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Income inequality and redistribution in the aftermath of the 2007-2009 crisis: the US case*

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Abstract

This paper provides a detailed empirical assessment of the evolution of income inequality and the redistributive effects of the tax and transfer system following the 2007-2008 crisis. It focuses on the US case, drawing on data from the Current Population Survey for the period 2007-2012. Contrary to most existing studies, it uses of a wide range of inequality indicators and looks in detail at several sections of the income distribution, allowing for a clearer picture of the heterogeneous consequences of the crisis. Furthermore, it analyses the contribution of different types of taxes and transfers, beyond the overall cushioning effect of the system, which allows for a more refined assessment of its effectiveness. Results show that although the crisis implied income losses across the whole income distribution, the burden was disproportionately born by low to middle income groups. Income losses experienced by richer households were relatively modest and transitory, while those experienced by poorer households were not only strong but also highly persistent. The redistributive system had a crucial role in taming the increase in income inequality in the immediate aftermath of the crisis, and during the GR years, particularly cash transfers. After 2010, however, its effect became weaker and income inequality experienced a new surge. The findings of this paper contribute to a better understanding of the distributional consequences of aggregate crises and the role of tax and transfer policies in stabilising the income distribution in a crisis aftermath.

Keywords: Crisis, Gini, Income, Inequality, Income tax, Low income, Personal Income Distribution, Redistribution, Safety net, Transfers

JEL codes: D31, E32, H24, I31, I32, I38

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1 Introduction

Macroeconomic shocks such as the 2007-2008 financial and economic crisis can have far-reaching effects on the distribution of resources at both the individual and household levels (Krueger, Perri, Pistaferri and Violante (2010), Heathcote, Perri and Violante (2010*a*), Heathcote, Perri and Violante (2010*b*)). The possibility that these distributional effects may in turn have non-negligible implications for the recovery of the aggregate economy from the crisis has recently gained attention (Stiglitz (2013), Cynamon and Fazzari (2014)). If a crisis-led surge in distributional imbalances can feedback into an anemic behaviour of economic activity, then redistributive policies, aimed at promoting a stabilisation of the income distribution, may also have an important macro-stabilisation role. In this case, a thorough assessment of the dynamics of the income distribution following a crisis and the relevance of strong redistributive policies is crucial for the design of well-informed and effective crisis-coping policies.

This paper takes these considerations seriously, providing empirical evidence on one important case study: the 2007-2008 crisis in the US. It offers detailed insights into the distributional effects of the crisis and the cushioning role of the tax and transfer system, drawing on data from the Current Population Survey (CPS), for the period between 2007 and 2012. Contrary to most existing studies, it makes use of a wide range of inequality indicators and looks in detail at several sections of the income distribution, allowing for a clearer picture of the heterogeneous consequences of the crisis. Furthermore, it analyses the contribution of different types of taxes and transfers, together with a decomposition into its main drivers, beyond the overall cushioning effect of the system, giving a more refined assessment of its effectiveness. In addition, it provides more up to date estimates, which proves to be crucial in obtaining a complete vision of the evolution of inequality and redistribution following the crisis. Inequality developments are assessed through the use of multiple indicators namely: summary measures given by the Gini index and percentiles ratios; behaviour of different income percentiles; evolution of average income and income shares for different income groups. Redistribution measures are obtained through a comparison of all these indicators applied to income measures with and without several types of taxes and transfers, and through a Gini-based inequality decomposition. The drivers of redistribution are estimated based on a decomposition into a progressivity, size and re-ranking effects.

Several interesting findings come out of the analysis. Firstly, the crisis had dramatic distributional consequences, determining an expressive increase in market income inequality. Although there were income losses across the whole income distribution, the burden was disproportionately

born by low to middle income groups. Income losses experienced by richer households were relatively modest and transitory, while those experienced by poorer households were not only strong but also highly persistent. Secondly, the tax and transfer system had a crucial role in cushioning the negative distributional impacts of the crisis, with disposable income inequality increasing by much less than market income inequality. Several instruments played an important role, but cash transfers had the highest equalising effect. Thirdly, despite their significant action, redistributive mechanisms were not enough to fully prevent a widening of the income distribution. Five years after the start of the crisis, income inequality was higher even after taking into account the effect of taxes and transfers. The redistributive action of the system was marked by two different phases: the years 2008 and 2009, when it was strong enough to prevent a widening of the disposable income distribution; the years between 2010 and 2012, when it was not, with disposable income inequality registering a positive growth, higher than the one of market income inequality. Although a strict causal analysis cannot be drawn in the context of this paper, these developments did coincide with two distinct phases in the setting of tax and transfer policies: the first two post-crisis years, where these policies were strongly reinforced; the period from then onwards, where they were gradually phased out.

The findings of this paper contribute to a better understanding of the distributional consequences of aggregate crises and the cushioning effects of tax and transfer policies. They set the stage for the study of how distributional developments following a crisis may influence the stabilisation of the aggregate economy, and whether redistributive policies may play an important role in shaping this relationship. The bottom line of this work is to contribute to the ongoing discussion on the importance of considering distributional aspects when targeting macroeconomic objectives, in particular the recovery from an aggregate crisis. As discussed in Lucas (2003) and Heathcote, Storesletten and Violante (2009), developments like these are key for the macroeconomics discipline as they set the road for the study, in a unified way, of the distributional impacts of aggregate stabilisation policies and the aggregate implications of redistributive policies. Only in this way can the possible trade-offs and complementarities between these two types of policies be assessed, such that true welfare-improving policies can be designed and implemented.

The remainder of the paper is organised as follows: Section 2 reviews related literature and presents the main contributions of the paper; Section 3 describes important changes that occurred in the American tax and transfer system following the crisis; Section 4 introduces the data and methods used; Section 5 presents the results; Section 6 concludes and discusses some implications.

2 Related literature and main contributions

The behaviour of income inequality in times of crisis and the mitigating effect of redistributive policies have by now received a fair amount of attention in the empirical literature.

Most studies find that crises are typically periods marked by sharp increases in earnings inequality. As discussed in Krueger et al. (2010), "one of the strongest evidence of the connection between inequality and the macroeconomy appears during recessions, when the overall macroeconomic activity slows down and, at the same time, inequality in many variables changes". In all the nine countries considered in this study, a common pattern that emerges is that "during bad times earnings inequality at the bottom of the distribution increases sharply", which is largely attributed to the rise in unemployment that pushes a larger number of individuals to the bottom of the earnings distribution. Focusing on the US, Heathcote et al. (2010a) and Heathcote et al. (2010b) also present evidence that recessions are times when earnings inequality widens sharply, with the bottom percentiles of the earnings distribution suffering the largest and more persistent losses. Hoynes and Bitler (2015) show that lower income-to-poverty levels are more affected by recessions than are higher income-to-poverty levels (the income-to-poverty ratio is defined as the ratio between individual income and the national poverty threshold).

The extent to which the increase in earnings inequality translates into a rise in disposable income inequality seems to considerably depend on country specific government policies. However, a general pattern emerges that, as put in Krueger et al. (2010), "in all countries and in all recessions, inequality in disposable income during the recession rises less than inequality in earnings", indicating that the tax and transfer system has typically an important mitigating effect. For the US, Heathcote et al. (2010b) find that "public transfers play a very important role in compressing inequality at the bottom of the income distribution" and "serve as a powerful stabilizing antidote to countercyclical surges in pre-government income inequality". Taxes are also found to have a significant role. Heathcote et al. (2010a) present further evidence that the rise in earnings inequality that occurs in recessions is substantially tamed by the tax and transfer system.

Focusing on the case of the 2007-2008 financial and economic crisis and subsequent recession and recovery periods, the evidence is somewhat mixed. In particular, there seems to be a disparity in results depending on the data, income definitions and inequality measures used as well as on the time frame considered. Two broad phases can be identified: a first one, the so-called "recession years" (2008-2009); and a second one, the so-called "recovery years" (from 2010 onwards).

Concerning the first phase, studies using survey data and inequality measures such as the Gini

coefficient, the 90/10 percentile ratio or the variance of the logarithm of income, typically find an expressive increase in market income inequality (Perri and Steinberg (2012), OECD (2013), Meyer and Sullivan (2013), Thompson and Smeeding (2013), Hellebrandt (2014)). Considering data on 17 OECD countries, OECD (2013) reports that market income inequality (measured by the Gini index) increased by more between 2007 and 2010 than what had been observed in the previous 12 years. In several studies, the bottom of the earnings distribution is pointed out as having been hit particularly hard (Meyer and Sullivan (2013), Perri and Steinberg (2012)). Considering the period during and immediately after the Great Recession, Perri and Steinberg (2012) find that "In terms of earnings, the bottom 20% of the US population has never done so poorly, relative to the median, during the whole postwar period.". In contrast, studies using administrative data and top income shares as inequality measures (Piketty and Saez (2013), Saez (2013), Mishel and Finio (2013)), find a fall in market income concentration during the first two post crisis years. Saez (2013) reports a decrease in the top percentile income share from 23.5 to 18.1 percent between 2007 and 2009, while Mishel and Finio (2013) find a drop in wages of the top percentile of 15.6 percent, for the same period.

The effect of tax and transfer policies during this period is also not clear-cut. Most studies indicate that the joint action of automatic stabilisers and the economic stimulus measures taken between 2008 and 2009 in many countries had a crucial role in offsetting increases in market income inequality (Perri and Steinberg (2012), OECD (2013), Thompson and Smeeding (2013), Armour, Burkhauser and Larrimore (2013a), Thompson and Smeeding (2014)). They find that disposable income inequality barely increased or even slightly decreased. The extent of the offset, however, seems to have varied across groups. For example, redistributive policies appear to have been successful at shielding the incomes of the elderly but not those of the working-age population (Thompson and Smeeding (2013)). Furthermore, making use of panel data for 2006 and 2008, Perri and Steinberg (2012) show that households who were already in the bottom of the distribution in 2006 did experience significant losses in their disposable income, suggesting that cross-section analysis may be undermined by important composition effects, understating the true redistributive effects of the GR.

When considering the second phase, a clearer picture arises, with the literature almost unanimously pointing to an unequal recovery. Looking at the shares of money income by quintile, in the US, Thompson and Smeeding (2014) show that the share received by the bottom three quintiles of the distribution declined steadily between 2007 and 2012, while the share of the fourth quintile

remained approximately the same and the one of the top quintile experienced an expressive rise. Saez (2013) finds that between 2009 and 2012 US top 1% incomes grew by 31.4% while bottom 99% incomes grew by only 0.4%. By 2012, top 1% incomes were close to fully recovering from the losses suffered during the GR, while the bottom 99% incomes had hardly started to recover. He discusses that, based on the US historical record, falls in income concentration due to economic downturns are temporary unless drastic regulation and tax policy changes are implemented to prevent income concentration from bouncing back. In an interesting comparison with the Great Depression (GD), he states that such policy changes took place after the GD during the New Deal permanently reducing income concentration until the 1970s, while allowing for a continued economic growth. He contrasts this with the policy changes that took place coming out of the GR, which although not negligible were relatively more modest.

Indeed, some studies point to a muting of the positive offsetting effects of tax and transfer policies from the end of 2009 onwards (Armour et al. (2013a), Jenkins, Brandolini, Micklewright and Nolan (2013)). Armour et al. (2013a) discuss that although stimulus programs regarding the tax code and public transfers managed to substantially offset the loss of market income for middle and lower income Americans in 2008 and 2009 these effects "were of a temporary nature": 2009 represented the start of the withdrawn of tax stimulus for the middle of the distribution and from 2010 to 2011 tax and transfer stimulus measures were further scaled back. They suggest that these shifts may have been done too prematurely, at a time when the bottom half of the distribution was still in an overall vulnerable position. Focusing on Europe, Jenkins et al. (2013) speculate (based on preliminary data) that the post-2009 distributional impacts of the GR are likely to have been considerably larger, in the context of the fiscal consolidation plans undertaken in several countries.

The present work draws on the analysis done in these studies but extends it in several ways. Firstly, it makes use of a wide range of inequality indicators, considering not only summary measures, as typically done, but also looking in detail at developments in different sections of the income distribution, which allows for a clearer understanding of the heterogeneous effects of the crisis. Secondly, it analyses the contribution of different types of taxes and transfers, together with a decomposition into its main drivers, beyond the overall cushioning effect of the system, which allows for a more refined assessment of its effectiveness. Thirdly, it gives an informative description of the evolution of the US tax and transfer system following the crisis, including the main policy actions taken by the government, which allows for a better understanding of

the factors underlying the obtained redistribution estimates. Fourthly, it considers the whole population, including individuals with zero earnings and the elderly, which is essential to capture the effect of important parts of the tax and transfer system, such as unemployment benefits and pensions. Finally, it provides more up to date estimates than most studies, which allows for a longer-term view on the persistence of the distributional effects of the crisis and the effectiveness of the cushioning action of the tax and transfer system. This provides useful information for the development of sound and effective policy actions following a crisis, rooted in a thorough understanding of its relevance and consequences.

3 The US tax and transfer system in the aftermath of the crisis

Several important changes were introduced to the US tax and transfer system, following the outburst of the 2007-2008 crisis. Although an exhaustive description of these changes is beyond the scope of this study, a summary of the main ones is provided in this section, which is useful for a better understanding of the results presented in Section 5.

The first major component of the crisis-coping policy mix was the Economic Stimulus Act (ESA) of 2008 (enacted February 2008). This was an extraordinary stimulus package, designed to promote spending by consumers and businesses during 2008, using targeted individual tax rebates to low and middle-income US taxpayers and targeted tax incentives to private companies. Tax rebates created by the law were paid to individual US taxpayers who filed tax returns concerning the year 2007 and had a taxable income of at least \$3000. The value of the rebate ranged between \$300 (\$600 for joint filers) and \$600 (\$1200 for joint filers), depending on the individual's 2007 income value, with phase out starting at \$75000 (\$150000 for joint filers). In addition to their individual payment, eligible taxpayers received \$300 per dependent child under the age of 17. People with no net tax liability were still eligible to receive a rebate, provided that they met the minimum qualifying income of \$3000 per year. These low income individuals were required to file a return to receive the payment, even if they would not be required to do so for income tax purposes. The total cost of this bill was projected at \$152 billion for 2008 ¹.

Another important initiative was the Food, Conservation and Energy Act (FCEA) of 2008 (enacted May 2008), which followed the 2002 Farm Bill, focusing on agricultural subsidies, energy, conservation, nutrition and rural development. It included significant increases in food assistance programs for low-income families, in particular the Food Stamp Program (SNAP) and the Emer-

¹<https://www.cbo.gov/sites/default/files/hr5140pgo.pdf>.

gency Food Assistance Program (TEFAP). The bill increased both funding and access to these programs. In the case of SNAP, some important changes were: increase in the minimum amount of income that is ignored when benefits are calculated; discount of all income spent on dependent care when calculating benefits; relaxation of eligibility rules relating to liquid assets such as retirement, savings and education savings; expansion of transitional benefits for those leaving public assistance programs allowing states to provide eligibility for up to 5 months' transitional benefits. The overall cost of the Act was estimated at \$258 billion over a five year period.

Besides the ESA and the FCEA, the federal government also introduced the Emergency Unemployment Compensation (EUC) program in 2008, which provided additional unemployment benefits to eligible claimants following exhaustion of their regular 26 weeks benefits. The program began in July 2008 and ended up being extended several times, with the final expiration date having been December 2013. However, as described in Rothstein (2011), the program proceeded in "fits and starts" after its introduction. It was left to expire in several occasions, notably throughout 2010, and was designed in a way such that actual benefit durations were often well below statutory benefit durations, an effect that was stronger from 2010 onwards.

A second wave of stimulus measures was brought by the American Recovery and Reinvestment Act (ARRA) of 2009 (also known as the Stimulus or the Recovery Act, enacted February 2009). Its main objectives were to save and create jobs, provide temporary relief programs for those most impacted by the recession and invest in infrastructure, education, health and renewable energy. The Act included federal tax incentives, an expansion of unemployment benefits and several social welfare provisions. On the benefits side, some of the most significant measures were: an extension of unemployment benefits through December 31; an increase in food stamp benefits through 2011; a provision of temporary welfare payments and of one-time \$250 dollar payments to recipients of Supplemental Security Income, Social Security Insurance, Veterans pension, Railroad retirement or State retirement systems. On the tax incentives side, a main measure was the introduction of a new tax credit, the Making Work Pay (MWP) tax credit, which replaced the one provided by the ESA. It provided a credit of up to \$400 for working individuals with a tax liability (\$800 for joint fillers), with annual taxable income between \$8100 and \$95000 (\$190000 for joint fillers), in both 2009 and 2010, with phaseout starting at \$75000 (\$150000 for joint fillers). Additionally, the ARRA provided: a reduction of the income floor for reciepience of the child tax credit; an increase in the amount of the EITC; the introduction of a new tax credit, the American Opportunity Tax Credit (AOTC), to help students and their families cover the cost of college tuition in 2009 and 2010;

a home energy credit, given to homeowners who made their homes more energy-efficient in 2009 and 2010; an exclusion from taxation of the first \$2400 received by individuals in unemployment compensation, in 2009. The total cost of the package was estimated to be \$831 billion between 2009 and 2019, with more than 90% of it realised by the end of 2011 ².

Additional measures came with the Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010 (also known as the Middle Class Tax Relief Act (MCTRA) of 2010, enacted December 2010). The Act centered on extending for two years (2011 and 2012) the tax cuts defined in the Economic Growth and Tax Relief Reconciliation Act (EGTRRA) of 2001 and the Jobs and Growth Tax Relief Reconciliation Act (JGTRRA) of 2003 (together known as the "Bush tax cuts"), which were set to expire at the end of 2010. The Act also extended some provisions from the ARRA and introduced new ones intended to have an additional stimulatory effect. On the tax side, key aspects of the bill included: extension of the EGTRRA 2001 income tax rates for two years (2011 and 2012); extension of the child tax credit refundability threshold established by the ARRA for two years; extension of ARRA's treatment of the EITC for two years; extension of ARRA's AOTC for two years; temporary one-year (2011) reduction in the FICA payroll tax; end of partial exclusion of unemployment benefits from taxable income. On the benefits side, the agreement provided an additional year (2011) of emergency unemployment insurance benefits at the level established by the ARRA. The overall cost of the Act was estimated at \$858 billion ³.

A final law was the American Taxpayer Relief Act of 2012 (enacted January 2013). It redressed the expiration of some of the "Bush tax cuts", which had already been extended by the 2010 Act. It gave permanence to much of these cuts for low to middle income families, while allowing for their expiration for upper income levels. Furthermore, it: established a phase-out of several tax deductions and credits for tax payers with incomes over \$250000 (\$300000 for joint fillers); extended some credits for poorer families for five years, including the AOTC and the EITC; provided an additional year (2013) expansion of emergency unemployment insurance benefits.

These interventions had a substantial impact on the value of resources available to American citizens during the post-crisis years and should therefore be taken into consideration when attempting to evaluate the income and distributional effects of the crisis and its aftermath.

²<http://www.cbo.gov/sites/default/files/02-22-ARRA.pdf>.

³<http://edition.cnn.com/2010/POLITICS/12/17/tax.deal/>

4 Data and methods

This section presents the main aspects of the data and methods used in this study.

4.1 Data sources and sample selection

This study uses annual data from the Annual Social and EConomic supplement (ASEC) (also known as the March supplement) of the Current Population Survey (CPS), for the period 2007-2012⁴. The CPS is a statistical survey sponsored jointly by the US Census Bureau and the US Bureau of Labor Statistics (BLS), corresponding to the primary source of labor force statistics for the population of the United States. It provides individual and household-level data on a wide range of issues relating to employment and income, as well as sociodemographic conditions.

