The Equality Multiplier

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Abstract

Equality can multiply due to the complementarity between wage determination and welfare spending. A more equal wage distribution fuels welfare generosity via political competition. A more generous welfare state fuels wage equality further via its support to weak groups in the labor market. Together the two effects generate a cumulative process that adds up to a sizeable social multiplier. The mutual dependence between wage setting and welfare spending explains how almost equally rich countries differ in economic and social equality among their citizens. Using data on 18 OECD countries over the period 1976-2002 we test the main predictions of the model and identify a sizeable magnitude of the equality multiplier. We obtain additional support by applying another data set for the US over the period 1945-2001.

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1 Introduction

It is well known that almost equally rich countries have huge differences in their distribution of incomes and in their welfare spending. Compared to the United States the Scandinavian countries of Denmark, Norway and Sweden, for instance, have twice as generous welfare spending, but only half of the US pre tax wage inequality (see Figure 1). In spite of the striking differences there is little consensus among economists on the mechanisms that can explain them.

Some of the most influential papers explain the stark US-Scandinavian difference by pointing to America's racial heterogeneity (Alesina, Glaeser and Sacerdote 2001), to more social homogeneity in Europe and an extraordinary Scandinavian commitment to equality (Therborn 1986), and to the possibility of one distinct European equilibrium and one distinct US equilibrium in terms of perceptions of the relative impact of luck versus compensation for effort (Alesina and Angeletos 2005). It is a challenge, however, that the negative association between pre tax inequality and welfare spending seems to be a general pattern. As we shall see it holds for almost any sub-group of the developed countries in our data.[1] It is also visible within countries over time.

In the US, for instance, periods with less growth in wage differentials have had higher growth in welfare generosity, and vice versa (Figure 2). Social spending increased sharply as a share of GDP during the 1940's, following president Roosevelt's Social Security Act of 1935, while pre tax wage inequality dropped to the extent that Claudia Goldin and Robert Margo (1992) labeled the period the "Great Compression". In contrast, during the 1980's there was an unprecedented rise in wage inequality and a marked retrenchment in social spending. [2]

In this paper we suggest a simple common explanation for the negative associations between wage inequality and welfare spending over time and across countries that is meant to cover both the US-Europe divide and the divisions within Europe. Our explanation consists of two distinct effects.

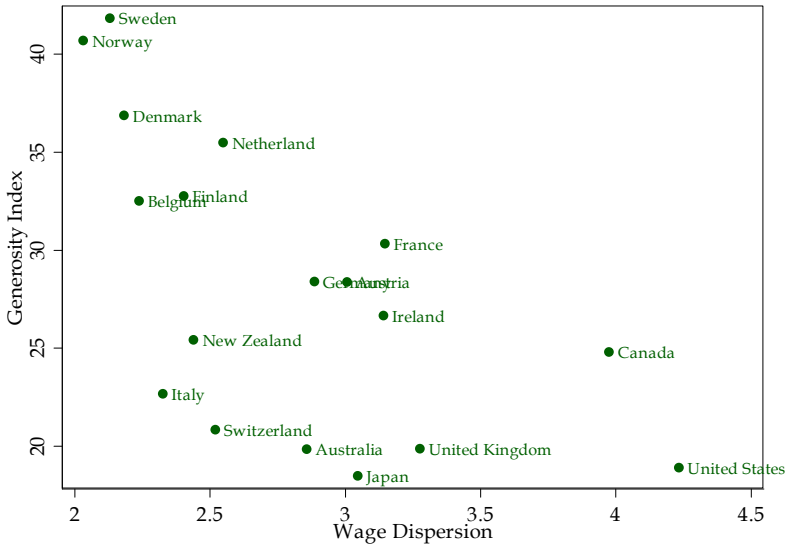
The equality magnifying effect, runs from the wage distribution to the determination of welfare state policies. More wage equality leads the majority of the population to support a more generous welfare state resembling what Peter Lindert (2004) calls the 'Robin Hood paradox': Redistribution from the rich to the poor is least present where it is the most needed.

The wage equalizing effect, runs from welfare state policies to wage determination. It builds on the observation that "the workman may be as necessary to his master as the

[1] For the US-Europe comparison Alesina and Glaeser 2004 offer an excellent discussion; for cross country discussions more generally, see for instance Branko 2000, Moene and Wallerstein 2001, Lindert 2004, and the overview by Lind 2005.

[2] For the development in the US over time see for instance Moffitt, Ribar and Wilhelm 1998, Lee and Roemer 2006, and the overview by Levy and Murnane 1992.

Figure 1: Welfare Generosity and Wage Inequality across Countries



Note: Wage dispersion is the ratio of the 9th decile to the 1st decile of gross hourly wage. Source: mainly OECD, see data appendix. The Generosity Index is an index of welfare generosity developed by Lyle Scruggs, University of Connecticut, see data appendix. The Figure shows average values in our data over the time period 1976-2002. N=343

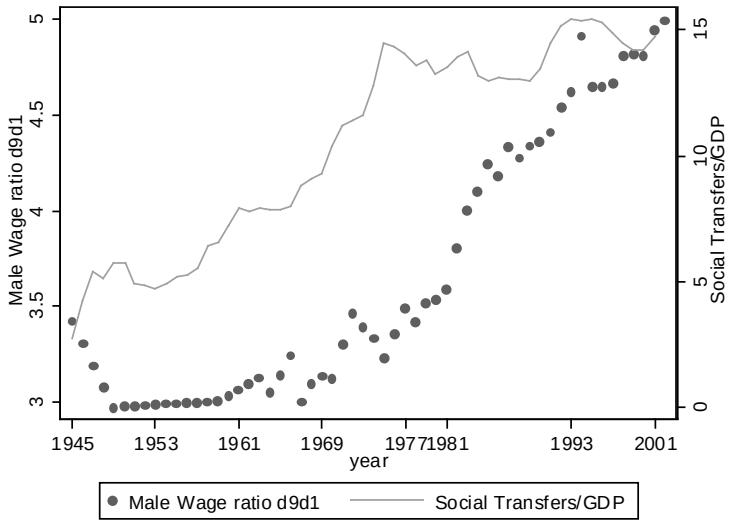
master to him, but the necessity is not as immediate" by Adam Smith (1776, I p 74). We incorporate how welfare benefits make low paid workers less vulnerable (how their necessities become less immediate), improving their bargaining position and their abilities to demand a better pay. In this way higher welfare benefits reduce wage inequality.

Together the two effects generate a cumulative process where a more equal wage distribution fuels welfare generosity, and a more generous welfare state fuels wage equality, adding up to a sizable social multiplier – the equality multiplier.[3] Thus the two effects are complementary and enhance structural and institutional differences across countries related to history, size, resources, and institutions, and that magnify changes over time.

To establish a micro foundation for the mechanisms we model how voters' preferences for welfare spending are associated with their social positions and incomes; how these preferences are aggregated by electoral competition; and how the resulting welfare spending empowers weak groups in the labor market and thus alters the pre-tax distribution of income, which again shapes the individual preferences for welfare spending. More equality before taxes means more income to voters with incomes below the mean (the majority of voters), which in turn generates higher political demand for welfare spending and further wage compression, adding up, step by step, to the equality multiplier.

[3]Glaeser, Sacerdote and Schenkman (2003) discuss social multipliers where individual behavior depends on aggregate behaviors. In our case the complementarity is between institutions of the labor market and the welfare state.

Figure 2: Welfare Generosity and Wage Inequality in the US. 1945-2002



Sources: Social Transfers 1945-1959, Historical Statistics of the United States, Millennial edition (includes Social insurance, public aid, health and medial programs, veterans programs, housing and other social welfare programs, Tables Bf189-195/GDP Table Ca1); 1960-2001 from the OECD Lindert-Allard Data Set (2009). d9d1 ratio, Male Wages from Goldin and Katz (2007) Figure 5: 1945-1960 Census data (interpolation for 45-48 (from 1939), 50-58, and 60-62. CPS-March data from 1963.

Empirically our goal is to identify the equality magnifying effect and wage equalizing effect and thus to quantify the equality multiplier using data from 18 OECD countries over the 26 years from 1976 to 2002. We use different instrumental variable approaches including country fixed effects and identify an equality multiplier of more than 1.5, implying that any initial change, or structural difference, is magnified by more than fifty percent due to the feedback effects. We also offer some supporting evidence by taking a closer look at the development of welfare spending and wage inequality in the US after World War II (using a different data set). The US is a particularly interesting example since it represents an important extreme case with high wage dispersion and low welfare generosity.

Our paper follows Alesina and Angeletos (2005) in highlighting the mutual two-ways dependence between welfare spending and gross earnings inequality. While Alesina and Angeletos explain the support for welfare spending by the perceived fairness of redistributive policies, we emphasize the related insurance motive. In our set-up, people in higher positions may prefer less welfare spending than people in lower positions. Yet important goods and services provided by the welfare state, such as social insurance, are normal goods in the sense that the individual's demand go up with individual income for a *given level of risk*. In contrast, Alesina and Angeletos model individual preferences for welfare spending as a trade-off between rewards and fairness where redistribution from the rich

to the poor is an inferior good. Alesina and Angeletos stress how the welfare state mitigates income differentials that emerge from unequal talents by hampering human capital investments through high taxes and compressing the distribution of earnings from above. In contrast, we emphasize how welfare benefits may empower weak groups in the labor market and therefore lead to a compression of the wage distribution from below. Finally, while Alesina and Angeletos rely on multiple equilibria to explain the divergence between the US and Europe, our approach relies on an equality multiplier to explain the difference.

To insist on a negative association between pre tax inequality and welfare spending, challenges the classical views on redistribution by Thomas Romer (1975), Kevis Robert (1977) and Allan Meltzer and Scott Richards (1981). Their prediction that higher pre tax inequality should be associated with higher redistribution is not supported by empirical studies such as the broad historical accounts by Peter Lindert (2004), the historical evidence across US counties and states by Rodneu Ramcharan (2010), and the comprehensive cross country studies by Roberto Perotti (1993, 1996) to mention a few central works.

We add the reverse linkage to the analysis of how wage equality fuels the political demand for normal welfare state provisions, such as social insurance against loss of income (as discussed in Moene and Michael Wallerstein 2001, and Torben Iversen and David Soskice 2001). The resulting two-ways link echoes de Toqueville's link between 'public spirit' and the 'habits to the governed' (Toqueville 1835, ch 1). We also incorporate elements of Gösta Esbing Andersen's (1990) classifications of welfare states, and the role of openness and country size emphasized by David Cameron (1978), Peter Katzenstein (1985), and Dani Rodrik (1997).

Finally, the cumulative changes across institutions connect our paper to the recent discussion of why seemingly similar countries sustain widely differing wage structures and have different developments of wage inequality over time (see eg. Devroye and Freeman 2001; Leuven, Oosterbeek, and van Ophem 2004; Kahn 2000; Blau and Kahn 1996; Acemoglu 2003; Scheve and Stasavage 2008; Katz and Murphy 1992; Card and DiNardo 2002; Katz and Autor 1999; Autor, Katz, and Kearney 2008; Goldin and Katz 2007).

After presenting our model of the equality multiplier (in section 2), we present our data and the empirical approach (in section 3), before we turn to the empirical analysis (in sections 4 and 5) and conclude (in section 6).

2 The Model

The mechanisms sketched out in the introduction are more general than the specific model interpretation offered here. We use a political economy set-up where voters are distributed over social positions p reflecting their jobs and their productivity. There is a continuum of voters normalized to size 1; the distribution of p is skewed in the sense that the median

job has a lower productivity than the mean, $p_m < \bar{p}$. The income of a voter in position p is represented by $w(p)$ with $w'(p) \geq 0$. Throughout we focus attention on the dispersion of incomes before and after taxes and transfers. To isolate the distributional issues we let the tax base $\bar{w}$ remain constant independent of wage determination and welfare policies.

