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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 an important social multiplier. We focus on a political economic equilibrium which incorporates this mutual dependence between wage setting and welfare spending. It explains how almost equally rich countries differ in economic and social equality among their citizens and why countries cluster around different worlds of welfare capitalism---the Scandinavian model, the Anglo-Saxon model and the Continental model. 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 for the cumulative complementarity between social spending and wage equality by applying another data set for the US over the period 1945-2001.

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1 Introduction

With only half of the pre-tax wage inequality of the US, the Scandinavian countries of Denmark, Norway and Sweden have twice as generous welfare spending as the US. This is a stark illustration of a general pattern illustrated in Figure 1. The vertical axis measures an index of the generosity of the welfare state and the horizontal axis measures the ratio of the 9th decile to the 1st decile of gross hourly wage. The pattern is visible regardless of what measures we use: Countries with smaller wage differentials tend to have more generous welfare spending, and visa versa[1].

This pattern is also visible within single countries over time. In the US, for instance, public social transfers were established by president president F.D Roosevelt in the landmark Social Security Act of 1935. The first years after World War II social spending increased considerably as percent of GDP. At the same time, wage inequality dropped to the extent that Claudia Goldin and Robert Margo (1992) labeled this period the time of the "Great Compression". During the era of president Ronald Reagan, there was a period of considerable retrenchment in social spending. At the same time, wage inequality surged to unprecedented levels. Figure 2 illustrates this pattern over time: Periods with less growth in wage differentials tend to have higher growth in welfare generosity, and vise versa.

Below we offer two separate mechanisms with distinct causal effects that together can explain this general pattern. One mechanism, *the equality magnifying effect*, runs from the wage distribution to the determination of welfare state policies: More wage equality leads the majority of voters to support a more generous welfare state. This positive association resembles what Peter Lindert (2004) calls the 'Robin Hood paradox' in which redistribution from the rich to the poor is least present where it is the most needed.[2]

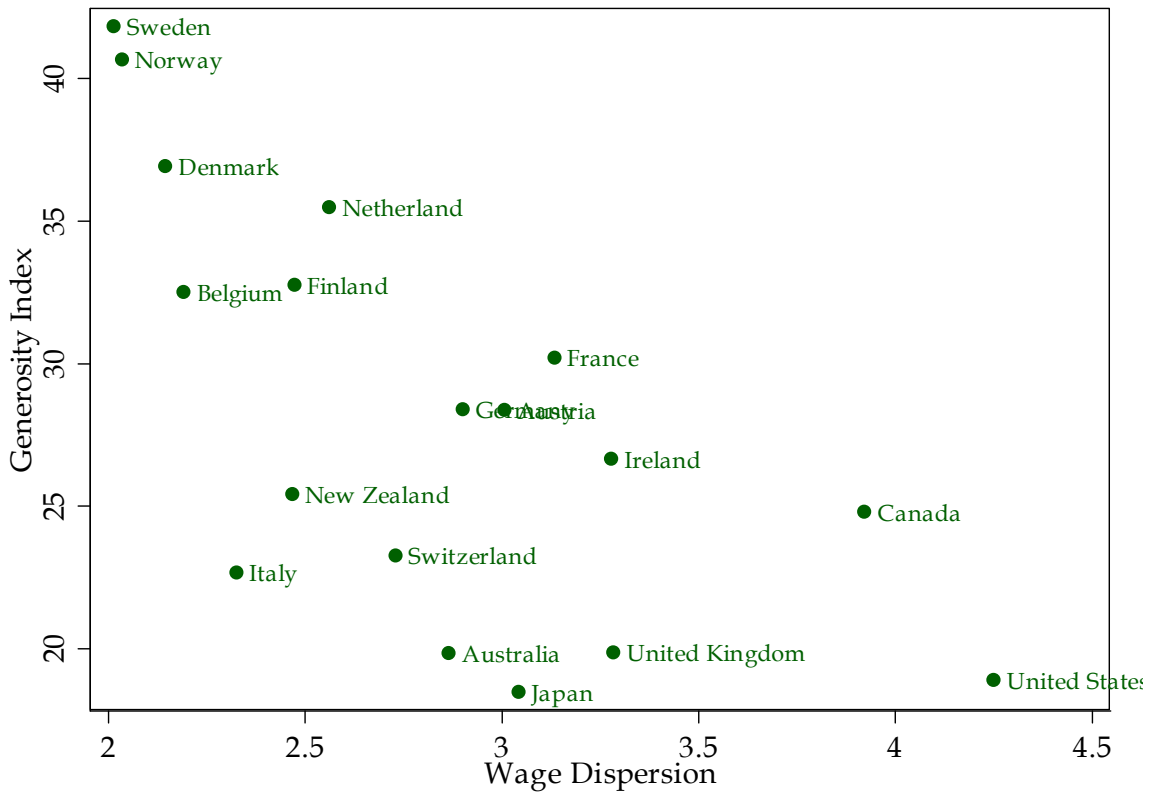
The other mechanism, *the wage equalizing effect*, runs from welfare state policies to wage determination: More generous welfare benefits lead to more wage equality as weak groups in the labor market improve their relative bargaining position, allowing them to command a higher pay. In this way improved welfare benefits compresses the wage distribution from below.

Combining the two effects we have two mechanisms that are complementary. A more equal wage distribution fuels welfare generosity and a more generous welfare state fuels wage equality, stimulating further welfare generosity and further wage equality in a cu-

[1] In the appendix, we show that this pattern is robust to a host of different types of measures.

[2] Lindert draws attention to a more general regularity than we do: "Poverty policy within any one polity or jurisdiction is supposed to aid the poor more, the lower the average income and the greater the income inequality. Yet over time and space, the pattern is usually the opposite". (Lindert 2004, p 15.) This equality-generosity puzzle runs counter to the most prominent theories of welfare spending such as the seminal papers by Romer (1975), Roberts (1977), and Meltzer and Richard (1981) which all predict that higher pre-tax inequality should be associated with a more generous welfare state.

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. Overall 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=361

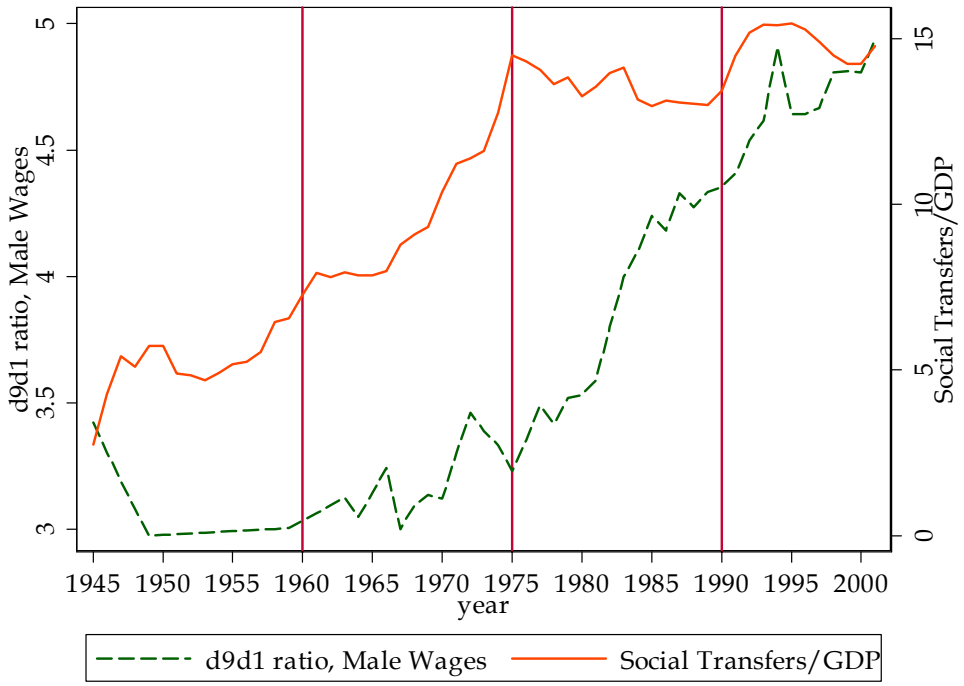
mulative process. This process can add up to a sizeable social multiplier.[3] Our paper provides a theoretical explanation of the mechanisms behind this *equality multiplier* and an empirical assessment of its magnitude in OECD countries.

In order to do so we derive an equilibrium where the level of equality induces social policies that again induce the level of equality. This is an example of Toqueville's (1835) observation that "equality ...gives a certain direction to public spirit, a certain turn to the laws, new maxims to those who govern, and particular habits to the governed"(p 3). The political-economic equilibrium we derive is not converging across countries. On the contrary, it is contingent on specific organizations and institutions.

We emphasize how certain policies and institutions fit together and strengthen each other. Societal arrangements therefore tend to come in different clusters of social and economic characteristics. One example is "the three worlds of welfare capitalism", distin-

[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.

guishing Northern Europe, Continental Europe, and the Anglo-Saxon countries into what Esping Andersen (1990) labels the Social Democratic model, the Conservative model, and the Liberal model. We explore this division further and find that it is complementarities between institutions—not the welfare states themselves—that account for the major differences between the three worlds.

While the complementarity of institutions may drive countries into different societal models, the exact same complementarity would also tend to magnify a drift away from an initial mode. The direction of change depends on the initial stimuli, and the magnitude of change depends on both the size of the stimuli and of the size of the equality multiplier. This is important as countries may differ along many dimensions such as their prehistory, size, resources, organizations, institutions and governments. In some cases these differences may be minor, in other cases they may be large. In all cases existing structural differences may be enhanced via our social multiplier. Even small changes can therefore be multiplied up via the cumulative process that we study.

In our empirical analysis we utilize the different experiences of OECD countries over

26 years from 1976 to 2002 in order to identify both the equality magnifying effect as well as the wage equalizing effect, and thereby to provide an estimate of the size of the equality multiplier. We also offer some supporting evidence by taking a closer look at the development of welfare generosity and wage inequality in the Post-World-War-II United States. The US is a particularly interesting example since it represents an extreme case with high wage dispersion and low welfare generosity, but also because there seems to be high expectations of changes arising from the new presidency of Barak Obama; changes that may affect both inequality and welfare generosity in the US.

Our focus extends the welfare state literature by incorporating one important aspect of the mutual dependence between markets and politics. We add the reverse linkage to the analysis of how wage equality fuels the political demand for social insurance against loss of income (see Iversen and Soskice, 2001, and Moene and Wallerstein, 2001). More generally, our paper contributes to the discussion of why welfare spending is so much higher in some countries than in others and why not all countries have an European style welfare state (see Alesina and Glaeser 2001, 2004 for a broad political economic approach, Lindert, 2004, for a comprehensive historical overview, and Cameroon 1978 and Katzenstein 1985 for the role of openness and country size)).

Our analysis also adds to the ongoing discussion of why seemingly similar countries sustain widely differing wage structures, in particular on the relative impact of market forces versus institutions in explaining cross country differences in the wage structure (see eg. Devroye and Freeman (2001), Leuven et al. (2004), Blau and Kahn (1996), Acemoglu (2003)), and Scheve and Stasavage (2008); and in explaining the development of wage inequality within countries over time (see eg. Katz and Murphy (1992), Card and DiNardo (2002), Autor et al. (2008), and Goldin and Katz (2006) for studies with focus on the US experience).

Section 2 gives our basic argument and presents the equality multiplier. Section 3 explains the equality magnifying effect and section 4 explains the wage equalizing effect. The empirical analysis is provided in sections 5 to 7. Section 8 concludes.

2 The basic argument

For each country j we combine two distinct mechanisms that can be associated with two downward sloping curves between wage inequality I_j and welfare generosity G_j.

2.1 The equality magnifying curve

The equality magnifying curve captures how equality in the distribution of pre-tax wages raises the generosity of the welfare state. It relates to the political competition over voters' support where the interests of voters are shaped by the pre-tax distribution of wages.

In short the mechanism can be written as

$$ln(G_j) = A_j - a_I ln(I_j) \quad \text{where} \quad A_j = A(z_j) \tag{1}$$

Here welfare generosity in country j is supposed to depend on country characteristics A_j where z_j is a vector including such things as the political orientation of the winning party, the income level of the country, and indicators that pick up the economic risks that voters are exposed to such as economic openness. Our main interest is related to $a_I > 0$ capturing the equality magnifying effect.

As we discuss further in section 3 a more compressed wage distribution, for a given mean, makes the majority of workers richer which in turn raises the political support for a generous welfare spending on commodities and services that are normal goods for the households. Deriving this equality magnifying effect we emphasize 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. Building on Moene and Wallerstein (2001, 2003) we focus on welfare spending as social insurance against loss of income due to sickness, unemployment, and old age. It matters which party wins the election, but all parties run on a program that is already adjusted to the wage distribution.

2.2 The wage equalizing curve

The wage equalizing curve captures how the generosity of the welfare state G_j strengthens weak group in the labor market. In short the mechanism is written as

$$ln(I_j) = B_j - a_g ln(G_j) \quad \text{where} \quad B_j = B(y_j) \tag{2}$$

Here wage inequality in country j is supposed to depend on country characteristics B_j where y_j is a vector including such things as indicators of the wage setting system, union density, and the level of income in the country (some of which may be shared with the vector z, of course). Our main interest is related to $a_g > 0$ capturing the wage equalizing effect.

As we discuss further in section 4 welfare benefits compresses the pre tax wage distribution from below. Deriving this wage equalizing effect, we focus on a simple bargaining framework where welfare benefits raises the fall back position of particularly vulnerable groups. They are therefore able to command a higher pay and to improve their relative wage. The bargaining framework allows for both decentralized and more coordinated wage setting.

