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IMF STAFF DISCUSSION NOTE

Inequality and Labor Market Institutions

Florence Jaumotte and Carolina Osorio Buitron

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Authorized for distribution by Olivier Blanchard

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EXECUTIVE SUMMARY

The rise of inequality in advanced economies, and in particular the growing concentration of incomes at the top of the distribution, has become a greater focus of attention for economists and policymakers. Understanding the factors behind this phenomenon is essential to determine whether policy action is needed to reduce income inequality, taking into account other policy objectives. Traditional explanations advanced for the rise in inequality have been technological progress and globalization. But there is little policymakers are able or willing to do to reverse these trends, because they benefit growth. Moreover, while high-income countries have been similarly affected by technological change and globalization, inequality in these economies has risen at different speeds. This has led economists to underscore the role of institutional changes, notably of financial deregulation and lower top marginal personal income tax rates.

This paper takes a fresh look at the causes of the rise of inequality in advanced economies, focusing on the relationship between labor market institutions and the distribution of incomes—which has featured less prominently in recent debates. We find evidence that the erosion of labor market institutions is associated with the rise of income inequality in our sample of advanced economies, notably at the top of the income distribution. Our key findings are that the decline in unionization is related to the rise of top income shares and less redistribution, while the erosion of minimum wages is correlated with considerable increases in overall inequality. There is also some evidence that the broad extension of collective agreements to non-union members is associated with higher inequality, likely owing to higher unemployment. Finally, we confirm that financial deregulation and lower top marginal tax rates are related with higher inequality.

The most novel result is the strong negative relationship between unionization and top earners' income shares. This finding challenges preconceptions about the channels through which union density affects income distribution. Indeed, the widely held view is that changes in labor market institutions affect low- and middle-wage workers but are unlikely to have a direct impact on top income earners. We argue that if de-unionization weakens earnings for middle- and low-income workers, this necessarily increases the income share of corporate managers and shareholders. The channels through which weaker unions could potentially lead to higher top income shares include the positive effect of weaker unions on the share of capital income—which tends to be more concentrated than labor income—and the fact that lower union density may reduce workers' influence on corporate decisions, including those related to top executive compensation.

While our findings, if interpreted as causal, suggest that higher unionization and minimum wages can help reduce inequality, they do not constitute a blanket recommendation for more unionization or higher minimum wages. Other dimensions are clearly relevant. Unions, if they primarily represent the interests of some workers, can lead to high structural unemployment for some other groups, such as the young. Minimum wages can be too high and lead to high unemployment among unskilled workers and loss of competitiveness. Deciding whether labor market institutions are appropriate needs to be done on a country-by-country basis, taking into account other policy objectives, including macroeconomic stability, competitiveness, growth, and unemployment. Finally, our results support a multi-pronged approach to addressing the increase in inequality, including tax reform and curbing excesses associated with the deregulation of the financial sector.

INTRODUCTION

Since the early 1980s, income inequality has risen in many advanced economies, as evidenced by the sustained increase in these countries' Gini coefficients and top earners' income shares (Atkinson and Piketty, 2007; OECD, 2012; Alvaredo and others, 2013). Although some degree of inequality can increase efficiency by strengthening incentives to work and invest, recent work suggests that higher inequality tends to be associated with lower and less sustainable growth in the medium run, and that under certain conditions redistribution may be benign for growth (Berg and Ostry, 2011; Berg, Ostry, and Zettelmeyer, 2012; Ostry, Berg, and Tsangarides, 2014). Long periods of rising inequality can increase the risk of economic crises, as they may induce the poor to over-borrow from the rich (Kumhof and Rancière, 2010). Inequality may also hinder the government's ability to react to shocks, as it incites political instability. Likewise, a rising concentration of income at the top of the distribution can be welfare reducing, if it enables top earners to manipulate the economic and political system in their favor (Stiglitz, 2012). Finally, income inequality may limit opportunities for the poor to invest in education and entrepreneurial activity, an outcome that ultimately undermines potential growth.

We study the causes of the rise in inequality and focus on the role played by labor market institutions in 20 advanced economies during 1980–2010.[2] Traditional explanations for the rise of inequality in advanced economies are skill-biased technological change (SBTC) and globalization, which have increased the relative demand for skilled workers, benefitting top earners relative to average wage earners. But technology and globalization foster economic growth, and there is little policymakers are able or willing to do to reverse these trends. Further, while high-income countries have been affected in broadly similar ways by SBTC and globalization, they have seen inequality rise at different speeds. As a consequence, the literature has more recently focused on the role played by institutional changes. Among these, financial deregulation and the decline in top marginal personal income tax rates are often cited as important contributors to the rise of inequality (Philippon and Reshef, 2012, 2013; Piketty, Saez, and Stantcheva, 2014). By contrast, the role of the erosion of labor market institutions has featured less prominently in recent debates, a gap in the literature that this paper intends to fill. Yet labor market institutions affect both gross and net income inequality: on the one hand, the rise in top income shares is possibly supported by the weakening of labor market institutions, as the latter reduces the bargaining power of average wage earners relative to top earners (Piketty, Saez, and Stantcheva, 2014; Duenhaupt, 2012); on the other hand, weaker labor market institutions can limit workers' influence on redistributive policies, thus contributing to the rise of *net* income inequality.

To examine the impact of labor market institutions on inequality, we draw on the experience of 20 advanced economies from the early 1980s to 2010. Further, given that different labor market

[2] The advanced economies in this study are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States.

institutions can affect different parts of the income distribution, we consider two measures of inequality: the income share of the top 10 percent earners and the Gini coefficient, which is more sensitive to changes at the middle and bottom of the income distribution. We also take into account Gini coefficients of both gross and net income, to assess the effect of labor market institutions on redistribution.

Our main findings can be summarized as follows. The results indicate that the rise of inequality in the advanced economies included in this study has been driven by the upper part of the income distribution, owing largely to the increase in income shares of top 10 percent earners. We find evidence that the decline in union density—the fraction of union members in the workforce—is strongly associated with the rise of top income shares. We discuss various channels through which lower union density could have contributed to the rise of income shares of top earners. In addition, we conduct a variety of robustness checks to ensure that the result is not driven by omitted variables, endogeneity problems, or the estimation method. Our empirical results also indicate that unions can affect income redistribution through their influence on public policy. We further find that reductions in the minimum wage relative to the median wage are related to significant increases in inequality. These findings, however, should not be seen as a blanket recommendation for strengthening these labor market institutions. In some countries (for example, in some southern European countries), strong unions and high minimum wages have led to high structural unemployment (especially for youth) and losses of competitiveness. Finally, while there is some evidence that collective agreements coverage in excess of union density is associated with higher inequality, likely due to higher unemployment, the empirical evidence concerning the effects of other labor market institutions (for example, unemployment benefits, employment protection) on inequality and redistribution is not robust.

The remainder of the paper is organized as follows. In Section II, we review briefly the literature and present a conceptual framework of the relationship between labor market institutions and inequality. In Section III, we present some stylized facts about inequality and labor market institutions. In Section IV, we discuss the results from the empirical analysis, which includes an event analysis and panel regressions. Section V summarizes the paper and concludes.

CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW

Although various measures indicate that inequality in advanced economies has risen considerably since the 1980s (OECD, 2012), the more recent literature has focused on the rise of top income shares based on tax returns data (Dew-Becker and Gordon, 2005; Piketty and Saez, 2006; Piketty, Saez, and Stantcheva, 2014). While it is well established that income shares at the top have increased at the expense of all other income groups in the United States, a similar pattern is observed in most other advanced economies. Further, the rise of inequality in high-income countries is mostly explained by the upper half of the distribution, reflecting rising income differentials between the 9th (highest) and 5th deciles and a stable ratio between the 5th and 1st (lowest) deciles.

These developments imply that the Gini coefficient may not be sufficient to assess the evolution of inequality in advanced economies, as the statistic is more affected by the underreporting of top incomes than the tax returns data used to construct top income shares (Alvaredo, 2011; Burkhauser and others, 2012).[3] Notwithstanding this limitation, the Gini effectively captures changes below the 9th decile of the distribution, as it gauges the *average* difference in income between any two individuals randomly chosen from the income distribution. Further, since the Gini is available for both gross and net incomes, it provides an indirect measure of the effectiveness of redistributive policies. Therefore, we consider Gini coefficients and top income shares in our analysis.

Explanations for the rise of inequality in the developed world either focus on market-driven forces or institutional changes. According to the market forces hypothesis, the increase in inequality reflects the rising demand for skills at the top, owing to technological progress and globalization (see Gabaix and Landier, 2008). On the other hand, the institutional features often cited as determinants of the rise in top income shares are the fall of top marginal personal income tax rates and financial deregulation (OECD, 2012; Bivens and Mishel, 2013; Philippon and Reshef, 2012, 2013; Alvaredo and others, 2013; Piketty, Saez, and Stantcheva, 2014). Substantial changes in labor market institutions also took place over the past 30 years, but these have featured less prominently in recent debates. We assess the role such institutional changes may have played in the rise of inequality, while controlling for the aforementioned determinants that have been established in the literature. Further, our analysis focuses on union density and the minimum wage, as the evidence of the effects of other labor market institutions was not robust.

The widely held view is that changes in unionization or the minimum wage affect low- and middle-wage workers, but are unlikely to have a direct impact on top income earners (Piketty and Saez, 2006; OECD, 2012). While our findings are consistent with priors about the minimum wage effects, we find strong evidence that lower union density is associated with a rise of top income shares, thus challenging preconceptions about the channels through which the relationship between union density and the distribution of incomes materializes. This is the most novel aspect of our paper which, albeit puzzling, sets the stage for further research on the link between the erosion of labor market institutions and the rise of inequality at the top.

We discuss below the channels through which union density and the minimum wage impact the distribution of earnings at the bottom and middle of the distribution—namely, the dispersion of wages, unemployment, and redistribution. Subsequently, we formulate hypotheses about the mechanisms through which weaker unions can lead to higher top income shares, although the empirical support for these theories remains largely unexplored.

Wage distribution. The literature provides much evidence that labor market institutions reduce inequality of the *wage distribution* (Betcherman, 2012; Kierzenkowski and Koske, 2012). Unions are found to have an equalizing impact on the distribution of labor compensation (Card, 1996, 2001;

[3] This problem is largely explained by under-coverage of highest income earners and top coding. See Ostry and Berg (2014) for a discussion of the measures of inequality.