2.1 Policies and political competition

There are two parties or blocks—left and right—that differ in their ideologies in the traditional manner. The ideology of parties may be based on the interests of the parties' core groups, or on inherited beliefs and perceptions of what constitute a good welfare society. These preferences over policy outcomes are written as $W_L(G)$ and $W_R(G)$, where the left prefers a high generosity and the right a low generosity.

Each party is willing to compromise somewhat on ideology in order to improve the chances of winning the election. When the left proposes G_L and the right proposes G_R, the expected party utilities are defined by

$$E(W_L) = qW_L(G_L) + [1-q]\,W_L(G_R) \tag{1}$$

$$E(W_R) = [1-q]\,W_R(G_R) + qW_R(G_L) \tag{2}$$

In these expressions $q = q(G_L, G_R)$ is the probability that the left wins, and $(1-q)$ that the right wins. How these probabilities are derived is explained shortly.

The policies of the parties are determined before each election and in a situation where each party takes the pre tax distribution of income for given and each party is required to balance the budget. With a tax rate equal to t and a tax base equal to the average wage $\bar{w}$, the balanced budget condition can be represented by

$$t\bar{w} = kG \tag{3}$$

where the constant $k < 1$ represents social and demographic factors such as the numbers of users relative to contributors, corrected for the deadweight costs of tax financed welfare spending. The higher is k, the more costly is the welfare state.

Voters' preferences

The preferences of voters reflect that protection against risks has been more universally sought, and has been more important for the expansion of the welfare state, than pure redistribution of resources (Baldwin 1990, Barr 1992). Welfare policies that, in addition to providing a more fair distribution, cover social demands for which the market fails to provide, are much more likely to be both legitimate and popular. In a comparative

perspective social insurance against loss of income due to sickness, unemployment, and old age reacts more to changes in the income distribution than other types of public spending (Moene and Wallerstein, 2003).

To capture social insurance within our simple framework we assume that the generosity of the welfare state G represents compensation in the event of lost income due to unemployment, sickness or old age. That all citizens obtain the same compensation is a oversimplified representation of the fact that social insurance in most welfare systems is offered on better terms for low wage earners than for high wage earners.[4] The utility function has constant relative risk aversion,

$$U(C) \equiv \frac{1}{1-\mu} C^{1-\mu} \quad \text{with} \quad \mu > 1 \tag{4}$$

where $C = (1-t)w(p)$ when the person is working, and where $C = G$ when he is not working. Total utility is

$$V(G;p) = (1-e)U((1-t)w(p)) + eU(G) \tag{5}$$

Here $e = e(p)$ is the probability of income loss with $e'(p) \leq 0$ where people in higher positions face lower risks of ending up receiving welfare benefits.

The implications from this self-interested expected utility formulation can be made indistinguishable from a more general formulation where total utility is $U - h(p)F$, where $F = [U((1-t)w(p)) - U(G)]$ is the deviation from perfect insurance, and where $h(p)$ is social vulnerability of people in position p with $h'(p) < 0$. This formulation may capture how people in higher positions benefit less from the welfare state either out of self-interests, or because they are more alienated from those who do benefit, or because they, more than others, believe that those who live on welfare benefits are lazy.[5] When social vulnerability equals the hazard rate of employment, $h = e/(1-e)$, the two formulations are identical. In

[4] In general, some benefits are proportional to present earnings or past contributions; others are not. We could have incorporated this by a given parameter $\theta \in (0,1]$ reflecting the composition of welfare spending and the extent to which the poor are offered social insurance on better terms than the rich:

$$\tilde{G}(p) = \left(\theta + (1-\theta)\frac{w(p)}{\bar{w}}\right) G$$

The benefits G (the benefit level to workers with the average wage) of the social insurance scheme are distributed with a fixed component common to all and a variable component that depends on past and present contributions. The fixed component is θG which defines the floor of welfare benefits to people without income. The variable component is proportional to income relative to the mean $G(1-\theta)w(p)/\bar{w}$, implying that here $G(p)$ is the welfare benefits to a worker in position p in the event of income loss. The higher is θ, the more redistributive are is the terms of the social insurance scheme. In the presentation we apply the simplifying assumption that $\theta = 1$.

[5] This is consistent with beliefs that people who have a high p tend to believe that a high pay is a fair reward for hard work, while people with a low p think that a low pay is due to bad luck for which they should not be held responsible, as suggested by Thomas Piketty (1995) and Alesina and Angeletos (2005).

any case the $G(p) = \arg\max_G V(G;p)$ can be solved explicitly for the preferred generosity $G(p)$ of a voter in position p (his ideal policy):

$$G(p) = \frac{\bar{w}h(p)^{\frac{1}{\mu}}}{k^{\frac{1}{\mu}}\bar{I}(p)^{\frac{\mu-1}{\mu}} + kh(p)^{\frac{1}{\mu}}} \tag{6}$$

Here $\bar{I}(p)$ is a measure of the wage gap of a person in position p relative to the per capita tax base, $\bar{I}(p) = \bar{w}/w(p)$. The maximum welfare generosity is obtained for $t = 1$ equal to $\bar{w}/k$, and $G \in [0, \bar{w}/k]$. Voters with lower p tend to be more vulnerable and $h'(p) \leq 0$. While a voter with sufficiently high p has $G(p) = 0$ (as $h(p) \to 0$), a voter with sufficiently low p has $G(p) = \bar{w}/k$ (as $h(p) \to \infty$). We assume that this pattern is monotone, implying that $G'(p) \leq 0$.

We also see from (6) that an increase in the income of a voter, given his position p, reduces $I(p)$ and thus increases his optimal level of welfare generosity. A mean preserving compression of wages thus raises the demand for welfare generosity among voters below the mean income. Thus as long as the median income is below the mean political parties face an electorate where the majority is more in favor of welfare spending the smaller the wage differentials.

The probability of winning

To derive the winning probabilities of each block we apply a probabilistic voting approach developed by Roemer (2001). We consider all relevant proposals where $G_L > G_R$. Voters for whom $V(G_L;p) \geq V(G_R;p)$ in (5) tend to vote left. Using the constant elasticity of $U(\cdot)$, this inequality is equivalent to

$$T(G_L, G_R) \equiv \frac{U(G_L) - U(G_R)}{U(\bar{w} - kG_R) - U(\bar{w} - kG_L)} \geq \frac{U(w(p)/\bar{w}))}{h(p)} \equiv H(p) \tag{7}$$

We are interested in the left-right vote threshold p^* that divides votersinto two distinct groups: those in positions below p^* tend to vote left, while those in positions above p^* tend to vote right. This threshold can be derived from the equality $T(G_L, G_R) = H(p^*)$ where $H'(p) > 0$. Hence, the expected vote share of the left can be expressed by $F(p^*)$ where $F(\cdot)$ is the cdf of the distribution of p. Voting is also affected by random effects (new issues, TV performance, popularity waves) after the policy programs are determined,

implying that the probability that the left wins the election[6] is

$$q(G_L, G_R) = \Pr\left(F(p^*) \geq 1/2\right) \tag{8}$$

The resulting welfare generosity, G_L or G_R, feed back to the wage setting.

2.2 Wage determination

Since immediate necessities may erode the bargaining power of workers—as Adam Smith observed—welfare benefits may empower them. Covered by the welfare state, workers can better tolerate delays and disagreements and become stronger in wage negotiations. To illustrate, consider the simple case where a worker is matched with an employer and they are negotiating the wage for the contract period with alternating offers. The worker risks to be replaced by another as long as no agreement is reached.

Negotiations consist of alternating offers. If the employer employer starts, he offers a wage w. The worker can be replaced with a probability δ if the offer is turned down. The employer can take advantage of being able to replace the worker if he does not accept the offer. This threat, however, is less severe if the worker can guarantee himself an income G in the case of displacement. The lowest wage that the worker would accept would than be

$$w = \delta G + (1 - \delta)\tilde{w} \tag{9}$$

where $\tilde{w}$ is the wage that the worker can obtain if he his not replaced and thus become the offensive part. The worker can then asks for the highest wage $\tilde{w}$ that the employer would accept taking into account, again, the chances of finding a replacement worker. If the employer finds one, he starts by offering him an wage w, implying that $\tilde{w}$ is determined by

$$p - \tilde{w} = \delta(p - w) \tag{10}$$

Solving (9) and (10) for w the resulting wage[7] can be written as

$$w(p; G) = \alpha p + (1 - \alpha)\, G \quad \text{where} \quad \alpha = \frac{(1 - \delta)^2}{1 - \delta\,(1 - \delta)} \tag{11}$$

[6]More precisely we can express the actual vote shares by $(s_L + \epsilon)$,$(s_R - \epsilon)$ where $E\epsilon = 0$, and $q(G_L, G_R) = \Pr(s_L + \epsilon > 1/2) = \Pr\left(F\left(H^{-1}(T(G_L, G_R))\right) + \epsilon) > 1/2\right)$. This expression of $q(G_L, G_R))$ is continuous and differentiable. From the concavity of $U(\cdot)$ it follows that $T_1 \equiv dT/dG_L$ and $T_2 \equiv dT/dG_R$ both are negative. Hence, $dq/dG_L \equiv q_1 < 0$ and $dq/dG_R \equiv q_2 < 0$. It is also straight forward to see that $T_1 = T_2$ when $G_L = G_R$ implying that $T_1 \approx T_2$ and $q_1 \approx q_2$ when G_L is not too different from G_R.

[7]Clearly, as long as $\delta < 1$ it is in advantage to move first. If the employee moves first we have the same formula, but now with $\alpha \equiv \frac{(1-\delta)}{1-\delta(1-\delta)}$.

As seen, higher welfare generosity raises the wage and the more so the less secure the employment, that is the higher is δ. When the worker is sure to be replaced if he declines the offer ($\delta = 1$), he gets no more than G. The probability of being replaced may be higher in lower positions, $\delta = \delta(p)$ with $\delta'(p) \leq 0$, implying that $\alpha = \alpha(p)$ with $\alpha'(p) \geq 0$. We extend this to systems of collective wage negotiations below.

2.3 Equilibrium

An equilibrium in this model consists of

- winning probabilities, $q = q(G_L, G_R)$ for the left, and $(1 - q(G_L, G_R))$ for the right, based on individual voting according to (8)
- policies G_L, G_R that solve the Nash equilibrium of policy game between political parties given by the first order conditions

$$\frac{\partial q(G_L, G_R)}{\partial G_L} \left[W_L \left(G_L \right) - W_L \left(G_R \right) \right] + q(G_L, G_R) \frac{\partial W_L}{\partial G_L} = 0 \tag{12}$$

$$-\frac{\partial q(G_L, G_R)}{\partial G_R} \left[W_R \left(G_R \right) - W_R \left(G_L \right) \right] + \left(1 - q(G_L, G_R) \right) \frac{\partial W_R}{\partial G_R} = 0 \tag{13}$$

- a wage distribution $w(p; G)$ that depends on the implemented policy $G = \{G_L, G_R\}$, where the elasticity of the wage wrt G can be expressed as

$$\frac{dw(p; G)}{dG} \frac{G}{w} = [1 - \alpha(p)] \frac{G}{w(p)} \equiv \gamma(p) \tag{14}$$

  and where the floor elasticity $\gamma(p)$ is higher in low paid position both because G relative to $w(p)$ is higher, and because employers strength $(1-\alpha(p))$ might be higher.

This equilibrium embodies both the equality magnifying effect and the wage equalizing effect.

2.4 More wage equality generates higher welfare generosity

The equilibrium exhibits this equality magnifying effect whenever the inequality of wage distribution is reduced for one reason or another.