2.3 Equilibrium and the equality multiplier

Combining the two curves we obtain *a political economic equilibrium* which incorporates the mutual dependence between wage setting and welfare spending. While welfare spending depends on wage inequality, it also feeds back to the determination of the level of wage inequality. The equilibrium outcome is the wage inequality and the level of welfare spending that are consistent taking the mutual feed-backs into account. It can be reached after a cumulative sequence of wage settlements and welfare state adjustments.

The equilibrium levels of welfare generosity and wage distribution are

$$ln(G_j) = m[A_j - a_I B_j] \quad \text{and} \quad ln(I_j) = m[B_j - a_g A_j] \tag{3}$$

where m is the multiplier given by

$$m = \frac{1}{1 - a_I a_g} \tag{4}$$

which is greater than one whenever the system is stable, i.e. whenever $a_I < 1/a_g$.

The equilibrium levels shift with changing circumstances and there is an *equality multiplier* (or inequality multiplier, depending on the stimuli) m between wage setting and welfare spending. The multiplier summarizes the feed back mechanisms between the equality magnifying effect and the wage equalizing effect. The effects of shifts in A_j (for instance caused by a change of the political color of government) or in B_j (for instance caused by a change in the level of wage coordination) are then magnified by $m > 1$. A rise in A_j, for instance,would lead to a total effect of $\frac{\Delta G_j}{G_j} = m\Delta A_j$ on welfare generosity and to a total effect on wage inequality of $\frac{\Delta I_j}{I_j} = m a_g \Delta A_j$.

3 Deriving the Equality Magnifying Effect

In this section we derive and characterize the relationship $ln(G) = A - a_I ln(I)$, focussing on how the political demand for protection against risk can be understood as a main mechanism behind the emergence of modern welfare states. We consider a society with a continuum of voters normalized to 1. They have jobs or occupations with different productivity and risks of income loss. The productivity p has continuous distribution with $E(p) = \bar{p}$, (throughout we use the expectation operator to indicate averages). In the exposition the distribution of p is given, but how earnings relates to productivity vary with wage determination systems as discussed in Section 4. There we derive how earnings are an increasing function of the productivity p of the position. We write it $w(p)$, where $w'(p) \geq 0$. b

3.1 Welfare generosity: Voters' preferences

The social chance that a person in position p will be on welfare benefits is $e(p)$. It reflects a combination of the risks of loosing one's income and the willingness to utilize welfare state arrangements. Richer workers tend to be less inclined to use the welfare state partly because they have a lower chance of job loss of a certain duration (they more easily get a new one) and partly because they tend to rely more on self insurance. We express this as $e'(p) \leq 0$.

As above we denote by G the generosity of the welfare system. In most welfare systems social insurance is offered on better terms for low wage earners than for high wage earners. We incorporate this by assuming that each worker who loses his income obtains welfare benefits equal to G. This is of course a grave simplification, but one that can easily be modified.[4]

The welfare benefits are financed by a constant marginal tax t on total income (wages plus profits), $E[(1-e(p))p]$, which we think of as representing total income per capita. To simplify we abstract from deadweight losses. The balanced budget equation is then

$$t = \gamma G \quad \text{with} \quad \gamma = \frac{E[e(p)]}{E[(1-e(p))p]} \tag{5}$$

The cost of welfare generosity is γ, measuring the impact on the tax rate of an increase in the generosity level of welfare spending. Thus the cost of welfare generosity is low whenever total income is high and the fraction citizens in need of support is low. Note that $1/\gamma$ expresses total income per capita relative to the average fraction of citizens without their ordinary pay.

The narrow self interests of a each citizen is expressed by an utility function with a constant relative risk aversion μ over consumption c

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

Since the individual risk of income loss must be considered a serious threat to the liv-

[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:

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

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 $G(1-\theta)w(p)/Ew(p)$, 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 is the terms of the social insurance scheme. In the presentation we apply the simplifying assumption that $\theta = 1$.

ing conditions of a typical voter, we limit the discussion to cases where citizens have a relatively high degree of risk aversion $\mu > 1$

Voters have political interests that reflect their social identification with people who have lost their income. The social preferences of voters are expressed as modified expected utility, where the weight on being without ordinary income is enhanced by a parameter $h \geq 1$ capturing social care. Inserting $c(p) = (1-t)w(p)$ and $t = \gamma g$ the social preferences of a worker in position p are

$$v\left(g;p\right) = (1-e(p))U\left(\left(1-\gamma G\right)w(p)\right) + e(p)hU\left(G\right) \tag{6}$$

When $h = 1$, we have the narrow self-interested case of standard expected utility; when $h > 1$ the probability $e(p)$ is enhanced further. The extra weight $e(p)(h-1)$ captures social identification: A voter in position p is assumed to have a stronger social identification with people who have lost their income, the more likely it is that he may end up on welfare himself.

We find his most preferred generosity of the welfare state—his ideal policy—from the first order condition $\partial v(G;p)/\partial G = 0$, which after some rearranging can be written as

$$G(p) = \frac{\left(w(p)\right)^{\frac{\mu-1}{\mu}}}{\left(\frac{\gamma(1-e(p))}{e(p)h}\right)^{\frac{1}{\mu}} + \gamma\left(w(p)\right)^{\frac{\mu-1}{\mu}}} \tag{7}$$

The most preferred welfare generosity $G(p)$ by a voter in position p depends positively on (i) his gross income $w(p)$, (ii) his odds $e/(1-e)$ of loosing the income, (iii) his social care h, and (iv) society's income per capita $1/\gamma$ relative to the average fraction of people without an income.

Opinion surveys in OECD countries show that high-paid wage and salary earners, prefer lower taxes (and lower welfare benefits) than low-paid wage earners. The reason is most likely that the high-paid are less exposed to risks of income loss than the low-paid and therefore identify less with those in need for a generous welfare state. From (7) it follows that the most preferred welfare generosity goes to zero for voters in sufficiently low risk positions (as the risk of loosing once income $e(p) \to 0$ implies $G(p) \to 0$); and that the most preferred generosity goes to its maximum level for voters in sufficiently high risk positions (as the risk of loosing once income $e(p) \to 1$ implies $G(p) \to 1/\gamma$). Hence, high p workers tend to prefer low welfare generosity, whereas low p workers tend to prefer high welfare generosity. To assure that this pattern is monotone as we move up the hierarchy of positions we assume

$$G'(p) < 0 \Leftrightarrow \mu < 1 - \frac{e'(p)/e(p)}{(1-e(p))w'(p)/w(p)} \tag{8}$$

Condition (8) [5] implies that within any wage distribution voters in higher positions always prefer lower taxes. Even though we do not apply median voter politics directly, it should be observed that, as long as (8) holds, the voter in the median position p_m is the median voter who prefers $G_m = G(p_m)$.

Mean preserving wage compression implies higher wages in positions below the mean, and lower wages in positions above the mean. It follows from (7) that the partial effect of a higher wage $w(p)$, for a given risk, is a higher welfare generosity $G(p)$. As long as the wage distribution is skewed with a median wage below the mean, a mean preserving compression of wage differentials implies a stronger support for a generous welfare spending from a majority of voters.

More equal wages imply that voters become more similar in their welfare state demands: A majority of them tend to support a higher level of welfare state generosity. The main intuition is that the majority of voters, the high risk workers, demand better social insurance as their income goes up holding the risks of their positions constant. As welfare policies normally also vary with the color of the party in power, it is important to incorporate political competition between parties that care about ideology and policies.

3.2 Welfare generosity: Political party competition

Political parties matter for welfare spending. With two parties or blocks—left and right—that differ in their ideologies in the traditional manner, median voter results are not directly applicable. Ideology draws the policies of each party away from the median voter's ideal policy, while the competition to win the election draws the policies in the direction of the ideal policy of the median voter (Whittman 1977, Roemer 2001).

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 $v_L(G)$ and $v_R(G)$, 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. In the language of John Roemer (2001) each party is reformist. It aims at maximizing the expected party utility, denoted V_L for the left and V_R for the right. The expected utilities for the two parties are defined by

$$V_L = qv_L(G_L) + [1-q]\, v_L(G_R) \tag{9}$$

$$V_R = [1-q]\, v_R(G_R) + qv_R(G_L) \tag{10}$$

[5] The assumption is not very restrictive: at a level of income loss of 5 per cent, and with an income security that moves half way in tandem with wage increases, i.e. $-e'(p)/(1-e(p)) \geq (1/2)w'(p)/w(p)$, the assumption implies that $\mu < 11$.

In these expressions the probability that the left wins, when it proposes G_L and the right proposes G_R, is denoted $q = q(G_L, G_R)$ and the probability that the right wins is $(1-q)$. We derive these probabilities for all relevant proposals G_L and G_R in an mathematical appendix (Appendix A) applying a particular version of probabilistic voting (by Roemer 2001). In the appendix we use that each party would obtain an expected vote share equal to 1/2 if both proposed the median's most preferred policy, $G = G_m$. If $G_L > G_R$, however, voters with an interest to vote left must have $v(G_L; p) \geq v(G_R; p)$ who thus tend tend be low p workers with high risk and low pay.

An increase in either G_L or G_R (for $G_L > G_R$) makes the left party less attractive for its marginal voters. The declining support is of the same magnitude irrespective of whether the left party raises G_L, or whether the right party raises G_R (see the appendix).

All this is decisive for how much each party is willing to compromise its ideology to improve its chance of winning the election. The trade-offs involved are captured by the first order conditions, describing the Nash-equilibrium of the policy game:

$$\frac{\partial q}{\partial G_L}\left[v_L(G_L) - v_L(G_R)\right] + q\frac{\partial v_L}{\partial G_L} = 0 \tag{11}$$

$$-\frac{\partial q}{\partial G_R}\left[v_R(G_R) - v_R(G_L)\right] + (1-q)\frac{\partial v_R}{\partial G_R} = 0 \tag{12}$$

In equilibrium we obtain policy divergence: The left party chooses $G_L > G_m$ such that the marginal reduction in the chance of winning the election times the gain of winning $[v_L(G_L) - v_L(G_R)]$, just equals the marginal ideological gain of running with a policy closer to the party's ideals. The right party chooses $G_R < G_m$ such that the marginal reduction in the chance of winning the election times the gain of winning $[v_R(G_R) - v_R(G_L)]$, equals the marginal ideological gain of running with a policy closer to the party's ideals.[6] When both parties deviate from the median's ideal policy, their chances of winning may end up close to fifty-fifty. As we show in the appendix the equilibrium value of q is 1/2 whenever each party's preferences are linear in G.

How does a more compressed wage distribution affect the proposals of the parties? A mean preserving wage compression implies the median voter gets a higher wage and his most preferred level of G goes up. In this way wage compression simply makes the majority of the electorate more pro left in their welfare state preferences inducing both parties to increase their promised welfare generosity. The left party can satisfy more of its ideological preferences without reducing its chances to win the election, whereas the right party must compromise its ideology in order to prevent lower chances of winning.

[6]The ideal policy of the median voter is not an equilibrium outcome since, for $G_R = G_m$ it pays for the left to deviate from G_m by setting a higher level of G_L. By so doing the marginal ideological gain $q\partial v_L/\partial G_L$ 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 $G_R = G_m$ by reducing the level of G_R in the direction of the party's ideal policy.

The discussion so far is summed up in the following proposition:

Proposition 1 *The equality magnifying effect:*

(i) More equal wages imply that voters become more similar in their welfare state demands: With a skewed wage distribution a mean preserving wage compression implies that a majority of them wants a higher level of welfare state generosity.

(ii) With two competing blocks or parties the implemented generosity of welfare spending depends on whic party wins the election. More equal wages lead to higher welfare spending contingent upon party in power.

4 Deriving the Wage Equalization Effect

In this section we derive and characterize the relationship $ln(I) = B - a_g ln(G)$, discussed in section 2, focussing on a stylized bargaining set-up.

Empirical work on relative wages in the US and elsewhere reveals large interfirm and inter industry wage differentials that cannot be explained by union membership or any other observable characteristics of the job or the workers (Krueger and Summers 1988, Groshen 1991, Gibbons and Katz 1992). There can be unequal pay for equal work in the labor market even without unions as the cost of filling vacancies or of training new workers may endow workers with bargaining power. We use the simplest explanation for such differences where wage differentials relate to rent sharing. Workers' share is denoted α. This parameter can be thought about as the bargaining power of the local work force with or without union locals. We do not explicitly distinguish between cases where higher job productivity p is caused by characteristics of the firm or of the worker.

4.1 Wage equalization: Decentralized system

To set ideas consider workers in position p who threaten with a strike or in other ways to be less cooperative. The expected duration of the industrial action is a fraction α of the contract period. By letting the conflict be carried out the employer obtains $(1-\alpha)(p - \omega(p, G))$ for the remaining period. Here $\omega(p, G)$ is the lowest wage that the employer can set, the implicit minimum wage, to workers who have lost a strike. Workers who fully utilize their bargaining power would demand a wage, backed by the strike threat, that is as high as possible, but not so high that it is in the employer's interest to turn down their demand. Hence, the wage demand must satisfy $p - w(p) \geq (1-\alpha)(p - \omega(p, G))$. Solving this with equality we obtain

$$w(p) = \alpha p + (1-\alpha)\omega(p, G) \tag{13}$$

Welfare benefits such as sickness pay, unemployment compensation and retirement pensions, affect the implicit minimum wage ω that employers can set. Such benefits are particularly important to vulnerable groups with a high chance of losing their incomes. To capture this the value of $\omega(p, G)$ is simply set equal to

$$\omega(p, G) = z(p) + e(p)G \tag{14}$$

where $z(p)$ is the wage set by employers in the absence of welfare benefits with $z'(p) \geq 0$. The important idea in (14) is not its additive form, but that higher welfare benefits constrain the lowest wage that employers can set, and that this effect is more important for groups that are more likely to receive welfare benefits than others. Clearly, more generous welfare benefits would benefit low paid workers most as $\partial\omega(p, G)/\partial G = e(p)$ which is highest for low-productivity workers.