Card, Lemieux, and Riddell, 2004; DiNardo, Fortin, and Lemieux, 1996), and the consensus is that a higher minimum wage reduces wage inequality (DiNardo, Fortin, and Lemieux, 1996; Lee, 1999; Teulings, 2003).[4]

Unemployment rate. While some labor market institutions may indeed lead to lower wage inequality, they might also cause higher unemployment as a result, leading to higher *gross income inequality*. The empirical evidence for the potential trade-off between wage inequality and unemployment is inconclusive. There is robust empirical support for the hypothesis that labor market institutions increase wage equality, while the evidence of their impact on unemployment is less robust. Studies have found that changes in union density and the minimum wage have generally modest adverse effects on unemployment, at least within the range of institutional arrangements observed in most advanced economies (Betcherman, 2012; Baker and others, 2004; Freeman, 2000; Howell and others, 2007; OECD, 2006).

Redistribution. Some labor market institutions can also play a role in the process of redistribution of market income and contribute to reduce *net income inequality*. In particular, strong unions can play an important role in the determination of redistributive policies, as evidenced by their contribution to the introduction of fundamental social and labor rights (Betcherman, 2012). Further, the *Power Resources Theory* (PRT) suggests that strong unions can induce policymakers to engage in more redistribution, by mobilizing workers to vote for parties that promise to redistribute income or by leading all political parties to engage in more redistribution (Korpi, 2006).[5]

Bargaining power and influence of average wage earners. The weakening of unions could increase top income shares by reducing the bargaining power of average wage earners. Theoretical models suggest that a decline in the bargaining power of workers *relative to capital owners* reduces the labor income share (Layard, Nickell, and Jackman, 1991; Pissarides, 1990). Since capital incomes tend to be highly concentrated, a higher capital income share is likely associated with increased top income shares. The Organisation for Economic Co-operation and Development (OECD) estimates that in the mid-2000s the average Gini for capital income was 0.84 in advanced economies, compared with 0.36 and 0.58 for wages and self-employment income, respectively.[6] Further, weaker unions can reduce workers' influence on corporate decisions that benefit *top earners*. By contrast, where unions are strong, firms tend to engage in consultations with worker representatives, allowing them to have some influence over the size and structure of top executive compensation (Lemieux, MacLeod, and Parent, 2009; McCall and Percheski, 2010; Sjöberg, 2009). An alternative interpretation of this channel is that weaker unions increase the productivity of top executives by giving them more managerial freedom, which justifies their higher remuneration.

[4] A few studies investigated the role of the wage bargaining process. Most, but not all studies, find that centralized wage setting also narrows the distribution of wages (OECD, 2012).

[5] The PRT is a theory in comparative welfare-state research that links class-based political power with income distribution.

[6] Similarly, Piketty and Saez (2006) and Fräßdorf and others (2008) show that the share of capital income is larger at the top of the distribution. Moreover, since the 1980s, the concentration of capital income has increased more than that of labor income in three-fourths of OECD countries (OECD, 2012).

DiNardo, Hallock, and Pischke (1997) find a negative correlation between executive compensation and unionization in cross-sectional data. They also find that where unions are stronger, fewer managers are employed. It is worth noting that other papers have also found evidence of the relation between lower union density and higher inequality at the top. Focusing on the effects of the political system on inequality, Scheve and Stasavage (2009) and Volscho and Kelly (2012) find a negative effect of union density on top income shares for a panel of countries and the United States, respectively. However, these studies fail to control for key determinants of inequality, notably technological progress, which can bias their results. Moreover, they do not conduct in-depth causality and robustness tests.

INEQUALITY AND LABOR MARKET INSTITUTIONS: SOME FACTS

Measures of inequality based on Gini coefficients of gross and net income have increased substantially since 1980 in most of the developed world (Figure 1). At the same time, the (gross) income shares of the top 10 and top 1 percent earners have grown continuously, indicating that the rise of inequality in advanced economies has been driven by both, a greater dispersion of incomes between the top 10 and bottom 90 percent income groups, as well as a more uneven distribution of incomes *within* the top decile.

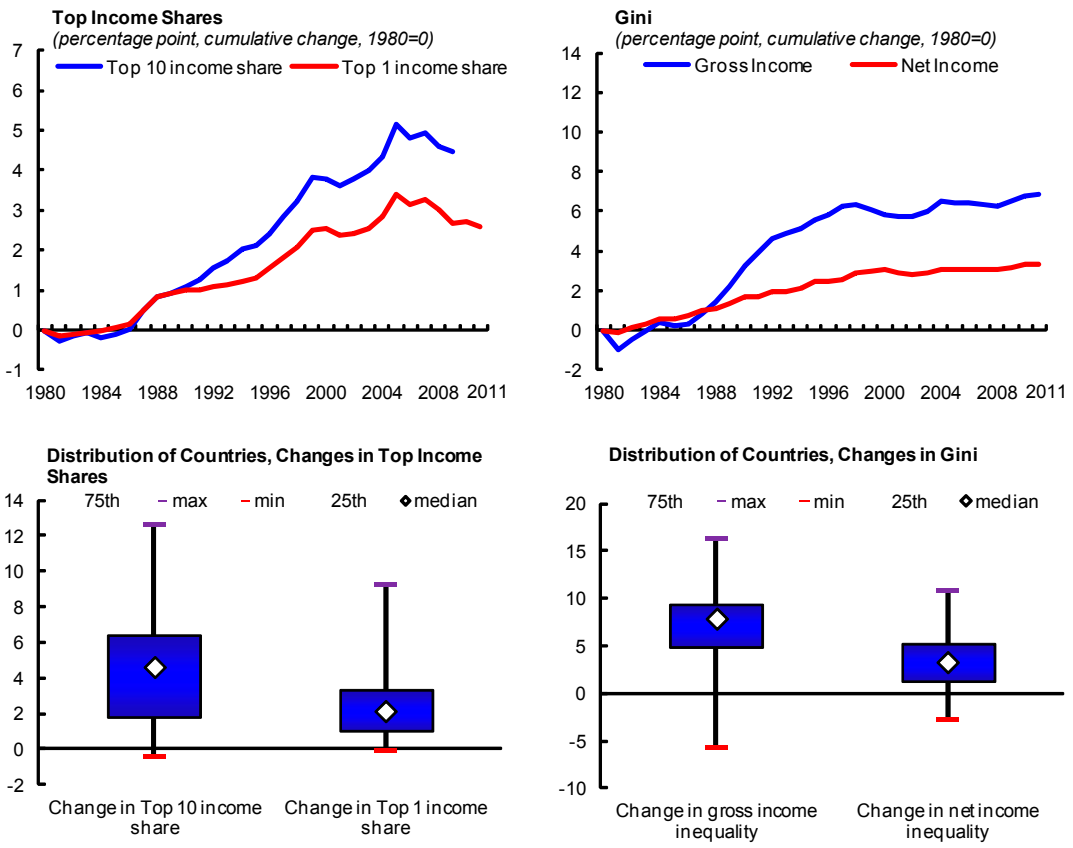
Since the mid-1990s, however, the behavior of the Gini and top income share statistics started to diverge, as the former increased at a significantly slower pace than the latter. The disconnect between these two measures likely reflects the fact that incomes have become so concentrated at the top, that Gini measures have not captured it well. Computations of the Gini index rely on household survey data, which suffer from top coding and under-coverage problems of top incomes. To illustrate, we calculate the increase in the Gini of gross income implied by the evolution of top income shares since the mid-1990s. For this counterfactual analysis, we assume a two-class economy: the top 10 percent and bottom 90 percent earners. Further, we suppose that inequality within the bottom 90 percent of the population remained constant since 1995, which is broadly consistent with the available evidence.[7] Our results suggest that, given the evolution of the top 10 percent income share, the Gini should have increased *by at least* 2.3 percentage points since 1995, 1.3 percentage points above the observed change.[8]

[7] We constructed a Gini coefficient for the bottom 90 percent of the population based on the Luxembourg Income Survey data of net income shares. The results indicate that net income inequality below the 90th percentile did not rise since the mid-1990s. This implies that the Gini of gross income below the 90th percentile likely rose and, thus, that our counterfactual estimate of the evolution of the Gini since 1995 is a lower bound estimate. These calculations are available upon request.

[8] Similarly, Atkinson and others (2009) argue that U.S. household survey data, which do not measure top incomes, fail to capture about half of the increase in overall inequality.

The increase in gross income inequality is on average larger than in net inequality, and the cross-country dispersion of changes in net income inequality is smaller than for the gross income measures. This suggests that redistributive policies have been somewhat successful. Indeed, Ostry, Berg, and Tsangarides (2014) find that, among advanced economies, higher inequality is associated with higher redistribution. However, the fact that net income inequality has increased in almost every year since 1980 indicates that the transfer and tax system has not kept pace with the rise in inequality.

Figure 1. Evolution of Inequality Measures in Advanced Economies, 1980–2011



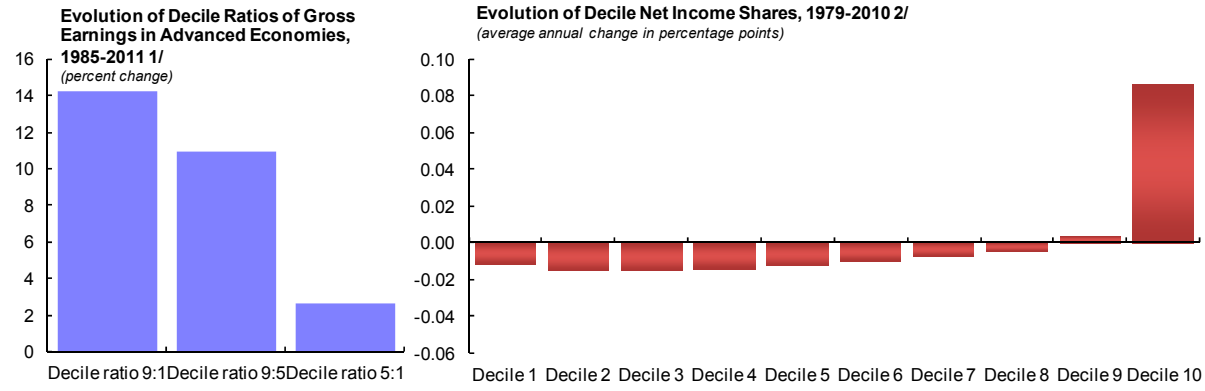
Sources: World Top Incomes Database; and SWIID (v. 4.0).
Note: Advanced Economies = USA, GBR, AUT, BEL, DNK, FRA, DEU, ITA, NLD, NOR, SWE, CHE, CAN, JPN, FIN, IRL, PRT, ESP, AUS, and NZL. Simple average.
For the top 10 income share, FIN, GBR, and PRT are excluded due to missing data over part of the 1980-2010 period.