The sample is representative of the civilian noninstitutional population, including members of the armed forces who live in off-base housing or on base with their families. The sampling is done at the household level, with households selected using a multistage stratified statistical sampling scheme, and interviewed under a 4-8-4 rotating panel design⁵. Each household is interviewed for 4 successive months, then not interviewed for 8 months, then returned to the sample for 4 months after that. While it is sometimes possible to follow households from one year to the next, it is not always possible to match records across consecutive years. Thus, we ignore the limited panel dimension of the CPS, and treat it as a pure cross section.

The basic CPS has a monthly frequency, and focuses on labor force statistics. It considers a sample of approximately 60,000 households. Several supplements complement the basic CPS, containing information on additional topics and in some cases having a different frequency. The ASEC, which has been running since 1962, applies to the sample surveyed in March and extends the basic set of sociodemographic and labour force questions to include detailed questions on income for each household member aged 15 or older. For the ASEC supplement, the basic CPS monthly sample is extended to include an additional 4,500 Hispanic households (since 1976), and an additional 34,500 households (since 2001) as part of an effort to improve estimates of children's health insurance. This constitutes the so-called State Children's Health Insurance

⁴The data was obtained from the Integrated Public Use Microdata Series (IPUMS)-CPS project carried out by the Minnesota Population Center, which provides harmonisation of CPS variables for the period 1962-2012. Official citation reads as: Miriam King, Steven Ruggles, J. Trent Alexander, Sarah Flood, Katie Genadek, Matthew B. Schroeder, Brandon Trampe, and Rebecca Vick. Integrated Public Use Microdata Series, Current Population Survey: Version 3.0. [Machine-readable database]. Minneapolis: University of Minnesota, 2010.

⁵A "household" is defined as all persons, related or unrelated, living together in a dwelling unit. It contrasts with a "tax unit" or "family", defined as all persons living together who are related by blood, marriage or adoption. A household can be composed by more than one tax unit or family.

Program (SCHIP) sample, which is the one used in this study.

The use of survey data, as opposed to administrative data on tax returns, is crucial for this study for two reasons: it allows to capture people at the very bottom of the distribution whose income is typically too low to be taxable and who are therefore not captured in administrative tax returns data; it provides information on transfer payments, which is typically not contained in tax returns data as these are often nontaxable either. One should however keep in mind that, contrary to administrative data that covers the entire population, survey data contains information on only a sample of the population, being subject to sampling variation and often suffering from undersampling/underreporting of very low or high incomes. Notwithstanding, in the case of the CPS and other broadly used surveys, the sampling process is carefully designed to be representative of the whole population and weights are attributed to account for potential underrepresentativeness of certain groups.

The CPS questionnaire directly captures all cash income, including transfers income⁶. Additionally, it provides values or imputations for certain in-kind benefits, including food stamps and energy subsidies. Tax liabilities and credits are not given by direct questioning of respondents. Rather, values for these variables are imputed using the Census Bureau's tax-simulation model, which incorporates information from non-CPS sources, such as the Internal Revenue Service's Statistics of Income series, the American Housing Survey and the State Tax Handbook⁷.

The CPS is subject to two sources of nonresponse: noninterview (when an individual is selected by the sampling procedure but is not captured by the survey) and item nonresponse (when an individual does not know or refuses to provide the answer to a question). To compensate for the first data loss, the weights on noninterviewed households are distributed among interviewed households. To compensate for the second data loss, the Census Bureau imputes missing income data using a "hot deck" procedure which matches individuals with missing observations to others with similar sociodemographic and economic information who did answer the questions. I do not exclude households with imputed income as imputation is widely-used, especially for asset income categories. Dropping households with imputed values would drastically reduce the sample size and call into question the appropriateness of the CPS-provided weights. Therefore, there are no missing values in the sample.

The whole population is considered, as opposed to restricting to, say, households with an employed head (as in most studies focusing on earnings inequality), the working-age population,

⁶The CPS does not provide a measure of capital gains and therefore these cannot be included in the analysis.

⁷Details on the model can be found in O'Hara (2004).

or households with positive earnings (as in some inequality studies). Dropping households with no employed head or non-positive earnings would exclude from the analysis many households that heavily depend on transfers income, in particular unemployment benefits, which is one of the main focus of this study. In the same vein, excluding the elderly population would miss almost all information on retired individuals and consequently on pensions, which is an important element of the transfer system. The option to include children is less straightforward, as they are not income earners by definition. They are, however, individuals benefiting/suffering from the developments concerning their parents income and therefore excluding them would understate the real impacts of income changes in the population as a whole.

Section C of the Appendix presents descriptive statistics concerning the number of observations by year and the sociodemographic characteristics of the individuals in the sample.

4.2 Income measures

The analysis relies on five main aggregate measures of income going from market income to disposable income, by sequentially accounting for four main categories of redistributive mechanisms namely cash transfers, taxes, tax credits and in-kind transfers. Accordingly, income aggregates correspond to:

1. Y^{mark} : Pre-government (or market) income, equal to the sum of earnings, private transfers and net asset income.
2. Y^{trnsf} : Post-cash transfers (or pre-tax) income, equal to the sum of pre-government income and public cash transfers.
3. Y^{tax} : Post-tax income, equal to the difference between post-cash transfers income and taxes.
4. Y^{cred} : Post-tax credits income, equal to the sum of post-tax income and tax credits.
5. Y^{kind} : Post-in-kind transfers (or disposable) income, equal to the sum of post-tax credits income and public in-kind transfers.

Table 1 provides a list of all the components of these five income measures, while Sections B and C of the Appendix provide more detailed explanations and descriptive statistics, respectively. This classification is broadly in line with the ones usually adopted in income distribution studies, although there is not a consensus on the subject, with many aspects being subject to debate (see for e.g. CBO (2011), Burkhauser, Larrimore and Simon (2012) and Armour, Burkhauser

and Larrimore (2013b) for a detailed discussion). An important issue is the inclusion of in-kind transfers in disposable income and, when including them, which ones to consider. Considering in-kind transfers seems natural as it is an important instrument through which the government provides assistance to low-income households, contributing on a regular basis to an enlargement of the households' budget constraint. The problem mostly resides on its measurement, which is less clear-cut and reliable than for cash transfers. This problem is particularly relevant in the case of health related transfers. The only in-kind transfers available in the IPUMS database for the entire period of analysis of this study are nutrition and energy assistance related transfers and therefore we restrict our analysis to these ones ⁸.

Also subject to debate is the classification of pensions as pre-government income or government transfers. Some studies argue that pensions should be considered as "forced savings" destined at intra-personal life-cycle transfers and not as a redistributive mechanism and should therefore be a part of pre-government income. Most studies, however, consider that pensions are an integrant part of the welfare system and should therefore not be treated as pure market income. Although they are indeed mostly designed to redistribute over the lifetime of an individual, they also contain elements of inter-personal redistribution and can substitute for unemployment and related welfare benefits, particularly in crisis times when a phenomenon of early retirement is often observed. I adopt this later perspective, considering pensions a part of the transfer system.

Finally, the classification of tax credits is not without questioning, particularly refundable ones. The debate centers around whether these should be added to cash transfers or deducted from taxes. Here I opt for not doing neither one nor the other and instead consider tax credits separately, as a category on its own.

All income measures are deflated, using the BLS CPI-U series, which converts current dollars to constant 1999 dollars and is provided directly by the Census Bureau, together with all the CPS variables. The analysis is performed at the individual level, using person-equivalised household income measures, with an equivalence scale equal to the square root of the household size⁹. Each equivalised observation is weighted using the CPS March supplement individual weights. The choices of the income unit, unit of analysis and equivalence scales are important issues to be dealt with when performing income distributional analyses and therefore I devote some time to its discussion in Section A of the Appendix, for the interested reader.

⁸Housing subsidies and school lunch subsidies are two other types that are typically considered. In IPUMS, however, they are available only for the period 2010-2012.

⁹Other equivalence scales were applied, namely the OECD equivalence scale and per capita income, which did not alter the results significantly. Results are available upon request.

Table 1: Income variables list

Income concept	Components
<i>(1) Earnings</i>	Labour earnings Self-employment earnings (farm and business)
<i>(2) Private transfers</i>	Child alimony Child support Friends and family assistance Retirement benefits (private) Disability benefits (private) Survivor's benefits (private) Worker's compensation (private) Educational assistance (private) Other sources
<i>(3) Net asset income</i>	Interests Dividends Rents
<i>(4) Pre-government income</i>	<i>(1) + (2) + (3)</i>
<i>(5) Public cash transfers</i>	Social security (SS) Supplemental social security Unemployment benefits Welfare Veteran's compensation Retirement benefits (public, non SS) Disability benefits (public, non SS) Survivor's benefits (public, non SS) Worker's compensation (public) Educational assistance (public)
<i>(6) Post-cash transfers income</i>	<i>(4) + (5)</i>
<i>(7) Taxes</i>	Federal income tax liability State income tax liability Social security payroll deduction (FICA) Federal retirement payroll deduction
<i>(8) Post-tax income</i>	<i>(6) - (7)</i>
<i>(9) Tax credits</i>	Earned income tax credit (EITC) Child tax credit Additional child tax credit Stimulus Making work pay credit
<i>(10) Post-tax credits income</i>	<i>(8) + (9)</i>
<i>(11) Public in-kind transfers</i>	Nutritional assistance (SNAP) Energy assistance (LIHEAP)
<i>(12) Post-in-kind transfers income</i>	<i>(10) + (11)</i>

4.3 Inequality and redistribution analysis

I apply several methods to study the evolution of inequality. I start by considering four summary measures, namely the Gini index and three percentile ratios, the P90P10, the P90P50 and the P50P10. All of these are typically used in inequality studies and provide somewhat complementary information. The Gini index is an "overall" measure of inequality, reflecting the behaviour of the whole income distribution, and being particularly sensitive to asymmetries in the central part of the distribution. It varies between 0 and 1, with 0 corresponding to the lowest level of inequality and 1 to the highest. Percentile ratios focus on two specific sections of the income distribution, providing an idea of how close/distant they are from each other. The P90P10 ratio gives the 90th percentile relative to the 10th, being a measure of the distance between the top and bottom extremes of the distribution; the P90P50 ratio gives the 90th percentile relative to the median, focusing more on disparities at the top half of the distribution; and the P50P10 ratio gives the median relative to the 10th percentile, capturing disparities at the bottom half of the distribution. Other popular methods include the variance of the logarithm of income and entropy indices. These, however, are often incompatible with negative and zero income values and are therefore not applicable to the present study, where these values are not excluded¹⁰.

These measures, although useful to get an overall picture of the evolution of income inequality, do not allow for a deep understanding of movements inside the income distribution. Only by looking in detail at different parts of the distribution can one obtain a comprehensive insight into the disparities of the distributive effects of the crisis and the effectiveness of the redistributive system, which is the main focus of this paper. To achieve this, I look at three types of measures namely: particular sections of the income distribution, specifically percentiles 10, 25, 50, 75 and 90; average income by income group, specifically groups composed by the bottom 10th, 20th and 50th percentiles and the top 50th, 20th and 10th percentiles; income shares by income groups, considering the same groups as for average income. These cover the whole span of the income distribution and allow for a symmetric analysis of the bottom vs the top.

Assessing the redistributive effect of taxes and transfers is a trickier issue. I start by computing the above described inequality measures for all the income variables defined in the previous Subsection and doing a comparison of their accumulated changes between 2007 and 2012, to obtain a first quantitative idea. I then proceed with a formal computation of the overall equalizing

¹⁰Typically these values are excluded in studies focusing on earnings inequality, which restrict the sample to the working population with earnings above a given positive threshold. As noted before, this would not be a good choice in the context of the present study, as it would imply dropping from the sample a large part of individuals who receive transfers from the government.

effect of the redistributive system and the contribution made by each transfer/tax type. Several methods have been proposed over the years including the well-known factor source decomposition, developed by Shorrocks (1982), and the marginal impact decomposition proposed by Lerman and Yitzhaki (1985). No consensus exists on the most appropriate one, with different methods often giving very different results. Here I follow Mahler and Jesuit (2006), Immervoll and Richardson (2011), Caminada and Wang (2011) and Fuest, Niehues and Peichl (2013), among others, applying a sequential decomposition approach to Gini-based inequality measures. I do so for essentially two reasons. Firstly, this approach is based on the Gini index, which, as previously mentioned, allows for the incorporation of negative and zero income values and is the most widely used measure of inequality. Secondly, it provides results that are fairly intuitive and in line with the majority of the evidence in comparable micro studies. For instance, cash transfers are found to have a strong equalising role while in the approach by Shorrocks (1982) they often have an unequalising effect.

The approach decomposes the trajectory of the Gini index from market to disposable income into the contributions of the different types of redistributive instruments by: (1) sequentially applying each instrument to income; (2) computing the corresponding Ginis; (3) comparing the Gini of income including a given instrument with the Gini of income without the instrument. As described in the previous Subsection, I start by adding cash transfers to market income, continue by subtracting taxes, move on by adding tax credits and end by adding in-kind transfers. Formally, consider a population of individuals $i = 1, \dots, n$ and define the income of individual i at time t after tax/transfer type k has been considered, $Y_{i,t}^k$, according to the following general expression:

$$Y_{i,t}^k = Y_{i,t}^{mark} + \sum_{j=trnsf}^k \alpha_j T_{i,t}^j, \quad i = 1, 2, \dots, n \quad , \quad j \in \{trnsf, tax, cred, kind\} \quad (1)$$

where $Y_{i,t}^{mark}$ stands for market income of individual i at time t , $T_{i,t}^j$ stands for the tax/transfer type j paid/received by individual i at time t , and α_j is an indicator equal to 1 for $j \in \{trnsf, cred, kind\}$ and equal to -1 for $j \in \{tax\}$.

The Gini index can then be computed for each of these income measures. For any period t , denote G_t^{mark} the Gini for market income, G_t^k the Gini for income after tax/transfer k , and G_t^{k-} the Gini for income before transfer/tax k , with $k \in \{trnsf, tax, cred, kind\}$. We can then compute several informative indicators of redistribution. The main indicator, providing the basis for all the others, is the Reynolds-Smolensky index (Reynolds and Smolensky (1977)). It constitutes a measure of **absolute redistribution** giving the absolute reduction in the Gini index resulting

from the action of the redistributive system as a whole, AR_t^{all} , or from the action of one particular tax/transfer type, AR_t^k . As put in Immervoll, Lietz, O'Donoghue, Verbist, Levy, Mantovani and Sutherland (2005), it allows to answer the question "starting from a situation without the instrument(s) in question, how much is inequality reduced by introducing it?". Formally, we have:

$$AR_t^{all} = G_t^{mark} - G_t^{kind}, \quad AR_t^k = G_t^{k-} - G_t^k \quad (2)$$

To obtain an idea of how meaningful these values are, it is common to compute them as a percentage of the market income Gini, which indicates what fraction of total market income inequality was "eliminated" due to the redistributive action of the tax and transfer system. These correspond to measures of **relative redistribution** and, analogously to absolute redistribution, can be obtained for the system as a whole, RR_t^{all} , and for each tax/transfer type, RR_t^k . Formally:

$$RR_t^{all} = \frac{AR_t^{all}}{G_t^{mark}}, \quad RR_t^k = \frac{AR_t^k}{G_t^{mark}} \quad (3)$$

The importance of each tax/transfer type in total redistribution can then be computed as the **weight of transfer/tax k in redistribution**, WR_t^k , given by the ratio of the redistributive action of transfer/tax k to the overall redistributive action of the system. Formally:

$$WR_t^k = \frac{AR_t^k}{AR_t^{all}} = \frac{RR_t^k}{RR_t^{all}} \quad (4)$$

It is also useful to look at the evolution of redistribution, which allows us to grasp not only its levels but also its dynamics, given by the annual **change in absolute redistribution**, both overall, ΔAR_t^{all} , and partial, ΔAR_t^k . This is equivalent to the difference between the change in pre tax/transfer Gini and the change in post tax/transfer Gini. Formally:

$$\begin{aligned} \Delta AR_t^{all} &= AR_t^{all} - AR_{t-1}^{all} = \Delta G_t^{mark} - \Delta G_t^{kind} \\ \Delta AR_t^k &= AR_t^k - AR_{t-1}^k = \Delta G_t^{k-} - \Delta G_t^k \end{aligned} \quad (5)$$

And finally, we can compute the **contribution of transfer/tax k to the change in absolute redistribution**, CR_t^k , as the ratio between the change in redistribution done by transfer/tax k and the change in overall redistribution. Formally:

$$CR_t^k = \Delta AR_t^k / \Delta AR_t^{all} \quad (6)$$

A closer look at the redistributive effect of each part of the system can then be obtained by decomposing the partial redistributive effects given by (2) into three elements: a size, a progressivity and a re-ranking effect. This provides a deeper understanding of the drivers of redistribution by each type of tax and transfer, which allows for a more informed choice of policy measures when dealing with a crisis. For e.g., when deciding to reinforce one of two instruments by the same amount, choosing the more progressive one will be most effective in terms of redistribution, all things equal. The **size effect** of tax (transfer) type k is a function of the average tax (transfer) rate, g_t^k , computed as the overall amount of taxes (transfers) paid (received) by all individuals divided by the corresponding total pre-tax (transfer) income. Formally:

$$g_t^k = \sum_{i=1}^n T_{i,t}^k / \sum_{i=1}^n Y_{i,t}^{k-} \quad (7)$$

The **progressivity effect** of tax (transfer) type k , K_t^k , is measured using the Kakwani index (Kakwani (1977)), which is given by the difference between the concentration coefficient of the tax (transfer) relative to pre-tax (transfer) income, $C(T_t^k, Y_t^{k-})$, and the Gini index of pre-tax (transfer) income. It quantifies the departure of the distribution of a tax (transfer) payment from proportionality. A tax (transfer) that is distributed in proportion to pre-tax (transfer) income has zero progressivity (the concentration coefficient equals the Gini index) and has no redistributive effect whatever its size. The Kakwani index ranges from plus 1 (maximum progressivity) to minus 2 (maximum regressivity). Formally:

$$K_t^k = C(T_t^k, Y_t^{k-}) - G_t^{k-} \quad (8)$$

The **re-ranking effect**, R_t^k , is given by the difference between the concentration coefficient of post-tax (transfer) income relative to pre-tax (transfer) income, $C(Y_t^k, Y_t^{k-})$, and the Gini index of post-tax (transfer) income. The re-ranking effect results from the fact that for each Gini measure individuals are ranked according to the corresponding income variable and therefore different rankings are subjacent to the different Ginis. The concentration coefficient takes essentially the same form as the Gini index except that individuals are ranked by their pre-tax (transfer) income. This way, the difference between the two provides the part of the Gini index that can be attributed to the change in ranking, corresponding to the re-ranking effect. Formally:

$$R_t^k = G_t^k - C(Y_t^k, Y_t^{k-}) \quad (9)$$

The redistributive effect of tax (transfer) type k is then given by:

$$AR_t^k = \frac{g_t^k}{1 - g_t^k} K_t^k - R_t^k \quad (10)$$

where $\frac{g_t^k}{1 - g_t^k}$ is the size effect. For a progressive instrument ($K_t^k > 0$), an increase in size increases redistribution, whereas for a regressive instrument ($K_t^k < 0$) it is the other way around. For a given size of the instrument, an increase in progressivity increases its redistributive effect. Finally, a higher re-ranking effect is associated with a smaller level of redistribution.