Firstly, it should be observed that following a mean preserving wage compression, a majority of voters demand more welfare generosity basically because they get a higher wage, as seen from (6). This result may seem contra-intuitive, since among a cross section of voters, we would expect the high wage voters to favor less rather than more welfare generosity. However, the result holds for a *given* level of vulnerability $h(p)$. Consistent with $h'(p) < 0$, we have already assumed that $G'(p) \leq 0$. Thus if we look across the

income distribution, we find that voters with higher income prefer a less generous welfare state as they are less vulnerable. A higher wage for a given vulnerability means that the voter has more to lose should he lose his income. He therefore favors a more generous welfare state.[8]

Secondly, it should be noted that the equality magnifying effect holds for the policy proposals from each of the two political parties. These proposals may diverge in equilibrium: The left party chooses $G_L > G(p_m)$ such that the marginal reduction in the chance of winning the election times the gain of winning $[W_L(G_L) - W_L(G_R)]$, just equals the marginal ideological gain of running with a policy closer to the party's ideals. The right party chooses $G_R < G(p_m)$ such that the marginal reduction in the chance of winning the election times the gain of winning $[W_R(G_R) - W_R(G_L)]$, equals the marginal ideological gain of running with a policy closer to the party's ideals.[9] When both parties deviate from the median's ideal policy, their chances of winning may end up close to fifty-fifty. In fact, the equilibrium value of q is close to $1/2$ whenever each party's preferences are linear in G.[10]

The equality magnifying effect implies that both blocks run on more generous welfare programs when the wage distribution becomes more compressed. The skewed distribution of p implies $w(p_m) < \bar{w}$ and a mean preserving increase in wage inequality therefore means that $I(p_m)$ goes up. More inequality implies that a majority of voters reduce the political demand for social insurance. Hence, declining inequalities imply raising welfare generosity (as stated in section 2). Wage compression for a given mean increases the political demand for welfare generosity, implying that growing equality generates growing welfare generosity.

Focussing on the inequality $\bar{I}(p)$ between a low paid group (one specific p) and the given average wage $\bar{w}$, the equality magnifying effect can be approximated by what we denote *the generosity equation*

$$ln(G) = A - a_I ln(\bar{I}(p)) \quad \text{where} \quad A = A(z) \tag{15}$$

with $a_I \approx (\mu - 1)/\mu < 1$ since from (6) $[dG(p)/G(p)] \approx [d\bar{w}/\bar{w}] - ((\mu - 1)/\mu)[d\bar{I}(p)/\bar{I}(p)]$

[8]This prediction of the model is supported by micro evidence in Barth, Moene and Nilsen (2010) using a long panel of the Norwegian Survey of Voters that indicates how i) the support for expanding social insurance is declining with income across the population in line with $G'(p) \leq 0$, and how ii) the effect of income flips to positive (higher incomes raise the support for social insurance) once the relative position in the income distribution is used as a proxy for social vulnerability $h(p)$ in line with the result.

[9]The ideal policy of the median voter is not an equilibrium outcome since, for $G_R = G(p_m)$ it pays for the left to deviate from $G(p_m)$ by setting a higher level of G_L. By so doing the marginal ideological gain $q\partial W_L/\partial G_L$ is strictly positive. By increasing the level of G_L, the left party's chance of winning the election declines and $\partial q/\partial G_L < 0$. Similarly, the right party would deviate from $G_R = G(p_m)$ by reducing the level of G_R in the direction of the party's ideal policy.

[10]With $W_L = A_0 - AG$ and $W_R = B_0 - BG$ where A and B positive, the Nash equilibrium for party policies is described by the two equations: $q_1(G_L - G_R) + q = 0$ and $-q_2(G_L - G_R) - (1 - q) = 0$. Since $q_1 \approx q_2$ we have $q \approx (1 - q)$, i.e. $q \approx 1/2$.

when k is small. The vector z in $A(z)$ includes such variables as per capita income ($\bar{w}$), demographics and skills (k), risks and openness (e), and the political party in power.

2.5 Higher welfare generosity compresses wages from below

The equilibrium exhibits this wage equalizing effect whenever the the generosity of welfare spending is changed for one reason or another. This is seen directly from 14 as the floor elasticity $\gamma(p)$ is higher in low paid position both because G relative to $w(p)$ is higher, and because employers strength $(1-\alpha(p))$ might be higher.

The rent sharing aspect of our simple wage equation is consistent with the empirical literature suggesting that there can be unequal pay for equal work even without unions (Krueger and Summers 1988, Groshen 1991, Gibbons and Katz 1992, Barth, Bryson, Davis, and Freeman 2010). The impact of welfare benefits on wages, our main interest, is also in line with efficiency wage mechanisms. For instance in the contested exchange version of efficiency wages by Bowles and Gintis (1993), each worker obtains an excess utility beyond the fall back position. The value of the fall back position is more sensitive for higher welfare generosity in low paid positions than in others.

Focussing again on the same specific inequality measure $\bar{I}(p)$ the wage equalizing effect can be approximated by what we denote *the wage inequality equation*

$$ln(\bar{I}(p)) = B - a_g ln(G) \quad \text{where} \quad B = B(y) \tag{16}$$

with $a_g \approx \gamma$ since from (14) we have $(d\bar{I}/dG)(G/\bar{I}) = -\gamma$ which is higher the higher the bargaining power of the employer. The vector y in $B(y)$ includes such variables as per capita income, skills, openness and wage bargaining system.

Collective wage negotiations

A similar wage equation to (11), $w = \alpha(p)p + (1-\alpha(p))G$, applies also when wages are determined by collective wage negotiations. The power of weak groups may still benefit from welfare benefits, and the value of $\alpha(p)$ may also change.

When wages are taken out of individual competition, worker-employer bargaining is to some extent replaced by worker-worker arguing. In collective bargaining with a high level of coordination, it is difficult to utilize the same type of industrial actions as in worker-employer bargaining with less coordination. Coordination strengthens the power of weak groups. Just to form a union of workers with different productivity levels implies that the union bargains on behalf of its members who in turn must have a way to distribute the total union rent between themselves. Further coordination between unions have, in fact, a stronger influence on relative wages than on the functional distribution of wages

and profits (Wallerstein 1999).[11]

Wage setting is affected by fairness norms and the level of wage coordination determines the units over which the fairness norms are applied. When wages are determined at the firm level, unions compress the distribution of wages within the firm. When wages are set at the industry level, unions compress the distribution of wages across firms within the industry. When wages are set at the national level, unions compress the distribution of wages across firms, industries and occupations throughout the entire nation. More coordination is associated with less wage inequality.

Consider, for instance, organized workers in position p who can guarantee themselves $\omega \geq (1-\alpha)G$. Thus they would obtain $w(p) = \omega + \alpha p$ if they bargained directly with their employer. If they coordinate their wage claims with workers within a bargaining unit with an average productivity of $\hat{p}$, they could obtain a pay $\omega + \beta(p)\alpha\hat{p}$. We can think of this as if the union association distributes the rents $\alpha\hat{p}$ over workers with different local productivity levels where workers in position p each get $\beta(p)\alpha\hat{p}$. Clearly, if $\beta(p) \equiv 1$ for every position p all workers get the same addition to their fall back position ω, implying a rise in the lowest wages compared to decentralization.

Unions are normally not as egalitarian as that. They seem to follow a norm that to some extent reward local productivity. One example is that workers in position p receive $\beta(p) = r + (1-r)(p/\hat{p})$ where $r \leq 1$ is the weight put on equal treatment. The coordinated wage structure can then be be expressed as $w(p) + r\alpha(\hat{p} - p)$. As long as $r > 0$, coordination implies that the lowest wages rise relative to the non-cooperative benchmark, while the highest wages fall. For workers in positions for which the difference $(\hat{p} - p)$ is large even a small dose of equal treatment (a small value of r) can contribute to significant wage compression by raising low wages and holding back high wages.

All this is important in the empirical part of this paper where we utilize that the level of wage coordination is associated with lower wage inequality for a given level of welfare generosity.

2.6 How equality multiply

Combining the generosity equation in (15) and the wage inequality equation in (16) we can express the equilibrium levels of welfare generosity and wage inequality as functions of the exogenous variables:

$$ln(G) = m[A - a_I B] \quad \text{and} \quad ln(\bar{I}) = m[B - a_g A] \tag{17}$$

[11] See also Freeman (1991), Card (2001), and Moene and Wallerstein (1997).

where m is the multiplier given by

$$m = \frac{1}{1 - a_I a_g} \approx \frac{\mu}{\mu - \gamma(\mu - 1)} > 1 \tag{18}$$

The multiplier is higher the higher is the coefficient of relative risk aversion μ and the floor elasticity of wage setting γ (and hence the higher the employers' bargaining power and the initial level of G). For instance, a coefficient of relative risk aversion $\mu = 2.5$ and a floor elasticity $\gamma = .6$ (the percentage increase in the lowest wages, say at the 10th percentile, as a response to a one percent increase in welfare benefits), would yield a equality multiplier $m = 1.5$. To see whether this guess makes sense at all we have to turn to empirical inferences of the mechanisms.

Consistent with the approximations the growth of welfare generosity is

$$\dot{G}/G = g_w - a_I \dot{I}/\bar{I} \quad \text{and} \quad \dot{I}/\bar{I} = g_I - a_g \dot{G}/G$$

where g_w is a exogen impulse in A in the generosity equation (15), and g_I is an exogenous impulse in B in the wage inequality equation (16). Equality multiplies along the path whenever the system is exposed to an equality impulse $g_w > 0$, or $g_I < 0$, or both. Welfare generosity rises and wage inequality declines and the initial impulse is magnified by the equality multiplier m.

Similarly, inequality multiplies along the path whenever the system is exposed to an inequality impulse $g_w < 0$, or $g_I > 0$, or both. Inequality rises and welfare spending declines and again the initial impulse is magnified now by the the equality multiplier in reverse.

Wage inequality and welfare generosity move in opposite directions ($\dot{G}$ and $\dot{I}$ have opposite signs), except in the interval $a_I < (g_w/g_I) < 1/a_g$ that narrows towards zero when a_I and a_g become large. In all cases initial impulses are magnified by the multiplier m and we are therefore particularly interested in the two parameters, a_I and a_g. Next we turn to how we can estimate them empirically.

3 Data and identification

Two hurdles immediately arise when trying to uncover the casual relationships in the two equations: simultaneity of effects and heterogeneity between countries.

Simultaneity

Since the causality between I and G runs both ways, the major empirical challenge is to identify the basic parameters of the two equations a_I and a_g.

As hinted to, in our generosity equation we use bargaining coordination, union density,

and the share of workers involved in conflict (failed coordination) as instruments for wage inequality. The identifying assumption is that these bargaining institutions do not influence generosity, conditional on the other variables in the generosity equation (including wage inequality and country fixed effects). This assumption does not preclude lobbying efforts from either union confederations or employer associations, but rather that the outcome of such lobbying efforts does not depend on the wage bargaining institutions. These assumptions are supported by the data: Our preferred models pass over-identification tests with a good margin, and neither of our instruments contribute significantly to the generosity equation when entered one by one.

In our wage inequality equation we use right wing government, measured as the fraction of the last five years that right wing parties had majority in government as instruments for generosity. This is consistent with the micro foundations discussed in section 3 emphasizing how political parties may have an independent influence on welfare generosity. We also include the percent of population over 65 years of age as an instrument for welfare generosity. The identifying assumption is that politics and the share of elderly have no independent effect on wage inequality, conditional on the other variables in the wage inequality equation. These assumptions are also supported by our data.

