm value was much lower, although it had increased from 0.13 in the early 1980s to 0.24 in the late 1980s and early 1990s*"). However, they also point out that remunerations are more sensitive to sector or market performance rather that corporate performance.

[83]A recent study for the US, by Parker & Vissing-Jorgensen (2010), found that top wage income is indeed to be considered one of the main reason for very high levels of income cyclicality at the top of the US income distribution since 1982. They also argue that the above mentioned cyclicality remains at a similar high level even when excluding those households who have been receiving stock options at least since 1997.

lower than the counterfactual level even after five years from the onset of the banking crisis. This is equivalent to almost a third of the top001 standard deviation or to approximately a 0.3 percentage point drop. The effect is tripled using the share including capital gains which is found to be be approximately 50% lower than the counterfactual after 5 years from the shock, equivalent to more than a 1 percentage point change in the share (almost one standard deviation).

The evidence for the top10-top5 share is specular to that of the top001. Indeed, the share of the P90-P95th percentile is found to be 0.9 (1.1) percentage points below the counterfactual measure at the fifth year from the crisis if one considers the series excluding (including) capital gains. Both figures account for approximately 1 standard deviation of the share.

The results are generally robust to different specifications. In particular the analysis controlled for the reverse direction of causality, namely the case where the probability of crisis may be affected by growing share of income accruing to the top of the distribution, as recently debated within the literature. Furthermore, the empirical findings are robust to the inclusion of additional lags of the crisis dummy variable in the baseline specification and to controlling for longer duration of the banking crises. However, once one controls for changes in taxation (controlling for changes in reported income at the top) and world level GDP growth (controlling that the effect of the crisis is net of the 'contagion' effect from other countries) I found that the initial shock is almost entirely reabsorbed by the 5th year from the crisis in the series which exclude the capital gains.

Therefore, there also appears to be some, although non conclusive, evidence that the total effect of crises on US top income shares are not just small in magnitude but also temporary in nature as richest top shares tend to recover fast following the initial hit.

Finally, the investigation also controlled that other types of financial crises like stock market crashes and currency crises do not have a similar effect on the top shares. This provides some evidence on the fact that the effect I captured for the banking crises is not a generic crisis effect which would have occurred in any other type of crisis.

These findings, taken together and irrespectively of the findings about the duration of the crisis effect, lend some indirect support to the conjecture recently advanced in Saez (2012) and Piketty & Saez (2012), suggesting that only radical changes to the institutional framework and to the income earning process (i.e. radical fiscal policies and financial regulations) may substantially affect the share of total income accruing to the top of the distribution. In fact, new waves of policies (e.g. New Deal) are often gradually implemented in the aftermath of major macroeconomic shock like a systemic banking crisis and these can have more substantial impact on top shares.

One may also be tempted to extrapolate these results further and argue that sys-

temic banking crises are not turning-points for the US income distribution as a whole. Indeed, the literature has provided some justification about the fact that tracing the dynamics of top income shares may be informative on the general disparity of income distributions (e.g. Gini coefficient)[84]. Although it might be reasonable to assume that it is unlikely to have substantial distributional implications without a considerable change in the top decile of the income distribution, one should be cautious about drawing a direct link between top shares and the overall income distribution, especially in the short-run. The factors affecting the bottom of the distribution during a systemic banking shock may be substantially different from those documented and discussed here for the top of the distribution and this work remain silent about this crucial difference. To what extent crises are likely to exert permanent impact on the distribution of income as a whole is an interesting question which remains open for future investigation.

[84]Indeed, as recalled by Atkinson & Piketty (2007, pg. 19), and proved more formally in Alvaredo (2011),"*If we treat the very top group as infinitesimal in numbers, but with a finite share S∗ of total income, then the Gini coefficient can be approximated by* $S * +(1 - S*)G$*, where G is the Gini coefficient for the rest of the population*". Empirical evidence on the link between top shares and overall measures of income distribution is provided, among others, in Burkhauser et al. (2009) and Leigh (2007).

Chapter 3

Banking Shocks and Top Income Shares Around the World

Contents

3.1 Introduction

The 2007-2008 financial collapse and its subsequent economic recession brought the investigation of the distributional impact of macroeconomic shocks back on the research agenda. Yet, there are very few systematic empirical investigations with a wide historical and geographic coverage. This chapter, contributing to a literature in the becoming, investigates the short-run impact of systemic banking shocks on countries top income shares since the beginning of the twentieth century and for 26 countries accounting for more than a third of world population.

Such an exercise responds to a genuine interest in understanding the distributional implications of major crises by researchers and policy makers, as well as the press and the general public. Moreover, there are growing concerns about the widespread rising level of economic disparity within most advanced countries, which is increasingly considered to be a source of distortion and inefficiency for the economy. Is the latest crisis (and its alleged inefficiency-correcting market forces) able to invert the positive trend in income dispersion?

In order to answer such a question, this chapter turns to the investigation of top income shares data taken from the recently assembled World Top Income Database (WTID). The data, although not representative for the entire income distribution, have several advantages. First of all, it is the only available source of information to analyse inequality over a long time span as well as across a number of countries, a crucial feature in order to investigate rare events such as banking crises. However, the long-time horizon under investigation imposes strong constraints on the type of data available for such an investigation. Moreover, the long annual series allow to better exploit the time-series properties of the data and to adopt more standard panel and time-series econometrics tools.

As in Chapter 2, the work investigates the richest fractional percentiles within the top decile (top001) and the share of relative poorer households within the richest top decile (ideally the top10 excluding the richest 5%). The choice is based on the consideration that banking crises can have heterogeneous impact on top-income groups given their enormous differences in average income and in its composition.

In practice, the empirical evidence for this paper is produced by estimating impulse response functions (IRFs) of the rate of *growth* of top income shares to the systemic banking crises. The effect is then cumulated to reproduce the IRF on the *levels* of the top shares. I also provide estimates based on different model specifications (i.e. different underlying counterfactuals) and different estimation methodologies (standard homogenous panel models as well as, less commonly applied heterogenous panel models, controlling for more general cross-section dependence).

These methodologies draw from both established and recent applications in macroe-

conomic studies. This work extends their use within the literature of income distribution and constitutes one of the first applications of this sort[1].

As in Chapter 2 the empirical investigation in this chapter has the following features:

i) Firstly, the focus is on the *total* short-run effect of a banking crisis rather than on its marginal impact. In other words I do not distinguish between the impact of a banking crisis from that of other contemporaneous shocks or macro-events caused by the crisis itself (e.g. rise in unemployment, economic slump and stock market crash). This is done by performing a so called "ex-post counterfactual analysis", recently postulated in a work by Pesaran & Smith (2012).

ii) Secondly, I adopt an empirical methodology consistent with an 'agnostic' view of the ending date of a banking crisis, a widely controversial issue within the literature.

iii) Thirdly, the use of data based on a gross income definition excludes any direct (not indirect[2]) impact of fiscal policy on the measure of inequality (top income shares).

iv) Fourthly, the use of a short time horizon (5 years), I argue, should be sufficient not to worry much about the potential role of new institutional and regulatory framework likely stemming from the crisis.

v) Finally, I test the robustness of the results to the assumption that systemic banking crises have exclusively lagged effects on the growth of the top shares. This addresses the concern of potential endogeneity of crisis indicators to changes (not levels) in 'inequality'[3].

Main Results The results show that systemic banking crises have, on average, a weak statistically significant impact on the dynamic of top shares when using the whole sample of countries and years. Analysing results across countries and over time, however, reveals a more complex relationship between inequality and crisis.

More specifically, the study broadly identifies two main macro-groups of countries, according to the response of their richest fractiles share to the banking crises

[1]Two other papers by the IMF staff were recently made available. The papers use a similar methodology and identify the impact of macroeconomic conditions on measures on income distribution using impulse response functions. Gorodnichenko et al. (2012) explored the distributional implication of monetary policy shocks in the US whereas Ball et al. (2013) analysed the effect of fiscal consolidation on inequality estimating IRFs.

[2]An example of indirect redistribution effect of taxation are the behavioral endogenous responses in income reporting due to changes in tax rates.

[3]the distinction between the so called 'level hypothesis' and the 'growth hypothesis' is thoroughly analysed in Chapter 4.

(adopting a country classification close to Atkinson et al.'s 2011 paper). On the one hand, there are the so called 'Nordic European', 'Western English Speaking' and 'Continental European' countries (in which Japan as well as Southern European countries are also included), in which the richest fractile share seems to suffer a negative shock following a banking crisis. On the other hand, there are the so called 'Developing Countries' which show the opposite response, namely an average increase in their top shares. In addition, once the observations for the so called 'Developing' countries are dropped from the analysis, recent crises (post-1970) appear, in the short-run and on average, up to three times as disruptive for the richest fractile share compared to the crises occurred in the interwar period. On the contrary and similarly to what was already found for the case of the US in the previous chapter, the bottom of the top decile tends to increase its share of total income following the shock and across different country-groups. This appears not to be true during other general macro-instability episodes excluding banking crises.

Nevertheless and despite these features, the results suggest that major systemic banking crises have an impact on top shares which is only relatively small in magnitude.

These results are controlled against a variety of model specifications and estimation techniques. The latter are classified into two main approaches. On one hand, I make use of the more standard 'pooled' estimators (i.e. POLS). On the other hand, I take advantage of the more recent advances within the heterogeneous models and common factors approach to panel estimation (i.e. the family of the Mean Groups estimators). Although still in its infancy and not widely applied within the empirical literature, these models are particularly suitable for macro-panels with 'large N' and 'long T' structure and strong cross-section dependence. I also perform a variety of robustness checks which are detailed within the paper.

Structure of the Chapter The work is organised in six sections. The first describes the complexity lying behind the question under investigation and summarises the existing literature on the topic. The second and third sections analyse in detail the assembled dataset, the methodology and estimation strategies. I further discuss the results, their robustness and their tentative interpretation in the following three sections.

3.2 Existing Literature

The present study builds on existing, and recently growing, literature about the distributional implication of crises. To the best of my knowledge, only three recent works explore, directly or indirectly, the impact of shocks on a set of measures of economic inequality directly comparable to ours (top income shares). These studies are respectively Roine et al. (2009), Atkinson & Morelli (2010, 2011) and Bordo & Meissner (2011).

The study carried out by Atkinson and Morelli explores the impact of systemic banking shocks and other macroeconomic shocks using a wider range of income inequality measures in order to maximise the number of crises episodes under investigation. In particular, the choice of "inequality indicators" includes top income shares only when other measures of overall income distribution were not available. Moreover, due to the widespread presence of gaps in data coverage over time, a non-automated and informal approach was preferred to the standard econometrics investigations. The two other remaining studies, however, explicitly analyse long annual series of data on the inequality 'at the top' using econometric techniques. Thus, the latter works are explored in more detail as they are more directly comparable to the present study.

The remainder of the literature generally deals with overall measures of income inequality (i.e. Gini coefficients) with a shorter time coverage and often focuses the attention mainly on 'Developing' countries and on specific crises episodes (e.g. Asian crisis of late 90s). Moreover, differently from this work, scholars have mainly studied the lower end of the income distribution[4], by investigating job market and poverty dynamics that follows the financial or the economic shock (e.g. Baldacci et al., 2002). Surveying this literature goes beyond the scope of this paper and for a recent perspective on the subject I refer the interested readers to the recent comprehensive works by Jenkins et al. (2013) and Brugiavini & Weber (2011).

The main evidence in Roine et al. (2009) suggests that banking crises are associated with an average reduction of the income share of the top 1 percent, whereas no evidence is found for the so called 'next 9 percent', the poorer groups of households below the 99th percentile up to the 90th. More specifically, Roine et al.'s model predicts an average drop of around 0.2 percentage points for every year (out of 5) in which a country is experiencing a banking crisis. On the other hand, no impact of any sort is found in the case of currency crises. The specification is estimated for the whole set of countries and years and makes use of first-difference variables, including a set of controls (changes in GDP per-capita, trade openness, population, and government expenditure). The work explores 17 countries from the early years of the twentieth century up to 2004. Moreover and most importantly, data are averaged over 5 year windows and information gaps on top income shares are occasionally linearly interpolated. Finally, the banking crisis control variable is either a dummy taking the value of 1 for each crisis-year or it represents "*the share of years during each 5-year time period that a country was exposed to a banking crisis*"(including the non-systemic one)(pag. 985).

The study by Bordo & Meissner (2011) uses a very similar empirical specification[5]

[4]To some extent, such argument appears more justifiable for 'Developing' countries where social protection and safety nets in job market are poorly effective if not existent at all. Indeed vulnerable individuals living in advanced countries are relatively more protected, at least temporarily, by welfare state policies and better functioning job market as well as insurance and financial markets. However a strong and deep financial shock generating mass unemployment may undermine the effectiveness of social security schemes, widening in turn wage inequality unless larger government social intervention takes place.

[5]Yet, the estimation methodologies are different. While Roine et al. use First-Difference GLS and

and explores cross-country data for 16 countries from 1880 to 2000. The variable of interest in Bordo and Meissner's work is the cumulative change in the top 1 percent over a fixed window of 5-years for the post-WWII period. A different measure of 'inequality' is used for the remaining years: the ratio of unskilled wages to GDP (taken from Williamson, 2002). Unlike Roine et al., the authors conduct their analysis for three sub-sample of adjacent periods: Pre-WWI, interwar and post-WWII. Notably, their results suggest that a banking crisis is associated with a reduction in inequality exclusively within the interwar period. The remaining periods see a significant increase in inequality following the banking shock. Given the very similar methodology and data used in the two studies above[6], this result is quite surprising and it is attributed by Bordo and Meissner to the disaggregate investigation across different periods.

Contribution The present study builds on the above-mentioned empirical contributions, although it significantly departs from them in several respects.

Indeed, this work studies the richest fractional percentiles within the top decile (top001) and the share of relative poorer households within the richest top decile (ideally the top10 excluding the richest 5%). As explained also in Chapter 2, I make this choice based on the consideration that banking crises can have different impact on different top-income groups given the substantial differences in income composition. Indeed, as it becomes clear in the following sections the two shares within the top decile are usually negatively correlated across crises episodes[7]. The methodological assumptions further depart from existent analyses in different ways.

i) Firstly this work is concerned uniquely with systemic banking crises, disregarding those events that affect isolated banks[8]. The data are described in Chapter 1.

ii) Secondly, I adopt an empirical methodology consistent with an 'agnostic' view of the ending date of a banking crisis (Chapter 1 discussed the reasons why this is a widely controversial issue within the literature). In particular I adopt a macroeconometrics counterfactual approach by estimating impulse response functions of inequality measures to the banking shock.

iii) Thirdly, I acknowledge the fact that macroeconomic shocks are not isolated events but occur in clusters[9]. I therefore also assemble data on real per-capita GDP collapses and other major financial and economic crises episodes (real per-capita

Dynamic Fixed effects, Bordo and Meissner use Pooled OLS. Both works include period and country fixed effects.

[6]Bordo and Meissner, similarly to Roine et al., also make use of banking crisis variables which detect the duration of the crisis and include the non-systemic shocks.

[7]Note that also the work by Roine et al. analyse the effect of crisis (and other variables) on non-overlapping top groups, namely the top1% and the top10-top1%.

[8]For instance, among others, the UK banking crisis in 1974-1976 is excluded from the database as it was not systemic in nature.

[9]The works by Roine et al. (2009) and by Bordo & Meissner (2011)also analysed the effect of currency crises and twin crises (banking and currency crises together) on top shares.

consumption crises, currency crises, domestic and external debt crises, world wars, civil wars, independence and hyperinflation episodes). This leads, among other things, to identify when systemic banking crises follow or happen contemporaneously to other major economic turmoils. However, differently from other works, I clearly specify the definition of the counterfactual and do not attempt to compute the *marginal* effect of the banking crisis (controlling for other macro events generally caused by the crisis). Rather I am interested in the *total* effect of the crisis.

iv) Fourthly, I exploit year-to-year percentage change variations of the top shares rather than the cumulated absolute changes over specific time-periods, as done in previous studies. I believe the latter is important as top income shares are not directly comparable across countries and using their first differences may complicate the interpretation of the results with issues linked to the units of measurement.

v) Furthermore, using both the updated versions of the WTID[10] and the Chartbook of Income Inequality[11] (Atkinson & Morelli, 2012) one can extend the analysis in space, to 26 countries[12], and in time in order to partially include the analysis of the recent financial meltdown which was excluded in previous works (the distributional data is extended to 2009 and 2010[13] for more than a half of the sample of countries, namely Canada, Finland, France, Ireland, Italy, Japan, New Zealand, Singapore, South Africa, Sweden, UK and the US). Fifthly, I present the results divided by period and country-group sub-samples, marking the importance of a long time *and* cross-country perspective.

vi) Finally I provide estimates consistent with different estimation methodologies, namely standard homogenous panel models as well as, less commonly applied, heterogenous panel models with common factors, controlling for more general cross-section dependence. These models are particularly suitable for macro-panels with 'large N' and 'long T' structure and strong features of cross-section dependence.

3.3 Data

The two main database sources needed for this study are those related to the top income shares and banking shocks. Chapter 1 extensively reviewed the existing information sources on banking crises, explaining how these were assembled to create a

[10] I use all countries available in June 2013 except Colombia, Mauritius and Tanzania as information on macroeconomic shocks is not complete

[11] The use of the Chartbook allows to recover top income shares for Iceland (based on estimation by Olafsson and Kristjansson, 2010) and Malaysia (preliminary figures estimated by Atkinson, forthcoming.) which are not yet included within the WTID.

[12] The two studies I surveyed analysed 16 or 17 countries.

[13] Available data on 2010 is available only for Sweden, Japan and the US.

systemic banking shocks database. Furthermore, the identification of general macroeconomic instability episodes was also discussed there and I refer the reader back to Chapter 1 for further details. Instead, the section below describes the features of the World Top Income Database (WTID) from which I mainly[14] draw information on the measure of within country income inequality used here - the top income shares.

3.3.1 Data on Top-Income Shares

The analysis discussed here makes use of the World Top Income Database (WTID), an extensive database[15] of top income shares' annual series based on historical tax statistics covering most of the 20th century for 26 countries[16]. Top income shares are calculated from national detailed tabulated income tax statistics or from tax administration micro data (this applies especially for recent years to specific countries as, for instance, Norway and the US). However, the computation of top shares also requires the estimation of the control totals for population and income.

Advantages of the data The WTID database constitutes a unique source of comparable information over time which allows to analyse proxy variables to within-countries income 'inequality' over an extraordinary long time horizon (covering most of the twentieth century and the beginning of the twenty-first century). This is a crucial advantage for a study on macroeconomic shocks and especially systemic banking crises which are very rare events in a country's history. Moreover, the data are typically from the same national source (Tax Statistics) over time and this guarantees a relatively high degree of comparability of data over time. Indeed, the empirical investigation presented here exploits the dynamic properties of the data series. Finally, the series of top shares are mostly based on gross income definition, excluding therefore any *direct* impact[17] of fiscal policy on measure of the inequality (top income shares). Finally, top income shares from the WTID capture information which is not normally contained within standard national surveys and this represents a unique opportunity to observe the dynamic of the tangible share of total national income accruing to a small share of rich individuals in the economy. Atkinson et al. (2011) and Morelli et al. (forthcoming)

[14] I recall, as anticipated before, that I draw on the Chartbook of Economic Inequality (Atkinson and Morelli, 2012) in order to recover top income shares for Iceland (based on estimation by Olafsson and Kristjansson, 2010) and Malaysia (preliminary figures estimated by Atkinson, forthcoming.). The data for these two countries are not yet included within the WTID as I am writing (July 2013).

[15] The database, managed by F. Alvaredo, T. Atkinson, T. Piketty and E. Saez, makes use of the findings from the collective research project on the dynamics of income distribution coordinated by Atkinson & Piketty (2007, 2010). On the other hand the database is constantly evolving and new countries and observations are being added.

[16] The countries covered by the WTID, at October 2012, are Argentina, Australia, Canada, China, Denmark, Finland, France, Germany, Iceland, India, Indonesia, Ireland, Italy, Japan, Malaysia, Mauritius, Netherlands, New Zealand, Norway, Portugal, Singapore, South Africa, Spain, Sweden, Switzerland, the UK and the US. I further complement this list with information on Iceland and Malaysia taken from Atkinson & Morelli (2012) .

[17] Although one can exclude any direct redistribution effect of taxation, one could not rule out behavioral endogenous responses in income reporting due to changes in tax rates.

further discuss these issues.

Heterogeneity of Top Groups The present study explores the share of total national income earned by the richest fractile (the share of the richest 0.01% of the population, called top001) as representative for the group of the richest within the top 10 percent of the income distribution. Conversely, the share of P90-P95 represents the 'poorer' group within the top decile (also called top10-top5)[18]. Generally speaking, one tends to assume that the groups of individuals/households populating the top10 percent of the income distribution is a relatively homogeneous bunch. In fact, as also shown previously in Chapter 2, enormous differences in income level characterise the subgroups within the top decile. This is also recalled in Atkinson, Piketty and Saez who posit that *"being in the top 1 percent does not necessarily imply being rich and there are also marked differences within this group. The very rich are different from the rich".* As an illustration lets take the case of the United States. In 2006, the minimum non-capital gains income in order for a tax unit to be counted above the P90, P95, P99, and P99.99 percentiles was respectively 111.772, 156.773, 392.922, and 8.568.365 US-2008 dollars[19]. Upper groups do not differ only by the level of income. Its composition varies considerably over time and across income groups as well. In 2007 the incidence of capital income for the bottom group of the upper decile was between 5 and 9 percent, depending on whether or not capital income includes realised capital gains. The same figure adds up to 33-42 percent of total income for the richest group (top 0.01%). The empirical evidence shows that richer fractiles (above P99) and 'poorer' ones within the top decile (between P90 and P99) seem to form two distinct groups as shown in the previous chapter. In the US, their respective shares in total income are negatively and significatively correlated, especially during the period surrounding the financial shocks[20]. By looking at the US data, the top decile share net of the top 5 percent (excluding capital gains), grew on average 4 percent during the 5 years after a crisis, while it had a negative average growth of around 1 percent in the years preceding the crisis. Instead, the richest fractile share in total income grew on average around 13 percent for all 5 years preceding banking turmoil. The average growth dropped to negative 9 percent in the 5 years following the crisis. As shown in the next sections, the present cross-country study also finds similar empirical evidence for specific groups of countries.

[18]It is not always possible to use these variables as observation availability vary across countries and time. When top001 is not available I revert to top005, top01, top05 or to top1 respectively (all of them nest the information about the top001). For instance I make use of data on top1% for the Nordic European countries as very little information is available on the top001. On the other hand when the share of P90-P95 is not available I make use information about P90-P99 or P95-P99

[19]Moreover, the 2006 ratios between the average incomes of independent fractiles within top decile (P90-P95, P95-P99, P99-P99.5 and P99.99-P100) and the above stated thresholds are respectively 1.17,1.39, 1.21 and 2.55.

[20]In the US the correlation is particularly highly significant for the series including capital gains and it appears robust to the use of different time windows. Moreover, the correlations before crisis appear slightly stronger than the period after the crises.

Limitations of the Data The data on top income shares of the WTID, as any economic data, suffer from several limitations. First of all, it is worth mentioning that despite the intention to cover an extensive time period this effort falls short of the expectations. In few countries data limitation is severe and a total coverage of the time period under investigation (1900-2010) is deemed an impossible task (i.e. China has information from mid 1980s to early 2000s allowing to analyse only 1 out the 5 crises identified. However, it is to be noted that, on one hand, the data coverage remains outstanding relative to the standards in empirical works on income inequality. For instance, top shares data cover almost the entire set of crises identified since 1900 for Australia, Finland, India, Singapore, South Africa, Japan, UK and the US. On the other hand, the gaps in the series are not always problematic for the sake of the empirical investigation. For instance, the coverage of top income shares for the case of Iceland begins in early 2000s[21]. Yet, the poor time data coverage allows to study the only systemic banking crisis recorded in Iceland since 1900, which occurred in 2007[22]. See Figures 3.4, 3.5, 3.6 and 3.7 within the appendix in order to compare the data availability for top income shares with the occurrence of systemic banking crises and macro-instability episodes under investigation.

Top income data are also not particularly appropriate to study the bottom groups of the population. However, tracing the dynamics of a relatively small number of richer households is not uninformative on the general disparity of income distributions (e.g. Gini coefficient) given that they own a considerable share of total income[23].

Furthermore, only few country series include capital gains in the definition of income[24] and excluding capital gains can leave out a sizable amount of income for richer tax units[25].

In addition, the series are generally constructed using tax statistics and they make use of gross type of income (i.e. in the US the gross market income is defined before deductions, individual income taxes, payroll taxes and all kind of government transfers.). On one hand, this characteristic is particularly welcome as facilitates the untangling of the impact of fiscal policy on the sources of income (normally following

[21]Note that a new series for Iceland is being prepared for the WTID. The new series may well have a longer extension and coverage over time.

[22]Of course the lack of long data series worsens, other things being equal, the estimation of the dynamic model upon which the distributional impact of the crisis is estimated, see the section of methodology.

[23]For instance, "*If we treat the very top group as infinitesimal in numbers, but with a finite share $S*$ of total income, then the Gini coefficient can be approximated by $S*+(1-S*)G$, where G is the Gini coefficient for the rest of the population*" as recalled by Atkinson & Piketty (2007, pg. 19) and proved more formally in Alvaredo (2011). Although this is an interesting result it does not necessarily imply that top shares and Gini coefficient comoves over time. The relationship, although empirically strong on average (see Leigh, 2007) may break down in the short-run.

[24]The countries including capital gains are Canada, Germany, Japan, Sweden, Spain and the US. Thus, for consistency, the empirical investigations are conducted with series that exclude capital gains.

[25]Capital gains are important to understand the true extent of the incidence of capital income in the total income. Indeed, capital gains has received favourable tax treatment with respect to dividends, especially in advanced countries and over the past decades.

the occurrence of a crisis as discussed above). On the other hand, it makes the comparison of levels across countries particularly cumbersome[26]. Indeed, the definition of income has to satisfy the administrative requirements of each specific country.

Finally, tax statistics suffer from common problems of tax avoidance and tax evasion as individuals report income so to minimise their tax liabilities (the equivalent of underreporting in the survey-based data).

For a more complete and extensive discussion about the potential caveats of the data and their actual relevance I direct the reader to Atkinson et al. (2011), Burkhauser et al. (2012) and Morelli et al. (forthcoming) .

Common dynamics across country groups Figures 3.8, 3.9 and 3.10 depict the top001, top1 and top10 shares for different sub-groups of countries. Following the work by Atkinson et al. (2011) and other recent works within the literature of top income shares, I group the countries in different sub-groups. The latter work summarises the empirical evidence respectively for the Nordic European (Denmark, Finland, Iceland, Norway and Sweden)[27], Southern European (Italy, Portugal and Spain), Western English speaking[28] (Australia, Canada, Ireland, New Zealand, United Kingdom and United States), Continental Central European (France, Germany, Netherlands and Switzerland) together with Japan, and Developing countries (Argentina, China, India, Indonesia, Malaysia, Mauritius, Singapore, South Africa and Tanzania)[29]. *"The grouping is made not only on cultural or geographical proximity but also on proximity of the historical evolution of top income shares."*(Atkinson et al., 2011, p. 40), although it is important to notice that the latter group (Developing countries) contains a 'residual' and heterogeneous group of countries.

In line with results and discussion within the literature (see Atkinson et al., 2011), the above mentioned charts 3.8, 3.9 and 3.10 show a strong common dynamic of the top shares across different groups. This provide a visual justification of the choice to group the countries in different sub-groups. Looking at the pattern of top1% for instance (see Figure 3.9), the Anglo-Saxon countries present a strong U-shape pattern with a sustained decline in inequality from the 1940s until the 1980s and a sustained increase since. Some of the Nordic European countries also feature a similar U-shaped pattern. However, on one side the increase in inequality only starts from the 1990s and the magnitude of the increase is lower on average (with the exception of Iceland and Norway). The Continental European countries, instead, present what Atkinson et al. (2011) call an L-shaped pattern. Indeed, while the reduction in inequality over

[26] Although the data series are fairly homogeneous across countries and over time, there are also differences in the definition of the unit of analysis (e.g. individuals vs. households). Sometimes the unit of analysis changes over time within a single country. This further complicates the comparability of levels across panel units and over time. For a more complete discussion see Morelli et al. (forthcoming) .

[27] Iceland and Denmark were not yet included in the APS study and I naturally included within the Nordic European countries list.

[28] Also called here Anglo-Saxon countries.

[29] Malaysia, Mauritius, South Africa and Tanzania are newly added countries with respect to APS.

time present similar features to the Anglo-Saxon and Nordic countries, the increase in top shares over the past decades has been less remarkable. Finally, Developing countries also present a U-shape or L-shape pattern over time and similar to the Nordic countries. However, the recent rise in top shares mostly occur since 1990s and is less pronounced when compared to the Western-English speaking countries.

The 'common dynamics' of the series, beside being a renowned feature of these data (see Atkinson et al., 2011), further suggests a strong role of cross-section dependence which ought to be taken into account in the empirical estimation.

Finally, it is worth noting that this work slightly departs from the categorisation described above by merging the Southern European countries to the group of Continental European countries. This is only done because the investigation of distributional impact of banking crises for the Southern European group, would only be able to capture the Italian crisis in 1992 and part of the 2008 crisis in Spain. Therefore, due to the few usable observations, studying the southern group on its own would not be a compelling exercise. The decision to merge the evidence of the two groups may be questioned on the ground that Southern European countries might not necessarily be comparable (i.e. on the base of institutional, cultural and macroeconomic features) to the original Continental group as described in Atkinson, Piketty and Saez. Nonetheless, this decision may be less contentious by noticing that every empirical finding is tested to the exclusion of Southern-European countries.

3.4 Conceptual Framework

In this section I develop a qualitative conceptual framework which would become useful to interpret the quantitative results in the later stage. However, developing a full theoretical model to interpret the results would clearly go beyond the scope of this paper.

In order to understand what may drive the results it is important to take a step back and analyse the factors influencing the change in top shares. Top income share are defined as $s_i = y_i/Y$, where y_i is the income accruing to the top income group i and Y represents the total income in the economy. Hence, one needs to carefully consider the potential driving forces of the numerator and the denominator of a top share.

Putting it simply, in a context of aggregate income shock to the economy, the share decreases (increases) if the top group 'looses more (less)' than the bottom or, putting it differently, if the bottom of the distribution is 'more (less) protected' than the top. The magnitude of such change would depend on the relative exposure of top income sources to the financial cycle and the degree of stability or protection of income sources accruing to the remaining majority of the population.

Broadly speaking, the degree of 'protection' of gross aggregate income may be influenced by some institutional factors (i.e. labour market institution, layoff policies etc.) and the structure of the economy (i.e. size of the financial sector, nature of automatic stabiliser, diversification of the economy, stock market participation rates etc.). The relative exposure of top income to the financial shock may depend on the composition of income accruing at the top and its relative elasticity to the overall aggregate changes[30]. Ultimately, it is likely to expect that the relative exposure of the top and the degree of protection of the bottom of the distribution are endogenous to each other[31].

3.4.1 The Determinants of Top Incomes

Is the crisis affecting temporarily the sources of income or is the crisis hinging structurally on the income earning processes of top groups? It is useful to define the actual top share (S) as determined by an equilibrium component (S^*) and a temporary deviation from it, depending on both deterministic and stochastic factors.

$$S_{i,t+1} = S_{i,t} + \lambda(I_i)[S^*_{i,t}(I_i) - S_{i,t}] + \varepsilon_{i,t+1}$$

Where I is a vector of structural factors ('institutions') presumably influencing both the equilibrium value of the share and the speed of disequilibrium adjustment ($\lambda(I)$). Although there is no available theory of distribution suggesting the structure described above it is worth noting that recent literature (Philippon & Reshef, 2007, Atkinson et al., 2011, Roine et al., 2009, Neal, 2013) has discussed some of the structural factors potentially driving the top income shares. Among these factors is worth mentioning the role of global economic integration (global trade and international financial integration), taxation policy for different types of income and wealth (e.g. change in top marginal tax rate and corporate taxes), social norms and practices in remuneration, financial development and sectoral changes within the economy (e.g. rise in the share in total value added of the financial sector), changes in political regimes (e.g. war effort, transition to democracy from dictatorship or *vice versa*, changes in political partisanship, end of colonial rule etc.) and shifts in regulatory frameworks

[30] Chapter 2 shows how capital income (including capital gains, dividends, rents and interests income) is found to be the most relevant source of income for the richer upper groups in the US, accounting for around 60% of total income growth. Wage income (including bonuses and other forms of monetary remuneration), instead, accounts for most of the income dynamics for the 'poorer' groups within the top decile (around 60%). Unfortunately, such calculation cannot be carried out for the whole set of countries under investigation as the income sources decomposition is not always available for the top income shares data. Indeed, the World Top Income Database, to date of consultation (March 2013), only provides decomposition of income sources for 8 countries, namely Australia, Canada, France, Italy, Japan, Netherlands, Spain and US. Furthermore, out of these 8 countries, only Canada, Japan, Spain and the US contain information about capital gains which might be an important driver of capital income around crisis episodes especially for very rich upper groups.

[31] As an example, a greater size of the financial sector within the economy influences the exposure of both segments of the distribution. On one hand the rich gets higher share of the profits from the sector and bear the brunt of a financial shock disproportionately. On the other hand, the 'middle class' tend to participate more in the stock market, sharing its gains as well as losses.

(e.g. substantial changes in the regulation of banks and financial markets, technological progress and changes in education policies). It is plausible to assume that banking crises only rarely affect substantially these structural factors, especially within the course of the 4-years horizon under investigation within the chapter.

It is therefore more plausible to explain short-term variation of top shares using theories explaining the temporary and cyclical deviations from a potential share equilibrium value. For instance, one can use the framework developed within Chapter 2 and link the capital and wage income sources to the economic activity, stock market and financial sector performance as well as to the economic and financial cycles. We have done this for the US case in Chapter 2, but this cannot be checked empirically here due to data limitation.

It is nonetheless important to recall that the changes in income (wages and capital) might not necessarily be exogenous, as they could reflect optimal endogenous responses of agents. A macroeconomic shock such as a banking crisis can bring about exogenous changes in both extensive and intensive margins of a specific source of income. For instance, on one hand individuals, and especially low-skilled individuals (Furman & Stiglitz, 1998), are laid-off during bad economic cycles (exogenous change on the extensive margins of wage income). Similarly, the total remuneration of workers (which include the bonuses and stock options earned by the CEOs) or the total working hours can be curtailed by the 'employers' in order to maintain the corporate profit margins (exogenous change on the intensive margins). On the other hand individuals could independently decide to reduce their hours of work[32] or not to exercise their stock options when assets prices are lower due to the economic and financial turbulence (endogenous changes on the intensive margins).

One can shift this argument to capital income originating from the stock market participation. Conditionally on holding stocks, agents may see their dividends curtailed as companies decide to retain profits during crisis periods. However, as also discussed in previous chapter, it is also very likely that the richest individuals liquidate the risky positions during financial turmoils so that the resulting reduction in dividend income can be the result of optimal restructuring of their financial portfolio[33].

[32] In practice the reduction of the hours worked conditioned on keeping the job accounts only for a small share of total variation in hours during business cycles due to the indivisibility of job. For instance, in US the variation in total hours worked is mostly (3/4) explained by variation in employment (Furman & Stiglitz, 1998).

[33] If the stock is not liquidated it can be also argued that agents prefer not to realise capital gains in periods of depressed assets valuations.

3.5 Empirical Methodology

Having described the data at hand and sketched the conceptual framework, this section describes the methodology used to investigate the short-term impact of systemic banking crises on a country's share of total national income detained by the richest segments of the population. The long annual series available for top income shares allows to better exploit the time-series properties of the data as well as to implement methodologies that are more commonly applied in the empirical macroeconomic literature.