4.4 Some limitations

Some important limitations of the above described data and methodology should be discussed. Firstly, one must acknowledge that the CPS data is not an adequate source for the study of the very high end of the distribution. It suffers from a host of difficulties, in particular a low response rate of higher income earners and difficulties in properly measuring capital income (which is typically more heavily concentrated at the very top of the income distribution). Furthermore, the CPS data is subject to top-coding, which implies that very high incomes are not registered with their original value but replaced by a maximum value defined by the Census Bureau in each year. An analysis of the behaviour of top incomes is best left to studies undertaken with income tax-filing data (in the line of the works done by Thomas Piketty and co-authors) which are not subject to top-coding (even though they also suffer from tax evasion and avoidance problems). It should be noted, nevertheless, that this fact should not affect any of the main results since if anything it would determine an underestimate of the increase in market income inequality (as a rise in the very top incomes would not be captured) and have a negligible impact in redistribution estimates (as the very top earners are typically less impacted by the benefits system).

Secondly, the choice of order for the sequence of redistributive instruments is not irrelevant for the assessment of their contribution to overall redistribution (naturally, it is not an issue when computing the effect of the system as a whole). In the analysis done here it is implicitly assumed that there are no interactions between the different stages of redistribution. In reality, however, this is often not true as benefits may be taxable and the amount of certain benefits may be determined as a function of after-tax income (this is usually the case when benefits are means-tested). By first adding benefits to market income, for e.g., we may overestimate its effect by not taking into account that a part of those benefits may be absorbed as a tax and not actually be available to the individual. Similarly, by first deducting taxes we may face cases with negative

post-tax income, if these taxes are being charged not on market income but on benefits received through transfers. A technical solution that is sometimes proposed is to average over all possible sequences. This, however, is not satisfactory as the average will still be affected by sequences that are not appropriate given the tax-benefit structure in the country under study. A better approach, and the one chosen here, is to choose a sequence that reflects as far as possible the actual legal sequence implicit in each country's tax-benefit system. In the US, a considerable amount of individuals have zero market income and are taxed on their benefits. It therefore seems more appropriate to consider the effect of taxes on post-benefits income, and not the other way around. Tax credits are often a function of after-tax income and therefore their effect is assessed after taxes have been deducted. In-kind transfers are typically attributed after all cash transfers, taxes and tax credits have been taken into account and therefore it is the last element of the sequence.

Thirdly, the analysis does not disentangle between the effects of discretionary measures and automatic stabilisers. The results obtained express the combined effect of these two aspects of the tax and transfer system, one resulting from a "direct" intervention of the government following the crisis and the other resulting "indirectly" from the existing structure of the system and the evolution of economic activity. Distinguishing the effects of these two sources would require the use of a microsimulation or theoretical model, which is beyond the scope of this study.

Fourthly, possible behaviour responses are not accounted for. Government tax and transfer policies may not only add/subtract to market income directly but change it indirectly, by creating incentives and/or constraints for individual behaviour. In principle, these potential indirect effects should also be taken into account when assessing the redistributive impact of the tax and transfer system. This would require building a counterfactual market income distribution corresponding to the distribution that would exist in the absence of a tax and transfer system, modelling the different behavioural reaction channels to the introduction of the system, and then disentangling the effect in income coming from the system itself from the effect due to a change in behaviour. The approach followed here should thus be considered as a purely budget incidence method, where only the direct effects measured by the amounts of taxes and benefits are considered.

Finally, the work done here is admittedly descriptive and does not claim a perfect identifying strategy allowing for the establishment of a clear causal relationship between the crisis, redistribution, and inequality. Nevertheless, it does seek to provide a detailed picture of developments concerning these aspects and produce some informative and useful evidence.

5 Findings

In this section the main findings of the study are presented and discussed¹¹. Additional results can be found in Section D of the Appendix.

5.1 Impact of the crisis on the market income distribution

I start by investigating the "pure" market distributional effects of the crisis, prior to any redistributive action by the government. Since my interest is mainly in understanding the dynamics of the income distribution following the crisis, I mostly focus on changes in the relevant indicators. The corresponding levels can however all be found in Tables 11 to 14 of the Appendix.

Figure 1 displays the levels and accumulated percentage changes (relative to 2007) of the summary measures of inequality introduced in Subsection 4.3, for market income¹². It undoubtedly shows that market income inequality experienced an expressive rise in the aftermath of the 2007-2008 crisis. Inequality as measured by the Gini coefficient and the P90-P50 ratio rose by approximately 6% and 10%, respectively, between 2007 and 2012, while inequality as measured by the P90-P10 and P50-P10 ratios exhibited particularly expressive increases, of 150% and 130%, respectively. This points to the increase in market income inequality being largely driven by significant losses at the bottom of the distribution, relative to both the middle and the top. Another interesting aspect is that for all indicators most of the increase occurred between 2007 and 2010, comprising the GR years. After 2010, the so-called recovery years, the annual growth rate of these measures was considerably smaller, being even negative in 2012. However, although market income inequality did not increase significantly after 2010 it did not decrease significantly either, pointing to a sizeable persistence of the market distributional impacts of the 2007-2008 crisis.

It is interesting to compare these results with the ones for the previous recession, of 2001. These can be found in Figure 2, which analogously to Figure 1 presents the evolution of inequality between one year before and five years after the start of the recession. The magnitude of the increase in market income inequality is considerably smaller, in accordance with the fact that this was a much less severe recession. However, the pattern is remarkably similar, with the bulk of the increase happening in the first two years and a stabilisation at high levels occurring afterwards and with the percentile ratios P90-P10 and P50-P10 exhibiting the most expressive increases.

¹¹For all the statistics here presented standard errors have been computed by bootstrapping using 1000 repetitions, showing that results are statistically significant. The standard errors and corresponding p-values are not presented here to keep the exposition concise but they are available upon request.

¹²Throughout the analysis I will use as synonyms market income and pre-government income. Likewise, I will use interchangeably disposable income and post-in-kind transfers income.

Figure 1: Summary measures of market income inequality (2007 - 2012)

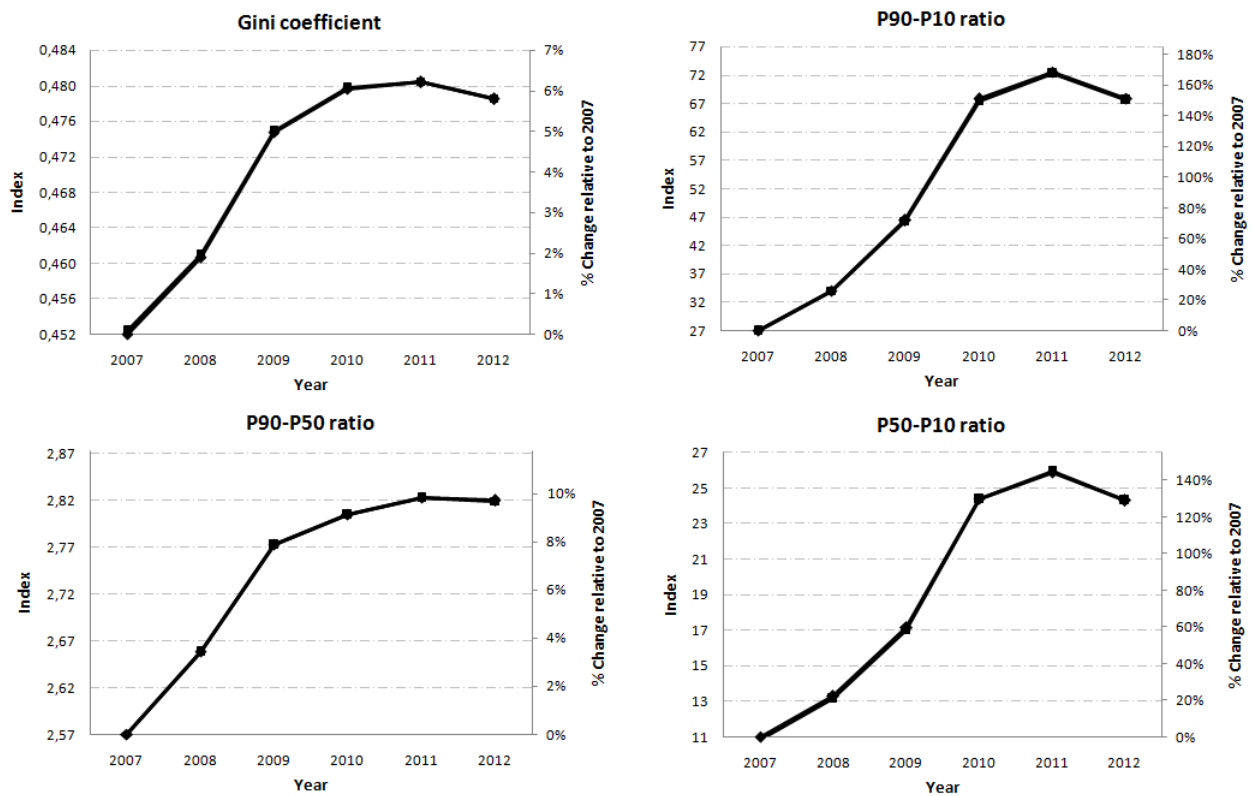
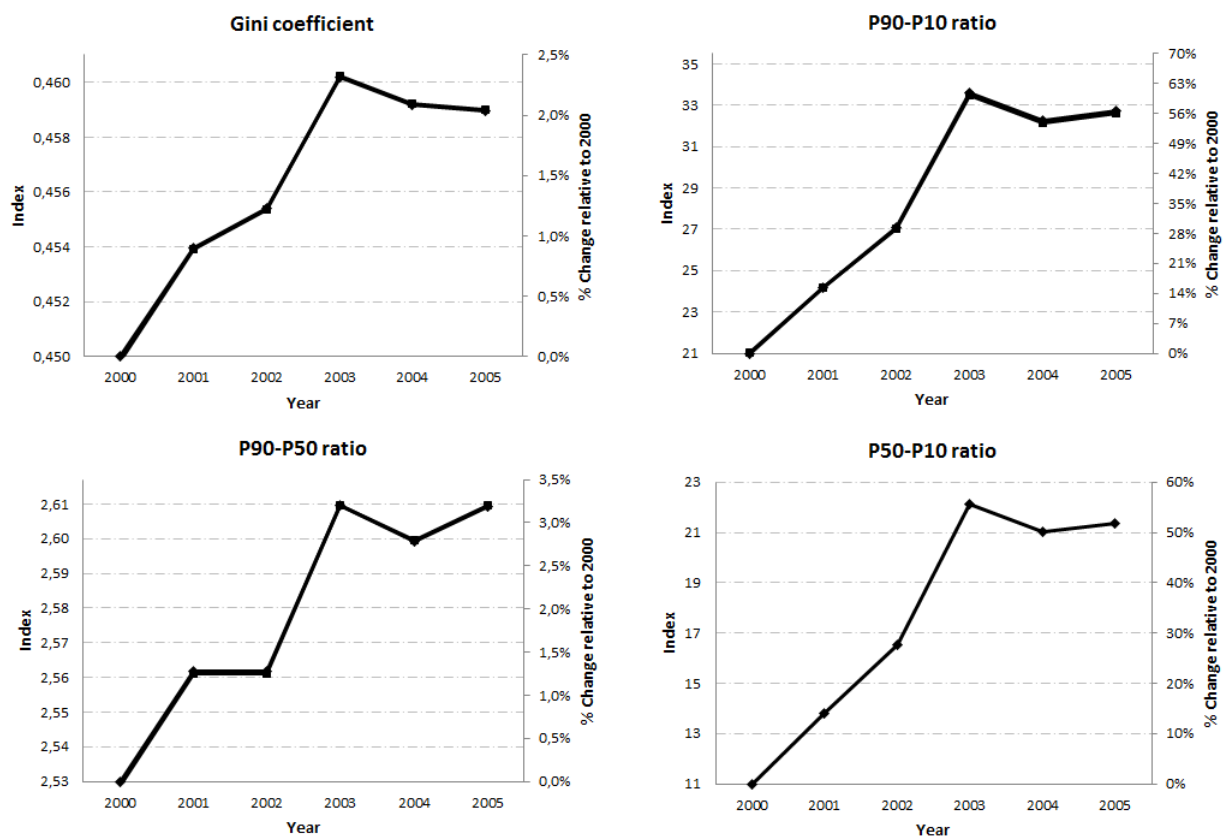
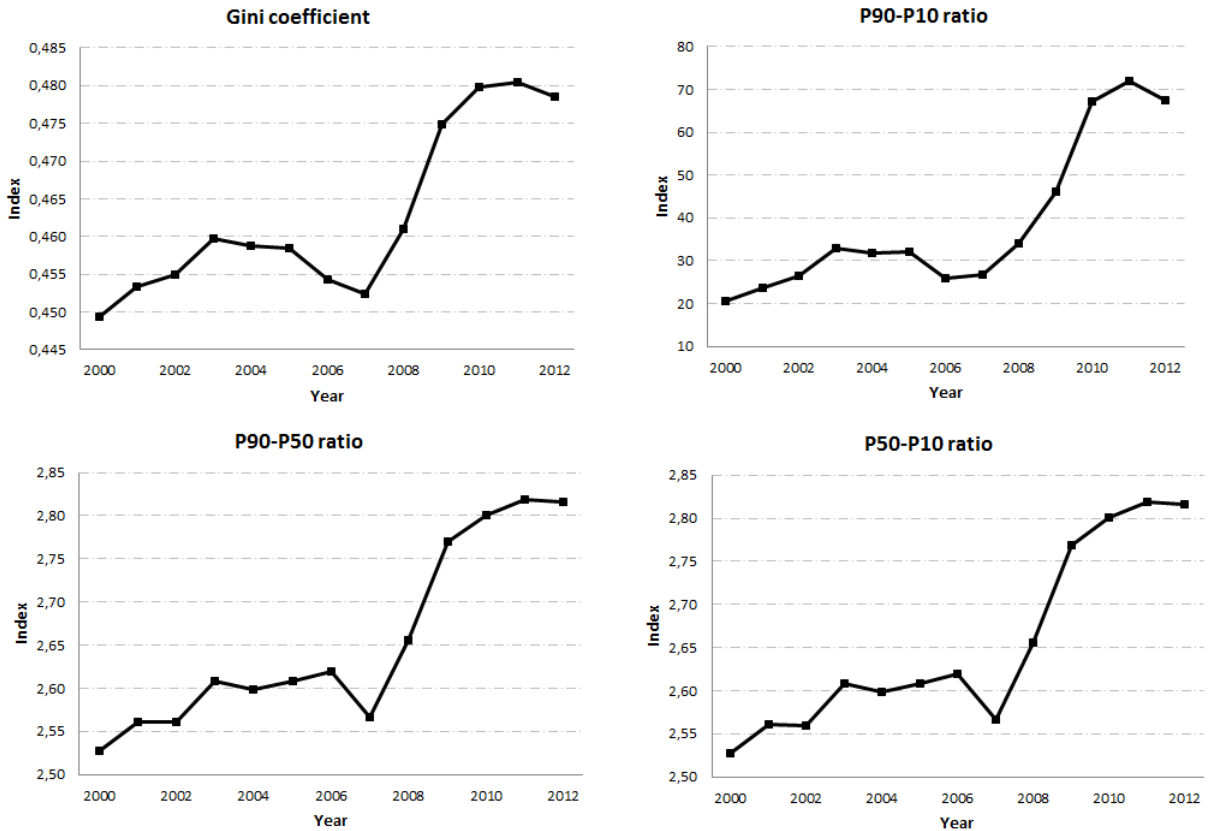


Figure 2: Summary measures of market income inequality (2000 - 2005)



Also informative is to contrast the evolution of market income inequality following the crisis with its evolution in the period preceding the crisis, which can be found in Figure 3. As can be seen, inequality was not increasing in the years before the onset of the crisis and, on the contrary, had been in a downward trend for some years. Although this does not constitute a formal proof that the increase in inequality observed from 2007 onwards was a causal impact of the crisis, it does show that it was not simply a continuation of a previous upward trend.

Figure 3: Summary measures of market income inequality (2000 - 2012)



The preliminary assessment based on summary measures, that the crisis hit harder individuals in the lower parts of the market income distribution, is confirmed by Figures 4 to 6, which provide three distinct approaches to a deeper insight into developments of the income distribution. Figure 4 focuses on the change in percentiles, while Figures 5 and 6 focus on the changes in average income and income shares by income group. Percentiles and income groups were chosen as described in Subsection 4.3¹³. All three figures starkly illustrate a widening of the market income distribution

¹³It should be noted that the individuals belonging to the different percentiles and income groups are not the same across years and therefore comparisons should always be interpreted as "situation of individuals in a given percentile/income group in a given year" versus "situation of individuals in that same percentile/income group in other years". To make the discussion "lighter" I sometimes interpret results as if they were the same individuals but it should be kept in mind that this is not the case.

over the 2007-2012 period. Furthermore, consistently with the evidence from inequality summary measures, it can be seen that the bulk of the losses for all percentiles and income groups occurred between 2007 and 2010, and that 2011 and 2012 brought about only a stabilisation of their market income situation, without any sizeable improvement.

Figure 4 shows that although all percentiles decreased throughout the period the bottom percentiles, particularly the first decile, were hurt disproportionately more. These declines were not only strong but also highly persistent. Indeed, five years after the beginning of the crisis individuals with income in the 10th and 25th percentiles had a market income respectively 60% and 20% lower than the one enjoyed by individuals in those same percentiles prior to the crisis. The 2012 median individual (corresponding to percentile 50) had an income 10% lower than the 2007 median individual. Individuals at the 90th percentile exhibited a loss of only 3.5%.

Figure 5 further corroborates that the bottom of the market income distribution was relatively more penalised by the crisis. By 2012, individuals in the bottom 10, 20 and 50 income groups had respectively an average income 80%, 40% and 20% lower than individuals in those same groups had in 2007. In contrast, individuals in the top 10 and 20 income groups experienced very modest losses, of approximately 5%.

Figure 6 paints a similar picture in what concerns the overall widening of the income distribution. Contrary to the previous two figures, however, the losses of the bottom 50 percentiles are more pronounced than the ones of the bottom 10 and 20 percentiles. It should be noted, however, that this is simply a reflection of the fact that the income shares of the bottom 10 and 20 percentiles were respectively 0.1% and 1.9% in 2007 and therefore, by construction, there could never exist substantial losses. A more interesting comparison is the one between the bottom 50 and top 50 (equally significant in terms of population size) income groups. It shows that not only their market income shares were already extremely unbalanced in the beginning of the crisis (approximately 17% for the bottom 50 and 83% for the top 50¹⁴) but also that this unbalance became even more pronounced over the whole course of the crisis aftermath, with the bottom (top) 50 losing (gaining) 2 percentage points (p.p.) in their share. Also noteworthy is the finding that top market income shares, already very high in 2007, did not experience any fall following the crisis and, conversely, experienced increases amounting to close to 2 p.p. in 2012.

¹⁴These numbers can be found in the Appendix.