There are examples that seemingly go against the assumption that government does not affect wage inequality directly. For instance, the Thatcher government clearly affected wage inequality in the UK, but in a way that does not contradict our assumptions. The UK government regulated how unions could operate and recruit members (see eg. Brown et al 2008). The effect on wage inequality is therefore indirect through changes in the bargaining system and in union density, variables that we do include in the vector y_j. Similarly, changing the unemployment compensation systems where unions administer funds that are subsidized by the government (the Ghent systems in Finland and Sweden), can affect union density.[12] Again the way the government affects wage inequality does not contradict our assumptions as the effect on wage inequality goes indirectly through changes in union density, which again is included in the vector y_j.

Empirically, the instruments have a significant and sufficiently strong impact on the instrumented variables. Furthermore, we provide robustness tests below showing that our results do not rely on one specific instrument, consistent with our tests of over-identification.

Heterogeneity across countries

The second hurdle is the large heterogeneity across countries that may arise from cultural, geographical, historical or economic reasons, and may potentially create significant omitted variable biases in our estimates. In order to address this problem, we include

[12]Several studies show that union density is higher in countries with the Ghent system (Holmlund and Lundborg 1999, and Bøckerman and Uusitalo, 2006).

fixed country effects in most of the key regressions below, i.e. country dummies in $A(z)$ and $B(y)$, sweeping all time-invariant differences across countries out of the analysis. Identification is obtained from within-country differences only. Some variables, such as population size, vary very little within each country, and are thus absorbed by the country fixed effects.

3.1 Data

We use a panel of 18 OECD countries from the period 1976-2002. The main results are obtained using 343 observations of country·year cells. Details on data and sources are provided in the appendix. We also provide supplementary evidence by taking a closer look at 56 years of experience in US, using a separate data set described in detail in the appendix.

Measures of wage inequality

The wage equalization effect is strongest for low incomes, and the equality magnifying effect also depends on the wage distribution below the mean (in particular around the median income). Our mechanisms obviously require that we use the same aspect of inequality in both equations. We use the ratio of the 5th decile to the 1st decile of gross hourly earnings (d5d1) as our main measure of inequality,[13] mainly as reported in the OECD Earnings Data base.[14] For robustness, however, we do check the effects of the alternative measures such as d9d1, d9d5, and combinations of them. All measures are gross of taxes and transfers, and based on individual outcomes in the labor market.[15] Table 10 in the appendix shows the d5d1 ratios. There are large differences in wage inequality; while the median earner made 2.07 times the earnings of the 1st decile earner in the US; the median earner made 1.38 times the earning of the 1st decile earner in Sweden. There are also large differences in changes over over time; while one half of the 18 countries experienced an increase in wage inequality from the first 5-year periods to the last, the other half experienced a decline.

[13]Using $I(p_{5,1}) = w(p_5)/w(p_1)$ the elasticity of $I(p)$ wrt. G becomes $-\gamma_{5,1} = -(\gamma(p_1) - \gamma(p_m))$. Since $\gamma(p)$ is declining in p, $-\gamma_{5,1} < 0$. Below we show empirically that welfare generosity is affected by the bottom half of the wage distribution, but not by the top half, and furthermore that the bottom half of the wage distribution is more affected by welfare generosity than the top half is.

[14]A few of the early observations are taken from OECD Employment Outlook, and we have supplemented with data from the European Community Household Survey to fill in some series where available. See data section for destails.

[15]Most of the OECD data sources report weekly earnings of full time employees, but a few report monthly or annual earnings. An indicator for data source as well as dummy variable for reported annual earnings is included in the analysis including earnings data below. France, Italy, and Switzerland report net wages, but this is controlled for using country dummies.

Measures of welfare generosity

Welfare spending is measured by the overall generosity index provided in the Comparative Welfare Entitlements Dataset, constructed and generously made available for other researchers by Lyle Scruggs at the University of Connecticut. The index captures the generosity of income support in the case of illness, in the case of unemployment and in case of disability (including old age) of each country·year cell. There are considerable differences across countries; while the index value in 2002 is 35.7 for Sweden, it is only 18.6 for Switzerland. The generosity index differs from simple measures of public spending as a share of GDP that so many studies apply. While spending varies with economic conditions, such as the business cycle, the generosity index varies only as the rules of the system change (replacement rates, coverage, entitlements, and timing). Both Sweden and Finland experienced a dramatic growth in public spending during the economic downturn during the early 1990's, while at the same time the generosity index is on a steady decline, reflecting a tightening of the rules of the welfare system. (For further details, see Figure 5 in Appendix A.) For robustness, we also show some results using public spending in stead of the generosity index.

Measures of political power and bargaining institutions

Key variables to provide independent variation in welfare spending are indicators of right versus left wing power in government. We use data from the Comparative Political Data Set obtained from Klaus Armingeon et. al. (2007). Key variables to provide independent variation in wage inequality are indicators of bargaining systems such as bargaining coordination and the percent of workers involved in conflicts, obtained from the Miriam Golden, Peter Lange, and Michael Wallerstein data set (see Golden et al 2006, and Armingeon et al 2007). These and other explanatory variables are detailed in the appendix.

4 The size of the equality multiplier

To quantify the magnitude of the equality multiplier we try out three approaches. First, we use transitory variation within each of 18 OECD countries. This is our main assessment. Second, we try to account for persistence and more long run effects in these data. Third, we consider a time series of one single country, the US, with an alternative 56 years data set. In all three approaches the simultaneity of the generosity equation (15) and the inequality equation (16) is dealt with using instrumental variables.

4.1 Exploiting transitory variation within countries

In this case we use country fixed effects (together with year dummies), sweeping out all differences in long run averages across countries. The results are given in Table 1.

The equality magnifying effect and the wage equalizing effect

As stated we instrument wage inequality with bargaining coordination, union density and the share of workers involved in industrial conflict. Doing that we obtain an IV-estimate of the elasticity of generosity with respect to inequality, a_I, of -.72. With $a_I \approx (\mu - 1)/\mu$ this is consistent with a coefficient of relative risk aversion as high as 3.5.

Instrumenting generosity with right government (average of last 5 years) and the percent of elderly in the population gives an elasticity of inequality w.r.t generosity, a_g (the floor elasticity), of -.53.

The 3SLS specification is our preferred model. The instruments pass both the Sargan overidentification test and the Cragg-Donald test of weak instruments with good margins. The Hausman tests also suggest that we should rely on the IV-specification. The results are robust to several changes in the specification and do not rely on single instruments only, as discussed below. We also show that the results do not rely on any one group of countries being in the data.

The equality multiplier

Using our preferred estimates of a_I and a_g from the 3SLS specification of Table 1, we can calculate the estimated value of the multiplier $m = 1/(1 - a_I a_g)$ from the two coefficients as reported in the first line of Table 2. We obtain an estimate of the equality multiplier as large as 1.62, significantly larger than 1. This multiplier quantifies the summarized effects of the feedbacks between the generosity and equality equations, suggesting that the immediate effect of a shift in any variable is magnified by 62 percent through the feedback mechanisms.

The next lines in Table 2 calculate the implied multiplier from the coefficients of the reduced form equations for each of the instruments and estimates of a_I and a_g from the 3SLS specification of Table 1. Consider the first equation in (20) representing the generosity equation in reduced form. The reduced form estimate is an estimate of $(-ma_I)$, while the direct estimate is an estimate of $(-a_I)$. An estimate of the multiplier m is therefore obtained as the ratio between the reduced form estimates and the direct estimates. Intuitively, this ratio measures the summarized effect of one variable after all feedbacks have been worked through, relative to the immediate effect of the same variable. We note that the multiplier calculated in this way does not vary much from the estimated value, suggesting that the instruments are reasonable.[16] Since 3SLS provides an optimal weighting

[16]More elaborate statistical test of instrument validity are presented in the robustness section.

Table 1: Welfare Generosity and Wage Inequality

	OLS-FE		3SLS FE		Reduced form	
	Generosity Coef./se	Inequality Coef./se	Generosity Coef./se	Inequality Coef./se	Generosity Coef./se	Inequality Coef./se
Inequality	–.5206***		–.7242***			
	(.0740)		(.1172)			
Generosity		–.1873***		–.5302***		
		(.0348)		(.1141)		
log GDP pc.	.3809***	–.0657	.3519***	.0895	.4779***	–.1548***
	(.0717)	(.0483)	(.0682)	(.0725)	(.0740)	(.0464)
ln(Tertiary)	.0920***	–.0411**	.0860***	.0097	.1299***	–.0564**
	(.0270)	(.0180)	(.0252)	(.0249)	(.0285)	(.0179)
Openness	–.0018*	–.0013**	–.0021**	–.0023**	–.0007	–.0019**
	(.0011)	(.0006)	(.0010)	(.0007)	(.0011)	(.0007)
Right gov.	–.0367***		–.0239**		–.0485***	.0158**
	(.0104)		(.0089)		(.0126)	(.0079)
Pct 65+	.0125***		.0108**		.0173***	–.0102***
	(.0037)		(.0035)		(.0039)	(.0024)
Barg. Coord.		–.0364***		–.0180***	.0106	–.0310***
		(.0062)		(.0053)	(.0117)	(.0073)
Union Dens.		.0033***		.0021***	–.0019*	.0033***
		(.0006)		(.0005)	(.0010)	(.0006)
Conflict(pct)		.0025***		.0018***	–.0024***	.0029***
		(.0003)		(.0004)	(.0005)	(.0003)
Constant	–.5544	1.7759***	–.1270	1.2881**	–1.8176**	2.1917***
	(.7348)	(.4608)	(.7161)	(.5088)	(.7450)	(.4676)
Fixed ctry eff.	Y	Y	Y	Y	Y	Y
Fixed year eff.	Y	Y	Y	Y	Y	Y
p-value ctry	.0000	.0000	.0000	.0000	.0000	.0000
p-value year	.0115	.0004	.0000	.0000	.0000	.0000
Cragg-Donald F			50.52	12.89		
Sargan p-value			.4876	.1389		
Hausman p-value			.0250	.0059		
No. of obs.	343		343		343	

Note: Dependent variables: ln(Overall Generosity Index) and ln(d5/d1). In the 3SLS specification, instruments for wage inequality are bargaining coordination, workers in conflict, and union density. Instruments for generosity are right cabinet and percent elderly (65+). Cragg-Donald, Sargan, and Hausman statistics are from the second stage models. All models include data set controls (see data section for details). Number of countries: 18. Number of years: 27.

Table 2: The Equality Multiplier

	3SLS FE $1/(1-a_I a_G)$	Reduced form b_{ols}/b_{3sls}
Inequality and Generosity	1.62	
p-value multiplier l.e. 1	0.019	
Right gov.		2.03
Pct 65+		1.60
Barg.Coord		1.72
Union Dens.		1.57
Conflicts(pct)		1.61

The first line shows the equality multiplier calculated from the coefficients of the two endogenous variables in the 3SLS specification of table 1, as well as the p-value of the one sided test of the hypothesis that the multiplier is less than one. This is our preferred estimate. The next lines show the implied multiplier from the ratio of the 3SLS to the reduced form coefficients of the instruments of the models in table 1.

scheme between the different variables in the first stage estimation, our preferred estimate is 1.62 in the first line of the table.

The feedbacks

Using this preferred estimate of the multiplier we discuss three contra-factual experiments in order to illustrate the size of the feedbacks.

Keeping a right wing government for five years reduces the overall generosity index directly by 2.4 percent. This would then increase wage inequality by 1.3 percent, which again reduces welfare generosity. The equality multiplier summarizes all the feedbacks, implying that the total effect of a right wing government adds up to a reduction in overall generosity by 3.9 percent. The total effect on wage inequality via lower generosity is a 2.1 percent increase. These effects are statistically significant, but not very large in magnitude.