This is important for how wage inequality is affected by the generosity of the welfare state. Consider the inequality I between two quartiles in the wage distribution (H and L)

$$I = \frac{w(p_H)}{w(p_L)} = \frac{\alpha p_H + (1-\alpha)\omega(p_H, G)}{\alpha p_L + (1-\alpha)\omega(p_L, G)} \tag{15}$$

We have

$$\frac{\partial I}{\partial G} = \frac{(1-\alpha)}{w(p_L)}\left[e(p_H) - e(p_L)I\right] < 0 \tag{16}$$

since $e(p_H) \leq e(p_L)$ and $I > 1$).

Hence, more generous welfare benefits lead to wage compression as the inequality between high and low wages declines. With low welfare benefits vulnerable groups can be weak in local wage disputes. They may have to accept that employers set a particularly low wage as a response to meagre outside opportunities. Higher welfare benefits empower such weak groups enabling them to raise their wages relative to others.[7]

4.2 Wage equalization: Coordinated system

Bargaining institutions seem to have stronger influence on relative wages than on the functional distribution of wages and profits. In the empirical part of the paper we utilize that the level of wage coordination tend to associated with lower wage inequality. Here we explain how.

In so doing we proceed as if the average productivity, defined as above $Ep = \bar{p}$, is the same across bargaining regimes. This is done in order to emphasize the impact on relative wages. Higher wage equality may in fact increase rather than lower average productivity

[7] In addition vulnerable groups might be weak because they are unable to hold out in a conflict for very long. Also in this case welfare benefits may empower them: their bargaining power α may go up as they can tolerate a conflict for a longer period when some of the expected expenditures are paid by the welfare state.

within a process of creative destruction of good and bad jobs: Wage compression raises the profitability of good jobs and reduces the profitability of bad jobs as shown in a vintage model by Moene and Wallerstein (1997). The potential productivity enhancing effect of wage compression may help explain how groups with relatively high pay do not opt out of the wage coordination.[8]

We define $\pi(p) = p - w(p)$, and the aggregates are $E\pi(p) + Ew(p) = Ep$. Clearly, a higher welfare generosity G raises the average wage $Ew(p)$ and lowers average profits $E\pi(p)$.

Coordination in wage setting implies that some wages are taken out of local competition and placed into a system of collective decision making. This alters the structure of who negotiates with whom. Worker employer bargains are replaced by worker worker bargaining. Since unions adhere to fairness norms this change strengthens the bargaining position of weak groups in the labor market. The level of wage coordination determines the units over which such fairness norms are applied. When wages are determined at the firm level, unions affect the distribution of wages within the firm. When wages are set at the industry level, unions affect the distribution of wages across firms within the industry. When wages are set at the national level, unions affect the distribution of wages across firms, industries and occupations throughout the entire nation.

We first consider an arrangement with coordination between unions and employers over a bargaining unit with average productivity $E_b p = \hat{p}$ where E_b indicates that averages are taken within this bargaining unit b. Using capital letters to indicate the outcome of coordination, wage coordination can be thought of as an arrangement with two states:

Stage A: the employers' association negotiate with the union confederation about the average wage (the total wage bill) $E_b W(p)$ with bargaining power α on the union side and $1 - \alpha$ on the employer side.

Stage B: the total wage bill $E_b W(p)$ is distributed between the employees via collective union-union bargaining.

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. Whether we should call stage B bargaining or arguing is an open question.

In both stages the non-cooperative benchmark is likely to work as a fall-back position if coordination breaks down. Thus if the union - employer negotiations in stage A breaks down, the average non-cooperative wage $E_b w(p)$ is the union's fall back position. If coordination between unions breaks down, individual wages $w(p)$ are workers' fall-back position.

[8] In some cases employers' associations threaten with a lock out against high paid unions that would like to opt out of wage coordination. In the Scandinavian countries of Sweden and Norway such lock out threats have used several times in the last fifty years.

We incorporate all this with an expected status quo bias in the sense that there might be delays before the non-cooperative system is in place, implying that the value of the fall back positions is diminished by a factor $\delta < 1$. The higher is δ the more labor disputes and lost working days are expected in the case of a breakdown. We assume that workers' bargaining power vis a vis employers is the same and equal to α in all bargaining units. This is done for convenience and does not affect the main conclusions.

Stage A: the employers' association negotiate with the union confederation. We apply the generalized Nash bargaining solution where the Nash product is given by

$$N = \left[E_b\left(p - W(p) - \delta\pi(p)\right)\right]^{1-\alpha}\left[E_b\left(W(p) - \delta w(p)\right)\right]^{\alpha} \tag{17}$$

Soving for its maximum value we obtain the bargaining solution

$$E_b W(p) = \delta E_b w(p) + \alpha(1-\delta)\hat{p} \tag{18}$$

where $\hat{p} = E_b p$ and $E_b[\pi(p) + w(p)] = \hat{p}$. To interpret (18) recall that the union confederation can guarantee itself the fall back pay-off $\delta E_b w(p)$—the first term in the expression. The second term stems from the potential loss of $\delta\hat{p}$ associated with a possible break down of coordination as the unions obtain their share α of the gain of no breakdown $(1-\delta)\hat{p}$.[9]

Stage B: the employees or unions share the rent above their fall-back position $\delta w(p)$ equal to $\alpha(1-\delta)\bar{p}$. We apply a simple generalization of the outcome from Nash-bargaining solution to a case with a continuous distribution of wages, expressed by

$$W(p) = \delta w(p) + \beta(p)\alpha\left(1-\delta\right)\bar{p} \tag{19}$$

where $\beta(p)$ is the strength of workers in position p. The equation says that the coordinated wage level to workers in position p is the value of the fall back position plus $\beta(p)$ times the total gain to unions of not letting wage coordination break down, where $E_b\beta(p) = 1$.In union-union bargaining the effective strength $\beta(p)$ must be legitimate, based on acceptable principles that can be defended publicly.

The effective strength of a union $\beta(p)$ is assumed to be a compromise between a concern for *equal treatment*, and for *rewards according to productivity*: We express the trade-off between the two principles as a weighted average:

$$\beta(p) = r + (1-r)\frac{p}{\hat{p}} \quad \text{with} \quad 0 \leq r \leq 1 \tag{20}$$

[9]Equation (18) can also be written as $E_b W(p) = E_b w(p) + (1-\delta)\left(\alpha\hat{p} - E_b w(p)\right)$ which shows that $E_b W(p) \leq E_b w(p)$ since $\alpha\hat{p} \leq E_b w(p)$ from (13). Thus in our set-up wage coordination is associated with wage moderation. In other words the generosity of the welfare state increases both the non-coordinated and coordinated average wage, but the rise in the coordinated average wage $E_b W(p)$ is less than the rise in the non-coordinated average wage $E_b w(p)$.

Clearly when $r = 1$ all weight is placed on the concern for similar treatment per member, whereas when $r = 0$ all weight is placed on contribution as reflected in local productivity. The value of r is likely to be strictly positive since all groups—also the lowest paid—can inflict a cost on the others by not cooperating. The value of r is likely to be strictly less than 1 since economic force easily translates into sharing power.[10]

By inserting (20) into (19)we obtain

$$W(p) = w(p) + (1 - \delta)r\alpha[\hat{p} - p] \tag{21}$$

Observe that if the strength of each union is determined only by its local productivity, that is $r = 0$, wage coordination just reproduces the non-coordinated wage structure. With some weight on equal treatment, however, wage coordination implies that jobs with productivity less than the average, $p < \hat{p}$, obtain a wage rise, while jobs with productivity above average, $p > \hat{p}$, obtain a wage decline. Hence, wage differentials are compressed both from below and above. Thus wage coordination reduces wage inequality within the bargaining unit by lowering high wages and raising low wages.

Positions that do not belong to the bargaining unit are supposed to be remunerated by local systems or sharing rules. This is particularly relevant for some high paid non-union positions. We use the indicator function $1(b)$ which is unity if the position belongs to bargaining unit b, and zero otherwise. Let us again consider the inequality between workers in positions H and L:

$$\hat{I} = \frac{W(p_H)}{W(p_L)} = \frac{w(p_H) + 1(b)(1 - \delta)r\alpha[\hat{p} - p_H]}{w(p_L) + (1 - \delta)r\alpha[\hat{p} - p_L]} < \frac{w(p_H)}{w(p_L)} \tag{22}$$

More coordination always reduces wage inequality, as long as more coordination implies that more high productivity positions are included in the bargaining unit, raising the average productivity of the bargaining unit. From (22) we have that

$$\frac{\partial \hat{I}}{\partial \hat{p}} = \frac{(1 - \delta)r\alpha[1(b)W(p_L) - W(p_H)]}{[W(p_L)]^2} < 0 \tag{23}$$

On the one hand, as long as more wage coordination means that the average productivity of positions included in the coordination goes up, the relationship between the degree of wage coordination and the level of wage inequality is monotone and negative. On the other hand, the tendency that particularly high paid positions are excluded from wage coordination makes the wage distribution (more) skewed (with a median below the mean).

Finally, with wage coordination, as in the case of decentralized wage setting discussed

[10] As the fairness norms held by unions become more visible and pronounced the more coordinated the wage setting system, the value of r can depend on the level of coordination. In highly coordinated wage systems union representatives must publicly defend the relative wages they have negotiated. Thus the pressure on equal treatment may become more severe.

above, higher levels of welfare benefits also compress the wage distribution

$$\frac{\partial \hat{I}}{\partial G} = \frac{(1-\alpha)}{W(p_L)} \left[e(p_H) - e(p_L)\hat{I} \right] < 0 \tag{24}$$

The discussion of wage compression and welfare benefits is summed up in the following proposition:

Proposition 2 *The wage equalizing effect:*

(i) A generous welfare state lead to wage compression as the inequality between high and low wages declines with higher welfare benefits. This is the case at all levels of wage coordination.

(ii) Wage coordination tends to compress wage differentials over the bargaining unit—both from below and above. While workers in jobs with above average productivity obtain lower wages, workers in jobs with productivity below the average obtain higher wages relative to the non-cooperative benchmark.

5 Empirical Identification

Two hurdles immediately arise when trying to uncover the casual relationships between inequality I and generosity G in the two basic equations discussed in section 2 (and the previous sections)

$$lnG_j = A(z_j) - a_I lnI_j \quad \text{and} \quad lnI_j = B(y_j) - a_g lnG_j \tag{25}$$

where the vectors of exogenous factors z_j and y_j may or may not overlap.

Heterogeneity across countries

The first hurdle is the large heterogeneity across countries. Heterogeneity may arise from cultural, geographical, historical or economic reasons, and may potentially create significant omitted variable biases in our estimates. In order to address the problem of large heterogeneity across countries we include fixed country effects in all of our regressions below, i.e. country dummies in $A_j = A(z_j)$ and $B_j = B(y_j)$. In this way all time invariant differences across countries are swept out of the analysis, and 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.

Simultaneity

The second hurdle is the simultaneity problem. Our two propositions suggest that wage inequality has an effect on welfare generosity, and that welfare generosity has an effect

on wage inequality. Since the causality between I_j and G_j runs both ways the major empirical challenge is to identify the basic parameters of the two equations a_I and a_g: We need some exogenous factors that are included in y_j and thus affect wage inequality, but do not affect welfare generosity; and some exogenous factors that are included in z_j and thus affect welfare generosity, but do not affect wage inequality. Our theoretical model suggests that the political color of the government should affect welfare generosity, but not wage inequality, and that the level of wage coordination should affect wage inequality, but not welfare generosity. We use these restrictions to identify the the slopes of the two curves.

Instruments

In our generosity equation we use bargaining coordination as well the share of workers involved in conflict, labeled bargaining institutions in the following, as instruments for wage inequality. In addition we include the share of tertiary education and the employment rate in the 16-64 population, labeled workforce composition in the following, as another instrument for wage inequality. The identifying assumption is that bargaining institutions and workforce composition do not influence generosity, conditional on the other variables in the generosity equation (including wage inequality and country fixed effects). These assumptions are supported by the data: Our preferred models pass over-identification tests with a good margin, and neither of our instruments contributes significantly to the generosity equation when entered one by one.

In our wage inequality equation we use right wing government, measured as the average number of the last five years that right wing parties had majority in the government as instrument for generosity. This is consistent with our theoretical model that emphasizes how political parties may have an independent influence on generosity. It also turns out that there is a significant trend in generosity, but not in wage inequality, and thus a trend is included among the instruments. The identifying assumption is that politics and the trend do not have an independent effect on wage inequality, conditional on the other variables in the wage inequality equation. From our model, the outcome of bargaining is determined by relative outside options, bargaining power and the gains to be shared. These factors are accounted for by such variables like union density, the generosity of the welfare state, and GDP per capita. These assumptions are also supported by our data. 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 (for instance the trend term in the generosity equation), consistent with our tests of over-identification.

