The Equality Multiplier

The complementarity between wage setting and welfare spending

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Abstract

The complementarity between wage setting and welfare spending can explain how almost equally rich countries differ in economic and social equality among their citizens. The piece shows that greater wage equality increases the welfare generosity via political competition in elections. A more generous welfare state fuels wage equality via empowerment of weak groups in the labor market. Together the two effects generate a cumulative process that adds up to a social multiplier that explains how equality multiplies. Using data on 18 OECD countries over the period 1975–2002, we provide an estimate of the magnitude of the equality multiplier.

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1 Introduction

Equally rich countries are rather unequal in their income distribution and welfare spending. The countries with the smallest wage differences have the largest welfare states. For instance, compared to the United States, the Scandinavian countries of Denmark, Norway, and Sweden are twice as generous with welfare spending but have only half of the US pre-tax wage inequality. Although the contrasts might be less stark, the pattern where small wage differentials coincide with large welfare states holds across almost any group of developed countries.

It is also visible over time.[1] In the US, for instance, social spending increased sharply as a share of GDP during the 1940s, following president Roosevelt's Social Security Act of 1935. At the same time, pre-tax wage inequality dropped to the extent that Claudia Goldin and Robert Margo (1992) labeled the period as the "Great Compression". In contrast, during the 1980s there was an unprecedented rise in wage inequality and a marked retrenchment in social spending. [2] Similarly, in European countries periods with less growth in wage inequality have had higher growth in welfare generosity, and vice versa.

In this paper we suggest a simple explanation for this pattern, both across countries and over time. We emphasize how welfare spending is both fueled by and fuels wage equality. The generosity of welfare benefits, on the one hand, mitigates wage differentials by empowering weak groups in the labor market–the wage equalizing effect. More wage equality, on the other hand, lifts the political support for generous welfare provisions by raising the income of the majority of the electorate—what we call the "equality magnifying effect."

The two effects add up to a social multiplier[3] that we refer to as the "equality multiplier." It enhances divergence across countries caused by history, resources, and institutions where equality creates more equality. The process can also operate

[1] For the US–Europe comparison, Alesina and Glaeser 2004 offer an excellent discussion; for cross-country discussions more generally, see, for instance, Milanovic 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.

[3] Glaeser, Sacerdote and Scheinkman (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.

in reverse, as it has done in many countries since the mid-1980s. In this period we have experienced an inequality multiplier, capturing how larger wage differentials induce less welfare spending, which in turn generates larger wage differentials and further declines in welfare spending.

Our emphasis on a negative link between income inequality and welfare spending is inspired by Roland Benabou's seminal article (2000) on unequal societies, which contests the classical view by Thomas Romer (1975), Kevis Roberts (1977), and Allan Meltzer and Scott Richards (1981). The argument that inequality induces redistribution has no support in empirical studies, such as Peter Lindert's broad historical accounts (2004), Rodneu Ramcharan's the long-term evidence across US counties and states (2010), and Roberto Perotti's comprehensive cross-country studies (1993, 1996), to mention a few central works.

More specifically, our approach is in line with Alberto Alesina and George-Marios Angeletos (2005) (and the extension in Alesina, Cozzi, and Mantovan 2009, and in Di Tella and Dubra 2010) by highlighting the two-way dependence between welfare spending and earnings inequality. Yet, while they explore voters' concern for fairness, we emphasize the related insurance motive; while they stress how the welfare state compresses the distribution of earnings from above by hampering human capital investments, we emphasize how the welfare state compresses the wage distribution from below by empowering weak groups. Echoing de Toqueville's link between "public spirit" and the "habits to the governed" (Toqueville 1835, ch 1), we add the linkage from welfare spending to wage equality to the analysis of how wage equality fuels the political demand for welfare state provisions, as discussed in Karl Moene and Michael Wallerstein (2001) and Torben Iversen and David Soskice (2001).[4]

Finally, the cumulative changes across institutions connect our paper to the recent discussion of why seemingly similar countries sustain widely divergent wage structures and have different developments of wage inequality over time (see e.g., Devroye and Freeman 2001; DiNardo, Fortin, and Lemieux 1996; Leuven, Oosterbeek, and van Ophem 2004; Kahn 2000; Blau and Kahn 1996; Acemoglu 2003;

[4]We also incorporate elements from 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).

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).

Below we address two motivating questions (in section 2); derive our mechanisms within a more general model of wage distributions and welfare spending (in section 3); discuss the complementarity between welfare spending and wage determination including the empirical support that we derive from data from 18 OECD countries over 28 years (in section 4); and conclude (in section 5).

2 Two puzzling questions

The first is this:

> Why do people with lower incomes support greater welfare spending, even when they become richer, while those with higher incomes prefer less welfare spending?

The equality magnifying effect provides an answer. It is based on the observation that protection against risks has been more important for the expansion of the welfare state than pure redistribution (Baldwin 1990; Barr 1992). Of all the items on the welfare budgets, social insurance against loss of income due to sickness, unemployment, and old age reacts the most to changes in the income distribution, and the political demand goes up when individual incomes rise (Moene and Wallerstein 2003). This may seem to contradict the fact that richer voters are less supportive of the welfare state than poorer voters, a salient feature in all opinion polls.

To solve the puzzle we must account for the negative correlation between risks and income. Job-loss rates are dramatically higher for low-income earners than for high-income earners. In the US, for instance, the job-loss rate for workers with twelve years of education are on average twice as high as for workers with at least 16 years of education (Farber 2011). Accordingly, low-skilled workers are unemployed more often and for longer periods than high-skilled workers. In 2009 the average unemployment rate in the whole OECD area was more than twice as high for men with 12 years of education as for men with at least 16 years education (OECD 2011).

This negative correlation between risks and income helps explain why welfare spending can be an inferior good as we move from lower to higher income classes, changing both incomes and risks, while it is a normal good when income differentials become smaller across income classes, for a given distribution of risks. But that leaves us with another question:

> As welfare spending goes up, why do market forces fail to compensate high-wage earners for their gap between tax contributions and expected welfare benefits, but rather reduce the gap between high and low wages?

The wage equalizing effect provides an answer. It is based on an observation of how labor market forces interact with the strength of wage earners. Even though higher welfare benefits may be costly to high-wage earners, these benefits do not make them stronger to command wage compensation for the high taxes they have to pay. This is in contrast to the situation of low-wage earners. They are more vulnerable to income loss in the case of no agreement and welfare benefits make their necessities less immediate. In this way the welfare state empowers weak groups, making them less dependent and thus improve their bargaining strength. Higher welfare benefits change bargaining outcomes and reduce the wage gap between rich and poor workers.

The two mechanisms interact. According to the equality magnifying effect less inequality for a given mean gives the majority of voters a higher wage w. As long as welfare provisions are normal goods, the majority thus demands a more generous welfare spending g, but less than the wage rise: $g = \phi(w)$ with $\phi' \in (0, 1)$.

According to the wage equalizing effect welfare benefits raise the wages for weak groups. This impact of a higher g is strongest in jobs with low productivity p. Thus we have $w = \psi(g, p)$, where $dw/dg \equiv \psi' \in (0, 1)$ and where the elasticity of ψ with respect to g, denoted e_i for jobs with productivity p_i, is higher for lower productivity jobs.