A change from full coordination to full decentralization (a drop in the index by 4 levels) increases wage inequality by 7.2 percent. This would then reduce the demand for welfare generosity of 5.2 percent, which again feeds back to wage inequality. The end result, taking the equality multiplier into account, is an increase in wage inequality of 11.7 percent and a drop in welfare generosity by 8.4 percent. Since the bargaining system has no direct effect on welfare generosity, this effect mimics the effect of any exogenous change in wage inequality that would imply 7.2 percent higher inequality. Examples of such changes could be skill-biased technological change or changes in the direction of more performance-related pay within firms.

Rising GDP per capita by 10 percent has a direct effect on both generosity (+3.5 percent) and wage inequality (+0.9 percent). The rise in generosity, however, changes the impact on wage inequality via the multiplier. Taking the feedbacks into account the overall effect is a 1.6 percent *reduction* in wage inequality and 4.6 percent increase in generosity. Even inequitable economic growth can therefore produce more wage equality when adjustments via welfare spending are taken into account.

Robustness and specification tests

Several questions can be raised to these estimates.

Are the instruments valid? Tables 6 and 7 in Appendix B check different instruments and provide some key statistics to evaluate their validity. The tests clearly show that we have strong instruments.

Are the results driven by outliers? A typical worry when using international data sets is that the results could be driven by the outcomes of a few countries, or by peculiar patterns of change in the instrumental variables. We have re-estimated the equations excluding different sets of countries, one group at the time. The estimates, reported in Table 8 in Appendix B, show that our key result does not depend on the inclusion of any groups of countries in our sample. The estimated equality multiplier from the sub-samples ranges from 1.39 to 1.83.

Are the results driven by specific measures? We have tried out the impacts of alternative measures reported in Table 9 in Appendix B. We use a different, but closely related, measure of generosity—OECD's measure of public social spending as a share of GDP. Still the estimated equality magnifying effect of -.68 is very close to what we found for the overall generosity index. Replacing the inequality measure ln(d5d1) by ln(d9/d1) shows that the observed wage equalization effect observed in Table 1 is robust and that even though welfare benefits tend to compress wages mostly from below, they also have some (more modest) effect on the whole wage distribution as well. We have also run specification where we have added d9d5 as an endogenous variable to the generosity equation (not shown in the table). It turns out that we get a positive, but not significant coefficient for d9d5 while the coefficient for d5d1 remains of the same size (-.69) and highly significant (t=5.05) as in Table 1.

4.2 Exploiting persistence and long run effects

Our second attempt to assess the magnitude of the equality multiplier builds on the observation that welfare generosity and the wage distribution change only slowly and that there seems to be a lot of persistence in both variables. Most of our exogenous variables, such as demographics and GDP change slowly as well, and there seems to be persistent variation across countries, or clusters of countries, in both politics and wage

setting regimes. This creates two problems for our analysis. Firstly, we lose a lot of variation when we use country fixed effects, utilizing only the 'transitory' variation in the exogenous variables. Secondly, we may miss out some underlying dynamics that may affect our estimates as well. In this section we use two methods (IV 3SLS with no country fixed effects, and system GMM with lagged endogenous variables) to investigate the potential impact of these problems for our conclusions.

Excluding country fixed effects

The fixed effect model uses only changes within all the countries over this 27 year period in order to sweep out all differences in long run averages across countries. These differences are of course also potentially due to the mechanisms we discuss in this paper. A long run representation of the model would make use of this long run variation as well, for instance estimated by standard cross sectional OLS. The reason why we do not use such a specification is that the models may be contaminated by a host of unobserved factors that may affect both the endogenous and the exogenous variables. An instrumental variable approach may alleviate this problem, and the first model of Table 3 provides the 3SLS specification of our two equations *without* country dummies.

Keeping in mind that this specification may be contaminated by the possible correlation between country-specific factors determining both the instruments and the endogenous variables, we still want to point out three observations.

First, it seems that the effect of inequality on generosity is enforced in the longer run, whereas the effect of generosity on inequality is weakened, and overall the multiplier shrinks to 1.39.

Second, without accounting for country fixed effects, the long run relationships between openness and both welfare generosity and wage inequality are positive. This observation is consistent with the view of a high level of openness being associated with higher risk, and thus a larger demand for social insurance, even though the short term impact of transitory changes in openness is negative (see Table 1 and eg. Rodrik, 1997). The positive relationship between openness and wage inequality may be consistent with the forces of factor price equalization working in the very long run, even if they do not appear to be particularly important in the short run.

Third, the effects of our instruments, in particular right government and bargaining coordination are much larger, in the order of 2-3 times larger, once we utilize variation between countries as well. The coefficient for bargaining coordination implies 23 percent lower wage inequality in a country with decentralized bargaining versus one with fully coordinated bargaining, adding up to a difference of 31 percent after taking the equality multiplier into account. Similarly, 5 years with right wing government implies 5 percent lower generosity, adding up to a difference of 9 percent after taking the equality multiplier into account.

Table 3: Welfare Generosity and Wage Inequality

	IV- No ctry dummies		System GMM	
	Generosity	Inequality	Generosity	Inequality
	Coef./se	Coef./se	Coef./se	Coef./se
Inequality	–.9618***		–.0464*	
	(.0780)		(.0236)	
L.Generosity			.9426***	
			(.0154)	
Generosity		–.3001***		–.0241**
		(.0612)		(.0096)
L.Inequality				.9069***
				(.0188)
Openness	.0063***	.0023***	.0004**	–.0001
	(.0005)	(.0004)	(.0002)	(.0001)
log GDP pc.	.4105***	.3159***	.0165	.0539***
	(.0671)	(.0425)	(.0228)	(.0151)
ln(Tertiary)	.0595***	.0031	–.0046	–.0045
	(.0169)	(.0098)	(.0050)	(.0031)
Right gov.	–.0494***		–.0029	
	(.0148)		(.0063)	
Pct 65+	.0296***		.0004	
	(.0039)		(.0013)	
Barg. Coord		–.0574***		–.0056**
		(.0061)		(.0021)
Union Dens		–.0005*		.0001
		(.0003)		(.0001)
Conflict(pct)		.0015**		–.0006**
		(.0005)		(.0002)
Constant	–.8352	–1.5034***	.0318	–.3999**
	(.6470)	(.3661)	(.2137)	(.1346)
Sargan p-value	.0000	.0000	.8366	.8266
	343		300	300

Dependent variables: ln(Overall Generosity Index) and ln(d5/d1). Instruments for wage inequality are bargaining coordination, union density, and workers in conflict. Instruments for generosity are right cabinet and percent elderly (65+). System GMM specifications instrument with endogenous variables from lag 2 and backwards and include all exogenous variables as ordinary instruments (see Blundell and Bond, 2000). In the system GMM specifications, controls for dataset and annual data are based on the model on the full sample, see data section for details.

Lagged endogenous variables

One way to incorporate persistence and long run effect is to estimate the model augmented with lagged endogenous variables. We estimate each equation separately, combining two representations of the same equation in a system consisting of both the first difference and the equation in levels (using system GMM[17], see Blundell and Bond 2000). Both variables display high levels of persistence, with coefficients of the lagged endogenous variables of .94 and .91 respectively. Still, both coefficients are significantly different from one.

We can solve for the long run (steady state) coefficients.[18] This yields a long run effect on inequality of generosity of -.81 and a long run effect of generosity on inequality of -.26. These coefficients are not far from the estimates given in the IV specification without country effects, and suggest an equality multiplier of 1.27 in the long run.

Again we note that the effect of openness on generosity is positive, with a long run coefficient of 0.007, which again is very close to what we obtain in the IV-specification without country fixed effects. The long run effect of bargaining coordination on wage inequality is estimated to -.06 whereas the effect of industrial conflict changes sign and is more difficult to interpret. The effect of right government on generosity is not statistically significant, but the point estimate suggest a long run effect of about -.05, which again is very close to the long run effect estimated without country dummies.

Caveats

Both methods used in Table 3 have some caveats: The specification without fixed country effects may be affected by heterogeneity across countries, a problem that is clearly indicated by the Sargan tests in both equations. The models pass the overidentification test in the fixed country effects specification of Table 1, but fail without fixed effects, suggesting that the instruments in Table 3 may pick up some country specific factors that should be in the models. A possible caveat of the system GMM method, is that it relies on the assumptions allowing lagged representations of the endogenous variables to be used as instruments (see Blundell and Bond, 2000 for details). The Sargan tests, however, are satisfactory in both equations.

[17]We use the standard specification where we use lagged levels of generosity and inequality dated t-2 and earlier as instruments for the equations in first-differences; and (correspondingly) the lagged first-differences of generosity and inequality dated t-1 (only) as instruments for the equations in levels. We include the exogenous variables as well as the instruments from Table 1 (bargaining coordination, right government and so on) as standard instruments in the equations. Year dummies are included as instruments in the levels equation only.

[18]Consider the two equations separately, conditional on the other endogenous variable, i.e. when ignoring the feedbacks through the equality multiplier. A coefficient on the lagged generosity variable of .9426 implies that the long run coefficients of the generosity equation equal the short run coefficients multiplied by $1/(1 - .9426) = 17.4$. The estimated long run effect of inequality on generosity is thus (-.0464x17.4)=-.81. A similar reasoning applied to the inequality equation gives a long run effect of generosity on inequality of -.26.

The results reported in Table 3 clearly suggests that there is high persistence in both wage inequality and in welfare generosity and that the short run response is smaller than the long run response. The results also indicate that the fixed country effects models of Table 1 rather underestimate the effect of inequality on generosity compared to the long run effect, but that the effect of generosity on inequality may be attenuated rather than enforced in the longer run. The long run equality multiplier seems to be somewhat smaller than the one estimated in the 3SLS specification, but is still in the same ballpark. Furthermore, the results suggest that the effects of our key instruments, bargaining coordination and right government, are conservatively estimated in the 3SLS specification.

Because of the caveats associated with the specifications in Table 3 we keep the 3SLS model of Table 1 as our preferred specification.

4.3 Exploiting an alternative time series for the US 1945-2001

Our last attempt to quantify the magnitude of the equality multiplier uses single time series over 56 years in the US. The US experience illustrates the mechanisms we have uncovered. Figure 2 displayed a negative relationship over time between pre-tax wage inequality and social spending, but a more formal analysis is needed in order to check if this relationship provides a useful illustration of our model. We use data from 1945 to 2001, all drawn from different sources than what is used in the previous analysis.[19]

Table 4 shows results from three different IV-specifications. Most importantly, we find clear support for both the equality magnifying effect (higher wage dispersion reduces welfare spending) and the wage equalizing effect (higher welfare spending reduces wage dispersion).

Details on the regressions

Since we now use data for actual social spending, we include log unemployment in the equations in order to adjust social spending for the consequences of economic fluctuations; and we may thus interpret the remaining coefficients as effects on welfare generosity. Since we only have one time series and are unable to utilize the difference in the development of exogenous variables across countries, we have dropped most of the slow moving variables from Table 1, to be picked up by the trend variable. There is a strong underlying positive trend in welfare generosity, most likely from GDP growth in combination with other

[19]The reason is that we need observations from the time period 1945-1975 in addition to what we have used so far. Using separate sources also add an element of robustness check to our analysis of course. See notes under Figures 2 and 3 and Table 10 for details on the sources. Welfare generosity is represented by social spending in percent of GDP. The data are taken from Historical Statistics of the US, and the programs include social insurance, public aid, health and medical programs, veteran programs, housing and other social welfare programs. The wage inequality data is the series of the d9-d1 ratio of male hourly wages reported in Goldin and Katz (2007). The series underlying Figure 5 in Goldin and Katz (2007) is kindly provided by the authors. See note under Figure 2 for details.