Thatcher, Ghent and the union lobby

There are examples that seemingly go against the assumption that government does not affect wage inequality. The Thatcher government, for instance, clearly affected wage inequality in the UK. The way it did this, however, does not contradict our assumptions as the government changed the regulations of how unions could operate and how they could recruit members (see eg. Brown et al 2008). The effect on wage inequality is therefore indirect through changes in bargaining system and in union density, variables that we do include in the vector y_j.

Another example is the recent policy changes in Sweden where the right wing government is effectively dismantling the so called Ghent system of unemployment compensation in which unions administer funds for unemployment insurance that are subsidized by the government. Several studies show that union density is higher in countries with the Ghent system (Lesh 2004, Holmlund and Lundberg 1999, and Bøckerman and Uusitalo, 2005). Again the way the government affects wage inequality—recently first in Finland in the 1990s and maybe now in Sweden—does not contradict our assumptions as the potential effect on wage inequality go indirectly through changes in union density, which again is included in the vector y_j.

There are also examples that seemingly go against the assumption that coordination of unions and employer associations do not affect welfare spending. There are lobbying efforts for specific welfare state policies both from union confederations and employer associations. Comprehensive unions are for instance sometimes seen as strong defenders of the welfare state. Their impact on welfare policies, however, are strongest when they lobby for the interests of the majority of the electorate. When they lobby for more special interests, the problem is credible threats and credible promises.

Both GDP per capita and openness appear to have a significant influence on both outcomes, and are thus included as exogenous variables in both equations. We have also included union density and the share of elderly in the population in both equations, basically because they turned out to violate overidentification tests once included only in one of the equations. The inclusion of these variables should of course be borne in mind when interpreting the trend variable.

5.1 Data

We use a panel of observations of 18 OECD countries to test key predictions from the model and to quantify the size of the equality multiplier. Our main results are obtained using 356 observations of year·country cells from the period of 1976-2002. *Wage inequality* is measured by the ratio of the 9th decile and the 1st decile of gross hourly earnings. This measure is gross of taxes and transfers, and based on individual outcomes in the labor market. Most of the observations of wage inequality are obtained from d9d1 ratios from

OECD's Earnings Database [11].

Table 10 in the appendix shows for each country 5-years averages of wage inequality. We find large differences in pre-tax wage inequality across countries. Not surprisingly, the wage ratio is highest in the United States: In 2005, the 9th decile earner in the US made 4.9 times the earnings of the 1st decile earner. On the other end of the scale, we find Norway where in the same year the 9th decile earner made 2.2 times the earning of the 1st decile earner. Using Esping Andersen's (1990) country classification of the Three Worlds of Welfare Capitalism, we find an average level of 3.3 for the Liberal countries, 3.1 for the Conservative countries, while the Social Democratic group of countries have an average of 2.3. We also find large differences in the time pattern experienced by the different countries. Out of the 26 countries listed here, 15 have experienced an increase in wage inequality from the first to the last of the observed 5-year periods while 11 countries have experienced a decline in wage inequality.

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, in the case of unemployment and in case of disability (including old age) of each country year cell. The generosity index is constructed using both the replacement ratio, coverage, entitlements and timing of different schemes. Detailed descriptions of the data are provided in the appendix. Again we find considerable differences across countries. In 2002 the index takes the value of 35.7 for Sweden and only 18.6 for Switzerland. Averaging the overall generosity index across the country groups of the Three Worlds of Capitalism gives 21.0 for the Liberal countries, 28.4 for the conservative countries and 37.4 for the Social Democratic countries.

Many studies use public spending as a measure of welfare generosity. In Figure 6 in the appendix displays the trend in both the generosity index (solid line) and in public social expenditures as reported by the OECD (scatterplot). Public spending is a measure of outlays associated with any given level of generosity, while the overall generosity index measures the generosity of the system, as reflected in the rules concerning replacement rates, coverage, entitlements, and timing. While spending varies with economic conditions, such as the business cycle, the generosity index varies only as the rules of the system change. We find, for instance, that both Sweden and Finland experienced a dramatic growth in public spending during the economic downturn the two countries experienced 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.

Key variables to provide independent variation in welfare spending are indicators of

[11] In all regressions below, a variable indicating data source as well as dummy variables indicating annual versus hourly earnings, and net versus gross earnings, are included when appropriate. See data appendix for details.

right versus left wing power in government, obtained from E. Huber et. al. (2004), Comparative Welfare States Dataset and from Armingeon et. al. (2007) Comparative Political Data Set. 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 Golden, Miriam; Peter Lange; and Michael Wallerstein data set (see Golden et al, 2006) and Armingeon et al (2007) respectively. Remaining explanatory variables, such as union density, openness, GDP per capita, the share of elderly in the population, the share of the population with tertiary education and the employment rate of the 16-64 population are detailed in the appendix.

We also provide supplementary evidence by taking a closer look at the last half a century of experience in the US, using a separate data set. The sources of these data are described in detail in the appendix.

6 Results

Table 1 provides the results from three stage least square (3SLS) estimations of both the generosity and inequality. Each equation includes fixed country effects, and the variables not included in one of the equations serve as instruments in the other equation. Year dummies are included in the second set of equations, but not in the first set. We find the year dummies to be insignificant in both equations, and thus prefer the first set.

6.1 Estimating the Equality Magnifying Effect

The first key prediction of our model is that more equal wages lead to higher welfare spending (*Proposition 1*). The first column of table 1 confirms this prediction empirically. The elasticity of welfare generosity with respect to wage dispersion is -.64. This effect is both statistically and economically significant. We also find that welfare generosity is lower when right government is in power; 5 years of right wing government implies a 2.6 percent reduction in welfare generosity. This effect is statistically significant, but not very large. Furthermore we find that welfare generosity increases with income (GDP per capita), decreases with openness and union density[12], and that there seems to be a downward trend in welfare generosity over time, conditional on income.

Welfare generosity is instrumented by both bargaining indicators; coordination and workers in conflict, and by workforce composition measures; tertiary attainment and employment ratio of the working population. Of course, the results depend heavily on the quality of the instruments. We thus investigate statistics from the second stage in some detail. Table 2 shows several specifications of the generosity equation, beginning with an

[12]The effect of openness and union density has the opposite sign in specifications without fixed country effects. The long run relationships between both openness and union density and welfare generosity are positive, but the transitory effect appears to be negative.

Table 1: Welfare Generosity and Wage Inequality

	3SLS FE		3SLS FE+Year	
	Generosity	Inequality	Generosity	Inequality
	Coef./se	Coef./se	Coef./se	Coef./se
Inequality	–.6412***		–.5403***	
- ln(Wage Disp.)	(.1251)		(.1290)	
Generosity		–.5324***		–.5552***
- ln(Gen.Index)		(.0744)		(.1673)
Trend	–.0196***		–.0245***	
	(.0029)		(.0042)	
Right cab. [0,1]	–.0264**		–.0368**	
	(.0083)		(.0119)	
ln GDP per cap.	.4464***	.1642***	.5202***	.1321
	(.0387)	(.0204)	(.0602)	(.1134)
Openness (pct GDP)	–.0037***	–.0043***	–.0032**	–.0047***
	(.0011)	(.0010)	(.0012)	(.0010)
Share 65+ pct	.0071	–.0084**	.0105*	–.0091*
	(.0046)	(.0030)	(.0047)	(.0039)
Union Density	–.0024**	–.0010	–.0026**	–.0013
	(.0008)	(.0008)	(.0008)	(.0008)
Barg. Coordination		–.0208**		–.0178**
		(.0065)		(.0069)
Conflict (pct)		.0015***		.0014**
		(.0003)		(.0006)
Tertiary (pct pop)		–.0021*		–.0010
		(.0009)		(.0012)
Empl.pct. 16-64		.0024***		.0031***
		(.0006)		(.0007)
Constant	–.7411	1.4466***	–1.6799*	1.7266**
	(.5218)	(.1911)	(.7116)	(.6550)
Country fixed effects	Y	Y	Y	Y
Year fixed effects			Y	Y
P-value years			.2747	.9830
No. of cases	356	356	356	356

Number of countries: 18. 3 stage least square estimations. Dependent variables: ln(Overall Generosity Index) and ln(Wage dispersion). Instruments for wage inequality are Bargaining coordination, Workers in conflict, Share of pop. with tertiary education and the employment pct(16-64). Instruments for generosity are Right cabinet and trend. All models include fixed country effects. Several statistics from second stage models are reported in tables 2 and 4.

Table 2: Welfare Generosity

Dependent variable: ln(Generosity Index)					
	OLS	OLS-FIX	IV-1	IV-2	IV-3
	Coef./se	Coef./se	Coef./se	Coef./se	Coef./se
ln(Wage Dispersion)	–.4938***	–.3743***	–.6343***	–.7833***	–.5083*
	(.0453)	(.0601)	(.1315)	(.2005)	(.2226)
Country Fixed Effects		Y	Y	Y	Y
Additionally included				Emp.rate Tertiary	Barg. coord. Work. confl.
F-value Fixed Country		75.8640			
Sargan test p-value			.2413	.0965	.1988
Cragg-Donald F-value			21.85	20.15	14.47
Hausman test p-value			.0219	.0163	.3733
P-value composition				.5633	
P-value bargaining					.2509
No. of cases	356	356	356	356	356

Note: The models also include the covariates Trend, Right cabinet, ln(GDP per capita), Openness, Percent 65+, and Union Density. In IV-1-IV-3 instruments for wage inequality include Bargaining coordination, Share of workers in conflict, Share with tertiary education and the Employment rate 16-64, when not additionally included in the equations.

OLS regression of the welfare generosity index as a benchmark. The models also include the same covariates as in table 1; a full set of results is provided in the appendix. We find a negative significant OLS elasticity of generosity with respect to wage dispersion of -.49. Including country fixed effects reduces the estimate to -.37, indicating that there is a negative correlation between the permanent country specific components of welfare generosity and wage inequality.

The subsequent models instrument for wage inequality. As in table 1, the instruments for wage inequality include Bargaining coordination, Share of workers in conflict, Share with tertiary education and the Employment rate 16-64. IV-1 is our preferred specification from table 1. We find an elasticity of generosity with respect to wage inequality of -0.63. Tests of overidentification and weakness of instruments are highly satisfactory and the Hausman test clearly indicates endogeneity of wage inequality in the previous model. In models IV 2 and IV 3 we check the robustness of our result, by adding the instruments to the generosity equation in two blocks. In model IV 2, the share of tertiary and the employment ratio (16-64) are included in the generosity equation. In this specification we use as instruments the bargaining variables only. The skills distribution proxies do not enter the generosity equation significantly (see appendix table 12), and the effect of wage dispersion is at least as strong when identifying the effects from the bargaining variables only. We also note that the Cragg-Donald F-value is 20.15, implying again that

Table 3: The Equality Magnifying Effect. Sub-samples

Dependent variable: ln(Generosity Index) Specification IV-1 from Table 2.
Group of countries excluded:

	America	Oceania	BritIsl	LargeEU	SmallEU	Nordic
	Coef./t	Coef./t	Coef./t	Coef./t	Coef./t	Coef./t
ln(Wage Dispersion)	–.6353	–.5508	–.6308	–.4750	–.6664	–.6195
	–4.04	–4.59	–4.80	–2.34	–5.35	–4.80
No. of cases	314	289	321	289	315	278

Note: The tables shows the coefficient (t-value) of ln(wage dispersion) in IV-regressions of ln(Generosity), with identical specification to that of model IV-1 in Table 3, 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, and Sweden.

our results from model IV 1 are not due to weak instruments. The next column provides the results from the complementary experiment of introducing the bargaining variables into the generosity equation, identifying wage dispersion from the skills-proxies only, with similar results (even though the C-D-value is less good, it is still clearly satisfactory).

We have run a host of other specifications. Most notably, similar results are obtained when we add year dummies instead of a linear trend, the coefficient for wage inequality changed only marginally to -.540(.132) and a high Cragg/Donald F-value of 19.73 was retained. A specification where wage dispersion enters directly, not in logarithmic form, gives an estimated coefficient of -.150(.042).

Equality magnified: Sub-samples

A typical worry when using international data sets is that the results could be driven in particular by the outcomes of only one country or one set of countries. This worry may arise out of two considerations. First, there is the standard problem of potential outliers. We don't want the results simply to be driven by one or two observations. But when we use instrumental variables methods, there is the added worry that the results could be driven by peculiar patterns of change in the instruments. We thus check that our instrument variable model produces similar results for sub-samples in our data. In this way we eliminate the possibility that the all relevant action in the instruments comes from changes in only one or two countries. Furthermore, comparing results from sub-samples may reduce worries about heterogenous effects arising from different dimensions of the instrument vector, worries that may arise since the instruments are likely to have changed differently across the full sample.

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 4 we show results from identical specification as IV-1 from table 5, estimated on these sub-samples. 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.

6.2 Estimating the Wage Equalizing Effect

The second key prediction of our model is that more generous welfare benefits lead to wage compression (*Proposition 2*). The second column of table 1 confirms this prediction empirically. The elasticity of wage dispersion with respect to welfare generosity is -0.53. This result is both statistically and economically significant. We find that increasing bargaining coordination by one unit reduces wage dispersion by 2 percent, while increasing the share of workers who are engaged in a conflict by ten percent of wage earners, increases wage dispersion by 1.5 percent. Higher tertiary attachment and lower employment ratio among both reduce wage dispersion. We also note that there is a significant positive impact of GDP per capita, and a negative impact of openness.