In particular, the evidence in this paper is produced by estimating impulse response functions (IRFs) of the rate of growth of top income shares[34] to systemic banking crises and performing a so called 'ex-post counterfactual analysis' as recently proposed in Pesaran & Smith (2012). To the best of my knowledge, this constitutes one of the first applications of this sort within the literature of income distribution. The IRFs are calculated from a standard multivariate Autoregressive Distributed Lag (ADL) model of the following (reduced) form:

$$g_{i,t}^{top} = \sum_{k=1}^{2} \theta_{i,k} g_{i,t-k}^{top} + \sum_{k=0}^{4} \phi_{i,k} BC_{i,t-k} + X'_{i,t}\rho_i + u_{i,t}. \tag{3.1}$$

where $g_{i,t}^{top}$ is the growth rate[35] of the specific top share under investigation for every country i from year $t-1$ to year t; $BC_{i,t}$ is a categorical variable coded 1 when the systemic banking crisis in country i begins and zero otherwise; $X_{i,t}$ is a vector of other suitable regressors[36].

In order to maintain the specification as general as possible, the unknown random coefficients are assumed to be of the following structure $\theta_{i,k} = \overline{\theta_k} + \eta_{i,k}^{\theta}$, $\phi_{i,k} = \overline{\phi_k} + \eta_{i,k}^{\phi}$, $\delta_i = \overline{\delta} + \eta_i^{\delta}$, $\rho_i = \overline{\rho} + \eta_i^{\rho}$ with $(\eta_{i,k}^{\theta}, \eta_{i,k}^{\phi}, \eta_i^{\delta}, \eta_i^{\rho}) \sim i.i.d.$

Similarly, I do not specify the structure of the error term $u_{i,t}$ which is discussed in more detail within the estimation subsection and the appendix. The modeling idea draws on the contributions by David and Christina Romer[37]. I first generalise this approach to a panel of countries (in a similar fashion to Cerra & Saxena, 2008) and later discuss the estimation of the model based on two main conceptual approaches.

[34] I recall the priority is given to the top hundredth percentile (top001). When the latter is not available, for a country or a specific period of time, I revert respectively to the growth rate of the top005, top01, top05 or top1 percent.

[35] I use the growth rate of top shares in order to mitigate the potential sources of non-stationarity and to obtain results free from the influence of the unit of measurement. I recall, in fact, that top income shares are not directly comparable across countries.

[36] The suitability criteria become clearer in the next section.

[37] The paper by Romer & Romer (1989) constitutes one of the first application of this methodology. Using a single time-series for the US, they attempted to gauge the implications of exogenous monetary policy shocks on unemployment rate and industrial output.

On one hand, I make use of the more standard 'pooled' estimators (the parameters of the model are estimated homogeneously across the units of the panel). On the other hand, I take advantage of the recent advances within the heterogenous parameters models and common factors approach to panel estimation (i.e. in the family of the Mean Groups estimators). Applications of this sort are less common in the empirical literature, but are particularly appropriate in the case of macro-panels (large N and long T) with features of non-stationarity and cross-section dependence (see Eberhardt et al. (2013) for a detailed discussion).

Before discussing the exact estimation procedure of the models, it is worth taking a step back to better explain how one can assess the impact of crises on top shares. In other words, one ought to highlight the nature of the counterfactual[38] under investigation to go beyond a "factual description" of data (as recalled in Cunha et al. (2006)).

3.5.1 The Nature of the Counterfactual

Ideally one would like to know what would the inequality have been like had there been no crisis in the first place. This observation could then be compared to the actual change in inequality in the post-crisis period. However, obtaining a reliable and compelling estimation of this counterfactuals is a very challenging task as we are essentially facing a problem of missing data. As an example, Jenkins et al. (2013) in their recent attempt to assess the distributional implication of the "Great Recession", state that ''*...counterfactuals are difficult to estimate with confidence. Hence we are left with the less satisfactory but feasible alternative of measuring changes relative to a baseline distribution for around 2007, while also looking at earlier years to consider outcomes for that year in the context of the previous trends*".

I clearly share the view that the problem is too complex to find a compelling and convincing solution and I also acknowledge the limitation of the tools at hand, especially in the context of aggregated data and repeated cross-section. Nonetheless, recent advances in the econometric literature suggesting different ways of tackling the problem, as analysed in recent work by Pesaran & Smith (2012). Following their work I firstly clarify the nature of the counterfactual suitable for the study presented here. Broadly speaking I choose between two main approaches which are called, for simplicity, the *micro* and *macro* approach. The former largely mirrors the issue faced by micro-economists in evaluating the effect of policies or shocks on individual behavior or outcome variables. This is generally done by randomly identifying the so called 'treatment' and 'control' groups in a single cross-section. Transposing this to the problem exposed here, it implies comparing, for any given year, what happened to inequality in countries who experienced a crisis versus those who did not experienced it. The 'macro' approach, instead, uses the time-series observations to compare

[38]The extension of this section on the nature of counterfactual followed a stimulating discussion with Andrea Brandolini

the periods preceding and following a crisis.

Both approaches require stringent assumptions to be valid, though the macro one is preferred in this context for reasons explained below. First of all, the 'micro' approach abandons the dynamic dimension of the data and requires a sufficient amount of countries within both the control and the treatment groups. This is very rare especially with seldom events like systemic banking crises (e.g. as shown in Figure 1 of Chapter 1, only in the year 1931 I counted 11 banking crises, the highest year frequency in the dataset of banking crises). Secondly, the selection of a 'treatment' group is clearly non random and different countries are not necessarily comparable entities. Indeed, if the countries included in the treatment and control groups are deemed to be alike (similar fundamentals, institutions, economic development etc.), it would be hard to explain why only few countries experienced a crisis in the first place.

The *ex-post* counterfactual approach I therefore turn to the 'macro approach', implementing a so called *ex-post* counterfactual analysis based on macro-econometrics. For every country 'i' and income group 'j' under investigation, I define the information set at time t as $\digamma_T = \{g_t^{top}, X_t, BC_t\}$ for every $t = (T, T-1, T-2, ...)$. I also define the set of 'crisis off' values as $\mathbf{\Theta}^0_{T+s} = \{BC^0_T = 0, BC^0_{T+1} = 0, ..., BC^0_{T+s} = 0\}$, assuming that the banking crisis lasts for $s+1$ years and begins at year T, where $s = (0, 1, ..., S)$. This leads to define the total impact of the occurrence on the outcome variable as follows:

$$I_{T+h} = g^{top}_{T+h} - E\{g^{top}_{T+h}/\digamma_T, \mathbf{\Theta}^0_{T+h}\}. \tag{3.2}$$

Where g^{top}_{T+h} is the actual growth rate of the top share[39] under analysis and $E\{g^{top}_{T+h}/\digamma_T, \mathbf{\Theta}^0_{T+h}\}$ represents the objective of the estimation, namely the value of the growth rate of top shares under the condition of no crisis, which depends on the empirical specification. As elegantly argued by Pesaran & Smith (2012), a simple reduced form model is sufficient in order to assess the *total* effect of a crisis (they discuss the role of macroeconomic policies instead) on a specific outcome variable. This holds true as long as one conditions the model on variables that, although influencing the outcome variables, are invariant to the occurrence of the crisis itself. This argument suggests, quite intuitively, that one does not have to worry about the estimation of the indirect implications of other macroeconomic shocks or events resulting from the banking shock itself by means of a structural model[40].

[39]Note that in the case of an *ex-ante* approach, even the 'crisis on' values of the top shares would be unknown and represented in expectation form. However, this approach can be very useful exclusively in a context of macro policy evaluation as discussed in Pesaran & Smith (2012).

[40]In other words, there is no need of calculating the marginal effect (structural parameters) of each single events using a system of equations relating the entire set of endogenous variables. Most importantly, note that a reduced form model conditioned on crisis-variant regressors is deemed to be misspecified for such a purpose.

This has pretty clear implications for the model in equation (3.2) and this is explained more formally within the appendix. In particular the model cannot be conditioned on control variables such as a country's GDP growth, stock market performance, measure of financial development and other macro-shocks. All these variables, although commonly used as control variables given their influence on the growth of top shares, are in fact expected to be influenced by the occurrence of a banking crisis.

One can however include time effects (control for time trend and general common dynamics) and lagged observations of the outcome variable as the set of crisis-invariant regressors. This would define the counterfactual exclusively on the basis of the trending and the mean reversion properties of the growth rate of top income shares, similarly to Romer & Romer (1989) and to what has been done in the previous chapter.

As part of the robustness exercise, the empirical model described above is further conditioned on the average 'world-level[41]' growth rate of per-capita GDP. This helps to check the validity of the findings controlling for other general forms of common factors and spill-over effects of crises from other countries. Indeed, some of the dynamics of the top shares could be partly due to some general contagion effect coming from external crisis occurring contemporaneously or general macroeconomic conditions which are independent to the country-specific crisis.

3.5.2 Derivation of the Impulse Response Function - IRF

This section shows the steps carried out in order to derive the realizations of the IRF for a four years time horizon, reflecting the stated goal of analysing the impact of crises over the short-run. The IRF, estimated directly from the empirical specification (equation (3.2)), provides the empirical evidence on the response of the rate of *growth* of top income shares to the occurrence of a crisis. Given the ultimate interest in the impact of the crisis on the *level* of top shares, one can cumulate the estimated realizations over time.

Since I am dealing with stationary series (growth rates of top shares), every impulse to the dynamic process would automatically decay over time and this approach can be informative about the depth and duration of a change in top shares brought about by banking shocks[42]. However, it should be noted that the derivation below is only valid under the invariance assumption discussed above[43]. The vector of the

[41] I proxy the word level using the average across the total sample of 27 countries representing more than a third of world GDP.

[42] Using graphical investigation it is worth noting that the processes underlying the growth rates of top income shares are very volatile and have very low level of persistence. Thus, perturbing such processes would hardly find any significant 'structural break' in growth rates which goes beyond a few years.

[43] The appendix contains a general derivation of the IRF encompassing the violation of invariance

realizations of the IRFs $I^G_{T+h}(F_T, \Theta^0_{T+h})$ is presented below for the growth rate of the specific top share and country group under investigation, evaluated at $h = 0, 1, 2, ..., H$ years following the banking shock. The superscript G indicates 'growth rate'. As an example, the IRF for $H = 4$ is derived below:

$$I^G_{T+h} = \begin{cases} \phi_0 & if \text{h=0}, \\ \phi_1 + [I^G_T]\theta_1 & if \text{h=1}, \\ \phi_h + [I^G_{T+h-1}]\theta_1 + [I^G_{T+h-2}]\theta_2 & if 2 \geq h \leq 4. \end{cases} \tag{3.3}$$

It is straightforward to show that the cumulated dynamic multipliers for $h > 1$ depend on the feedback effect due to the presence of lagged variables of the top share growth rates. By cumulating the above realizations of the IRF over time (for every 'h' year following the crisis) one can obtain the impulse response function on the level of top shares. For instance the effect on the level of the share after H years from the onset of the crisis is the following for every $H > 0$:

$$I^L_{T+H}(\psi, h) = \sum_{h=0}^{H} I^G_{T+h} \tag{3.4}$$

where ψ is the vector of parameters and the superscript L refers to the fact that the IRF is estimated for the levels of top shares. The estimated version of the IRF $I^L_{T+H}(\widehat{\psi}, h)$, the ultimate interest of the investigation, represents the residual dynamics of the top income share when a banking shock occurs compared to the no-crisis case. In other words, the model predicts and compares the dynamics of the top income share with and 'without' the occurrence of a banking crisis and given its past dynamics and time trend[44]. For instance, an estimated figure of -0.1 in the third year following the shock (I^L_{T+3}) should not be interpreted as a decrease of top shares by an average of 10%. Rather, the figure suggests that in the third year following the beginning of the banking crisis the top income share is still 10% lower than expected on the basis of its past dynamics and its trend.

Endogeneity of Crisis As extensively discussed in Chapter 2, the consistency of the estimated parameters in the ADL model rests on the assumption of 'exogeneity' of the crisis dummy variables with respect to the growth rates of top income shares. This cab be achieved by simply assuming that $\phi_0 = 0$ for every country under investigation, implying that the model is conditioned on predetermined variables and that crisis has no contemporaneous effect on the top shares. This constitutes the baseline approach and all the results presented in this chapter satisfies this assumption. Nonetheless, the appendix shows the results where ϕ_0 is assumed to be different from zero as well.

assumptions also, as discussed in the previous section.

[44]Later in the paper I also consider other macroeconomic conditions

Possible Extension The above derivation of the IRFs assumes that the propagation impact of the shock is coming exclusively from the initial impulse in year T. As also explained in Chapter 2, this is a conservative approach estimating a 'lower bound' of the total effect of crisis on top shares. Moreover it is a rather 'agnostic' approach with regards to the duration of the financial turmoil, which is preferred given how little one knows about the ending date of a banking crisis, as discussed within Chapter 1. The above methodology is, however, very flexible and, although this is not done here, can easily accommodate an 'upper-bound' of the total effect of crises on top shares. This was shown for the case of the US in the previous chapter, by computing the IRFs assuming that a banking crisis lasts for the whole period under investigation. In the case under analysis this is equivalent to the set ($D_{T+h} = 1$ for every $h = 1, 2, 3, 4$).

3.6 Estimation Approach

Having already discussed the empirical model, this section proceeds to the description of the estimation methodology. In particular, this section describes the two main approaches used to estimate each single specification, namely the homogeneous panel models specification (e.g. Pooled OLS) as well as the heterogeneous panel models (e.g. Mean Group estimator). It also points out that the latter approach, the one based on heterogeneous panel models, is preferred to the former as it is thought to provide more reliable estimates in this context. Indeed, all results presented in the text are based on the latter estimation methodology, whereas the appendix compare the findings with those based on homogenous panel model method.

Homogeneous Panel Models It is common in the empirical literature to estimate the empirical specification assuming that parameters are homogenous across panel units (i.e. the effect of crisis is the same across countries). For instance in this chapter I also estimate the empirical specifications for the whole sample of countries and years using standard pooled least squares regression with robust standard errors as suggested by standard post-estimation tests[45]. The model is further augmented by time fixed effects in order to control for general unobserved common factors (assuming that they have homogenous impact across countries).

However, it is worth noting that the class of homogeneous parameter models can generate a number of problems as formally explored within the appendix. Indeed, on the one hand, the assumption of parameter homogeneity can be the source of biased estimation if the true data generating process (DGP) suggests the heterogeneity of

[45]Indeed, for every RE model I test the systematic difference across panel units, namely the so called 'panel effect'. The test for random effects is carried out with a standard Breusch-Pagan Lagrange Multiplier (LM) test with the null hypothesis of zero variance across panel entities, μ_i. The latter is never rejected and this confirms the consistency of the standard pooled least squares estimator (POLS). I also jointly test the validity of country effects in the POLS regression and I fail to reject the null hypothesis. This, together with the very long period under investigation, would rule out concerns for the classic source of 'Nickell bias' in a dynamic specification (3.2).

the parameters of the model (i.e. the impact of crisis on top shares is different across countries). On the other hand, it can generate forms of autocorrelation of the error terms too.

Heterogeneous Panel Models In order to mitigate these problems I mainly estimate the model and the IRFs discussed above using heterogenous panel techniques such as the 'Mean Group' estimator, allowing for heterogeneity in the model parameters by averaging out the results obtained from country-specific regressions. The results indicate the average relationship across panel units. In particular, I estimate[46] the model in eq.(3.2) augmented by linear time trend using the Pesaran & Smith (1995) Mean Group (MG) estimator[47]. The additional linear time trend accounts for unobserved common factors as done by the time fixed effects in the pooled estimators case above. However, differently from the case above, this approach allows for an heterogenous impact of unobserved common factors across countries imposing at the same time a linear structure on their evolution.

Estimation of the Standard Errors For every IRF, irrespectively of the estimation approach described above, I derive a 90 and 95 percent confidence band through *bootstrapping* technique with 100 replications[48].

3.7 Results

This section describes the main findings. As a first step, the empirical model is estimated for the entire sample of countries and years. However, averaging out the results across the whole sample can downplay the role of a database of repeated cross-sections spanning a long time horizon and covering more than a third of the world population. Therefore a model based on sub-samples of years and country-groups is also estimated. Results are discussed below.

3.7.1 Results for the Whole Sample

Chart 3.1 shows the average dynamic impact of a systemic banking shock on the level of the share, in total national income, of the richest and the bottom groups within the top decile (I recall that these groups are typically the share of P99.99-P100 and P90-P95

[46] Importantly, as shown in Chapter 2, a country-specific (linear) time trend is include in the regression. I believe a linear trend to be sufficient in the case under analysis given that the dynamic of top income shares over time can be reasonably approximated by a quadratic trend. Indeed, it is straightforward to show that if y follows an AR(p) model with a quadratic time trend, its first difference is still linearly dependent on time.

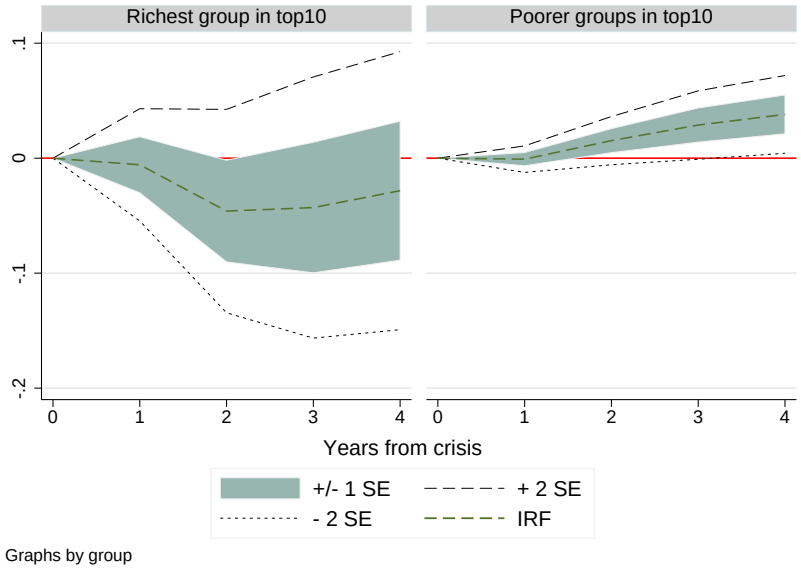
[47] This estimator, though allowing for parameters heterogeneity, does not directly cope with the problem of cross-section dependence which is tackled within the robustness exercise.

[48] The program was coded using Stata 12 routine.

in total national income), estimated using MG estimator. Despite their poor statistical significance, it is worth noting the main features of the findings for the whole sample. In particular, the two non-overlapping groups appear to be negatively correlated around crises episodes[49]. Thus, loosely speaking and similarly to what shown in Chapter 2, the richest groups appear to 'lose' and the less-rich ones to 'gain', in relative terms with respect to the whole population. The latter suggests that the level of income dispersion is reduced within the top decile leading, therefore, to lower 'inequality' among the rich.

Are these findings consistent over time and across countries? The sections below explore the importance of a long term *as well as* a cross-country perspective.

Figure 3.1: Impact of banking shocks on top001 and top10-top5 - entire sample - MG Estimator



Notes: The Y-axis represents the percentage deviation of top shares from the NO-crisis case. IRFs are estimated using the MG estimator and the confidence interval is obtained through bootstrapping with 100 replications.

3.7.2 Results across Country-Groups

Analysing results across different country-groups reveals a more complex relationship between inequality and crisis. Indeed, I acknowledge that the distributional impact of shocks may well differ across different institutional and economic features characterising specific country-groups. Hence, I show the estimated IRFs accordingly.

[49]This was anticipated within the data description section.

General features Following the classification described in the data section, two main sets of countries can be identified according to their different distributional response to banking crises. This is shown graphically in Figure 3.2 where results for different country groups are represented separately in different panels from (a) to (d). On the one hand, there are the so called 'Continental European' (3.2(a))[50], 'Western English Speaking' (3.2(b)) and 'Nordic European' (3.2(c)) countries. In these groups of countries the richest fractile share seems, on average, to suffer a negative shock following a banking crisis whereas the impact on the relatively 'poorer' group is generally positive instead. On the other hand, there are the 'Developing' countries (3.2(d)) and which show, on average, the opposite response, namely an increase in their richest top shares. Similarly, the impact on the poorer groups within the top decile is positive in all country-groups[51] with the exception of Developing countries.

Finally, it is worth noting that the overall effects of crisis do not appear to be reabsorbed within the time horizon under investigation (5 years). Indeed, despite a potential 'recovery' of the level of top shares, this does not appear to be sufficient -on average- to reach the predicted patter in the absence of the crisis. The results described above are also fairly robust across different specifications as it becomes clear within next sections.

Detailed evidence The predicted estimated impact of crisis on the specific top shares can be compared to the average and standard deviation of the share for the country group under investigation. This information can be retrieved from Table 3.1.

The richest share of the Continental European country group, as shown in Figure 3.2(a), drops, on average, by approximately 11% with respect to the no-crisis scenario. By consulting Table 3.1 this is equivalent to approximately 1/9 of the standard deviation of the top001 share. Comparing the drop to the average value of the top001, the finding suggests that the richest share of the top decile is found to be 0.13 points below the counterfactual after two years from the crisis. This is a rather small implied change[52].

The impact appears even lower (and estimated with lower precision) for the Anglo-Saxon countries, where on average a crisis reduces the richest top share by approximately 0.07 percentage points or by less than a tenth of a standard deviation.[53] Indeed, the IRF shown in the Figure 3.2(b) shows a drop of the richest fractile share by approximately 5% by the third year from the crisis.

[50] Results are robust to the exclusion of Italy, Portugal and Spain.

[51] The latter feature appears less evident for the Anglo-Saxon group of countries.

[52] It is also to be noted that this effect is also downsized using POLS estimation as shown in the appendix.

[53] These average findings for the Anglo-Saxon group are considerably lower than what found for the US in the previous Chapter. In that specific case the impact was approximately four-fold as the share of the top hundredth percentile was found to drop by around 0.3 percentage points.

Particularly outstanding appears the case of the Nordic countries, where the impact of banking crises seems quite substantial as show in Figure 3.2(c). Two years after the banking shock the richer group within the top decile is found to be lower than what expected in the absence of the crisis by a 20% margin. This has to be compared to the average value of top1% in the Nordic countries, which equal to 8.48%[54]. The absolute magnitude of predicted changes in the share is now bigger and equal to around 1.7 percentage points. This is equivalent to 2/5 of standard deviation in top1% share.

Finally, using the sample of 'Developing' countries, the occurrence of a banking crisis seems to justify a marginal increase in the share of the richest group of the top decile equivalent to 1/3 of a standard deviation (or approximately equal to an increase of 0.24 percentage points). In particular, at the third year post-crisis, the share is on average around 16% higher with respect to the no-crisis scenario. However, as can be seen in Figure 3.2(d) the estimates for the 'Developing' countries are more uncertain, presumably given the number of heterogeneous countries pooled together under the same label.

3.7.3 Results across Periods

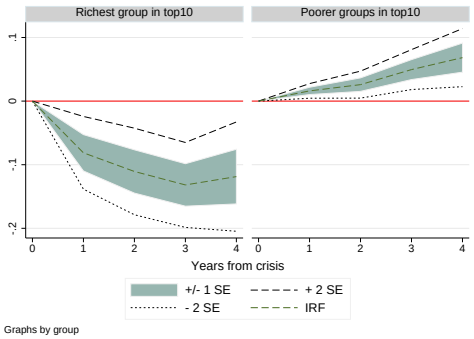
In this section, I analyse the results over different time periods. Figure 3.3 shows the results divided by different income groups (top and bottom groups of the richest decile) and by sub-periods samples, namely pre-1970 and post-1970. The figures show that the pre-1970 crises appear to exert a mild negative impact on the 'inequality' of income, pushing the richest top shares downward. The findings show that at the second year following the crisis, the richest top share is still, on average, around 4% lower than what would be expected if the crisis had never occurred (the result is robust to the exclusion of individual country groups from the sample) (see panel (a) and panel (c)) . This is not a very substantial drop, as it is comparable to an average drop of around 0.08 percentage points in top001, equivalent to one twelfth of its average standard deviation[55]. Conversely, the crises that occurred within the post-1970 sub-sample do not seem to have any significant effect on the average dynamics of the richest top shares if one considers the sample of all countries.

However, this result is not robust to the exclusion of country groups. Indeed, given the divergent experience of Developing countries described above, the IRFs across time periods is computed excluding this group from the estimation and the exercise reveals a great deal of information about the average distributional impact of recent crisis on the top shares. As Figure 3.3(c) shows, the effect of crises is now qualitatively similar to what found within the pre-1970 sub-sample but, most importantly,

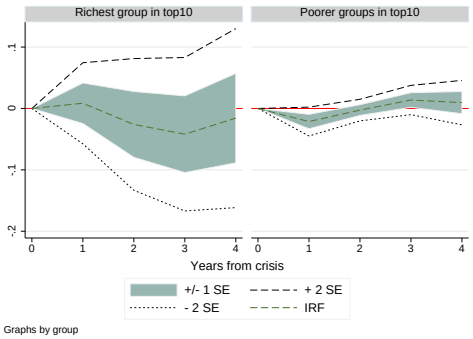
[54]It is worth recalling that the empirical investigation for the Nordic European countries is conducted using top1% shares as information about top001 is very scarce. Indeed, only Finland has information about top001 in the whole group of countries.

[55]For the pre-1950 period only, the mean value of top001 across countries is around 2 and its average standard deviation is approximately 1

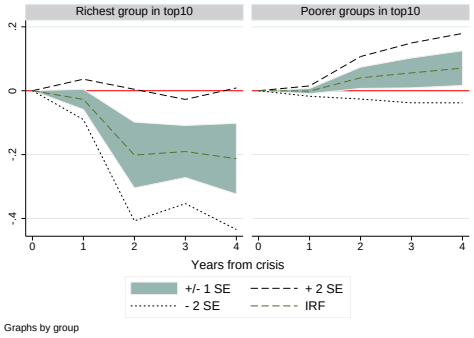
Figure 3.2: Impact of Banking Shocks on Selected Top Shares - (MG Estimator): Evidence Across Country Groups



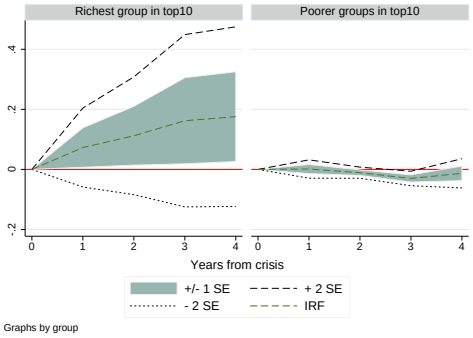
(a) 'Continental' European countries



(b) 'Western English' speaking countries



(c) 'Nordic European' countries



(d) 'Developing' countries

Notes: The Y-axis represents the percentage deviation of top shares from the NO-crisis case. IRFs are estimated using the MG estimator and the confidence interval is obtained through bootstrapping with 100 replications. The 'Continental European' countries' group also includes Japan and Southern European countries. Finally the IRF on Nordic countries is calculated using data on top1%.

its magnitude is now more than three times as big.[56] More specifically, at the second year following the crisis, the richest top share is found, on average, to be around 12% lower than what expected in the no-crisis scenario. This is now comparable to around 0.1 and 1 percentage points change respectively for the top001 and top1 shares[57]. The impact is long lasting and continues to depress the shares with respect to the no-crisis pattern till the 4th year from the crisis.

Differently from the case for the richest fractiles, the results for the top10-top5 group are robust to the exclusion of 'Developing' countries[58] as a simple comparison of panel (b) and (d) within Figure 3.3 reveals. More specifically, the effect on the poorer group within the top decile is positive and the magnitude is bigger for the pre-1970 period where the predicted change in the share reaches a peak of 0.5 percentage points, equivalent to 2/5 of standard deviation for the top10-top5 share.

Comparison with other findings in the literature The results described above, unlike the ones associated to the pre-1970 sub-period, are at odds with the work by Bordo & Meissner (2011)[59] who suggest that 'inequality' is increasing following the post-WWII crises[60]. The heterogeneity of these results may be ascribed to different empirical methodology as well as data availability.

On the one hand, the updated information of the WTID (as well as the use of few observations from the Chartbook of Economic Inequality) allows the partial analysis of banking crisis episodes in the recent years 2007-2010 and extends the coverage to more 'Developing' countries especially in the post-1950 period. On the other hand, Bordo and Meissner's empirical specification, exploring a 5 year cumulative change in top1 share, is by construction less informative about the within-period change in top shares (ultimately the object of interest of the investigation presented here) and, most importantly, does not control for the within-period time trend. This fact may partly explain their findings of a strong increase in inequality following a banking shock, as all the banking shocks occurring in the so called 'post-WWII' are posterior

[56]The effect on the pre 1970 sub-sample is not affected much as data for Developing countries are mostly available for the post-1970 sample.

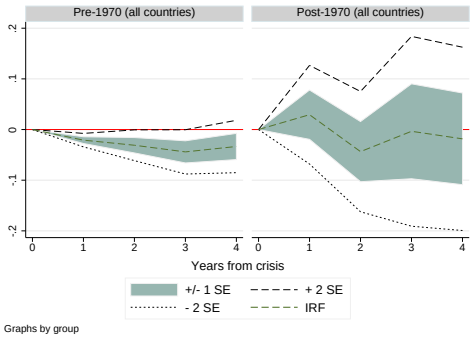
[57]The values correspond approximately to 1/6 and 1/3 of their respective average standard deviation in the sub-sample excluding the years prior 1970 and Developing countries. This is, indeed, an impact between 2 and 4 times higher than what recorded in the pre-1970 period.

[58]This is mainly due to the fact that the data coverage for the poorer groups within top decile is not extensive for the Developing countries.

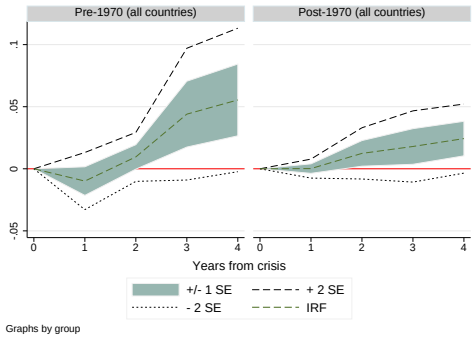
[59]Results are instead in line with what found in Roine et al. (2009) who found that banking crises mildly reduce the top 1% share and has no statistically significant impact on the top10-top1 share.

[60]Bordo & Meissner (2011) also split the sample into 'pre-WWI', 'post-WWII' and 'interwar' periods. The post-1970 period discussed here differs from Bordo and Meissner's so called 'post-WWII' period as the latter ends in 2000 whereas our analysis includes the latest financial turmoils (2007-2010). In general, 62 out 88 crises within the sample occur before the 1950, with zero crisis between 1948 and 1977. Only 15 crises are identified between 1900 and 1914 but, due to data limitation, only Japan 1907 is effectively analysed. Therefore the pre-1970 differs from the so called 'interwar' period as the latter excludes all the crises occurred during the two World Wars.

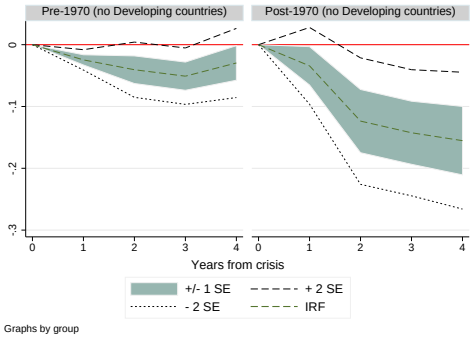
Figure 3.3: Impact of Banking Shocks on Selected Top Shares - Analysis by Time Periods - (MG Estimator)



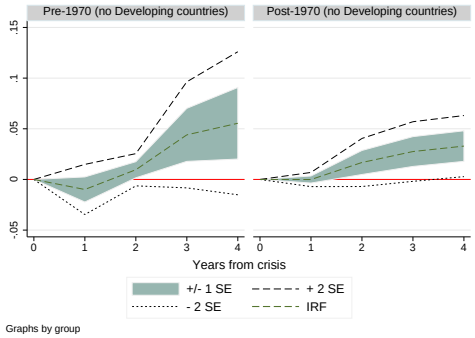
(a) Richest group (all countries)



(b) Poorer group within top decile (all countries)



(c) Richest group (no Developing countries)



(d) Poorer group within top decile (no Developing countries)

Notes: the IRFs are calculated using Mean Group estimator. Confidence interval is obtained through bootstrapping with 100 replications.

to 1977[61], a time in which top shares are strongly trending upward.

Summary To summarise, the results by different time horizons provide interesting insights and underline the importance of a long time perspective. In fact, the distributional implication of systemic banking shocks may well differ over time, suggesting that "*this time may be different*", paraphrasing C. Reinhart and K. Rogoff. In fact, there is some evidence that recent crises appear, in the very short-run and on average, up to approximately three times as disruptive for the richest fractiles share compared to the crises which occurred in the interwar period. This evidence also contradicts recent findings in the literature suggesting that top shares are increasing in the short-run following the crises occurred after 1970.

Note of Caution It is worth noting that the results have to be nuanced for different reasons. First of all, the evidence on the recent crisis is still only partial as data availability poses strong operational constraints. Secondly, the data on banking crises do not allow to collect information on the severity of each crisis and one cannot compellingly identify the magnitude of the effect of a crisis without controlling for its 'depth' and severity[62]. Finally it is also worth noting that the use of the standard POLS estimates[63] does not clearly reveal the different features of pre and post-1970 crises as discussed above.

3.8 Robustness Tests

This section explores whether the results are robust to using different specifications and methodology into account. I first check the validity of our findings controlling for additional general form of common factors and spill-over effects of crises. Indeed, some of the dynamics of the top shares could be partly due to some general contagion effect coming from external crisis occurring contemporaneously or general macroeconomic conditions which are independent to the country-specific crisis. More specifically, I control for this by applying heterogenous panel methods extending the set of control variables and including the average growth of real per-capita GDP across the whole set of countries under investigation. Secondly, the validity of the results is checked by making use of those banking crises which are not preceded by other macroeconomic shocks. This avoids to confound the effect of a banking crisis with that of other shocks. Furthermore, the empirical model is also tested using a different set of macro-economic crises. More specifically, using the list of macro-instability episodes identified in Chapter 1, it is possible to verify that the results obtained for systemic banking shocks are not replicable using any other type of crisis.

[61] In general, the period within 1947 and 1977 is banking-crisis free for the countries under investigation and according to the database of reference. This applies also to non-systemic banking crises.

[62] I thank Tullio Jappelli for pointing this out.

[63] Results are not shown but available upon request.

3.8.1 Controlling for the *Common Factors*

As discussed in the methodology section, the estimation strategy varies according to the testable restrictions imposed upon the empirical specification with respect to what is believed to be the true data generating process (DGP). In particular, the adopted estimation strategy depends on the assumptions about the nature of the unknown parameters and the unobservable error structure. The approach followed in this chapter began with the standard panel estimations based on the assumption of homogeneity of the parameters across panel units ($\theta_{i,k} = \overline{\theta_k}$, $\phi_{i,k} = \overline{\phi_k}$, $\delta_i = \overline{\delta}$, $\rho_i = \overline{\rho}$). However this approach, as discussed above and within the appendix, can create a list of problems to the estimation, some of which can bias the results, as it is shown below. In order to mitigate these problems, the discussion so far has mainly focused on estimates based on the Mean Group estimator. I have discussed above how the latter estimator mitigates some of the problems of homogenous panel estimation. Moreover, I also discussed how the heterogenous panel model, augmented with linear time trend, can control for linear unobserved common factors[64]. However, this may account only partially for the correlation between cross-sectional units. As pointed out within the recent literature on cross-section dependence, this can result in inconsistent estimators, as is also explored in detail within the appendix.

I discuss below the standard approach in the literature to deal with this issue as well as the approach undertaken within this paper.

The Common Factors

> *"The common factor approach assumes that the error term, as well as the covariates in the empirical model, contain a finite number of unobserved common processes ('factors'), whose impact may differ across industries or countries. Recent work in this area has emphasised the distinction between 'strong' factors representing global shocks such as the recent global financial crisis, and 'weak' factors such as spillovers between a limited group of industries or countries"* (extract from Eberhardt, Helmers and Strauss, 2011).

There are different ways to address this issue and recent literature proposed different approaches. For instance, Pesaran (2006) proposed the Common Correlated Effects Mean Group (CCEMG) estimator and Eberhardt & Teal (2010) proposed the Augmented Mean Group (AMG) estimator[65].