Now, if an exogenous shock (of say Δ in welfare spending) leads to larger equilibrium changes in the endogenous variables than the 'first step' changes, there is a multiplier effect. Combining the two equations and differentiating, we obtain $dg = m\,\Delta$ and $dw = m\,\psi'\,\Delta$, showing how immediate effects are magnified by the multiplier $m = [1/(1 - \phi' \psi)] > 1$. It is an equality multiplier as long as the wage gap between jobs with high productivity p_s and jobs with low productivity $p_\omega < p_s$, as measured by $I = \psi(g, p_s)/\psi(g, p_\omega)$, is declining in welfare spending g. In the long run welfare policies adjust to the changes in the income distribution, and the income distribution adjusts to changes in welfare polices. Hence, the first step adjustment is magnified by the multiplier leading to a total reduction in inequality equal to $(e_\omega - e_s)\, m\, \Delta$.

3 Wage distribution and welfare spending

We shall now explore these two mechanisms in a more general set-up that combines a simple version of the Diamond-Mortensen-Pissarides model of segregated labor markets (see Pissarides 2000) with a political economy model of probabilistic voting with ideological parties (see Persson and Tabellini 2000 and Roemer 2001).

There is a sequence of events. First, policies are formed by two opposing political parties; second, election is held and the winner implements its policy; third, the distribution of wages are determined, and then we start over again by new polices being formed given the new wage distribution and so on. During the election period, the welfare policy remains fixed, while workers can go in and out of employment and unemployment. Accordingly, we model workers' interests within a set-up with continuous time, while policies are determined for the entire election period in discrete time intervals.

We want to characterize each separate link where

1. wages are determined by worker–firm bargaining, taking the tax rate and the welfare benefits as given;

2. the political parties decide on their welfare state programs, taking the wages, the interests, and the ideological sympathies of workers as given;

3. the workers vote on political parties, taking the distribution of wages as given.

Throughout we maintain the premiss that heterogeneity across jobs and firms can create considerable wage differences even in decentralized labor markets.

Jobs

Jobs have different productivity levels, where $p_1 \leq p_2, ... \leq p_T$. To fill a job with productivity p_i, workers need specific qualifications. Only workers of type i qualify. With a wage equal to w_i immediate profits are simply $p_i - w_i$. There are exogenous separation rates, λ_i, where we assert that lower productivity jobs have a higher turnover in line with the empirical evidence mentioned in section 2.

The number of successful employer worker matches depends on the level of unemployment u_i and the number of vacancies v_i, represented by a matching function with constant returns, $M(u_i, v_i) \equiv q_0 u_i^{\eta} v_i^{1-\eta}$. Thus, the probability that a vacancy is filled depends negatively on the number of vacancies per unemployed, the tightness of the labor market $\theta_i = v_i/u_i$. With a constant matching elasticity $\eta \in (0, 1)$, the probability that an unemployed finds a job is $q_i = q_0 \theta_i^{1-\eta}$, where q_0 is a positive constant, and the probability that a vacancy is filled is q_i/θ_i.

To establish a vacant position costs s_i and new unfilled vacancies are created until the present value, $r\Pi_i^v = -s_i + q_0 \theta^{-\eta} \Pi_i^f$ equals zero. Here Π_i^f is the present value of a filled vacancy, determined by $r\Pi_i^f = p_i - w_i - \lambda_i \Pi_i^f$. Using both expressions, we obtain an explicit solution for θ_i and u_i

$$\theta_i = \left[\frac{p_i - w_i}{(\lambda_i + r) s_i} \right]^{\frac{1}{\eta}} \frac{1}{q_0} \quad \text{and} \quad u_i = \frac{\lambda_i}{\lambda_i + q_i} \tag{1}$$

where the second equation expresses the steady state unemployment rate (inflows equal outflows). The two equations in (1) show that a higher employer rent $(p_i - w_i)$ leads to more job creation and thus to a tighter labor market, while greater tightness induces a lower unemployment rate. As low-productivity jobs have lower employer rents (as shown below) and a higher separation rate λ_i, they have a higher unemployment rate.

Let n_i indicate the share of the workforce of type i. With a tax rate equal to t and a tax base equal to $\sum(1 - u_i) n_i w_i$, the balanced budget condition is $t = bg$, with

$$b = \frac{\sum n_i u_i}{\sum n_i (1 - u_i) w_i} \tag{2}$$

indicating the cost per unit of welfare benefits as the number of benefit receivers relative to the size of the tax base. We assume that each worker group is small, implying that the impact on b of an increase in any single wage is negligibly small.

Workers

Each worker has a concave utility function $U(c_i)$ of consumption c_i with a constant relative risk aversion $\mu \geq 1$, implying that $U_i(c_i) = c_i^{1-\mu}(1/(1-\mu)$. Jobs are assets, where the present value of the expected utility stream is V_i^e for a worker with a job and V_i^u for a worker without a job, defined by the two asset equations $r_i V_i^e = U(c_i) - \lambda_i(V_i^e - V_i^u)$ and $r_i V_i^u = U(g) + q_i(V_i^e - V_i^u)$. Here r_i is the discount rate and g the income of an unemployed worker, determined by the generosity of the welfare state, and $c_i = (1 - bg)w_i$. As mentioned we consider welfare spending as insurance against income loss.[5] Social insurance in most welfare systems is offered on better terms for lower income classes than for higher ones, an aspect that we here capture by a common compensation g in the event of income loss due to unemployment.[6]

Solving the two asset equations, we obtain

$$r_i V_i^e(g) = \gamma_i U(c_i) + (1-\gamma_i)U(g) \quad \text{where } \gamma_i = \frac{r_i + q_i}{r_i + \lambda_i + q_i} \tag{3}$$

$$r_i V_i^u(g) = \tilde{\gamma}_i U(c_i) + (1-\tilde{\gamma}_i)U(g) \quad \text{where } \tilde{\gamma}_i = \frac{q_i}{r_i + \lambda_i + q_i} \tag{4}$$

The weight put on the state of unemployment is higher for an unemployed worker than one with employment. For both the employed and unemployed this weight is increasing in the rate of job separation λ_i. The higher vulnerability of lower income classes implies a higher weight on the unemployment state, $(1-\gamma_i)$, both because of the direct impact of a higher λ_i and because the higher job separation rate reduces the tightness of the labor market and thus reduces the rate of reemployment.

[5]The resulting insurance logic may also hold in the case where we in addition to social insurance also add redistribution among the employed (Moene and Wallerstein 2001).

[6]It can easily be generalized by combining a fixed component ξg, the floor of welfare benefits to people without income, and a variable component proportional to income relative to the mean $g\,(1-\xi)\,w_i/\bar{w}$. In the presentation we apply the simplifying assumption that $\xi = 1$.

Wages

When workers and employers bargain they take the tax rate and the welfare benefits as a given. The rents to the employer of the match are $\Pi_i^f - \Pi_i^v$, and the rents to each worker $V_i^e - V_i^u$. Obviously, both depend on the wage, which is determined in accordance with the asymmetric Nash bargaining solution.