Wage inequality is instrumented by the right government indicator and the trend variable. Again we show some statistics from the second stage models in order to provide an assessment of the quality of the instruments (full results are reported in appendix table 13). The first model of table 4 shows OLS results as a benchmark. The next model includes country fixed effects. In both models, we find a negative coefficient for wage dispersion of between -.25 and -.3. Model IV 1 shows the preferred instrumental variable model, including fixed country effects. The estimated elasticity of wage inequality with respect to welfare generosity is -.51.

The Cragg-Donald F-value of 48.11 is highly satisfactory, the Sargan test of overidentification clearly indicates that the instruments do not belong in the main equation, and the Hausman test indicates endogeneity of generosity in the previous fixed-effects model. In models IV2 we include right wing government in the regression, and find that it has no significant independent influence on wage inequality. In model IV3 we include year dummies in order to allow for a fully flexible time trend and to check how the model performs when we identify generosity through changes in government only. The coefficient for generosity remains practically unaltered. Furthermore, Cragg-Donalds F-statistics are satisfactory in both IV2 and IV3. This means that we do not have to rely on any of the two instruments in order to obtain our main result. In particular, it is comforting to note that the model performs well also when we do allow for a fully flexible trend in both equations. However, since the year dummies are not significant in specification IV 3, specification IV 1 remains our preferred model. All in all we get strong support for our second key prediction from the theoretical model.

Table 4: Wage Inequality

Dep.var. ln(d9/d1)					
	OLS	OLS-FIX	IV 1	IV 2	IV 3
	Coef./se	Coef./se	Coef./se	Coef./se	Coef./se
Generosity	–.2891***	–.2697***	–.5143***	–.5207***	–.5033**
	(.0417)	(.0388)	(.0840)	(.0854)	(.1823)
Country Fixed Effects		Y	Y	Y	Y
Additionally included				Right government	Year dummies
F-value ctry.fix.eff		93.70			
p-value year dummies					.9496
Sargan test p-value			.6581		
Cragg-Donald F-value			48.11	93.43	19.98
Hausman test p-value			.0004	.0004	.0523
No. of cases	356	356	356	356	356

Note: The models also include the covariates Bargaining Coordination, Workers in Conflict, Tertiary, Employment percent 16-64, ln(GDP per capita), Openness, Population 65+. The instruments for generosity in models IV1-IV3 include right cabinet and trend with the exception of the included variable in each model. All equations include data source controls (see data section for details).

Table 5: Wage Inequality

Dep.var. ln(d9/d1) Group of countries excluded:						
	America	Oceania	BritIsl	LargeEU	SmallEU	Nordic
	Coef./t	Coef./t	Coef./t	Coef./t	Coef./t	Coef./t
Generosity	–.4539	–.6212	–.4777	–.4247	–.5738	–.5429
	–4.77	–6.16	–3.56	–4.97	–6.32	–6.32
No. of cases	314	289	321	289	315	278

Note: The table shows the coefficient (t-value) of ln(Generosity) in IV-regressions of ln(Wage Inequality), with identical specification to that of model IV-1 in Table 5, 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, and Sweden.

Wages equalized: Sub-samples

Again, we may worry that this result arise from some outlier, or from instruments kicking in only for a very few observations. We thus do the same exercise for the wage inequality equation as we did for the generosity equation: We estimate the model excluding different groups of countries. No country is included in all of the models. Table 6 shows the result from this experiment. 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.

Close tie in parliament

Since the identification of the wage inequality curve depends on one single substantial instrument only, namely right government, we have undertaken a few further tests in order to check the quality of this instrument. The idea is that comparing observations where there is a close tie in the parliament, we compare situations where the assumption that right versus left government can be treated as if it was an exogenous random event. The results are reported in table 15 in the appendix where we provide three different experiments.

In the first two we constructed a "tie-variable" taking the value of one with a 50/50 setting in the parliament, and declining linearly towards zero at 0/100 and 100/0. The first two columns of table 15 show the results where our instrument is right government weighted by the tie variable, and the next two columns show the results when we weight each observation by the tie variable, using the specification from table 1. In both experiments we find even stronger effects of the right government variable in the generosity equation, and an estimated equality multiplier of 1.49 and 1.28. The results indicate that our instrument (right government) is even more likely to be valid than in the cases where voters have given one of the blocks a strong support.

In the last experiment we replace our right government variable with the 5-year lead of the same variable.[13] In this 'placebo' experiment, the 5 year lead has no effect on generosity (identification of the wage equation is only through the trend variable in that case).

All in all, as a supplement to the specification tests presented in section 5.5, these experiments strengthen the case for right government as a valid instrument.

6.3 Estimating the Equality Multiplier

We have shown how wage equality stimulates the generosity of welfare spending, and how the generosity of welfare spending generates further wage compression. But a shift in one of the two curves generates feed-back effects until system reaches a new equilibrium. The

[13]Note that since right government is an average of the last 5 years, the 5-year lead starts moving already with a right wing government the next year.

Table 6: The Equality Multiplier

	3SLS FE		3SLS FE+Year	
	Generosity Coef./se	Inequality Coef./se	Generosity Coef./se	Inequality Coef./se
Inequality	–.6412***		–.5403***	
	(.1251)		(.1290)	
Generosity		–.5324***		–.5552***
		(.0744)		(.1673)
Equality multiplier	1.5183		1.4285	
E.M l.e. 1:p-value	.0018		.0440	
No. of cases	356		356	

Summary statistics from the first models of table 1. Number of countries: 18. Dependent variables: ln(Overall Generosity Index) and ln(Wage dispersion). Instruments for wage inequality included in the IV specifications are Bargaining coordination, Workers in conflict, Share of pop. with tertiary education and the employment pct(16-64). Instruments for generosity included in the IV specifications are Right cabinet and trend. Models are identical to the two first columns in table 1 and include fixed country effects. p-value for one-sided test.

initial shift is then magnified by the multiplier. This section combines the two equations of the 3SLS framework in order to provide an empirical estimate of the equality multiplier.

Table 6 shows the key coefficients of this model, taken from table 1. Below the line we show the calculated equality multiplier (see equation 4) from the two equations. In our preferred model, the estimated equality multiplier is as large as 1.52, implying that any exogenous change is magnified by 52 percent due to the cumulative impact of the feed back effects. This effect is both statistically and economically significant.

We re-estimated the model using only OECD figures of reported wage inequality from every country.[14] The number of observations was reduced to 331, but the results were almost identical to those of the full sample. The equality multiplier is now estimated to 1.49. This shows that our results do not depend on the inclusion of additional data sources for wage inequality.[15] We also re-estimated the model using two different semi-logarithmic specifications as well as a linear-linear specification. The key coefficients are reported in appendix table 14. The estimated equality multipliers varies reasonably within the range from 1.33 to 1.57. Hence, the gist of the results is robust to changes in functional form.

[14]Results (not shown) are available from the authors on request

[15]Note that this experiment not only changes the sample size, but also that the wage data are different for country·year observations that include data from several sources in the original data set. See appendix table 3 for a description of wage data sources.

Orders of magnitude

To illustrate the order of magnitude of the effects and the feedbacks, we discuss some contra-factual experiments, using the 3SLS fixed effects results of table 1. Keeping a right wing government for five years reduces the overall generosity index directly by 2.6 percent. A reduction of the overall generosity index by 2.6 percent would then increase wage inequality by 1.4 percent, which again feeds back to 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 4 percent. The total effect on wage inequality via decreased generosity is a 2.1 percent increase. These effects are statistically significant, but not very large in magnitude.

A drop in the coordination index by 4 levels, from full coordination to full decentralization, increases wage inequality by 8.3 percent. Such an increase in wage inequality has a direct negative effect on the demand for welfare generosity of 5.3 percent, which again feeds back to wage inequality. The end result, taking the equality multiplier into account, is an increase in wage inequality of 12.6 percent and a drop in welfare generosity by 8.1 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 8.3 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. Again the end result is an increase in wage inequality of 12.6 percent and a drop in welfare generosity by 8.1 percent.

Rising GDP per capita by 10 percent has a direct effect on both generosity (+4.5 percent) and on wage inequality (+1.6 percent). However, because of the feedback effects, the overall effects are a 5.3 percent increase in generosity and a 1.2 percent reduction in wage inequality. The effect of openness is negative on both generosity and inequality, as is the effect of union density. In both of these cases, the feedback effects thus tend to cancel out the initial impacts, and thus dampen the final effect on both outcomes. We also note, for instance, that increased tertiary education increases the demand for the social insurance, but only through its equalizing effect on wage dispersion. A similar observation may be made with respect to the employment rate of the working age population, which tends to give higher wage dispersion and thus reduced demand for social insurance.

Three worlds

How much of the differences between the three worlds of welfare capitalism of Esping Andersen (1990) can be explained by our model? The first column of table 7 shows the raw differences in wage inequality and generosity between the three worlds, measured as the percentage difference from the (unweighted) 18-country de-trended averages. We

Table 7: Three Worlds of Capitalism

Inequality and Generosity:
Percent differences from 18-country mean

	Raw detrended	Reduced form	3SLS-FE
Wage Inequality			.
Liberal	19.44	13.60	6.47
Conservative	-0.15	-2.15	-8.19
Soc.Dem	-19.29	-11.45	1.72
Span Lib-Soc.D	38.73	25.04	4.75
Generosity			.
Liberal	-19.96	-13.32	-4.93
Conservative	-6.96	-9.62	-12.52
Soc.Dem	26.92	22.94	17.46
Span Lib-Soc.D	-46.88	-36.26	-22.39

Note: Each entry shows the percentage deviation of the (unweighted) mean of the country fixed effects of each group of countries, relative to the overall mean. The first column shows the deviation of the average fixed country effects from a model only including a trend, the second column shows the deviation of the average fixed country effects from the reduced form equations underlying the table 1. The third column shows the deviation of the average fixed country effects from the 3sls specification of table 1. See data section for exact definition of each group of countries (or World of Capitalism). The percentageage deviation is calculated as 100x(eb -1), where b is the (unweighted) mean deviation of the estimated fixed effect for each group. Dependent variables; Wage inequality: ln(wage dispersion), Generosity: ln(Overall generosity index).

find, for instance, that the liberal countries have almost 20 percent higher wage inequality than the 18-country average in our sample, and that the span between the liberal and the social democratic countries adds up to more than 38 percent of the average wage inequality. The liberal countries have 20 percent lower welfare generosity, and the span between the liberal and the social democratic countries adds up to 47 percent of the average welfare generosity score. We note that the conservative countries as a group are relatively close to the OECD average in terms of both generosity and wage inequality.

The second column of table 8 shows the same type of aggregate country effects for the reduced form model. Concerning wage inequality, we find that when conditioning on all the exogenous variables, the unexplained gap between liberal and social democratic countries drops significantly from 38 percent to 25 percent of the average value. Similarly, the gap between liberal and social democratic countries in terms of generosity, drops from 47 to 36 percent.

The third column shows the aggregate remaining fixed effects in each single endogenous variable, when also conditioning on the other endogenous variable. The numbers are

calculated as averages of the fixed effects of the 3SLS model of table 7. The upper panel shows the remaining unobserved differences in wage inequality when we force welfare generosity to be equal in every country, in addition to the other exogenous variables in the model. We find a span between the liberal countries and the social democratic countries of 5 percent. The gap between these two worlds of capitalism in terms of wage inequality is reduced to 1/6th of the raw gap, once controlling for all factors in our model.

The lower panel shows the remaining unobserved differences in generosity when we force wage inequality to be equal in every country, in addition to the other exogenous variables in the model. We find a span between the liberal countries and the social democratic countries of 22 percent. The gap between the two worlds of capitalism in terms of welfare generosity is less than one half of the raw gap, once controlling for all factors in the model.

Our estimated mechanisms are thus able to pick up a significant part of the differences in wage inequality and welfare generosity between the three worlds. In particular, it turns out that the feed back effects between labor market institutions and welfare generosity contribute considerably to the differences between the three worlds of welfare capitalism.

6.4 Inequality at the top or at the bottom?

Most of the action in our theoretical model arises from the lower part of the wage distribution. The Equality Magnifying effect is likely to be more affected by the bottom half of the wage distribution than the top half since the majority of workers earn less than the average pay. Compressing the wage differentials below the mean should therefore induce a more generous welfare spending than compressing the differentials at the top.

The Wage Equalizing effect of welfare generosity arises from a strengthening of low paid workers. Thus our arguments assert that employees at the top of the wage distribution are largely insulated from changes in welfare generosity.[16] Hence, one should expect that higher welfare benefits should leave inequality at the top unchanged, and have a similar effect on inequality at the bottom as on overall inequality.The results reported in table 8 confirms this pattern empirically.

When using the bottom part of the wage distribution (i.e. the ratio of the median to the first decile) as our measure of wage inequality, we find a clear equality magnifying effect (although of a somewhat lower magnitude than the one we found using the ratio between d9 and d1); and a clear wage equalizing effect of welfare generosity (of a similar magnitude to the one we found using the ratio between d9 and d1). The estimated equality multiplier is 1.31.

[16]This is partly because there is a larger gap between their income from work and their benefits while on government support, and partly because they have very good employment prospects and are less likely to be dependent on government support.