Table 4: Generosity and Wage Inequality, United States 1945-2001

	Generosity Coef./se	Wage Disp. Coef./se	Generosity Coef./se	Wage Disp. Coef./se	Generosity Coef./se	Wage Disp. Coef./se
ln(Wage Dispersion)	-1.4326**		-1.5199**		-1.3333**	
	(.4999)		(.4962)		(.4779)	
ln(Social Spending)		-.1998***		-.1290**		-.1517***
		(.0367)		(.0429)		(.0396)
Trend	.0347***	.0022	.0356***	-.0004	.0337***	.0068**
	(.0072)	(.0025)	(.0071)	(.0023)	(.0070)	(.0024)
ln(Unempl.)	.3006***	.0115	.2974***	.0038	.3042***	.0034
	(.0442)	(.0139)	(.0459)	(.0134)	(.0444)	(.0117)
Age 65+ (pct pop)	-.0215		-.0254		-.0170	
	(.0668)		(.0669)		(.0656)	
Right gov.[0,1]	-.0555		-.0565		-.0544	
	(.0815)		(.0809)		(.0820)	
Trend*Right gov.	.0044		.0046		.0042	
	(.0026)		(.0025)		(.0025)	
Truman	-.0331		-.0444		-.0202	
	(.0802)		(.0757)		(.0806)	
Eisenhower	-.2371*		-.2551*		-.2165*	
	(.1090)		(.1074)		(.1051)	
Kennedy/Johnson	-.0980		-.1174		-.0759	
	(.1124)		(.1089)		(.1068)	
Nixon/Ford	-.0053		-.0264		.0186	
	(.1205)		(.1175)		(.1154)	
Carter	-.0110		-.0265		.0067	
	(.0993)		(.0967)		(.0955)	
Reagan/Bush	-.0946		-.1009*		-.0874	
	(.0515)		(.0514)		(.0494)	
Union Density		-.0233***		-.0230***		-.0183***
		(.0019)		(.0019)		(.0019)
Tertiary (pct pop)		.0081		.0077		-.0016
		(.0055)		(.0050)		(.0052)
Added trend 1980+				.0036*		.0010
				(.0017)		(.0014)
ln(Real min.wage)						-.1056**
						(.0347)
Constant	2.8706***	2.0594***	3.0134***	1.9714***	2.7083**	2.0464***
	(.8717)	(.0946)	(.8487)	(.0792)	(.8416)	(.0709)
Hansen J-test p-value	.1015	.0836	.0884	.0736	.0038	.0983
Cragg-Donald F-value	14.98	11.53	10.00	8.49	7.66	9.21
Equality multiplier	1.40		1.24		1.25	
P-value E.mult l.e. 1	0.014		0.037		0.027	
No. of cases	58		58		58	

Dependent variables: ln(Social Spending) and ln(d9/d1). Instruments for wage inequality included in the first model are Union Density and Tertiary attainment, the next model adds a trend after 1980, and in the last model ln(Real Federal Minimum Wage) is added. Instruments for generosity included in the IV specifications are Right cabinet (0,1; Share of last 5 years with Republican President), interacted with trend, dummies for Presidential period, and the percent of population over 64 years of age. Statistics from 2SLS robust to heteroscedasticity and autocorrelation (except p-values for the equality multiplier which is calculated from joint estimation.

trends.[20]

We include right government, as before, and allow for an interaction between right government and the trend variable. In addition, we include a dummy for each presidential period. Even if these political variables are not individually significant, they are strongly jointly significant (more on this below). We find a negative impact of having a Republican president, but the effect is dampened by a positive interaction with time.[21] In addition we find significant differences across presidential periods. The upward shift during the Nixon and Ford administrations, which seems quite contrary to Nixon's rhetoric, has been noted by others (see eg. Trattner, 1989), and we find a negative coefficient most notably for the Eisenhower and for the Reagan era. The elasticity of social spending with respect to wage inequality is estimated to -1.43.

The first inequality equation shows a significant negative effect of union density, and a negative elasticity of wage dispersion with respect to social spending of .2. The estimated equality multiplier is 1.4. Several authors have argued that after 1980, skill-biased technological change, computerization in particular, shifted the trend in demand for high skilled workers.[22] The next model allows for such a shift in relative demand and represent the trend in wage inequality as a spline with different trends before and after 1980. Wage inequality now displays a positive trend only after 1980. The elasticity w.r.t. social spending is reduced to -0.13, and the estimated equality multiplier in this model is 1.24.

A strong correlation between wage inequality and the minimum wage has been observed by several authors, most notably DiNardo, Fortin, and Lemieux (1996). In the last two models of Table 9, the log of the real federal minimum wage is included in the wage equation. Two results stand out: First, the minimum wage has a significant impact on wage inequality, and second, the estimated effect of social spending is larger rather than smaller after inclusion of the minimum wage. The estimated equality multiplier is 1.25 in this case.

Note, however, that the Hansen J-test of the generosity equation now drops below 1 percent, clearly suggesting that the minimum wage is correlated with generosity, even conditional on wage inequality. This may not be so surprising, since the minimum wage is a policy instrument as well. We thus conclude that adding the minimum wage to the model changes the key results very little.[23]

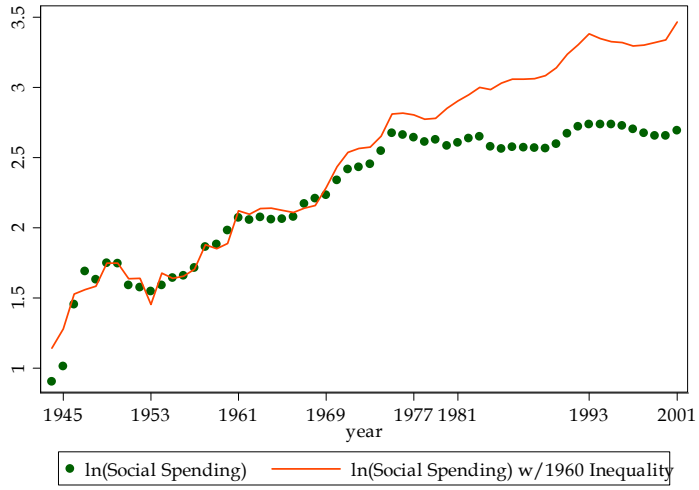
[20]Replacing the trend variable by the log of GDP per capita in the first generosity equation yields a highly significant coefficient of 0.78 for ln(GDP) and introduces only small changes in the other coefficients; adding ln(GDP) to the model with trend yields a negative insignificant coefficient.

[21]Browning (1986) discuss this pattern and attributes much of it to the interaction between the Presidency and the Congress: Democratic presidents have initiated new programs, while the republican presidents have not been able to cut the growth in spending from these programs due to resistance in the Congress

[22]See however Katz and Goldin, 2008, who argue forcefully that SBTC has been a stable factor throughout the whole of last century. This observation may be consistent with the fact that the added trend looses explanatory power in the next specification.

[23]Further analysis of the effects of the minimum wage is warranted. The ideal strategy would be to

Figure 3: Actual and Counterfactual Welfare Generosity. United States 1945-2001.



Note: Scatter plot shows ln(Social Spending) (Historical Statistics of the US, see note under Figure 2 for details). The line shows predicted values of Social Spending, using model 2 in Table 10, when setting wage inequality equal to the 1960 level throughout

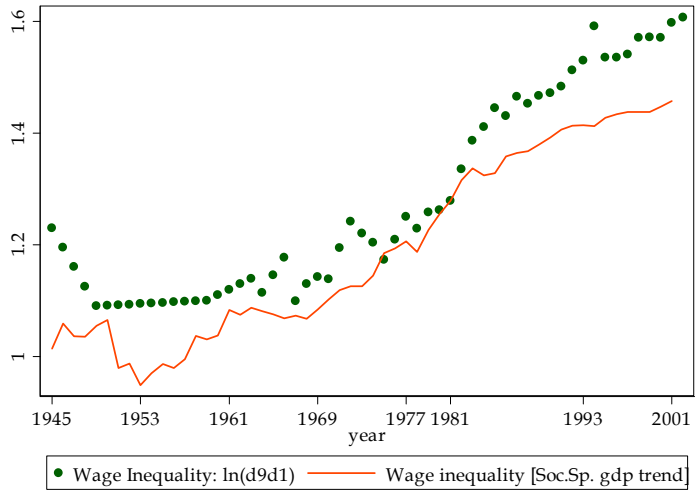
(In)equality magnifying effect

What was the effect on social spending of the surge in wage inequality after the period of the great compression? Figure 3 shows the factual and a contra-factual development of public social spending. The dotted line shows the actual development of public social spending, whereas the line illustrates the predicted value of log public spending according to the IV models in the middle of Table 9, for the hypothetical case where wage inequality is kept at its 1960 level throughout the whole post-war period. The gap between the dotted line and the smooth line illustrates the size of the inequality magnifying effect of the surge in wage inequality since 1980.

Note first that there is a strong underlying positive trend towards higher social spending, most likely from an increased demand for social insurance among voters as GDP per capita grows. Next, we find that the increase in wage inequality after 1975 and in particular from the 1980's onwards have led to a retrenchment of social spending. One interpretation of this, in line with our model, is that rising wage inequality after 1980 (partly due to technological change and partly due to changes in unionism) lead to a drop in income for the median worker relative to the overall trend. This relative deprivation reduced the popular demand for social insurance making it easier for president Ronald Reagan to get closer to his preferred level of welfare generosity without loosing voters, while the Democrats had to move in the same direction in order not to lose voters. This

instrument the minimum wage, but this would be outside the scope of our paper. A recent analysis is provided by Autor, Manning, and Smith (2009) who use differences in the minimum wage across states over time to estimate the effect of the minimum wage on the US wage structure.

Figure 4: Actual and Counterfactual Wage Inequality. United States 1945-2001.



Note: Scatter plot shows actual Wage Inequality (ln(d9/d1) from Goldin and Katz, (2006) , see Figure 2 for details). The line show the predicted value of Wage Inequality from model 2 of Table 10, when social spending follows a GDP trend only, adjusted to hit the actual 1981 level of social spending. (The GDP-trend is estimated from a simple regression of social spending on ln(GDP) per capita.)

figure is an illustration of the partial effect only, of course, in particular since we condition on the other endogenous variable in our model.

Wage equalizing effect

What was the effect on inequality of the retrenchment of social spending since the early 1980's? To illustrate this we consider the hypothetical case where social spending follows a GDP-trend throughout, i.e. we predict social spending from GDP per capita only, and adjust the level to be consistent with the 1981 level of social spending.[24] Figure 4 shows the factual and contra-factual development of wage inequality in this case. We first note that the model predicts the dip during the great compression (actual values are linear interpolations between 1949 and 1959) even when keeping social spending on a fixed GDP trend. However, we also note that the earliest level of wage inequality would have been lower, had welfare generosity been consistent with the 1981 level.

We also find that the surge in wage inequality during the 1980's was considerably steeper as a result of the retrenchment of social spending. One interpretation of this observation, which would be in accordance with our model, is that the underlying increase in wage inequality was kept in check as a result of increased relative bargaining power of low wage groups from the expansion of social insurance from the 1960's onwards. The retrenchment period of the 1980's on, however, reduced the relative bargaining power of low wage groups which allowed wage inequality to surge even more than the underlying

[24]The Figure is virtually identical to a figure where social spending follows a linear trend.

trend. Again we should point out that this figure is an illustration of the partial effect only, in particular since we condition on the other endogenous variable in our model.

Caveats

As emphasized above one should exercise caution when interpreting the results from a single time series, and we do not regard the evidence presented in this section as sufficient casual evidence by itself for the mechanisms we propose. However, the results fit nicely with the more robust results from the panel study across countries and thus provide additional empirical support for our propositions.