The asset values of workers account for turnover and the possibility of reemployment in other firms. The wage in other firms, denoted $\bar{w}_i$, is of course not directly affected by the negotiation. Taking account of this, and using (3) and (4), the employment rent can be defined by

$$V_i^e - V_i^u = \frac{(r_i + q_i)U(c_i) - q_i U(\bar{c}_i) - r_i U(g)}{(r_i + q_i + \lambda_i)} \tag{5}$$

where $\bar{c}_i = (1 - bg)\bar{w}_i$. The employer rent is simply $\Pi_i^f - \Pi_i^v = (p_i - w_i)/(r + \lambda_i)$. Now we can use these expressions in the bargaining set-up. As long as the tightness of the labor market (θ_i) is taken as a given, it turns out that maximizing the Nash product $[V_i^e - V_i^u]^{\alpha_i} \left[\Pi_i^f - \Pi_i^v\right]^{1-\alpha_i}$ is equivalent to

$$\max_w \left[U(c_i) - (1 - k_i)U(\bar{c}_i) - k_i U(g)\right]^{\alpha_i} \left[p_i - w_i\right]^{1-\alpha_i} \tag{6}$$

We assume that workers in more productive jobs have no less bargaining power, implying $\alpha_j \leq \alpha_{j+1}$.

The first-order condition for (6) can be expressed as

$$\frac{(\mu - 1)\alpha_i}{(1 - \alpha_i)k_i} \left[\frac{p_i - w_i}{w_i}\right] = \frac{w_i^{\mu-1} - [g/(1 - bg)]^{\mu-1}}{[g/(1 - bg)]^{\mu-1}} \tag{7}$$

where we have inserted that in equilibrium all jobs of a specific type i pay the same wage, implying $c_i = \bar{c}_i$.

Obviously, the negotiated wage is higher in more productive jobs. The magnitudes can be seen by differentiating (7) to obtain

$$\frac{dw_i}{dp_i} = \frac{\alpha_i}{\alpha_i + (1-\alpha_i)k_i + \mu\alpha_i \frac{p_i - w_i}{w_i}} \tag{8}$$

which is positive but less than 1, implying that both the employment rent and the employer rent go up with p_i. Notice that the corresponding rise in w_i is declining in μ, reflecting how risk aversion makes workers weaker in the negotiations.

In addition, the negotiated wage is affected by the general employment options in the labor market as captured by

$$k_i = \frac{r_i}{r_i + q_i} \leq 1 \tag{9}$$

A higher chance of finding another job (a higher value of q_i) lowers the value of k_i, improving the fall-back position if no deal is reached in the negotiations. Since low-productivity jobs have higher unemployment and most likely more impatient workers (higher r_i), the value of k_i is higher in low-productivity jobs than in high-productivity jobs. In fact, weak groups in the labor market are likely to have a value of k_i that is close to unity.

The negotiated wage is also affected by the bargaining power of the workers and their risk aversion, which have opposing effects. Workers with the same level of risk aversion may have different bargaining power, as discounting reflects the power to tolerate postponements, while the degree of risk aversion tells us how various income levels are evaluated, no matter how future utilities are discounted. As low-paid workers have more immediate needs than high-paid workers, they are more impatient with a corresponding weaker bargaining power towards their employer.

Finally, the negotiated wage is affected by the welfare benefits, our main interest. From (7) we immediately see that the strongest possible groups with $\alpha_i = 1$ have $w_i = p_i$, and an increase in the level of g has no impact on the wage. The weakest possible groups with $\alpha_i = 0$, in contrast, have $w_i = g/(1-bg)$, and a 1 percent increase in the level of g raises the wage by more than 1 percent. Hence, a higher level of g narrows the gap between the wages of the strongest and the weakest groups.

This wage equalizing effect also holds in less extreme cases as the welfare state compresses the pre-tax wage distribution between low-paid and better-off workers more generally defined. Social insurance empowers weak groups in the labor market much more than stronger groups. To see this, consider any group ω working in a low-productivity job in the context of a highly slack labor market (low θ_i and thus a high value of k_i close to unity) with a possible low bargaining power (and a high r_i) relative to the risk aversion.[7] We can show the following result

Proposition 1 *More generous welfare benefits reduce the pre-tax wage inequality $I = w_s/w_\omega$ between any weak group ω, with $\alpha_\omega \leq 1/\mu$, and any group $s > \omega$ with a more productive job.*

Proof. As demonstrated in Appendix A, the elasticity of the wage equation with respect to g is higher for weak groups ω than for stronger groups s, where $p_s > p_\omega$. ■

The stated condition, that the weak group has $\alpha_\omega \leq 1/\mu$ in order for the welfare spending to compress the pre-tax wage distribution from below, is sufficient, but not necessary.

Proposition 1 characterizes the wage inequality equation, $I = F(g)$. It says: fix any weak group and any stronger or more productive group, then the relative wage inequality between the two goes down when welfare benefits go up. The intuition for $F' < 0$ is simple: Risk aversion weakens workers' ability to raise wages through bargaining with risk-neutral employers. Stronger groups, with better employment opportunities and higher bargaining power, compensate somewhat for this weakness by being more patient in bargaining and by having better opportunities to get another job. Therefore, they benefit less, when compared to weaker groups, from higher welfare generosity, implying that the wage gap between the two groups declines as g goes up. All groups obtain a higher wage from higher welfare generosity, but the wage rise at the bottom of the pay scale is relatively highest. Thus welfare spending empowers weak groups.

[7] In the case of risk-neutral workers the bargaining outcome in (7) is $w_i = \tilde{\alpha}_i p_i + (1 - \tilde{\alpha}_i)G$, where $\tilde{\alpha}_i = \alpha_i/[\alpha_i + k_i(1 - \alpha_i)]$. In this case the impact of higher welfare benefits on the pre-tax wage distribution is more significant in the left tale of the wage distribution, where k_i is high and therefore $(1 - \tilde{\alpha}_i)$ is particularly high as well.

Clearly, $I = F(g)$ also depends on the distribution of the productivity $\mathbf{p} = [p_1, p_2...p_T]$, an we can write $F(g) \equiv \hat{F}(g; \mathbf{p})$. Using (7) and (8) we easily see that a mean preserving compression in the distribution of productivity (from $\mathbf{p}$ to $\mathbf{p}'$) implies that $\hat{F}(g; \mathbf{p}') < \hat{F}(g; \mathbf{p})$, and thus a lower wage inequality $I' < I$. Smaller differences in the productivity of jobs lead to declining wage differentials.

Voting

We now move to the welfare generosity by deriving how the wage distribution affects the political economy of welfare spending.

There are two blocs, that we denote the left-wing and the right-wing party. The left-wing party proposes g_L and the right-wing party g_R. Voting preferences depend on how voters evaluate these policies in accordance with their narrow interests, given by (3) and (4), and on which ideological sympathies they have. In accordance with workers' interests the generosity of the welfare state is a normal good for each worker in the sense that $\arg\max V_i^e(g)$ is increasing in income w_i (as long as $\mu > 1$, as we demonstrate in Appendix C).