Figure 4: Market income percentiles

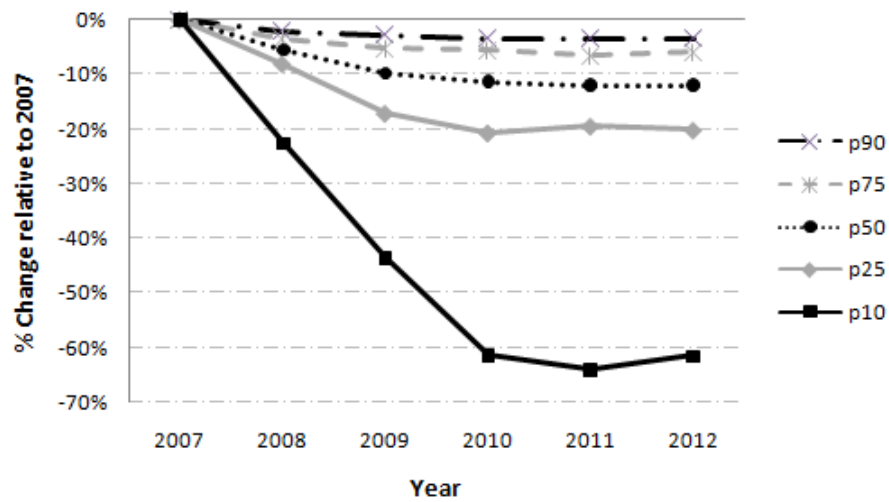


Figure 5: Average market income by income group

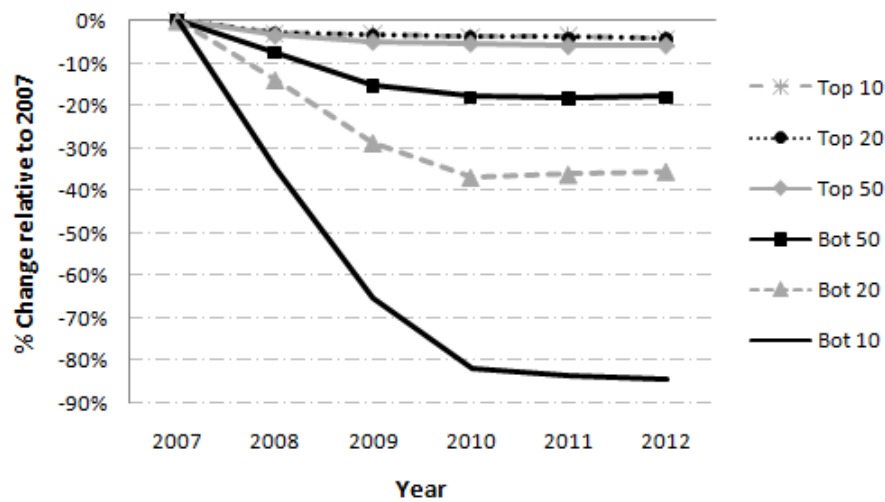
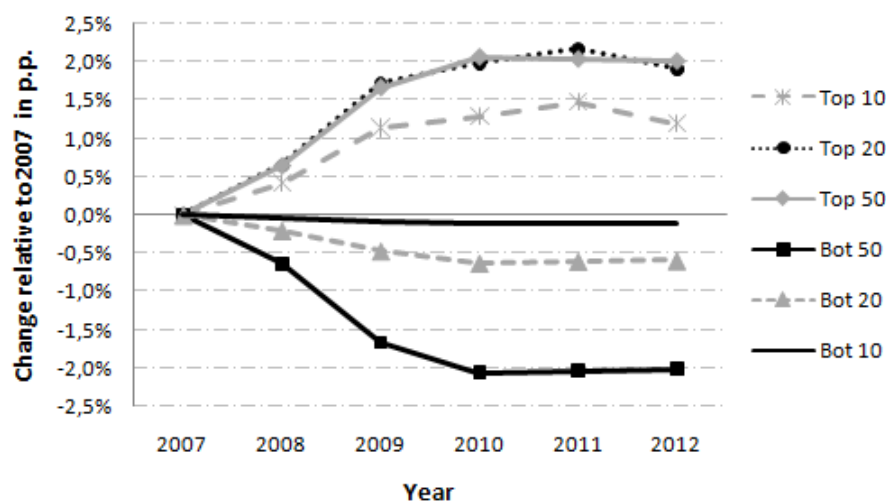


Figure 6: Market income shares by income group



To obtain an even clearer image of movements inside the market income distribution, I look at the relative evolution of different percentiles more in detail. In particular, I consider how the top (P90), middle (P50) and bottom (P10) behaved relative to other sections. Results are presented in Figure 7. As can be seen in the top panel, individuals with income corresponding to the 10th percentile lost relative to all other percentiles during the post-crisis period. These losses were particularly expressive in the case of higher percentiles. The middle panel, in turn, shows that there was a clear widening of the distribution around the median, with percentiles below the P50 losing in relative terms and percentiles above evolving in a relatively better way. Finally, the bottom panel clearly shows that the top of the distribution, as measured by the P90, improved significantly more than all others, particularly when compared to the very bottom.

The analysis done in this subsection showed that the crisis brought about a pronounced spreading of the market income distribution, with sharp losses at the bottom sections, suggesting the need for strong redistributive policies.

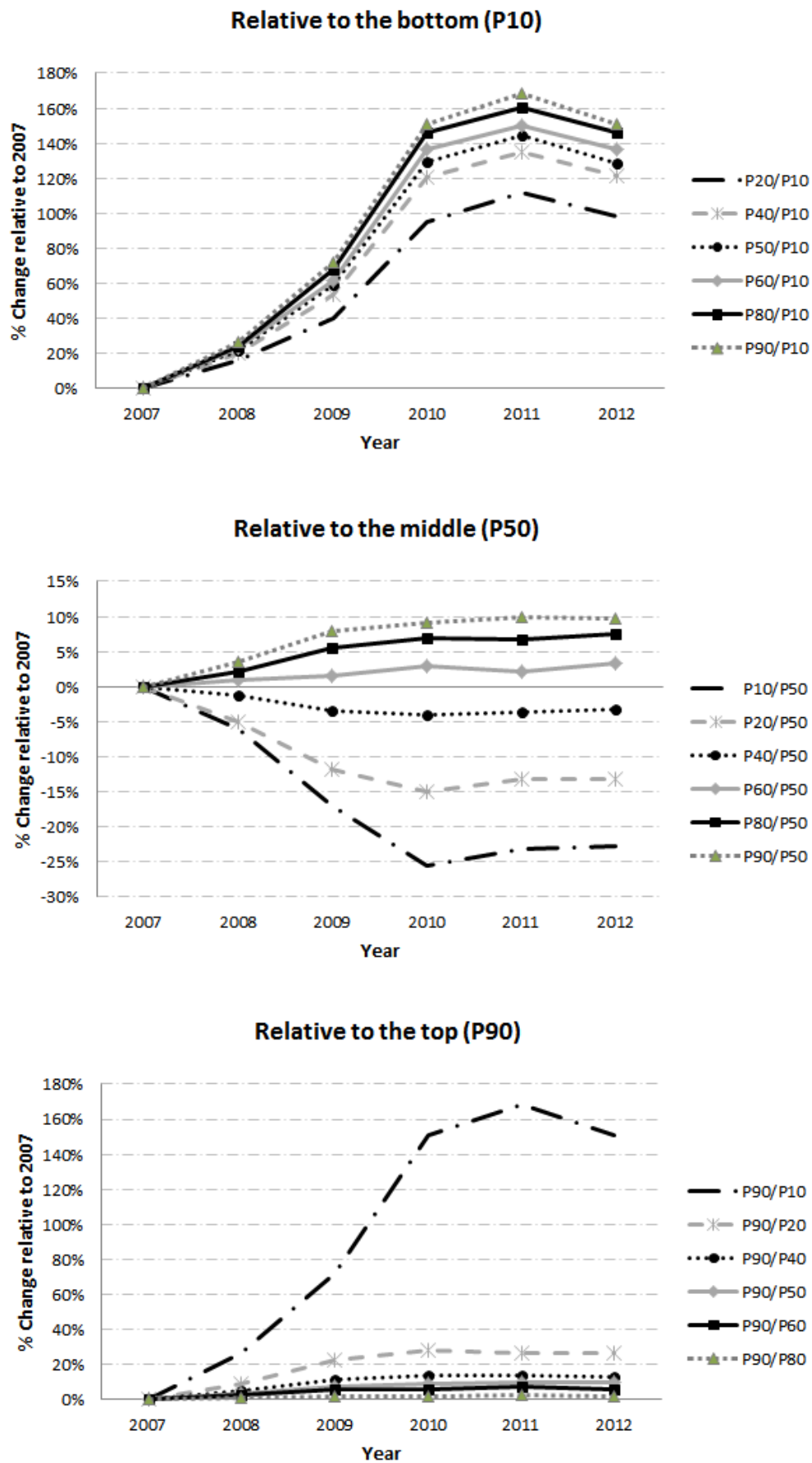
5.2 Size and relevance of the tax and transfer system

Before conducting an assessment of the redistributive action of the tax and transfer system, it is informative to look at its size and relevance. Although budget size is certainly not the single determinant of the redistributive power of a given instrument, it is nevertheless a significant factor to take into account. Importantly, one should note that it is not possible to draw a direct causal relationship between the figures presented here and the discretionary policy measures described in Section 3, as "mechanical" changes induced by automatic stabilisers are also likely to play a crucial role. Indeed, for each individual, changes in tax burdens and benefit entitlements do not only result from policy action but also from the evolution of its market income. Since income taxes depend on pre-tax income levels, higher or lower pre-tax income will alter the amount of taxes to be paid, even if the rate stays the same. Likewise, means-tested benefits will typically increase if an individual's pre-benefit income decreases. Nevertheless, it remains an interesting "stock-taking" exercise that allows for a clearer understanding of the structural characteristics of the American tax and transfer system and its evolution following the crisis.

I start by investigating the importance of the different components of the tax and transfer system for households' available resources, by looking at the composition of disposable income in terms of pre-government income and all the benefits and taxes considered¹⁵. As suggested in

¹⁵From here onwards the tax credits in "stimulus" and "making work pay credit" are grouped in one single variable named "extraordinary", which embodies all extraordinary credits given following the crisis.

Figure 7: Market income percentile ratios



Immervoll et al. (2005), one can interpret this as an answer to the question "how much market income is necessary to achieve 100 euros of disposable income, and how much is deducted as taxes and added as benefits?". Results are presented in Table 2, as an average over all the years in the sample, for the population as a whole and for different income groups.

When all households are considered, market income accounts for approximately 110% of disposable income, which means that on average the amount of benefits received is smaller than the amount of taxes paid, such that the average individual is a net taxpayer. Indeed, cash transfers, tax credits and in-kind transfers together account for 15% of disposable income, while taxes account for 25%. Among the three types of benefits, cash transfers are clearly the most significant one, accounting for almost 13% of disposable income, while tax credits and in-kind transfers represent only 2% and 1%, respectively. Among the different types of cash transfers, social security, (non SS) retirement benefits and unemployment benefits are the most significant ones. In the case of taxes, the largest burden is the one imposed by the federal income tax, followed by social security contributions. The EITC is the most significant tax credit, while nutritional assistance makes up for almost all the contribution done by in-kind transfers.

When considering different income groups, we see that the composition of disposable income differs dramatically across the income distribution. Cash transfers are particularly important for the bottom of the distribution, amounting to as much as 38% of disposable income for the bottom 10%. Although not irrelevant for the top, they account for a much smaller fraction of disposable income, around 6% for the top 10%, for e.g.. For taxes, the picture is reversed. They represent a large burden for top income groups, close to 39% for the top 10% for e.g., and although not irrelevant for the bottom groups they are much less significant, being close to 9% for the bottom 10%. It is interesting to note that the composition of the tax burden is also different across income groups. For the bottom 50%, for e.g., social contributions have a bigger weight than the federal income tax, while for the top 50% it is the other way around. Tax credits are almost irrelevant for top income groups. They are, however, non-negligible for the bottom income groups, accounting for almost 10% of disposable income for the bottom 20%, for e.g.. Interestingly, the weight of the extraordinary credits given following the crisis is more similar across groups, than that of the other "regular" credits, indicating that these measures were not concentrated on the lower parts of the income distribution. Finally, in-kind transfers almost exclusively benefit the bottom of the income distribution, accounting for close to 10% of disposable income for the bottom 10%.

I now turn to the size of the tax and transfer system. Results are presented in Table 3, which

Table 2: Importance of taxes and transfers in disposable income, overall and by income group

Variable	Share in disposable income (average over 2007-2012)						
	Bot 10	Bot 20	Bot 50	Top 50	Top 20	Top 10	Overall
Market income	49,8%	59,3%	81,8%	118,9%	127,8%	132,8%	109,3%
Cash transfers							
Social security	22,3%	22,1%	15,4%	5,0%	3,5%	2,9%	7,7%
Supplemental social security	8,2%	4,7%	1,8%	0,2%	0,1%	0,1%	0,6%
Unemployment benefits	2,9%	2,5%	1,9%	0,7%	0,4%	0,3%	1,0%
Welfare	2,5%	1,2%	0,4%	0,0%	0,0%	0,0%	0,1%
Veteran's compensation	0,4%	0,4%	0,5%	0,5%	0,5%	0,5%	0,5%
Retirement benefits (non SS)	0,7%	0,9%	1,6%	2,2%	2,0%	1,8%	2,1%
Disability benefits (non SS)	0,2%	0,2%	0,2%	0,1%	0,1%	0,0%	0,1%
Survivor's benefits (non SS)	0,1%	0,1%	0,2%	0,1%	0,1%	0,1%	0,1%
Worker's compensation	0,1%	0,1%	0,1%	0,1%	0,0%	0,0%	0,1%
Educational assistance	0,4%	0,3%	0,3%	0,2%	0,1%	0,1%	0,2%
Overall	37,9%	32,6%	22,4%	9,1%	6,9%	5,9%	12,5%
Taxes							
Federal income tax	3,4%	2,5%	4,2%	17,0%	22,0%	25,2%	13,7%
State income tax	1,9%	1,5%	2,1%	4,3%	5,0%	5,5%	3,8%
SS payroll tax (FICA)	3,4%	4,1%	5,6%	7,6%	7,8%	7,9%	7,1%
Federal retirement payroll tax	0,1%	0,1%	0,1%	0,2%	0,3%	0,3%	0,2%
Overall	8,7%	8,3%	12,0%	29,1%	35,1%	38,9%	24,7%
Tax credits							
Earned income tax credit (EITC)	6,3%	6,5%	2,7%	0,1%	0,0%	0,0%	0,8%
Child tax credit	0,0%	0,1%	1,0%	0,5%	0,1%	0,0%	0,6%
Additional child tax credit	1,0%	2,0%	1,0%	0,0%	0,0%	0,0%	0,3%
Extraordinary	1,0%	1,0%	0,9%	0,5%	0,3%	0,2%	0,6%
Overall	8,3%	9,5%	5,6%	1,1%	0,4%	0,2%	2,3%
In-kind transfers							
Nutritional assistance (SNAP)	12,3%	6,6%	2,1%	0,0%	0,0%	0,0%	0,6%
Energy assistance (LIHEAP)	0,4%	0,3%	0,1%	0,0%	0,0%	0,0%	0,0%
Overall	12,7%	6,8%	2,2%	0,0%	0,0%	0,0%	0,6%
Transfers net of taxes	50,2%	40,7%	18,2%	-18,9%	-27,8%	-32,8%	-9,3%
Disposable income	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%

Note: All statistics refer to per-person equalised household income and consider individual weights.

provides the levels and annual percentage changes of each component and subcomponent of the system, together with the weight of each subcomponent in the corresponding component. Results confirm the conclusions obtained from the last column of Table 2, concerning the relative importance of each component and subcomponent. Furthermore, they show that significant changes occurred in the size and composition of the system following the crisis.

Overall cash transfers experienced sizeable increases in both 2008 and 2009. This reflected rises in social security and retirement benefits expenditures and a sharp increase in unemployment benefits spending. The latter was induced by both discretionary policies taken in the form of the EUC program and the surge in the number of unemployed people during the GR years. In

the following years, this growth came to a halt with the overall value of cash transfers slightly dropping. These mostly reflected sharp declines in unemployment benefits, which are likely to be a consequence of an improvement in labour market conditions in the context of the recovery on the one hand, and the weakening of unemployment benefit policies on the other hand (as described in Section 3). Despite these drops in later years, cash transfers still remained at considerably higher levels than before the start of the crisis (approximately 24% higher).

Overall tax liabilities declined in both 2008 and 2009, mostly resulting from decreases in income taxes, which are likely to reflect a reduction in personal taxable income in the context of the GR. In 2010 the value of tax liabilities stabilised, following the positive impact of the beginning of the recovery in households' market income and the extinction of the partial exclusion of unemployment benefits from taxable income, bringing about a positive growth of the federal income tax. In 2011, a significant negative growth was observed, as a result of the decrease in the FICA tax liabilities, in the context of the temporary one-year reduction in the tax rate introduced by the MCTRA. In 2012, no additional measures were taken and tax liabilities spending exhibited a mild increase. Relative to 2007, overall tax liabilities were approximately 12% lower in 2012.

The evolution of tax credits is particularly interesting. In 2008, an expressive increase occurred, of more than 100%, reflecting the tax rebates given by the ESA. In 2009 and 2010, although the value of tax credits still remained high, there was a decrease relative to 2008 as the MWP credit was less generous than the one provided by the ESA. 2011 marked the end of the extraordinary tax credits, implying a sharp decrease in the overall level, with only the EITC exhibiting a mild increase. By 2012, tax credits were 10% higher than in 2007.

As for in-kind transfers, big increases in overall spending were observed in 2008, 2009 and 2010, following the expansion of food assistance programs adopted in the context of the FCEA and the ARRA. The level then remained stable at its 2010 value throughout 2011 and 2012, representing an increase of 100% relative to 2007.

All in all, the post-crisis years were marked by significant increases in the amount of resources made available to households through the tax and transfer system. This overall evolution was however marked by two distinct phases: the years of the GR were characterised by significant increases, while the years of the recovery brought about a less expressive boost. Although a causal relationship cannot be drawn here, these developments are aligned with the evolution of tax and transfer policies, marked by significant stimulus measures in 2008 and 2009 and a progressive withdrawn from thereafter.