Both approach allows for unobserved time-varying heterogeneity without imposing any structure on their evolution. Indeed, unobserved heterogeneity can have non-linear, stationary or non-stationary evolution and could take the form of global spill-overs or more general common shocks (e.g. in our case the evolution over time of

[64] Instead, the initial empirical specification, for pooled estimators, controls for very general contagion or spill-over effects only to the extent that these are captured by homogeneous common time effects.

[65] Estimation based on both approaches were carried out but results are not presented here as the standard errors for the IRFs were not computed. The two estimators are also discussed further within the appendix.

remuneration and social norms, political ideology, global macro-economic conditions and financial openness) affecting all countries or subgroups of countries in different ways. The unobserved common factor might even take the form of local spill-overs between a small number of countries. For instance, episodes of financial and economic crises create spill-overs or contagion effects to 'neighboring' countries so that top income shares can be influenced even in countries where there has been no formally detected crisis.

The CCEMG estimator simply adds cross-section averages of dependent and independent variables to the country-specific regressions. However, for the sake of the study here, where the degrees of freedom are already limited, this approach can be inappropriate. The AMG estimator is a valid alternative to the CCEMG estimator as discussed in Eberhardt (2011). This is implemented in three steps: the first step estimates the 'common dynamic process'; the second augment the country-specific regression with the above-mentioned estimated common factor. The third steps averages out the results across countries. However, the estimation of the common dynamic factor is not easily interpretable and for the sake of this work it is preferred to use a 'common dynamic process' with easier interpretation.

The Approach Followed Here Rather than adopting a different estimator, I preserve the use of MG estimator and address the issue of cross-section dependence simply by augmenting the model (3.2) with the 'world-level average[66]' growth rate of per-capita GDP. The latter can indeed affect the dynamics of the top income shares differently across countries and country groups (common global macro-economic factor driving the income earning process of a group of countries). Moreover, it can affect the probability of country-specific crisis as well, implying a potential bias for the estimates. The augmented model, estimated with the Mean Group estimator[67], compute an average relationship between the growth rate of world average per-capita GDP and the country-specific top income share growth rate which. The latter is therefore netted out from the estimated total effect of country-specific crisis on top shares.

Results The results are shown in panel (d) of Figures 3.11-3.14 within the appendix and are remarkably similar to what is described in the baseline estimation. This perhaps suggests that the general control for time trend in the country-specific estimation captured most of the unobserved heterogeneity and the cross-section dependence in the data.

Caveats Although, as mentioned above, the results by including and excluding the additional covariate are essentially unvaried, it is worth discussing a series of issues that may arise from such augmented model specification. First of all, it may affect the

[66] I proxy the word level using the average across the total sample of 27 countries representing more than a third of world GDP.

[67] The linear time trend is also kept within the specification.

way we interpret the estimated IRFs. Indeed, if the growth of per-capita world GDP is not invariant to the occurrence of a country-specific shock, a correct derivation of the IRF would also require the estimation of the dynamic of the average world GDP per-capita in the absence of a crisis, a very difficult task[68]. Indeed, a depressed average growth rate of world per-capital GDP may also capture the severity of a country-specific crisis which created repercussions in other countries as well. In this case, the inclusion of the additional variable may incorrectly downsize the total effect of crises on top shares. Nonetheless, this concern can be downplayed for two main reasons. Indeed, the inclusion of the additional covariate in the model specification captures the general and average interrelation between world per-capita GDP growth and the US top income shares growth over the entire time period under analysis and not just across crisis periods. Moreover, as mentioned above the estimated changes in top shares is not substantially affected by the inclusion of the new variable.

Secondly, the addtional covariate might be endogenous as it may be driven by the country specific top income share. However, I have already suggested within Chapter 2 that this may not be a relevant concern.

Finally, the possibility that the world average per-capita GDP growth could impact directly on the probability of country-specific crisis can affect the nature of the interpretation of the results at hand. The crisis might be entirely or partly the result of spill-overs or contagion effects. In such a case, the IRFs lose any causal connotation as the changes in top income shares have to be ascribed not to the country-specific crisis but to the externally conditions. However, the fact that results are very stable even with the augmented model described above, is again suggestive about the relative irrelevance of such a problem (e.g. coefficients estimation does not seem to have suffered from omitted variable bias). Moreover, establishing causality is not the objective of this chapter.

3.8.2 Different Set of Crises

A systemic banking crisis can be the results of other economic or financial turmoils (e.g. currency crises or slow-down of economic activity). Hence, the methodologies used so far can confound the total effect of systemic banking crisis with the total effect of other types of crises. This issue is tackled in two different ways. Firstly the assembled dataset on macro-economic shocks discussed in Chapter 1 is used to select those banking crises which are not preceded (within two years) by other crisis episodes. By doing that, 21 banking crises are eliminated (out of the 88 originally identified) and the general validity of the results is checked by re-estimating the IRFs accordingly. Secondly, the IRFs are also calculated for the general 'macro-instability' periods beginning with and featuring any of the listed crises except banking crises. By doing

[68] In other words the new covariate does not comply with the 'invariance assumption' postulated in Pesaran & Smith (2012). The practical implications for the derivation of the IRF are explained within the appendix.

this, one can compare the response of top shares to the onset of the general instability period (not stemming from or causing a banking crisis) to the 'baseline' results.

Banking Crises as the Initial Impulse

The results are valid when reducing the original crisis sample from 88 to 67 as described above (excluding all banking crises which were preceding by the onset of a different type of macroeconomic shock)[69] Results are shown in the panel (c) of Figures 3.11-3.14 within the appendix.

Macro-Economic Instability Episodes

Finally, as stated above, I document the response of top income shares to the occurrence of general macro-instability episodes featuring no banking crises. More precisely following what was discussed in Chapter 1, I have isolated the onset of 155 alternative general macro-instability periods, excluding those which are not associated with a banking crisis (e.g. a GDP collapse followed by a currency crisis and a debt restructuring but not generating any systemic banking crisis).

Results are shown in the panel (f) of Figures 3.11-3.14 within the appendix and highlight that the response of top income shares to any other crises other than systemic banking shocks are generally very different from the results discussed so far. In particular there appears to be no general pattern and the overall effect on the shares is generally not significant. Furthermore, similarly to what was found in Chapter 2 for the case of the US, the two income groups under investigation appear no longer negatively correlated following a general crisis. Nonetheless, it is worth noting that for the Continental European countries only, the magnitude and the direction of the impact of macro-instability on the richest income group appears very much in line with that estimated for the banking crisis.

3.9 Interpretation of the Results

Making use of the theoretical framework discussed earlier and some of the available findings within the literature, I provide here some tentative and qualitative interpretation of the results presented so far.[70] The findings relate to four main features, namely :

1. the small magnitude of the estimated total impact of crises

[69]The lack of higher frequency data (I only have annual observations) prevents the understanding of whether a systemic banking crisis could be considered the initial impulse of the instability within the economy in those cases where other major crises happen contemporaneously. This happens in 17 episodes, of which only 6 are effectively included with the estimation due to the lack of distributional data.

[70]This is a mere speculative exercise as the assumptions put forward cannot be directly tested with the data.

2. the heterogeneity of the impact across time periods

3. the heterogeneity of the impact across country-groups.

Small magnitude of the crisis effect As mentioned in the introduction and made clear in the findings, it seems that even major macroeconomic shocks *per se* do not mark a turning point for top income shares as they exert only a mild impact on the share of total national income accruing to the top of the distribution.

This evidence lends some indirect support to the conjecture that top income shares are not substantially affected by the market forces stemming from the occurrence of a 'crisis', unless the latter are coupled with substantial changes in regulatory and institutional frameworks as well as taxation and shift in political regimes. This was recently observed in Saez (2012) and Piketty & Saez (2012) who also argue that "*Downturns per se do not seem to have long run effects on inequality, even when they are very large. The reason why the Great Depression was followed by huge inequality decline is not the depression per se, but rather the large political shocks and policy responses - in particular the tremendous changes in institutions and tax policies - which took place in the 1930s-1940s. The Great Recession is likely to have a large long run impact only if it is followed by significant policy changes.*"

It is nonetheless important to notice that one should be careful about drawing any direct link between top income shares and overall income distribution.

Box A: Structural Breaks and Major Crises In order to illustrate the point made in the text, I compare the major banking crises and the general macro-economic instability episodes identified within Chapter 1 to the occurrence of identified structural breaks in top income share series, drawing from the evidence assembled by Roine & Waldenström (2011). The latter work formally identified the timing of the structural breaks for the top 1% shares series for the countries covered by the WTID for the post-1960 period. Out of the 40 structural breaks identified only 2 coincide with a banking crisis[a] (or fall within 1 year before or 1 year after its beginning). The two breaks occur respectively in 1991 for Sweden's series and in 1989 for the US series. I can further compare the timing of breaks with that of the identified macro-instability episodes. Even in this case, the evidence reveals that only 9 breaks coincide with the beginning of a macro-economic shock or a financial crisis of any sort[b]. Therefore, systemic banking crises and major macroeconomic instability episodes are not to be generally considered as structural breaks for top income shares. This finding is also helpful to overcome a potential criticism of the investigation methodology so far applied within the work. Indeed, if a crisis were not be a structural break for the series under investigation one can rely on models fitted to past data as a meaningful guide (see Jenkins et al., 2013, p. 15.

[a] From 1960 to 2010 there are 22 identified banking crises.

[b] Using the work done in Chapter 1 I observe that there are 72 macro-economic instability episodes from 1960 to 2010. The 9 episodes which coincide with a structural break in the top share series are the following: Australia 1984, Finland 1971, India 1970, New Zealand 1988, Portugal 1971, Singapore 1998, Sweden 1990, UK 1961 and US 1988.

Different results over time The heterogeneity of the results across time can have two potential sources of explanation. On one hand, it can be argued, although it cannot be proved, that the bottom of the distribution was more protected in the post-1950 period. Better job market institutions, welfare policies and higher diversification of

the economy are indeed in line with the argument (note also that pre-1950 banking crises were more often associated with disruptive collapses in per-capita GDP[71]). On the other hand, some or all of the sources of income may have recently become more cyclical. Similarly, the composition of the income at the top may have tilted, over the years, towards more cyclical sources of income (as shown within the previous chapter for the case of the US). I believe that both of these explanations have a role to play in explaining on one hand the different magnitude of the effect of recent crises and, on the other hand, the faster recovery of the top shares of the richest documented during recent crises.

For instance, Atkinson, Piketty and Saez discuss, in their extensive survey, how most of the countries in the sample recorded a "*decline in capital incomes and the rise in top earnings*" especially in the post-1950 period. The introduction of bonuses and stock option schemes together with general performance-related pay schemes, makes the latter source of income particularly cyclical[72]. Moreover, as discussed within Chapter 2, a great part of the income coming from capital may have been composed of dividends, a source of income which is only mildly cyclical [73].

This conjecture is however based on the observation of the US data which may not necessarily apply to all the countries under investigation.

Different Results across Country Groups Using similar arguments, as a second step, one can also attempt to explain why my results seem to diverge or to have different magnitude across country groups. For example, the impact of crises on 'Nordic' countries' top shares is qualitatively similar to that experienced by the English speaking ones, although it has bigger magnitude. In light of the above arguments, this is likely to happen if the bottom 99% of the population within the 'Nordic' countries is relatively more 'protected' from income fluctuations (income relatively a-cyclical) and if the composition of income accruing to the richest households have particularly cyclical properties. The former can be true as the Anglo-Saxon do not have the 'social democratic' welfare state present within the Scandinavian countries. The latter explanation might also be valid. For example Atkinson, Piketty and Saez recalled that the "*major difference between the Nordic countries and the United States is the continuing importance in the former of capital income*" (2011, p. 55). Furthermore, Western English speaking countries have generally higher stock market participation rates which may

[71] As an example, the recent US banking shock was associated with a rise in unemployment from 5 to 10% and a drop of real per-capita GDP of approximately 3.5%. Conversely, in 1929 crisis, the unemployment rose from from 2 to 25% whereas the GDP per-capita fell by approximately 27% from 1929 to 1932

[72] A more recent study by Parker & Vissing-Jorgensen (2010) posits that top wage income is to be considered one of the main reason for very high levels of income cyclicality at the top of the US income distribution since 1982.

[73] It is however to be noted that dividend income can in practice be very cyclical if the changes are due to endogenous reallocation of investment portfolios. In other words, agents may sell stocks so that its related dividends flow would automatically drops to zero.

contribute to spread the losses more evenly across the income distribution.

Richest groups within the 'Developing' countries seem to be instead relatively more protected to banking shocks compared to the bottom of the distribution. This can happen for a variety of reasons. First of all the labour market and the industrial corporate sector can be more fragile leading to bigger layoffs and/or wage reduction following each shock. In addition, the richest households might be more insulated from wage-cuts and unemployment. Secondly, the smaller size of the financial sector and lower level of competition in the economy, relatively to the richest members of the OECD group, makes the income accruing to the top more stable across disequilibriums in the markets. A third purely statistical factor, due to the nature of the data, may also be a driver of the results. In particular, the amount of reported income within the economy can be cyclical to the occurrence of the crisis. Countries labeled here as 'Developing', have a notoriously higher incidence of underground economy (part of which by definition escapes the tax records). If one is willing to assume that the propensity to evade taxes increases during crisis periods and that the extent of the *change* in tax evasion is lower for the richest individuals, I can explain at least part of the estimated increase in top shares following the financial shock.

Concluding Remarks

This paper has investigated the short-run total impact of systemic banking shocks on the top income shares of around 27 countries from 1900 to 2010. In practice, the empirical evidence was produced by estimating impulse response functions (IRFs) of the rate of growth of top income shares to the systemic banking crises. This approach was coupled with an ex-post counterfactual analysis. The estimation of the model was based on two main approaches, namely the homogeneous as well as the heterogeneous models approach to panel estimation which are more suitable for macro-panels with 'large N' and 'long T' structure and strong features of cross-section dependence. The methodology adopted here constitutes, to the best of my knowledge, a novelty within the literature of income distribution.

With the exclusion of the Developing countries, the effect of banking crises on top shares of different country groups (Continental European, Nordic European and Anglo-Saxon countries) is generally found to be negative on the share of richer groups populating the top decile, and positive on the share of poorer groups within the top decile. Systemic banking crises appear, therefore, to be followed by a reduction of inequality at the top.

The findings also show that the pre-1970 crises appear to exert a relatively mild negative impact on the richest top shares, whereas the crises that occurred within the post-1970 sub-sample do not seem to have any significant effect unless one excludes the so called Developing countries from the sample. Indeed, once the latter group of countries is excluded, recent crises appear to have a negative impact on top shares up

to three times as big compared to the crises that occurred in the pre-1970 period (the richest top shares within the top decile are found to be around 12% lower than what would be expected in the no-crisis scenario).

Nonetheless, it is important to notice that the estimated effects across different specifications is always found relatively small in magnitude. Indeed, all the estimated responses of the specific top income shares under investigation to the occurrence of systemic banking crises, are never found to be higher than 2/5 of a standard deviations. This is a rather mild effect on the levels of the shares, although it was on average not re-absorbed within the 4 years under investigation.

The findings discussed above indirectly suggest that systemic banking crises may not be turning-point events for a countrys income distribution. In other words, major historical crises per se and their associated market forces, may not be sufficient to structurally change the distribution of income within the economy. This lends some support to the structuralist hypothesis that only strong shifts in regulatory, fiscal and political regimes can substantially and permanently affect the income distribution within countries. As mentioned in above this was recently argued in the work by Piketty & Saez (2012). However, it is important to recognise that the work described above deals with a specific small (although relevant) group of relatively rich individuals in the society and any inference or extrapolations of the results to the overall distribution of income in the economy requires careful thought and should not be taken for granted. This appears a rather interesting avenue for future research.

Two additional things are worth noting. First of all, this work is completely silent about different dimensions of well-being other than income. For instance, banking crises might have a greater impact on household assets valuations as well as on the accumulation of wealth (including savings decision and pension contributions) and portfolio choices. These features are of clear importance but were left out of the analysis due to data limitation. Secondly, it is important to bear in mind that, despite the effort to secure the widest data coverage in space and time, income distribution data present numerous gaps which limit the extent of a more compelling estimations of the distributional implication of crises.

Appendix A: Tables and Charts

Table 3.1: Descriptive Statistics of the Top Income Shares across Country-Groups

Country group	Variable	Obs	Mean	Std. Dev.	Min	Max
Continental European Countries						
	top001	443	1.243025	0.9829257	0.3	4.52
	Grtop001	375	.0004167	0.1273022	-0.6	0.9545455
	top01	467	3.779636	2.478306	0.73	13.02
	Grtop01	392	-.0042136	0.0833373	-0.5216285	0.3625
	top1	426	11.13793	4.593693	3.97	27.88
	Grtop1	353	-.0022723	0.0566125	-0.4013035	0.2228117
	top5-top1	388	13.27719	1.611759	8.13	17.71
	Grtop5-top1	312	.0007552	0.0380776	-0.1657143	0.1766304
	top10-top5	304	10.41664	1.200091	6.28	13.5
	Grtop10-top5	231	.0010184	0.0325372	-0.187067	0.0952381
	top10-top1	301	23.65761	2.5801	14.45	31.21
	Grtop10-top1	228	-.0004338	0.0300695	-0.1753653	0.0894419
	top10	304	34.38888	5.364089	18.77	53.31
	Grtop10	231	-.0017683	0.0325822	-0.1849178	0.116416
variables used in the empirical work						
	growth of share of richer within top decile	417	-.0008533	0.1312177	-0.6	0.9545455
	growth of share of 'poorer' within top decile	318	.0022226	0.0370825	-0.187067	0.1766304
Developing Countries						
	top001	240	1.514929	0.7937642	0.3	4.18
	Grtop001	216	.0176931	0.1866468	-0.4558414	0.9491526
	top01	279	4.127631	2.202329	0.46	11.62
	Grtop01	239	.0166883	0.1225731	-0.2722803	0.4973822

Table 3.1:continues in next page

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Country group	Variable	Obs	Mean	Std. Dev.	Min	Max
	top1	295	12.04726	4.472857	2.65	25.96
	Grtop1	253	.0116207	0.0898952	-0.3253866	0.4323725
	top5-top1	122	14.38395	4.835485	5.569182	22.57
	Grtop5-top1	98	.0143311	0.0679261	-0.2802982	0.3040495
	top10-top5	60	9.851167	2.221793	7.57	15.82
	Grtop10-top5	52	.0150301	0.05083	-0.0944206	0.1625767
	top10-top1	60	23.46617	6.044661	14.72	38.4
	Grtop10-top1	52	.0169355	0.0486422	-0.0785071	0.1612903
	top10	60	33.07533	9.211637	17.37	51.3
	Grtop10	52	.0174369	0.048512	-0.0693558	0.1526536
variables used in the empirical work						
	growth of share of richer within top decile	298	.0179736	0.1508888	-0.3006988	0.9491526
	growth of share of 'poorer' within top decile	98	.011784	0.0672604	-0.2802982	0.3040495
Western English Speaking Countries	top001	313	1.322971	0.9984477	0.21	4.4
	Grtop001	304	-.0023322	0.1263672	-0.4795918	0.6666667
	top01	483	3.542422	2.111126	0.96	11.24
	Grtop01	467	-.0014514	0.1106236	-0.445283	0.8027211
	top1	454	10.05216	3.402851	4.61	19.6
	Grtop1	436	.0026853	0.0741976	-0.3943355	0.3486778
	top5-top1	389	13.46177	2.129127	6.96	22.98
	Grtop5-top1	372	.0019263	0.0457298	-0.1773604	0.2874058
	top10-top5	360	11.24169	1.3657	5.97	14.56
	Grtop10-top5	343	.002646	0.0451716	-0.3482533	0.3524804
	top10-top1	397	24.47496	2.710806	16.95	32

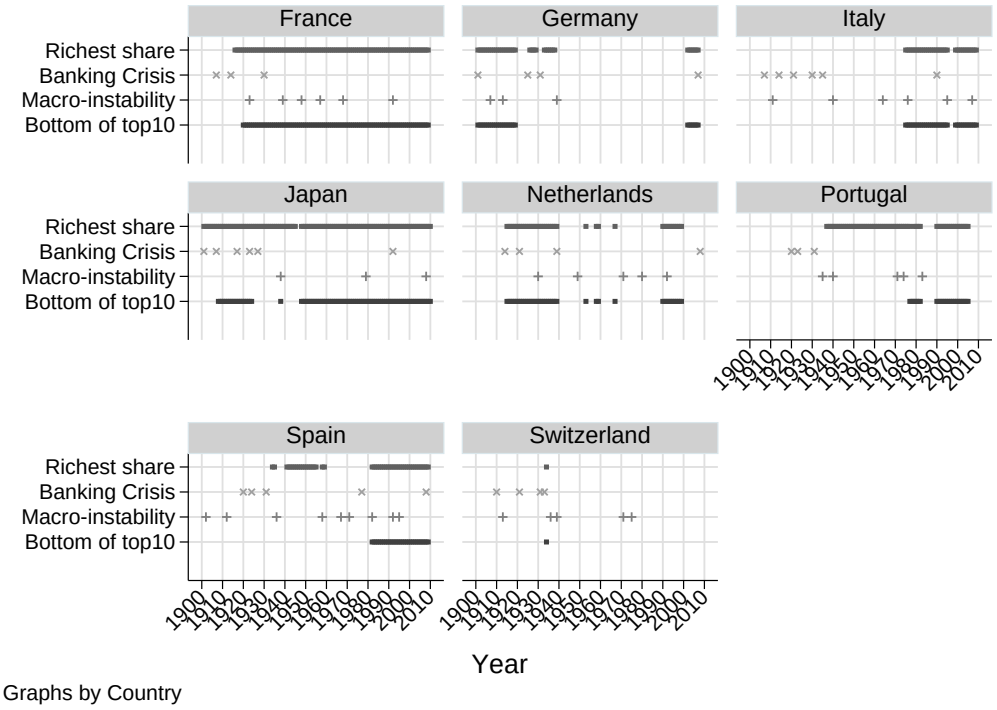
Table 3.1:continues in next page

Table 3.1:continues from previous page

Country group	Variable	Obs	Mean	Std. Dev.	Min	Max
	Grtop10-top1	377	.0021639	0.0353516	-0.1929499	0.3174041
	top10	397	34.10511	5.081748	23.99	47.61
	Grtop10	377	.0019513	0.0373091	-0.1547733	0.2409337
variables used in the empirical work:						
	growth of share of richer within top decile	515	.0019414	0.1214591	-0.445283	0.8027211
	growth of share of 'poorer' within top decile	406	.002499			
Nordic European Countries	top001	79	.7024051	0.861207	0.17	5.12
	Grtop001	70	.0051976	0.1197378	-0.3676976	0.3157895
	top01	146	2.42589	2.245524	0.74	13.7
	Grtop01	131	.0060987	0.154716	-0.6789536	0.7
	top1	281	8.484105	4.559055	3	28.04
	Grtop1	261	.0031357	0.1052846	-0.5208582	0.5
	top5-top1	191	11.14408	1.856222	7.5	15.68
	Grtop5-top1	172	-.0027917	0.0320966	-0.1504366	0.2
	top10-top5	169	10.08509	1.219113	7.73	13.06
	Grtop10-top5	153	-.0040829	0.0238324	-0.0935738	0.0874364
	top10-top1	189	21.47138	2.62437	16.97	28.75
	Grtop10-top1	172	-.0027049	0.0244083	-0.1262705	0.0853462
	top10	189	28.54312	5.365662	21	52.97
	Grtop10	172	-.0021155	0.0379799	-0.2370586	0.1709667
variables used in the empirical work:						
	growth of share of richer within top decile	261	.0095752	0.1532518	-0.7111111	0.8461537
	growth of share of 'poorer' within top decile	191	-.0020783	0.0276752	-0.0935738	.

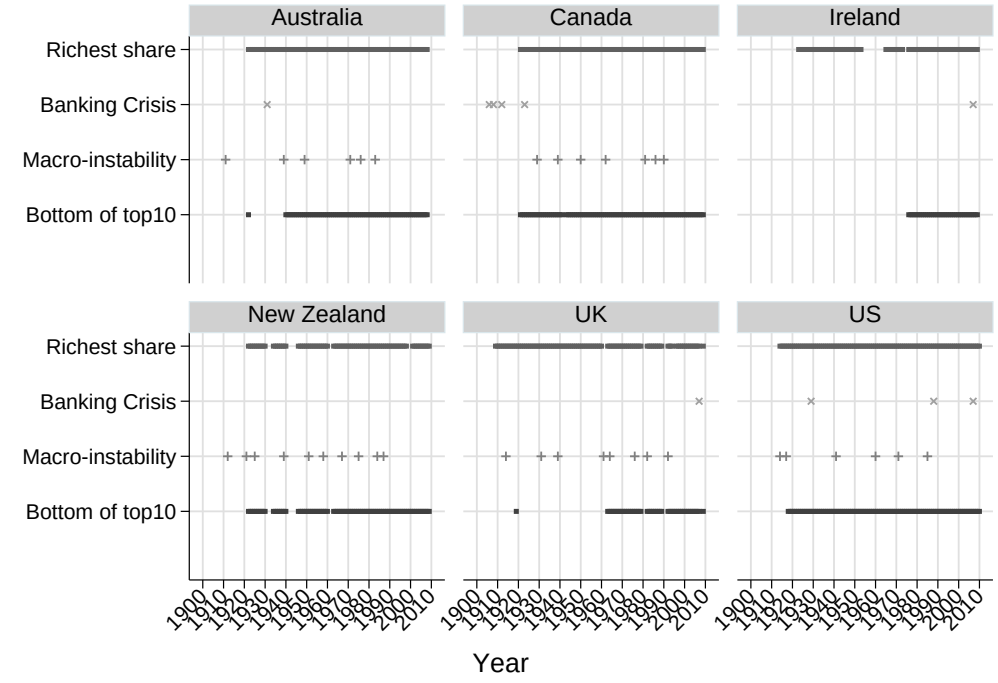
Table 3.1:complete

Figure 3.4: Data Availability over Time: Growth Rate of The 'Richest' and the 'Poorest' Groups within the Top Decile: Continental European Countries



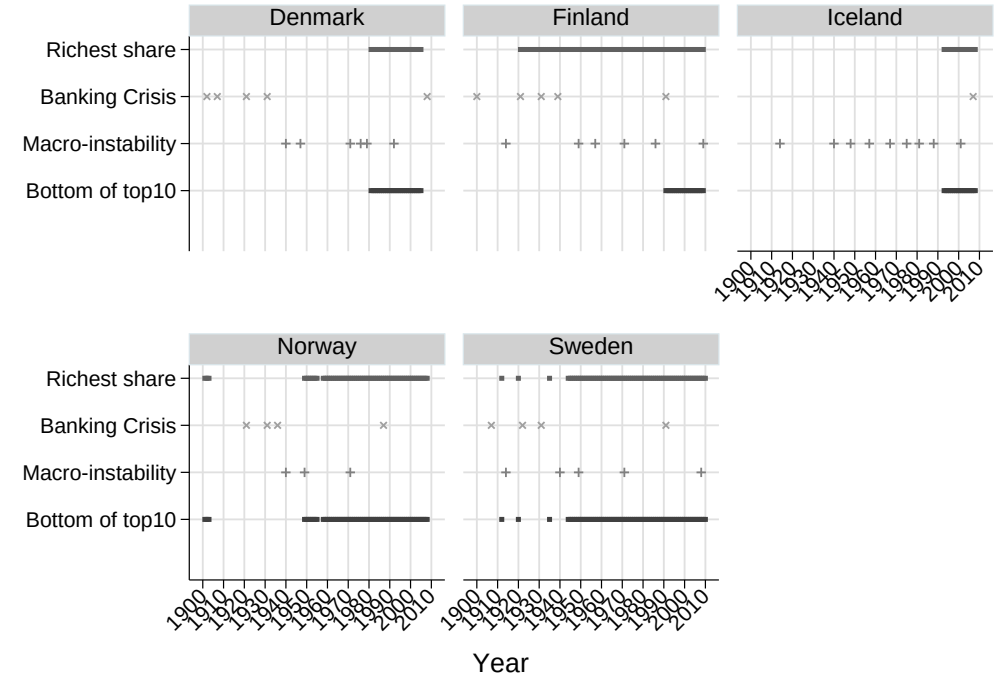
The graph shows the availability of distributional data for the empirical investigation with respect to the occurrence of banking shocks and general macro-instability episodes as estimated within Chapter 1. I only represents the beginning year of the crises and within the macro-instability episodes I do not represent those who include a banking crisis episode. The variables 'richest share' and 'bottom of the top10' represent the availability of distributional data for the growth rate of the shares of the two main groups of income under investigation within this chapter. I recall that the present study explores the share of total national income earned by the richest fractile (top001) as representative for the group of the richest within the top 10 percent of the income distribution. Conversely, the share of P90-P95 represents the 'poorer' group within the top decile. However it is not always possible to use these variables as observation availability vary across countries and time. When top001 is not available I revert to top005, top01, top05 or to top1 respectively (all of them nest the information about the top001). On the other hand when the share of P90-P95 is not available I make use information about P90-P99 or P95-P99. For instance I make use of data on top1% for the Nordic European countries as very little information is available on the top001.

Figure 3.5: Data Availability over Time: Growth Rate of The 'Richest' and the 'Poorest' Groups within the Top Decile: Western English Speaking Countries



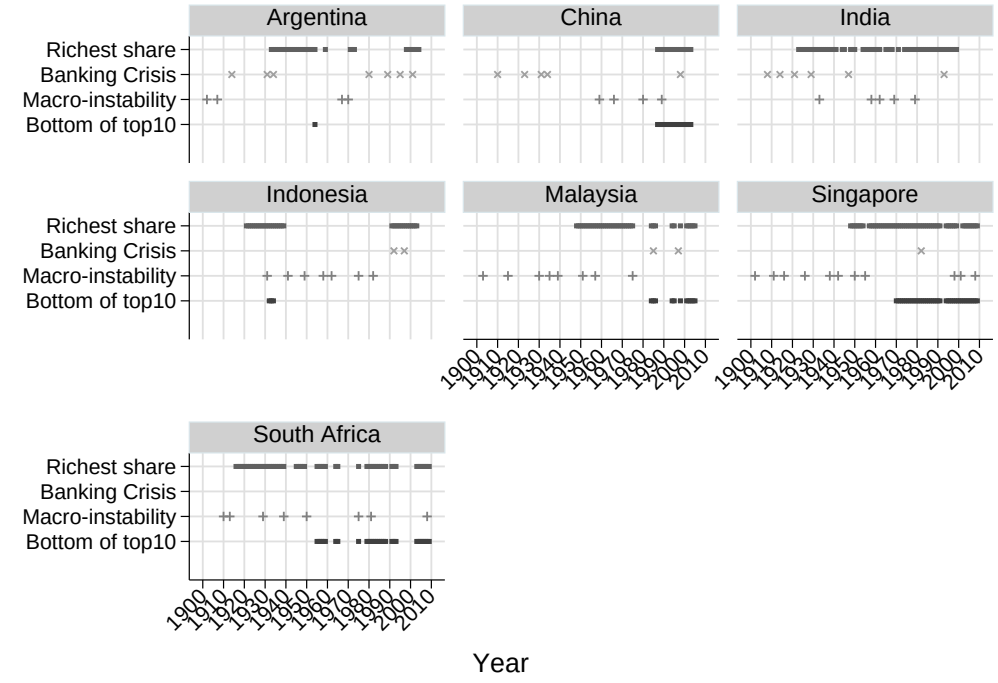
The graph shows the availability of distributional data for the empirical investigation with respect to the occurrence of banking shocks and general macro-instability episodes as estimated within Chapter 1. I only represents the beginning year of the crises and within the macro-instability episodes I do not represent those who include a banking crisis episode. The variables 'richest share' and 'bottom of the top10' represent the availability of distributional data for the growth rate of the shares of the two main groups of income under investigation within this chapter. I recall that the present study explores the share of total national income earned by the richest fractile (top001) as representative for the group of the richest within the top 10 percent of the income distribution. Conversely, the share of P90-P95 represents the 'poorer' group within the top decile. However it is not always possible to use these variables as observation availability vary across countries and time. When top001 is not available I revert to top005, top01, top05 or to top1 respectively (all of them nest the information about the top001). On the other hand when the share of P90-P95 is not available we will use information about P90-P99 or P95-P99.

Figure 3.6: Data Availability over Time: Growth Rate of The 'Richest' and the 'Poorest' Groups within the Top Decile: Nordic European Countries



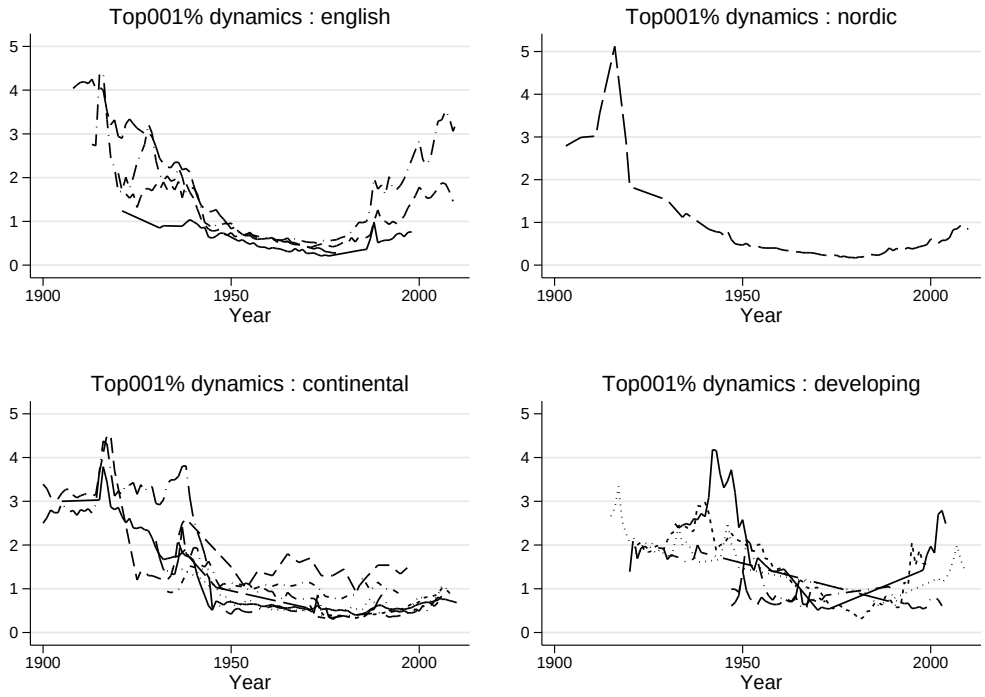
The graph shows the availability of distributional data for the empirical investigation with respect to the occurrence of banking shocks and general macro-instability episodes as estimated within Chapter 1. I only represents the beginning year of the crises and within the macro-instability episodes I do not represent those who include a banking crisis episode. The variables 'richest share' and 'bottom of the top10' represent the availability of distributional data for the growth rate of the shares of the two main groups of income under investigation within this chapter. I recall that the present study explores the share of total national income earned by the richest fractile (top001) as representative for the group of the richest within the top 10 percent of the income distribution. Conversely, the share of P90-P95 represents the 'poorer' group within the top decile. However it is not always possible to use these variables as observation availability vary across countries and time. In the case of Nordic European countries I make use of data on top1% as very little information is available on the top001. On the other hand when the share of P90-P95 is not available I use information about P90-P99 or P95-P99.