Driving countries apart

Our main empirical results are estimated using within country variation only, and do not rely on between country variation. We find similar results both when excluding the US from the data, and when analyzing the US separately. In particular this rules out the great "Atlantic divide" as a source of identification in our analysis, and suggests that the effects do not arise from multiple equilibria across countries. We do not reject, however, the possibility of multiple equilibria. Rather we identify mechanisms that operate also conditional on long term country specific attributes. Such attributes could be country specific perceptions of luck versus compensation for effort, as in Alesina and Angelotos (2005) or the heterogeneity of the population, as discussed in Alesina, Glaeser and Sacerdote (2001), all of which could affect the political support for the welfare state. Even though we focus on magnifying feed-back effects of changes in labor market institutions and political ideology of the government, changes in heterogeneity of the population or in fairness perceptions could also set off a similar cumulative process. In any case the forces behind the equality multiplier are likely to widen the US-Europe divide, and more generally to drive countries apart, simply because they tend to magnify the impact of existing differences and changes.

As stated, our theoretical mechanisms are somewhat different from the ones discussed by Alesina and Angelotes (2005) in our emphasis on the bottom of the wage distribution. Is this emphasis supported by the data? Firstly, our results show that the generosity of the welfare state mainly compresses the wage distribution from below. This is consistent with a view that the welfare state tends to empower workers at the bottom of the wage distribution rather than to mitigate the human capital formation higher up in the distribution. Secondly, we find that wage compression from below, as measured by d5d1, affects welfare spending more than wage compression higher up in the wage distribution. This is consistent with a view that a mean preserving increase in wage inequality makes the majority of voters less affluent and less supportive of social insurance, in contrast to their view that smaller differences higher up in the wage hierarchy are considered unfair

because luck now plays a more prominent role for pre tax distribution.

5 Conclusion

Why does a high level of pre tax inequality favor a small rather than a large welfare state? The basis for our answer in this paper is that higher inequality means lower incomes relative to the mean for a majority of voters. With a lower income each of them would like to allocate a larger share of it to immediate consumption rather than to tax-financed welfare programs with less direct benefits. Thus, increasing wage inequality means a declining electoral support for a larger welfare state, and an increasing electoral support for a smaller one.

Faced with voters with more unequal incomes, proponents of the welfare state (political parties or blocks) have to run on a less ambitious welfare program in order not to lose voters, while proponents of a smaller welfare state can satisfy more of their ideological preference for welfare cuts without losing as many voters as otherwise. As a result the political equilibrium change in the direction of less generous welfare spending. Conversely, a more equal distribution of incomes means that the political equilibrium changes in the direction of a more generous welfare spending. Thus smaller wage differentials induce larger welfare states — what we denote the equality magnifying effect.

Why does not a tax financed welfare state favor increasing rather than decreasing wage differentials? Our simple answer is that generous welfare programmes first and foremost increase the bargaining power of weak groups in the labor market. Thus larger welfare states induce smaller wage differentials—what we denote the wage equalization effect.

We have shown how these two effects, the wage equalization effect and the equality magnifying effect, together generate a self-enforcing process that adds up to a sizable social multiplier. Along the development path economic and social equality can multiply due to the complementarity between politics and markets. Accordingly, higher equality may induce even more equality; and higher inequality may induce more inequality. In both cases we obtain a pattern where welfare generosity and wage inequality become negatively related—as in Figure 1. Empirically, we are able to identify a sizeable equality multiplier of more than 1.5 in our preferred specifications. This means that an initial impulse that affects either welfare generosity, wage equality, or both, has a 50 percent stronger effect on the same variable after the feedback between the two has been allowed to work. There appears to be rather high persistence in both variables, suggesting that the feedbacks take time to work.

Our results do not apply to European style welfare states only. Also within the US the feedback effects have a strong impact on the joint development of social spending and wage inequality. This is further explored using US time series data from 1946 to 2002, providing additional empirical support for our mechanisms. There are trends in the US

data caused by GDP growth, new technologies and institutional change. Up until the late 1960's, the growth in social spending tends to strengthen the forces underlying the 'great compression' of wages. In this period social spending seems to keep the growth in wage inequality in check, sustaining the growth in welfare spending. After the late 1970's, however, US experiences a retrenchment in social spending strengthening the underlying forces of increasing wage inequality.

While the trends in the US, at least since 1980, have been towards greater economic and social inequality, the trends both in the labor market and in social policies have been less distinct in European welfare states. The social multiplier enhances long term consequences of these underlying trends. In this way the equality multiplier magnifies differences across countries over time and may help explaining for instance why the Scandinavian countries have twice as generous welfare spending as the US, and only half of its pre-tax wage inequality.

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Appendix A: Data sources and definitions

The data used in the core analysis of this paper is a panel of 343 observations from 18 OECD countries from 1976 to 2002. The variables we use are collected from different sources. Wage dispersion is measured by the ratio of the 5th to the 1st decile of hourly gross wages. The data collected are mainly provided by the OECD. Most of the OECD data are collected from the OECD Earnings database [`http://www.oecd.org/dataoecd/9/59/39606921.xls`, `http://stats.oecd.org/Index.aspx?DataSetCode=DEC-I`], supplemented by data from Employment Outlook, 1996, Table 3.1 (1979-1995). Additional series are calculated on the European Community Household Survey- ECHP (1994-2001). In order to minimize measurement errors, an average over these sources is constructed for each countryxyear cell, so that each countryxyear is one observation. In the empirical analysis below, we always include a variable indicating the weight of the different sources (OECD, ECHP) in the construction of each countryxyear-cell average in order to account for potential heterogeneity in definitions etc. between the sources. Because of a large discrepancy in the Austrian OECD and ECHP series a separate indicator is included. In addition an indicator variable taking the value of 1 if wages are measured annually is included in all regressions involving wage dispersion. France, Italy, and Switzerland report net wages, but this is controlled for by the use of country dummies. Table 5 below provides an overview of the years covered from the different sources and a description of the ratio between the 5th decile and the first decile of pre-tax wages of the OECD countries from 1976 to 2005.

Generosity of the welfare state is measured by the overall generosity index provided in the Comparative Welfare Entitlements Dataset, constructed and generously made available for other researchers by Lyle Scruggs at the University of Connecticut. The index captures the generosity of income support in the case of illness, of unemployment and of disability pensions (including old age) of each country year cell. Generosity is constructed using both the replacement ratio, coverage, entitlements and timing of different schemes, in addition to other features of the schemes. The construction of the index is described in Scruggs (2004, 2007). The data set is available at `http://sp.uconn.edu/\symbol{126}scruggs/wp.htm)`.

Figure 5 displays the trend in the overall generosity index for each country in our sample, together with public social spending as reported by OECD.

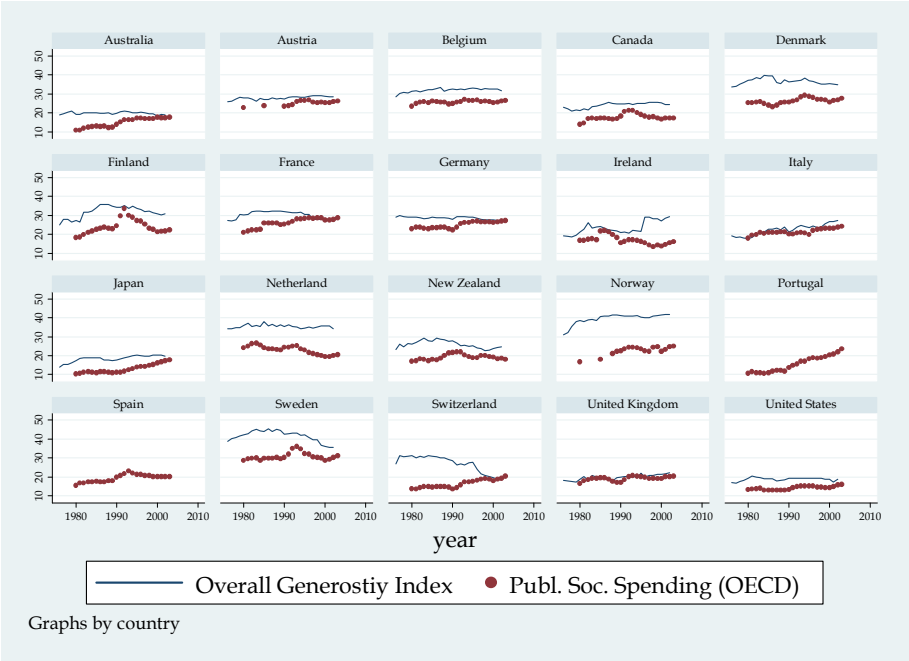
The political variables used in our analysis are obtained from Armingeon et. al. (2007) Comparative Political Data Set (CPD). Right government is the five year average of an (current and lagged) indicator variable taking the value of one if the right parties has a majority in government (g.t. 50 percent), constructed from the variable govright (defined as right-wing parties in percentage of total cabinet posts, weighted by days) from (CPD) Armingeon et al (2007). The percent of elderly in the population is taken from the same

Table 5: Wage ratio: d5/d1. 5 year averages

Country	Dataset		1976-80	1981-85	1986-90	1991-95	1996-00	2001-05
Australia	OECD		1.62	1.68	1.68	1.64	1.63	1.66
Austria	OECD	a,b,c	1.94		1.95	1.99		1.70
	ECHP					1.64	1.47	1.42
Belgium	OECD			1.46	1.45	1.44	1.40	1.39
	ECHP					1.37	1.37	1.42
Canada	OECD	b		2.24		2.24	2.40	2.26
Denmark	OECD		1.41	1.40	1.40		1.47	1.52
	ECHP					1.36	1.34	1.34
Finland	OECD	b	1.53	1.48	1.47	1.41	1.40	1.42
	ECHP						1.43	1.42
France	OECD	b,d	1.79	1.69	1.63	1.63	1.62	1.58
	ECHP					1.57	1.58	1.56
Germany	OECD	c		1.68	1.65	1.60	1.61	1.76
Ireland	OECD					2.06	1.82	1.83
	ECHP					1.75	1.68	1.55
Italy	OECD	a,c,d	1.89	1.72	1.43	1.41	1.38	
	ECHP					1.39	1.40	1.41
Japan	OECD	c	1.69	1.72	1.71	1.64	1.62	1.63
Netherlands	OECD	b	1.59	1.54	1.56	1.57	1.65	1.65
	ECHP					1.39	1.42	1.47
New Zealand	OECD			1.48	1.51	1.52	1.59	1.56
Norway	OECD	a,c	1.41	1.37	1.45	1.32	1.38	1.43
Sweden	OECD	b	1.39	1.31	1.31	1.33	1.36	1.38
Switzerland	OECD	c, d					1.50	1.47
UK	OECD		1.92	1.75	1.76	1.82	1.82	1.81
USA	OECD		1.90	1.94	1.98	2.04	2.08	2.07
OECD avg.	OECD		1.67	1.63	1.59	1.67	1.63	1.65

Source: 5-years averages of available years from OECD Earnings database, ECHP European Community Household Panel. a) data from 1976-95 is supplemented from Employment Outlook 1996, table 3, b) Annual earnings, (Austria 04-05,Canada 81-94), c) Monthly earnings, d) Net earnings, (Italy 79-84).

Figure 5: Trends in Welfare Generosity.



Note: Source; Overall Generosity Index: The Comparative Welfare Entitlements Dataset by Lyle Scruggs, University of Connecticut. Public Social Spending: OECD Social Expenditure Database.

source (CPD).