Table 3: Size of the tax and transfer system

Variable	Levels, in \$ billions					Weight in component, in percentage					Annual percentage change			
	2007	2008	2009	2010	2011	2012	2007	2008	2009	2010	2011	2012	2011	2012
<i>Cash transfers</i>														
Social security	551	584	631	622	653	668	65%	63%	59%	58%	61%	63%	5%	2,3%
Supplemental social security	40	45	48	48	52	51	5%	5%	4%	4%	5%	5%	8,3%	-0,9%
Unemployment benefits	29	50	129	124	86	66	3%	5%	12%	12%	8%	6%	-30,2%	-23,3%
Welfare	8	9	9	10	10	8	1%	1%	1%	1%	1%	1%	-2,0%	-20,5%
Veteran's compensation	35	39	43	41	47	48	4%	4%	4%	4%	4%	5%	14,4%	2,1%
Retirement benefits (non SS)	148	161	165	176	175	173	17%	17%	15%	17%	16%	16%	-0,7%	-1,4%
Disability benefits (non SS)	8	7	8	8	9	9	1%	1%	1%	1%	1%	1%	11,0%	6,3%
Survivor's benefits (non SS)	11	11	12	12	11	9	1%	1%	1%	1%	1%	1%	-0,8%	-16,4%
Worker's compensation	6	6	7	6	5	6	1%	1%	1%	1%	0%	1%	-17,9%	16,2%
Educational assistance	13	14	16	18	17	17	2%	2%	2%	2%	2%	2%	-8,2%	0,3%
<i>Overall</i>	849	925	1069	1065	1064	1054	100%	100%	100%	100%	100%	100%	-0,3%	-0,9%
<i>Taxes</i>														
Federal income tax	1150	1124	1069	1077	1080	1071	54%	55%	54%	54%	58%	58%	0,3%	-0,8%
State income tax	313	299	298	292	297	311	15%	15%	15%	15%	16%	17%	-2,2%	4,5%
SS payroll tax (FICA)	636	618	608	604	462	464	30%	30%	31%	30%	25%	25%	-0,7%	0,4%
Federal retirement payroll tax	14	14	16	16	17	16	1%	1%	1%	1%	1%	1%	-0,2%	-6,4%
<i>Overall</i>	2113	2056	1991	1989	1856	1862	100%	100%	100%	100%	100%	100%	-0,1%	0,3%
<i>Tax credits</i>														
Earned income tax credit (EITC)	50	49	66	64	66	67	40%	19%	31%	30%	47%	49%	2,3%	2,0%
Child tax credit	59	55	51	49	48	46	47%	22%	24%	23%	34%	33%	-3,5%	-4,0%
Additional child tax credit	16	15	26	25	25	25	13%	6%	12%	12%	18%	18%	-3,4%	-1,2%
Extraordinary	0	135	72	73	0	0	0%	53%	33%	35%	0%	0%	1,8%	-
<i>Overall</i>	125	255	215	212	139	138	100%	100%	100%	100%	100%	100%	-1,5%	-0,7%
<i>In-kind transfers</i>														
Nutritional assistance (SNAP)	26	33	48	54	54	54	96%	95%	96%	96%	97%	97%	-0,3%	-0,1%
Energy assistance (LIHEAP)	1	2	2	2	2	2	4%	5%	4%	4%	3%	3%	8,3%	-6,1%
<i>Overall</i>	27	34	50	56	56	56	100%	100%	100%	100%	100%	100%	11,7%	-0,3%
<i>Transfers net of taxes</i>														
	-1111	-841	-658	-656	-598	-614	100%	100%	100%	100%	100%	100%	0,3%	-2,7%

Note: All statistics refer to per-person equivalised household income and consider individual weights.

5.3 The cushioning effect of the tax and transfer system

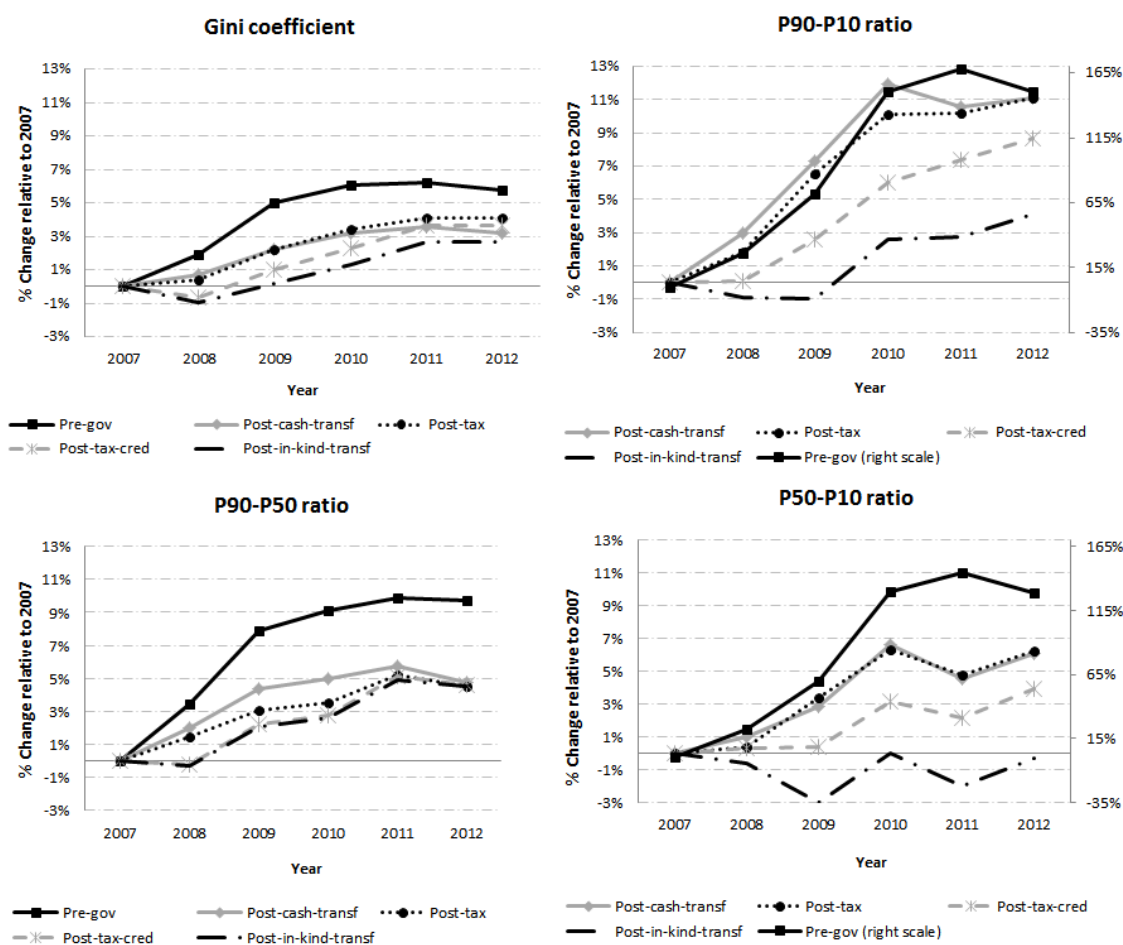
I now turn to the analysis of the cushioning action of the tax and transfer system. I start by doing the same type of exercise as in Subsection 5.1 for the post tax and transfer income aggregates, and then move to a Gini-based inequality decomposition as described in Subsection 4.3.

Figure 8 displays the changes in the same four summary measures of inequality considered in Figure 1, but this time for the five income aggregates of interest. Several interesting facts emerge. Firstly, it is clear that inequality in disposable income rose by much less than inequality in market income, which points to an expressive role of the tax and transfer system in cushioning the negative distributional impacts of the crisis. Secondly, between 2008 and 2009, inequality in disposable income increased by little or even decreased, depending on the indicator considered, but from 2010 onwards this changed, with inequality in disposable income growing more in line with market income inequality. This increase seems to have been mostly induced by a stronger recovery of the top of the distribution. Indeed, by 2012, both the P90-P10 and P90-P50 ratios were approximately 4% higher than in 2007, while the P50-P10 ratio was basically the same. The Gini coefficient, encompassing developments both at the top and bottom of the distribution, was higher by approximately 3%. The offsetting role of taxes and transfers in the post-crisis period, although significant, was therefore only partial, and more effective in the early stage of the crisis aftermath. Five years after the onset of the crisis, the distribution of resources available to households was more unequal than at the start, even when considering the equalising effects of the redistributive system. The system was only capable of preventing the bottom and the middle of the distribution from growing apart, but not the top from distancing itself relative to both the bottom and the middle. Thirdly, some preliminary considerations can be done on the relative redistributive role of each type of instrument. All of them gave a relevant contribution to the difference between the growth in market and disposable income inequality, but with distinct relative importance. While cash transfers were the most significant contributor overall, as expressed by the Gini coefficient results, tax credits and in-kind-transfers were crucial at taming the growth in the divergence between the 10th percentile and the 50th and 90th percentiles.

Figure 9 provides a deeper insight into the distributional effects of the tax and transfer system, by showing the evolution of average income by income group for the four post tax and transfer income aggregates of interest. To keep the analysis concise, results for percentiles and income shares are presented only in the Appendix (in Figures 15 and 16) but with no loss of information, as they provide the same conclusions. The figure confirms that the system played a role in

taming the increase in the gap between bottom and top income groups stemming from the crisis, as differences between the losses for higher and lower income groups are much less pronounced than those for market income (in Figure 5). Furthermore, it shows that the system was effective at preventing a widening of the disposable income distribution up to 2010, but not from then onwards. Indeed, losses in disposable income of the bottom and middle groups were smaller than those of top groups in the first period, but in the second period the situation reversed, with top groups starting to recover while bottom groups continued to lose.

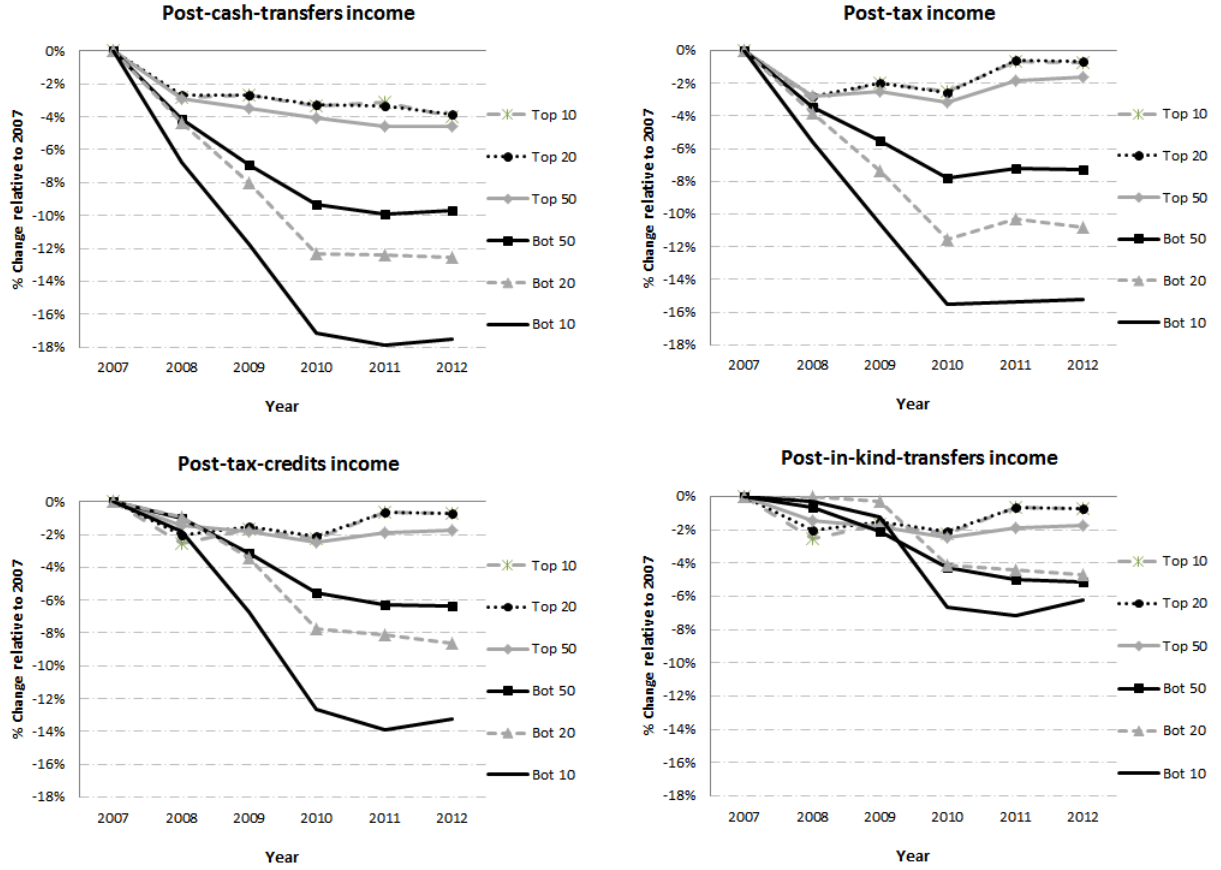
Figure 8: Summary measures of pre and post tax and transfer income inequality



As in Figure 7, Figure 10 presents the evolution of percentiles P90, P50 and P10 relative to other sections, this time for disposable income. When comparing the two figures several interesting conclusions appear, which corroborate the findings discussed above. Looking at the top panel, one can see that the tax and transfer system was able to prevent the bottom of the distribution from losing ground to other sections until 2009, but that from then onwards it did not manage to prevent significant losses relative to top percentiles. The middle panel shows that the system

was ineffective at protecting the median income individual, as a relative increase was observed for most of the other sections. Finally, the bottom panel clearly illustrates that the system did not stop the top of the distribution from distancing itself from all other parts.

Figure 9: Average post tax and transfer income by income group



I now move to a Gini-based decomposition analysis, to formally quantify the magnitude of the redistributive action of the tax and transfer system. All results are given in Table 4, and the most important ones are illustrated in Figures 11-13. Figure 11 focuses on the levels of absolute redistribution. The left-hand panel presents the figures for overall redistribution, together with the Ginis for market and disposable income. It clearly shows that taxes and transfers had a sizeable role in decreasing income inequality throughout the post-crisis period. They reduced inequality by almost 13 Gini points on average, which represented 27% of market income inequality. The right-hand panel presents a decomposition of overall redistribution into the contribution done by each tax and transfer type. It is clear that cash transfers played the most important role, accounting for 50% of overall redistribution, on average. They were followed by taxes, which accounted for 35%, on average. Tax credits and in-kind transfers played a smaller, although non-negligible, role representing an average of 10% and 5%, respectively.

Figure 10: Disposable income percentile ratios

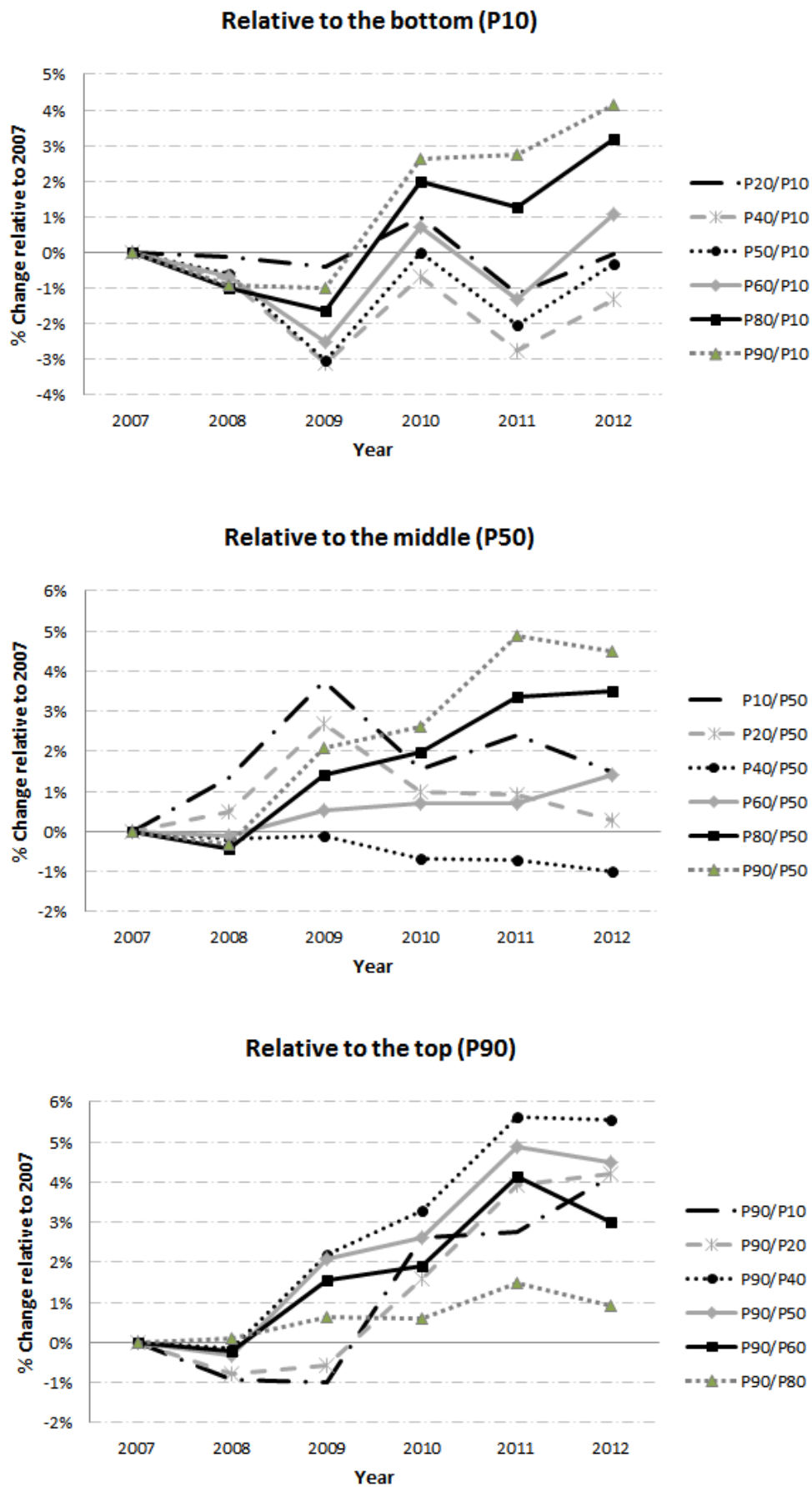


Table 4: Gini-based redistribution measures

Variable	2007	2008	2009	2010	2011	2012
<i>Gini (X 100)</i>						
Pre-government	45,24	46,10	47,49	47,98	48,05	47,86
Post-cash-transfers	39,87	40,16	40,75	41,15	41,29	41,13
Post-tax	35,42	35,56	36,21	36,63	36,88	36,88
Post-tax-credits	34,41	34,18	34,76	35,20	35,66	35,67
Post-in-kind-transfers	34,04	33,72	34,10	34,49	34,94	34,95
<i>Change in Gini</i>						
Pre-government		0,86	1,39	0,49	0,07	-0,19
Post-cash-transfers		0,29	0,59	0,40	0,14	-0,16
Post-tax		0,14	0,65	0,41	0,25	0,01
Post-tax-credits		-0,23	0,58	0,44	0,46	0,01
Post-in-kind-transfers		-0,32	0,38	0,39	0,45	0,01
<i>Absolute redistribution</i>						
Cash-transfers	5,37	5,94	6,74	6,82	6,76	6,73
Taxes	4,45	4,59	4,54	4,52	4,41	4,25
Tax-credits	1,01	1,38	1,45	1,43	1,21	1,21
In-kind-transfers	0,37	0,46	0,66	0,71	0,72	0,72
Overall	11,20	12,38	13,39	13,49	13,11	12,91
<i>Relative redistribution</i>						
Cash-transfers	11,9%	12,9%	14,2%	14,2%	14,1%	14,1%
Taxes	9,8%	10,0%	9,5%	9,4%	9,2%	8,9%
Tax-credits	2,2%	3,0%	3,1%	3,0%	2,5%	2,5%
In-kind-transfers	0,8%	1,0%	1,4%	1,5%	1,5%	1,5%
Overall	24,8%	26,9%	28,2%	28,1%	27,3%	27,0%
<i>Weight in redistribution</i>						
Cash-transfers	48,0%	48,0%	50,3%	50,6%	51,6%	52,1%
Taxes	39,7%	37,1%	33,9%	33,5%	33,7%	32,9%
Tax-credits	9,0%	11,2%	10,9%	10,6%	9,2%	9,4%
In-kind-transfers	3,3%	3,7%	4,9%	5,3%	5,5%	5,6%
Overall	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%
<i>Change in absolute redistribution</i>						
Cash-transfers		0,57	0,80	0,08	-0,07	-0,03
Taxes		0,15	-0,06	-0,01	-0,11	-0,16
Tax-credits		0,38	0,07	-0,02	-0,22	0,00
In-kind-transfers		0,09	0,20	0,05	0,01	0,00
Overall		1,18	1,01	0,10	-0,38	-0,19
<i>Contribution to change in redistribution</i>						
Cash-transfers		48,0%	79,4%	82,7%	17,5%	15,6%
Taxes		12,6%	-5,9%	-10,5%	28,6%	84,2%
Tax-credits		31,9%	7,1%	-24,3%	56,6%	-0,4%
In-kind-transfers		7,5%	19,4%	52,0%	-2,7%	0,6%
Overall		100,0%	100,0%	100,0%	100,0%	100,0%

Note: All statistics refer to per-person equivalised household income and consider individual weights.