Table 8: Top and Bottom of the Wage Distribution

	Bottom		Top	
	Generosity Coef./se	Ineq. ln(d5d1) Coef./se	Generosity Coef./se	Ineq. ln(d9d5) Coef./se
Ineq. ln(d5d1)	–.7127***			
	(.1355)			
Ineq. ln(d9d5)			–.1698	
			(.4417)	
Generosity		–.3283***		–.1741***
		(.0566)		(.0450)
Equality multiplier	1.3055		1.0305	
E.m l.e. 1:p-value	.0013		.3535	
No. of cases	355		355	

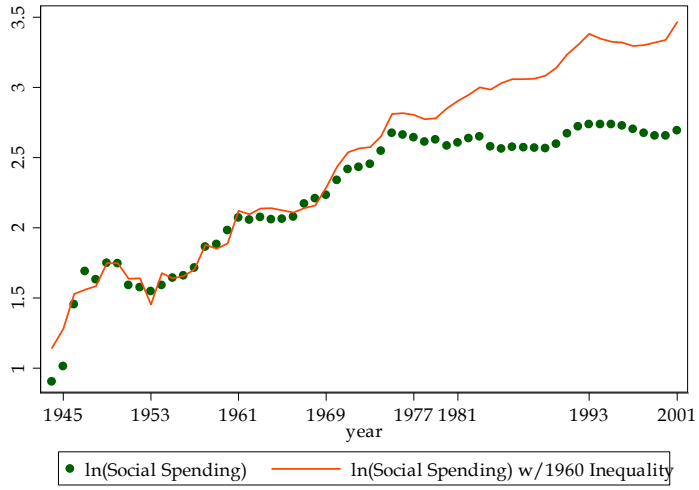
Number of countries: 18. Dependent variables: ln(Overall Generosity Index) and ln(Wage dispersion). Models include the covariates of table 1, including fixed country effects. Instruments for wage inequality included in the IV specifications are Bargaining coordination, Workers in conflict, Share of pop. with tertiary education and the employment pct(16-64). Instruments for generosity included in the IV specifications are Right cabinet and trend. All models include fixed effects.

The picture becomes quite different, however, when we use the top of the wage distribution (i.e. the ratio between the ninth decile and the median) as our measure of wage inequality. The equality magnifying effect is now not significantly different from zero; and the wage equalizing effect is less than half of the estimated effect on the bottom of the wage distribution. There is no multiplier effect when focussing on the top of the wage distribution since wages at the top does not influence welfare generosity.

Hence, interpreting the effect of exogenous changes in the wage distribution, it should be kept in mind that the equality magnifying effect of compressing wage differentials at the bottom is significant both economically and statistically, whereas there is no equality magnifying effects of compressing wage differentials at the top of the distribution. We can therefore conclude that it is changes in the bottom part of the distribution that are magnified through the equality multiplier—as our model predicts.

These results also speak to the current debate about the impact of institutions and politics on inequality. In a challenging contribution Scheve and Stasavage (2008) question the traditionally held beliefs about the impact of wage determination systems and partisanship on the level of (wage)inequality across rich countries. Since, wage data are available only from the 1970s and onwards, they use top income shares for the period 1916-2000 to construct an inequality measure, denoted *Top10-1*, which is highly correlated with d9d1 measures of wage inequality, but not with d5d1—for the period with observations from both. Since we find that both the equality magnifying effect and the wage equalizing effect basically work through the bottom part of the wage distribution

Figure 3: 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

(d5d1) we are skeptical of the use of *Top10-1* as a proxy for wage inequality that are likely to be affected by the institutions of wage bargaining and the color of the government.

6.5 The United States 1945-2001

The US experience of the last century 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 for 1945 to 2001, all drawn from different sources than what is used in the previous analysis.[17]

Table 9 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 sending reduces wage dispersion).

[17]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 Golden and Katz (2006). The series underlying figure 5 in Golden and Katz (2006) is kindly provided by the authors. See note under figure 2 for details.

Table 9: 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), trend*(Right cabinet)and dummies for Presidential period. Statistics from 2SLS robust to heteroscedasticity and autocorrelation (except p-values for the equality multiplier which is calculated from joint estimation (reg3 in stata, 3SLS).

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 trends (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 yields a negative insignificant coefficient).

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[18]. In addition we find significant differences across presidential periods. The upward shift during the Nixon and Ford administration, 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.

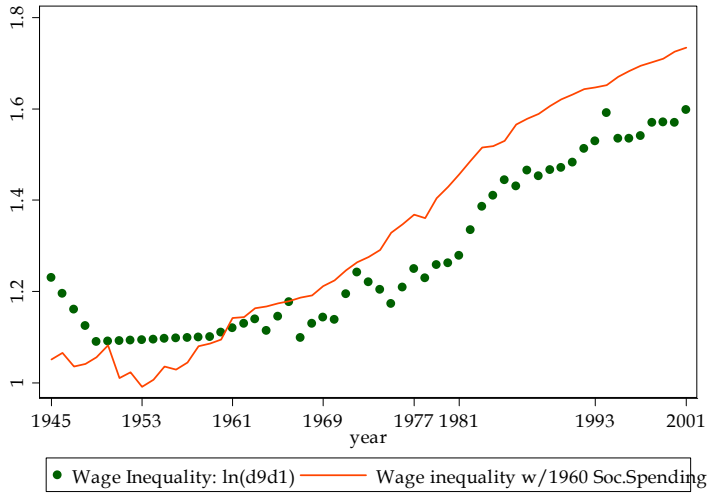
The first inequality equation shows a significant negative effect of union density, and a negative elasticity of wage dispersion with respect to social spending of .2. The estimated equality multiplier is 1.4. Several authors have argued that after 1980, skill-biased technological change, computerization in particular, shifted the trend in demand for high skilled workers[19]. 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 display 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

[18]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

[19]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.

Figure 4: 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 keeping social spending at 1960 level throughout.

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. The ideal strategy would be to instrument the minimum wage as well, but this would be outside the scope of our paper. We thus conclude that adding the minimum wage to the model changes the key results very little, and that further analysis of the effects of the minimum wage is warranted [20].

(In)equality magnifying effect

Figure 3 shows the factual and a contra-factual development of public social spending for the US. 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 effect of changes in wage inequality on the development of social spending.

[20] A recent analysis is provided by Autor and Manning (2008) who use differences in the minimum wage across states over time to estimate the effect of the minimum wage on the US wage structure

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. Next, we find that the increase in wage inequality after 1975 and in particular from the 1980's onwards have led to a considerable entrenchment in social spending. One interpretation of this observation, which would be in accordance with our model, is that the increase in wage inequality after 1980, partly due to technological change and partly due to changes in unionism in the US, reduced the popular demand for social insurance, since it lead to a drop in income for the median worker, relative to the overall trend. This made it easier for Ronald Reagan to get closer to his preferred level of welfare generosity without loosing voters, and vice versa for the Democrats.

Wage equalizing effect

Looking at the factual and contra-factual development of wage inequality displayed in figure 4, 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 constant. However, we also note that the earliest level of wage inequality would not have been so high, had welfare generosity been at the 1960 level. Furthermore, we note that the increase in wage inequality, a result possibly of technological change after 1980, reduced union density and an increasing growth in college attainment over the whole period, would have been even stronger, had welfare generosity stayed at the 1960 level.

A careful look also reveals that the surge in wage inequality during the 1980's was even steeper as a result of the retrenchment in social spending, than what it otherwise would have been. 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 trend.

Interpreting the US case

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 proper casual evidence by itself for the mechanisms we propose. However, the results fit nicely with the results from the panel study across countries and thus provide additional empirical support for our propositions. The picture that emerges from this country analysis is one where there are strong underlying forces working in the direction of higher social spending, in particular growth in GDP per capita, and at the same time there has been underlying forces working in the direction of higher wage inequality, in particular recent

technological changes and the decline in union power in the US. Because of the negative feedbacks between these two variables, these underlying trends are partly kept in check by each other.

7 Conclusion

We have demonstrated how economic and social equality can multiply due to the complementarity between wage determination and welfare spending. On the one hand a more equal wage distribution fuels welfare generosity via political competition. This is the equality magnifying effect. On the other hand a more generous welfare state fuels wage equality further via its support to weak groups in the labor market. This is the wage equalization effect. Together the two effects generate a cumulative process that adds up to a sizable social multiplier. Using data on OECD countries over the period 1976-2002 we are able to identify an equality multiplier of more than 50 per cent. Using time series data for the US, we have also shown that this cumulative process had a significant impact on the joint development of social spending and wage inequality in the United States over the last half century.

The political economic equilibrium approach that we use incorporates the mutual dependence between institutionalized labor markets and social welfare policies. While social welfare spending depends on the wage dispersion in the labor market, it also feeds back to the determination of this wage dispersion. The political economic equilibrium outcome is a wage dispersion and a level of welfare spending that are consistent taking the mutual feed-backs into account.

Using this political economic equilibrium in the empirical part of the paper we are able to explain why countries cluster around different societal models: the Scandinavian model, the Continental model, and the Anglo-Saxon model. Combined with country fixed effects and differences in other explanatory factors, the equality multiplier helps explain why almost equally rich countries differ so much in the economic and social equality that they offer their citizens. We find that it is complementarities between institutions—not specific features of the welfare states themselves—that can account for the major differences between these three worlds of welfare capitalism.

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A The political equilibrium of welfare spending

We derive first the probability that the left wins: $q = q\left(G_L, G_R\right)$. If $G_L = G_R = G_m$, the expected vote shares are $1/2, 1/2$. With $G_L > G_R$ voters with

$$v\left(G_L; p\right) \geq v\left(G_R; p\right) \tag{A-1}$$

vote left. This means that voters in positions p below a threshold tend to vote left. Using the constant elasticity of the utility function this threshold can implicitly be expressed as:

$$k(g_L, G_R) \equiv \frac{U\left(G_L\right) - U\left(G_R\right)}{U\left((1-\gamma G_R)\bar{p}\right) - U\left((1-\gamma G_L)\bar{p}\right)} \geq \frac{1-e(p)}{e(p)} \frac{U(w(p))}{U(\bar{p})} \equiv h(p) \quad \text{for } G_L \neq G_R \tag{A-2}$$

where $h(p)$ is strictly increasing in p as long as (8) holds.

$k(G_L, G_R)$ is declining in G_L and G_R:

$$\frac{\partial k}{\partial G_L} = \frac{\Delta_g/(G_L - G_R)}{\Delta_p} \left[\frac{U'(G_L)}{\Delta_g/(G_L - G_R)}) - \frac{U'\left((1-\gamma G_L)\bar{p}\right)}{\Delta_p/(G_L - G_R)\gamma\bar{p}} \right] < 0 \tag{A-3}$$

$$\frac{\partial k}{\partial G_R} = \frac{\Delta_g/(G_L - G_R)}{\Delta_p} \left[\frac{U'\left((1-\gamma G_R)\bar{p}\right)}{\Delta_p/(G_L - G_R)\gamma\bar{p}} - \frac{U'(G_R)}{\Delta_g/(G_L - G_R)} \right] < 0 \tag{A-4}$$

where

$$\Delta_g = U(G_L) - U(G_R)) \tag{A-5}$$

$$\Delta_p = U\left((1-\gamma G_R)\bar{p}\right) - U\left((1-\gamma G_L)\bar{p}\right) \tag{A-6}$$

The signs follow as for concave $U(\cdot)$ we have

$$\frac{U'(G_L)}{\Delta_g/(G_L - G_R)}) < 1 < \frac{U'\left((1-\gamma G_L)\bar{p}\right)}{\Delta_p/(G_L - G_R)\gamma\bar{p}} \tag{A-7}$$

$$\frac{U'\left((1-\gamma G_R)\bar{p}\right)}{\Delta_p/(G_L - G_R)\gamma\bar{p}} < 1 < \frac{U'(G_R)}{\Delta_g/(G_L - G_R)} \tag{A-8}$$

Observe that

$$\frac{\partial k}{\partial G_R} \approx \frac{\partial k}{\partial G_L} \tag{A-9}$$

as long as

$$\left[\frac{U'\left((1-\gamma G_R)\bar{p}\right)}{\Delta_p/(G_L - G_R)\gamma\bar{p}} - \frac{U'(G_R)}{\Delta_g/(G_L - G_R)} \right] \approx \left[\frac{U'(G_L)}{\Delta_g/(G_L - G_R)}) - \frac{U'\left((1-\gamma G_L)\bar{p}\right)}{\Delta_p/(G_L - G_R)\gamma\bar{p}} \right] \tag{A-10}$$

which is the case since

$$\frac{U'(G_L) + U'(G_R)}{\Delta_g/(G_L - G_R)} \approx \frac{U'\left((1-\gamma G_L)\bar{p}\right) + U'\left((1-\gamma G_R)\bar{p}\right)}{\Delta_p/(G_L - G_R)\gamma\bar{p}} \tag{A-11}$$

Since $h(p)$ is strictly increasing in p, we can express (A-2) as $p < h^{-1}(k(G_L, G_R))$, implying that the expected vote share for the left $s_L = 1 - s_R$ is

$$s_L = \Phi(h^{-1}(k(G_L, G_R))) \quad \text{for} \quad G_L \neq G_R, \quad s_L = 1/2 \quad \text{otherwise} \tag{A-12}$$

where $\Phi(\cdot)$ is the cumulative density function for p.

To eliminate an artificial kink in the vote shares at $G_L = G_R$ we assume that the actual vote shares are affected by random events (new political issues, performance on TV, and popularity waves) after party proposals are determined, but before the election. We have that the vote share for left is $s_L + \varepsilon$, and similarly for the right $s_R - \varepsilon$. The stochastic error term ε has a symmetric distribution around $E\varepsilon = 0$.

The probability that left wins is

$$q = q\left(G_L, G_R\right) = \Pr\left(s_L + \varepsilon > 1/2\right) = \Pr\left(\Phi(h^{-1}(k(G_L, G_R))) + \varepsilon > 1/2\right) \tag{A-13}$$

which is continuous and differentiable.