Bargaining indicators: Union density and bargaining coordination from 1976-2000 are obtained from: Golden, Miriam; Peter Lange; and Michael Wallerstein (2006). "Union Centralization among Advanced Industrial Societies: An Empirical Study." Dataset from `http://www.shelley.polisci.ucla.edu/`, version dated June 16, 2006, now available at `http://dvn.iq.harvard.edu/dvn/dv/golden/faces/study/StudyPage.jsp?studyId=636\&tab=files`. Union density is defined as net density (see Ebbinghaus and Visser, 2000); 2001 and 2002 values are set at 2000 level. Figures for Ireland and New Zealand from OECD Employment Outlook 2004 Table 3.3 (linearized decennial values). Coordination in bargaining is defined as the ten year average of (present and lagged) bargaining level 2 from Golden et al (2006). Bargaining level 2 is the level at which wages are determined, coded as follows:

1 = plant-level wage-setting

2 = industry-level wage-setting without sanctions

3 = industry-level wage-setting with sanctions

4 = central wage-setting without sanctions

5 = central wage-setting with sanctions

2001-2002 values of bargaining level 2 are set at 2000 values. Figures for Ireland and New Zealand from OECD Employment Outlook 2007 Table 3.5 Centralisation index. Workers in conflict is obtained from (CPD) Armingeon et. al. (2007), calculated as workers involved in

industrial conflict, wi, in percent of civilian labor force 15-64.

Openness is defined as 100x(export+import)/2GDP (openk/2) from Penn World Tables, version 6.2 (see Alan Heston, Robert Summers and Bettina Aten, 2006). GDP per capita (USD, real PPP-adjusted) is taken from OECD Factbook 2006: Economic, Environmental and Social Statistics. The percent of population with tertiary education from 1990-2003 is taken from OECD Education at a Glance, various years (linearised when missing). From 1976-1989 education data is imputed using linearised values of five years figures reported in Delafuente and Domenech (2002).

Sources for the US-analysis 1945-2001: *Social Transfers 1945-1959*, Historical Statistics of the United States, Millennial edition (includes Social insurance, public aid, health and medial programs, veterans programs, housing and other social welfare programs, Tables Bf189-195/GDP Table Ca1); 1960-2001 from the OECD Lindert-Allard Data Set (2009). *d9d1* from Goldin and Katz (2007) Figure 5: 1945-1960 Census data (interpolation for 45-48 (from 1939), 50-58, and 60-62. CPS-March data from 1963. *Unemployment*: 1940 Historical Statistics of the United States, Millennial edition, BA352. 1941 Interpolation. 1942-1969 Bureau of Labor Statistics, Annual household data, employment data statistics. 1970 - 2001 Source: OECD (2007), OECD Main Economic Indicators, April, Paris. Table A. *Share of Population 65 +* : Historical Statistics of the United States, Millennial edition, Table Aa139. *Right Government*: 5 year average of an (present and lagged) indicator variable for a Republican President. Source: Armingeon et al (2007). *Union density*: 1940-1950 from Historical Statistics of the US Millenial ed. Series Ba4791. *College attainment*: 4 years or more of college: US Census `http://www.census.gov/population/www/socdemo/educ-attn.html`, Linear interpolation 41-49, 51-59, 61, 63, 65, 94. *Real Federal Minimum Wage*: 1940-59 USGovinfo, cpi adj. `http://usgovinfo.about.com/library/blminwage.htm` 1960-2001 OECD Stat.: Real hourly minimum wage.

Appendix B: Robustness and specification tests of the 3SLS IV estimates

This appendix addresses some key robustness issues concerning the 3SLS model of Table 1.

Are the instruments valid?

Tables 6 and 7 check different instruments and provide some key statistics to evaluate their validity. Consider welfare generosity first. The 2SLS specification corresponding to the 3SLS model of Table 1 gives an elasticity of welfare generosity with respect to inequality of -0.74. The Sargan test strongly suggests that the instruments do not belong in the equation, something that is also confirmed in the next two specifications where the instruments are added in two clusters. We also note that the Cragg-Donald F-values are very satisfactory, clearly showing that we have strong instruments.

In the last specification, the year dummies are replaced by a linear trend. We show this specification for two reasons, one is to provide an assessment of the average trend, a retrenchment

Table 6: Welfare Generosity

Dependent variable: ln(Generosity Index)					
	OLS-FIX	IV-1	IV-2	IV-3	IV-4
	Coef./se	Coef./se	Coef./se	Coef./se	Coef./se
Inequality	–.5206***	–.7365***	–.7314***	–.5661**	–.8254***
	(.0740)	(.1207)	(.1339)	(.2831)	(.1331)
Union Density			–.0001		
			(.0009)		
Barg. Coord.				–.0069	
				(.0096)	
Conflict(pct)				–.0007	
				(.0010)	
Trend					–.0065***
					(.0021)
adj. R-square	.51	.49	.49	.51	.37
Sargan p-value		.4876	.2316		.3598
Cragg-Donald F		50.52	61.54	26.52	57.09
Hausman p-value		.0250	.0394	.5887	.0109
P-value barg.				.4740	
No. of obs.	343	343	343	343	343

Note: The models also include country and year dummies (in IV 4 the year dummies are replaced by a linear trend) the covariates right cabinet, ln(GDP per capita), openness, percent 65+ tertiary share. All models include data set controls (see data section for details). In IV-1-IV-4 the instruments for wage inequality include bargaining coordination, union density, the conflict share, when not added to the equations.

of about half a percentage point per year, conditional on the other variables.[25] The other is to show that the equality magnifying effect is strong and significant also when estimated under this more restrictive assumption.

Table 7 shows similar statistics for wage inequality. The Sargan p-value of .14 and a Cragg-Donald F-value of 12.9 are satisfactory. Again we show that our key results do not hinge only on one of the instruments, and again that none of them belong in the equation when entered one by one. Furthermore, we show that there is no average trend in wage inequality once we have controlled for the other covariates of the model.

Driven by out-layers?

With the small sample sizes and limited scope for variation in the instruments, there are clearly limits as to how we can cut the data in order to check for outliers. We have chosen to exclude different sets of countries, geographically determined, in each of several sub-samples. In Table 7 we show results from identical specification as the 3SLS model of Table 1, estimated on these

[25]Remember, however, that the model also include factors like GDP per capita and tertiary education, both displaying strong upward trends over time.

Table 7: Wage Inequality

Dependent variable: ln(d5/d1)					
	OLS-FIX	IV-1	IV-2	IV-3	IV-4
	Coef./se	Coef./se	Coef./se	Coef./se	Coef./se
ln(Generosity)	–.1873***	–.4887***	–.5884***	–.3265**	–.5682***
	(.0348)	(.1283)	(.1555)	(.1534)	(.1854)
Right gov.			–.0127		
			(.0092)		
Pct 65+				–.0045	
				(.0028)	
Trend					.0010
					(.0027)
adj. R-square	.68	.60	.53	.67	.50
Sargan p-value		.1389			.0954
Cragg-Donald F		12.89	20.21	14.92	6.97
Hausman p-value		.0059	.0013	.2741	.0038
N	343	343	343	343	343

Note: The models also include year and country dummies (with the exception of IV-4 where time is represented by a linear trend only). All models include data set controls (see data section for details). Instruments for welfare generosity are right cabinet and pct elderly (65+) when not included in the equation.

sub-samples[26]. The table shows that our key result does not depend on the inclusion of any country or any of these groups of countries in our sample and the estimated equality multiplier from these sub-samples ranges from 1.39 to 1.77.

Driven by specific measures?

The first two columns of Table 8 show OLS and IV specifications where the dependent variable is defined in levels in stead of logs, and show that our identification strategy works well also with this specification.

The next two columns show OLS and IV models using two different, but closely related, measures of generosity and wage inequality. In the upper panel, welfare generosity is replaced by OECD's measure of public social spending as percent of GDP. Our specification works reasonably well, and the estimated equality magnifying effect of -.68 is very close to what we found for overall generosity in Table 1 (-.72). In the lower panel, inequality is replaced by ln(d9/d1) in stead of ln(d5/d1). The Sargan and Cragg-Donald statistics are satisfactory, and the effect is larger than what we observed for the lower part of the wage distribution, -.69 versus -.53. This result shows that the observed wage equalization effect observed in Table 1 is not due to a depression of d5 only (which could theoretically be the case), but rather of a compression from below. It also suggests that even if generosity tend to compress wages mostly from below, it also has some (more modest) effect on the whole wage distribution as well.

[26]When estimating on sub-samples, control for data set and annual wages is based on model 2 in Table 1 on the full sample.

Table 8: Welfare, Inequality and Multiplier. Sub-samples

Specification 3SLS from Table 1

	Group of countries excluded:					
	America	Oceania	Brit. Isl	Large EU	Small EU	Nordic
	Coef./t	Coef./t	Coef./t	Coef./t	Coef./t	Coef./t
Dep.var ln (Generosity)						
Inequality	–.8420***	–.7854***	–.6957***	–.4752*	–.8177***	–.8133***
	–7.59	–7.13	–7.05	–1.66	–7.19	–7.13
No. of cases	302	276	308	276	309	270
Dep.var ln (d5/d1)						
Generosity	–.4387**	–.5525***	–.3998***	–.5852***	–.5107***	–.5590***
	–2.50	–3.13	–3.61	–3.96	–3.21	–3.68
No. of cases	302	276	308	276	309	270
Multiplier	1.58	1.77	1.39	1.39	1.72	1.83

Note: The tables shows the coefficient (t-value) of ln(d5d1) in IV-regressions of ln(Generosity), and the coefficient (t-value) of ln(Generosity) in IV-regressions of ln(d5d1) in identical specification to that of the 3SLS model in Table 1, after exclusion of different sub-sets of countries. America=US,Canada; Oceania=Australia, New Zealand, Japan; BritIsl=UK, Ireland; LargeEU=France, Germany, Italy; SmallEU=Austria, Belgium, Netherlands, Switzerland; Nordic=Denmark, Finland, Norway, Sweden. Control for dataset and annual wage data is based on the model on the full sample.

We have also conducted a placebo experiment, where the key instruments, right government and bargaining coordination, are replaced by the average of five year leads, in stead of lags as in the rest of this paper. The Cragg-Donald in the generosity equation is 0.00: Future bargaining coordination has no bite in defining wage inequality. Doing the same experiment for right government produces a Cragg-Donald statistics of 1.66 (which corresponds to a p-value in the first stage of 0.16); again the instrument has no bite. We have also conducted an experiment where we interact right government as an instrument for wage inequality with a variable taking the value of unity if there is a 50/50 situation in the parliament, declining linearly to zero in both ends (0 and 1 in the parliament). The model produces qualitatively similar results to that of Table 1 (a coefficient of -.49 for generosity in the inequality equation), but since both the Cragg-Donald and the Sargan statistics turned out less satisfactory than in Table 1, we do not include the results in the table.

Table 9: Robustness checks

Generosity	G-Index OLS Coef./se	G-Index IV Coef./se	ln(Publ) OLS Coef./se	ln(Publ) IV Coef./se
Inequality	–1.5442***	–1.8849***	–.6064***	–.6778**
	(.1960)	(.2980)	(.1234)	(.2673)
adj. R-square	.44	.44	.62	.62
Sargan p-value		.6486		.1669
Cragg-Donald F		63.00		29.58
Hausman p-value		.1400		.7661
No. of obs	343	343	298	298
Inequality	**d5/d1 OLS Coef./se**	**d5/d1 IV Coef./se**	**ln(d9/d1) OLS Coef./se**	**ln(d9/d1) IV Coef./se**
Generosity	–.3403***	–.8763***	–.2485***	–.6854***
	(.0603)	(.2239)	(.0468)	(.1756)
adj. R-square	.67	.58	.73	.65
Sargan p-value		.2508		.1375
Cragg-Donald F		12.89		12.89
Hausman p-value		.0048		.0030
No. of obs	343	343	343	343

Note: The models include the same covariates as in Table 1, including year and country dummies. In IV specifications, instruments for welfare generosity are right cabinet and pct elderly (65+), and instruments for inequality are bargaining coordination, union density and workers in conflict.