Figure 12 focuses on the changes in absolute redistribution. The left-hand panel presents the annual change, while the right-hand panel presents the cumulative change, relative to 2007. When considering the whole post-crisis period, it is clear that redistribution increased substantially,

by 1.71 points, such that redistribution was 15% higher in 2012 than in 2007. However, this overall evolution embodied very distinct phases. The first two years of the post-crisis period were marked by an expressive increase in redistribution, which completely cushioned the increase in market income inequality observed in this period. Indeed, although market income inequality increased by a total of 2.25 points between 2007 and 2009, redistribution increased by 2.19 points, leaving disposable income inequality practically unchanged. From 2010 onwards, however, the mitigation effect of taxes and transfers started to decrease (even though it remained at high levels, as previously seen). In 2010, market income inequality continued to increase, by 0.5 points, and redistribution increased only slightly, by 0.1, such that disposable income inequality also increased, by 0.4. In 2011 and 2012 however the situation reversed, with redistribution decreasing such that the change in disposable income inequality was actually higher than the change in market income inequality. Whereas the latter decreased by 0.12 points during the two years, the former increased by 0.46 points, reflecting a decrease in redistribution of 0.58 points.

Figure 13 decomposes the changes in absolute redistribution into the contributions done by each type of redistributive instrument. As in the previous figure, the left-hand panel presents annual changes, while the right-hand panel presents cumulative changes. Several interesting conclusions also emerge. Between 2008 and 2009, cash transfers were clearly the main drivers of the increase in redistribution, accounting for 1.37 points of the overall increase of 2.19 points. Tax credits also contributed significantly, with its redistributive action increasing by 0.45 points across the two years. They were followed by in-kind transfers, which contributed with an increase of 0.28 points. The smallest contribution was given by taxes, which increased by a total of only 0.09 points. In 2010, the small increase in redistribution was driven by the positive contributions of cash transfers and in-kind transfers, of 0.08 and 0.05 points, respectively. Tax credits and taxes, however, contributed negatively, with decreases of 0.02 and 0.01 in their redistributive action, respectively. Between 2011 and 2012, all instruments but in-kind transfers contributed negatively to the change in redistribution. Taxes exhibited the most significant drop, of 0.27 points in total, followed by tax credits and cash transfers with drops of 0.22 points and 0.1 points, respectively. Overall, when considering the whole post-crisis period, cash transfers were clearly the most important contributor to the increase in redistribution, accounting for 1.35 points of the overall value of 1.71 points. In-kind transfers and tax credits also contributed positively although to a much smaller extent, with a change of 0.35 and 0.21 points, respectively. Taxes, however, contributed negatively, exhibiting a redistributive effect 0.19 points lower in 2012 than in 2007.

Figure 11: Absolute redistribution

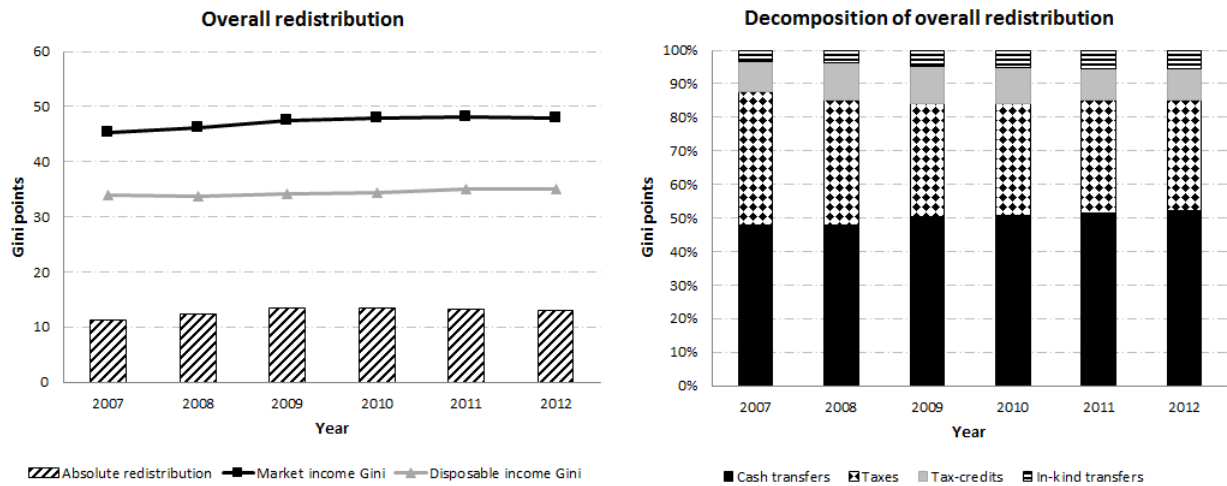


Figure 12: Change in absolute redistribution

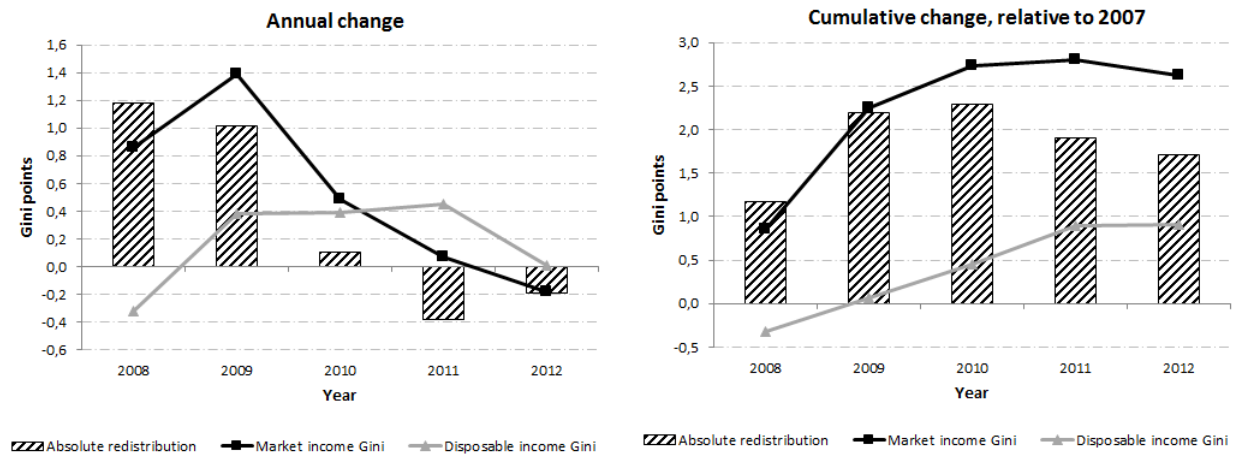
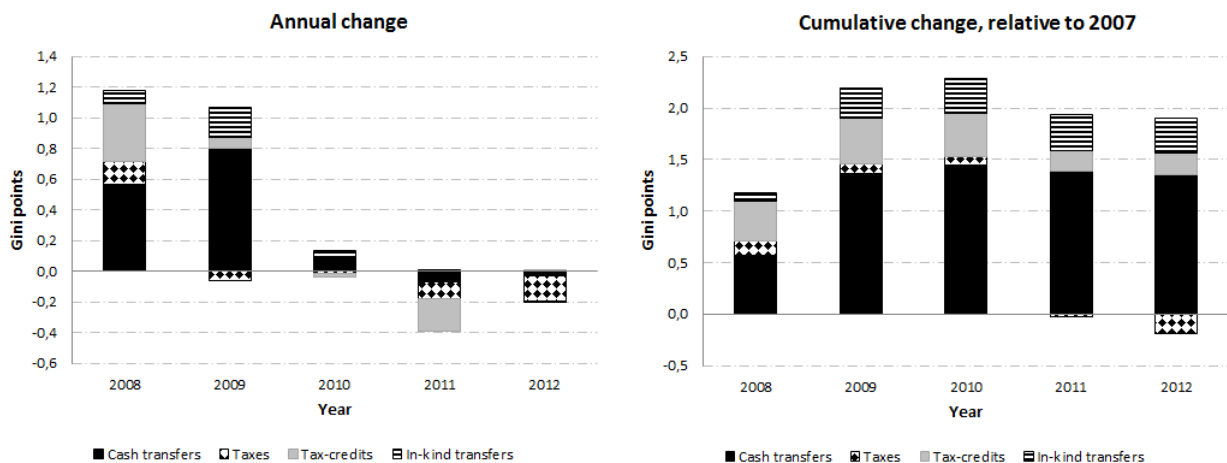
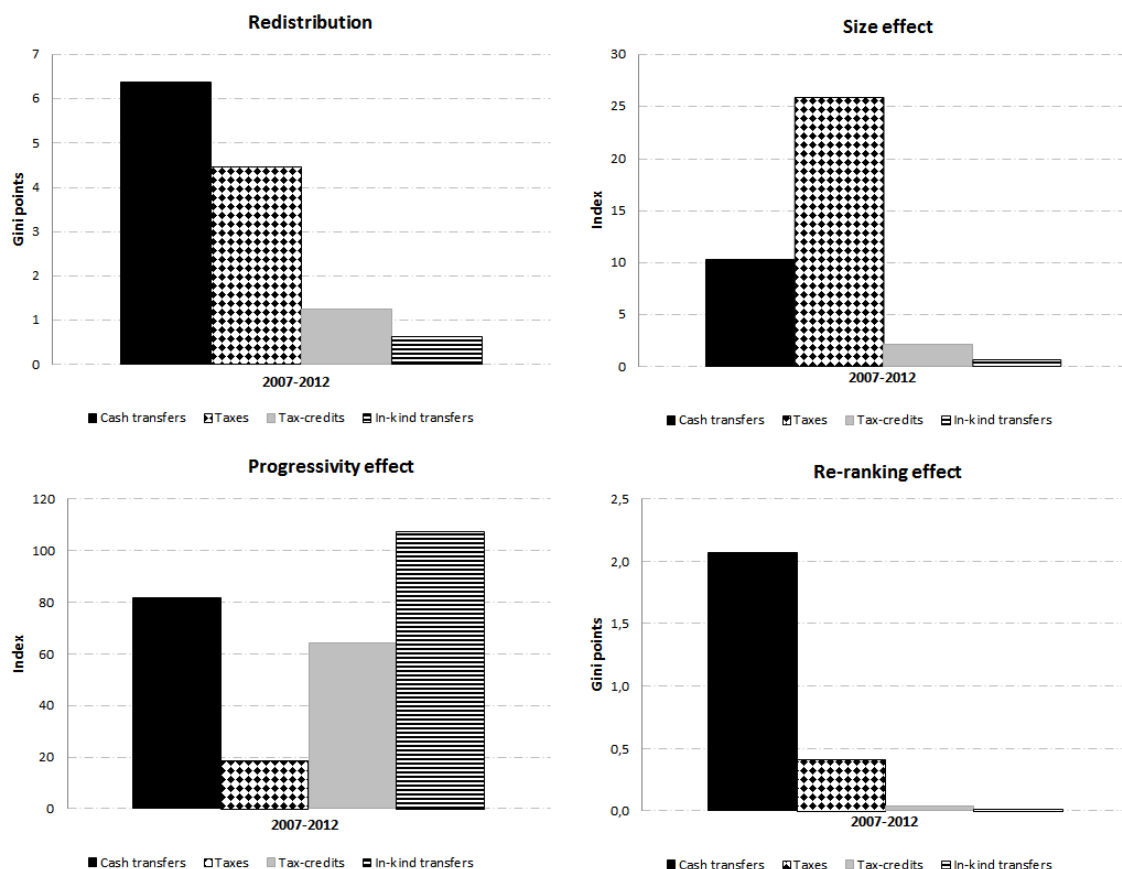


Figure 13: Decomposition of change in absolute redistribution



Finally, Figure 14 provides the decomposition of the redistributive effect of each tax and transfer type into a size, progressivity and re-ranking effect as described in Subsection 4.3¹⁶. Results are depicted over the whole post-crisis period and are multiplied by 100, to allow for a clearer exposition. We can see that the size effect is substantially higher for taxes than for cash transfers, which is in line with the results in Tables 2 and 3. However, cash transfers are considerably more progressive, which more than compensates their smaller size effect rendering them more effective in terms of redistribution. Interestingly, in-kind transfers are the most progressive instrument of all and tax credits are more significant in this respect than taxes. However, due to their small size, the overall redistributive effect of these two types of instruments is considerably weaker than the one of cash transfers or taxes. The re-ranking effect is small except for cash transfers, as cash transfers include pensions, which for many individuals determines a substantial rise in their position in the income distribution. This however, does not change the results qualitatively, the same conclusions are obtained before and after deducting the re-ranking effect.

Figure 14: Drivers of redistribution



¹⁶One should note that technically, transfers and tax credits are regressive as they decline at higher income levels and therefore their progressivity index is negative. Likewise, their size index is negative, as they represent a "negative tax rate". The combination of a negative progressivity index with a negative size indicator results in a positive redistributive effect. To allow for a simpler interpretation, both indices are presented here as positive.

5.4 Summary of main findings

The analysis done in this paper shows that there was considerable heterogeneity in the distributional effects of the 2007-2008 crisis and in the ability of the tax and transfer system to mitigate them. It is therefore useful to do a short wrap up of the main findings, which can be found below.

1. The crisis entailed a **dramatic and persistent widening of the market income distribution**. There were losses along the whole distribution, but the bottom and middle sections were undoubtedly more penalised, exhibiting the strongest and more persistent income losses.
2. The post-crisis years were marked by **significant increases in the size and relevance of the tax and transfer system**. This evolution was however not monotonic, with an expressive boost occurring during the so-called Great Recession years, but less so during the so-called recovery years.
3. The action of the **tax and transfer system was crucial at taming the rise in inequality**. The system was particularly beneficial for the bottom-middle parts of the income distribution, but not exclusively, also helping considerably upper-middle income groups.
4. **Cash transfers provided the most important contribution** to the redistributive action of the tax and transfer system, followed by taxes. Tax credits and in-kind transfers also provided non-negligible contributions.
5. Despite its positive action, the **redistributive system did not fully cushion the distributional impacts of the crisis**. Five years into the start of the crisis, income inequality was higher even after the effect of taxes and transfers is considered. This evolution was marked by two distinct phases: 2008 and 2009, when redistribution fully prevented a widening of the disposable income distribution; between 2010 and 2012, where disposable income inequality grew more than market income inequality. The system was only capable of preventing the bottom and the middle of the distribution from growing apart, but not the top from distancing itself relative to both the bottom and the middle. These developments coincided with two moments in the setting of tax and transfer policies: 2008 and 2009, when they were strongly reinforced; the years after when they were gradually phased out.

6 Concluding remarks

This paper analysed in detail the evolution of income inequality and the cushioning effect of the tax and transfer system following the 2007-2008 economic crisis, in the US.

A crucial finding is that the crisis did nothing to stem the tide of rising inequality that was being observed before the crisis and, on the contrary, it accentuated it. A significant increase in market income inequality occurred, being largely driven by dramatic and persistent losses in the lower parts of the distribution, which contrasted with weaker and more transitory losses in the upper parts. The tax and transfer system strongly reacted in the immediate aftermath of the crisis, notably in the form of increases in both cash and in-kind transfers, introduction of new tax credits and reinforcement of existing ones, and tax cuts. It managed to tame a rise in disposable income inequality between 2008 and 2009, particularly by offsetting to a large extent the sharp losses suffered by lower and middle income individuals. From 2010 onwards, however, although the system remained strong, a gradual weakening of both its budget size and redistributive power was observed. Disposable income inequality began to rise, reflecting a stagnation of the bottom and middle of the distribution and a recovery of the top. Five years after the onset of the crisis, the upper part of the income distribution had managed to almost fully recover from its losses, while the bottom and middle parts were still experiencing significant ones. This conclusion always holds, irrespectively of whether pre or post government income is considered, showing that the action of the tax and transfer system following the crisis, although crucial, did not fully prevent an increase in inequality. It suggests that the unwinding of redistributive efforts after the crisis may have been too premature and mistargeted, missing a substantial degree of persistence in losses for lower and middle income groups.

The findings of this paper provide clear evidence on the link between inequality and the business cycle. They show that aggregate shocks, such as the 2007-2008 crisis, may have substantial heterogeneous impacts across income groups in what concerns both its immediate impact and the persistence of its effects. Furthermore, they shed light on the importance of tax and transfer policies as a cushioning device in times of crisis. These findings raise awareness for the importance of considering inequality and redistribution issues when designing policies aimed at coping with aggregate shocks. If recovery from a negative shock may be compromised by a rise in inequality, then policies ensuring that the burden of adjustment is more equally distributed may be key at stabilising the aggregate economy, helping to prevent a protracted period of anemic activity like the one experienced following the 2007-2008 crisis.

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Appendices

A Unit of analysis and equivalence scales

When doing distributional analyses, the ultimate source of concern is typically the welfare of the individual. However, an individual is usually not the appropriate choice for income unit as it fails to capture the fact that economic decisions are largely made at the household level (in particular labour-supply decisions) and that a substantial sharing of resources occurs among members of a given household. For e.g., children and spouses working at home do not have recorded income, but may nevertheless enjoy a high standard of living as a result of income sharing with parents and spouses. To consider these individuals as enjoying zero income would be misleading. An alternative is to pool the income of all individuals living in the same household and consider the household as the unit of income and analysis, with one household corresponding to one observation in the income distribution. This, however, is also misleading as it completely ignores differences in household size and composition, which naturally affect the true living standards of its members. For e.g., individuals living in a household of four people with a total income of 400 euros will enjoy a smaller standard of living than a single individual receiving the same 400 euros.

A more sensible way to proceed is to compute person-equivalised household income measures. These consider the household as the unit of income but the person as the unit of analysis, adjusting household income by dividing it by an equivalence scale to arrive at a measure of equivalent per-person income. They take into account the fact that economies of scale typically exist at the household level, since there are expenses that do not increase with the size of the household (internet connection, for e.g.) and savings that can arise by buying large quantities. A typical formulation is one where $\text{Equivalence scale} = (\text{Household size})^\alpha$. This formulation implicitly considers that adults and children are counted equally. An alternative formulation takes into account differences in the composition of the household: instead of considering each element of the household as one unit of the household size, weights are attributed to each element, according to their importance in the household's budget. These typically give less weight to children than to adults and often differentiate between the first child and the following ones. This is the case for the official OECD equivalence scale, for e.g.. The value of α determines the amount of economies of scale considered. $\alpha = 1$ implies that equivalised income is simply per capita income, in which case there are no economies of scale. $\alpha = 0$ implies that equivalised income is equal to household income, in which case there are infinite economies of scale. I consider the intermediate value of

$\alpha = 1/2$, which is the one typically considered in studies performing income distribution analysis (see for e.g. Jenkins (1995), Armour et al. (2013b), Thompson and Smeeding (2013) or CBO (2014)). This implies, for e.g., that a household composed by two people with total income equal to 200 is equivalent to two separate individuals earning 141 each. With no economies of scale ($\alpha = 1$) it would be equivalent to each individual earning 100, whereas with full economies of scale ($\alpha = 0$) it would be equivalent to each individual earning 200.