Figure 3.7: Data Availability over Time: Growth Rate of The 'Richest' and the 'Poorest' Groups within the Top Decile: Developing Countries



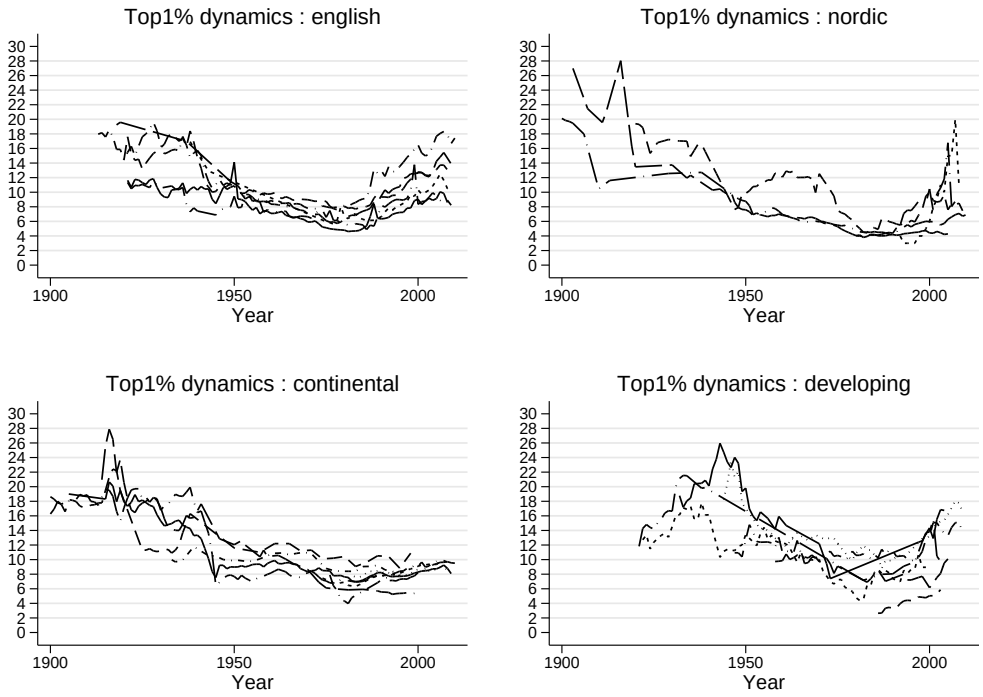
The graph shows the availability of distributional data for the empirical investigation with respect to the occurrence of banking shocks and general macro-instability episodes as estimated within Chapter 1. I only represents the beginning year of the crises and within the macro-instability episodes I do not represent those who include a banking crisis episode. The variables 'richest share' and 'bottom of the top10' represent the availability of distributional data for the growth rate of the shares of the two main groups of income under investigation within this chapter. I recall that the present study explores the share of total national income earned by the richest fractile (top001) as representative for the group of the richest within the top 10 percent of the income distribution. Conversely, the share of P90-P95 represents the 'poorer' group within the top decile. However it is not always possible to use these variables as observation availability vary across countries and time. When top001 is not available I revert to top005, top01, top05 or to top1 respectively (all of them nest the information about the top001). On the other hand when the share of P90-P95 is not available we will use information about P90-P99 or P95-P99.

Figure 3.8: The Common Dynamics of the Top001 Share across Country Groups as a Percentage of Total National Income



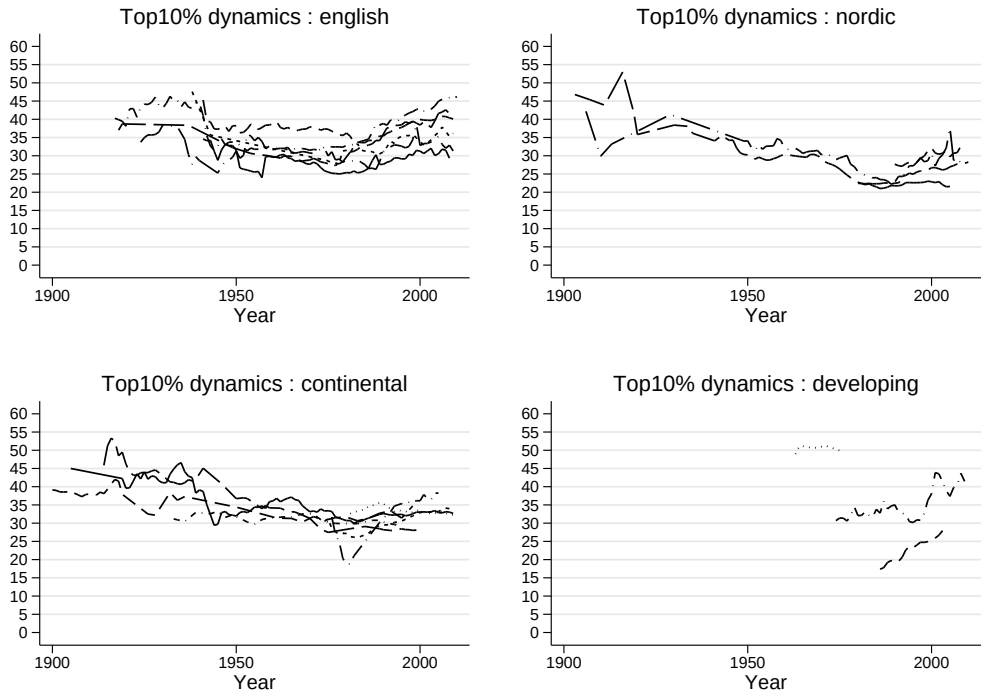
Source: World Top Income Database (March 2013) and author's calculation. I group the shares respectively for the Nordic European (Denmark, Finland, Iceland, Norway and Sweden), Developing (Argentina, China, India, Indonesia, Malaysia, Mauritius, Singapore, South Africa and Tanzania), Western English speaking (Australia, Canada, Ireland, New Zealand, United Kingdom and United States), and Continental central European countries (France, Germany, Netherlands, Switzerland, Italy, Portugal and Spain) together with Japan. Note that differently from Atkinson, Piketty and Saez(2011) I merge the Southern European countries (for which few observations are actually usable in the empirical exercise) within the Continental European group.

Figure 3.9: The Common Dynamics of the Top1 Share across Country Groups as a Percentage of Total National Income



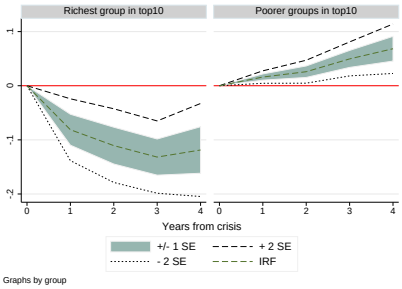
Source: World Top Income Database (March 2013) and author's calculation. I group the shares respectively for the Nordic European (Denmark, Finland, Iceland, Norway and Sweden), Developing (Argentina, China, India, Indonesia, Malaysia, Mauritius, Singapore, South Africa and Tanzania), Western English speaking (Australia, Canada, Ireland, New Zealand, United Kingdom and United States), and Continental central European countries (France, Germany, Netherlands, Switzerland, Italy, Portugal and Spain) together with Japan. Note that differently from Atkinson, Piketty and Saez(2011) I merge the Southern European countries (for which few observations are actually usable in the empirical exercise) within the Continental European group.

Figure 3.10: The Common Dynamics of the Top10 Share across Country Groups as a Percentage of Total National Income

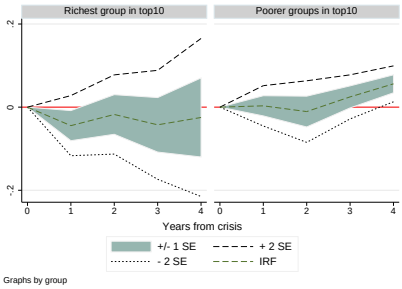


Source: World Top Income Database (March 2013) and author's calculation. I group the shares respectively for the Nordic European (Denmark, Finland, Iceland, Norway and Sweden), Developing (Argentina, China, India, Indonesia, Malaysia, Mauritius, Singapore, South Africa and Tanzania), Western English speaking (Australia, Canada, Ireland, New Zealand, United Kingdom and United States), and Continental central European countries (France, Germany, Netherlands, Switzerland, Italy, Portugal and Spain) together with Japan. Note that differently from Atkinson, Piketty and Saez(2011) I merge the Southern European countries (for which few observations are actually usable in the empirical exercise) within the Continental European group.

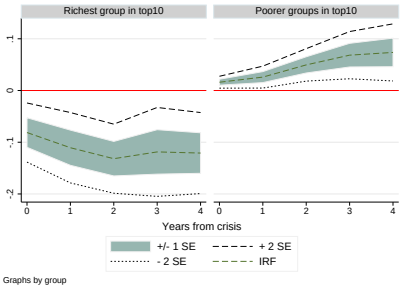
Figure 3.11: Impact of Banking Shocks on the Top Shares of 'Continental' European Countries



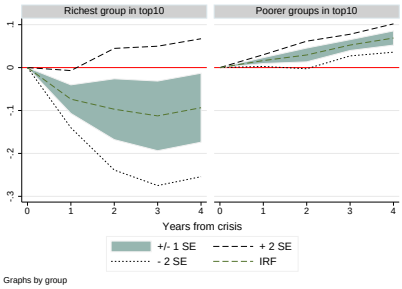
(a) Baseline - MG



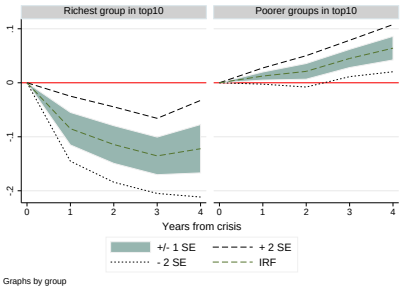
(b) Baseline - POLS



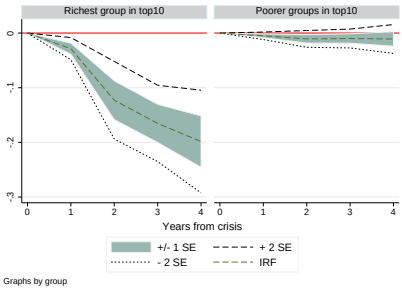
(c) Including contemporaneous effect of crisis on top shares - MG



(d) Controlling for average per-capita GDP growth - MG



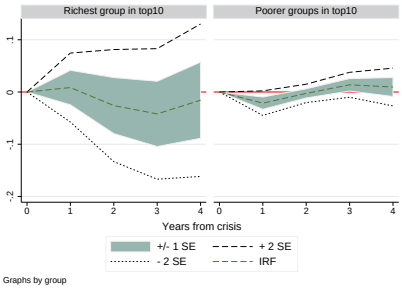
(e) Excluding banking crises preceded by different shocks - MG



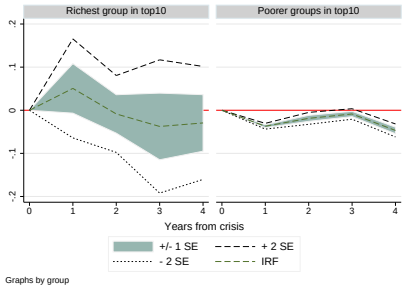
(f) Macro-instability episodes other than banking crises - MG

Notes: The Y-axis represents the percentage deviation of top shares from the NO-crisis case. MG and POLS indicate respectively the use of the Mean Group estimator or the Pooled Ordinary Least Squares estimators. The confidence interval is obtained through bootstrapping with 100 replications.

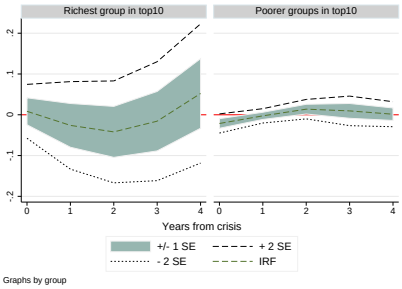
Figure 3.12: Impact of Banking Shocks on the Top Shares of 'Western English-speaking' countries



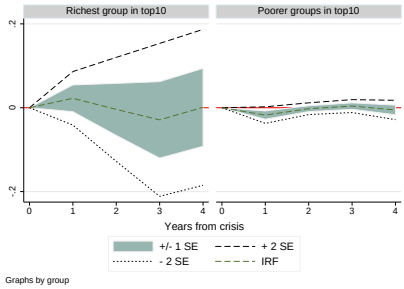
(a) Baseline - MG



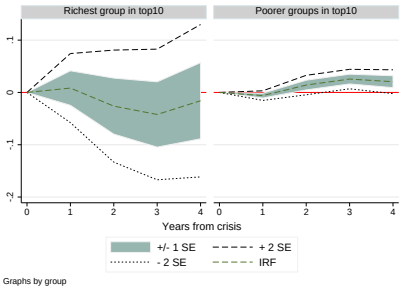
(b) Baseline - POLS



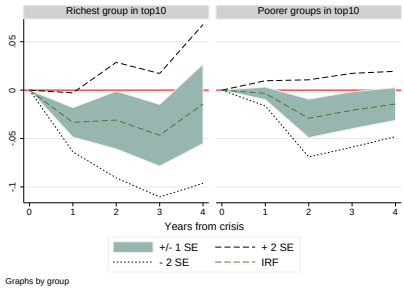
(c) Including contemporaneous effect of crisis on top shares - MG



(d) Controlling for average per-capita GDP growth - MG



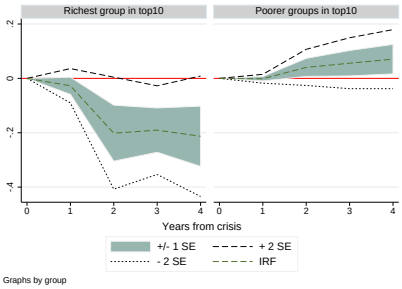
(e) Excluding banking crises preceded by different shocks - MG



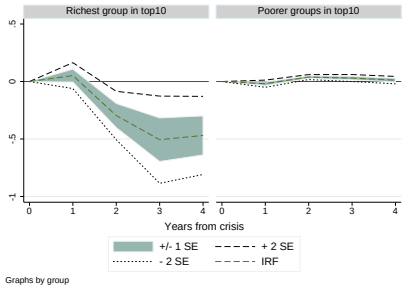
(f) Macro-instability episodes other than banking crises -MG

Notes: The Y-axis represents the percentage deviation of top shares from the NO-crisis case. MG and POLS indicate respectively the use of the Mean Group estimator or the Pooled Ordinary Least Squares estimators. The confidence interval is obtained through bootstrapping with 100 replications.

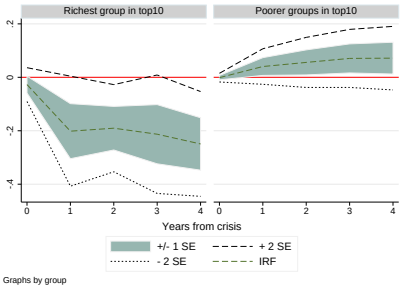
Figure 3.13: Impact of Banking Shocks on the Top Shares of 'Nordic European' countries



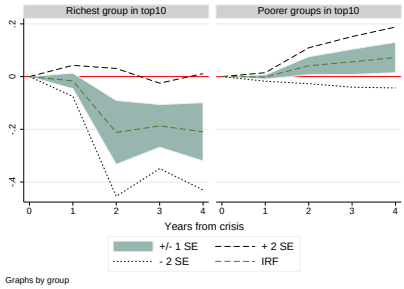
(a) Baseline - MG



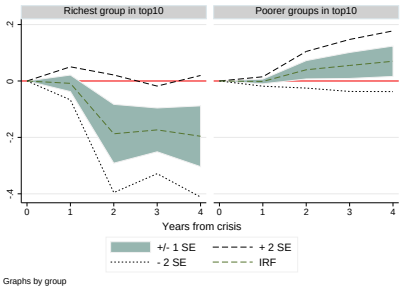
(b) Baseline - POLS



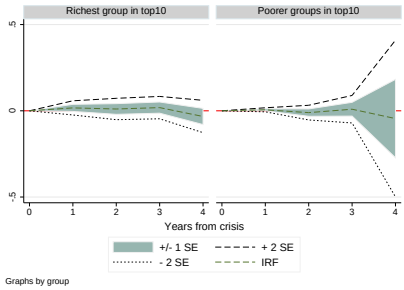
(c) Including contemporaneous effect of crisis on top shares - MG



(d) Controlling for average per-capita GDP growth - MG



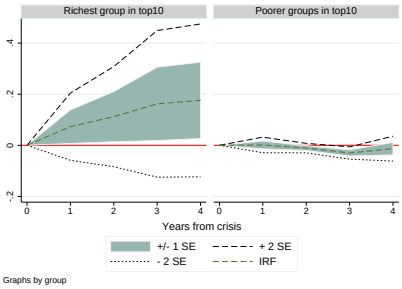
(e) Excluding banking crises preceded by different shocks - MG



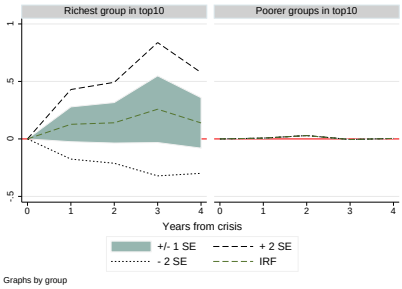
(f) Macro-instability episodes other than banking crises - MG

Notes: The Y-axis represents the percentage deviation of top shares from the NO-crisis case. MG and POLS indicate respectively the use of the Mean Group estimator or the Pooled Ordinary Least Squares estimators. The confidence interval is obtained through bootstrapping with 100 replications.

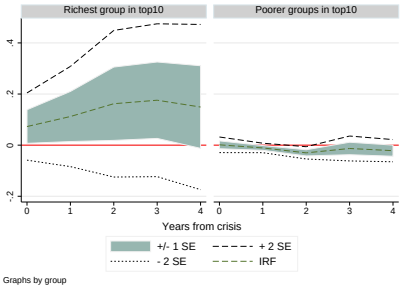
Figure 3.14: Impact of Banking Shocks on the Top Shares of 'Developing' countries



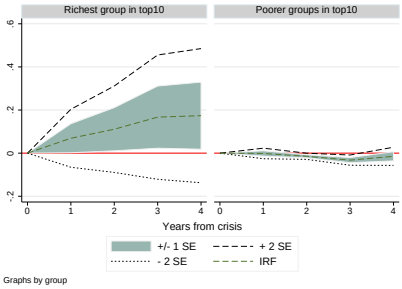
(a) Baseline - MG



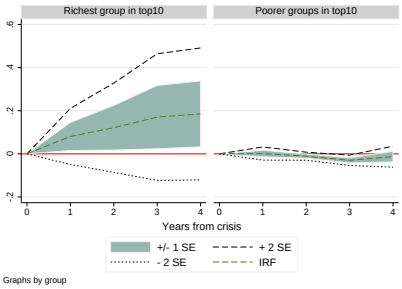
(b) Baseline - POLS



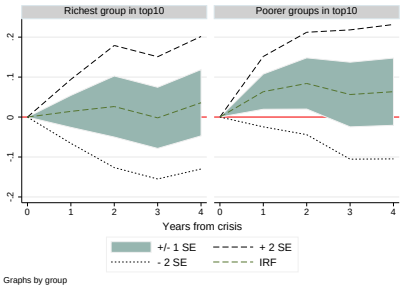
(c) Including contemporaneous effect of crisis on top shares - MG



(d) Controlling for average per-capita GDP growth - MG



(e) Excluding banking crises preceded by different shocks - MG



(f) Macro-instability episodes other than banking crises - MG

Notes: The Y-axis represents the percentage deviation of top shares from the NO-crisis case. MG and POLS indicate respectively the use of the Mean Group estimator or the Pooled Ordinary Least Squares estimators. The confidence interval is obtained through bootstrapping with 100 replications.

Appendix B: Methodology

Homogeneous Parameters Panel - "Pooled" Estimators

The typical "pooled" estimators used in the analysis is the classic Pooled OLS (POLS)[74].

The pooled estimator is applied to the general ADL model discussed in the text (equation (3.2)). The parameters of the model are assumed to be homogeneous across panel units ($\theta_{i,k} = \overline{\theta_k}$, $\phi_{i,k} = \overline{\phi_k}$, $\delta_i = \overline{\delta}$, $\rho_i = \overline{\rho}$ $\alpha_i = \overline{\alpha}$) and error term $u_{i,t} = \mu_i + \mu_t + \epsilon_{i,t}$, where μ_i represents the time-invariant and country-specific factor, μ_t the so called time effect (common to all panel units) and $\epsilon_{i,t} \sim i.i.d.$

$$g_{i,t}^{top} = \sum_{k=0}^{2} \overline{\theta_k} g_{i,t-k}^{top} + \sum_{k=0}^{4} \overline{\phi_k} D_{i,t-k} + X_{i,t}' \overline{\rho} + \mu_i + \mu_t + \epsilon_{i,t}. \tag{3.5}$$

For every specification I carried out an Hausmann test for fixed and random effects confirming the non-systematic differences between the estimators and therefore the orthogonality between the individual characteristics and the regressors. This rules out the classic source of bias in a dynamic specification. Hence, for every RE model I then test the systematic difference across panel units, namely the so called "panel effect". The test for random effects is carried out with a standard Breusch-Pagan Lagrange Multiplier (LM) test with the null hypothesis of zero variance across panel entities, μ_i. The latter is never rejected and this confirms the consistency of the standard pooled least squares estimator (POLS).[75]

Homogenous Models as a Source of Autocorrelation However, although every model is estimated using residuals robust to the heteroskedasticity (which specific test strongly suggests to be present), using POLS alone cannot control for another classic source of problems for the statistical inference, namely the presence of autocorrelation structure in the error terms (errors are not independently distributed). A solution might be to estimate the model using FGLS estimator accounting for an AR(1) structure in the residuals. This should result in a more efficient estimation of parameters. However, this is not sufficient because the use of a homogenous panel model *itself* might be the source of the autocorrelation. The fact that the source of autocorrelation can be endogenously driven by the restriction of parameters homogeneity, when the true DGP is suggesting the opposite is shown below.

As an example consider the pooled dynamic regression model (equation (3.5)) when the true DGP is represented by equation (3.2). For simplicity consider exclusively one lag of the dependent variable and no lags for the rest of the regressors. It is

[74] As described in the text this was preferred this was preferred over the two other common estimators, namely the Fixed Effects (FE) and Random Effects (RE), following classic post-estimations tests.

[75] I also jointly test the validity of country effects in the POLS regression and I fail to reject the null hypothesis.

easy to show that the regression residuals are represented by $v_{i,t} = \eta_i^{\theta} g_{i,t-1}^{top} + \eta_i^{\phi} D_{i,t} + X'_{i,t}\eta_i^{\rho} + u_{i,t}$. In other words, the assumption of parameters homogeneity implies serially correlated residuals.

Homogeneous Models as a Source of Bias The assumption of parameter homogeneity can also be the source of biased estimation as well as the autocorrelation of error terms themselves. The biases may arise for two different reasons. On one hand is the use of the pooled estimator, when the DGP suggests the opposite that creates the problem. On the other hand, an additional source of bias may arise from the assumption of unobserved common factors which can exert different impact across countries and most importantly can drive both the regressors and the residuals. These two sources of bias, which can severely distort the estimates of the coefficients, are described below.

First of all, it is straightforward to show that the homogeneity assumption is also the source of problem for the identification of the slope parameters. Indeed the error term $v_{i,t}$ described above is clearly correlated with the regressors.

Secondly, it can be shown that the exclusion of more flexible and general time common factors from the specification (lack of general control for cross-section dependence)[76] can be another source of bias for the estimated coefficients. This happens if the same common factor is driving the residuals and some or all the covariates (an example might be the process of globalization driving both the growth of output, the growth of top income shares and potentially the likelihood of crisis.)

In order to illustrate this problem, I propose here the example reported in Eberhardt et al. (2013):

$$y_{i,t} = \beta_i x_{i,t} + u_{i,t}. \tag{3.6}$$

with a multi-factor error structure and the latent variable f_t driving both the regressor and the residuals,

$$u_{i,t} = \varphi_i f_t + \psi_i + \varepsilon_{i,t} \tag{3.7}$$

$$x_{i,t} = \varrho_i f_t + \pi_i g_t + \psi_i + \phi_i + e_{i,t} \tag{3.8}$$

and $\varepsilon_{i,t}, e_{i,t}$ being white noise.

Note also that in a dynamic context like ours this is an inevitable problem if the common factors are autocorrelated, very much similar to the source of bias coming from the time-invariant country-specific effects.

[76] Note that the standard time-effects included in the pooled estimations is effectively a specific common factor. However this is assumed to have an homogeneous impact across countries

Detailed Derivation of the IRF

It has already been suggested that the IRFs are calculated from a standard multivariate Auto-regressive Distributed Lag (ADL) model of the following (reduced) form:

$$g_{i,t}^{top} = \sum_{k=1}^{2} \theta_{i,k} g_{i,t-k}^{top} + \sum_{k=0}^{4} \phi_{i,k} BC_{i,t-k} + \rho_i' X_{i,t} + u_{i,t}$$

where $g_{i,t}^{top}$ is the growth rate of the top fractional percentile for every country i from year $t-1$ to year t; $BC_{i,t}$ is a categorical variable coded 1 when the systemic banking crisis in country i begins and zero otherwise; $X_{i,t}$ is a vector of other regressors.

Then, a so called *ex-post* counterfactual analysis based on macro-econometrics is implemented in order to estimate the total effect of crises on the top shares. The information set at time t is defined as $F_T = \{g_t^{top}, X_t, BC_t\}$ for every $t = (T, T-1, T-2, ...)$ and $h = (1, 2, ..., H)$. I also define the set of "crisis off" values as $\Theta_{T+h}^0 = \{BC_{T+1}^0 = 0, BC_{T+2}^0 = 0, ..., BC_{T+h}^0 = 0\}$, assuming that the banking crisis lasts for h years. This leads to define the total impact of the occurrence on the outcome variable as follows:

$$I_{T+h} = g_{T+h}^{top} - E_T \left\{ g_{T+h}^{top} / F_T, \Theta_{T+h}^0 \right\}.$$

Where g_{T+h}^{top} is the actual growth rate of the top share under analysis and $E\{g_{T+h}^{top} / F_T, \Theta_{T+h}^0\}$ represents the objective of the estimation, namely the value of the growth rate of top shares under the condition of no crisis, which depends on the empirical specification.

If on is willing to assume for simplicity that the ADL model features only one lag of the growth rate of top income share, the first ADL model can be rewritten as follows[77]:

$$g_{i,t}^{top} = \left(1 - \theta_{i,1} L\right)^{-1} \left[\sum_{k=0}^{4} \phi_{i,k} BC_{i,t-k} + \rho_i' X_{i,t} + u_{i,t} \right]$$

and

$$g_{i,t}^{top} = \sum_{k=0}^{4} \sum_{j=0}^{\infty} \phi_{i,k} \theta_{i,1}^j BC_{i,t-k-j} + \sum_{j=0}^{\infty} \theta_{i,1}^j \rho_i' X_{i,t-j} + \sum_{j=0}^{\infty} \theta_{i,1}^j u_{i,t-j}$$

The counterfactual can now be subtracted from g_i^{top} in order to obtain the realiza-

[77] This transformation is valid under the assumption of stationarity of g^{top}

tion of the IRF at the h'th period following the shock.

$$I_{T+h} = \sum_{k=0}^{4} \sum_{j=k}^{h+k} \phi_{i,k} \theta_{i,1}^{j-k} + \sum_{j=0}^{h} \theta_{i,1}^{j} \rho_i' X_{i,T+h-j} - E_T^0 \left\{ \sum_{j=0}^{h} \theta_{i,1}^{j} \rho_i' X_{i,T+h-j} \right\} + \sum_{j=0}^{h} \theta_{i,1}^{j} u_{i,T+h-j} - E_T^0 \left\{ \sum_{j=0}^{h} \theta_{i,1}^{j} u_{i,T+h-j} \right\}.$$

It is clear from above that one can ignore the last two terms only by assuming that the error term and the whole set of parameters do not change with the occurrence of the crisis and by conditioning the reduced form model solely on variables which are crisis-invariant. Under these strict invariance assumptions one obtains the type of formula estimated in the model:

$$I_{T+h} = \sum_{k=0}^{4} \sum_{j=k}^{h+k} \phi_{i,k} \theta_{i,1}^{j-k}$$

Indeed, as stated in Pesaran & Smith (2012) and recalled in the text, a simple reduced form model is sufficient in order to assess the *total* effect of a crisis (they discuss the role of macroeconomic policies instead) on a specific outcome variable. This holds true as long as one conditions the model on variables that, although influencing the outcome variables, are invariant to the occurrence of the crisis itself. In particular the model cannot be conditioned on control variables such as a country's GDP growth, stock market performance, measure of financial development and indexes of other macro-shocks. All these variables, although commonly used as control variables given their influence on the growth of top shares, are infact expected to be influenced by the occurrence of a banking crisis.

Chapter 4

On Inequality, Crises and Consumption

Contents

Introduction

The conventional analytical distinction between income distribution and the functioning of the macroeconomy has perhaps come to an end in light of the recent crisis. The high level of income inequality (broadly seen as a combination of stagnation of average incomes at the middle and bottom of the distribution and an increase in average incomes at the top) has been singled out as one of the structural causes of the recent crisis, especially in the US.

Nonetheless, recent literature and debate has devoted little attention to formal accounts and to compelling empirical validation of the alleged relationship between inequality and banking crises. The existing empirical evidence so far (e.g. Atkinson & Morelli, 2010, 2011; Bordo & Meissner, 2012), based on aggregate data, suggests that the nexus between growing inequality and the occurrence of a crisis is not backed by significative statistical evidence across different countries and time periods.

Using updated data and methodology, this chapter reassesses 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. More specifically, I 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. Similarly, I discuss the importance of looking a different segments of the income distribution spectrum represented by different inequality indicators.

However, it is still premature to know where the weight of the evidence lies, as both empirical and theoretical models have not yet been placed under the thorough lens of academic scrutiny. In particular, the debate on the possible link between inequality and crisis is still in its infancy and many hypotheses have been put forward. A recurrent argument in the current debate sees growing income inequality as a main driver of stagnating aggregate demand and private consumption.

Therefore, within this chapter I further explore and discuss the theoretical conditions under which one can observe a negative impact of increasing dispersion of income on aggregate consumption in the economy. This is done by estimating a consumption model using survey data on UK households and simulating how aggregate consumption can change when, other things being equal, income inequality is assumed to vary.

Finally, I review the theories that link household consumption and savings choices directly to income distribution. This happens when utility functions are interrelated and individuals value their consumption and welfare in relation to the other members of their reference group. In support of these theories, I provide evidence on the

evolution of the saving rates across the UK income distribution from the 60s to 2010.

Structure of the chapter This chapter, is composed of four core sections. The first contains new updated empirical evidence on the relationship between crisis and different dimensions of inequality. The second section provides a brief overview of the main theoretical arguments in support of the inequality/crisis nexus. The third begins to deal with the first important hypothesis: To what extent does a redistribution of income towards the top of the distribution justify a reduction in aggregate demand due to lower pressure on aggregate consumption? In order to answer this question I unveil the theoretical justifications for this argument and I assess their empirical relevance. The fourth section reviews the theories that link household consumption and savings choices directly to income distribution. The section further discusses the empirical validity of these theories and their broader implications.

4.1 Inequality and Crises: New Empirical Evidence

Recent literature and debate has devoted little attention to the empirical validation of the alleged relationship between inequality and banking crises, with the exception of works by Atkinson & Morelli (2010, 2011) and Bordo & Meissner (2012). The existing empirical evidence so far, based on aggregate data, suggests that no systematic relationship exists between cumulative *changes* of inequality and the occurrence of systemic banking crises. Conversely, the first available evidence based on the *levels* of inequality Bellettini & Delbono (2013) appears more supportive of a stronger association between relatively high inequality and occurrence of banking crises.

The distinction between the '*level*' hypothesis and the '*growth*' hypothesis is an important one as already exposed in length within Atkinson and Morelli's work. Indeed, the policy implications and the theoretical models of reference can be quite different under the different hypotheses that either growing inequality or its high level are generating the onset of the crisis. If it was the growth of inequality that caused the recent crisis, then the available evidence does not indicate that there is a risk of a further crisis; whereas if it was the level of inequality, than we may face a risk of recurrent crises as long as inequality remains high.

This section discusses the main results in the literature and presents new evidence on both the 'growth' and the 'level' hypothesis. 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[1]. Therefore, based on time dimension the risk of a crisis may seem significantly enhanced but this is not the case observing the cross-country dimension.

I therefore follow two main approaches in this paper, 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.

4.1.1 Description of the Data

Financial crises and in particular systemic banking crises are rare events in a country's history and their investigation requires to obtain data covering a long period of time. "*A data set that covers only twenty-five years simply cannot give one an adequate perspective*" as recalled by Reinhart & Rogoff (2009). Indeed, since the beginning of the twentieth century -the focus of this study- there are two main waves of banking crisis as detailed in Chapter 1: one before the second world war and one after the fall of Bretton Woods at the end of the 1970s. It is worth noting that, for the subset of countries under investigation, only two crises occur between 1939 and 1977, namely the Indian crisis in 1947 and the Brazilian[2] crisis in 1963. Thus, in order to analyse the two waves of crisis one has to go back in time to the early years of the twentieth century.

In the first systematic empirical investigation of the inequality-crisis hypothesis, Atkinson & Morelli (2010, 2011) faced the major challenge with regards to distributional data that such studies pose. Indeed, there are no ready to use database on different dimensions of inequality compiled with an emphasis on time-comparability. In order to address this issue and to maximise the available observations, the authors assembled a new dataset (The Chartbook of Income Inequality, 2012) drawing on the collection of historical data assembled over the years from a variety of individual researchers as well as research institutions and statistical offices. The database collects

[1]Using the wave VI of Luxemburg 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.

[2]Note that Brazil was not included in the list of countries analysed in the previous chapter. Here I include Brazil in order to make the analysis in this chapter comparable to the work by Atkinson & Morelli (2010, 2011).

information on 5 different annual measures of 'inequality' (top income share, income or consumption based poverty measure, Gini index on equivalised household disposable income, earnings dispersion measure and top wealth share). This goes clearly beyond the WTID data described in Chapter 2 and 3. In fact, the WTID is nested within the Chartbook as far the very top of the distribution is concerned[3] The data cover an 100 year period from 1911 to 2010 for 25 different countries accounting for more than a third of the worlds population[4].

4.1.2 What do we know so far

Atkinson and Morelli's (2010 and 2011) work did not find any systematic relationship between changes in inequality and occurrence of macroeconomic disasters, in particular systemic banking crises[5]. The work made use of a narrative approach and a straightforward 'window-study' methodology, making no adjustment to the raw inequality data[6]. The results in Atkinson & Morelli (2010, 2011) were obtained observing the dynamics of selected 'inequality' measures prior the onset of each systemic banking crises[7]. Their code also made use of 'lexicographic' preferences for inequality indexes. The Gini index of net equivalised household income was given priority over the rest of the indicators. When the Gini measure was not available, measures of top-income shares were utilised followed by measures of relative poverty[8]. Finally, crisis episodes overlapping (even partially) with war, civil war and independence episodes (so called 'special circumstances') were considered to be missing values.

Similarly, Bordo & Meissner (2012) broadly confirm these findings using a narrower definition of inequality (top income shares only) and a more conventional econometric specification[9]. Conversely, Bellettini & Delbono (2013), focusing exclusively on

[3]The Chartbook include top1% and top0.1% shares for each country under investigation

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

[5]Atkinson & Morelli (2011) also focus on other types of crises, namely real per-capita GDP and consumption crises which I am not considering within this section.

[6]Although data series have been linked where two comparable series overlapped in at least one year. For more details I refer the reader to Atkinson & Morelli (2012) .

[7]In particular, they adopted a short-term horizon comparing the 'inequality' level at the year preceding the beginning of the crisis (T-1) to the average level observed in the fourth to the sixth years before the crisis (T-4, T-5 and T-6).

[8]Changes in the above mentioned indicators were classified as salient if the absolute value of the observed change was greater or equal than 2/3 percentage points, for Gini and poverty measures, and 1 percentage points, for top income shares. Smaller changes were classified as no change in order to minimise measurement errors concerns.

[9]Atkinson and Morelli preferred not to apply any econometric specification due to the highly unbalanced nature of the dataset and in order to maximise the number of observed crisis episodes. Observations are not evenly spaced and the mechanical calculation of the cumulative changes over specific period of time would result in information loss. Moreover, by using different inequality indicators one can complement missing information where needed. Finally, the use of indicators on different dimensions of inequality carries important implications for the unit of measurement which are easier to handle

the post-1980 sub period, find evidence supporting the 'level' hypothesis and point out that "*a large majority of crises occurred between 1982 and 2008 have been preceded by persistently high levels of income inequality*".

Yet, I believe the overall evidence is far from being conclusive and there are several reasons to shed further light on this important research topic. The subsections below further explore the empirical relationship between crisis and inequality and discuss the main issues that still remain open. In particular, I update the empirical methodology of previous work by Atkinson & Morelli (2011) and extend the analysis to test the 'level' hypothesis as well as the 'growth' one.