As with measures of income inequality, changes in the distribution of earnings indicate that inequality has risen owing largely to a concentration of earnings at the top of the distribution. Gross earnings differentials between the 9th and 5th deciles of the distribution have increased over four times as much as the differential between the 5th and 1st deciles (Figure 2). Moreover, data from the Luxembourg Income Survey on net income shares indicate that income shares of the top 10 percent earners have increased at the expense of all other income groups. While there is some country heterogeneity, the increase in top income shares since the 1980s appears to be a pervasive phenomenon.

At the same time, significant changes have taken place in some labor market institutions. As mentioned earlier, the labor market institutions that seem to be more strongly associated with the rise of inequality are the share of workers affiliated to a trade union (union density) and the ratio of the minimum wage relative to the median wage. Figure 3 shows the evolution of these institutions. Union density declined steadily in most advanced economies including after the mid-1990s (OECD, 2012), whereas the evolution of the minimum wage relative to the median wage has been more varied, for instance, declining in the United States and rising in France. Several explanations have been advanced to explain the decline in unionization, including globalization, which increases competition and reduces rents that could be appropriated by unions; SBTC and improvements in education levels, which reduce workers' incentives to organize unions by, respectively, raising the outside option of skilled employees and inducing workers to move to less unionized sectors (Acemoglu, Aghion, and Violante, 2001); and deindustrialization, which led to an increase in the relative size of the less-unionized services sector. While one could think a priori that union density and the existence and level of a statutory national minimum wage would be closely related, there is no clear relationship between the two variables. If anything, the relationship appears to be negative; for instance, the Nordic European countries that have strong unions do not have a statutory national minimum wage.[9]

Regarding the other institutional variables, there has been a clear trend decline in top marginal tax rates and continued reforms aimed at liberalizing financial markets until the mid-1990s.

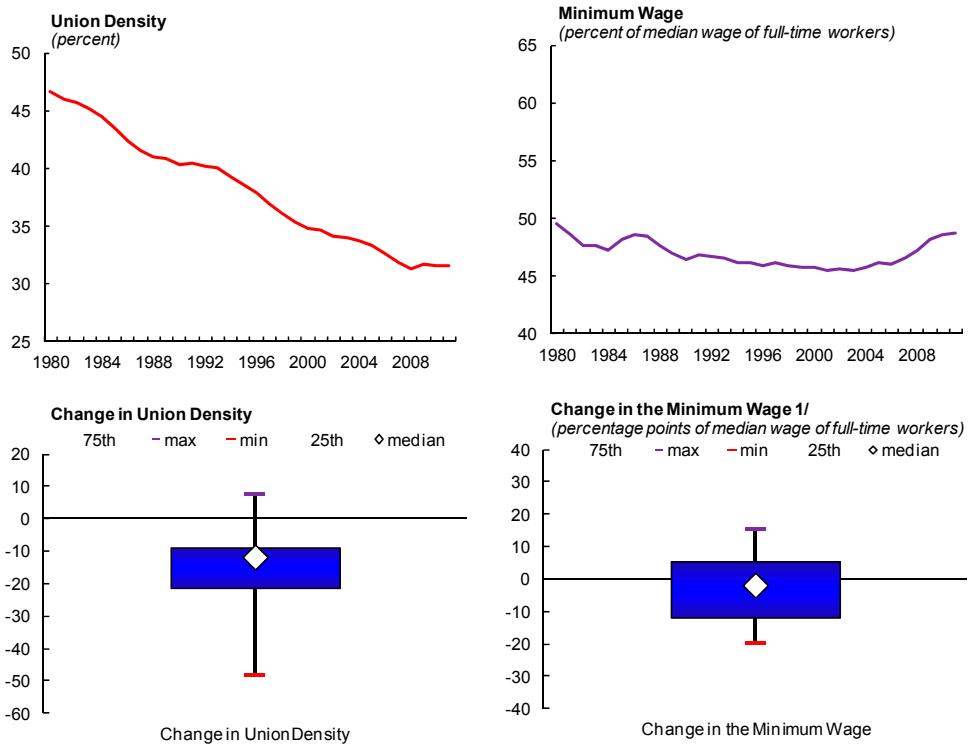
Figure 2. Distributional Changes in Advanced Economies, 1980–2011



Sources: OECD Wages and Earnings Database; and LIS / New York Times Income Distribution Database (2014).
1/ Earnings-dispersion measures - ratio of 9th-to-1st, 9th-to-5th and 5th-to-1st - where ninth, fifth (or median) and first deciles are upper-earnings decile limits, unless otherwise indicated, of gross earnings of full-time dependent employees. AEs include AUS, DNK, FIN, ITA, JPN, NZL, SWE, GBR, and USA. Simple average.
2/ Shares of disposable income by decile using Luxembourg Income Study data. Varying years for countries, including AUS, AUT, BEL, CAN, DNK, FIN, FRA, DEU, IRL, ITA, NLD, NOR, ESP, SWE, CHE, GBR, and USA.

[9] Other labor market institutions that weakened include collective bargaining structures, which became more decentralized in some countries, and employment protection laws, which were weakened, particularly for temporary contracts in Europe. On the other hand, unemployment benefits became more generous.

Figure 3. Evolution of Selected Institutions in Advanced Economies, 1980–2011



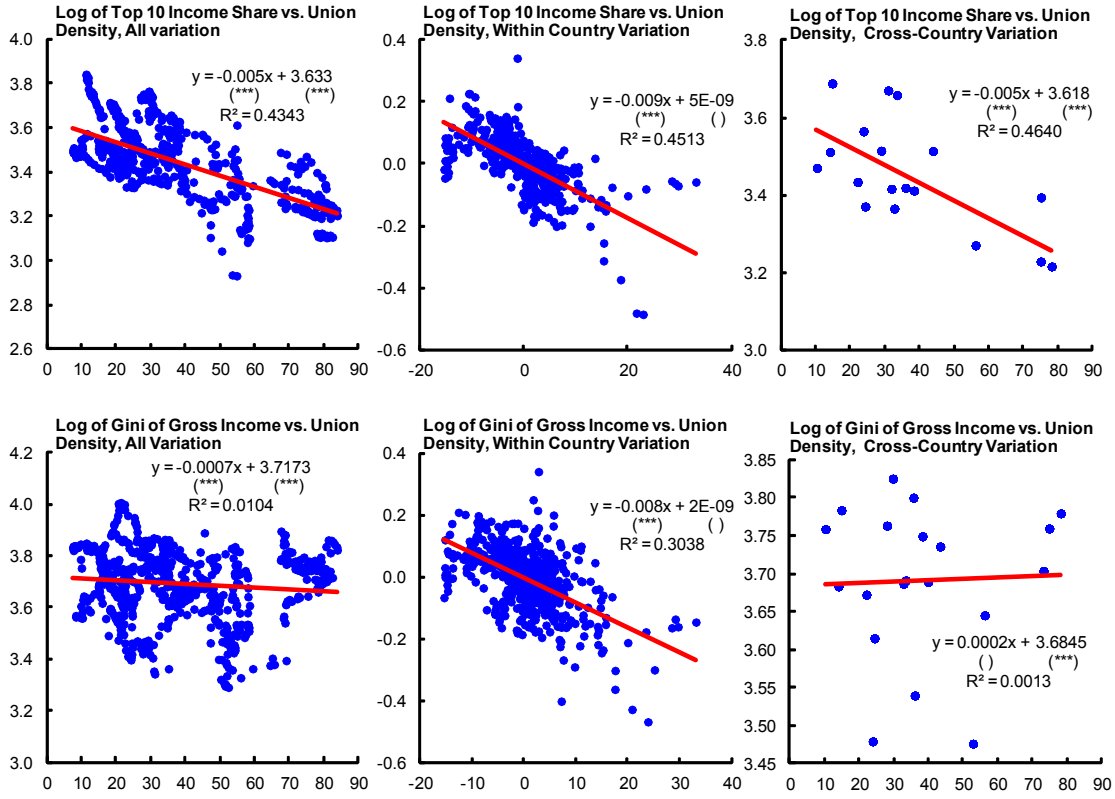
Source: OECD = Organisation for Economic Co-operation and Development.
Note: Advanced Economies = USA, GBR, AUT, BEL, DNK, FRA, DEU, ITA, NLD, NOR, SWE, CHE, CAN, JPN, FIN, IRL, PRT, ESP, AUS, and NZL. Simple average.
For the minimum wage, AUT, DNK, FIN, DEU, ITA, NOR, SWE, and CHE are excluded from the distribution because these countries do not have a statutory national minimum wage; AUS, IRL, and GBR are also excluded because they introduced a statutory national minimum wage in a later year (past 1980).
1/ For the minimum wage, 1985-2011 for Australia, 2000-11 for Ireland, and 1999-2011 for United Kingdom.

To assess the relationship between the observed changes in inequality and developments in labor market institutions, we first analyze simple correlations between these variables. There is a strong negative relation between the top 10 percent income share and union density, both within and across countries (Figure 4). The Gini of gross income is also negatively related with union density, but the relationship is somewhat weaker and mostly present within countries. The correlation coefficients for the minimum wage and the various inequality measures are more mixed (not reported).

A similar exercise suggests a positive association between union density and redistribution: while the correlation between union density and the Gini coefficient of gross income is weak, its correlation with the Gini of net income is clearly negative (Figure 5).

Figure 4. Gross Income Inequality Measures and Union Density in Advanced Economies, 1980–2011

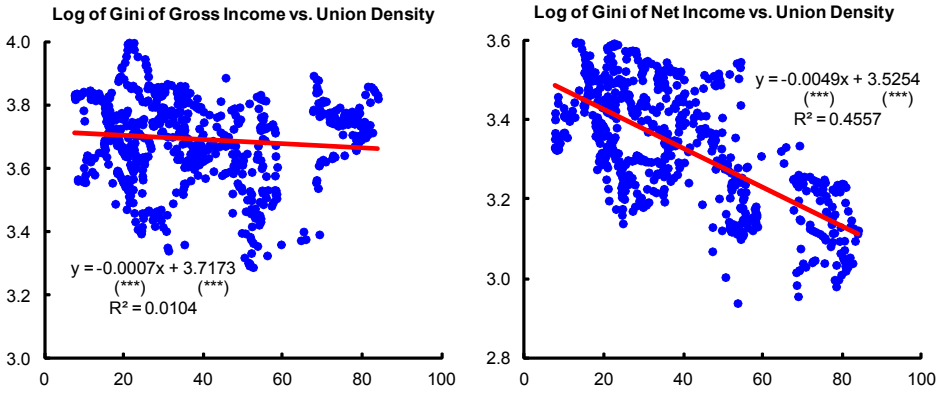
(percent)



Sources: OECD; SWIID (v. 4.0); and World Top Incomes Database.
Note: *** denote significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level. For top 10 income share, Advanced Economies = USA, AUT, CAN, DNK, FIN, FRA, DEU, IRL, ITA, JPN, NLD, NZL, NOR, PRT, ESP, SWE, CHE, and GBR. For Gini of gross income, Advanced Economies = USA, FRA, DEU, ITA, NLD, NOR, SWE, CHE, CAN, JPN, IRL, PRT, ESP, AUS, AUT, BEL, DNK, FIN, NZL,and GBR.