The first order conditions for party proposals:

$$\frac{\partial q}{\partial G_L}\left[v_L\left(g_L\right) - v_L\left(g_R\right)\right] + q\frac{\partial v_L}{\partial G_L} = 0 \tag{A-14}$$

$$-\frac{\partial q}{\partial G_R}\left[v_R\left(G_R\right) - v_R\left(G_L\right)\right] + \left(1 - q\right)\frac{\partial v_R}{\partial G_R} = 0 \tag{A-15}$$

Consider the case with linear party preferences $v_R = -Ag$ and $v_L = Bg$, with A and B positive. The expressions (A-14) and (A-15) then simplify to

$$\frac{\partial q}{\partial G_L}\left[G_L - G_R\right] + q = 0 \tag{A-16}$$

$$-\frac{\partial q}{\partial G_R}\left[G_L - G_R\right] - \left(1 - q\right) = 0 \tag{A-17}$$

Since

$$\frac{\partial q}{\partial G_L} \approx \frac{\partial q}{\partial G_R} \tag{A-18}$$

equations (A-16) and (A-17) imply that $q \approx 1 - q$, i.e. $q \approx 1/2$.

B Data sources and definitions

The data used in the core analysis of this paper is a panel of 356 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 9th 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], supplemented by data from Employment Outlook, 1996, table 3.1. (1979-1995), and 2007 Table H.(1995,2005) and from the OECD Society at a Glance, Social Indicators, 2006 (data EQ2 – earnings dispersion of full time workers, 1990-2003). Additional series are calculated on the European Community Household Survey-ECHP (1994-2001). For the Nordic countries, we have collected additional series from national data sets, obtained from the NOS-S project (see Asplund et al 2007), covering the period from 1980-2001. In order to minimize measurement errors, an average over these three 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, NOS-S) in the construction of each countryxyear-cell average, as well as a separate trend variable for the ECHP data, in order to account for potential heterogeneity in definitions etc. between the sources. In addition, an indicator variable taking the value of 1 if wages are measured annually and an indicator variable taking the value of 1 if wages are measured net of taxes are included in all regressions involving wage dispersion. The table in figure 5 provides an overview of the years covered from the different sources, and table 10 provides a description of the ratio between the 9th decile and the first decile of pre-tax wages of the OECD countries from 1975 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/˜scruggs/wp.htm).

Figure 6 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 E. Huber et. al. (2004), Comparative Welfare States Dataset and from Armingeon et. al. (2007) Comparative Political Data Set. Right (left) seats are the percentage of seats in Parliament held by

Table 10: Wage Inequality. D9/D1 Ratio, 1975-2005.

Country	Dataset	1975-1979	1980-1984	1985-1989	1990-1994	1995-1999	2000-2004	2005
Australia*	OECD	2.64	2.88	2.83	2.83	2.94	3.08	3.12
Austria*	OECD		3.45	3.51	3.56		3.23	3.26
	ECHP					2.41	2.14	
Belgium*	OECD			2.41	2.28	1.96	1.97	
	ECHP					2.06	2.04	
Canada*	OECD		4.02	4.45	4.21	3.56	3.65	3.74
Chzechia	OECD			2.40	2.74	2.84	2.99	3.10
Denmark*	OECD		2.17	2.18	2.16	2.47	2.58	2.64
	NOS-S		1.98	2.03	2.05	2.09	2.13	
	ECHP					1.87	1.86	
Finland*	OECD	2.65	2.49	2.50	2.39	2.36	2.43	2.42
	NOS-S			2.74	2.71	2.54	2.66	
	ECHP					2.20	2.18	
France*	OECD	3.35	3.18	3.19	3.21	3.07	2.98	2.91
	ECHP					2.88	2.87	
Germany*	OECD		2.88	2.86	2.78	2.93	3.07	3.26
	ECHP					2.88		
Greece	OECD						1.80	
	ECHP					2.70	2.75	
Hungary	OECD			2.84	3.70	4.13	4.37	4.46
Iceland	NOS-S			2.97	3.19	3.29		
Ireland*	OECD				4.06	3.97	3.59	3.57
	ECHP					2.99	2.68	
Italy*	OECD	2.94	2.55	2.28	2.35	2.40		
	ECHP					2.05	2.02	
Japan*	OECD	3.00	3.08	3.15	3.07	2.99	2.96	3.12
Korea	OECD		4.59	4.25	3.75	3.77	4.04	4.48
Netherlands*	OECD	2.57	2.47	2.55	2.60	2.83	2.91	2.91
	ECHP					2.16	2.23	
New Zealand*	OECD		2.17	2.16	2.29	2.57	2.72	2.79
Norway*	OECD		2.06	2.16	1.98	1.94	2.06	2.21
	NOS-S		2.11	2.10	2.06	2.01	2.03	
Poland	OECD		2.59	2.65	3.03	3.49	4.05	4.31
Portugal	OECD			3.56	3.85		3.07	
	ECHP					3.09	2.98	
Spain	OECD					4.22	3.53	3.53
	ECHP					3.13	3.02	
Sweden*	OECD	2.13	2.01	2.09	2.11	2.23	2.31	2.33
	NOS-S			1.81	1.74	1.82	1.94	
Switzerland*	OECD				2.71	2.56	3.01	2.61
United Kingdom*	OECD	2.94	3.09	3.30	3.39	3.46	3.52	3.62
United States*	OECD	3.75	3.91	4.23	4.40	4.57	4.66	4.86
OECD average	OECD	2.89	2.92	2.93	3.02	3.06	3.11	3.30

Note: Five years averages of available data. Each cell does not necessarily represent data from each of the five years of the interval. (*) indicates that a country is one of the 18 countries included in the main analysis in this paper (due to availability of the welfare generosity score). OECD average is an average of the figures obtained from OECD sources.

Figure 5: Wage Data Sources

	OECD Earnings Database 08(*)	Employment Outlook 96	Socity at a Glance 06	ECHP	NOS-S
Australia	76-95, 97-03				
Austria		80,87-94		95-01	
Belgium	85-93		99-03	95-01	
Canada	81,86,88,90-94, 97-03				
Denmark	80-90, 96-03			95-01	80-01
Finland	80,83,86-03	77		96-01	83,87,89,91,93,95,97-03
France	76-98, 00-03			95-01	
Germany	84-03			95,96	
Ireland	94, 97, 00, 03			95-01	
Italy	86-96	79-84		95-01	
Japan	75-03				
Netherlands	77-03			95-01	
New Zealand	82,84,86,88,90,92,94-03				
Norway	97-03	80,83,87,91			80,83,87,91,95,97,00,03
Portugal		85,89,91-93	01-03	95-01	
Spain	95,02			95-01	
Sweden	75,78,80-03				86-02
Switzerland	96,98,00,02		91-03		
United Kingdom	76-03				
United States	76-03				

* OECD Earnings Database figures have been supplemented with data from Employment Outlook 2007 for 1995 when missing. NOS-S are figures reported by Asplund et al (2008).

right (left) parties taken from Huber et al 1976-2000 and supplemented by data from Armingeon et al for 2001-2003. Right (left) government is the five year average of an (present and lagged) indicator variable taking the value of one if the right (left) parties has a majority in government (g.t. 50 percent), constructed from the variable govright (left) of Armingeon et al (2007) (defined as right (left)-wing parties in percentage of total cabinet posts, weighted by days). Population, the employment rate of the 16-64 population as well as the share of elderly in the population are taken from Armingeon et al (2007).

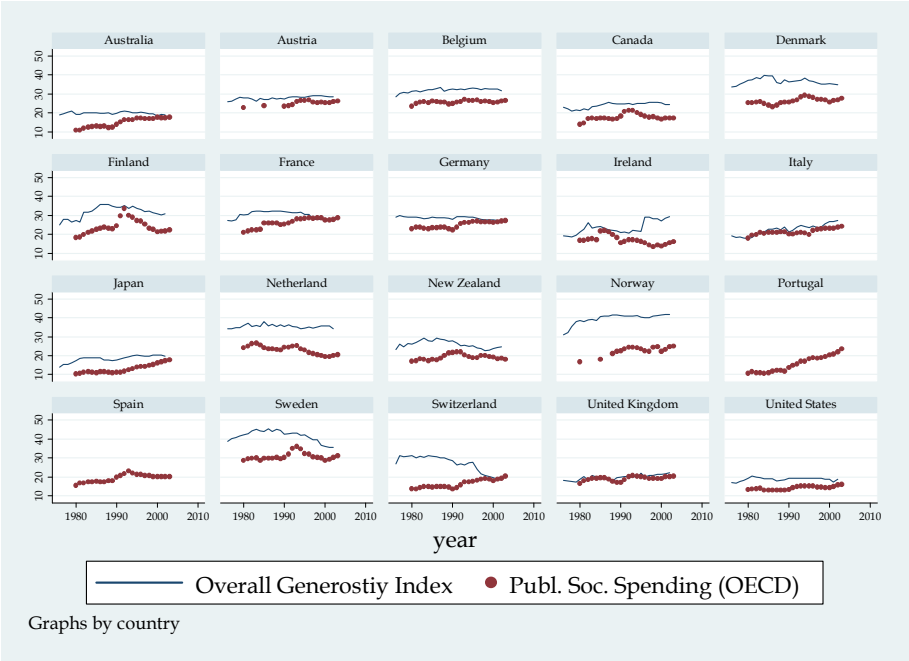
Bargaining indicators: Union density and bargaining coordination from 1976-2000 are obtained from: Golden, Miriam; Peter Lange; and Michael Wallerstein. 2006. "Union Centralization among Advanced Industrial Societies: An Empirical Study." Dataset from http://www.shelley.polisci.ucla.edu/, version dated 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, New Zealand, and Portugal 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

Figure 6: 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.

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, New Zealand and Portugal from OECD Employment Outlook 2007 table 3.5 Centralisation index.

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, 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 data is imputed using linearised values of five years figures reported in Delafuente and Domenech (2002).

The following country classification, which is based on Esbing-Andersen's (1990) decommodification index with some modifications (see eg. Scruggs, 2007), is used illustratively throughout:

Liberal countries: Australia, Canada, Ireland, New Zealand, United Kingdom, United States.

Conservative countries: Finland, France, Germany, Italy, Japan, Portugal, Spain, Switzerland.

Social Democratic countries: Austria, Belgium, Denmark, Netherlands, Norway, Sweden.

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.

B.1 Negative Correlation between Inequality and Generosity

Figure 1 in the introduction shows that countries with high wage inequality tend to have lower welfare generosity scores. Here we check the robustness of this negative association, first by using various measures of both inequality and generosity and secondly by calculating the correlation between the residuals of the two variables in a simple regression framework.

In figures 7 and 8 we ensure ourselves that the negative association is not simply due to the particular measures we have chosen to represent inequality and generosity. In figure 7 we measure the overall generosity index on the y-axis of each figure, while we vary the inequality measure on the x-axis.

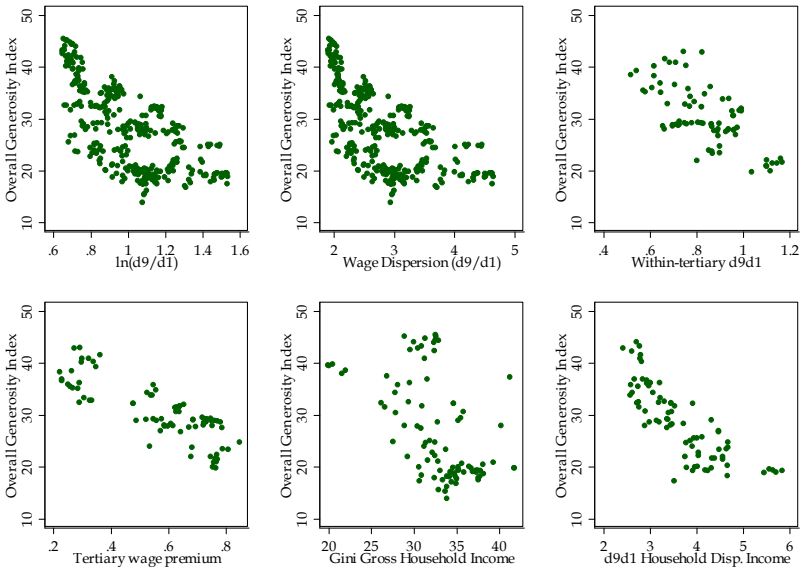
The first panel shows the log of the d9 d1 ratio. The next panel displays d9d1 directly. The next two panels show more detailed measures of wage dispersion, utilizing different dimensions of the data calculated from quantile regressions. These observations constitute a panel of estimates from separate micro data sets for each country-year of 11 European countries (see note to the figure for details). The first; within group wage inequality, shows the interquartile range between d9 and d1 of conditional wages for men with tertiary education, within the same age group working in private manufacturing (see note to the figure for details). The second shows between group wage inequality; measured as the wage premium associated with tertiary education in median Mincer regressions.

The last two panels show measures of household income rather than individual wages. The first shows the gini coefficient of gross household income from Deininger and Squire (1996) while the last panel shows d9d1 ratio of disposable household income calculated from the Luxembourg Income Study.

Figure 8 plots our preferred measure of wage inequality against different measures of welfare generosity and public welfare spending. Again we find a consistent negative pattern between welfare generosity and wage dispersion. Simple regression analyses (not shown), including year dummies, confirm that the downward slope displayed in all panels of figures 3 and 4 display statistically significant downward patterns.