4.1.3 New Empirical Evidence on the '*Growth*' Hypothesis

In what follows, I extend Atkinson and Morelli's empirical investigation on the '*growth hypothesis*' by making use of the most updated version of the Chartbook of Economic Inequality (March 2013) as well as an updated empirical methodology. In particular:

(i) Firstly, I control the validity of the findings for different width of the time windows of observation and for different salience thresholds of inequality changes. Indeed the growth hypothesis can be quite sensitive to this *ad-hoc* parametric assumptions.

(ii) Secondly, I decompose the analysis by different inequality dimensions going beyond the aggregate results which confounds different dimensions of inequality.

Other relatively minor changes with respect to the original study by Atkinson and Morelli are worth noting. For instance, I explicitly identify the crisis-country pairs under investigation without concealing this important information behind the anonymity implied by a crude statistical summary. In addition, I provide a classification for those episodes partially overlapping with 'special circumstances' like major wars, civil wars and independence episodes. Some of these changes allow to recover usable information which was entirely ignored within tables reported in Atkinson & Morelli (2010, 2011). Essentially, I am able to double the number of observations and classify an additional 20 crises.

Results are shown in Figure 4.1 where the changes in inequality before each detected banking crisis are tabulated. Similarly to Atkinson & Morelli (2011) have done[10], I categorise the distributional changes as follows:

- A Sign '**+**' or '**-**' is given to all positive and negative changes which are greater than the salience threshold. Indeed, results are determined by recording the

in a qualitative analysis.

[10]The authors also tabulate the changes of inequality posterior to the crisis. Their study also extended beyond banking crises to include other economic shocks such as the real per-capita GDP and consumption cris

changes of inequality only when their magnitude is greater than 1 percentage point (for Gini and poverty measures) and 1.5 percentage points (for top measures)[11].

- 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**'.

The table represented in Figure 4.1 focuses the attention on the row marginal distribution which summarises the available information about what happened to inequality prior to the onset of a crisis in all classifiable episodes.[12]

Following the work by Atkinson and Morelli I prefer information on the Gini coefficient when the latter is available. Top income shares are the second preferred measures followed by poverty indicators. Therefore Figure 4.1 combine 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, I found the same number of crises preceded by salient increase or decrease in inequality in the 5 years window before a crisis (12 out of 42 classifiable cases and out of 72 identified crises)[13].

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 I find no support for the hypothesis that sees increasing levels of inequality systematically associated to higher incidence of crises.

Note also that both most recent systemic banking crises identified in the US (1988 and 2007), according to classification in Figure 4.1, are 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'. Indeed, 5 years may not be a sufficient time horizon in order to detect major changes in income distribution. In fact, the next section explores the growth hypothesis using a different time observation window.

[11] Atkinson & Morelli (2010, 2011) recorded the changes in inequality as long as they were, in absolute term, greater than 2/3 percentage points in the case of Gini and Poverty indexes. The threshold was 1 for measures of dispersion of income ar the top. I decided to increase slightly the baseline salience threshold in order to run further robustness check on the possible influence of measurement errors in the data

[12] Atkinson & Morelli (2010, 2011) also focus on post-crisis variation in inequality. I dealt with this within the previous Chapters by focusing on top income shares exclusively.

[13] Note that the number where inequality is found increasing before a crisis rises to 23 out of 42 if one does not use any threshold of salience for the classification of changes in inequality.

Figure 4.1: Inequality Before and After 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 Iceland 2007	Indonesia 1997 Japan 1923; Japan 1992 Netherlands 2008 Netherlands 1939 US 1929	***12***
	=	Canada 1923 Finland 1931; Finland 1991 Germany 1931 India 1929 Indonesia 1992 Japan 1927 Malaysia 1997	Norway 1987 Singapore 1982 Spain 2008 Sweden 1991 Switzerland 1931 UK 2007 US 1988; US 2007	***16***
	-	Argentina 1995 Australia 1931 Brazil 1994 Finland 1939 France 1930	Germany 1925 India 1993 Italy 1990 Malaysia 1985 Netherlands 1921 Sweden 1922 Switzerland 1921	***12***
	#	*Netherlands 1914* *Switzerland 1933* *Finland 1921* *Argentina 1914; Argentina 1931;* *Argentina 1934 Brazil 1914; Brazil 1923; Brazil 1926; Brazil 1929 Brazil 1963* *Canada 1912*	*France 1914* *India 1914; India 1921* *Italy 1914; Italy 1921; Italy 1930; Italy 1935* *Norway 1921; Norway 1931;* *Norway 1936;* *Portugal 1920; Portugal 1923;* *Portugal 1931* *Spain 1920; Spain 1924; Spain 1931; Spain 1977 Sweden 1931*	***30***
	S	India 1947 Japan 1917		***2***

Author's update and re-elaboration of results in Atkinson & Morelli (2010, 2011).

Expanding the time window

Whereas Atkinson and Morelli used only a short-time window (comparing T-1 to the average of T-4 to T-6, where T is the year of the crisis outbreak), I explore below how the results might change when I also look at the medium-run (comparing T-1 to the average of T-9 to T-12).

The expansion of the time window allows to better categorise changes in inequality beyond the temporary factors that might influence them (e.g. 'bubbles' in the financial sector). Indeed, the number of episodes in which no change in inequality has been recorded is drastically reduced and no longer constitutes the majority of observations as shown in Figure 4.2. Furthermore, the number of crises preceded by growing inequality increased to 17 over 40 classified episodes. For example, after expanding the time window, the pre-crisis change in inequality becomes salient in the case of two crucial crises like the US Savings and Loans crisis and the recent 2007 financial meltdown.

Figure 4.2: Inequality Before and After Systemic Banking Crises: Medium-run

Medium-run		List of crises		Total
Pre-crisis change in income inequality	+	Argentina 1980; Argentina 1995; Argentina 2001 Brazil 1990; Brazil 1994 Germany 2007 Iceland 2007 Indonesia 1997	Japan 1923;; Japan 1992 Sweden 1991 Switzerland 1931 UK 2007 US 1929; US 1988; US 2007	***17***
	=	Australia 1931 Finland 1991 Italy 1921 Japan 1927 Malaysia 1997	Netherlands 2008 Norway 1987 Spain 2008 Sweden 1931	***9***
	-	Finland 1931 Finland 1939 France 1930 Germany 1925; Germany 1931 India 1993 Indonesia 1992	Italy 1990 Malaysia 1985 Netherlands 1939 Singapore 1982 Sweden 1922	***12***
	#	*Argentina 1914; Argentina 1931; Argentina 1934* *Brazil 1914; Brazil 1923; Brazil 1926; Brazil 1929; Brazil 1963* *Canada 1912; Canada 1923* *Finland 1921* *France 1914* *India 1914; India 1921; India 1929*	*Italy 1914 Italy 1930 Italy 1935* *Netherlands 1914; Netherlands 1921* *Norway 1921; Norway 1931; Norway 1936* *Switzerland 1921; Switzerland 1933* *Portugal 1920; Portugal 1923; Portugal 1931* *Spain 1920; Spain 1924; Spain 1931; Spain 1977*	***32***
	S	India 1947 Japan 1917		***2***

Author's update and re-elaboration of results in Atkinson & Morelli (2010, 2011).

This adjustment to a medium-run analysis has also some drawbacks as the number

of classifiable crises is now reduced from 42 to 40[14] This change in methodology can also radically modifies the way some of the crises are recorded. As an example, prior the Argentinean crisis in 1995 the change in the Gini coefficient can be recorded as -3.6 or + 2.2 percentage points depending on whether one is focusing on the short or medium-run.

Controlling for Different Salience Thresholds

One may object that the results presented above are dependent on the choice of the salience threshold for the changes in different inequality indicators.

Nonetheless, the investigation of the changes in inequality as a structural cause of crisis should perhaps focus on major or substantial changes in income distribution rather than ordinary ones. Is a change of 1 Gini point to be considered a major or 'salient' change in income distribution? 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 tax rate, a very difficult task for a policy maker (see also Atkinson & Marlier (2010, p. 112)). In particular, this is true assuming constant marginal tax rate on all incomes and uniform tax credit[15]. The choice of an alternative threshold of 3 percentage points could therefore be an appropriate one and I assess the validity of the 'growth' hypothesis accordingly. However, as minor changes would no longer be classified, the statistical support for the 'growth' hypothesis shrinks further with the use of the new threshold[16].
A 3 percentage points 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[17]. 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. In fact, it may well be that the choice of a salient threshold ought to be linked to the information about data volatility in each individual country.

[14]It is worth mentioning that I also run the estimations for the long run (comparing T-1 to the average of T-19 to T-22). This further reduces the available usable observations to 24 and the results, overall, do not carry any additional useful information compared to the short-run and medium-run cases. I do not report results for the long-run but tabulations are available upon request.

[15]See Atkinson (2003) who 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).

[16]It is also interesting to mention the main results in relation to the long run which is not tabulated. Using the Gini coefficient as the variable of reference I can classify a total of 11 crises only. In 7 of these cases the Gini coefficient grew by more than 3 percentage points in the years preceding the crisis. The 7 cases are respectively two crises in Argentina (1995 and 2001), Japan 1992, US 1988 and 2007 as well the recent crises in Germany and UK in 2007. When I look at top income shares only 7 cases are classifiable in the long-run analysis. However, only two countries were found at a record high level of top share prior the 2007 crisis, the UK and the US.

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

Table 4.1: The 'Growth' Hypothesis Revisited: 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	12	17	4	11	4	12
NO	28	21	36	27	33	23
S	2	2	2	2	2	2
Missing	30	32	30	32	33	35
Total	72	72	72	72	72	72

Notes: The table checks the validity of the 'growth' hypothesis under different time horizon and salience thresholds. On one hand I compare the short-run (approx. 5 years) to the medium-run (approx. 10 years). On the other hand, I 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.

Hence, and using the UK observation as the benchmark, I 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.

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 I 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 the inequality is rising or falling. Is the increasing inequality a phenomenon reflecting the 'polarization' of income, away from the middle-class and towards the two tails of the distribution? Or are the upper income brackets concentrating more and more economic resources? Similarly, it is important to understand whether the bottom of the distribution is losing out with respect to the median household or whether the distribution of income as a whole is becoming more unequal. Each of these stories carries important different implications for policy.

I therefore decompose the analysis by different dimensions of inequality. As mentioned above, I 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% of the population[18] (dispersion at the '*top*') and the head-count measure of households below the 60% of the median income in the country (inequality of in-

[18]The word 'population' is used here to refer to the country-specific definition of 'tax units'.

come between the '*bottom*' households and the median). These are not just arbitrary indicators. Indeed, they span the whole income distribution and this reflects the fact the word 'inequality' acquires different meaning for different people, depending on which segment of the income distribution one is investigating.

Table 4.2 summarises the results disaggregated by inequality measures and different time horizons. In particular the 'growth' hypothesis is assessed using exclusive 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 more than double (15) the number of crises preceded by declining Gini (7) and is indeed higher than the cases of declining and stable Gini taken together (summing up to 11). Table 4.3 provides further details for each country and crisis-year pairs. It is observed that, of the above mentioned 15 cases, all except the 1929 crisis in US occur in the post-1980 period. This reflects the positive trend in income inequality experienced in many countries since the early 1980s. In addition, 7 of these 15 crises are in Latin American countries (or Indonesia). Furthermore, all crises 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 relevant crises like 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 horizon. 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.

Summary: the 'Growth' Hypothesis

In the section above I analysed and re-assessed the validity of the hypothesis that growing levels of inequality can systematically precede the onset of systemic banking crises. In particular, the analysis showed whether or not the change in inequality preceding each crisis is positive and higher than predetermined salience threshold[19]. The actual evidence in support of the 'growth' hypothesis is weak at best and findings are in line with the analysis already carried out in Atkinson & Morelli (2010, 2011).

Results are robust to the expansion of the time window beyond the short-run and to the use of different salience thresholds for the classification of changes in inequal-

[19] If the evidence does not support the hypothesis the pre-crisis change in inequality is found to be either negative or with a magnitude lower than the benchmark designated by the parametric threshold

Table 4.2: 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	12	9	9	3	17	15	6	6
NO	28	16	25	16	21	11	22	10
S	2	0	2	0	2	0	2	0
Missing	30	47	38	53	32	46	42	56
Total	72	72	72	72	72	72	72	72

Notes: The table checks the validity of the 'growth' hypothesis under different inequality indicators and time horizons. On one hand I compare the short-run (approx. 5 years) to the medium-run (approx. 10 years). On the other hand, I 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. 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.

ity. In particular, the investigation of medium-run (approximately 10 years before the crisis) reveals stronger support for the 'growth' hypothesis only at a first glance. For example, it is worth mentioning that 17 out of 39 classifiable crises were found to be preceded by increasing inequality, 12 by decreasing inequality and 9 by stable inequality[20]. However, these findings are not robust to the increase in the salience threshold to 3 percentage points[21], as only 11 cases are found in support of the growth hypothesis and 27 cases are found against it. The latter results is important as it is based on a magnitude of the threshold which is closer to an extraordinary change in income distribution. Similarly, cases in support of the hypothesis are 12 (versus 23 against) by allowing the salience threshold to vary across countries. Finally, the investigation of the disaggregated evidence on different inequality indicators finds mild support for the 'growth' hypothesis only when one looks at the findings for the Gini coefficient. The number of crises in which the Gini grew more than 1 percentage point adds up to 15, against 11 cases where the changes in inequality do not support the growth hypothesis. However, this has to be nuanced on the ground that most of the identified crises are actually non-classifiable (46) as no information on the Gini is available in those cases.

[20]Such difference, although more in favor of the inequality-crisis nexus, is yet not sufficient to infer any meaningful conclusion from a pure statistical stand point. Indeed, it is also worth noting that the silent information (crises for which there are no distributional data) constitutes a substantial part of the sample as shown in table 4.1.

[21]I recall that the baseline assumption is that changes in the Gini coefficient and the poverty measure are classified as such only if they are higher than 1 percentage point in magnitude. For income dispersion measures at the top the threshold is 1.5 percentage points.

Table 4.3: 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	1914								
Argentina	1931								
Argentina	1934								
Argentina	1980	+	+		=	+	+		
Argentina	1989	+	+		+	+	+		+
Argentina	1995	-	-		-	+	+		+
Argentina	2001	+	+	+	+	+	+		+
Australia	1931	-		-		=		=	
Brazil	1914								
Brazil	1923								
Brazil	1926								
Brazil	1929								
Brazil	1963								
Brazil	1990	+	+		+	+	+		=
Brazil	1994	-	-		=	+	+		-
Canada	1912								
Canada	1923	=		=					
Finland	1921								
Finland	1931	=	=	=		-	-	-	
Finland	1939	-	-	=		-	-	=	
Finland	1991	=	=	=	-	=	=	=	-
France	1914								
France	1930	-		-		-		-	
Germany	1925	-		-		-		-	
Germany	1931	=		=		-		-	
Germany	2007	+	+	+	=	+	+	=	+
Iceland	2007	+	+	+	=	+	+	+	
India	1914								
India	1921								
India	1929	=		=					
India	1947	S		S		S		S	
India	1993	-	-	=	-	-	-	=	-
Indonesia	1992	=	=		-	-	-		-
Indonesia	1997	+	+	=	-	+	+		-
Italy	1914								
Italy	1921					=	=		
Italy	1930								
Italy	1935								
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	1921								
Norway	1931								
Norway	1936								
Norway	1987	=		=		=		=	
Portugal	1920								
Portugal	1923								
Portugal	1931								
Singapore	1982	=	=	=		-	-	=	
Spain	1920								
Spain	1924								
Spain	1931								
Spain	1977								
Spain	2008	=	=	=		=		=	
Sweden	1922	-		-		-		-	
Sweden	1931					=		=	
Sweden	1991	=	=	=		+	+	=	
Switzerland	1921	-		-					
Switzerland	1931	=		=		+		+	
Switzerland	1933								
UK	2007	=	=	=	=	+	+	=	-
US	1929	+		+		+	+	+	
US	1988	=	=	+	-	+	+	+	+
US	2007	=	=	+	=	+	+	+	=

Notes: extended version of Table 4.2

4.1.4 The Investigation of the '*Level*' Hypothesis

The work by Atkinson & Morelli (2011) did not investigate *"whether inequality level was relatively higher before identified macroeconomic shocks"* and this led them to conclude that " *the level hypothesis cannot be ruled out at this stage*". In what follows I provide new evidence about the level hypothesis using two different empirical strategies. The level of inequality before the crisis (typically in the three years preceding the eve of the crisis) is compared, on the one hand, to the country's own historical evidence (e.g. 'time comparator') and, on the other hand, to the average experience of other countries (e.g 'cross-country comparator'). This constitutes one of the first attempt to assess the validity of the 'level' hypothesis across different dimensions. Whereas the investigation of the level hypothesis with a cross-country comparator has already been investigated in Bellettini & Delbono (2013), no attempts have been carried out in the literature to investigate the level hypothesis using a time comparator as well.

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, I 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.

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 I 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, I draw on the historical experience of countries, for which I have constructed time-comparable inequality series, in order to estimate an empirical distribution of the main inequality indicators. I then compare these empirical distributions on different inequality measures to the observations that I have at the eve of each crisis (e.g. I 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) 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 72 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 I am interested in. In order to acknowledge this important shortcoming I discard all the estimates coming from the use of less than 20 observations[22]. Moreover, if different results based on different inequality measures lend mixed support to the validity of the level hypothesis, I 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 4.4. The table shows that the level hypothesis based on time comparator does not find greater support in the data compared to other tested hypothesis. For instance, in 22 out of 51 classified cases (43% of the cases) inequality was found to be above the country-specific 80th percentile in the years preceding the crisis. On the other hand the highest support for the growth hypothesis (found using medium-run time window and the baseline salience threshold) counts 17 cases out 40 classified crises (42%).

A few things are worth noting. This methodology allows to classify crisis which were otherwise unclassifiable due to lack of continuous information over time. As an example, the Table 4.5 classifies the two Italian crises in 1914 and 1935, the 1923 crisis in Canada, the 1931 crisis in Norway 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 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 high level of inequality by historical standards. Further detailed information is found in Table 4.5.

[22]By doing this I exclude entirely the data on Iceland for which I only have 19 observations

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 I attempt to do in the following section.

Nonetheless, the data at hand impose now 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 country 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[23].

In order to overcome the problems mentioned above I proceed as follows. First of all, I take the observations available in LIS in 2004 (or the nearest available year) and I adjust the available series in the Chartbook. More precisely I link (with proportional adjustment[24]) the Chartbook Gini series to the 2004 (or nearest) LIS observation. By doing this I reshape the Gini series in the database at hand to be also comparable across countries. This is true under the (strong) assumption that the adjustment is valid back to the 1980, the beginning year of the investigation. Once obtained a set of Gini observations which are comparable (under the assumptions above) across countries one needs to construct a comparator against which to evaluate the levels of Gini in different countries and years. For this I 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 to compare the inequality level for a specific country and year to the average '*world*' Gini level in the specific decade.

[23]This dataset is the most closely comparable across countries, but only provides observations at intervals. There are 'waves' every 5 years approximately, but not annual data (Waves I (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.

[24]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.

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, I consider this as an observation in support of the cross-country 'level' hypothesis. Out of 24 classifiable cases 11 episodes could not be assessed as data were missing, while 7 and 6 cases were found respectively in support and not in support of the 'level' hypothesis. Overall, this findings suggest that even the level hypothesis, evaluated with a cross-country comparator, is not unequivocally supported in the data.

The main results of this exercise are found in a compact version in Table 4.4 and in an expanded and detailed format in Table 4.5. 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.

Findings in the Literature As mentioned before, this is not the first attempt to assess the validity of the 'level' hypothesis with cross-section information as I followed the lead undertaken by the working paper by Bellettini & Delbono (2013). In their work the authors make 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)[25]. Their main conclusion, differently from ours, suggests that a 'substantial' share (approximately 2/3) of classifiable banking crisis[26] in the post-1980 period are preceded by high inequality relatively to the OECD average[27]. More specifically, they are able to classify 14 crises and found evidence supporting the level hypothesis in 9 cases. These results are confirmed using pre-tax and post-tax definition of crises[28]. Moreover, the evidence is also corroborated by the evidence of countries which did not experience banking crises which were not systematically found to have Gini coefficients above the relevant OECD average.

The authors suggest 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,

[25] In particular, in selecting data sources on Gini coefficient for the analysis directly comparable to ours (comparing pre-crisis average to a cross-country comparator) they use only series with at least three years in the relevant period [T-10, T-1] and give priority to the dataset by Atkinson & Morelli (2012) "*or the longest time series between OECD (2011, Overview, Fig. 2) and WIID (UNU-WIDER, 2008)*".

[26] Bellettini & Delbono (2013) use the same classification adopted by Atkinson & Morelli (2011) for the detection of banking crises.

[27] Differently from the case presented here, their comparator only includes the OECD-countries average of the Gini coefficients and not the 'world' average.

[28] Gini coefficient based on income pre-tax and transfers are mostly based on WIID database

Table 4.4: 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	17	11	12	22	12	7
NO	21	27	23	27	37	6
S	2	2	2	2	2	-
Missing	32	32	35	21	21	11
Total	72	72	72	72	72	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.

I believe the findings presented in the section above are not too distant from Bellettini and Del Bono's as both empirical findings are only weakly supporting the level hypothesis by means of any statistical standard. The divergence is rather found in the interpretation of such findings. The analysis presented above finds only 7 cases (out of 13) in support of the level hypothesis whereas Bellettini & Delbono (2013) find 9 cases (out of 14) supporting the hypothesis. I believe this is too small a difference to infer any meaningful conclusion[29].

Summary: 'Level' Hypothesis

The section above provided new evidence about the level hypothesis using two different empirical strategies. In particular, I have assessed whether the level of inequality prior each banking crisis (detected since the beginning of the twentieth century for 25 countries) was deemed to be high using both a time comparator and across-country comparator. The overall evidence described above suggests that also the level hypothesis does not find convincing support in the data, irrespectively of the comparator under investigation. More specifically, in 22 out of 51 classified crises (43% of the cases) inequality was found to be above the country-specific 80th percentile in the years preceding the crisis. In addition, out of 24 potentially classifiable cases, only 7 were found in support of the cross-country level hypothesis while, 6 cases were found against it and 11 episodes could not be assessed as data were missing.

4.1.5 Call for Additional Investigation

The new empirical evidence on the relationship between inequality and crisis continues to suggest the sheer *statistical* insignificance of the hypothesis that *growing* levels

[29] Moreover, it is to be noted that the core of the results in Bellettini & Delbono (2013) are based on data which are not necessarily comparable across countries (no adjustment is done to the data) and this makes more difficult to interpret the results. The authors also provide a robustness check using exclusively the data from LIS, which are indeed comparable across panel units. However, the latter test involves only 9 crises and the authors make use of a cross-country comparator based on the OECD source of data.

Table 4.5: '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	1914						na
Argentina	1931						na
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	1914						na
Brazil	1923						na
Brazil	1926						na
Brazil	1929						na
Brazil	1963				NO	NO	na
Brazil	1990	YES	YES	YES	YES	YES	YES
Brazil	1994	YES	NO	YES	NO	NO	YES
Canada	1912						na
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	1914						na
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	NO	NO
Iceland	2007	YES	YES	YES			
India	1914						na
India	1921						na
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	YES	NO	
Italy	1914				YES	YES	na
Italy	1921	NO	NO	NO	YES	YES	na
Italy	1930						na
Italy	1935				YES	YES	na
Italy	1990	NO	NO	NO	NO	NO	YES
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	YES	YES	NO	NO	
Malaysia	1985	NO	NO		NO	NO	
Malaysia	1997	NO	NO	NO	NO	NO	
Netherlands	1914				YES	NO	na
Netherlands	1921				YES	YES	na
Netherlands	1939	NO	NO	NO	NO	NO	na
Netherlands	2008	NO	NO	NO	NO	NO	NO
Norway	1921						na
Norway	1931				YES	YES	na
Norway	1936						na
Norway	1987	NO	NO	NO	NO	NO	NO
Portugal	1920						na
Portugal	1923						na
Portugal	1931						na
Singapore	1982	NO	NO	NO	NO	NO	
Spain	1920						na
Spain	1924						na
Spain	1931						na
Spain	1977						na
Spain	2008	NO	NO	YES	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	1921				NO	NO	na
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	YES	YES

Notes: extended version of Table 4.4

or *high* levels of inequality systematically precede, let alone cause, the onset of systemic banking crises. However, it is worth qualifying this statement and mentioning few caveats which support the need for additional empirical investigation, given the important question at hand.

First of all, statistical insignificance does not rule out the economic relevance of the question at hand. As correctly pointed out by Stiglitz (2012) in his account about the role of inequality in causing the US crisis, "*we are not claiming here that all financial crises are caused by inequality, or that inequality necessarily leads to a financial crisis*". Stiglitz commented on Atkinson and Morelli's empirical investigation which implicitly assumed that the hypothesis should be applicable indistinguishably to all country-crises pairs. In fact, it may be 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.

Secondly, as pointed out in Bellettini & Delbono (2013), some of the most disruptive systemic banking crises in important countries like the US and the UK -allegedly the financial hubs of the whole world- were preceded by either increasing or record high levels of inequality (depending on the adopted metrics and methodology). This comment appears particularly relevant in the context of high financial and economic integration where financial contagion appears to be a crucial channel through which a crisis can be spread from one country or region to others. Hence, the change in inequality in 'crisis-originator' countries acquires substantial additional importance compared to that occurring in 'crisis-receiving' countries. In the latter case, inequality ought to be investigated for its role in the crisis-propagation and not the generation itself.

Moreover, most of the recent debate centred around the hypothesis that inequality could have contributed to the rise of a credit bubble. To date the limited empirical evidence suggests at best a weak evidence at the macro level (Jappelli et al., 2010, Bordo & Meissner, 2012) and a stronger evidence at the micro level. For example, recent works suggest an interesting association between inequality and household 'over-consumption' and indebtedness in the US (Frank et al., 2010, Bertrand & Morse, 2013, Carr & Jayadev, 2012). As recalled in Lucchino & Morelli (2012) "*micro-data is arguably more appropriate to the question at hand (and) further microeconomic investigation is desirable*". In particular, I advocate the exploration of individuals behavioral response (e.g. optimal consumption, saving and debt decisions) to changes in income distribution. This can possibly provide the most compelling link between inequality and macroeconomic instability and it appears to be a domain of future proficuous research.

Finally, the discussion above also points out the need to refine the theoretical investigation which in turn might provide guidance for a new wave of empirical investigation. The type of hypothesis under investigation ('level' versus 'growth') has to be specified as well as the nature of inequality under investigation (overall inequality,

dispersion at the top or at the bottom). Next section begins by reviewing the current theoretical debate around the inequality/crisis nexus. The chapter then continues to investigate the role of inequality in affecting both aggregate consumption and individual consumption choice. Instead, I do not directly explore here the interesting alleged link between indebtedness and income distribution. The latter would require additional thorough investigation both on the empirical and the theoretical points of view.

4.2 Inequality and Crises: Review of the Current Theoretical Debate

A recent body of literature has forcefully suggested that the increase in income inequality that most developed countries experienced in the past decades might have been one of the structural determinants of the onset of the recent crisis[30]. 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.

(b) Increase the demand of credit of those individuals left behind in order to keep up with the rising living standard. This was also supported by the intervention of central banks, with interest rates cuts, to stimulate the economy contributing to the creation of unsustainable debt.

(c) Increase the supply of funds available in the economy as richer individuals were searching for new investments.

(d) Increase the supply of credit as inequality created pressure for redistribution through easier access to credit.

The arguments above were suggested in different forms and to different extent by, among others, Milanovic (2009); Stiglitz (2009); Fitoussi & Saraceno (2010), Rajan (2010) and Kumhof & Ranciere (2010). 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. His empirical work led him to conclude that :

> "*Most economists place a premium on growth. But as things stand, growth may not be possible unless a significant segment of the population continues to be willing to borrow on a scale that creates or intensifies budgetary pressure on the*

[30] Literature has also suggested that this might be an entirely coincidental story where income inequality and financial instability were driven by the same or different concurrent forces. See Atkinson & Morelli (2010, 2011), Krugman (2010) and Acemoglu (2011) for further discussion

household. To the extent that reduced income inequality means diminished macro-dependence on credit, there is yet another factor why nations should pursue it."

Some of these aspects were already surveyed in recent work by Atkinson & Morelli (2010, 2011) and more recently in Van Treeck (2013). Atkinson & Morelli (2010, 2011) discuss how different hypotheses implicitly attach different importance to the economic unit of reference of inequality measures (i.e. income vs. wealth), to the relevant segment of the income distribution (i.e. top vs. bottom) and to the different dimension of inequality dynamics (i.e. increasing levels of inequality versus high inequality per se). Van Treeck (2013) provides, with the conceptual support of the 'relative income hypothesis', a more focused discussion around the hypothesis 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.

However, theoretical literature which explicitly links income distribution to the increase in household unsustainable indebtedness (which is thought to have destabilised the economy during the latest financial crisis) is almost non-existent with notable exceptions such as the work by Iacoviello (2008) and Kumhof & Ranciere (2010)[31]. Moreover, the role of household indebtedness for macroeconomic instability was largely neglected before the crisis. High level of household indebtedness may leave the bank balance sheets vulnerable to increase in the lending interest rate as non-performing loans would rise as households find themselves in a position of being unable or unwilling to service their debt. Such an adverse shock is not easily diversifiable and it would increase the chances of a systemic banking crisis as bank's assets fall shorts of their liabilities value.

The economic position of borrowers can also be adversely affected by a downturn in economic activity (i.e. increase in unemployment rates) hitting the sustainability of bank balance sheets by increasing the share of non-performing loans. Indeed, empirical studies have often found a strong significant association between worsening real economic performance and higher probability of financial crises (Detragiache & Demirgüc-Kunt (1998)). Thus, inequality may become indirectly relevant for financial stability to the extent that it is able to have a tangible impact on economic performance.

Other aspects of the proposed theoretical foundations remain to be clarified. In the following sections, the current chapter examines the theoretical as well as the empirical validity of some of the conjectures about the alleged link between income inequal-

[31] Iacoviello (2008), constructs a simulated model with heterogeneous agents in which US households demand higher debt when earnings (not income) inequality increases in order to smooth consumption (inequality is referred to as the increased volatility of individual's earnings pattern). Kumhof & Ranciere (2010) 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. The two agents in the model, capitalists and workers, have infinite-horizon CRRA utility functions with minimum acceptable consumption level. The latter drives the need for borrowing when current levels of income is insufficient to guarantee the minimum acceptable level of consumption.

ity and the instability of the macro-economy. In particular, new empirical evidence on the UK is proposed. However, due to the richness of the arguments to be discussed, this chapter only focuses on the analysis of the link between inequality and economic growth, aggregate demand and individual consumption choices. It is worth noting, however, that this thesis does not directly investigate the role of inequality as one of the structural factor leading to the surge of household indebtedness and to an overall increase of debt leverage in the economy.

4.2.1 Inequality and Economic Performance

The view that inequality can have pernicious effects on economic activity, and especially on aggregate demand, was shared by Keynes and hence by the school of thought inheriting his vast legacy. This view was mainly supported by the assumption that poorer individuals have a higher marginal propensity to consume, so that a redistribution towards the richer segments of the population generates reduced pressure on aggregate consumption. On the contrary, the same set of hypotheses led the classical economists to suggest that higher inequality is instead good for incentives and therefore necessarily 'good for growth'. Indeed, the heterogeneity of marginal propensity to consumption, of the kind described above, also implies that richer 'economic classes' have a higher propensity to save and, therefore, a greater potential to support productive investments and the accumulation of physical capital (Kaldor, 1957, Pasinetti, 1962). Inequality, hence, becomes a fundamental ingredient for economic growth.

> *"The story can be summarised by saying that inequality has both an inhibiting and a stimulating influence on economic performance, and that different theoretical mechanisms tend to focus on different aspects of the distribution."* (Voitchovsky, 2005)

But income inequality has not always been acknowledged as an important ingredient for macroeconomic performance. For instance, the Neo-classical paradigm, which followed the classical approach in the 70s and the 80s, has instead ignored the consequences of distribution of income and wealth on aggregate economic performance. This result is a logic consequence of the pervasive use of the representative agent hypothesis, which rules out the heterogeneity of agents by construction. It is indeed the linear saving function (independent from wealth or income) that reproduces, in neoclassical models of economic growth, a law of aggregate accumulation of capital that is independent from income and wealth distribution (Stiglitz, 1969).

The view that inequality exerts no relevant influence on the aggregate performance of the economy and its rate of growth was largely challenged in the 1990s, following a large body of empirical and theoretical literature. The latter was surveyed extensively by authoritative surveys by Benabou (1996), Aghion et al. (1999b) and Voitchovsky (2005). Efforts to validate the negative correlation between the unequal distribution

of resources and economic performance have been successful in some cases (Alesina & Rodrik, 1994, Perotti, 1996, Persson & Tabellini, 1991 and more recent work by Berg et al., 2012). The evidence is much more mixed in other works (see Barro, 2000 and Banerjee & Duflo, 2003) suggesting that the available empirical evidence is far from being conclusive.

On the theory side, the above mentioned body of literature has mostly emphasised the influence of inequality on capital investments as well as governmental policies and politics. More unequal societies may tend to grow at a slower pace as the extent of inequality biases government policies towards redistribution and confiscatory fiscal policies. The latter reduce the incentives to produce, invest in physical and human capital as well as in riskier and rewarding activities (see Persson & Tabellini, 1991 and Alesina & Rodrik, 1994). Alternatively, inequality can create political instability and therefore macroeconomic instability (Alesina & Perotti, 1996).

A major turning point in the theoretical investigation of the relationship between the distribution of resources and development gained momentum when growth theory shifted its paradigm from the physical capital to human capital accumulation, typical of more advanced economies (Galor, 2009). Indeed, the well-known work by Galor & Zeira (1993) highlighted how the conventional assumption about diminishing returns to (human) capital, coupled with imperfections in the credit markets[32] (and fixed costs of acquisition of human capital) generate suboptimal economic performance as the talented less-wealthy individuals are cut off from highly productive investments in education. In another important work, Banerjee & Newman (1993) have also shown that wealth inequality is detrimental to economic growth and in particular to investments in entrepreneurial activity. They obtain these results by assuming a very similar set of assumptions to Galor and Zeira's (1993) model, namely credit market imperfections[33] and fixed costs of undertaking entrepreneurial activity.

A later work by Aghion et al. (1999a) followed this tradition of relating inequality and economic growth through credit market imperfections. In their very interesting dynamic representation of the economy, savers and lenders are separated from investors and interest rate is determined endogenously in the model, generating business cycle fluctuations and short-run macroeconomic volatility.

[32]Galor & Zeira (1993) assume that, due to asymmetric information, credit is available, exclusively or at better conditions, to wealthy individuals. Therefore the market would not fund a great deal of profitable investments resulting in a misallocation of resources and aggregate productivity and growth would suffer.

[33]Banerjee & Newman (1993) reached similar conclusions to Galor & Zeira (1993) assuming a different structure of credit market imperfection. In a few words, the presence of limited liability (the borrower's repayment to his lender is bounded above by the value of personal wealth) creates a source of moral hazard reducing the amount of optimal effort (costly and unobservable) which the borrower is willing to exert. This in turn reduced the success probability of investments in risky projects.

Aghion et al. (1999a) replicate the feature of endogenous business cycles a' la Goodwin (1967). The latter is essentially a model of growth cycles in which unemployment and wage share cycle around a center equilibrium. In this classical growth theory (with constant productivity growth), functional income distribution has a crucial role. Profits generate investments which in turn generate employment. However, the latter increases the wage share reducing in turn the investment and growth in the economy. Goodwin essentially formalises the paradigmatic "class struggle" model of Marxian tradition. Indeed, Marx itself wrote that

> "*the ultimate reason for all real crises always remains the poverty and restricted consumption of the masses*" [Karl Marx - Capital , Volume III, Chapter 30].

The belief that income distribution matters for aggregate consumption is what I explore in the next section.

4.3 Inequality and Aggregate Consumption

As mentioned above, a recurrent argument in the current debate sees growing income inequality as a main driver of stagnating aggregate demand and private consumption.