Figure 5. Redistribution Effect of Unions in Advanced Economies, 1980–2011

(percent)



Sources: OECD; and SWIID (v.4.0).
Note: *** denote significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level. Advanced Economies = USA, FRA, DEU, ITA, NLD, NOR, SWE, CHE, CAN, JPN, IRL, PRT, ESP, AUS, AUT, BEL, DNK, FIN, NZL,and GBR.

INEQUALITY AND LABOR MARKET INSTITUTIONS: EMPIRICAL RESULTS

Many factors can impact inequality simultaneously, possibly blurring the relationships between these variables. Moreover, some of our inequality measures are interrelated: this is for example the case of the Gini coefficients of gross and net income. We adopt two approaches to look at the relationship between inequality and labor market institutions: an event analysis and panel regressions.

The *event analysis* identifies meaningful changes in labor market institutions and examines the evolution of inequality around those events. While this approach cannot control for concurrent institutional changes or for other determinants of inequality, it can be useful to draw lessons from past experiences. Further, since the analysis focuses on the evolution of inequality around large institutional changes, it can expose non-linear relationships that may be missed in the econometric specification.

We also use *panel regressions* to test more rigorously the effect of labor market institutions on inequality, by controlling for contemporaneous changes in other determinants of inequality and potential omitted factors (through country and time fixed effects).

A. Event Analysis

An event analysis requires defining large institutional changes. We focus only on episodes for which union density declines significantly, as few events of rapid and large minimum wage reductions are identified. The identification of events, which is a complex and somewhat arbitrary task, is as follows. Downward turning points in the evolution of unionization are first identified using the Bry and Broschan algorithm.[10] Subsequently, we narrow the sample to large institutional changes, by selecting declines in unionization whose six-year cumulative fall is larger than the sample average. Finally, events preceded by an institutional change three or fewer years earlier are discarded. This removes the potential downward bias in our estimates, owing to lagged effects from previous reforms. The implementation of these criteria yields 13 events with an average decline in union density of 8 percentage points over a five-year period.

The results suggest that large declines in union density are followed by an increase in top income shares in 75 percent of the cases. The impact on the Gini coefficients is not as strong, as there is no evidence that de-unionization generated a clear break from the pre-event trend. By contrast, top income shares rise by 1.8 percentage points five years after the event, which contrasts with their stability in the years preceding the event (Figure 6). Episodes of de-unionization are also followed by a significant decline in the labor income share—of around 3 percentage points after five years—and

[10] The Bry and Broschan algorithm identifies turning points as the local maxima/minima in the series.

a sharp increase in the relative compensation in finance—of about 13 percent after five years—both of which are associated with higher top income shares. The results should be treated with caution, as the number of events is relatively small and contemporaneous changes in other determinants of inequality are not controlled for. These limitations are addressed in the empirical analysis of the next section.

B. Panel Regression Analysis

The previous section provided useful insights into the relation between de-unionization and inequality. However, alongside the events of large declines in union density selected for the event analysis, advanced economies faced other institutional changes and technological advancements that contributed to the rise of inequality. Therefore, to assess the soundness of the relationship identified in the event analysis and explore the role played by labor market institutions other than union density, we use panel regression analysis.

We first estimate a simple model in which *gross inequality measures* (top 10 percent income share and Gini of gross income) depend on labor market institutions and a vector of controls, which includes other determinants of inequality. Further, year and country fixed effects are introduced to capture year- and country-specific determinants omitted from the model.[11]

The system is specified as follows:

$$\text{Ln}(Top\ 10)_{it} = \alpha_1 X_{it} + \beta_1 Z_{it} + \mu_{1i} + \theta_{1t} + \epsilon_{it} \qquad (1)$$

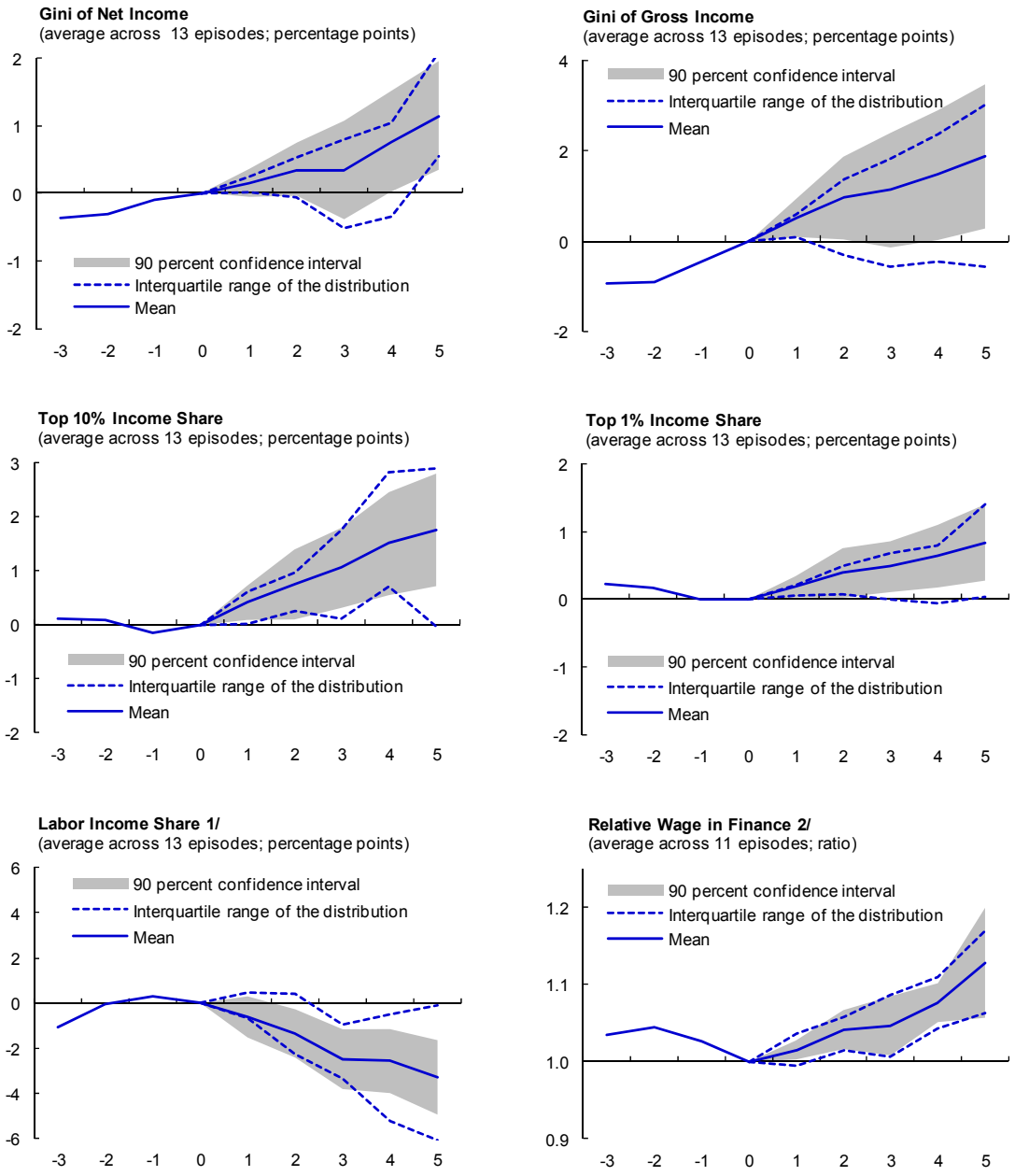
$$\text{Ln}(Gini\ Gross)_{it} = \alpha_2 X_{it} + \beta_2 Z_{it} + \mu_{2i} + \theta_{2t} + \epsilon_{it} \qquad (2)$$

in which i denotes the country, and t the year. X includes labor market institution variables and Z is a vector of controls, comprised of other determinants of inequality: technology (the share of information and communications technology capital in the total capital stock); *globalization* (the share of China in world exports interacted with the country's lagged level of income per capita); *financial reform* (the index constructed by Abiad, Detragiache, and Tressel, 2008, which varies with changes in credit controls and reserve requirements, interest rate controls, entry barriers, state ownership, securities market policies, banking regulations, and capital account restrictions); the *top marginal personal income tax rate*; and a *Banking crisis* dummy variable.[12,13] Finally, μ and θ capture country and time fixed effects, respectively.

[11] Country fixed effects also allow us to focus on within country changes, which is necessary to explain the evolution of inequality over time. Finally, using deviations from country means rather than levels can also help mitigate any remaining cross-country comparability issues in the measurement of inequality across countries.

[12] Technology is measured by the capital stock share of information and communications technology, which is the key general-purpose technological innovation over the sample period considered. Similarly, the share of China in world export proxies for the growing competition from low-cost foreign labor. Its effect is allowed to vary in function of the income level of the country.

Figure 6. Event Analysis: Effect of Lower Union Density on Inequality



Sources: EU Klems; OECD; SWIID (v. 4.0); World Top Incomes Database; and authors' calculations.
1/ Labor income share is share of labor compensation in value added, adjusted for the labor income of the self-employed (who are assumed to earn the average labor compensation of employees, as is customary).
2/ Relative wage in finance is the ratio of labor compensation per hour worked in finance to the labor compensation per hour worked in the rest of the economy.

[13] The financial reform index is available through 2005. For 2006–10, the financial reform index is assumed to remain constant at its 2005 value. Preliminary work on an update of the database suggests that this is a reasonable assumption for the most relevant components of the index.