The extent of sympathies, ϵ_i, can take positive and negative values. More positive values mean more right-wing sympathies. In addition, the popularity of parties and politicians may shift with a magnitude δ after the program is decided. With policy platforms $g_L \geq g_R$ all employed voters in income class i for whom

$$V_i^e(g_L) - V_i^e(g_R) \geq \epsilon_i + \delta$$

vote left, just as all unemployed voters in income class i for whom

$$V_i^u(g_L) - V_i^u(g_R) \geq \epsilon_i + \delta$$

vote left.

To be clear let us assume that the distribution of ideological sympathies within income class i is uniform on $[-1/2f, 1/2f]$ and similarly that the common popularity shock has an uniform distribution on $[-1/2z, 1/2z]$ where f and z are the densities of the two uniform distributions. Using the shorthand

$$(1 - u_i)V_i^e(g) + u_i V_i^u(g) \equiv V_i(g)$$

the probability that the left wins can be expressed as

$$Q(g_L, g_R) = 1/2 + z \sum_i f n_i [V_i(g_L) - V_i(g_R)] \tag{10}$$

where for a given density of political shocks z in (10) each income group obtains an influence on the probability of winning according to its size n_i and its density f of political sympathies.

Political competition

To demonstrate that our theoretical results do not rely on non-ideological politics, we incorporate political forces on each side that drag the policy towards the party ideal. Following Roemer (2001, ch. 8), we let each party consist of two factions: the idealist, who are motivated by the internal flame of the party, and the realists, who are motivated by the chances of obtaining power.[8]

The preferences of the idealists over policy outcomes are written as $W_L(g)$ in the left-wing bloc and $W_R(g)$ in the right-wing bloc. At least for intermediate values of welfare benefits g the left-wing idealists prefer a higher generosity and the right-wing idealists a lower generosity, as $W_L'(g) > 0$ and $W_R'(g) < 0$.

Before the election the basic welfare policies of each party are determined by negotiations between the two factions. If no intra-party agreement is obtained, the party loses the election. In the left-wing party, the threat points of the factions, $\hat{Q} = 0$ and $\hat{W}_L = W_L(g_R)$, are the payoffs when the left is defeated. Similarly, in the right-wing party, $(1 \hat{-} Q) = 0$ and $\hat{W}_R = W_R(g_L)$.

With bargaining power $\beta_j \in [0, 1]$ to the realists in party j and $(1 - \beta_j)$ to the

[8]Roemer (2001) calls them militants and opportunists. 'Opportunist' may sound too negative when we are thinking of a faction that actually is responsive to the opinions of the electorate, that may try to come as close as possible to the will of the people, but yet may be strategic towards the opposing side. We use 'the realists' to indicate a motivation about what actually is within the reach of the party, and as a contrast to 'the idealists' motivated by what could be done if the party were all powerful.

idealists, the Nash-products for the two parties can be written as

$$N_L(g_L, g_R) = [Q(g_L, g_R)]^{\beta_L} [W_L(g_L) - W_L(g_R))]^{1-\beta_L} \tag{11}$$

$$N_R(g_L, g_R) = [1 - Q(g_L, g_R)]^{\beta_R} [W_R(g_R) - W_R(g_L))]^{1-\beta_R} \tag{12}$$

The equilibrium in the mixed cooperative–non-cooperative policy game consists of values $\tilde{g}_L$, $\tilde{g}_R$ that fit in the internal bargaining solution and that are consistent best responses to the program of the opposing bloc, i.e. where

$\max_{g_L} N_L(g_L, \tilde{g}_R) = N_L(\tilde{g}_L, \tilde{g}_R)$ and $\max_{g_R} N_R(\tilde{g}_L, g_R) = N_R(\tilde{g}_L, \tilde{g}_R)$.[9]

Using the notations $\partial Q(g_L, g_R)/\partial g_L \equiv Q_1$ and $\partial Q(g_L, g_R)/\partial g_R \equiv Q_2$, the first-order conditions can be written as

$$\beta_L Q_1 [W_L(g_L) - W_L(g_R)] + (1 - \beta_L) Q W_L'(g_L) = 0 \tag{13}$$

$$-\beta_R Q_2 [W_R(g_R) - W_R(g_L)] + (1 - \beta_R)(1 - Q) W_R'(g_R) = 0 \tag{14}$$

With completely realist parties, $\beta_R = \beta_L = 1$, policies in each party would converge to a common level, say $\hat{g}$. When idealist have some power, however, policies do matter. The bargaining compromise then implies that the party on the left deviates from $\hat{g}$ by setting a higher level. By doing so, the marginal ideological gain $q\partial W_L/\partial g_L$ is strictly positive. The left-wing's chance of winning the election partially declines, but this is counteracted by the the right-wing party's similar deviation from $\hat{g}$ by setting a level of g_R closer to right-wing idealists' preferred policy. Observe that when $\beta_j = 1/2$, the mixed cooperative–non-cooperative policy game turns out to be as if each party maximized its expected party utility.

What implications does lower wage inequality have for the polices proposed by the parties? We can prove the following characterization

Proposition 2 *As long as the bargaining power of the realists is positive, $\beta_j > 0$ for $j = R, L$, a mean preserving compression of wages raises the welfare generosity of the political programs of both sides of the political spectrum.*

Proof. See Appendix B. ■

[9]This is an example of what John Roemer calls a party unanimity Nash equilibrium for the simple case of a one-dimensional policy game.

This proposition characterizes the most important aspects of the generosity equations $g_L = L(I)$ and $g_R = R(I)$ as $L'(I) < 0$ and $R'(I) < 0$. It is also straightforward to demonstrate that $dg_j/d\bar{w} > 0$ as a higher average income works as if welfare benefits become relatively less expensive.

The main result remains that more wage equality leads each party to offer a more generous welfare spending. In demonstrating this we account for how the policy of each side is determined by an internal compromise between idealists and realists. In this compromise realists are responsive to potential voters in all income classes, depending on how likely it is that they swing over to vote for the opposing side. Finally, the outcome is affected by how each party reacts strategically to the policy of the opposing side. Our result holds even in cases where the idealists are strong so long as the realists are not completely powerless.

The political convergence between parties is not complete unless the realists on both sides are all-powerful. When idealists have some power, the generosity equation may shift depending on whether or not the election gives a change of incumbent. In deciding the party programs, the full equilibrium effects (of less inequality) on the policies of each side are stronger than the partial effects for a given policy of the opposing side: When the opposition increases its proposed welfare generosity, the opportunists are likely to force the compromise in their own party even further towards higher generosity.

Intuitively, proposition 2 is easiest to understand by emphasizing how wage compression may make the majority of voters richer. As long as welfare spending is a normal good, the majority might therefore favor a higher level of g. The party realists on both sides pick up these changes in voters' attitudes, insisting on a more generous welfare program to improve the chances of winning swing voters.

4 Institutional complementarity

We have used the model[10] to characterize 1) $I = F(g)$, capturing the wage equalizing effect that shows how welfare benefits provide the greatest help to the weakest

[10]For each political regime L, R the model consists of $2 + 3T$ variables: g and b in addition to θ_i, u_i w_i for $i = 1, 2...T$. There are $2 + 3T$ equations as well: (4) and (18) in addition to the $3T$ equations in (3) and (10).

groups of workers, and 2) $g_L = L(I)$ and $g_R = R(I)$, characterizing the equality magnifying effect that shows how wage compression leads to more welfare spending by both sides of the political spectrum.