B Income variables

Labour earnings

Labour earnings correspond to each respondent's pre-tax wages and salaries, i.e. income received as an employee.

Self-employment earnings

Self-employment earnings indicates each respondent's pre-tax income accruing to any activity where the respondent is working directly for her own benefit, as opposed to working for an employer. It is split into non-farm (or business) and farm self-employment earnings. The former corresponds to income coming from a personal business and/or professional practice, while the later corresponds to income obtained as a tenant farmer, sharecropper or operator on an own farm. Income earned as an employee on a farm is a part of labour earnings.

These are net concepts, obtained after deducting all expenses from gross receipts. They may therefore assume negative values.

Private transfers

Private transfers correspond to all pre-tax income received from friends or family members (or ex members), not living in the same household. They include:

- Child alimony: child support payments made from one ex-spouse to the other. They are tax deductible to the person who pays it and taxable income to the person who receives it.
- Child support: similar to child alimony but a non-deductible expense for the payer and tax-free income for the receiver.
- Friends and family assistance: income obtained from regular financial assistance from friends or relatives, not living in the same household.

- Retirement funds (private): payments received from a private pension or retirement scheme. These include company or union pension, regular payments from annuities or paid-up insurance policies and regular payments from IRA, KEOGH or 401K.
- Disability benefits (private): payments received as a result of a health condition, disability or handicap, from a private source. Include company or union disability funds and private accident/disability insurance payments.
- Survivor's benefits (private): payments received as a dependent of a deceased worker, from a private source. Include company or union survivor pensions, regular payments from estates or trusts and regular payments from annuities or paid-up life insurance.
- Worker's compensation (private): payments received as a result of a job-related injury or illness, from private entities. Includes employer's insurance and own insurance. Distinct from non-work related sick and disability payments, which are counted as disability benefits.
- Educational assistance (private): financial aid given by private entities for studies beyond the high school level. Can cover tuition fees, books or living expenses while attending school. Includes non-governmental scholarships and grants and financial assistance from employers, friends or relatives (excluding household members).
- Other sources: income from non-specified sources. Includes small amounts of income from hobbies, severance pay and foster child care.

Net asset income

Net asset income corresponds to all financial pre-tax income received by the respondent. It includes:

- Interests: on saving accounts, certificates of deposit, money market funds, bonds, treasury notes, IRAs, and other investments paying interest.
- Dividends: from stocks and mutual funds.
- Rents: from charges to roomers or boarders and from money paid by estates, trusts and royalties. It is a net concept, obtained after deducting all expenses. It may therefore assume negative values.

Public cash transfers

Public cash transfers correspond to all pre-tax cash income received from the government. They include:

- Social security (SS): payments to retired persons, dependents of deceased insured workers (survivors) and disabled workers, funded by workers' contributions to social security.
- Supplemental social security: means-tested, non-contributory income assistance given to needy aged, blind and disabled adults and children who have limited income and resources.
- Unemployment insurance benefits: payments provided by the government to unemployed people, funded in large part by state and federal payroll taxes levied against employers. Generally, unemployed people who meet certain eligibility requirements can receive unemployment insurance for a maximum of 26 weeks. The US Department of Labor oversees the system, but each state administers its own program, with eligibility conditions and maximum benefit levels differing from state to state. Unemployment insurance benefit income is subject to both Federal and State government income tax, but is exempted from social security taxes.
- Welfare (public assistance): non-contributory financial aid aimed at insuring a minimal level of well-being and social support for all citizens. Includes several instruments in particular: the Temporary Assistance for Needy Families (TANF), which provides cash assistance to eligible indigent families with dependent children, being limited to a federal lifetime limit of 60 months (states may decide on shortening or extending this limit); the General Assistance Program, which is the equivalent of the TANF for persons without dependent children; the Emergency Assistance, which is provided to people who are homeless, at immediate risk of becoming homeless or having experienced a substantial loss of housing, food, clothing or household furnishings due to fire, flood or similar disaster.
- Veteran's compensation (VC): payments provided to veterans by the Veteran's Administration. May include service-related disability compensation, survivor's benefits, pensions, educational assistance, among others.
- Retirement funds (public, non-SS, non-VC): retirement-related payments received from the government, excluding social security and veteran's compensation. Includes federal, state and local government employee pensions, and US military and railroad retirement.

- Disability benefits (public, non-SS, non-VC): payments received from the government, as a result of a health condition, disability or handicap, excluding social security and veteran's compensation. Includes federal, state and local government employee disability and US military and railroad disability.
- Survivor's benefits (public, non-SS, non-VC): payments received from the government, as a dependent of a deceased worker, excluding social security and veteran's compensation. Includes federal, state and local government and US military and railroad employee survivor benefits.
- Workers's compensation (public): payments received from the government as a result of a job-related injury or illness. Distinct from non-work related sick and disability payments, which are counted as disability benefits.
- Educational assistance (public): non-contributory financial aid given by the state to people studying beyond the high school level. Can cover tuition, fees, books or living expenses while attending school. Includes Pell grants and other aid from government sources.

Taxes

Taxes correspond to all direct personal income taxes levied by the government. They include:

- Federal income tax: provides for several federal government spending needs in particular for national programs such as defense, foreign affairs, law enforcement, and interest on the national debt.
- State income tax: collected by most states (currently 43), in addition to the federal income tax, to account for state-level spending needs. The spending mix varies from state to state, but a significant amount is typically devoted to education, health care and infrastructures.
- Social security payroll deduction (Federal Insurance Contributions Act (FICA)): taxes imposed on labour earnings to finance social security benefits and Medicare (which provides health care for the elderly).
- Federal retirement payroll deduction: taxes imposed on labour earnings of people employed by the federal government, to help fund retirement benefits via programs such as Civil Service Retirement System (CSRS) or Federal Employees Retirement Systems (FERS).

Tax credits

Tax credits are tax incentives which allow certain taxpayers to subtract the amount of the credit from the total tax liabilities they owe the state. A credit directly reduces tax bills, unlike tax deductions and tax exemptions, which indirectly reduce tax bills by reducing the size of the base from which the tax bill is calculated. Tax credits can be nonrefundable, meaning that they can only be used to the point at which no more taxes are owed, or refundable, meaning that if the credit exceeds the amount of taxes owed, the difference is received by the taxpayer as a cash payment. They include:

- **Earned Income Tax Credit (EITC):** refundable tax credit that reduces or eliminates the amount of income tax of low-to moderate-income working individuals and couples, particularly those with children. Operates as a wage subsidy for low-income workers. The amount attributed depends on the household's income and composition (e.g. single, couple without children, couple with one child).
- **Child tax credit:** tax credit given to low-to moderate-income working people with dependent children, as a function of the household's income and the number of children, according to some qualification criteria that must be met by each child (concerning age, relationship, support, dependence, citizenship and residence).
- **Additional child tax credit:** if the child tax credit exceeds the household's tax liability, the "unused" portion of the credit is refundable as the additional child tax credit.
- **Stimulus:** part of the Economic Stimulus Act of 2008, provided payments, in the form of refundable tax payments, to persons with a 2008 tax liability or with 3000 dollars in "qualifying income". Ranged from 300 dollars for single people without a tax liability to 1200 for married couples with a tax liability. For households with dependent children, additional 300 dollar payments per "qualifying child" were given (see Section 3 for a more thorough description).
- **Making work pay tax credit:** extraordinary refundable tax credit, provided only in 2009 and 2010 as a part of the American Recovery and Reinvestment Act (ARRA) of 2009. Available to all working single taxpayers earning between \$8100 and \$95000 per year and joint filers earning between \$8100 and \$190000 per year. It gave up to 400 dollars for individuals and up to 800 dollars for joint fillers.

In-kind transfers

Public in-kind-transfers correspond to transfers given or paid by the government in goods, commodities, or services, instead of cash. They include:

- Supplement Nutrition Assistance Program (SNAP) (formerly called Food Stamps Program): food-purchasing assistance given to eligible low-income people. They are provided at the household level, with the amount of assistance each household gets depending on the household's size, income, and expenses. For most of its history, the program used paper-denominated "stamps" or coupons bound into booklets of various denominations, to be torn out individually and used in single-use exchange. Since 2004 stamps have been replaced by a specialised debit card system known as Electronic Benefit Transfer (EBT), in all states. Each month, SNAP food stamp benefits are directly deposited into the household's EBT card account. Households may use EBT to pay for food at supermarkets, convenience stores, and other food retailers, including certain farmers' markets. They are not included in the means test of any other benefit and are not taxable. They are given indefinitely, as long as eligibility conditions are fulfilled.
- Low Income Home Energy Assistance Program (LIHEAP): initiatives that assist low-income people in managing energy associated costs, in particular: home energy bills, energy crises, weatherisation and energy-related minor home repairs.

C Data

Tables 5 and 6 provide some basic information on the characteristics of the sample. Table 5 gives the number of observations at both the individual and household levels, for each of the years included in the sample, both unweighted and weighted (using individual weights for individuals and household weights for households). Table 6 gives descriptive statistics on some relevant sociodemographic characteristics of the individuals in the sample, namely: age group, sex, race, marital status, education level, employment status and class of worker. These statistics are computed using individual weights.

In Tables 7 and 8, information is given on aggregate income measures, as defined in Subsection 4.2. All statistics are based on person-equivalised household income, weighted using individual weights (which corresponds to what is done in the distributional analysis performed in Section 5). Table 7 considers the full sample, while Table 8 considers only individuals for whom the value

of each aggregate is higher than zero, i.e. those who effectively benefit from that type of income. The last column of Table 8 gives the fraction that these individuals represent out of the whole sample.

Tables 9 and 10 provide the same type of information for the four main categories of redistributive mechanisms considered in this study, together with all their components.

Table 5: Number of observations by year

Year	Households	Individuals
<i>Non weighted</i>		
2007	75 510	205 660
2008	76 154	207 809
2009	76 215	209 647
2010	75 164	204 909
2011	74 366	201 361
2012	74 802	202 589
Total	452 211	1 231 975
<i>Weighted</i>		
2007	116 297 894	297 944 628
2008	117 216 356	301 356 799
2009	118 450 185	304 053 000
2010	119 952 675	306 429 561
2011	121 138 353	308 767 580
2012	122 520 230	311 050 965
Total	715 575 693	1 829 602 533

Table 6: Descriptive statistics of sociodemographic characteristics

Variable	Freq	% Freq
Sex		
Male	897 188 029	49%
Female	934 185 210	51%
Age group		
Child (age<15)	366 874 552	20%
Working age (15=age=65)	1 244 048 310	68%
Older (age>65)	220 450 377	12%
Race		
White	1 443 616 273	79%
Black	234 051 448	13%
Other	153 705 518	8%
Marital status		
Married	751 053 592	41%
Divorced or separated	178 324 524	10%
Widow	85 848 876	5%
Single	816 146 247	45%
Education		
Up to middle school	79 494 486	4%
Secondary school, no diploma	185 146 512	10%
Secondary school, diploma	423 016 330	23%
Higher education, no diploma	270 986 481	15%
Higher education, diploma	505 854 878	28%
NIU (children)	366 874 552	20%
Employment status		
Armed forces	5 532 086	0%
Employed	844 525 579	46%
Unemployed	78 333 329	4%
NILF (not in labour force)	536 107 693	29%
NIU (children)	366 874 552	20%
Class of worker		
Armed forces	5 532 086	0%
Self-employed	93 879 019	5%
Private entity employee	699 507 037	38%
Government employee	132 085 425	7%
NIU (children and NILF)	900 369 672	49%

Notes:

¹Age is top-coded at 80 years; average age is 37.²Statistics are computed using individual weights.³The total number of observations is 1 829 602 533 for all variables.

Table 7: Descriptive statistics of income aggregates, full sample

Variable	Mean	Median	Min	Max	N
Pre-government income	28 753	22 839	-17 526	296 731	1 829 602 533
Post-cash-transfers income	32 047	25 935	-14 819	325 166	1 829 602 533
Post-tax income	25 561	22 330	-14 819	244 228	1 829 602 533
Post-tax-credits income	26 153	22 932	-14 819	244 228	1 829 602 533
Post-in-kind-transfers income	26 305	22 965	-14 819	244 228	1 829 602 533

Notes:

¹All statistics are in dollars, except for N (N as a %), which refers to the number (proportion) of individuals.

²All statistics refer to per-person equivalised household income and use individual weights.

Table 8: Descriptive statistics of income aggregates, only positive values

Variable	Mean	Median	Min	Max	N	N as % of all individuals
Pre-government income	30 636	24 580	0	296 731	1 717 339 078	94%
Post-cash-transfers income	32 410	26 215	0	325 166	1 809 182 843	99%
Post-tax income	25 851	22 552	0	244 228	1 809 165 119	99%
Post-tax-credits income	26 450	23 153	0	244 228	1 809 173 424	99%
Post-in-kind-transfers income	26 514	23 124	0	244 228	1 815 286 507	99%

Notes:

¹All statistics are in dollars, except for N (N as a %), which refers to the number (proportion) of individuals.

²All statistics refer to per-person equivalised household income and consider individual weights.

Table 9: Descriptive statistics of redistributive mechanisms, full sample

Variable	Mean	Median	Min	Max	N
<i>Cash transfers</i>					
Social security	2 027	0	0	67 290	1 829 602 533
Supplemental social security	155	0	0	27 471	1 829 602 533
Unemployment benefits	264	0	0	77 698	1 829 602 533
Welfare	29	0	0	20 100	1 829 602 533
Veteran's compensation	138	0	0	77 698	1 829 602 533
Retirement benefits (non SS)	546	0	0	69 930	1 829 602 533
Disability benefits (non SS)	27	0	0	38 318	1 829 602 533
Survivor's benefits (non SS)	36	0	0	47 899	1 829 602 533
Worker's compensation	19	0	0	54 941	1 829 602 533
Educational assistance	52	0	0	25 149	1 829 602 533
<i>Overall</i>	<i>3 294</i>	<i>0</i>	<i>0</i>	<i>116 548</i>	<i>1 829 602 533</i>
<i>Taxes</i>					
Federal income tax	3 592	1 365	0	108 043	1 829 602 533
State income tax	989	358	0	80 398	1 829 602 533
SS payroll tax (FICA)	1 853	1 467	0	37 458	1 829 602 533
Federal retirement payroll tax	51	0	0	58 050	1 829 602 533
<i>Overall</i>	<i>6 486</i>	<i>3 456</i>	<i>0</i>	<i>181 131</i>	<i>1 829 602 533</i>
<i>Tax credits</i>					
Earned income tax credit (EITC)	198	0	0	3 369	1 829 602 533
Child tax credit	168	0	0	2 234	1 829 602 533
Additional child tax credit	73	0	0	1 776	1 829 602 533
Stimulus	74	0	0	1 523	1 829 602 533
Making work pay credit	79	0	0	871	1 829 602 533
<i>Overall</i>	<i>592</i>	<i>359</i>	<i>0</i>	<i>4 444</i>	<i>1 829 602 533</i>
<i>In-kind transfers</i>					
Nutritional assistance (SNAP)	147	0	0	8 039	1 829 602 533
Energy assistance (LIHEAP)	6	0	0	1 607	1 829 602 533
<i>Overall</i>	<i>152</i>	<i>0</i>	<i>0</i>	<i>8 978</i>	<i>1 829 602 533</i>

Notes:

¹All statistics are in dollars, except for N (N as a %), which refers to the number (proportion) of individuals.

²All statistics refer to per-person equalised household income and consider individual weights.

Table 10: Descriptive statistics of redistributive mechanisms, only positive values

Variable	Mean	Median	Min	Max	N	N as % of all individuals
<i>Cash transfers</i>						
Social security	9 035	8 359	0,4	67 290	410 500 435	22,4%
Supplemental social security	3 701	3 130	0,3	27 471	76 716 883	4,2%
Unemployment benefits	3 034	1 948	0,3	77 698	159 252 896	8,7%
Welfare	1 381	1 083	0,3	20 100	39 060 142	2,1%
Veteran's compensation	6 311	4 004	0,4	77 698	39 885 242	2,2%
Retirement benefits (non SS)	13 214	11 318	0,3	69 930	75 592 066	4,1%
Disability benefits (non SS)	6 573	4 753	0,4	38 318	7 569 632	0,4%
Survivor's benefits (non SS)	8 134	5 911	0,4	47 899	8 114 234	0,4%
Worker's compensation	3 807	2 190	0,3	54 941	9 213 626	0,5%
Educational assistance	3 032	2 054	0,3	25 149	31 449 318	1,7%
<i>Overall</i>	<i>8 806</i>	<i>6 876</i>	<i>0,3</i>	<i>116 548</i>	<i>684 395 154</i>	<i>37,4%</i>
<i>Taxes</i>						
Federal income tax	4 986	2 636	0,2	108 043	1 318 176 200	72,0%
State income tax	1 482	884	0,3	80 398	1 221 351 587	66,8%
SS payroll tax (FICA)	2 187	1 785	1,3	37 458	1 550 177 143	84,7%
Federal retirement payroll tax	2 722	2 258	1,7	58 050	34 539 597	1,9%
<i>Overall</i>	<i>7 252</i>	<i>4 207</i>	<i>0,4</i>	<i>181 131</i>	<i>1 636 490 857</i>	<i>89,4%</i>
<i>Tax credits</i>						
Earned income tax credit (EITC)	893	859	0,3	3 369	405 521 010	22,2%
Child tax credit	540	464	0,3	2 234	570 960 009	31,2%
Additional child tax credit	467	425	0,4	1 776	284 700 459	15,6%
Stimulus	527	536	0,5	1 523	257 000 104	14,0%
Making work pay credit	307	306	0,4	871	471 707 062	25,8%
<i>Overall</i>	<i>940</i>	<i>726</i>	<i>0,3</i>	<i>4 444</i>	<i>1 152 472 468</i>	<i>63,0%</i>
<i>In-kind transfers</i>						
Nutritional assistance (SNAP)	1 308	1 228	3,8	8 039	205 143 458	11,2%
Energy assistance (LIHEAP)	189	145	0,3	1 607	56 696 335	3,1%
<i>Overall</i>	<i>1 252</i>	<i>1 143</i>	<i>0,4</i>	<i>8 978</i>	<i>222 741 003</i>	<i>12,2%</i>

Notes:

¹All statistics are in dollars, except for N (N as a %), which refers to the number (proportion) of individuals.

²All statistics refer to per-person equivalised household income and consider individual weights.