Equations (1) and (2) are estimated by three-stage least squares (3SLS), a technique that improves the efficiency of the estimates by taking account of the correlation between the equations' residuals. The sample consists of 18 countries for which the top income share data are available, and the period covered is 1981–2010.[14]

To explain *net income inequality*, we estimate a model where the Gini of net income is assumed to depend on the Gini of gross income and a subset of labor market institutions and controls that can affect redistribution: union density, unemployment benefits and the top marginal tax rate.[15]

$$\mathrm{Ln}(Gini\ Gross)_{it} = \alpha_2 X_{it} + \beta_2 Z_{it} + \mu_{2i} + \theta_{2t} + \epsilon_{it} \qquad (2)$$

$$\mathrm{Ln}(Gini\ Net)_{it} = \gamma Ln(Gini\ Gross)_{it} + \alpha_3 X'_{it} + \beta_3 Z'_{it} + \mu_{3i} + \theta_{3t} + \epsilon_{it} \qquad (3)$$

X′ and Z′ denote, respectively, the subset of labor market and control variables that could influence redistribution. This specification imposes the restriction that determinants of inequality that do not enter equation (3) only affect the Gini of net income through their impact on the Gini of gross income. The system is also estimated by 3SLS, for a sample of 20 economies over the 1981–2010 period.[16]

Baseline Results

Table 1 reports results from the joint estimation of determinants of the top 10 percent income share and the Gini coefficient of gross income, and Table 2 reports results from the joint estimation of the determinants of the Gini coefficients of gross and net income.

In general, our estimations of gross and net income inequality validate the role of traditional determinants of income inequality highlighted in the literature (see Tables 1 and 2). We find that technological progress and globalization have a positive relation with inequality and, among the institutional variables, the results confirm that lower top marginal tax rates and financial liberalization are associated with an increase in top income shares and the Gini of gross income.

Our benchmark estimates of gross income inequality (Table 1, column 1) indicate that the weakening of *unions* is related to increases in the top 10 percent income share. A 10 percentage point decline in union density is associated with a 5 percent increase in the top 10 percent income share. The relation between union density and the Gini of gross income is also negative and

[14] The main results are robust to excluding the global financial crisis period and estimating the equations on the period 1981–2005.

[15] See IMF (2014) for a discussion of the role of government spending (for example social assistance benefits, pension, education, health) in redistribution. Controlling for indicators of government spending on pension, education, and health did not affect our results for other variables in the equation for the Gini of net income.

[16] The country sample is larger than the group of countries considered for the estimation of equations (1) and (2) because data on Gini coefficients are available for more economies.

Table 1. Determinants of Market Income Inequality, 1981–2010 1/

Dep. variable: Ln(Top 10 income share)	Benchmark model (1)	Coll. Barg. Coverage (2)	Other LMIs (3)
Ln(share ICT in K stock)	0.065	0.042	0.049
	(6.34)**	(4.06)**	(4.62)**
Ln(lag inc. per capita)	0.045	0.06	0.139
	(0.79)	(1.12)	(2.40)*
Ln(lag inc. per capita) * China export share	0.191	0.151	0.181
	(8.69)**	(6.93)**	(7.88)**
Ln(financial reform)	0.06	0.014	0.051
	(3.74)**	(0.85)	(2.99)**
Top tax	-0.115	-0.116	-0.074
	(4.18)**	(4.39)**	(2.65)**
Union density	-0.462	-0.453	-0.496
	(8.62)**	(8.87)**	(8.00)**
Minimum w age	-0.143	-0.045	-0.093
	(1.64)	(0.53)	(1.04)
Bank crisis dummy	-0.018	-0.017	-0.019
	(1.18)	(1.17)	(1.27)
Excess coll. barg. coverage		0.32	
		(6.85)**	
Unemployment benefits			0.103
			(3.44)**
EP regular contracts			0.001
			(0.05)
EP temporary contracts			-0.015
			(3.59)**
Dependent variable: Ln(Gini of gross income)			
Ln(share ICT in K stock)	0.101	0.087	0.114
	(9.43)**	(7.85)**	(10.41)**
Ln(lag inc. per capita)	-0.157	-0.148	-0.22
	(2.67)**	(2.55)*	(3.66)**
Ln(lag inc. per capita) * China export share	0.083	0.06	0.131
	(3.65)**	(2.58)**	(5.50)**
Ln(financial reform)	0.083	0.056	0.064
	(4.98)**	(3.15)**	(3.66)**
Top tax	-0.113	-0.113	-0.123
	(3.95)**	(4.01)**	(4.27)**
Union density	-0.364	-0.359	-0.526
	(6.55)**	(6.55)**	(8.20)**
Minimum w age	-0.464	-0.407	-0.357
	(5.10)**	(4.47)**	(3.84)**
Bank crisis dummy	-0.015	-0.014	-0.009
	(0.95)	(0.93)	(0.6)
Excess coll. barg. coverage		0.185	
		(3.70)**	
Unemployment benefits			-0.061
			(1.98)*
EP regular contracts			-0.081
			(4.75)**
EP temporary contracts			-0.003
			(0.72)
Number of observations	478	478	478

Sources: Top 10 income share (World Top Incomes Database); Gini of gross income (SWIID, v.4); share of ICT in capital stock (Jorgenson and Vu, 2011); income per capita (IMF WEO); China world export share (IMF direction of trade statistics); financial reform index (Abiad, Detragiache and Tressel, 2008); union density, top marginal personal income tax rate, minimum wage expressed as percent of median wage, first-year gross unemployment benefit replacement rate, employment protection on regular and temporary contracts (OECD); collective bargaining coverage (Visser, 2013); banking crisis dummy= 1 if systemic banking crises (Laeven and Valencia, 2013).
1/ The equations for the top 10 income share and the Gini of gross income are estimated simultaneously using three-stage least squares with country and year fixed effects. T-statistics in parentheses, where * denotes significance at the 5 percent level and ** at the 1 percent level.

Table 2. Determinants of Redistribution, 1981–2010 1/

Dep. variable: Ln(Gini of gross income)	Benchmark model	Coll. Barg. Coverage	Other LMIs
	(1)	(2)	(3)
Ln(share ICT in K stock)	0.108	0.102	0.120
	(9.83)**	(8.90)**	(10.52)**
Ln(lagged inc. per capita)	-0.136	-0.129	-0.209
	(2.19)*	(2.09)*	(3.23)**
Ln(lag inc. per capita) * China export share	0.091	0.085	0.127
	(4.15)**	(3.85)**	(5.55)**
Ln(financial reform)	0.077	0.059	0.064
	(4.69)**	(3.31)**	(3.70)**
Top tax	-0.109	-0.115	-0.126
	(3.58)**	(3.80)**	(4.05)**
Union density	-0.308	-0.296	-0.417
	(5.59)**	(5.38)**	(6.74)**
Minimum wage	-0.365	-0.306	-0.303
	(3.86)**	(3.27)**	(3.16)**
Bank crisis dummy	-0.02	-0.019	-0.015
	(1.18)	(1.18)	(0.94)
Excess coll. barg. coverage		0.123	
		(2.39)*	
Unemployment benefits			-0.043
			(1.32)
EP regular contracts			-0.069
			(4.15)**
EP temporary contracts			0.002
			(0.42)
Dependent variable: Ln(Gini of net income)			
Ln(Gini gross income)	0.431	0.331	0.411
	(6.60)**	(3.90)**	(6.43)**
Ln(lag inc. per capita)	0.309	0.297	0.319
	(6.68)**	(6.33)**	(6.76)**
Top tax	-0.131	-0.143	-0.13
	(5.13)**	(5.38)**	(5.10)**
Union density	-0.29	-0.299	-0.294
	(5.87)**	(5.91)**	(6.00)**
Bank crisis dummy	-0.017	-0.019	-0.017
	(1.19)	(1.33)	(1.21)
Excess coll. barg. coverage		0.117	
		(2.42)*	
Unemployment benefits			0.026
			(0.98)
Number of observations	556	556	556

Sources: Gini of gross and net income (SWIID, v.4); share of ICT in capital stock (Jorgenson and Vu, 2011); income per capita (IMF WEO); China world export share (IMF direction of trade statistics); financial reform index (Abiad, Detragiache and Tressel, 2008); union density, top marginal personal income tax rate, minimum wage expressed as percent of median wage, first-year gross unemployment benefit replacement rate, employment protection on regular and temporary contracts (OECD); collective bargaining coverage (Visser, 2013); banking crisis dummy = 1 for systemic banking crises (Laeven and Valencia, 2013).

1/ The equations for the Gini of gross and net income are estimated simultaneously using three-stage least squares with country and year fixed effects. T-statistics in parentheses, where * denotes significance at the 5 percent level and ** at the 1 percent level.

significant. The relation between union density and top income shares may appear surprising, as lower union density is believed to impact middle- and low-income earners directly but not top income shares. However, at the macroeconomic level, top income *shares* are mechanically influenced by what happens in the lower part of the income distribution (Volscho and Kelly, 2012; Bivens and Mishel, 2013). If de-unionization restrains earnings for middle- and low-income workers, this necessarily increases the income share of corporate managers and shareholders.

At the other end of the income distribution, the minimum wage is closely associated with the Gini coefficient of gross income but not with the top income share. A 10 percentage point decline in the ratio of the *minimum wage* to the median wage is related to a 5 percent increase in the Gini coefficient of gross income.[17] The results on the determinants of the Gini of gross income are similar on the larger sample (Table 2).

A caveat to these results is that union density need not equate union strength. Owing to extension agreements, collective bargaining coverage—the fraction of workers covered by collective agreements—can be very high and union density very low. Two noteworthy examples are France and Spain. While higher collective bargaining coverage may increase the incomes of the population covered by the agreements, an excess coverage of collective agreements (relative to union density) may also raise unemployment, thereby leading to higher inequality. That is, since unions do not internalize the effects of their wage demands on the whole workforce, these may become excessive. Indeed, Bouis and others (2012) find that increases in the excess coverage of collective bargaining, defined as the difference between the share of workers covered by collective agreements and the share of workers that are members of a union, lead to higher unemployment. We therefore re-estimate our benchmark model adding excess collective bargaining coverage as an explanatory variable (Table 1, column 2). The coefficients of union density in the top 10 percent income share and the Gini of gross income equations are broadly unaffected and remain significantly negative. By contrast, the results indicate that excess collective bargaining coverage is positively associated with the top 10 percent income share and the Gini coefficient. Thus, for countries where collective agreements coverage exceeds considerably the extent of unionization, inequality may rise. The relation between inequality and excess collective bargaining coverage, however, does not survive all the robustness tests discussed in the next section—possibly reflecting low quality of the data. For this reason, this labor market institution is not included in the benchmark model.