Combining the wage equalizing effect and the welfare magnifying effect there can be strong feedbacks between them as welfare spending fuels wage equality, which again fuels welfare spending, and so on. According to the model the process takes time as welfare spending by assumption only adjusts after elections.

To see the complementarity consider first a hypothetical uninterrupted sequence of left-wing governments. In that case inequality would tend towards I_1 and welfare spending towards $g_1 = L(I_1)$, where I_1 is implicitly defined by $I_1 = F(L(I_1))$. From propositions 1 and 2 we know that $F' < 0$ and $L' < 0$, and from the stability of the long run equilibrium we have $F'L' < 1$.[11] An exogenous upward shift in the $L(I)$ curve by Δ would magnify the immediate impact $\Delta F'$ by the multiplier $m_1 = [1/(1 - F'L')] > 1$ to $dg_1 = m_1 \Delta F'$.

Similarly, with a hypothetical uninterrupted sequence of right-wing governments, inequality would tend towards I_2 and welfare spending towards $g_2 = R(I_2)$, where I_2 is implicitly defined by $I_2 = F(R(I_2))$. Assuming that also this long run right-wing equilibrium is stable, we have that an exogenous upward shift in the welfare spending of the right-wing party $R(I)$, would magnify the immediate impact $\Delta F'$ by the multiplier $m_2 = 1/(1 - F'R') > 1$.

Alternatively, we could have considered an exogenous change in the distribution of job productivity $\mathbf{p}$. Clearly, an exogenous compression of the productivity distribution would compress wages even more when welfare spending adjusts as compared to when it remains fixed.

The characterization of the long term effects of any exogenous shift becomes more complicated once we leave the hypothetical assumption of an uninterrupted sequence of similar governments. Political competition leads to alternating gov-

[11]The stability of the long run left-wing equilibrium requires that higher, or lower, inequality than I_1 is self correction with a left-wing government. Mathematically this requires that $[F^{-1}(I) - L(I)]$ must be declining in I. When this holds $I' < I_1$ would generate a higher provision $g'_L = L(I')$ than g_1, but to sustain this level of inequality $g = F^{-1}(I')$ must be even higher (since $[F^{-1}(I) - L(I)]$ declining means that $F^{-1}(I') > L(I')$). Instead we get an adjustment to $I = F(L(I')) > I'$. The process continues till we reach the long run equilibrium g_1 and I_1. Deviation $I'' > I_1$ would also be self correcting, which can be easily seen by similar arguments. As long as $[F^{-1}(I) - L(I)]$ is declining in I we have $1/F' < L'$, or that $1 > F'L'$.

ernments (with a turnover of Q and $(1-Q)$ in the model). A new government may change welfare spending. Yet, the feedback effects also work in this case since both sides of the political spectrum adjust their policies towards more spending as inequality declines. For any given sequence of changes of government a start from a higher welfare spending and lower inequality implies that the process ends with a higher welfare spending and lower inequality as well.

We can say more, however. As long as both the hypothetical left-wing equilibrium and the hypothetical right-wing equilibrium are stable, the long run inequality will be located between an upper and lower bound: $I_1 \leq I \leq I_2$. This is so since an inequality lower than I_1 is self-correcting with a left-wing government, the possible entry of a right-wing government would lead to more than self-correction as $R(I) < L(I)$. Similarly, since an inequality higher than I_2 is self-correcting with a right-wing government, it would be more than self-correcting with a left wing government. Thus in the long run inequality will lay between I_2 and I_1 and exogenous changes would move both in the same direction by a similar multiplier.

In the case where realists dominate on each side of the political spectrum, the policies converge so that for all I we have $L(I) = R(I)$ and the equilibrium level of inequality $I = I_1 = I_2$ solves $I = F(R(I))$, implying that $m_1 = m_2$. Even in this case it is not possible to give an explicit expression of the equality multiplier in terms of the parameters of the model. Yet, the simplistic version of the multiplier that we presented in section 2, can be viewed as a special approximation of the present model, and we can show that $m \geq 2\mu/(\mu+1)$ (see Appendix C). Hence, if $\mu = 3$ we have a multiplier $m \geq 1.5$. We now turn to an empirical assessment.

Empirical Assessment

We utilize log-linear approximations of the wage inequality equation, $\ln I = A - a \ln g$, and of the welfare generosity equations, $\ln g_j = B_j - b \ln I$, where $j = R, L$, assuming that all party differences show up in the constants B_j. The estimates of the two mechanisms provide us with an assessment of the multiplier, $m = 1/(1-ab)$.

We use an unbalanced panel of observations of welfare generosity and wage inequality from 18 OECD countries from 1975 to 2002. The nature of the data and the lack of a clean experiment to rely on obviously limit our ability to obtain a clear-cut identification of the two separate effects, and the results should thus be interpreted with appropriate caution. The estimated equality multiplier that we report below is as large as 1.5, suggesting that the immediate effect of a shift in any variable is magnified by 50 percent through the feedback loops.

Welfare generosity is measured by the overall welfare generosity index provided in the The Comparative Welfare Entitlement Data Set (Scruggs 2004).[12] In accordance with the model, wage inequality is measured at the lower part of the wage distribution by the the ratio of median gross wages relative to the first percentile gross wages (d5/d1), obtained for the most part from the OECD earnings database.[13]

An instrumental variables approach is used in an attempt to separate the two effects. Changes in the wage bargaining regime, conditional on union density, are used as instruments for wage inequality in the generosity equation[14]. Changes in government basic ideology (right versus left) and the share of elderly in the population are used as instruments for welfare generosity in the inequality equation. Under the appropriate exclusion restrictions this method identifies the two effects separately. These are our best estimates given the available data, but they are of course only as good as the assumptions underlying the exclusion restrictions.

In addition to the instruments, we add controls for openness to account for both competitive pressures and risk, GDP per capita to condition mean productivity and the overall tax base, the share of tertiary education to account for changes in the skills distribution, and union density to account for membership among voters. A full set of year and country effects are included as well, ensuring that we obtain identification from changes within countries over time only.

Table 1 first shows the reduced form results for the two equations. This is the first stage of the IV regression. Both equations include time and country fixed-effects[15]. The next two columns show the results from the instrumental variable

[12]The index captures the generosity of income support in the case of illness, unemployment, and disability and old-age pensions of each country for each year.

[13]See Appendix D for a description of the data sources and summary statistics.

[14]See eg Wallerstein (1999) for an analysis of the effect of coordination in bargaining on wage inequality.