This principle is clearly stated in Keynes' work[34]:

> "*Since I regard the propensity to consume as being (normally) as such to have a wider gap between income and consumption as income increases, it naturally follows that the collective propensity for the community as a whole may dependon the distribution of incomes within it.*" (Keynes, 1939, p. 129)

Under these conditions a redistribution of resources toward the richer segments of the population is expected to decrease the level of total consumption in the economy. This can be classified as the so called 'under-consumption' story of the economic stagnation echoed in the work of J. K. Galbraith in his classic study of the Great Crash of 1929. In his 1954 book Galbraith argued that the highly unequal distribution of personal income weakened the pressure on aggregate demand, which had to rely strongly on high levels of investments and spending on luxury goods or both.

This argument is also recalled in recent work by J.Stiglitz:

> "*Moving money from the bottom to the top lowers consumption because higher-income individuals consume a smaller proportion of their income than do lower-income individuals (those at the top save 15 to 25 percent of their income, those at the bottom spend all their income). The result: until and unless something else happens, such as an increase in investment or exports, total demand in the economy will be less than what the economy is capable of supplying - and that means there will be unemployment.*"(2012, pg. 85)

[34]Keynes' quotation is taken from Brown (2004) who mantains that "*Income distribution matters for effective demand if, ceteris paribus, a change in the personal distribution of income, causes a change in the aggregate propensity to consume*".

However, it is hard to reconcile this conjecture with the available empirical evidence as this so called 'under-consumption' story finds little support in the data. An earlier study by Blinder (1975) for the US shows that a redistribution of income from the top to the bottom (reduction in inequality) would, if anything, slightly decrease the aggregate consumption. It follows that an increase in inequality would not necessarily reduce consumption[35].

4.3.1 New Evidence on Aggregate Consumption and Inequality in the UK: a First Look

In line with these findings, Figure 4.3 shows the trend, from 1963 to 2010, in the aggregate proportion of total UK household disposable income that is not saved and is therefore consumed[36]. Over the past decades and net of short-term fluctuations linked to economic cycles, the UK aggregate household consumption rate appears positively correlated[37] with the share of total gross income held by the richest 1% of the population (a measure of income inequality). This appears true also by looking at the consumption rates by household income. In order to show this I make use of the micro data from the UK Family Expenditure Survey (FES) from 1971 to 2010[38] and compute, for each household surveyed in the database[39], total disposable income (the income measure used in this study excludes capital gains but includes earnings and pensions, investment income and monetary benefits, with the exclusion of housing-related support) and total expenditure (including a wide range of expenditure categories, including durable purchases, housing costs, mortgage-interests costs and rent costs). I then plot the real growth in total expenditure and total disposable income for each decile and over the entire period of reference since 1971 (Figure 4.5) and over a subset of the 10 years preceding the 2007 crisis (Figure 4.4). Over the past 40 years overall expenditure grew faster than income only for both relatively poor and relatively rich households as Figure 4.5 shows. Conversely, focusing on the post-1997 period only, every decile across the whole income distribution appears to have experienced a growth in consumption in excess of disposable income (Figure 4.4). Such

[35]It is worth noting that later work by Brown (2004) found evidence that if spending is assumed to be 'income-constrained', a substantial redistribution of income from the top to the bottom can create a substantial change in aggregate consumption.

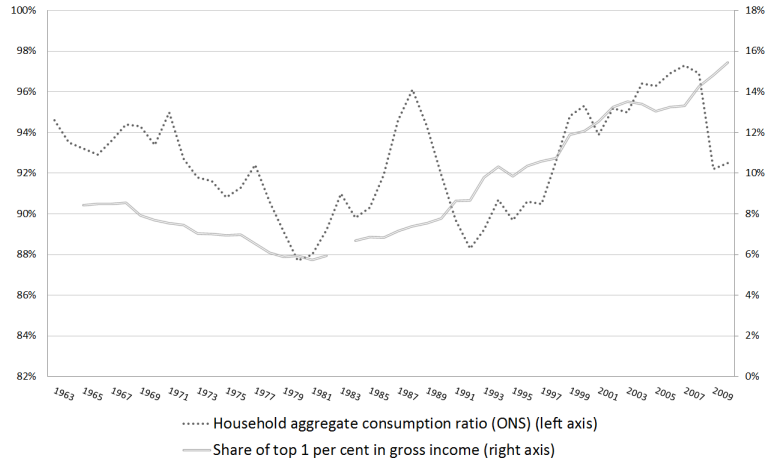
[36]Data on consumption and disposable income of the Household Sector (excluding the non-Profit institutions serving households - NPISH) are taken from the National Accounts Blue Book of the UK Office of National Statistics, ONS.

[37]The pair-wise correlation of consumption ratio with top1% share is 0.47 and significant to 1% significance level

[38]The data are collected using a two-week diary method where households respondents are asked to record all the purchases they make. Figures are based on FES data between 1984 and 2000-01, the Expenditure and Food Survey (EFS) data between 2000-01 and 2007, and Living Costs and Food Survey (LCF) thereafter.

[39]The FES is a cross-sectional survey with no longitudinal component using age-representative sample consisting of approximately 6000 interviewed households every year.

Figure 4.3: Aggregate Consumption Ratio and Top 1% Income Share in UK: 1963-2010



Data on consumption and disposable income of the Household Sector (excluding the non-Profit institutions serving households - NPISH) are taken from the National Accounts Blue Book of the UK Office of National Statistics, ONS. Data on top1% is taken from the World Top Income Database (WTID).

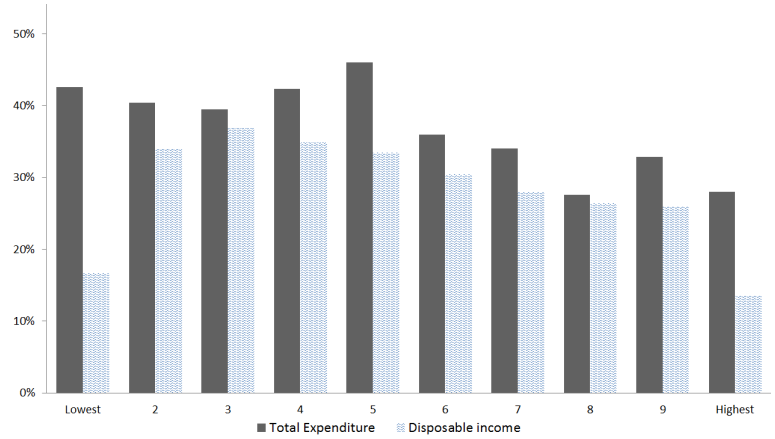
evidence points out to an '*over-consumption*' rather than a '*under-consumption*' hypothesis[40]

Road Map The section above has provided empirical evidence for the UK suggesting that, at a first glance, the rise in income inequality has been associated with increasing consumption share in the aggregate data and across the income distribution over the past decades. These results run counter the conventional argument that a redistribution of resources towards agents with lower propensity to consume would reduce the aggregate consumption in the economy.

In order to explain this counterintuitive result I describe the theoretical foundations as well as the intuition behind the idea that inequality may reduce the average propensity to consume. In particular, I show in detail that this is true under the assumption of a concave consumption function for the income in the cross-section. Therein, the fact that one does not observe a negative correlation between increasing inequality and aggregate consumption share may be due to three different factors: firstly the assumption of concavity may be wrong; secondly, and taking for granted the existence of a concave consumption function, there may be second-order effects of

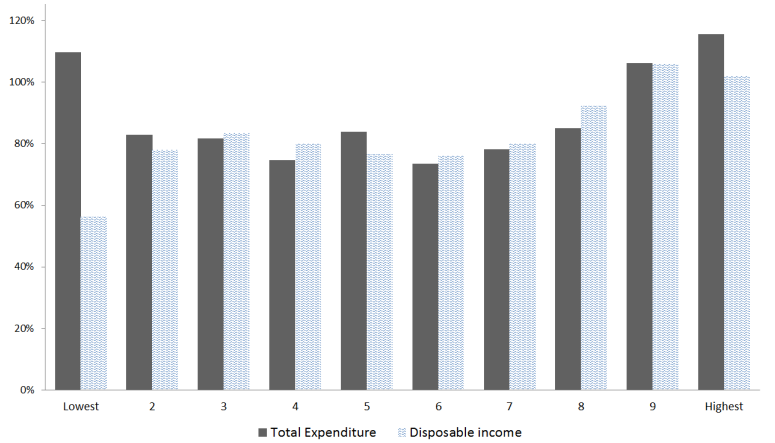
[40] In line with these findings, Bertrand & Morse (2013), using data from the US Consumer Expenditure Survey (CEX) document a robust increase in expenditure share especially for lower-middle income US households. Similarly, complementing the evidence on two other dimensions, savings and indebtedness, Frank et al. (2010) document a statistical association between variables of financial distress (proxies for saving decisions) and income inequality at the US county-level. In addition, Carr & Jayadev (2012), using data from the Panel Survey on Income Dynamics (PSID), document a robust increase in indebtedness of lower income US households during the past decades.

Figure 4.4: Real Expenditure and Disposable Income Growth: 1997-2007, by Disposable Income Decile



Figures are based on FES data between 1984 and 2000-01, the Expenditure and Food Survey (EFS) data between 2000-01 and 2007, and Living Costs and Food Survey (LCF) thereafter.

Figure 4.5: Real Expenditure and Disposable Income Growth: 1971-2007, by Disposable Income Decile



Figures are based on FES data between 1984 and 2000-01, the Expenditure and Food Survey (EFS) data between 2000-01 and 2007, and Living Costs and Food Survey (LCF) thereafter.

the rise in inequality on the aggregate consumption share operating through change in individuals consumption decisions; thirdly, exogenous factors may be responsible for both the increase in inequality and the aggregate propensity to consume.

Next steps in the investigation respectively explore the extent of the theoretical and empirical support for a concave consumption function and for consumption behavioral response of agents to changes in income distribution.

4.3.2 Inequality and Consumption: Deriving the Formal Conditions

In this section I provide a formal interpretation of the idea that an increase in income 'inequality' brings about a reduction in aggregate consumption. I follow below a similar exposition structure to Blinder (1975) and I define aggregate consumption C and average income $\overline{y}$ in the economy as follows:

$$C = \int_a^b c(y)f(y,I)dy \tag{4.1}$$

$$\frac{dC}{dI} = \int_a^b c(y)f_I(y,I)dy \tag{4.2}$$

$$\overline{y} = \int_a^b yf(y,I)dy$$

Where y is the income level between the range a and b, $c(y)$ is the consumption function and $f(y,I)$ is the density function. The latter integrates to 1 and determines the cumulative distribution function $F(b,I) = 1$ and $F(a,I) = 0$. Finally, following Blinder's exposition, the indicator 'I' represents a so called 'mean-preserving spread[41]'. Essentially I am interested in the response of total aggregate consumption to changes in the mean preserving spread I, as shown by equation 4.2.

Integrating the latter equation by parts, it can be shown that:

$$\frac{dC}{dI} = c(y)F_I(y,I)|_a^b - \int_a^b c'(y)F_I(y,I)dy = -\int_a^b c'(y)F_I(y,I)dy \tag{4.3}$$

as long as one assumes that the increase in income dispersion does not change the range of income[42]($\frac{\partial a}{\partial I} = \frac{\partial b}{\partial I} = 0$) and that $F_I(y,I)$ is continuous on the interval $a \leq y \leq b$. These assumptions, together with the invariance of mean income to changes

[41]The concept of 'mean preserving spread' as a series of regressive transfers from poor to rich individuals preserving the average income in the economy is found in Rothschild & Stiglitz (1970).

[42]This assumption implies that, irrespectively of the income distribution, the cumulative distribution function has to be equal to zero at the lower bound a and 1 at the income upper bound b.

in distribution ($\frac{d\overline{y}}{d\tilde{I}}$), imply that $F_I(y, I)$ integrates to zero ($\int_a^b F_I(y, I)dy = 0$)[43] so that it exist a $y^\star$ included in the income range [a,b] such that $F_I(y, I) \geq 0$ if $a \leq y \leq y^\star$ and $F_I(y, I) \leq 0$ if $y^\star \leq y \leq b$.

It is now clear from the result above that the derivative of aggregate consumption with respect to changes in income dispersion (mean-invariant), as shown in equation 4.3, becomes negative as long as the MPC is decreasing in income ($c''(y) < 0$). Indeed, the integrand in equation 4.3 is greater than zero given that the positive values of $F_I(y, I)$ have extra weight at lower levels of income.

$$\frac{dC}{dI} = -\int_a^b c'(y)F_I(y, I)dy < 0$$

It follows that the idea that income inequality depresses aggregate demand is broadly justifiable following any theoretical construct about consumption decision as long as it implies a decreasing MPC as one increases income in the cross-section.

A Note of Caution It is worth noting however that this simple result is obtained by assuming that an increase in income dispersion does not occur contemporaneously with an increase of average income. Although this assumption allows to focus on the increase in income dispersion, it appears a rather implausible one. A relaxation of this assumption requires to move beyond the framework highlighted in Blinder (1975). Equation (4.1) needs to include a support of the income density function which varies with income dispersion $\tilde{I}$. However, $\tilde{I}$ would no longer be a 'mean-preserving' spread in income and one needs to investigate the change in the aggregate consumption share to changes in income dispersion and not the aggregate consumption as done before (total income is no longer constant)[44].

In what follows I proceed to explore the support of decreasing MPC in the theoretical literature and I subsequently provide some empirical evidence to shed further light on the issue.

[43] In order to prove this I first define $\frac{\partial\overline{y}}{\partial\tilde{I}} = \int_a^b yf_I(y, I)dy$. Integrating by parts I show that $\int_a^b yf_I(y, I)dy = yF_I(y, I)|_a^b - \int_a^b F_I(y, I)dy$. As explained above the cumulative distribution function at the lower and upper bound would not change as the mean-preserving spread changes in value, so that $F_I(a, I) = F_I(b, I) = 0$. It follows that $\frac{\partial\overline{y}}{\partial\tilde{I}} = -\int_a^b F_I(y, I)dy$ implying that $F_I(y, I)$ integrates to zero if one imposes, as I do by construction, that mean income does not vary with changes in I.

[44] For illustrative purpose and in order to compare the results with what discussed before one can now write the aggregate consumption as $C = \int_{a(\tilde{I})}^{b(\tilde{I})} c(y)f(y, \tilde{I})dy$. If one is willing to assume that $f(y, \tilde{I})$ is continuosly differentiable in the interval $[a(\tilde{I}), b(\tilde{I})]$, the Leibniz's rule can be used in order to define $\frac{dC}{d\tilde{I}}$. In other words $\frac{dC}{d\tilde{I}} = \int_{a(\tilde{I})}^{b(\tilde{I})} c(y)f_{\tilde{I}}(y, \tilde{I})dy + b'(\tilde{I})c(b(\tilde{I}))f([b(\tilde{I}), \tilde{I}]) - a'(\tilde{I})c(a(\tilde{I}))f([a(\tilde{I}), \tilde{I}])$. It is intuitive from the latter equation that aggregate consumption increases as total income increases (augmenting the upper bound of the income range). Similarly a decreasing MPC is no longer sufficient to obtain $\frac{dC}{d\tilde{I}} < 0$.

The MPC in the Theory of Consumption

The result of a decreasing MPC with respect to income is not always supported by conventional modern consumption theory in its simplest form. Nonetheless, once appropriately modified versions of the models are considered, the negative relationship between the income (or the appropriate measure specific to the features of the model) and the marginal propensity to consume is preserved. I first discuss the conventional life-cycle and permanent income models and subsequently move to an exposition of some of the non-conventional consumption theories, including the consumption theory based on the 'relative income hypothesis' and on the 'two social classes' model of post-keynesian tradition.

Life-cycle and Permant Income Models The Friedman-Modigliani-Blumberg permanent income hypothesis and life-cycle models predict, at least in their simplest versions, an optimal consumption which is proportional to total 'life-time wealth' (i.e. constant MPC[45]). This makes the aggregate demand independent from the (life-time) income or wealth distribution and largely justified the use of representative agent models in conventional dynamic general equilibrium macroeconomic theory. These results follow principally from the main assumptions used by economists in order to work with tractable models with an explicit solution for optimal consumption. A crucial choice has been the use of so called 'perfect foresight' (i.e. uncertainty is assumed away) and 'certainty equivalent' (agents have quadratic utility functions) models which were formulated in order to exclude the role of the uncertainty in future streams of income (Carroll, 2001).

Indeed, the optimal consumption function returns to a strict concave form as soon as uncertainty is introduced back into the optimization problem (excluding preexisting uncertainty or constraints) as proved by Carroll & Kimball (1996) for a wide range of utility functions. Existing uncertainty of future labour income realizations creates the need for precautionary savings which substantially reduce the level of consumption with regard to baseline 'perfect foresight' model. However the reduction is much stronger for lower levels of cash-on-hand (sum of labour income and beginning-of-period wealth) where the precautionary saving motive is stronger. The MPC therefore increases with precautionary savings, resulting higher at lower level of cash-on-hand.

By construction, the presence of uncertain future labour income makes individuals reluctant to borrow and unwilling to spend much. It is therefore not surprising that "*the precautionary saving motive can generate behavior that is virtually indistinguish-*

[45]Nonetheless, a positive association between 'income' and savings at the cross sectional levels can be obtained within a standard Friedman's PIH theory if differences in income depend on transitory deviation from the permanent level of income. An individual whose income is temporarily below its permanent level consumes much more than the individual whose income is temporarily above its permanent level.

able from that generated by a liquidity constraint" (Carroll, 2001, p. 12). Indeed, models including liquidity constraints also replicate the concavity feature of consumption function as shown in Carroll & Kimball (2001).

Similarly, a standard life-cycle model too can easily accommodate a decreasing marginal propensity to consume in (permanent) income/wealth. To show the latter point, Blinder (1975) assumes agents consuming for T years and leaving a bequest before dying. The utility is assumed to be additively separable in time and the utility function for consumption and for the bequests are assumed to have the conventional constant elasticity of substitution form (CES). After setting up and solving the optimization problem of maximising lifetime utility, Blinder shows that the marginal propensity to consume additional permanent income is decreasing if one assumes that the elasticity of marginal utility of consumption is lower than the elasticity of marginal utility of bequests. In other words, this is true under the condition of bequests being luxury goods.

Non-Conventional Theories Other, non-conventional, consumption theories are also broadly consistent with a decreasing MPC with respect to income. For instance, consumption models of the so called Post-Keynesian School posit a positive relationship between inequality (of income of production factors or of different 'classes') and growth[46]. In particular aggregate consumption is thought to be dependent on how aggregate product is distributed between wage-earners -'workers'- and profit-earners -'capitalists'-. Assuming that the propensity to consume of the two 'classes' differ, it is easy to show algebraically that aggregate consumption depends on how the income is distributed between wage and profit. A redistribution that favors profit would reduce aggregate propensity to consume and therefore negatively affect the overall level of consumption-led economic growth (under the assumption that marginal propensity to consume of workers is higher as commonly assumed).

For instance, the aggregate consumption function is simply $C = C_w Y_w + C_p Y_p$ defining (C_w, Y_w) and (C_p, Y_p) the vectors of average propensity and the income level for the wage-earners and profit-earners respectively, with $C_w > C_p$ and typically $Y_w < Y_p$. If one assumes an exogenous redistribution of resources from profit earners to wage-earners so that $Y'_w > Y_w$ and $Y'_p < Y_p$ the new aggregate consumption becomes $C' = C_w Y'_w + C_p Y'_p > C$.

Finally, the relative income hypothesis formulated by Duisenberry in the 1950s supports the concave structure of consumption at the cross-sectional level. The so called demonstration effects are assumed stronger for lower relative incomes in order to justify a decreasing MPC as formulated in Duisenberry's words:

[46]For a review about this aspect I refer the interested reader to Bertola (2000)

> "*At (relatively) low incomes the desires for present consumption outweigh considerations of the future to such an extent that little or no saving occurs. At higher levels the pressure for increased current consumption is sufficiently reduced to permit some attention to the future*" (Duisenberry 1949, Ch. III pp.37-38)

Summary The discussion above suggests that the condition required in order to support[47] a negative response of the aggregate consumption following a redistribution of 'income', finds a fair amount of support across different theories of consumption decision[48]

I now move to explore the empirical validity of such condition, namely the concave consumption function in the income cross-section.

4.3.3 Inequality and Aggregate Consumption: New Empirical Evidence for the UK

Does inequality actually increase or decrease the aggregate propensity to consume? As discussed above, and holding other concurrent factors constant, this depends on the degree of concavity of the consumption function.

In what follows I simulate a model of Keynesian consumption using UK micro data and find only little evidence supporting an increase in the consumption share as a consequence of equalization of incomes.

UK Micro-Data As in previous sections above, I make use of the micro data from the UK Family Expenditure Survey (FES) from 1971 to 2010[49] in order to compute the saving rate for each household surveyed in the database. The FES is a cross-sectional survey with no longitudinal component using an age-representative sample consisting of approximately 6000 interviewed households every year. The data are collected using a two-week diary method where household respondents are asked to record all the purchases they make.

Estimating a Keynesian Consumption Model

As shown in previous section, Keynesian approach to consumption modelling clearly reflects the need for a concave consumption function in order to reflect the MPC het-

[47] I recall that some of the assumptions needed in order to derive the result are quite stringent

[48] However, it is important to bear in ming that the definition of 'income' consistent with this conjecture is not necessarily that of 'spendable' income that people in the street may have in mind. More specifically, the precise definition may depend strictly on the specific consumption theory under investigation.

[49] Figures are based on FES data between 1984 and 2000-01, the Expenditure and Food Survey (EFS) data between 2000-01 and 2007, and Living Costs and Food Survey (LCF) thereafter.

erogeneity across the income distribution. In line with this approach, I consider[50] an economy composed of ten different household groups (different deciles) and superimpose a Keynesian type of consumption function on the FES survey data. The consumption function has the following functional form:

$$C_{it} = \varphi_t + Y_{it}^{\alpha_t} \text{ s.t. } 0 < \alpha < 1$$

for every $i - th$ decile in the income distribution and every year t, where $\varphi_t = \rho\overline{Y_t}$ represents the time-variant social minimum acceptable consumption assumed to be in fixed proportion of the average 'living standard'. This functional form clearly exhibits a decreasing marginal propensity to consume, and thus supports the conjecture that aggregate consumption, for any level of income, is negatively associated with increases in (mean preserving) income inequality.

Parameters Estimation This section describes how to obtain the parameters of the consumption function above by matching the function with FES and National Accounts data.

First of all, in order to closely approximate the spending behaviour found in the UK data, the values of $alphas$ are derived by matching the aggregate consumption share in total income as computed by National Accounts to that obtained by using the equation above and the baseline data from the FES (1971-2010). This is done for any given ρ and at each point in time. In other words, the computed α_t has to equate:

$$\frac{\sum_i (\rho\overline{Y_t} + Y_{i,t}^{\alpha_t})}{\sum_i Y_i, t} = \frac{C_t^{NA}}{Y_t^{NA}}$$

where variables with NA superscript refer to estimates from the National Accounts[51].

Secondly, I chose the optimal value of ρ in order to match as close as possible the predicted consumption levels (based on the consumption function above with estimated α for every year) to the actual ones as obtained from the baseline FES data. More practically, I pick the value of ρ that minimises the sum of squared errors of the differences, for every equivalised income decile and year, between the estimated and actual consumption[52]. This procedure leads to obtain the 'optimal' value of the min-

[50] As mentioned in the forewords of the thesis this section represents a re-elaborated version of a joint work with Paolo Lucchino (Lucchino and Morelli, 2012).

[51] As described before, the data on consumption and disposable income of the Household Sector (excluding the non-Profit institutions serving households - NPISH) are taken from the National Accounts Blue Book of the UK Office of National Statistics, ONS.

[52] Importantly, the set of $alphas$ is recalculated for any value of ρ and year t.

imum socially accepted consumption (ρ) equal to 12% of the average income.[53] The parametric estimation of the consumption function following the above stated procedure suggests a range of possible $alphas$ between 0.95 and 0.98 (i.e. low degree of concavity).

Simulations of the Variations in the Average Propensity to Consume to Changes in Inequality

Once the preference parameters are recovered, I obtain the baseline values of consumption and I can exogenously simulate different scenarios of income dispersion, with respect to the baseline income distribution (calculated from actual FES data), and observe the predicted change in aggregate consumption. Following the theoretical approach derived from Blinder (1975) and described above, I only use mean-preserving changes in income dispersion.

Note that, differently from what analysed above, this section focuses the attention on scenarios of decreasing inequality as these are easier to justify by means of policy interventions. The translation of the findings to the reverse case of increasing inequality scenarios are straightforward and simply involves to invert the line of argument.

Within the simulation exercise I consider three different scenarios: a realistic 'policy' scenario in which the Gini coefficient is reduced by approximately 1 to 2 percentage points; a more unrealistic 'back to the 70s' scenario in which the Gini index drops by approximately 10 percentage points[54]; and a totally unrealistic 'full equality' scenario in which the Gini coefficient drops to 0. In practical terms, the 'full equality' scenario is reached by reducing the income of all deciles to the average income in every year. On the same lines of reasoning, a partial realization of the full convergence to the aggregate mean income can reproduce any intermediate scenarios of reduced inequality by means of the following transformation function:

$$Y_i t \rightarrow \left(\frac{\overline{Y_t}}{Y_i t} \right)^p Y_i t \text{ with } 0 < p < 1$$

where $\overline{Y}_t$ represents the average income and p the coefficient of full convergence realization. In particular, this empirical investigation considers three values of p, namely 5%, 20% and 100% coinciding with the 'policy', 'back to 70s' and 'full equality' scenarios respectively[55].

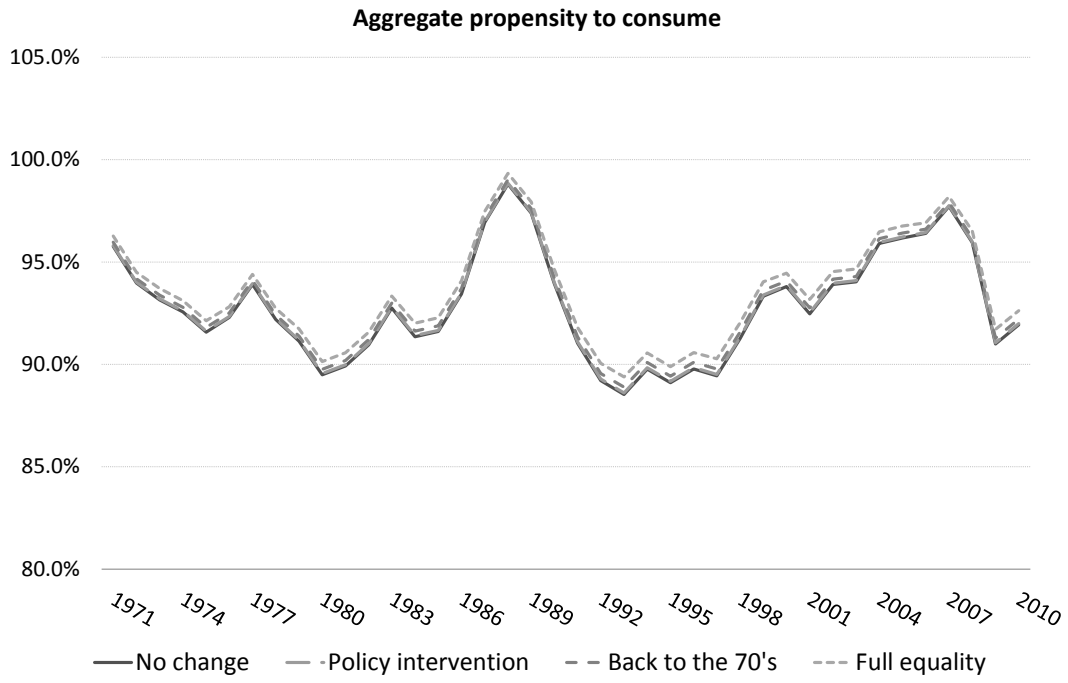
[53] As discussed in Lucchino & Morelli (2012), this equals approximately £65 per week. Coincidentally, it is the exact value of the adult single rate of Job Seeker's Allowance in the UK (£65.45 in 2012).

[54] Note that the salience criterion in the empirical exercise in the first section of the chapter was a 3 percentage points change only.

[55] A further proportional adjustment of the transformed income is needed in order to insure that total income is entirely unchanged. This also ensures that the social minimum accepted consumption remains unchanged.

I can now proceed to the (static) simulations exercise and plot the predicted aggregate propensity to consume implied by the model. Two sets of simulations are carried out. The first considers an unconstrained consumption function where income does not constrain actual consumption (Figure 4.6). The second assumes that agents are liquidity constrained and their income represents a binding constraint for the amount of possible consumption (Figure 4.7).

Figure 4.6: Actual and Simulated Aggregate Propensity to Consume

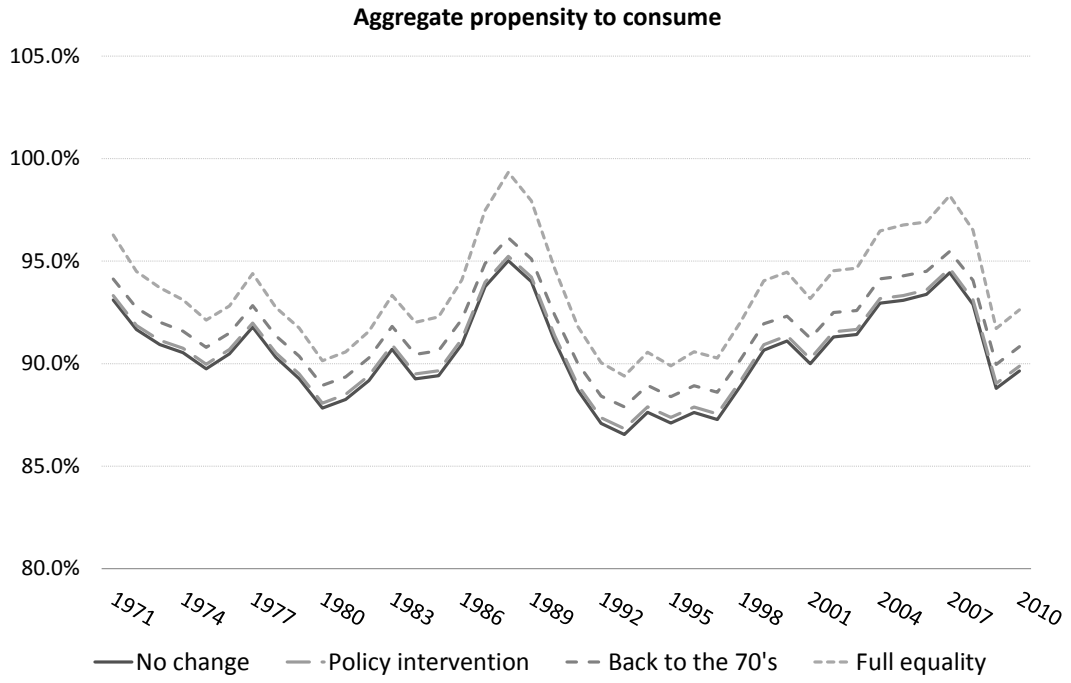


The simulations suggest that even the full equalization of income (keeping the average income constant) has only a small positive impact on aggregate consumption (around 1% change[56]). The effect is more than tripled but remains relatively small even when I allow the households to be credit constrained (household predicted level of consumption cannot exceed the actual income level)[57].

[56]Same results are found in the US by Brown (2004)

[57]Conversely, such findings diverge from Brown (2004) who found that "*inequality has a substantial negative impact on consumption when household spending is assumed to be income-constrained*". The order of magnitude was around 16% change in aggregate consumption when full equality is simulated

Figure 4.7: Actual and Simulated Aggregate Propensity to Consume with Income Constrained Agents



Summary To summarize, the assumption of strict concavity of the consumption function is strongly supported by theoretical models and some evidence is also found using consumption data in the UK. However, in the model described above I do not find support for a high degree of concavity of the consumption function and this justifies a small estimated effect on aggregate consumption due to substantial redistribution of income.

Nevertheless, a note of caution should be included. The exercise abstracts from the potential endogenous changes in the parameters of the consumption function to changes in income distribution (this is extensively discussed in the next section). Moreover, the analysis abstracts also from the conventional discussion about the nature of income changes (transitory vs. permanent) and does not address the issue of identification of pure income shocks in order to correctly estimate the MPC to changes in income (Jappelli & Pistaferri, 2010). Hence, such lack of direct identification of a "*genuine income shock*" may simply lead to observe the influence of other confounding factors on the consumption decision. Recent work by Jappelli & Pistaferri (2013) suggests that MPC may vary across households to an extent where fiscal policies aiming at redistributing income within the economy can have substantial impact on aggregate consumption. In particular, drawing on survey questions in the 2010 Italian Survey of Household Income and Wealth (asking the hypothetical response of consumers to unexpected transitory income changes), they suggest a strong negative correlation between MPC and cash-on-hands. Although, a measure of cash-on-hands is substantially different from the income concept used in the simulations, this may well suggests a higher degree of concavity for the consumption function in the cross-section.

4.4 Inequality and Agents' Optimal Consumption: the Relative Income Hypothesis

In the previous sections I argued that the assumption of concavity of consumption function is valid and finds support both in theory and in the data (although evidence for different degrees of concavity may undermine the strong empirical implications of this property).

Hence, I am left with the investigation of whether, among other explanations, the rise in inequality can increase the optimal household/individual consumption level and therefore contribute to the evidence of 'over-consumption' I found in the UK data (and others have found in US data). For example, I discuss how the considerations stemming from the so called 'relative income hypothesis' denote a very promising theoretical explanation about how inequality can be, *ceteris paribus*, directly linked to 'over-consumption' (and potentially to over-indebtedness). At a first glance, this might be considered as a peculiar hypothesis as no conventional consumption theory

allows for any role of income distribution on consumption optimal choice. Instead, by recognising the social nature of the consumption decision, the distribution of income may acquire a prominent role in affecting optimal consumption decisions. For instance, assuming that income inequality and individual consumption are positively associated, then one can explain why an increase in income dispersion is not necessarily associated to a decrease in aggregate consumption. This was also pointed out in Blinder (1975) who writes:

> *"If the kinds of "demonstration effects" stressed by Duesenberry are at all important, disequalization can conceivably lead to more rather than less consumption.* (p.472)"

The relative income hypothesis is therefore a promising candidate to explain the 'over-consumption' of households observed over the past decades (see next section) and potentially the higher demand for credit to finance this overconsumption.

However, to date the available theory and empirical evidence are not clear cut and I devote the focus of the next two sections to the evaluation and the discussion of the main features of available models exploring the role of relative income hypothesis for agents consumption choice. Some evidence from UK household survey data is also discussed.

Relative Evaluation of Households Consumption: Keeping-up with the 'Joneses'

As mentioned above, the considerations stemming from the relative income hypothesis denote a very promising theoretical explanation about how inequality can be, *ceteris paribus*, directly linked to over-consumption and households' overstretched finances. The conventional formulation of this hypothesis implies that individuals value their relative living standard.

In a conceptual formalization of the relative income hypothesis, Dupor & Liu (2003) describe that a positive change in relative consumption can increase (decrease) the marginal utility of consumption relatively to that of leisure, pushing individuals to desire more (less) consumption in order to 'keep up with' ('run away from') the 'Joneses'.

More formally:

$$U = U(c, \bar{c}, 1 - l) \tag{4.4}$$

where U is assumed to be continuously and twice differentiable utility function ($U_c > 0$ and $U_{\bar{c}} < 0$) with $1 - l, c$ and $\bar{c}$ being the individual labour, consumption and per-capita consumption respectively[58]

Dupor & Liu (2003) further define the concept of 'jealousy' and 'keeping up with the Joneses' and by reflex their respective negations, 'admiration' and 'running away

[58] c and $\bar{c}$ are ≥ 0 whereas $0 \leq 1 - l \leq 1$.

from the Joneses'. The increase in per-capita consumption ($\bar{c}$) may reduce personal wellbeing as an individual feels 'jealous' ($U_{\bar{c}} < 0$) and, other things being equal, the individual might be induced to consume more if $\frac{d(\frac{U_c}{U_{1-l}})}{d\bar{c}} > 0$ (e.g. preferences exhibit 'keeping up with the Joneses'[59]).