The strong relation we find between union density and inequality could capture the impact of other labor market institutions, either because these institutions are jointly determined by underlying

[17] In the benchmark estimation, the minimum wage data are coded as zero for countries that do not have a statutory national minimum wage (and hence do not report minimum wage data). However, some of these countries may have de facto minimum wages (for example, in Germany several economic sectors had a minimum wage negotiated through sectoral agreements during the sample period). Restricting the sample to countries which have a statutory minimum wage confirms our results, but the magnitude of the minimum wage effect on the Gini coefficient of gross income is larger. This suggests that if non-reporting countries are assumed to have a zero statutory national minimum wage, the minimum wage effect can be underestimated. Notwithstanding this bias, the coefficient estimates for the other variables remain broadly unaffected, in spite of the smaller country sample.

social preferences, or because unions are active in defending institutions that protect workers. Therefore, we now take account of the role played by other labor market institutions: the generosity of unemployment benefits (the average gross income replacement rate in the first year of unemployment) and the stringency of employment protection for regular and temporary contracts (Table 1, column 3). The relations between inequality and union density and the minimum wage are unaffected by the introduction of these other labor market institutions. Moreover, there is some evidence that lower employment protection is associated with a higher Gini of gross income and that weaker employment protection on temporary contracts is related to increased top income shares—although the coefficient is small. By contrast, the empirical findings on the relation between the generosity of unemployment benefits and the various measures of inequality are inconclusive. Since the results for unemployment benefits and employment protection are not robust across the analysis, these institutions are also excluded from the benchmark model.

The results of the joint estimation of the determinants of the Gini coefficients of gross and net income, reported in Table 2, indicate that net income inequality is strongly associated with the Gini of gross income. The coefficient is less than one, reflecting the impact of redistribution. Further, lower union density is correlated with a higher Gini of net income for a given Gini of gross income (column 1). This result supports the hypothesis that unions influence redistribution (though it could also reflect a third factor, such as changes in underlying social preferences). Similarly, the evidence suggests that higher top marginal tax rates play a redistributive role. Adding excess collective bargaining coverage does not affect the coefficient of union density. But excess collective bargaining coverage itself tends to increase net inequality, again, likely through higher unemployment (column 2). Surprisingly, the unemployment benefits variable does not appear to have a significant effect on redistribution (column 3).

Robustness

To test the robustness of our results we control for factors not included in the baseline exercise, which could have led to both lower unionization and higher inequality and, thus, explain "away" the strong relationship between these variables. We also explore alternative estimation techniques. We find that the strong relation between top 10 percent income shares and union density is robust, whereas the relation of this institution and the Gini of gross income is weaker. A priori, one would expect the relation of union density to be stronger with the Gini of gross income, as labor market institutions are conceived to protect the bottom and middle part of the distribution. However, our empirical findings, alongside the fact that inequality appears to be driven by rising income shares at the top, suggest that our priors could be wrong. The results of the alternative models for the top 10 percent income share are described below and displayed in Table 3.[18] We do not show the

[18] Although not reported here, we also confirmed the robustness of the effect of union density on the top 10 percent income shares to additional control variables, including: (i) demographic variables (female participation rate, immigration rate, population aging); (ii) public indebtedness which may have forced governments to cut social spending; (iii) the start of the European Monetary Union which may have limited government's scope for discretionary policies; (iv) the ratio of private sector credit to GDP; and (v) traditional measures of trade openness.

robustness tests for the Gini of gross income owing to their lack of robustness, but these results are available upon request.

- *Globalization and SBTC*. Globalization is one of the factors that has contributed to the decline in union density, as increased competition reduces rents that could be appropriated by unions. Similarly, SBTC is seen as an important factor in de-unionization, because it increases the outside option of skilled workers, and weakens their incentives to join unions (Acemoglu, Aghion, and Violante, 2001). Since globalization and SBTC also contributed to the rise in inequality, including at the top, the negative relationship between inequality and union density could reflect the simultaneous effect of globalization and SBTC on these two variables. However, in the baseline regression, we find that union density is statistically significant even when these factors are controlled for.

- *Political factors and social norms*. From the late 1970s to the mid-1990s, there was a shift toward elected governments that favored the implementation of more market-driven policies, which could have led to a decline in union density and an increase in inequality (Korpi, 2006). However, controlling for political orientation of elected governments does not alter the union density result (Table 3, Column 1). Moreover, the coefficient on union density remains unaffected by the inclusion of a measure of social preferences toward inequality (column 2).[19] Changes in the top marginal tax rate could also be seen as an indirect measure of social preferences with respect to inequality. Controlling for this variable in the baseline regression, however, does not affect the union density result.

- *Sectoral shift*. Another major shift that occurred under the pressure of globalization was the deindustrialization of advanced economies. This phenomenon could have led to a decline in union density—as the services sector outgrew the industrial sector and industry workers tend to be more unionized—and a rise in inequality—as industry workers struggled to find alternative high-paying jobs in services. Controls for employment shares in industry and services actually increase the magnitude and significance of the coefficient on union density (column 3). Further, in the top 10 percent income share equation, the coefficients on the share of employment in the industry sector and in services are broadly similar. This likely reflects the fact that highly unionized public subsectors are included in services.

- *Role of employment in finance*. The financial sector has grown in importance in many countries. Its unionization rate is one of the lowest of all sectors; and compensation in this sector relative to the rest of the economy has been growing fast. Thus, we control for the share of hours worked in finance relative to the total economy (column 4). We find that the share of finance has a positive relation with the top income share: a one percentage point increase in the share of

[19] Social preferences toward inequality is measured by the mean country sentiment toward the statement "We need larger income differences as incentives for individual effort," from the World Values Surveys and European Values Surveys.

finance is associated with an increase in the top 10 percent income share of 7 percent. Once more, the coefficient on union density is robust, even increasing in magnitude and significance.[20]

- *Higher education*. Over the 1980–2010 period, education levels in advanced economies improved considerably, reflected in a rise of the share of workers with at least some postsecondary education. More formal schooling leads workers toward jobs and/or sectors in which the incentives to organize unions are weaker (Acemoglu, Aghion, and Violante, 2001), while at the same time generating larger income differentials. However, we do not find evidence of a significant relation between the share of workers with higher education and the top income share, while our result on union density remains unaffected (column 5).

- *Endogeneity of union density*. To mitigate concerns that inequality at the top may itself influence union density, the latter was instrumented. The results proved robust whether we used lagged values of union density (first three lags) (column 6) or a more sophisticated set of instruments.[21]

We further test the robustness of our results to alternative estimation methods, and find that the strong negative relationship between union density and the top 10 percent income share is robust (the results are available upon request).[22] Having excluded a number of alternative hypotheses and established the robustness of our results across time and countries, our findings tentatively support the view that the weakening of unions contributed to the rise of inequality at the top. Since this result seems to contradict the widely held view that union membership mostly affects low- and middle-class workers, and to gain further insights into the impact of union density on the distribution of incomes, the benchmark model is estimated using data on the (net) income shares of the ten deciles of the population. Table 4 presents the results of this exercise without fixed effects[23] (the estimates for union density remain similar when fixed effects are controlled for).

[20] The empirical finance literature, however, finds a negative link between broad proxies for financial development (such as private sector credit to GDP) and inequality measured by the Gini coefficient (see Beck, Demirguc-Kunt, and Levine, 2007).

[21] The more sophisticated set of instruments (kindly suggested by Suresh Naidu) includes the (five-year) lagged OECD unemployment rate interacted with a dummy for countries having a Ghent system (where unemployment benefits are managed by unions) and with a measure of centralization of collective bargaining; and the (five-year) lagged country's unemployment rate. The rationale for these instruments is that poor economic conditions and higher unemployment tend to weaken unionization because they reduce labor's market power and increase employers' resistance to unions, while this effect is less present in countries with Ghent systems or more centralized bargaining (Wallerstein and Western, 2000).

[22] The tests included: (i) using standard errors clustered at the country level (ii) using Driscoll-Kraay standard errors, which assume the error structure is heteroskedastic, autocorrelated, and possibly correlated between the panels; (iii) estimating panel regressions with random effects and between effects; (iv) fitting a cross-section regression with the variables expressed in differences between the latest and earliest observation; and (v) re-estimating the system in first differences with country fixed effects. The results for union density under all specifications are broadly similar to those reported in the benchmark model.

[23] This is motivated by the very small sample size, and the fact that the relationship between union density and the Gini holds both in the time series and cross-section dimensions.

Table 3. Determinants of Top 10 Percent Income Shares: Control Variables, 1981–2010 1/

Control variables	Political factors	Social values	Deindustria-lization	Role of finance	Higher education	IV for union density
	(1)	(2)	(3)	(4)	(5)	(6)
Ln(share ICT in K stock)	0.057	0.086	0.03	0.02	0.069	0.065
	(5.58)**	(3.83)**	(2.39)*	(1.65)	(6.55)**	(6.32)**
Ln(lag inc. per capita)	0.074	-0.104	0.044	-0.015	0.016	0.044
	(1.18)	(1.35)	(0.69)	(0.22)	(0.26)	(0.77)
Ln(lag inc. per capita) * China export share	0.191	0.107	0.217	0.075	0.195	0.19
	(8.81)**	(3.68)**	(8.88)**	(1.85)	(8.83)**	(8.63)**
Ln(financial reform)	0.005	0.056	0.067	0.076	0.065	0.061
	(0.26)	(1.14)	(3.18)**	(5.07)**	(3.99)**	(3.82)**
Top tax	-0.102	0.136	-0.125	-0.149	-0.109	-0.115
	(3.49)**	(2.79)**	(4.56)**	(5.40)**	(3.91)**	(4.18)**
Union density	-0.443	-0.471	-0.706	-0.811	-0.455	-0.446
	(8.32)**	(2.76)**	(10.88)**	(10.51)**	(8.51)**	(8.12)**
Minimum w age	-0.012	-0.015	0.177	-0.015	-0.183	-0.143
	(0.13)	(0.1)	(1.74)	(0.15)	(2.01)*	(1.63)
Bank crisis dummy	-0.016	-0.017	-0.017	-0.022	-0.015	-0.018
	(1.09)	(1.1)	(1.16)	(1.23)	(1.02)	(1.19)
Political right	0.035					
	(2.71)**					
Political left	0.028					
	(2.19)*					
Social preference for inequality		-0.007				
		(0.85)				
Emp share industry			0.005			
			(1.67)			
Emp share services			0.006			
			(2.37)*			
Hours share finance				6.853		
				(5.27)**		
Higher education					0.002	
					(1.61)	
Number of observations	445	247	459	354	478	478

Sources: Political right (left) =1 if ruling executive party is from right (left) (Beck et al., 2001); social preference for inequality (World and European Values Surveys); employment shares in industry and services (World Development Indicators, World Bank); finance share of total hours worked (EU Klems); higher education = proportion of population aged 15 and above with at least some post-secondary education (Barro and Lee, 2011). Other variables are defined as in Tables 1 and 2.
1/ The equation for the top 10 income share is estimated simultaneously with that of Gini of gross income (not reported) using three-stage least squares with country and year fixed effects. T-statistics in parentheses, where * denotes significance at the 5 percent level and ** at the 1 percent level.