[15]It may be noteworthy that both openness and union density switched signs in the inequality equation once we introduced fixed country-effects. More open countries and countries with lower

Table 1: Welfare Generosity and Wage Inequality

	First stage (reduced form)		IV regressions	
	Generosity	Inequality	Generosity	Inequality
	Coef./se	Coef./se	Coef./se	Coef./se
Inequality			−.7045***	
			(.1374)	
Generosity				−.4738***
				(.1268)
Openness (pct GDP)	−.0013	−.0024**	−.0029**	−.0029***
	(.0011)	(.0006)	(.0010)	(.0007)
ln GDP per cap.	.5279***	−.1607**	.4260***	.0925
	(.0734)	(.0416)	(.0693)	(.0826)
Tertiary education (pct)	.0012	−.0030***	−.0009	−.0024**
	(.0019)	(.0011)	(.0016)	(.0012)
Union Density (pct)	−.0014	.0030***	.0009	.0024***
	(.0011)	(.0006)	(.0009)	(.0006)
Right cabinet [0,1]	−.0324**	.0145**	−.0219**	
	(.0133)	(.0075)	(.0087)	
Share 65+ pct	.0189***	−.0094***	.0130**	
	(.0042)	(.0024)	(.0042)	
Barg. Coord. [0,1]	.0775*	−.0865**		−.0582**
	(.0465)	(.0263)		(.0222)
Conflict (pct)	−.0022***	.0033***		.0022***
	(.0005)	(.0003)		(.0005)
p-value country dummies	.0000	.0000	.0000	.0000
p-value year dummies	.0000	.0000	.0002	.0000
Cragg-Donald F-value			67.5	10.3
p-value Hansen J-test			.666	.830
Equality multiplier (m)			1.50	
p-value m lt 1			.037	
No. of obs.	351		351	

Dependent variables: ln(Overall Generosity Index) and ln(d5/d1). Instruments for wage inequality are bargaining coordination, and share of workers in conflict. Instruments for generosity are right cabinet and percent elderly (65+). IV estimations allow for correlated errors using 3SLS. Statistics from 2nd stage regression (C-D-F and Hansen J) are based on robust standard errors.

estimation[16]. The two statistics on the impact of the instruments in the first-stage model (C-D F-test) and on the overidentifying restrictions (Hansen J-test) perform satisfactorily. The estimate of the equality magnifying effect from the generosity equation indicates that a 1 percent increase in wage inequality induces a .7 percent drop in realized welfare generosity. The estimate of the wage equalizing effect from the inequality equation indicates that a 1 percent increase in generosity induces a .47 percent drop in wage inequality.

Our emphasis on the bottom part of the wage distribution has support in the data. Adding ln(d9/d5) to the generosity equation gives an insignificant coefficient of -.185(.371) for ln(d9/d5), whereas ln(d5/d1) remains highly significant at -.725 (.144). Generosity is significantly negative at -.493 (.133) in the lnd5d1 equation and insignificantly negative at -.119(.010) in the ln(d9/d5) equation.[17]

The two estimates for the slopes of the welfare generosity equation and the wage inequality equations, *a* and *b*, give an equality multiplier of 1.5, as reported in Table 1.

Re-estimating the equations while excluding different sets of countries, one at the time, shows that our key results remain (see Table 3 in Appendix D). The two effects are larger when the small and rather egalitarian countries are excluded (Small EU and Nordic), suggesting that the multiplier is highest in countries with relatively large initial inequalities.

We have also experimented with models involving lagged dependent variables. Estimates using the Blundell-Bond GMM-sys specifications[18] suggest that the short-run impacts are 5 to 10 times smaller than the long-run impacts. The estimated long-run elasticities suggest a multiplier of 1.42. These results indicate considerable persistence in both wage inequality and welfare generosity, and that the feedbacks take time to work.

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union density have higher wage inequality. Still, in periods with more openness or lower union density, the same country experiences less inequality.

[16]We use a three-stage, least squares procedure to account for correlations between the error terms of the two equations

[17]Using ln(d9/d1) instead of ln(d5/d1) gives -.7041 (.1532) and -.6597 (.1825) for inequality and generosity, respectively. Results are available on request.

[18]See Blundell and Bond (2000). The results are available on request.

5 Conclusion

We have shown how 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 while higher inequality may induce more inequality. In both cases we obtain a pattern where welfare generosity and wage inequality become negatively related.

The simultaneity problem inherent in our theoretical model makes it difficult empirically to obtain a clear identification of the two separate effects. Using an instrumental variables approach, we find a sizable inequality multiplier of around 1.5. This would imply 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.

Our results do not apply to European-style welfare states only. The US experience may also be interpreted according to our model. Up until the late 1960s, the growth in social spending may have strengthened 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 1970s, however, US experiences a retrenchment in social spending that may have strengthened the underlying forces for 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 adjustments to 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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A Proof of proposition 1

The first-order condition of maximizing the Nash product, $N_i' = 0$, can be expressed as

$$A_i \frac{p_i - w_i}{w_i} = \frac{w^{\mu-1} - G^{\mu-1}}{G^{\mu-1}} \tag{15}$$

where $G = g/(1-bg)$ and where

$$A_i = \frac{\mu - 1}{k_i} \frac{\alpha_i}{1-\alpha_i} \tag{16}$$

$$k_i = \frac{r_i}{r_i + \theta_i^{1-\eta}} \tag{17}$$

$$\theta_i = \left[\frac{p_i - w_i}{(\lambda_i + r)s}\right]^{1/\eta} \tag{18}$$

Let $I = w_s/w_\omega$ and $e_i = (dw_i/dG)(G/w_i)$. We shall show that $dI/dG < 0$ when $\mu\alpha_w \leq 1$. This is equivalent to demonstrating that $e_w > e_s$ since $(dI/dG)(G/I) = e_s - e_\omega$.

Differentiating the first-order condition, (15) we get

$$\frac{dw_i}{dG} = \frac{(1-\mu)w^{\mu-1}G^{-\mu}}{-A_i p w_i^{-2} - (\mu-1)w^{\mu-2}G^{1-\mu} - \frac{p_i - w_i}{w_i}\frac{\mu-1}{k_i^2}\frac{\alpha_i}{1-\alpha_i}\frac{dk_i}{dw_i}} \tag{19}$$

From (17)and (18) we obtain

$$\frac{dk_i}{dw_i} = \frac{(1/\eta - 1)k_i(1-k_i)}{p_i - w_i} \tag{20}$$

Inserting this and $A_i p_i/w_i$ from the first-order condition in (19) and rearranging, we get

$$e_i = \frac{(\mu-1)G^{1-\mu}}{\left[A_i\left(1/\eta - k_i(1/\eta - 1)\right) - 1\right]w_i^{1-\mu} + \mu G^{1-\mu}} \tag{21}$$

Clearly, $e_\omega > e_s$ is equivalent to

$$w_s^{1-\mu}\left[A_s\left(1/\eta - k_s(1/\eta - 1)\right) - 1\right] > w_\omega^{1-\mu}\left[A_\omega\left(1/\eta - k_\omega(1/\eta - 1)\right) - 1\right]$$

which can also be expressed as

$$X_s \equiv \left[A_s\left(1/\eta - k_s(1/\eta - 1)\right) - 1\right] > \left[A_\omega\left(1/\eta - k_\omega(1/\eta - 1)\right) - 1\right] I^{\mu-1} \equiv X_\omega I^{\mu-1}$$

where $A_s > A_\omega$, since $k_s < k_\omega$,and $1/\eta - k_i(1/\eta - 1) > 0$ since multiplying by $\eta > 0$ yields $1 - k_i + k_i\eta > 0$. Therefore, $X_s > X_\omega$.

Hence, a sufficient condition for $dI/dG < 0$ for all levels of $I > 0$, is that

$$A_\omega\left(1/\eta - k_\omega(1/\eta - 1)\right) \leq 1 \tag{22}$$

since then $X_\omega \leq 0$ and $X_\omega I^{\mu-1} < X_s$. As k_w goes to 1 for weak groups, the condition (22) goes to $(\mu - 1)\alpha_\omega \leq 1 - \alpha_\omega$, equivalent to $\mu\alpha_w \leq 1$.