D Findings

Table 11: Summary measures of income inequality

Variable	Levels						% Change relative to 2007				
	2007	2008	2009	2010	2011	2012	2008	2009	2010	2011	2012
<i>Gini index</i>											
Pre-government	0,45	0,46	0,47	0,48	0,48	0,48	1,9%	5,0%	6,1%	6,2%	5,8%
Post-cash-transfers	0,40	0,40	0,41	0,41	0,41	0,41	0,7%	2,2%	3,2%	3,6%	3,2%
Post-tax	0,35	0,36	0,36	0,37	0,37	0,37	0,4%	2,2%	3,4%	4,1%	4,1%
Post-tax-credits	0,34	0,34	0,35	0,35	0,36	0,36	-0,7%	1,0%	2,3%	3,6%	3,6%
Post-in-kind-tranfers	0,34	0,34	0,34	0,34	0,35	0,35	-0,9%	0,2%	1,3%	2,6%	2,7%
<i>P90-P10 ratio</i>											
Pre-government	26,85	33,90	46,16	67,33	72,07	67,40	26,3%	71,9%	150,8%	168,5%	151,1%
Post-cash-transfers	8,16	8,41	8,76	9,14	9,03	9,07	3,0%	7,3%	11,9%	10,5%	11,1%
Post-tax	6,51	6,63	6,94	7,17	7,17	7,23	1,8%	6,5%	10,1%	10,2%	11,1%
Post-tax-credits	5,83	5,83	5,98	6,18	6,26	6,34	0,1%	2,6%	6,1%	7,4%	8,7%
Post-in-kind-tranfers	5,59	5,53	5,53	5,73	5,74	5,82	-0,9%	-1,0%	2,6%	2,8%	4,1%
<i>P90-P50 ratio</i>											
Pre-government	2,57	2,66	2,77	2,80	2,82	2,82	3,5%	7,9%	9,1%	9,8%	9,7%
Post-cash-transfers	2,39	2,44	2,50	2,51	2,53	2,51	2,0%	4,4%	4,9%	5,7%	4,7%
Post-tax	2,09	2,12	2,15	2,16	2,20	2,18	1,5%	3,1%	3,6%	5,2%	4,6%
Post-tax-credits	2,05	2,05	2,10	2,11	2,16	2,15	-0,2%	2,2%	2,8%	5,1%	4,6%
Post-in-kind-tranfers	2,05	2,05	2,10	2,11	2,15	2,15	-0,3%	2,1%	2,6%	4,9%	4,5%
<i>P50-P10 ratio</i>											
Pre-government	10,46	12,77	16,67	24,04	25,57	23,94	22,1%	59,3%	129,8%	144,4%	128,8%
Post-cash-transfers	3,41	3,44	3,51	3,64	3,57	3,62	1,0%	2,8%	6,6%	4,6%	6,1%
Post-tax	3,12	3,13	3,22	3,31	3,26	3,31	0,4%	3,4%	6,3%	4,7%	6,2%
Post-tax-credits	2,84	2,85	2,85	2,93	2,90	2,95	0,3%	0,4%	3,2%	2,2%	3,9%
Post-in-kind-tranfers	2,72	2,70	2,64	2,72	2,66	2,71	-0,6%	-3,0%	0,0%	-2,0%	-0,3%

Notes:

¹All statistics refer to per-person equivalised household income and consider individual weights.

Table 12: Income percentiles

Variable	Levels						% Change relative to 2007				
	2007	2008	2009	2010	2011	2012	2008	2009	2010	2011	2012
<i>P10</i>											
Pre-government	2 381	1 843	1 346	918	856	916	-22,6%	-43,5%	-61,5%	-64,0%	-61,5%
Post-cash-transfers	8 040	7 662	7 342	7 028	7 074	7 074	-4,7%	-8,7%	-12,6%	-12,0%	-12,0%
Post-tax	7 451	7 177	6 885	6 627	6 754	6 691	-3,7%	-7,6%	-11,1%	-9,4%	-10,2%
Post-tax-credits	8 325	8 233	8 037	7 738	7 745	7 640	-1,1%	-3,5%	-7,0%	-7,0%	-8,2%
Post-in-kind-transfers	8 688	8 679	8 692	8 346	8 447	8 322	-0,1%	0,0%	-3,9%	-2,8%	-4,2%
<i>P25</i>											
Pre-government	11 390	10 466	9 428	9 015	9 158	9 075	-8,1%	-17,2%	-20,8%	-19,6%	-20,3%
Post-cash-transfers	15 102	14 461	14 002	13 668	13 501	13 501	-4,2%	-7,3%	-9,5%	-10,6%	-10,6%
Post-tax	13 699	13 214	12 912	12 570	12 575	12 603	-3,5%	-5,7%	-8,2%	-8,2%	-8,0%
Post-tax-credits	14 330	14 149	13 953	13 583	13 431	13 430	-1,3%	-2,6%	-5,2%	-6,3%	-6,3%
Post-in-kind-transfers	14 412	14 265	14 180	13 844	13 688	13 643	-1,0%	-1,6%	-3,9%	-5,0%	-5,3%
<i>P50</i>											
Pre-government	24 905	23 534	22 431	22 055	21 889	21 916	-5,5%	-9,9%	-11,4%	-12,1%	-12,0%
Post-cash-transfers	27 416	26 388	25 746	25 558	25 219	25 219	-3,8%	-6,1%	-6,8%	-8,0%	-8,0%
Post-tax	23 224	22 450	22 185	21 966	22 051	22 159	-3,3%	-4,5%	-5,4%	-5,0%	-4,6%
Post-tax-credits	23 625	23 438	22 897	22 655	22 457	22 534	-0,8%	-3,1%	-4,1%	-4,9%	-4,6%
Post-in-kind-transfers	23 631	23 467	22 931	22 702	22 510	22 561	-0,7%	-3,0%	-3,9%	-4,7%	-4,5%
<i>P75</i>											
Pre-government	42 241	40 758	40 034	39 860	39 440	39 736	-3,5%	-5,2%	-5,6%	-6,6%	-5,9%
Post-cash-transfers	44 341	42 971	42 638	42 466	42 237	42 237	-3,1%	-3,8%	-4,2%	-4,7%	-4,7%
Post-tax	35 153	34 234	34 218	34 070	34 338	34 384	-2,6%	-2,7%	-3,1%	-2,3%	-2,2%
Post-tax-credits	35 455	35 177	34 838	34 668	34 608	34 631	-0,8%	-1,7%	-2,2%	-2,4%	-2,3%
Post-in-kind-transfers	35 455	35 182	34 840	34 682	34 611	34 636	-0,8%	-1,7%	-2,2%	-2,4%	-2,3%
<i>P90</i>											
Pre-government	63 919	62 487	62 118	61 778	61 703	61 710	-2,2%	-2,8%	-3,3%	-3,5%	-3,5%
Post-cash-transfers	65 646	64 424	64 347	64 223	63 843	63 843	-1,9%	-2,0%	-2,2%	-2,7%	-2,7%
Post-tax	48 504	47 582	47 755	47 507	48 447	48 388	-1,9%	-1,5%	-2,1%	-0,1%	-0,2%
Post-tax-credits	48 526	48 034	48 066	47 837	48 480	48 406	-1,0%	-0,9%	-1,4%	-0,1%	-0,2%
Post-in-kind-transfers	48 526	48 035	48 069	47 837	48 480	48 406	-1,0%	-0,9%	-1,4%	-0,1%	-0,2%

Notes:

¹All statistics refer to per-person equivalised household income and consider individual weights.

Table 13: Average income by income groups

Variable	Levels						% Change relative to 2007				
	2007	2008	2009	2010	2011	2012	2008	2009	2010	2011	2012
Bottom 10											
Pre-government	382	249	133	70	63	60	-34,9%	-65,1%	-81,7%	-83,6%	-84,3%
Post-cash-transfers	4 558	4 251	4 024	3 776	3 743	3 743	-6,7%	-11,7%	-17,2%	-17,9%	-17,9%
Post-tax	4 234	3 998	3 785	3 575	3 584	3 589	-5,6%	-10,6%	-15,6%	-15,4%	-15,2%
Post-tax-credits	4 751	4 665	4 430	4 149	4 091	4 122	-1,8%	-6,8%	-12,7%	-13,9%	-13,2%
Post-in-kind-transfers	5 276	5 262	5 209	4 926	4 897	4 947	-0,3%	-1,3%	-6,6%	-7,2%	-6,2%
Bottom 20											
Pre-government	3 064	2 637	2 183	1 932	1 954	1 975	-13,9%	-28,8%	-37,0%	-36,2%	-35,6%
Post-cash-transfers	7 464	7 141	6 866	6 546	6 540	6 540	-4,3%	-8,0%	-12,3%	-12,4%	-12,4%
Post-tax	6 917	6 654	6 411	6 120	6 207	6 168	-3,8%	-7,3%	-11,5%	-10,3%	-10,8%
Post-tax-credits	7 612	7 540	7 350	7 024	6 993	6 954	-0,9%	-3,4%	-7,7%	-8,1%	-8,6%
Post-in-kind-transfers	7 988	7 986	7 965	7 658	7 637	7 614	0,0%	-0,3%	-4,1%	-4,4%	-4,7%
Bottom 50											
Pre-government	11 316	10 465	9 598	9 266	9 241	9 277	-7,5%	-15,2%	-18,1%	-18,3%	-18,0%
Post-cash-transfers	14 941	14 323	13 912	13 552	13 461	13 461	-4,1%	-6,9%	-9,3%	-9,9%	-9,9%
Post-tax	13 247	12 785	12 513	12 209	12 293	12 282	-3,5%	-5,5%	-7,8%	-7,2%	-7,3%
Post-tax-credits	13 847	13 711	13 410	13 081	12 976	12 962	-1,0%	-3,2%	-5,5%	-6,3%	-6,4%
Post-in-kind-transfers	14 025	13 934	13 731	13 431	13 325	13 310	-0,7%	-2,1%	-4,2%	-5,0%	-5,1%
Top 50											
Pre-government	49 777	48 073	47 350	47 116	46 825	46 908	-3,4%	-4,9%	-5,3%	-5,9%	-5,8%
Post-cash-transfers	51 853	50 356	50 066	49 751	49 499	49 499	-2,9%	-3,4%	-4,1%	-4,5%	-4,5%
Post-tax	39 361	38 248	38 366	38 115	38 641	38 712	-2,8%	-2,5%	-3,2%	-1,8%	-1,6%
Post-tax-credits	39 602	39 016	38 883	38 624	38 858	38 918	-1,5%	-1,8%	-2,5%	-1,9%	-1,7%
Post-in-kind-transfers	39 605	39 021	38 893	38 641	38 869	38 928	-1,5%	-1,8%	-2,4%	-1,9%	-1,7%
Top 20											
Pre-government	72 127	70 062	69 685	69 319	69 243	69 019	-2,9%	-3,4%	-3,9%	-4,0%	-4,3%
Post-cash-transfers	74 000	72 022	72 037	71 590	71 506	71 506	-2,7%	-2,7%	-3,3%	-3,4%	-3,4%
Post-tax	53 262	51 755	52 204	51 896	52 930	52 908	-2,8%	-2,0%	-2,6%	-0,6%	-0,7%
Post-tax-credits	53 331	52 251	52 511	52 209	52 983	52 953	-2,0%	-1,5%	-2,1%	-0,7%	-0,7%
Post-in-kind-transfers	53 332	52 253	52 514	52 216	52 983	52 955	-2,0%	-1,5%	-2,1%	-0,7%	-0,7%
Top 10											
Pre-government	89 502	86 970	86 658	86 172	86 260	85 755	-2,8%	-3,2%	-3,7%	-3,6%	-4,2%
Post-cash-transfers	91 342	88 779	88 912	88 309	88 469	88 469	-2,8%	-2,7%	-3,3%	-3,1%	-3,1%
Post-tax	63 498	61 572	62 243	61 887	63 096	63 027	-3,0%	-2,0%	-2,5%	-0,6%	-0,7%
Post-tax-credits	63 520	61 890	62 446	62 102	63 113	63 042	-2,6%	-1,7%	-2,2%	-0,6%	-0,8%
Post-in-kind-transfers	63 520	61 897	62 448	62 107	63 115	63 043	-2,6%	-1,7%	-2,2%	-0,6%	-0,8%

Notes:

¹All statistics refer to per-person equivalised household income and consider individual weights.

Table 14: Income shares by income groups

Variable	Levels						Change in p.p. relative to 2007				
	2007	2008	2009	2010	2011	2012	2008	2009	2010	2011	2012
<i>Bottom 10</i>											
Pre-government	0,1%	0,1%	0,0%	0,0%	0,0%	0,0%	0,0%	-0,1%	-0,1%	-0,1%	-0,1%
Post-cash-transfers	1,4%	1,3%	1,3%	1,2%	1,2%	1,2%	-0,1%	-0,1%	-0,2%	-0,2%	-0,2%
Post-tax	1,6%	1,6%	1,5%	1,4%	1,4%	1,4%	0,0%	-0,1%	-0,2%	-0,2%	-0,2%
Post-tax-credits	1,8%	1,8%	1,7%	1,6%	1,6%	1,6%	0,0%	-0,1%	-0,2%	-0,2%	-0,2%
Post-in-kind-transfers	2,0%	2,0%	2,0%	1,9%	1,9%	1,9%	0,0%	0,0%	-0,1%	-0,1%	-0,1%
<i>Bottom 20</i>											
Pre-government	2,0%	1,8%	1,5%	1,4%	1,4%	1,4%	-0,2%	-0,5%	-0,6%	-0,6%	-0,6%
Post-cash-transfers	4,5%	4,4%	4,3%	4,2%	4,2%	4,2%	-0,1%	-0,2%	-0,3%	-0,3%	-0,3%
Post-tax	5,3%	5,2%	5,0%	4,9%	4,9%	4,8%	0,0%	-0,2%	-0,4%	-0,4%	-0,4%
Post-tax-credits	5,7%	5,7%	5,6%	5,4%	5,4%	5,4%	0,0%	-0,1%	-0,3%	-0,3%	-0,3%
Post-in-kind-transfers	6,0%	6,0%	6,1%	5,9%	5,9%	5,8%	0,1%	0,1%	-0,1%	-0,1%	-0,1%
<i>Bottom 50</i>											
Pre-government	18,5%	17,9%	16,9%	16,5%	16,5%	16,5%	-0,6%	-1,7%	-2,1%	-2,0%	-2,0%
Post-cash-transfers	22,4%	22,1%	21,7%	21,4%	21,4%	21,4%	-0,2%	-0,6%	-1,0%	-1,0%	-1,0%
Post-tax	25,2%	25,1%	24,6%	24,3%	24,1%	24,1%	-0,1%	-0,6%	-0,9%	-1,0%	-1,1%
Post-tax-credits	25,9%	26,0%	25,6%	25,3%	25,0%	25,0%	0,1%	-0,3%	-0,6%	-0,9%	-0,9%
Post-in-kind-transfers	26,2%	26,3%	26,1%	25,8%	25,5%	25,5%	0,2%	-0,1%	-0,4%	-0,6%	-0,7%
<i>Top 50</i>											
Pre-government	81,5%	82,1%	83,1%	83,5%	83,5%	83,5%	0,6%	1,7%	2,1%	2,0%	2,0%
Post-cash-transfers	77,6%	77,9%	78,3%	78,6%	78,6%	78,6%	0,2%	0,6%	1,0%	1,0%	1,0%
Post-tax	74,8%	74,9%	75,4%	75,7%	75,9%	75,9%	0,1%	0,6%	0,9%	1,0%	1,1%
Post-tax-credits	74,1%	74,0%	74,4%	74,7%	75,0%	75,0%	-0,1%	0,3%	0,6%	0,9%	0,9%
Post-in-kind-transfers	73,8%	73,7%	73,9%	74,2%	74,5%	74,5%	-0,2%	0,1%	0,4%	0,6%	0,7%
<i>Top 20</i>											
Pre-government	47,2%	47,9%	48,9%	49,2%	49,4%	49,1%	0,7%	1,7%	2,0%	2,2%	1,9%
Post-cash-transfers	44,3%	44,5%	45,0%	45,2%	45,4%	45,4%	0,2%	0,7%	0,9%	1,1%	1,1%
Post-tax	40,5%	40,6%	41,0%	41,2%	41,6%	41,5%	0,1%	0,5%	0,7%	1,1%	1,0%
Post-tax-credits	39,9%	39,6%	40,2%	40,4%	40,9%	40,8%	-0,3%	0,3%	0,5%	1,0%	0,9%
Post-in-kind-transfers	39,8%	39,5%	39,9%	40,1%	40,6%	40,5%	-0,3%	0,1%	0,3%	0,8%	0,8%
<i>Top 10</i>											
Pre-government	29,3%	29,7%	30,4%	30,6%	30,8%	30,5%	0,4%	1,1%	1,3%	1,5%	1,2%
Post-cash-transfers	27,4%	27,4%	27,8%	27,9%	28,1%	28,1%	0,1%	0,4%	0,5%	0,7%	0,7%
Post-tax	24,1%	24,1%	24,5%	24,6%	24,8%	24,7%	0,0%	0,3%	0,5%	0,6%	0,6%
Post-tax-credits	23,8%	23,5%	23,9%	24,0%	24,4%	24,3%	-0,3%	0,1%	0,2%	0,6%	0,5%
Post-in-kind-transfers	23,7%	23,4%	23,7%	23,8%	24,2%	24,1%	-0,3%	0,1%	0,2%	0,5%	0,5%

Notes:

¹All statistics refer to per-person equalised household income and consider individual weights.

Figure 15: Post tax and transfer income percentiles

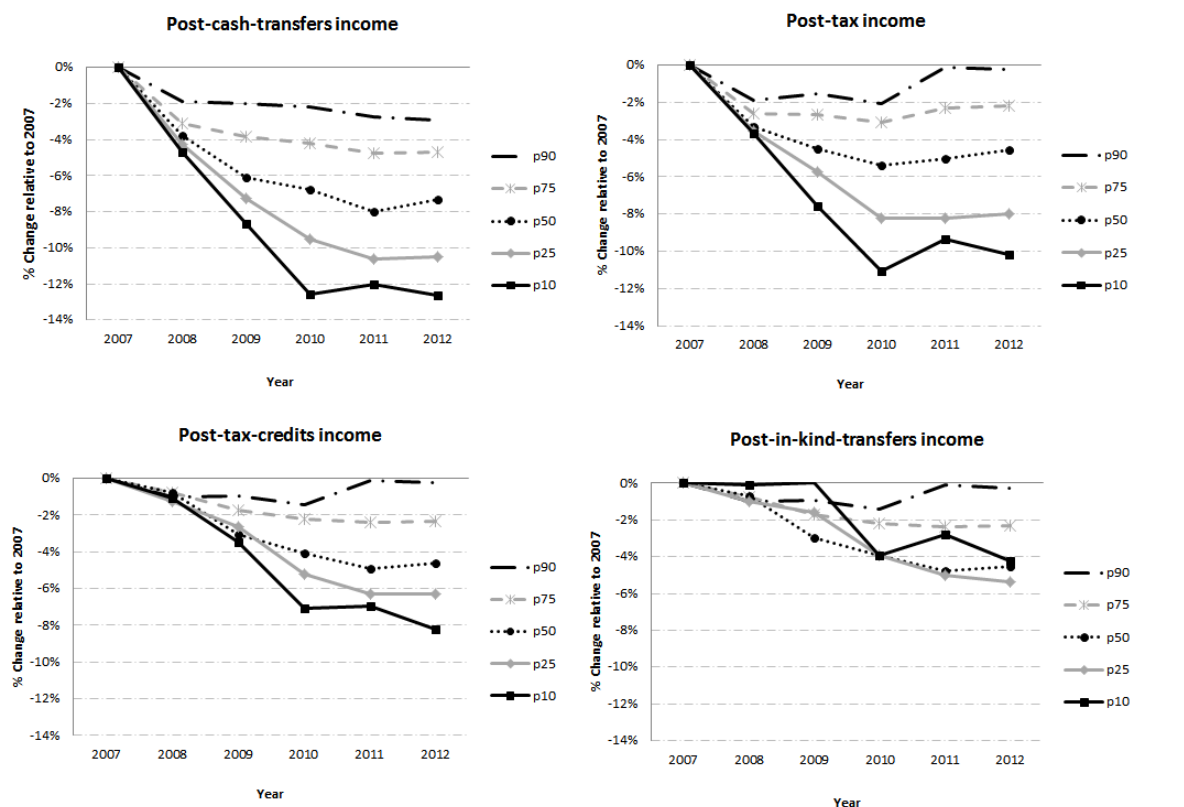


Figure 16: Post tax and transfer income shares by income group