Table 4. Impact of Union Density on Decile Shares of Equivalized Net Income, Selected Years, 1981–2010 1/

Dep. variable	Bottom Decile	Decile 2	Decile 3	Decile 4	Decile 5	Decile 6	Decile 7	Decile 8	Decile 9	Top Decile
Union density	0.021	0.02	0.019	0.018	0.016	0.012	0.005	-0.005	-0.022	-0.085
	(7.59)**	(7.52)**	(7.78)**	(8.76)**	(9.82)**	(9.47)**	(4.00)**	(2.83)**	(8.00)**	(8.03)**

Sources: Decile shares of equivalized net income (LIS/New York Times Income Distribution Database); union density (OECD).
1/ The equations for the deciles are estimated simultaneously using three-stage least squares and include the same controls as in Table 1, column 1. T-statistics in parentheses, where * denotes significance at the 5 percent level and ** at the 1 percent level.

The results suggest that higher union density is associated with higher income shares from the 1st to 7th deciles and lower shares for the 8th to 10th deciles. Moreover, note that the coefficient of union density on the 10th decile is much larger than for any other decile. Since these are the same data used to construct the Gini coefficient, it does not capture well developments at the very top of the distribution. Hence, the fact that a large effect on the 10th decile obtains provides strong support for our baseline result.

Magnitude of the effects

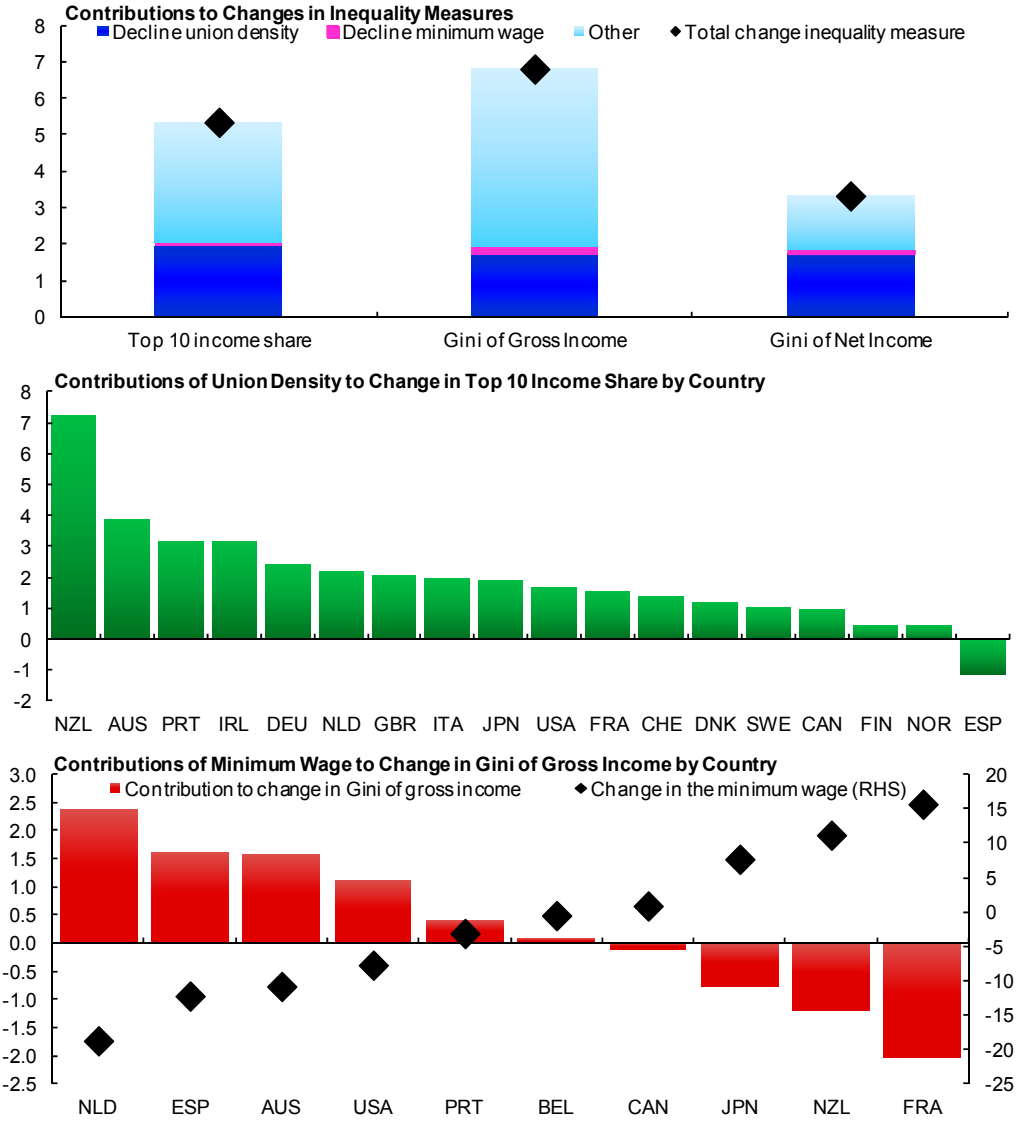
Figure 7 presents graphically the contributions of key labor market institutions to the rise in inequality. It shows the relative importance of union density, the minimum wage, and all the other determinants of inequality included in the benchmark model. The height of each bar measures the contribution of a variable to the rise in inequality over the period 1980–2010—calculated as the product of the change in the variable over the period and its coefficient—averaged across countries.

On average, the decline in union density explains about 40 percent of the 5 percentage point increase in the top 10 percent income share (top panel). This contribution rises to over 50 percent when controlling for sectoral employment shifts over the sample period. By contrast, the decline in unionization contributes more modestly to the rise of the gross income Gini, reflecting the somewhat weaker relation between these variables. However, about half of the increase in the Gini of net income is explained by the decline in union density, evidencing the additional and statistically significant relation between this institution and redistribution. The decline in union density was a widespread phenomenon which, as our estimation results suggest, could be an important contributing factor to the rise in top income shares (middle panel).

Contributions of changes in the minimum wage to inequality appear close to zero on average. However, averaging its contribution across countries hides the important role the minimum wage has played in driving inequality in some countries, as its evolution has been highly heterogenous. Bottom panel in Figure 7 shows the country-specific impact of changes in the minimum wage on the Gini of gross income. In countries where the minimum wage declined the most, it accounts for about 2 percentage points of the increase in the Gini coefficient. Conversely, where the minimum wage rose substantially, it appears to have contributed to reduce the Gini coefficient by 2 percentage points. Overall, these illustrative calculations suggest that changes in labor market institutions are key drivers of the evolution of inequality, alongside other determinants.

Figure 7. Effect of Selected Institutions on Inequality Measures in Advanced Economies, 1980–2010

(percentage points)



Sources: World Top Income Database; SWIID (v.4.0); OECD; and authors' calculations.
Note: The figure presents the results from Table1 column 1 and Table 2 column 1. For each variable, the height of the column shows the increase in the inequality measure associated with the change in that variable observed over the period 1980-2010 (unless otherwise specified) on average in advanced economies. For the top income share, AEs include USA, GBR (1990-2010), DNK, FRA (1980-2009), DEU (1980-2008), ITA (1980-2009), NLD , NOR, SWE, CHE, CAN , JPN, FIN (1990-2009), IRL (1980-2009), PRT (1980-2005), ESP (1981-2010), AUS, and NZL. For Gini coefficients, AEs include USA, GBR, AUT (1983-2010), BEL, DNK, FRA, DEU, ITA, NLD, NOR, SWE, CHE, CAN, JPN, FIN, IRL, PRT, ESP, AUS, and NZL. Minimum wage data for AUS refer to 1985-2010, for GBR to 1999-2010, and for IRL to 2000-2010.

CONCLUSION

Our analysis shows that the rise of inequality in most advanced economies was driven by the upper part of the income distribution, owing largely to the increase in income shares of the top 10 percent earners. We found strong evidence that the erosion of labor market institutions in the advanced economies examined is associated with an increase of income inequality. If interpreted as causal, our results suggest that the weakening of unions contributed to the rise of top earners' income shares and less redistribution, and eroding minimum wages increased overall inequality considerably. We also found some evidence that collective agreements coverage in excess of union density may be related to higher inequality, likely through higher unemployment. Finally, the evidence confirmed that other institutional factors, such as financial deregulation and lower top marginal tax rates, are related to higher inequality.

The strong link we found between unions and top income shares in our sample contrasts with the bulk of the literature, where the relationship between labor market institutions and top income shares has not been explored much. This likely reflects the perception that policy variables like union density are only relevant for low- and middle-income earners. However, if de-unionization restrains earnings at the middle and bottom of the distribution, income shares of top earners necessarily rise. Further, other channels may be at work. For example, the positive effect of weaker unions on the share of capital income—which tends to be more concentrated than labor income—and the fact that lower union density may reduce workers' influence on corporate decisions, including those related to top executive compensation. While these hypotheses have been discussed in the literature, they have not been much explored empirically. We plan to test these theories in future work, as identifying the most relevant channels would determine the appropriate policy responses.

Whether there is ground for policy action depends on the welfare implications of the rise in inequality brought about by the weakening of labor market institutions. Such an assessment can only be conducted on a country-by-country basis. For instance, while the rise in top earners' income shares could reflect a relative increase in their productivity (good inequality), top earners' compensation may be larger than what is justified by their contribution to the economy's output, reflecting what economists call rent extraction (bad inequality). Inequality could also hurt society by allowing top earners to manipulate the economic and political system. In such cases, there would be grounds for policy action; our results suggest that higher unionization and minimum wages can help reduce inequality. On the other hand, where unions primarily represent the interests of some workers, this is effectively another form of rent extraction at the expense of other workers, such as the young.

Ultimately, the scope for action depends on careful consideration of potential conflicts between strengthening these institutions and achieving other macroeconomic policy objectives, notably in countries (for example, in some southern European countries) where strong unions and high minimum wages led to high structural unemployment and losses of competitiveness. A country-by-country approach is therefore needed. Finally, our results indicate that addressing the increase in inequality may also require tax reform and regulations to curb excesses in the financial sector.