Notice that $\mu < 1$, implies that $e_\omega > e_s$ always holds.

B Proof of proposition 2

Fix g_R. We first prove that g_L goes up as the wage structure becomes more compressed. Consider the first-order condition for the left-wing party

$$P'_L \equiv \beta_L Q_1\left[W_L(g_L) - W_L(g_R)\right] + (1 - \beta_L)QW'_L(g_l) = 0$$

Clearly, $P''_L < 0$ from the second-order condition.

A mean preserving *reduction* of wage inequality affects g_L via the impact of a lower spread in the wage distribution on Q and Q_1. Using (10), we can write $Q = 1/2 + zfE_w[V(g_L : w) - V(g_R; w)]$ and $Q_1 = zfE_w[V'(g_L; w)$, where we use the expectation operator E_w to indicate that these are averages over the wage distribution, with the relative size of each group n_i as weights. Both $[V(g_L; w) -$

$V(g_R;w)]$ and $V'(g_L;w)$ are concave functions of w since

$$\begin{aligned}\text{sign}[\frac{d^2[V(g_L;w)-V(g_R;w)]}{dw^2}] =&\text{sign}[\left[U''((1-t_L)w)(1-t_L)^2 - U''(1-t_R)w)(1-t_R)^2\right]\\ =&\text{sign}\left[w^{-(\mu+1)}\mu\left((1-t_R)^{1-\mu}-(1-t_L)^{1-\mu}\right)\right]<0\end{aligned}$$

and

$$\text{sign}\frac{d^2V'(g_L:w)}{dw^2} = \text{sign}(\mu-1))U''((1-t_L)w)<0$$

Accordingly, we have from Jensen's inequality that lower inequality (a mean preserving reduction in the spread of the wage distribution) leads to higher values of Q and Q_1, denoted $dQ>0$ and $dQ_1>0$. Using this in the first-order condition for the policy compromise of the left-wing party g_L, we obtain

$$dg_L = \frac{\beta_L[W_L(g_L)-W_L(g_R)]dQ_1+(1-\beta_L)W_L'(g_L)dQ}{-P_L''}>0$$

demonstrating that lower wage inequality leads the left-wing party to expand its welfare policy.

Similarly, we now consider the right-wing party. The first-order condition (14) for the determination of g_R is

$$P_R' \equiv -\beta_R Q_2[W_R(g_R)-W_R(g_L)]+(1-\beta_R)(1-Q)W_R'(g_R)=0$$

where the second-order condition implies $P_R''<0$. A mean preserving increase in wage equality affects the policy of the right-wing party g_R via q and q_2. From (10 we have $-q_2 = zfE_w[V'(g_R;w)$. We can show that $V(g_R;w)$ is concave in w since

$$\text{sign}\frac{d^2V'(G_R:w)}{dw^2} = \text{sign}(\mu-1))U''((1-t_R)w)<0$$

Hence, using Jensen's inequality, we demonstrate that low wage inequality (a mean preserving reduction in the spread of the wage distribution) leads to $d(-Q_2)>0$

(and to $dQ > 0$ as before). From the first-order condition for g_R, we have

$$dg_R = \frac{-(dQ_2)[W_R(g_R) - W_R(g_L)] - dQW'_R(g_R)}{-P''_R} > 0$$

(where $W'_R(g_R) < 0$), demonstrating that lower wage inequality also leads the right-wing party to expand its welfare policy.

Now, since both parties expand their proposed policies, for any given policy of the opposing party (where $g_L > g_R$), the new equilibrium after the mean preserving reduction in the spread in the wage distribution must be one where both parties propose higher levels of generosity.

It is straightforward to see that the policies g_L and g_R are strategic complements, implying that a higher level of g_R contributes to a higher level of g_L: From the first-order condition for the policy compromise in the left-wing party we have

$$\frac{dg_L}{dg_R} = \frac{-\beta_L Q_1 W'_L(g_R)}{-P''_{LL}} > 0$$

since in equilibrium $Q_1 < 0$ and $W'_L(g_R) > 0$.

Similarly, a higher level of g_L contributes to a higher level of g_R: From the first-order condition for the compromise of the right-wing party we have

$$\frac{dg_R}{dg_L} = \frac{\beta_R Q_2 W'_R(g_L)}{-P''_{LL}} > 0$$

since in equilibrium $Q_2 < 0$ and $W'_R(g_L) < 0$

C Ideal policies and the multiplier

Calculating the ideal policy, each voter incorporates the correct equilibrium value of b in (2). The ideal point of (the employed members of) group i is $g_i^* = \arg\max V_i^e(g)$. The first-order condition is

$$-U'(c_i)bw_i + h_i U'(g_i^*) = 0 \quad \text{where } h_i \equiv \frac{1-\gamma_i}{\gamma_i} = \frac{\lambda_i}{r_i + q_i} \tag{23}$$

Using the shorthand $G = g/(1 - bg)$, (23) can be written as

$$G_i^* = w_i^{1-1/\mu}(h_i/b)^{1/\mu} \tag{24}$$

Here the value of h_i expresses the vulnerability[19] of income class i, which is higher for lower income classes both because of higher job separation rates and because of more slack in the labor market (lower q_i). The vulnerability relates to k_i used in the wage determination, as $h_i = \lambda_i k_i / r_i$. Members of poor income classes are more vulnerable than members of rich income classes. Yet, welfare spending is a normal good within income classes, since from the first-order condition $dV_i^e(g)/dg = 0$ in (23) we have

$$\frac{dg}{dw_i} = \frac{(\mu - 1)U'(c_i)b}{-d^2V_i^e(g)/dg^2} > 0 \tag{25}$$

as long as $\mu > 1$.

Consider the ideal policy of the median group $G = w^{1-1/\mu}(h/b)^{1/\mu}$ where variables without subscripts w, μ , h refer to the median group. Here b is defined by (4) and h by (12). A rough approximation of h/b is $\bar{w}$ times a constant. Using this and differentiation yields

$$dG = \left(1 - \frac{1}{\mu}(1 - n\frac{w}{\bar{w}})\right)\frac{G}{w}dw + \Delta$$

From (10), we obtain

$$\frac{1}{w}\left[A\frac{p}{w} + (\mu - 1)\left(\frac{w}{G}\right)^{\mu-1} + A(1/\eta - 1)(1 - k)\right]dw = (\mu - 1)\frac{1}{G}\left(\frac{w}{G}\right)^{\mu-1} dG$$

In this expression we have used that $[(p - w)/w]dA/dw = p - [(p - w)/w]\left[\alpha(\mu - 1)/(1 - \alpha)\right](1/k^2)(dk/dw)$, which, by utilizing that, $dk/dw = (1/\eta - 1)k(1 - k)/(p - w)$ can be written as $[(p - w)/w]dA/dw =$

[19]To the extent that fairness norms and beliefs play a role in the social interests of each income class, these factors should be incorporated in h_i.

$-A(1/\eta - 1)(1/k - 1)(1/w)$.