This type of formulation found useful applications in macroeconomics of finance and models for assets pricing and portfolio choice. For instance, Gali (1994) summarises the concept of positive consumption externality with a positive and constant average consumption elasticity of marginal utility of consumption ($\frac{U_{c\bar{c}}\bar{c}}{U_c} > 0$)[60]. Other important works have formulated consumption preferences as a function of past values of average consumption. These formulations, like the one in Abel (1990) and Campbell & Cochrane (1995), reflect a "*catching-up* to the Joneses" type of preferences where consumption function exhibits habit formation.

Linking Consumption Choice to Income Distribution Consumption functions like the one just described, clearly reflect the original conceptualization of the relative income theory.

However, deriving consumption decisions as a mere function of the average income does not fully describe the link between consumption choice and income distribution. For example, this formalization entirely ignores the influence of what I have described before as a mean-preserving increase in income dispersion.

In particular, the original relative income theory points out that the consumption share of an individual depends on the relative position of her income in the society. Friedman himself, describing the relative income hypothesis in his seminal work *A Theory of the Consumption Function*, wrote:

> *"a unit at any given absolute income level will spend more on consumption in a community in which this income is a relatively low income than in a community in which this income is a relatively high income, partly because it must spend more to keep up with the Joneses, it will have more opportunity to observe superior goods and so will be tempted by what Duisenberry calls the 'demonstration' effect"*
> (Friedman, 1957, Ch. VI, pag. 167)

The quotation from Friedman, therefore, also highlights the importance of a disaggregated analysis at the geographical levels or at a general 'community' level.

[59] Notice that increase in average consumption creates externality of consumption by reducing individual's wellbeing. 'Jealousy' is therefore, according to this formulation, the source of Pareto-inefficiency. The decentralised consumption equilibrium is be sub-optimal as overall consumption becoms too high for social welfare objective (e.g. a tax on consumption could increase social welfare, see Dupor & Liu, 2003). The 'keeping up with the Joneses' preferences are, instead, not responsible for the sub-optimality of the over-consumption result *per se*.

[60] Such elasticity would be equal to $\alpha\gamma$ assuming a symmetric equilibrium $c = \bar{c}$ and the following utility function $U(c, \bar{c}) = \frac{c^{1-\alpha}}{1-\alpha}[\bar{c}]^{\alpha\gamma}$ with $\alpha > 0$ and $\gamma < 1$.

A more complete characterization of consumption responses to changes in distribution of income is described in Frank et al. (2010):

> *"...people do not exist in a social vacuum... The rich have been spending more ... Their spending shifts the frame of reference that shapes the demands of those just below them, who travel in overlapping social circles. So this second group, too, spends more, which shifts the frame of reference for the group just below ..."*

Their model begins by considering a highly stylised version of the permanent income hypothesis which predicts that consumption of an individual is a constant fraction of her permanent income and does not depend on other people's level of income or consumption. In order to replicate this feature of the model, the authors assume the following Cobb-Douglas utility function:

$$U = [(1 - s_i)y_i]^{1-\alpha} s_i^{\alpha} \tag{4.5}$$

describing agent i's preferences over current consumption ($(1 - s_i)y_i$) and future consumption (today's savings s_i). The utility-maximising choice of consumption rate is a constant fraction $1 - \alpha$ of income y_i (similarly the optimal choice of saving rate is α and it is independent from income[61]). In order to include social comparison elements in the optimal consumption decision, Frank et al. (2010) modify the utility function in order to include utility premium had the personal consumption been higher than that of other persons within the social group of reference ($N(i)$).

$$U = (y_i(1 - s_i) + \theta \sum_{j \epsilon N(i)} [(1 - s_i)y_i - (1 - s_j)y_j])^{1-\alpha} s_i^{\alpha} \tag{4.6}$$

where θ represents the extent of the concern for relative income. Setting the first order condition of the maximization problem, Frank et al. (2010) are able to show that:

$$s_i = \alpha - \frac{\alpha\theta}{(1 + n_i\theta)y_i} \sum_{j \epsilon N(i)} y_j(1 - s_j)$$

in other words, "*the optimal savings rate is decreasing in the total consumption of neighbors but increasing in own income.*". This feature gives rise to what Frank and his coauthors call 'Expenditure Cascades'. Indeed, according to their formulation, consumption by the richest households of the income distribution induces higher consumption by the classes slightly below them and this spill-over effects ripples down the bottom of the income distribution. Furthermore, Frank et al. (2010) use the above solution to develop a formal network model in which the saving rate of one individual is interdependent with others in her own group of reference. Given the complexity of this type of model the authors provide a simulation for an economy with only 15 individuals ranked by income (number 1 being the poorest individual) and further assume that

[61] The optimal condition is derived by setting the first order condition of the unconstrained optimization problem, namely $\frac{\partial U}{\partial s_i} = 0$.

every individual compares her consumption with that of the three richer individuals above. By means of these simulations they show how an increase in income dispersion leads every individual below the richest one to optimally reduce the saving rate with respect to the benchmark case of no utility interaction (in the benchmark case, optimal saving equals the parameter α as shown before). Although this is a very interesting result it should be noted that an explicit solution linking optimal consumption to income dispersion is not yet obtained and further research is required to generalise the theoretical framework.

'Outward-Looking' Consumers or 'Forward-Looking' Consumers? The mere social comparison of consumption levels fails to properly account for the forward-looking nature of the consumption decision. This is regarded as an important point as individuals have to satisfy the inter-temporal budget constraint and the inter-comparison of consumption applies in theory also to the future.

> "*Since savings represents future consumption, saving less implies consuming less in future, and thus falling further behind the Joneses. Thus one can just as well argue that concern about relative consumption causes individuals to try to catch up with the Joneses in the future, and thus lowers rather than raises current consumption.*" (Romer, 1996, p. 349)

This issue has been acknowledged in Alvarez-Cuadrado & Van Long (2011) who propose a 'permanent income version' of the relative income hypothesis. By means of an overlapping generations model the consumption of one agent is driven by interpersonal comparison of lifetime income. This leads to show that individual saving rates increase with relative income as discussed originally in Duesenberry (1949) and discussed above. However, aggregate saving rate is found independent from income distribution[62].

4.4.1 Investigation of Household Savings Rates and Income Distribution in the UK

In this section I document how the saving rate of UK households has changed over time and across the whole income distribution since 1971 and comment on whether the available evidence can lend any support to the 'expenditure cascade' type of hypothesis.

As above, I make use of the micro data from the UK Family Expenditure Survey (FES) from 1971 to 2010[63] in order to compute the saving rate for each household

[62] Alvarez-Cuadrado & El-Attar (2013) extend further the analysis and find that a mean preserving spread in the distribution of wages decrease the aggregate saving rate in the economy as discussed above.

[63] Figures are based on FES data between 1984 and 2000-01, the Expenditure and Food Survey (EFS) data between 2000-01 and 2007, and Living Costs and Food Survey (LCF) thereafter.

surveyed in the database.

Computing Household Savings Rates Computing the preferred definition of saving rate is not an easy task as data availability might be limiting the scope of action. But what is the definition of saving in the first place? I define saving as the residual of total disposable income following the consumption decision. This definition follows automatically from the full Haig-Simons definition of income as "*the sum of the market value of rights exercised in consumption and the change in the value of the store of property rights between the beginning and end of the period*" (Simons, 1938, p. 50). It follows, therefore, that saving is defined as the difference between income and consumption (where no capital expenditure is included) and it is equivalent to the change in household net worth[64]. The practical calculation of the amount of saving, however, is strongly constrained by the available categories of income and consumption/expenditure available within the survey under investigation. For instance, as the FES does not collect any information on wealth I could not compute the saving variable as the change in net worth from on year to the other[65]. Instead, FES collects information on 'income' and 'expenditure[66]' and I can obtain a proxy of the total saving variable by subtracting these two variables. More precisely and as mentioned above, I calculate total disposable income (including earnings and pensions, investment income and monetary benefits but excluding housing-related support and any realised or accrued capital gains) and total expenditure (including a wide range of expenditure categories, including durable purchases[67], housing costs, mortgage-interests costs and rent costs).

Adjustments and Summary Measures Before calculating the summary measures for the saving rates of each decile, a last caveat remains to be addressed. Especially in recent years, the aggregate estimates of expenditure and disposable income have increasingly diverged from the the aggregates estimated in the National Accounts by the Office for National Statistics. Indeed, the total household expenditure computed using the FES[68] accounted for only 70% of total aggregate expenditure according to

[64]I assume here an *accrual* base for the calculation of changes in assets valuation and not the *realization* base, according to which the change in asset value depends on the actual transaction. The distinction is quite important as discussed in Atkinson (2009b).

[65]The use of other survey such as the British Household Panel Survey (BHPS) allows to compute savings savings as difference of wealth value from one period to the next as well as on the family level and based on longitudinal data.

[66]I generally use the terms expenditure and consumption interchangeably. However an example on durable goods taken from Banks & Leicester (2006) may clarify the distinction: "*Imagine a household that purchases a TV at the start of the year for 500. A survey that records households expenditures week-by-week would record a pattern of 500, 0, 0, 0 and so on. However, the consumption flows the household receives from that TV would not follow the same pattern the household would get some consumption benefits from the TV each week. Imagine the set was expected to last for 250 weeks before being replaced; one possibility is that we could say the consumption value from the TV would be 2 each week.*"

[67]Crossley & O'Dea (2010) compute also the saving rate excluding durable purchases, showing that this change does not affect substantially the results.

[68]The cross-section survey uses a national representative sample and it is possible to gross up the survey estimates to aggregate values with the use of appropriate weights

the ONS definition in 2010. The coverage of total expenditure in FES data went down from around 90% in 1971 and began to fall in the late 80s. Similar patterns occurred to total income (although the coverage of total income went down by less, from approximately 90% to 75% of national account figures). However, as recalled in Crossley & O'Dea (2010) and Van de Ven (2011), besides a concurrent reduction in FES response rate there is no other clear justification to this pattern. This suggests prudence in the interpretation of original estimated saving rates from the FES database.

In order to tackle this issue, I follow the approach in Van de Ven (2011) proportionally adjusting[69] the cross-sectional estimates of saving rates by matching the survey data to figures reported in the National Accounts. The effect of this adjustment is shown in Figure 4.9 for selected deciles and its comparison with unadjusted series is shown in Figure 4.8 and Figure 4.10.

With these details in mind I finally compute the saving ratio (total savings over total income) and, controlling for the influence of outliers and measurement errors, I eliminate the highest and lowest 1% of computed saving rates. I also compute three different statistical summary values for each decile in the income distribution, following the approach taken in Crossley & O'Dea (2010). The three summary measures are the 'democratic mean' (the saving rate of each household has equal weight and I take the arithmetic average across all households within each decile), the 'plutocratic mean' (the sum of total saving over total income in each decile which gives more weight those with higher income) and the 'median' (the value of saving rate that separates in two the households within each decile so that half of the households lies above and half below). In this section I focus on the median values whereas the series based on the other two measures are shown within the Appendix. Each series is shown in its original form and with the adjustments needed to match the national accounts aggregates.

Main Results Median saving rates of the households[70] are plotted by income decile (defined over household equivalised disposable income) in Figure 4.9. First of all, it is clear from the estimates that the saving rate increases as we move up the income ladder, consistently with the decreasing MPC discussed above. Although one has to be cautious in reading too much into the trends (for caveats expressed above), the series also shows that there was a mild reduction in saving rates during the '80s and from the early '90s to the eve of the crisis across all the income distribution.

The effect is much stronger (and also robust to the adjustments) for the bottom

[69] I first compute the per-capita income and expenditure from the FES survey data and the National account. I then take note, for every year, of the proportional difference between these two estimates and apply this adjustment factor to household income and expenditure. The resulting adjusted measure of income and expenditure, thus, adjusts the income and expenditure of every households irrespectively of their position in the income distribution. Moreover, the income ranking it is preserved.

[70] I plot the three-years moving average figures in order to smooth out the year-to-year volatility.

decile with a reduction in the saving rate of 15 percentage points from 1993 to 2006. This change is threefold the size of the decline in saving rate for the highest decile over the same period. Thus, the differences between the saving rates of different deciles tend to broaden in the latest decades[71].

This is also a period of strong increase in the share of total income accruing to the top of the UK gross income distribution (for instance Figure 4.3 has shown how top1% share in the UK has been on the rise since the early 80s). This piece of evidence is clearly consistent with the relative income hypotheses and 'expenditure cascades' described above. Indeed, the latter predicts an increase in consumption anywhere in the income distribution as a consequence of the shift of consumption frame. For instance, the increase in expenditure by the richest segments of the population can generate expenditure spill-overs in the classes slightly below them and the chain can continue down to the bottom of the distribution.

However, the evidence is not so clear-cut as it might appear at the first glance. Although one can theorise that income dispersion can directly and positively influence the optimal consumption decision, the MPC or both[72], from a practical point of view this may be indistinguishable from other confounding factors occurring contemporaneously with the change in inequality. As a matter of fact, one can observe a similar shift in the consumption curve, as depicted in Figure 1, although the underlying cause of the shift remains structurally different.

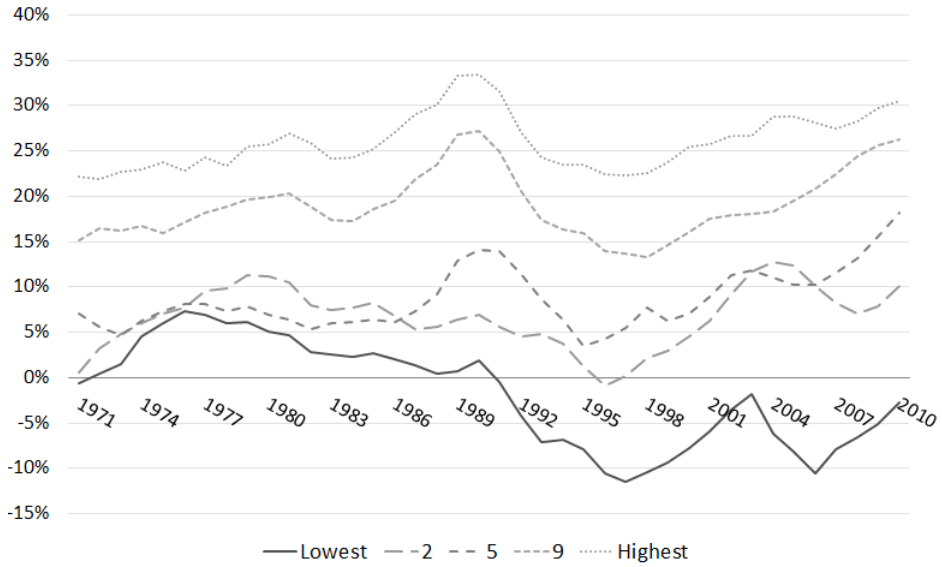
Whereas in the latter case (of concurrent coincidental factors) a re-parametrization of the consumer problem is assumed to occur independently from the change in income dispersion, in the former case (the expenditure cascade hypothesis), the change in the distribution of income directly affects the optimal consumption decisions. These aspects are discussed below.

Inequality and Households Consumption: the Problem of Identification The rise in inequality may occur contemporaneously with a variety of other factors affecting in turn the optimal consumption decision so that the evidence presented above can be also consistent with a variety of other explanations. In particular, the more conventional explanation derived from life-cycle and permanent income models of consumption choices can also replicate the empirical evidence detailed above, potentially

[71] This feature does not appear to be driven by changes in the composition of households characteristics within the decile. In particular I check whether the composition of households within the bottom decile changed from the period 1983-1987 to 2003-2007 in the following characteristics: % of under-25, % of over-65, % of workless households, number of individuals in Part-Time and Full-Time work, number of children and adults. Only the % of over 65 changed substantially between these two subperiods but results on savings are quite robust to the exclusion of over-65 from the sample. See also Lucchino & Morelli (2012) for a more complete description.

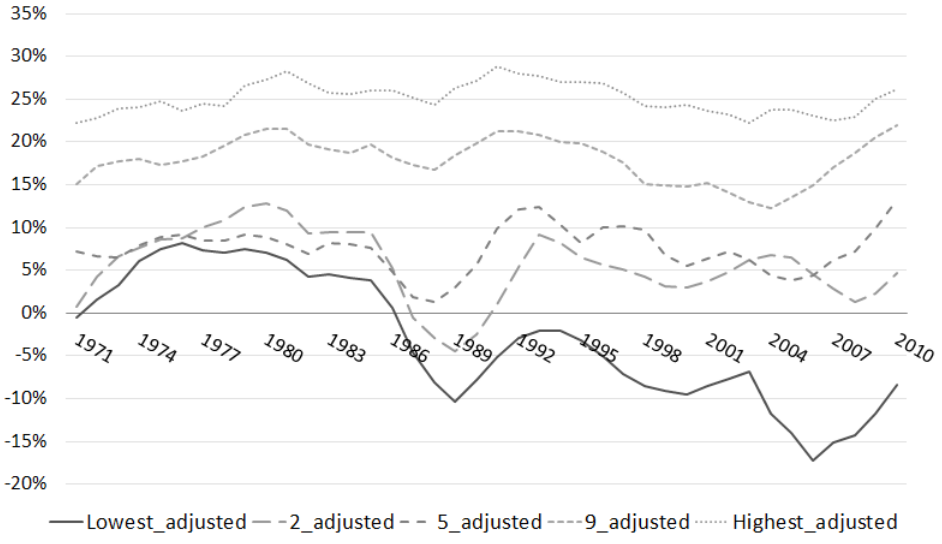
[72] Using the terminology of the previous section one can represent the aggregate consumption function as follows: $C = \int_a^b c(y, I) f(y, I) dy$

Figure 4.8: UK Median Saving Ratios by Selected Deciles from 1971-2010 (Non-Adjusted Figures)



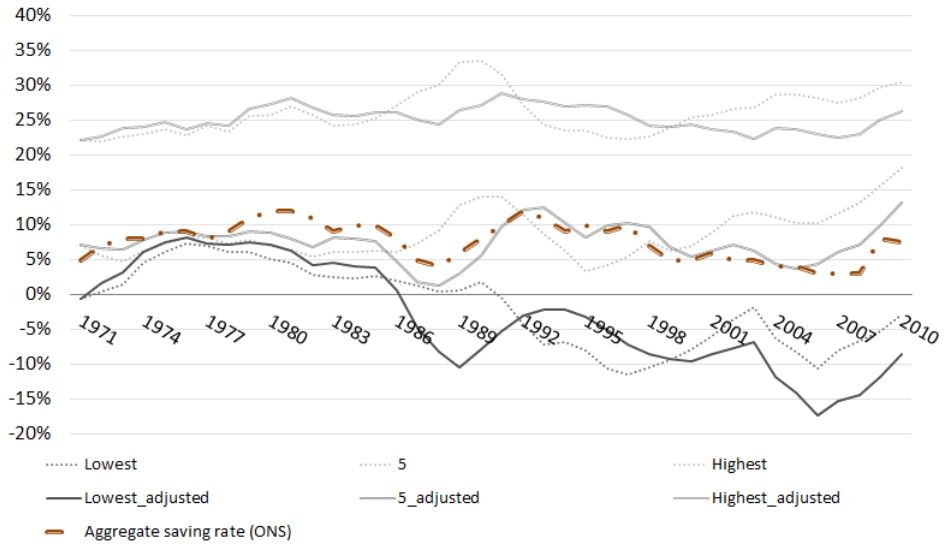
Three-years moving average of saving rates by selected deciles estimated from the Family Expenditure Survey.

Figure 4.9: UK Median Saving Ratios by Selected Deciles from 1971-2010 (Adjusted Figures)



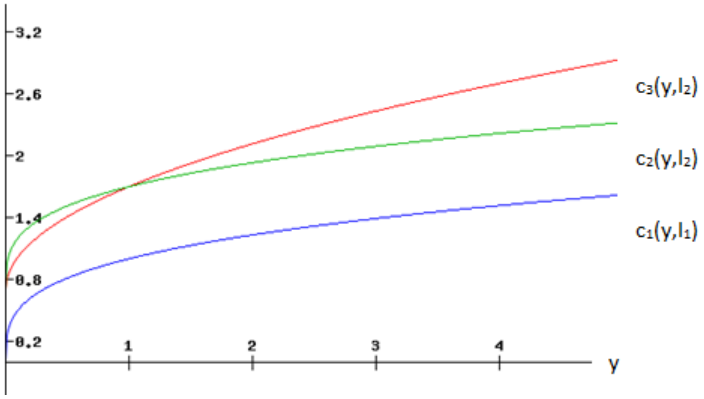
Three-years moving average of saving rates by selected deciles estimated from the Family Expenditure Survey. Figures are adjusted to match national aggregates (ONS).

Figure 4.10: Comparing Original and Adjusted Median Saving Ratios by Selected Deciles: UK 1971-2010



Three-years moving average. The aggregate saving rate is obtained from the Office for National Statistics (ONS).

Figure 4.11: Consumption Function



Note: the graph shows the relationship between consumption (y-axis) and income (x-axis) for any level of income distribution I. The original consumption function (blue line) is assumed to shift upward when income inequality increases from I_1 to I_2. Optimal consumption increases for every level of income (green line). The red line shows a heterogenous impact on the optimal level of consumption (MPC changes across the distribution).

ruling out any role of income distribution and of the relative income channels. A non exclusive list of potential coincidental factors might be the following:

i) A reduction in future income uncertainty (e.g. due to more efficient social protection system) could have occurred coincidentally with an increase in income dispersion, reducing the need for savings (lessening of the precautionary motive as found in Carroll (2001)[73].

ii) Pressure to reduce savings may also be coming from an increase in prices for the habitual goods consumed by individuals as the latter increases the consumption as a share of income (Chetty & Szeidl, 2010).

iii) Similarly, periods of increasing inequality can coincide with periods in which income growth trickles down to lower income class households or simply periods in which individuals are optimistic about their future income prospects leading to lower savings (e.g. Attanasio & Weber, 1994).

iv) Alternatively, households may happen to have less incentive and willingness to forego consumption as the risk-free real interest rate declines (creating less incentives to save), the discount rate increases[74] and the credit conditions improve (e.g. financial integration and development may have improved both the price and the quantity of available credit[75]) or the willingness to bequeath fortune declines.

v) Finally, households may have less incentive to actively save and more willingness to consume as wealth assets increase in value (both housing and financial wealth, see for example Mian and Sufi, 2011).

Disentangling the direct impact of inequality on consumption from coincidental confounding factors described above is an extremely challenging question for future research which goes beyond the scope of this section.

Other Works in the Literature In an important work, Parker (2000) attempted to explain the "*striking increase in the share of the US output that is consumed*" over the past decades and concludes that "*There are many theories that can explain an increase in the consumption of aggregate output. This paper shows that the main mono-causal explanations fail to match the household behavior or macroeconomic outcomes observed during the decline*

[73] Although it may be that more people are expected to be on income-tested and asset-tested benefits (cutting their savings) as inequality goes up, this mechanism seems rather implausible. In fact, the increase in inequality in advanced countries over the past decades went together with scaling back the welfare state, including the greater reliance on private saving for retirement.

[74] For instance an increase in impatience and 'short-sightedness' features of the consumers

[75] see for example Mian & Sufi, 2009 and Dynan & Kohn, 2007

in U.S. saving over the past two decades. More importantly, we have an increasing number of facts that new theories or combinations of theories must fit.".

A step towards the solution of this important issue has been undertaken by Bertrand & Morse (2013) who has investigated the reasons why the consumption share of middle-class (between the 20th and 80th percentiles) has been positively associated with changes in upper income (a cruder measure of income dispersion) in the US since early 1980s. Merging US Consumer Expenditure survey (CEX) with data from the Panel Study of Income Dynamics (PSID), March Current Population Survey (CPS) and the University of Michigan's Survey of Consumers, the authors do not find any support for some of the conventional explanations exposed above where inequality is simply coincidentally associated with the increase in consumption. Hence, their findings point to the relevance of direct behavioral responses of consumers to changes in upper income, not usually contemplated in conventional consumer theories.

In particular, they find strong evidence for two hypotheses. The first suggests that the growth of income at the top of the income distribution increases the supply of 'rich' goods in the economy which automatically leads to an increase in demand for those goods by poorer individuals. Secondly they support the 'relative income hypothesis' suggesting that greater consumption by relatively richer households sets the consumption standards also for the rest of the population which is pushed to consume a greater share of their income in order to imitate their wealthier peers and to 'keep up with the Joneses'.

Further evidence consistent with the 'expenditure cascade theory' findings are also discussed in Frank et al. (2010) which find a statistical association between variables of financial distress (proxies for saving decisions) and income inequality at the US county-level. Such evidence points out to an 'over-consumption' rather than an 'under-consumption' hypothesis. Although Frank et al. use disaggregated data at the county level in order to isolate a proxy for 'peer group of reference', they do not attempt to disentangle the role of rival consumption theories.

Further Discussion The relative income theory has been neglected for a long time in conventional accounting of consumer theory and has been recently invoked as a useful theoretical framework in order to justify the apparent association between increasing dispersion of income and higher consumption shares in the economy. However, some caveats remain as I illustrated in the previous account.

First of all, available theories do not always formally link a measure of dispersion of incomes *per se* to optimal consumption decisions. Rather, it is common to assume that individual utility and welfare is affected by consumption per capita (living standards) or by the relative distance of personal consumption from the consumption of peers in the reference group.

Secondly, although some models have already attempted to tackle this issue, the

concerns about the social nature of consumption and the interconnectedness of utility functions often fail to properly account for the forward-looking nature of the consumption decision. The latter is however an important component of consumption decision and needs to be properly accounted for.

Finally, it is important to recognise that the identification of the relative income channel is quite a challenging task and no available empirical study has carried out yet a comprehensive empirical investigation successfully completing this task. Conventional theories of consumption (Modigliani-Blumberg-Friedman life cycle and permanent income theories) do not consider a role for income distribution in optimal consumption choice but are extremely important to identify other confounding factors, contemporaneous to the rise in inequality.

Fully addressing all the issues above would clearly go beyond the scope of this chapter. In fact, the conceptual framework highlighted above it is useful to address these issues in future research.

Conclusions

Within the chapter I explored three main hypotheses at the centre of the on-going debate about the crisis/inequality nexus, namely that inequality (high levels or growing levels) can be systematically associated with the occurrence of banking crises, that an increase in inequality reduces aggregate consumption and depresses the economic activity and finally that income dispersion can have a direct impact on consumption and saving choices.

I discuss the main approaches and results below:

1. Using the Chartbook of Economic Inequality (Atkinson & Morelli, 2012), I 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 (with new data and methodology) of my previous works in collaboration with A. B. Atkinson[76]. On the other hand, I 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 my knowledge, the first attempt to assess the validity of the 'level' hypothesis across different dimensions (over time and across-countries).

[76] See Atkinson & Morelli (2010, 2011).

The collected 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).

2. As mentioned in the introduction, a recurrent argument put forward by scholars and researchers sees growing income inequality as a main driver of stagnating aggregate demand and private consumption. However, it is hard to reconcile this conjecture with the available empirical evidence. For instance, I showed that from 1963 to 2010, the aggregate proportion of total UK household disposable income that is not saved, and is therefore consumed, appears positively correlated with the share of total gross income held by the richest 1% of the population (a measure of income inequality). These findings also hold when computing the consumption shares using household survey data. Using the micro data from the UK Family Expenditure Survey (FES) from 1997 to 2010 I was able to show that every decile across the whole income distribution experienced a growth in consumption in excess of disposable income. Extending the time window back to 1971, I observe that the overall expenditure grew faster than income only for both relatively poor and relatively rich households. Such evidence points out to an '*over-consumption*' rather than an '*under-consumption*' hypothesis.

   To address this seemingly puzzling evidence, I further verified the empirically validity as well as the theoretical support of the concavity of the consumption function which constitutes the theoretical condition under which one can observe the negative impact of increasing income dispersion (keeping average income constant) on aggregate consumption in the economy. My investigation, reports that the latter condition is confirmed by a variety of conventional and unconventional consumption models. This was also confirmed by estimating a Keynesian consumption function on the micro data from the UK Family Expenditure Survey. However, the findings only support a low degree of concavity of the consumption function. This justifies a small estimated effect on aggregate consumption even following a substantial redistribution of income. For instance, I simulated the change in aggregate consumption to a series of mean-preserving changes in income dispersion, including a hypothetical scenario of 'full equality'. Simulations suggest that even such a radical change in income distribution translates into a 3% increase in aggregate consumption share at most.

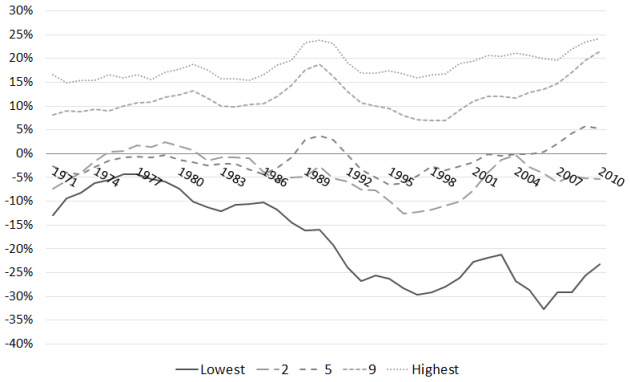
3. Other scholars have suggested that the rise in inequality can increase the optimal household/individual consumption level and therefore contribute to the evidence of 'over-consumption' I found in the UK data (and others have found in US data). Indeed, I also discussed how the considerations stemming from the so called 'relative income hypothesis' denote a very promising theoretical explanation about how inequality can be, *ceteris paribus*, directly linked to 'over-consumption'. By exploring the UK FES data, I found evidence of a reduction in

saving rates during the '80s and from the early '90s to the eve of the recent crisis across all the income distribution. The effect is much stronger for the bottom decile with a reduction in the saving rate of 15 percentage points from 1993 to 2006. This change is threefold the size of the decline in saving rate for the highest decile over the same period. This was also a period of strong increase in the share of total income accruing to the top of the UK gross income distribution. This evidence is consistent with the 'expenditure cascades' theory by Frank et al. (2010) who posits that higher consumption by the richest households of the income distribution induces higher consumption by the classes slightly below them and this spill-over effects ripples down to the bottom of the income distribution.

However, it is also worth noting that the relative income theory has been neglected for a long time in conventional accounting of consumer decisions and neither the theory nor the evidence for this is clear-cut. In the chapter I discussed some of the aspects related to the relative income hypothesis that future research needs to address.

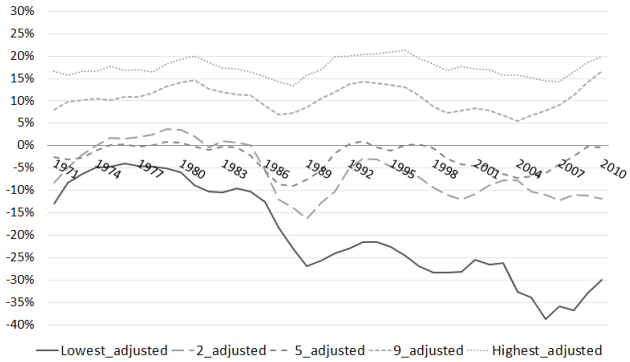
Appendix

Figure 4.12: 'Democratic' Mean Saving Ratios by Selected Deciles: 1971-2010



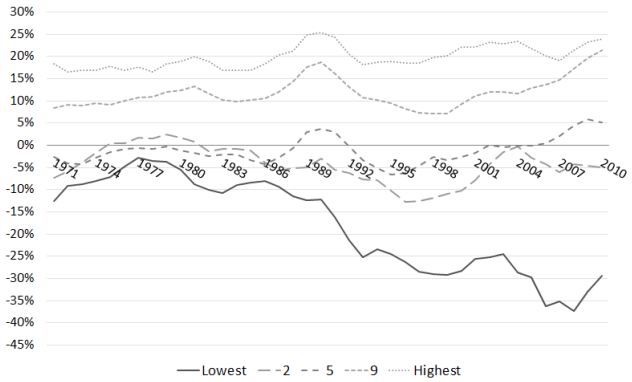
Three-years moving average.

Figure 4.13: Adjusted 'Democratic' Mean Saving Ratios by Selected Deciles: 1971-2010



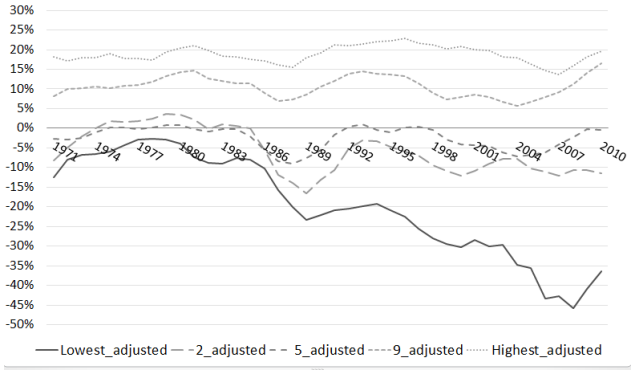
Three-years moving average. Figures are adjusted to match national aggregates.

Figure 4.14: 'Plutocratic' Mean Saving Ratios by Selected Deciles: 1971-2010



Three-years moving average.

Figure 4.15: Adjusted 'Plutocratic' Mean Saving Ratios by Selected Deciles: 1971-2010



Three-years moving average. Figures are adjusted to match national aggregates.

Conclusions

The core of this thesis was structured around two main parts. The first investigated the distributional implications of major banking shocks by studying the response of top income shares to the occurrence of the shocks, both in the US and in a panel of 26 countries since the beginning of the twentieth century. The second explored more closely the empirical and the theoretical implications of the hypothesis that inequality may be the source of macroeconomic and financial instability. Before relating the main findings on the crisis and inequality nexus I start with a short overview of the new data series I created in order to perform my empirical analysis.

New Data Series An important part of my thesis, which contributed to the literature on the topic of inequality and crises, included the identification of a variety of new data series which have already been disseminated in the research community for research purposes:

Data series of banking crises, per-capita real GDP and consumption crises, and general macro-instability episodes Chapter 1 identified a new list of banking crises, per-capita real GDP and consumption crises and general macro-instability episodes which were used in the empirical investigation of the inequality and crisis nexus. Although the primary goal of this exercise was to collect data for the empirical investigation, it is worth mentioning that the new list of macro-economic shocks highlighted the following issues:

i. First of all, banking crises are not isolated events but tend to occur in cluster with crises and shocks of other type. Collecting data on different types of economic and financial crises I proposed a new indicator of macro-instability periods. This approach can be taken as a first step to improve the multidimensional approach to the study of macro-economic shocks which should be acknowledged within every empirical investigation about banking crises.

ii. Moreover, available historical indicators of banking crises present several limitations. In particular, there is a lack of continuous quantitative indicators about the

instability of the banking sector and a lack of identification of the end point and the severity of crisis episodes. These are limitations that future research will need to address.

The Chartbook of Economic Inequality The work has also introduced, thanks to the joint collaboration of A.B. Atkinson, a new database on economic inequality for a variety of countries and years, the Chartbook of Economic Inequality (Atkinson & Morelli, 2012) represents a readily available dataset on 5 different dimensions of inequality and for 25 countries from early 1900 to 2010. Extra effort was put in order to preserve the cross-time comparability of data series within countries. The database has already been widely disseminated within the research community.

The main findings about the crisis and inequality nexus also based on these new datasets are summarised below

Part I: the distributional implications of major banking shocks

The effect of crises on top income shares, main findings The second and third Chapters estimated the total effect of systemic banking crises on the measures of top income shares using impulse response functions and an 'ex-post' counterfactual approach. The main finding of the work suggests that the estimated total effects of crises on the levels of specific top shares with respect to the no-crisis scenario (counterfactual) are, by any statistical standard, rather small in magnitude (i.e. the implied changes for the specific share are usually substantially smaller than 1 percentage point). Moreover, the estimated effects of the crisis appears long-lasting and does not generally appear to be re-absorbed by the end of the period under investigation (4 or 5 years). The analysis of the US data, however, constitutes an exception and it reveals some, although non conclusive, evidence that the total effect of crises on US top income shares are not just small in magnitude but also temporary in nature as richest top shares tend to recover fast following the initial hit.

It is also worth noting that the analysis has highlighted important heterogeneity of the results across specific top income groups, country groups and time periods under investigation.