References

Abiad, A., E. Detragiache, and T. Tressel, 2008, "A New Database of Financial Reforms," IMF Working Paper No. 08/266 (Washington: International Monetary Fund).

Acemoglu, D., P. Aghion, and G. L. Violante, 2001, "Deunionization, Technical Change and Inequality," *Carnegie-Rochester Conference Series on Public Policy*, Vol. 55, No. 1, pp. 229–264.

Alvaredo, F., 2011, "A Note on the Relationship between Top Income Shares and the Gini Coefficient," *Economics Letters*, Vol. 110, No. 3, pp. 274–77.

Alvaredo, F., A. B. Atkinson, T. Piketty, and E. Saez, 2013, "The Top 1 Percent in International and Historical Perspective," *Journal of Economic Perspectives*, Vol. 27, No. 3, pp. 3–20.

———, 2014, *The World Top Incomes Database*. Retrieved July 31, 2013. http://topincomes.parisschoolofeconomics.eu/

Atkinson, A. B., and T. Piketty, (eds.), 2007, *Top Incomes over the Twentieth Century: A Contrast between Continental European and English-Speaking Countries* (Oxford: Oxford University Press).

Atkinson, A.B., T. Piketty, and E. Saez, 2009, "Top Incomes in the Long Run of History," NBER Working Paper No. 15408 (Cambridge, Massachusetts: National Bureau of Economic Research).

Baker, D., A. Glyn, D. R. Howell, and J. Schmitt, 2004, "Labor Market Institutions and Unemployment: Assessment of the Cross-Country Evidence," *Fighting Unemployment: The Limits of Free Market Orthodoxy*, (New York: Oxford University Press) pp. 72–118.

Barro, R., and J. W. Lee, 2011, Barro-Lee Educational Attainment Dataset, available at www.barrolee.com.

Beck, T., A. Demirguc-Kunt, and R. Levine, 2007, "Finance, Inequality, and the Poor," *Journal of Economic Growth*, Vol. 12. No. 1, pp. 27–49.

Berg, A., and J. Ostry, 2011, "Inequality and Unsustainable Growth: Two Sides of the Same Coin?" IMF Staff Discussion Note No. 11/08 (Washington: International Monetary Fund).

———, and J. Zettelmeyer, 2012, "What Makes Growth Sustained?" *Journal of Development Economics*, Vol. 98, No. 2, pp. 149–66.

Betcherman, G., 2012, "Labor Market Institutions: A Review of the Literature," World Bank Policy Research Working Paper No. 6276 (Washington: World Bank).

Bivens, J., and L. Mishel, 2013, "The Pay of Corporate Executives and Financial Professionals as Evidence of Rents in Top 1 Percent Incomes," *The Journal of Economic Perspectives*, Vol. 27, No. 3, pp. 57–77.

Bouis, R., O. Causa, L. Demmou, R. Duval, and A. Zdzienicka, 2012, "The Short-term Effects of Structural Reforms: An Empirical Analysis," OECD Economics Department Working Papers No. 949 (Paris: Organisation for Economic Co-operation and Development).

Burkhauser, R. V., S. Feng, S. P. Jenkins, and J. Larrimore, 2012, "Recent Trends in Top Income Shares in the United States: Reconciling Estimates from March CPS and IRS Tax Return Data," *Review of Economics and Statistics*, Vol. 94, No. 2, pp. 371–88.

Card, D., 1996, "The Effect of Unions on the Structure of Wages: A Longitudinal Analysis," *Econometrica: Journal of the Econometric Society*, Vol. 64, No. 4, pp. 957–979.

———, 2001, "The Effect of Unions on Wage Inequality in the US Labor Market," *Industrial and Labor Relations Review*, Vol. 54, No. 2, pp. 296–315.

———, T. Lemieux, and W. C. Riddell, 2004, "Unions and Wage Inequality," *Journal of Labor Research*, Vol. 25, No. 4, pp. 519–559.

Dew-Becker, I., and R. J. Gordon, 2005, "Where did the Productivity Growth Go? Inflation Dynamics and the Distribution of Income," NBER Working Paper No. w11842 (Cambridge, Massachusetts: National Bureau of Economic Research).

DiNardo, J., N. Fortin, and T. Lemieux, 1996, "Labor Market Institutions and the Distribution of Wages, 1973–1992: A Semiparametric Approach," *Econometrica*, Vol. 64, No. 5, pp. 1001–44.

DiNardo, J., K. Hallock, and J. S. Pischke, 1997, "Unions and Managerial Pay," NBER Working Paper No. w6318 (Cambridge, Massachusetts: National Bureau of Economic Research).

Duenhaupt, P., 2012, "Financialization and the Rentier Income Share–Evidence from the USA and Germany," *International Review of Applied Economics*, Vol. 26, No. 4, pp. 465–87.

Fräßdorf A., M. Grabka, and J. Schwarze, 2008, "The Impact of Household Capital Income on Income Inequality: A Factor Decomposition Analysis for Great Britain, Germany and the USA," Working Paper No. 89, Society for the Study of Economic Inequality, ECINEQ.

Freeman, R. B., 2000, "Single Peaked vs. Diversified Capitalism: The Relation between Economic Institutions and Outcomes," NBER Working Paper No. w7556 (Cambridge, Massachusetts: National Bureau of Economic Research).

Gabaix, X. and A. Landier, 2008, "Why Has CEO Pay Increased So Much?" *Quarterly Journal of Economics*, Vol. 123, No. 1, pp. 49–100.

Howell, D. R., D. Baker, A. Glyn, and J. Schmitt, 2007, "Are Protective Labor Market Institutions at the Root of Unemployment? A Critical Review of the Evidence," *Capitalism and Society*, Vol. 2, No. 1, pp. 1–73.

International Monetary Fund (IMF), 2014, "Fiscal Policy and Income Inequality," IMF Policy Paper, (Washington).

Jorgenson, D. W., and K. M. Wu, 2011, "The Rise of Developing Asia and the New Economic Order," *Journal of Policy Modeling*, Vol. 33, No. 5, pp. 698–716.

Kierzenkowski, R., and I. Koske, 2012, "Less Income Inequality and More Growth—Are they Compatible? Part 8, The Drivers of Labour Income Inequality—A Literature Review," OECD Economics Department Working Papers, No. 931 (Paris: Organisation for Economic Co-operation and Development).

Korpi, W., 2006, "Power Resources and Employer-centered Approaches in Explanations of Welfare States and Varieties of Capitalism," *World Politics*, Vol. 58, pp. 167–206.

Kumhof, M., and R. Rancière, 2010, "Inequality, Leverage and Crises," IMF Working Paper No. 10/268 (Washington: International Monetary Fund).

Laeven, L., and F. Valencia, 2013, "Systemic Banking Crises Database," *IMF Economic Review*, Vol. 61, No. 2, pp. 225–70.

Layard, R., S. Nickell, and R. Jackman, 1991, *Unemployment: Macroeconomic Performance and the Labour Market* (Oxford: Oxford University Press).

Lee, D. S., 1999, "Wage Inequality in the United States during the 1980s: Rising Dispersion or Falling Minimum Wage?" *Quarterly Journal of Economics*, Vol. 114, No. 3, pp. 977–1023.

Lemieux, T., W. B. MacLeod, and D. Parent, 2009, "Performance Pay and Wage Inequality," *Quarterly Journal of Economics*, Vol. 124, No. 1, pp. 1–49.

McCall, L., and C. Percheski, 2010, "Income Inequality: New Trends and Research Directions," *Annual Review of Sociology*, Vol. 36, pp. 329–47.

Organisation for Economic Co-operation and Development (OECD), 2006, *OECD Employment Outlook* (Paris).

———, 2011, *Divided We Stand: Why Inequality Keeps Rising* (Paris).

———, 2012, *OECD Employment Outlook* (Paris).

Ostry, J. D., and A. Berg, 2014, "Measure to Measure. *Finance and Development*," Vol. 51, No. 3, pp. 35–38.

———, and C. G. Tsangarides, 2014, "Redistribution, Inequality and Growth," IMF Staff Discussion Note No. 14/02 (Washington: International Monetary Fund).

Philippon, T., and A. Reshef, 2012, "Wages and Human Capital in the US Financial Industry: 1909–2006," *The Quarterly Journal of Economics* Vol. 127, No. 4, pp. 1551–609.

———, 2013, "An International Look at the Growth of Modern Finance," *The Journal of Economic Perspectives*," pp. 73–96.

Piketty, T., and E. Saez, 2003, "Income Inequality in the United States, *1913–1998*," *Quarterly Journal of Economics*, Vol. 118, No. 1, pp. 1–39.

———, 2006, "The Evolution of Top Incomes: A Historical and International Perspective," *American Economic Review*, Vol. 96, No. 2, pp. 200–05.

———, and S. Stantcheva, 2014, "Optimal Taxation of Top Labor Incomes: A Tale of Three Elasticities," *American Economic Journal: Economic Policy*, Vol. 6, No. 1, pp. 230–71.

Pissarides, C. A., 1990, *Equilibrium Unemployment Theory* (Cambridge, Massachusetts: MIT Press).

Scheve, K., and D. Stasavage, 2009, "Institutions, Partisanship, and Inequality in the Long Run," *World Politics*, Vol. 61, No. 2, pp. 215–53.

Sjöberg, O., 2009, "Corporate Governance and Earnings Inequality in the OECD Countries 1979–2000," *European Sociological Review*, Vol. 25, No. 5, pp. 519–33.

Solt, F., 2009, "Standardizing the World Income Inequality Database," *Social Science Quarterly*, Vol. 90, No. 2, pp. 231–42.

Stiglitz, J, 2012, *The Price of Inequality: How Today's Divided Society Endangers Our Future* (New York: W.W. Norton).

Teulings, C. N., 2003, "The Contribution of Minimum Wages to Increasing Wage Inequality," *The Economic Journal*, Vol. 113, No. 490, pp. 801–33.

Visser, J., 2013, ICTWSS: Database on Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts in 34 Countries between 1960 and 2007," Institute for Advanced Labour Studies, AIAS (Amsterdam: University of Amsterdam).

Volscho, T. W., and N. J. Kelly, 2012, "The Rise of the Super-Rich: Power Resources, Taxes, Financial Markets, and the Dynamics of the Top 1 Percent, 1949 to 2008," *American Sociological Review*, Vol. 77, No. 5, pp. 679–99.

Wallerstein, M., and B. Western, 2000, "Unions in Decline? What Has Changed and Why," *Annual Review of Political Science*, Vol. 3, No. 1, pp. 355-377.