Referring to the exposition in section 2, we can now calculate

$$\phi' \equiv \frac{dG}{dw} = \left(1 - \frac{1}{\mu}(1 - n\frac{w}{\bar{w}})\right)\frac{G}{w}$$

and

$$\psi' \equiv \frac{dw}{dG} = \frac{(\mu - 1)\frac{w}{G}\left(\frac{w}{G}\right)^{\mu-1}}{\left[A\frac{p}{w} + (\mu - 1)\left(\frac{w}{G}\right)^{\mu-1} + A(1/\eta - 1)(1 - k)\right]}$$

and inserting for A we have $dG = m\,\Delta$, where the multiplier $m = 1/(1 - \phi'\psi')$ becomes

$$m \equiv \frac{\left(\frac{w}{G}\right)^{\mu-1} + y}{\frac{1}{\mu}(1 - n\frac{w}{\bar{w}})\left(\frac{w}{G}\right)^{\mu-1} + y} > 1$$

with

$$y \equiv \frac{\alpha\frac{p}{w} + \alpha(1/\eta - 1)(1/k - 1)}{(1 - \alpha)k}$$

Observe that for a sufficiently high μ, we have

$$y \leq \frac{\alpha(\mu - 1)}{(1 - \alpha)k}\frac{p}{w} - \left(\frac{\alpha(\mu - 1)}{(1 - \alpha)k} - 1\right) = \left(\frac{w}{G}\right)^{\mu-1}$$

where we use (10). Since the multiplier m is declining in y, replacing y with $(w/G)^{\mu-1}$ in the expression of m yields

$$m \geq \frac{2\left(\frac{w}{G}\right)^{\mu-1}}{(\frac{1}{\mu} + 1)\left(\frac{w}{G}\right)^{\mu-1}} = \frac{2\mu}{\mu + 1}$$

D Data sources and definitions

The data is a panel of 351 observations from 18 OECD countries from 1975 to 2002. Wage dispersion is measured by the ratio of the 5th to the 1st decile of gross hourly wages, mainly provided by the OECD Earnings database. Additional series are calculated from the European Community Household Survey (ECHP) for the years 1994–2001.[20]

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[21]. The index captures the generosity of income support in the case of illness, unemployment, and disability and old-age pensions of each country for each year. Generosity is constructed by using the replacement ratio, coverage, entitlements, and timing of different schemes, in addition to other scheme features.

The political variables used in our analysis are obtained from the Comparative Political Dataset (CPD) compiled by Armingeon et al.(2007). Right-wing government is the five-year average of an (current and lagged) indicator variable taking the value of 1 if the right-wing parties have a majority in government (g.t. 50 percent), constructed from the variable "govright" (defined as right-wing parties in percentage of total cabinet

[20]OECD data from `http://www.oecd.org/dataoecd/9/59/39606921.xls`, `http://stats.oecd.org/Index.aspx?DataSetCode=DEC-I` supplemented with data from Employment Outlook, 1996, Table 3.1(1979–1995). The wage measure in ECHP is based on reported earnings for the year preceding the survey year, and is added for countries that have gaps in the OECD series between 1994 and 2001. The unit of observation is countryxyear and when data is available from both sources, an average over the sources is constructed for each countryxyear. A variable indicating the weight of the different sources (OECD, ECHP) in the construction of each countryxyear-cell average in order is included 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. In the robustness check reported in Table 2, these data set controls are netted out of the wage dispersion measure before estimating on each sub-sample, based on the model from Table 1 on the full sample. France, Italy, and Switzerland report net wages, but this is controlled for by the use of country dummies. The years and countries included are Australia (75–95, 97–02), Austria (80, 87–94, 95–01 (1)), Belgium (85–95, 99–02, 94–01 (1)), Canada (81,86,88,90–94,97–02), Denmark (80–90,96–02, 94–01(1)), Finland (77,80,83,86–02), France (75–98, 00–02, 94–01(1)), Germany (84–02), Italy (86–96, 86,87,89,91,93,98,00,02), Ireland (94,97,00, 94–01(1)), Japan (75–02), Netherlands (77–02), New Zealand (84,86,88,90,92,94–02), Norway (80,83,87,91,97–02), Sweden (75, 78, 80–02), Switzerland (96,98,00,02), United Kingdom (75–02), United States (75–02); (1):echp.

[21]The construction of the index is described in Scruggs (2004, 2007). The data set is available at `http://sp.uconn.edu/scruggs/wp.htm`

posts, weighted by days) from the CPD. The percent of elderly in the population is taken from OECD Factbook 2011-2012.

Bargaining indicators: Union density and bargaining coordination from 1975–2000 are obtained from Golden, Lange, and Wallerstein (2006), "Union Centralization among Advanced Industrial Societies: An Empirical Study."[22] 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. The coordination index is normalized to [0,1]. Workers in conflict is obtained from the CPD, as compiled by Armingeon et al. (2007), and is calculated as workers involved in industrial conflict, "wi," in percent of civilian labor force aged 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.Stats, National Accounts at a Glance. The percent of population with tertiary education from 1990–2002 is taken from OECD Education at a Glance, various years (linearized when missing). From 1975–1989 education data is imputed by using linearized values of five-years figures reported in De la Fuente and Domenech (2002).

[22] `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`. Figures for Ireland and New Zealand are from OECD Employment Outlook 2004. Union density is defined as net density (see Ebbinghaus and Visser,2000) from Table 3.3 (linearized decennial values). Coordination values from Table 3.5 Centralization Index. Values for 2001 and 2002 for netden and barglev2 are set at the 2000 level.

Table 2: Summary Statistics

	Mean	St.dev.
Inequality (ln(d5/d1))	0.492	0.132
Generosity ln(Index)	3.28	0.284
Openness (pct GDP)	29.0	17.7
log GDP per cap.	10.1	0.20
Tertiary (pct)	20.2	8.5
Union Density	38.5	19.5
Conflict (pct)	3.9	8.7
Share 65+ pct	13.8	2.29
Right cabinet [0,1]	0.34	0.41
Barg. Coordination	0.53	0.29

The table shows summary statistics for the sample used in table 1, n=351.

Table 3: Generosity and Wage Inequality, Subsets of countries excluded

Excluded group:	America	Oceania	LargeEU	SmallEU	Nordic
Inequality	-.7547***	-.5739***	-.6137**	-.6992***	-.8540***
	(.1395)	(.1185)	(.2920)	(.1393)	(.1455)
Generosity	-.4477**	-.3348**	-.4542**	-.4851***	-.6270***
	(.1775)	(.1237)	(.1377)	(.1198)	(.1670)
Equality multiplier	1.51	1.24	1.39	1.51	2.15
No. of cases	309	282	254	323	276

The table shows the coefficient (std.error) for ln(d5d1) in IV-regressions of ln(Generosity), and the coefficient (std.error) for ln(Generosity) in IV-regressions of ln(d5d1) in identical specification to that of the IV models of Table 1, after exclusion of different sub-sets of countries. America=US,Canada; Oceania=Australia, New Zealand, Japan; LargeEU=France, Germany, Italy, the UK ; SmallEU=Austria, Belgium, Ireland, Netherlands, Switzerland; Nordic=Denmark, Finland, Norway, Sweden.