For instance, top income groups are heterogeneous in nature and their relative response to systemic banking shocks appear different. The overall evidence suggests that the short-term impact of systemic banking crises on the upper income brackets of the income distribution is negative at the very top of the income distribution (top001 share) and positive at the bottom of the top decile respectively (top10-top5 share). 'Inequality' *at the top* of the distribution, thus, tend to temporarily shrink following a systemic banking crisis. This also implies that the overall effect on the entire top decile share is mostly insignificant. Thus, the use of different top income shares in the analysis matters, as it can provide contrasting evidence, marking the importance of the

decomposition of income groups at the top. Information on the Top10 solely would lead us to conclude that crises have no impact on the 'rich' share of total income.

The exploitation of data variability across countries and over time has also highlighted the importance of a 'panel' investigation. The effect of banking crises on top shares of different country groups (Continental European, Nordic European and Anglo-Saxon countries) is generally found to be negative on the share of richer groups populating the top decile, and positive on the share of poorer groups within the top decile. The only exception to these finding are the so called 'Developing' countries. Moreover, once the latter group of countries is excluded, more recent crisis episodes (post-1970) appear to have a negative impact on top shares up to three times as big compared to the crises that occurred in the pre-1970 period.

Further discussions and directions for future research The overall evidence described in Chapters 2 and 3 seems to indicate that systemic banking crises may not to be unequivocally considered as turning-point events for income distribution. In other words, major historical crises per se and their associated market forces, may not be sufficient to structurally change the distribution of income within the economy, at least in the short-run. This lends some support to the structuralist hypothesis that only strong shifts in regulatory, fiscal and political regimes can substantially and permanently affect the income distribution within countries as recently argued in the work by Piketty & Saez (2012). Indeed, new waves of policies (e.g. the New Deal) are often implemented years from the occurrence of major banking shocks and economic crises and it is to be expected that these changes would exert substantial impact on the distribution of income.

However, I should be stressed that the data investigated in the thesis are not representative for the entire income distribution and one should be careful in mechanically extrapolating the results discussed within Chapter 2 and 3 to the overall income distribution. This appears a rather interesting avenue for further investigation.

In this context, it is worth pointing out the main limitations of the empirical investigation described above. First of all, despite the intention to fully cover the time period under investigation (1900-2010), in few countries data limitation remains severe and a total coverage of the time period is deemed an impossible task. Moreover, the timely availability of distributional data remains a serious limitation to empirical investigations and the lack of complete coverage for the recent crisis calls for more caution about the validity of the finding that "this time it may be different".

Moreover, Economic inequality has many dimensions, many of which were neglected by the empirical evidence presented here. I have focused on a very narrow indicator of income 'inequality', namely top income shares. This, on one hand, allowed me to cover an unprecedented very long time time horizon by the standards of empirical works on income distribution. On the other hand, this led to ignore other segments of the income distribution but also other economic dimensions such as con-

sumption or wealth that may be more relevant to social well-being and may have been affected differently by the crisis. Moreover, individuals differ in many respects and it may well be that crises have more substantial and long-lasting effects on different cohorts of individuals. Young individuals might be severely hit by the shocks through labour market channels and the hysteresis effect on the unemployment rate. Alternatively, the financial shock and assets devaluation that usually follow major crises, may affect substantially the value of the accumulated pensions as well as the decision to retire and to save. These crucial considerations were excluded from my empirical investigation mainly due to the historical perspective of the work as well as the strong data limitation associated with this approach.

Part II: The Empirical and the Theoretical Implications of the Inequality/ Crisis nexus

The evidence about inequality and crises In the fourth Chapter I used new data and methodology to re-assess, the validity of the hypothesis that *growing* inequality can systematically precede the onset of systemic banking crises, as originally done in Atkinson & Morelli (2010, 2011). I also provided new evidence about the '*level*' hypothesis by comparing different measures of inequality before the crisis, on the one hand, to the country's own historical evidence (e.g. 'time comparator') and, on the other hand, to the average experience of other countries (e.g 'cross-country comparator'). This constitutes, to the best of my knowledge, the first attempt to assess the validity of the 'level' hypothesis across different dimensions (over time and across-countries). The distinction between the '*level*' hypothesis and the '*growth*' hypothesis, as discussed within the thesis, is important as the policy implications and the theoretical models of reference can be quite different under the different hypotheses.

However, both analyses do not provide any conclusive and compelling statistical support to either the 'growth' or the 'level' hypothesis and the findings are in line with the analysis already carried out in Atkinson & Morelli (2010) who concluded their work positing that "*the history of systemic banking crises in different countries around the world does not suggest that either rising or high inequality has been adduced as a significant causal factor*".

The effect of inequality on aggregate consumption Despite the lack of conclusive statistical evidence on the connection between inequality and the occurrence of banking crises and given the economic relevance of such a conjecture, within Chapter 4 I took a step back and analysed more deeply the theoretical arguments that are relevant in the ongoing economic debate about the nexus between inequality and macroeconomic and financial stability. This led me to analyse two additional important issues, namely the relationship of inequality with both aggregate consumption and individual consumption and saving choices.

As mentioned in the introduction, a recurrent argument put forward by scholars and researchers sees growing income inequality as a main driver of stagnating aggregate demand and private consumption. However, it is hard to reconcile this conjecture with the available empirical evidence. For instance, I showed that from 1963 to 2010, the aggregate proportion of total UK household disposable income that is not saved, and is therefore consumed, appears positively correlated with the share of total gross income held by the richest 1% of the population (a measure of income inequality). This finding holds by computing consumption shares using household survey data. Using micro data from the UK Family Expenditure Survey (FES) from 1997 to 2010 I was able to show that every decile across the whole income distribution experienced a growth in consumption in excess of disposable income. Extending the time window back to 1971, I observe that the overall expenditure grew faster than income only for both relatively poor and relatively rich households. Such evidence points to an '*over-consumption*' rather than a '*under-consumption*' hypothesis.

To address this seemingly puzzling evidence, I further verified the empirically validity as well as the theoretical support of the concavity of the consumption function which constitutes the theoretical condition under which we can observe the negative impact of increasing income dispersion (keeping average income constant) on aggregate consumption in the economy. My investigation, reports that the latter condition is confirmed by a variety of conventional and unconventional consumption models. This was also confirmed by estimating a Keynesian consumption function on the micro data from the UK Family Expenditure Survey. However the findings only support a low degree of concavity of the consumption function. This justifies a small estimated effect on aggregate consumption due to substantial redistribution of income. For instance, I simulated the change in aggregate consumption to a series of mean-preserving changes in income dispersion, including a hypothetical scenario of 'full equality'. Simulations suggest that even such a radical change in income distribution translates into a 3% increase in aggregate consumption share at most.

The effect of inequality on individual consumption Hence, I was left with the investigation of whether, among other explanations, the rise in inequality can increase the optimal household/individual consumption level and therefore contribute to the evidence of 'over-consumption' we found in the UK data (and others have found in US data). For example, I discussed how the considerations stemming from the so called 'relative income hypothesis' denote a very promising theoretical explanation about how inequality can be, *ceteris paribus*, directly linked to 'over-consumption' and households stretched finances.

Indeed, by recognising the social nature of the consumption decision, the distribution of income may acquire a prominent role in affecting optimal consumption decisions. This can explain why an increase in income dispersion is not necessarily associated to a decrease in aggregate consumption (as also pointed out in Blinder

(1975)). An interesting theory by Frank et al. (2010), the so called 'Expenditure Cascades' hypothesis, posits that higher consumption by the richest households of the income distribution induces higher consumption by the classes slightly below them and this spill-over effects ripples down to the bottom of the income distribution. Indeed, by exploring the UK FES data, I found evidence of a reduction in saving rates during the '80s and from the early '90s to the eve of the recent crisis across all the income distribution. The effect is much stronger for the bottom decile with a reduction in the saving rate of 15 percentage points from 1993 to 2006, threefold the size of the decline in saving rate for the highest decile over the same period. This was also a period of strong increase in the share of total income accruing to the top of the UK gross income distribution, and this evidence is consistent with the 'expenditure cascades' prediction about the increase in consumption share anywhere in the income distribution as a consequence of the shift of consumption frame.

Further discussions and directions for future research Despite the lack of conclusive statistical evidence on the connection between inequality and the occurrence of banking crises at the aggregate level, the analysis presented in this thesis has highlighted a few important issues that justify the need for a more refined theoretical approach as well as additional empirical investigation.

Indeed, contrary to standard textbook assumptions in economics, recent research and commentary have emphasised how relative income and spending comparisons may have important influences on what people spend their money on, how much they save and even how much debt they accumulate. These considerations rather suggest that the degree of inequality should have a direct effect on aggregate savings, debt accumulation and thus on economic activity. My findings in Chapter 4 on UK micro-data and recent investigations by other scholars on household behaviour, in the US suggest preliminary associations between inequality and household 'over-consumption' and indebtedness (Iacoviello (2008); Frank et al. (2010); Bertrand & Morse (2013); Carr & Jayadev (2012). As recalled in Lucchino & Morelli (2012) "*micro-data is arguably more appropriate to the question at hand (and) further microeconomic investigation is desirable*".

However it is also worth noting that the relative income theory has been neglected for a long time in conventional accounting of consumer decision and neither the theory nor the evidence for this is clear-cut. On the empirical side, the evidence discussed above is also consistent with a variety of other explanations. Indeed, from a practical point of view the potential role of relative income concerns may be indistinguishable from other confounding factors occurring contemporaneously with the change in inequality. Disentangling the direct impact of inequality on consumption from coincidental confounding factors is an extremely challenging research question for future investigation and remains, to date, an important limitation for the assessment of the validity of the relative income hypothesis. On the theoretical side, the concerns about the social nature of consumption and the interconnectedness of utility functions also

needs to properly account for the forward-looking nature of the consumption decision. Moreover, available theoretical framework do not formally link a measure of dispersion of incomes *per se* to optimal consumption decisions yet. In fact, to date, available theories of relative income assume that individual utility is only affected by consumption per capita (living standards) or by the relative distance of personal consumption from the consumption of peers in the reference group.

If confirmed, the influence of relative income comparisons on individual consumption choices would have far-reaching social and policy implications that go well beyond the concerns of economic theorising. Indeed, if relative income comparisons do influence consumption choices, greater income disparity becomes a negative externality that pushes consumption beyond efficient levels, to the detriment of long-term growth and stability. Furthermore, inequality and relative income distinctions may also shift the allocation of resources towards forms of conspicuous and/or wasteful consumption at the expense of more important investments whose benefits are however more intangible, such as education. Indeed, Frank states: "*much of the extra spending of recent years has been a relatively inefficient source of extra utility*" but *"crowd[s] out other forms of spending that would produce real improvements in the quality of life*". In addition, a lower aggregate saving rate may also contribute to the deterioration of the current account (see recent IMF work by Kumhof et al., 2012). Beyond traditional concerns related to equity, this evidence would support the need to monitor trends in inequality for effective macro-prudential governance.

Moreover, to the extent that income distribution in the economy may be able to affect individual consumption choices, it is reasonable to expect this to be true also for the demand for credit. The investigation of the alleged relationship between inequality and private debt becomes particularly relevant in light of the fact that the latest crisis was largely the result of the burst of a debt-financed housing and consumption bubble that involved the private sector of the economy. However, this analysis faces two main substantial limitations, namely the lack of long term data on personal debt and the lack of appropriate macro-economic models explaining growth, debt and inequality as endogenous outcomes of the economic structure. Macroeconomic theory has largely neglected the destabilising role of households balance sheets in the macroeconomic modelling framework and to date there is no model of macroeconomic cycles that allows studying the impact of high or increased inequality. A deeper understanding of the mechanisms that may link inequality to greater indebtedness is however needed as it may have far-reaching implications for macroeconomic policy.

Finally, the importance of interrelated utility functions also raises welfare economics issues of first order importance. Namely, how can we form a social welfare function that aggregates the relative concerns of individuals? Should the concern about other people's living standard be included within the social welfare function? This is crucial to evaluate the welfare implications of public policies such as the im-

plementation of taxation policies on consumption or tax incentives for savings[77].

[77] See Atkinson, 2009a for further discussion

Bibliography

Abel, A. B. (1990). Asset prices under habit formation and catching up with the joneses. *The American Economic Review*, 80(2), 38–42.

Acemoglu, D. (2011). Thoughts on inequality and the financial crisis. In *AEA meeting, Denver*, volume 8.

Aghion, P., Banerjee, A., & Piketty, T. (1999a). Dualism and macroeconomic volatility. *The Quarterly Journal of Economics*, 114(4), 1359–1397.

Aghion, P., Caroli, E., & Garcia-Penalosa, C. (1999b). Inequality and economic growth: the perspective of the new growth theories. *Journal of Economic literature*, 37(4), 1615–1660.

Alesina, A. & Perotti, R. (1996). Income distribution, political instability, and investment. *European Economic Review*, 40(6), 1203–1228.

Alesina, A. & Rodrik, D. (1994). Distributive politics and economic growth. *The Quarterly Journal of Economics*, 109(2), 465–490.

Alvaredo, F. (2011). A note on the relationship between top income shares and the gini coefficient. *Economics Letters*, 110(3), 274–277.

Alvaredo, F., Atkinson, A., Piketty, T., & Saez, E. (2013). The world top income database (wtid). Database accessed in March 2013, http://topincomes.gmond.parisschoolofeconomics.eu/.

Alvaredo, F., Atkinson, A., Piketty, T., & Saez, E. (forthcoming). The top 1 percent in international and historical perspective. *Journal of Economic Perspectives*.

Alvarez-Cuadrado, F. & El-Attar, M. (2013). Income inequality and saving. *IZA Discussion Paper*.

Alvarez-Cuadrado, F. & Van Long, N. (2011). The relative income hypothesis. *Journal of Economic Dynamics and Control*, 35(9), 1489–1501.

Andrews, D. W. (1991). Heteroskedasticity and autocorrelation consistent covariance matrix estimation. *Econometrica: Journal of the Econometric Society*, (pp. 817–858).

Atkinson, A. (2009a). Giving overseas and public policy. *Journal of Public Economics*, 93(5-6), 647–653.

Atkinson, A. B. (2003). Income inequality in oecd countries: Data and explanations. *CESifo Economic Studies*, 49(4), 479–513.

Atkinson, A. B. (2009b). Factor shares: The principal problem of political economy? *Oxford Review of Economic Policy*, 25(1), 3–16.

Atkinson, A. B. (2013). Putting people first and macro-economic policy. *mimeo, Nuffield College*.

Atkinson, A. B. & Marlier, E. (2010). *Income and living conditions in Europe*. European Union.

Atkinson, A. B. & Morelli, S. (2010). Inequality and banking crises: A first look. *report for the International Labour Organisation*.

Atkinson, A. B. & Morelli, S. (2011). Economic crises and inequality. *Human Development Research Paper*, 6.

Atkinson, A. B. & Morelli, S. (2012). Chartbook of economic inequality: 25 countries 1911-2010. *INET Research Notes Series*, 15.

Atkinson, A. B. & Piketty, T. (2007). *Top incomes over the twentieth century: a contrast between continental european and english-speaking countries*. Oxford university press.

Atkinson, A. B. & Piketty, T. (2010). *Top incomes: A global perspective*. Oxford University Press.

Atkinson, A. B., Piketty, T., & Saez, E. (2011). Top incomes in the long run of history. *Journal of Economic Literature*, 49(1), 3–71.

Attanasio, O. P. & Weber, G. (1994). *Is Consumption Growth Consistent with Intertemporal Optimization? Evidence from the Consumer Expenditure Survey*. Working Paper 4795, National Bureau of Economic Research.

Baker, J. C. (1939). Executive compensation payments by large and small industrial companies. *The Quarterly Journal of Economics*, 53(3), 404–434.

Baldacci, E., De Mello, L., & Inchauste, G. (2002). *Financial crises, poverty, and income distribution*. Number 2002-2004. International Monetary Fund.

Ball, L. M., Furceri, D., Leigh, M. D., & Loungani, M. P. (2013). The distributional effects of fiscal consolidation. *IMF Working Papers*, (13-151).

Banerjee, A. V. & Duflo, E. (2003). Inequality and growth: what can the data say? *Journal of economic growth*, 8(3), 267–299.

Banerjee, A. V. & Newman, A. F. (1993). Occupational choice and the process of development. *Journal of political economy*, (pp. 274–298).

Banks, J. & Leicester, A. (2006). 9. expenditure and consumption. *Retirement, health and relationships of the older population in England*, (pp. 243).

Barro, R. J. (2000). Inequality and growth in a panel of countries. *Journal of economic growth*, 5(1), 5–32.

Barro, R. J. & Ursúa, J. F. (2008). Macroeconomic crises since 1870. *Brookings Papers on Economic Activity*, (Spring), 255–335.

Barro, R. J. & Ursúa, J. F. (2009). *Stock-Market Crashes and Depressions*. Working Paper 14760, National Bureau of Economic Research.

Beach, C. (1976). *Cyclical Impacts on the Personal Distribution of Income*, (pp. 33–56). NBER.

Beach, C. (1977). Cyclical sensitivity of aggregate income inequality. *The Review of Economics and Statistics*, 59(1), 56–66.

Bellettini, G. & Delbono, F. (2013). *Persistence of high income inequality and banking crises: 1980-2010*. Working papers, CESifo Group Munich.

Benabou, R. (1996). Inequality and growth. In *NBER Macroeconomics Annual 1996, Volume 11* (pp. 11–92). MIT Press.

Berg, A., Ostry, J. D., & Zettelmeyer, J. (2012). What makes growth sustained? *Journal of Development Economics*, 98(2), 149–166.

Bertola, G. (2000). Macroeconomics of distribution and growth. *Handbook of income distribution*, 1, 477–540.

Bertrand, M. & Morse, A. (2013). *Trickle-Down Consumption*. Working Paper 18883, National Bureau of Economic Research.

Bilias, Y., Georgarakos, D., & Haliassos, M. (2010). Portfolio inertia and stock market fluctuations. *Journal of Money, Credit and Banking*, 42(4), 715–742.

Blank, R. M. (1989). Disaggregating the effect of the business cycle on the distribution of income. *Economica*, 56(222), pp. 141–163.

Blank, R. M. & Blinder, A. S. (1985). *Macroeconomics, Income Distribution, and Poverty*. Working Paper 1567, National Bureau of Economic Research.

Blinder, A. & Esaki, H. (1978). Macroeconomic activity and income distribution in the postwar united states. *The Review of Economics and Statistics*, (pp. 604–609).

Blinder, A. S. (1975). Distribution effects and the aggregate consumption function. *The Journal of Political Economy*, (pp. 447–475).

Bordo, M., Eichengreen, B., Klingebiel, D., & Martinez-Peria, M. S. (2001). Is the crisis problem growing more severe? *Economic Policy*, 16(32), 51–82.

Bordo, M. & Meissner, C. (2011). Do financial crises always raise inequality. In *Some evidence from history, JIMF 4th Annual Conference at UC Santa Cruz*.

Bordo, M. D. & Meissner, C. M. (2012). Does inequality lead to a financial crisis? *Journal of International Money and Finance*, 31(8), 2147–2161.

Boyd, J. H., De Nicolò, G., & Loukoianova, E. (2009). Banking crises and crisis dating: Theory and evidence. *IMF Working Papers*, (pp. 1–50).

Brown, C. (2004). Does income distribution matter for effective demand? evidence from the united states. *Review of Political Economy*, 16(3), 291–307.

Brugiavini, A. & Weber, G. (2011). *Longer-term consequences on income distribution of the Great Recession*. Report, Fondazione Rodolfo Debenedetti.

Brunnermeier, M. K. & Nagel, S. (2008). Do wealth fluctuations generate time-varying risk aversion? micro-evidence on individuals. *American Economic Review*, 98(3), 713–36.

Burkhauser, R. V., Feng, S., & Jenkins, S. P. (2009). Using the p90/p10 index to measure us inequality trends with current population survey data: a view from inside the census bureau vaults. *Review of Income and Wealth*, 55(1), 166–185.

Burkhauser, R. V., Feng, S., Jenkins, S. P., & Larrimore, J. (2012). Recent trends in top income shares in the united states: reconciling estimates from march cps and irs tax return data. *Review of Economics and Statistics*, 94(2), 371–388.

Campbell, J. Y. & Cochrane, J. H. (1995). *By Force of Habit: A Consumption-Based Explanation of Aggregate Stock Market Behavior*. Working Paper 4995, National Bureau of Economic Research.

Caprio, G. & Klingebiel, D. (1996). Bank insolvencies: cross-country experience. *World Bank policy research working paper*, (1620).

Caprio, G. & Klingebiel, D. (1999). Episodes of systematic and borderline financial distress. *mimeo, The World Bank*.

Caprio, G. & Klingebiel, D. (2003). Episodes of systemic and borderline financial crises. world bank research dataset.

Carr, M. & Jayadev, A. (2012). Relative income and indebtedness: Evidence from panel data. *mimeo*.

Carroll, C. D. (2001). *Precautionary Saving and the Marginal Propensity to Consume out of Permanent Income*. Working Paper 8233, National Bureau of Economic Research.

Carroll, C. D. & Kimball, M. S. (1996). On the concavity of the consumption function. *Econometrica: Journal of the Econometric Society*, (pp. 981–992).

Carroll, C. D. & Kimball, M. S. (2001). *Liquidity Constraints and Precautionary Saving*. Working Paper 8496, National Bureau of Economic Research.

Cavaliere, G. (2005). Limited time series with a unit root. *Econometric Theory*, null, 907–945.

Cavaliere, G. & Xu, F. (2013). Testing for unit roots in bounded time series. *Journal of Econometrics*, (0), –.

Cerra, V. & Saxena, S. C. (2008). Growth dynamics: the myth of economic recovery. *The American Economic Review*, 98(1), 439–457.

Chetty, R. & Szeidl, A. (2010). *The Effect of Housing on Portfolio Choice*. Working Paper 15998, National Bureau of Economic Research.

Crossley, T. F. & O'Dea, C. (2010). *The wealth and saving of UK families on the eve of the crisis*. Number R71. IFS Reports, Institute for Fiscal Studies.

Cunha, F., Heckman, J. J., & Navarro, S. (2006). Counterfactual analysis of inequality and social mobility. *Mobility and Inequality: Frontiers of Research in Sociology and Economics*, (pp. 290–348).

Curry, T. & Shibut, L. (2000). The cost of the savings and loan crisis: truth and consequences. *FDIC Banking Review*, 13(2), 26–35.

Detragiache, E. & Demirgüc-Kunt, A. (1998). *Financial Liberalization and Financial Fragility (EPub)*. International Monetary Fund.

Dolls, M., Fuest, C., & Peichl, A. (2012). Automatic stabilizers and economic crisis: Us vs. europe. *Journal of Public Economics*, 96(3), 279–294.

Duesenberry, J. S. (1949). *Income, saving, and the theory of consumer behavior*, volume 87. Harvard University Press: Cambridge MA.

Dupor, B. & Liu, W.-F. (2003). Jealousy and equilibrium overconsumption. *The American Economic Review*, 93(1), 423–428.

Dynan, K. E. & Kohn, D. L. (2007). *The rise in US household indebtedness: Causes and consequences*. Divisions of Research & Statistics and Monetary Affairs, Federal Reserve Board.

Eberhardt, M. (2011). Xtmg: Stata module to estimate panel time series models with heterogeneous slopes. Statistical Software Components, Boston College Department of Economics.

Eberhardt, M., Helmers, C., & Strauss, H. (2013). Do spillovers matter when estimating private returns to r&d? *Review of Economics and Statistics*, 95(2), 436–448.

Eberhardt, M. & Teal, F. (2010). *Productivity Analysis in Global Manufacturing Production.* Technical report.

Eichengreen, B. & Bordo, M. D. (2002). Crises now and then: What lessons from the last era of financial globalization.

Elton, E. J. & Gruber, M. J. (1970). Marginal stockholder tax rates and the clientele effect. *The Review of Economics and Statistics*, 52(1), 68–74.

Fisher, I. (1930). *The stock market crash–and after*. The Macmillan Company.

Fitoussi, J. & Saraceno, F. (2010). Inequality and macroeconomic performance. *Documents de Travail de lOFCE*, 13.

Frank, R., Levine, A., & Dijk, O. (2010). Expenditure cascades. *Available at SSRN 1690612*.

Friedman, M. (1957). *A Theory of the Consumption*. Princeton University Press, Princeton.

Frydman, C. & Saks, R. E. (2010). Executive compensation: A new view from a long-term perspective, 1936–2005. *Review of Financial Studies*, 23(5), 2099–2138.

Furman, J. & Stiglitz, J. E. (1998). Economic consequences of income inequality. In *Income Inequality: Issues and Policy Options–Proceedings of a Symposium Sponsored by the Federal Reserve Bank of Kansas City* (pp. 255).

Gali, J. (1994). Keeping up with the joneses: Consumption externalities, portfolio choice, and asset prices. *Journal of Money, Credit and Banking*, 26(1), 1–8.

Galor, O. (2009). Inequality and economic development: An overview. *Providence, RI: Brown University*.

Galor, O. & Zeira, J. (1993). Income distribution and macroeconomics. *The review of economic studies*, 60(1), 35–52.

Gomes, F. & Michaelides, A. (2005). Optimal life-cycle asset allocation: Understanding the empirical evidence. *The Journal of Finance*, 60(2), 869–904.

Goodwin, R. M. (1967). *A growth cycle*. Cambridge University Press, Cambridge.

Gorodnichenko, Y., Kueng, L., Silvia, J., & Coibion, O. (2012). Innocent bystanders? monetary policy and inequality in the us. *IMF Working Papers*.

Granger, C. W. (2010). Some thoughts on the development of cointegration. *Journal of Econometrics*, 158(1), 3 – 6. ¡ce:title¿Twenty Years of Cointegration¡/ce:title¿.

Haliassos, M. & Bertaut, C. C. (1995). Why do so few hold stocks? *the economic Journal*, (pp. 1110–1129).

Haliassos, M. & Michaelides, A. (2003). Portfolio choice and liquidity constraints*. *International Economic Review*, 44(1), 143–177.

Hall, B. J. & Liebman, J. B. (1998). Are ceos really paid like bureaucrats? *The Quarterly Journal of Economics*, 113(3), 653–691.

Haugh, D., Ollivaud, P., & Turner, D. (2009). *The macroeconomic consequences of banking crises in OECD countries*. Technical report, OECD Publishing.

Heaton, J. & Lucas, D. (2000). Portfolio choice and asset prices: The importance of entrepreneurial risk. *The Journal of Finance*, 55(3), 1163–1198.

Hodrick, R. J. & Prescott, E. C. (1997). Postwar us business cycles: an empirical investigation. *Journal of Money, credit, and Banking*, (pp. 1–16).

Iacoviello, M. (2008). Household debt and income inequality, 1963–2003. *Journal of Money, Credit and Banking*, 40(5), 929–965.

Jäntti, M. & Jenkins, S. P. (2010). The impact of macroeconomic conditions on income inequality. *The journal of economic inequality*, 8(2), 221–240.

Jappelli, T., Pagano, M., & di Maggio, M. (2010). *Households Indebtedness and Financial Fragility*. Working paper, Centre for Studies in Economics and Finance (CSEF), University of Naples, Italy.

Jappelli, T. & Pistaferri, L. (2010). *The Consumption Response to Income Changes*. Working Paper 15739, National Bureau of Economic Research.

Jappelli, T. & Pistaferri, L. (2013). *Fiscal Policy and MPC Heterogeneity*. Working paper, Centre for Studies of Economics and Finance.

Jenkins, S. P., Brandolini, A., Micklewright, J., & Nolan, B. (2013). *The Great Recession and the distribution of household income*. Oxford University Press.

Kaldor, N. (1957). A model of economic growth. *The economic journal*, 67(268), 591–624.

Kaplan, G. & Violante, G. L. (2011). *A model of the consumption response to fiscal stimulus payments*. Technical report, National Bureau of Economic Research.

Kaplan, S. N. & Rauh, J. (2010). Wall street and main street: What contributes to the rise in the highest incomes? *Review of Financial Studies*, 23(3), 1004–1050.

Keynes, J. M. (1939). Mr. keynes on the distribution of incomes and propensity to consume: A reply. *The Review of Economics and Statistics*, 21(3), 129–129.

Krugman, P. (2010). Inequality and crises. *New York Times blog" The Conscience of a liberal,(June), http://krugman. blogs. nytimes. com/2010/06/28/inequality-and-crises*.

Kumhof, M., Lebarz, C., Ranciere, R., Richter, A., & Throckmorton, N. A. (2012). Income inequality and current account imbalances.

Kumhof, M. & Ranciere, R. (2010). Inequality, leverage and crises. *IMF Working Papers*, (pp. 1–37).

Laeven, L. & Valencia, F. (2008). Systemic banking crises: a new database. *IMF Working Papers*, (pp. 1–78).

Laeven, L. & Valencia, F. (2010). *Resolution of Banking Crises: The Good, the Bad, and the Ugly*. Working paper, International Monetary Fund.

Laeven, L. & Valencia, F. (2012). *Systemic banking crises database: An update*. Working Paper 12/163, International Monetary Fund.

Leigh, A. (2007). How closely do top income shares track other measures of inequality? *The Economic Journal*, 117(524), F619–F633.

Lucchino, P. & Morelli, S. (2012). Inequality, debt and growth. *Report for the Resolution Foundation*.

Mian, A. R. & Sufi, A. (2009). *House Prices, Home Equity-Based Borrowing, and the U.S. Household Leverage Crisis*. Working Paper 15283, National Bureau of Economic Research.

Milanovic, B. (2009). Two views on the cause of the global crisis? *YaleGlobal Online. http://yaleglobal. yale. edu/content/two-views-global-crisis*.

Miller, M. H. & Modigliani, F. (1961). Dividend policy, growth, and the valuation of shares. *the Journal of Business*, 34(4), 411–433.

Mishkin, F. S. & White, E. W. (2003). *US Stock Market Crashes and Their Aftermath: Implications for Monetary Policy*. Cambridge, MIT Press.

Morelli, S., Smeeding, T., & Thompson, J. (forthcoming). Post-1970 trends in within-country inequality and poverty. *Handbook of Income Distribution*, Volume 2, Elsevier. Atkinson and Bourguignon eds.

Neal, T. (2013). Using panel co-integration methods to understand rising top income shares. *The Economic Record*, 89(284), 83–98.

Nolan, B. (1986). Unemployment and the size distribution of income. *Economica*, 53(212), pp. 421–445.

Nolan, B. (1987). Cyclical fluctuations in factor shares and the size distribution of income. *Review of Income and Wealth*, 33(2), 193–210.

Parker, J. A. (2000). *Spendthrift in America? On Two Decades of Decline in the U.S. Saving Rate*, (pp. 317–387). MIT.

Parker, J. A. & Vissing-Jorgensen, A. (2009). Who bears aggregate fluctuations and how? *The American Economic Review*, 99(2), 399–405.

Parker, J. A. & Vissing-Jorgensen, A. (2010). *The Increase in Income Cyclicality of High-Income Households and its Relation to the Rise in Top Income Shares*. Working Paper 16577, National Bureau of Economic Research.

Pasinetti, L. L. (1962). Rate of profit and income distribution in relation to the rate of economic growth. *The Review of Economic Studies*, 29(4), 267–279.

Perotti, R. (1996). Growth, income distribution, and democracy: what the data say. *Journal of Economic growth*, 1(2), 149–187.

Persson, T. & Tabellini, G. (1991). *Is Inequality Harmful for Growth? Theory and Evidence*. Working Paper 3599, National Bureau of Economic Research.

Pesaran, M. & Smith, R. (2012). Counterfactual analysis in macroeconometrics: An empirical investigation into the effects of quantitative easing.

Pesaran, M. H. (2006). Estimation and inference in large heterogeneous panels with a multifactor error structure. *Econometrica*, 74(4), 967–1012.

Pesaran, M. H. & Smith, R. (1995). Estimating long-run relationships from dynamic heterogeneous panels. *Journal of econometrics*, 68(1), 79–113.

Philippon, T. & Reshef, A. (2007). Skill biased financial development: education, wages and occupations in the us financial sector.

Piketty, T. & Saez, E. (2003). Income inequality in the united states, 1913–1998. *The Quarterly Journal of Economics*, 118(1), 1–41.

Piketty, T. & Saez, E. (2006). The evolution of top incomes: A historical and international perspective. *American Economic Review*, 96(2), 200–205.

Piketty, T. & Saez, E. (2012). Top incomes and the great recession: Recent evolutions and policy implications. In *13th Jacques Polak Annual Research Conference, Washington, DC- November* (pp. 8–9).

Piketty, T., Saez, E., & Stantcheva, S. (2011). *Optimal Taxation of Top Labor Incomes: A Tale of Three Elasticities*. Working Paper 17616, National Bureau of Economic Research.

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

Reinhart, C. M. (2010). *This Time is Different Chartbook: Country Histories on Debt, Default, and Financial Crises*. Working Paper 15815, National Bureau of Economic Research.

Reinhart, C. M. & Rogoff, K. (2009). *This time is different: Eight centuries of financial folly*. Princeton University Press.

Reinhart, C. M. & Rogoff, K. S. (2008). *This Time is Different: A Panoramic View of Eight Centuries of Financial Crises*. Working Paper 13882, National Bureau of Economic Research.

Roine, J., Vlachos, J., & Waldenström, D. (2009). The long-run determinants of inequality: What can we learn from top income data? *Journal of Public Economics*, 93(7), 974–988.

Roine, J. & Waldenström, D. (2011). Common trends and shocks to top incomes: a structural breaks approach. *Review of Economics and Statistics*, 93(3), 832–846.

Romer, C. D. & Romer, D. H. (1989). Does monetary policy matter? a new test in the spirit of friedman and schwartz. In *NBER Macroeconomics Annual 1989, Volume 4* (pp. 121–184). MIT Press.

Romer, D. (1996). *Advanced Macroeconomics*. Third Edition. Boston: The McGraw-Hill Companies.

Rothschild, M. & Stiglitz, J. E. (1970). Increasing risk: I. a definition. *Journal of Economic theory*, 2(3), 225–243.

Saez, E. (2004). Reported incomes and marginal tax rates, 1960-2000: evidence and policy implications. In *Tax Policy and the Economy, Volume 18* (pp. 117–174). MIT Press.

Saez, E. (2012). Striking it richer: the evolution of top incomes in the united states (updated with 2009 and 2010 estimates). *University of California, March*, 2.

Saez, E., Slemrod, J., & Giertz, S. H. (2012). The elasticity of taxable income with respect to marginal tax rates: A critical review. *Journal of Economic Literature*, 50(1), 3–50.

Sialm, C. (2009). Tax changes and asset pricing. *The American Economic Review*, (pp. 1356–1383).

Simons, H. C. (1938). Personal income taxation: The definition of income as a problem of fiscal policy.

Slemrod, J. (1996). *Tax progressivity and income inequality*. Cambridge University Press.

Slemrod, J. (2000). Does atlas shrug?: The economic consequences of taxing the rich. Harvard University Press.

Sprague, O. M. W. (1915). the crisis of 1914 in the united states. *The American Economic Review*, 5(3), 499–533.

Stiglitz, J. (2009). Joseph stiglitz and why inequality is at the root of the recession. *Next Left website*, 9.

Stiglitz, J. E. (1969). Distribution of income and wealth among individuals. *Econometrica: Journal of the Econometric Society*, (pp. 382–397).

Stiglitz, J. E. (2012). Macroeconomic fluctuations, inequality, and human development. *Journal of Human Development and Capabilities*, 13(1), 31–58.

Thompson, J. & Smeeding, T. M. (2013). *Country case study - USA*, (pp. 202–233). In Jenkins et al. (2013).

Van de Ven, J. (2011). Expenditure and disposable income trends of uk households: Evidence from micro-data. *National Institute Economic Review*, 218(1), R44–R57.

Van Treeck, T. (2013). Did inequality cause the us financial crisis? *Journal of Economic Surveys*.

Viceira, L. M. (2001). Optimal portfolio choice for long-horizon investors with nontradable labor income. *The Journal of Finance*, 56(2), 433–470.

Voitchovsky, S. (2005). Does the profile of income inequality matter for economic growth? *Journal of Economic Growth*, 10(3), 273–296.

Williamson, J. G. (2002). Land, labor, and globalization in the third world: 18701940. *The Journal of Economic History*, 62, 55–85.

Wolff, E. N. & Zacharias, A. (2009). Household wealth and the measurement of economic well-being in the united states. *The Journal of Economic Inequality*, 7(2), 83–115.

Wood, A. (1975). *A theory of profits*. Cambridge University Press (Cambridge Eng. and New York).