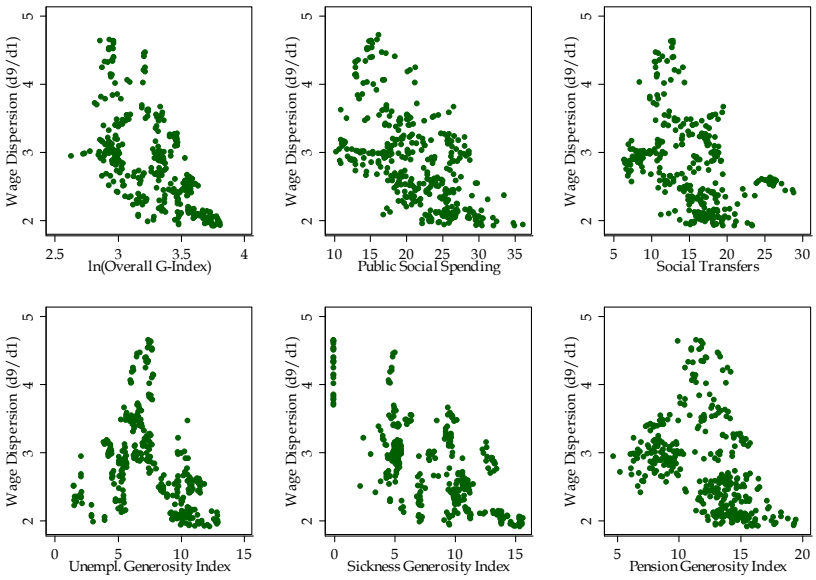
Countries with high wage inequality tend to have lower welfare generosity scores as the figures

Figure 7: Measures of Inequality.



Source; Y-axis: Overall Generosity Index from The Comparative Welfare Entitlements Dataset by Lyle Scruggs, University of Connecticut. X-axis: Panels a and b use wage inequality measures from our data, mainly from OECD sources, see data section for details. Panel c and d display wage inequality measures calculated from quantile regressions from a panel of 11 European countries (Aut, Bel, Den, Fin, Fra, Ger, Ita, Nor, Swe, UK; N=79, years 19080-2002) by the EDWIN project (see www.etla.fi/edwin). Panel c displays the d9-d1 interquantile range of the conditional wage distribution, calculated for individuals with completed tertiary education, of the same age, gender, and within private sector manufacturing. Panel d displays the wage premium associated with tertiary education from q5 of the same quantile regression. Panel e displays the gini coefficient of gross household income from the Deininger and Squire (1996) data. Contries included are Aus, Aut, Bel, Can, Den, Fin, Fra, Ger, Ita, Jap, NZ, Nor, Swe, UK, US; N= 93, years 1976-1992. Panel f shows the d9d1 ratio of disposable household income from the Luxembourg Income Study, countries included are Aus, Aut, Bel, Can, Den, Fin, Fra, Ger, Ire, Ita, Net, Nor, Swe, UK, US; N= 93, years 1976-1992.

Figure 8: Measures of Generosity.



Source; Y-axis: Wage Dispersion from our own data set, mainly from OECD sources, see data section for details. X-axis: Panel a use our preferred measure of generosity: ln(Overall Generosity Score) from the Comparative Welfare Entitlements Dataset, see data section for details. Panels b, c, and d show the underlying indexes which add up to the overall generosity score: Panel b shows the generosity of unemployment benefits, panel c the generosity of sickness benefits, and panel d the generosity of disability and old age pensions. The two last panels show spending data from OECD sources (OECD Social Spending Database), panel e gives the sum of public social spending [Countries included are Aus, Aut, Bel, Can, Den, Fin, Fra, Ger, Ire, Ita, Jap, Net, NZ, Nor, Por, Spa, Swe, UK, US; N=365, years 1970-2003] and panel f shows the sum of social transfers [Contries included are Aus, Aut, Bel, Can, Den, Fin, Fra, Ger, Ire, Ita, Jap, Net, NZ, Nor, Swe, UK, US; N=79, years 1980-2002].

Table 11: Wage Inequality and Generosity

Descriptive regressions

	SUR1		SUR2		SUR3	
	Generosity Coef./se	Inequality Coef./se	Generosity Coef./se	Inequality Coef./se	Generosity Coef./se	Inequality Coef./se
Trend	−.011*	.006	−.012**	.009**	−.033***	.005
	(.005)	(.004)	(.004)	(.003)	(.004)	(.003)
Trend squared	−.001***	.000	−.001***	.000	−.000	.000*
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
log Population			−.135***	.114***	−.096***	.104***
			(.009)	(.007)	(.013)	(.009)
log GDP per capita					.400***	.186**
					(.080)	(.057)
Openness(pct GDP)					.005***	.001
					(.001)	(.001)
Union Density					.001	−.002**
					(.001)	(.001)
Age 65+(pct pop)					.051***	−.043***
					(.005)	(.004)
Constant	3.302***	1.067***	4.632***	−.093	−.752	−1.221*
	(.020)	(.016)	(.088)	(.073)	(.805)	(.576)
R sq.inquality	.044		.426		.647	
R sq.generosity	.295		.561		.726	
No. of cases	356		356		356	
Corr. residuals	−.417		−.373		−.325	
Chi-sq Breush-Pagan	61.9		49.4		37.6	

Dependent variables:ln(Wage Dispersion) and ln(Generosity Index). Inequality equations also include data source controls (see data section).

shows. In table 11 we report descriptive regressions of wage inequality and generosity, using standard SUR-regressions on the pooled data set. Dependent variables are ln(Wage dispersion) and ln(Overall Generosity Index). In the first model, SUR1, we confirm a statistically significant negative correlation between the residuals of wage inequality and welfare generosity, in line with the patterns observed in figures 1 and 2. The correlation coefficient between the de-trended residuals is -0.42 and highly significant.

In model SUR2 we establish that the correlation is not just due to the fact that small countries tend to have more generous welfare states and at the same time less wage inequality. In model SUR3 we find that the richer countries have more generous welfare states and tend to have more inequality. Furthermore we find that more open economies have more generous welfare states, that higher union density is associated with more generous welfare states and more compressed wage distributions, and that the proportion of the population over 65 is positively correlated with welfare generosity and negatively associated with wage inequality. The correlation between the residuals of the two regressions remains negative and highly significant.

C Some further robustness checks

Table 12 and 13 provide the full regression results of tables 2 and 4 in the main text. The first two models are OLS specifications, the third model is the preferred IV-specification, used in the second stage of our 3SLS models in table 1, and the last two models provides a check of the validity of the instruments.

Table 15 reports the results from three different experiments involving the right government variable as instrument. The two first models weights the government variable up if there is a close tie in the parliament, the last model uses the lead rather than the lag of the right wing government variable. See the main text for details and interpretation.

Table 12: Welfare Generosity

Dependent variable: ln(Generosity Index)

	OLS	OLS-FIX	IV-1	IV-2	IV-3
	Coef./se	Coef./se	Coef./se	Coef./se	Coef./se
ln(Wage Dispersion)	−.4938***	−.3743***	−.6343***	−.7833***	−.5083*
	(.0453)	(.0601)	(.1315)	(.2005)	(.2226)
Trend	−.0219***	−.0226***	−.0196***	−.0171***	−.0213***
	(.0027)	(.0027)	(.0030)	(.0046)	(.0033)
Right cabinet [0,1]	−.0341*	−.0382***	−.0285*	−.0223	−.0366**
	(.0170)	(.0111)	(.0121)	(.0138)	(.0128)
log GDP per capita	.4248***	.4649***	.4452***	.4120***	.4498***
	(.0503)	(.0386)	(.0400)	(.0527)	(.0403)
Openness (pct GDP)	.0051***	−.0032**	−.0037**	−.0046**	−.0031**
	(.0005)	(.0011)	(.0011)	(.0015)	(.0012)
Age 65+ (pct pop)	.0167***	.0132***	.0073	.0023	.0106*
	(.0033)	(.0039)	(.0047)	(.0068)	(.0053)
Union Density	.0003	−.0021*	−.0024**	−.0026**	−.0015
	(.0005)	(.0008)	(.0009)	(.0010)	(.0010)
Empl.pct 16-64				.0015	
				(.0015)	
Tertiary (pct pop)				.0008	
				(.0018)	
Bargaining Coord.					−.0088
					(.0142)
Workers in confl.(pct)					−.0009
					(.0007)
Constant	−.9989*	−1.0704*			
	(.5027)	(.4300)			
F-value fixed ctry		75.8640			
Sargan test p-value			.2413	.0965	.1988
Cragg-Donald F-value			21.85	20.15	14.47
Hausman test p-value			.0219	.0163	.3733
P-value composition				.5633	
P-value bargaining					.2509
No. of cases	356	356	356	356	356

Note: The instruments for wage inequality include Bargaining coordination, Share of workers in conflict, Share with tertiary education and the Employment rate 16-64, when not included in the equations.

Table 13: Wage Inequality

Dep.var. ln(d9/d1)

	OLS	OLS-FIX	IV 1	IV 2	IV 3
	Coef./se	Coef./se	Coef./se	Coef./se	Coef./se
Generosity	−.2891***	−.2697***	−.5143***	−.5207***	−.5033**
	(.0417)	(.0388)	(.0840)	(.0854)	(.1823)
Bargaining Coord.	−.0835***	−.0369***	−.0276**	−.0294**	−.0272**
	(.0073)	(.0087)	(.0094)	(.0103)	(.0099)
Workers in confl.(pct)	−.0003	.0014**	.0009*	.0009	.0007
	(.0007)	(.0004)	(.0005)	(.0005)	(.0007)
Tertiary (pct pop)	.0024	−.0001	−.0009	−.0010	−.0001
	(.0013)	(.0014)	(.0014)	(.0015)	(.0017)
Empl.pct 16-64	−.0007	.0028***	.0032***	.0032***	.0043***
	(.0009)	(.0008)	(.0008)	(.0008)	(.0009)
log GDP per capita	.0145	.0959***	.1414***	.1416***	.0719
	(.0286)	(.0227)	(.0273)	(.0274)	(.1200)
Openness (pct GDP)	−.0003	−.0021*	−.0043***	−.0043***	−.0047***
	(.0005)	(.0008)	(.0011)	(.0011)	(.0011)
Age 65+ (pct pop)	−.0138***	−.0107***	−.0095**	−.0090**	−.0110**
	(.0033)	(.0031)	(.0033)	(.0035)	(.0041)
Union Density	−.0023***	−.0008	−.0007	−.0006	−.0005
	(.0005)	(.0008)	(.0009)	(.0009)	(.0010)
Right government[0,1]				−.0046	
				(.0104)	
Year dummies					Y
Constant	2.3396***	1.0933***			
	(.2481)	(.2004)			
F-value ctry.fix.eff		93.70			
p-value year dummies					.9496
Sargan test p-value			.6581		
Cragg-Donald F-value			48.11	93.43	19.98
Hausman test p-value			.0004	.0004	.0523
No. of cases	356	356	356	356	356

Note: The instruments for generosity in models IV1-IV3 include right cabinet and trend with the exception of the included variable in each model. All equations include data source controls (see data section for details).

Table 14: E-multiplier: Different specifications

	3SLS FE G-Index Coef./se	ln(W-disp.) Coef./se	3SLS FE ln(G-index) Coef./se	W-Dispersion Coef./se	3SLS FE G-Index Coef./se	W-Dispersion Coef./se
ln(W-disp.)	−11.932***					
	(3.160)					
Trend	−.560***		−.019***		−.549***	
	(.073)		(.003)		(.078)	
Right cabinet [0,1]	−.798***		−.026**		−.793***	
	(.238)		(.008)		(.236)	
log GDP per cap.	11.755***	.161***	.448***	.577***	11.829***	.558***
	(.972)	(.022)	(.039)	(.063)	(.985)	(.070)
Openness(pct)	−.101***	−.005***	−.005***	−.019***	−.116***	−.021***
	(.028)	(.001)	(.001)	(.003)	(.030)	(.003)
Share 65+ pct	.204	−.010***	.007	−.028**	.215	−.034***
	(.115)	(.003)	(.005)	(.009)	(.119)	(.009)
Union Density	−.054*	−.001	−.002*	−.000	−.041*	.000
	(.021)	(.001)	(.001)	(.002)	(.021)	(.002)
W-Dispersion			−.196***		−3.521***	
			(.041)		(1.048)	
G-Index		−.021***				−.073***
		(.003)				(.010)
Barg. Coord.		−.025***		−.065**		−.077***
		(.007)		(.020)		(.022)
Conflict (pct)		.002***		.003***		.004**
		(.000)		(.001)		(.001)
Tertiary (pct pop)		−.002*		−.003		−.003
		(.001)		(.003)		(.003)
Empl.pct. 16-64		.003***		.009***		.011***
		(.001)		(.002)		(.002)
ln(G-index)				−1.855***		
				(.235)		
Constant	−85.773***	.302	−.845	4.038***	−88.893***	.091
	(13.101)	(.176)	(.526)	(.603)	(13.302)	(.547)
Equality multiplier	1.332		1.573		1.345	
E.m l.t.1:p-value	.005		.003		.009	
No. of cases	356		356		356	

Number of countries: 18. Instruments for wage inequality included in the IV specifications are Bargaining coordination, Workers in conflict, Share of pop. with tertiary education and the employment pct(16-64). Instruments for generosity included in the IV specifications are Right cabinet and trend. See tables 2 and 4. All models include fixed country effects.

Table 15: Robustness checks - 3SLS

	Right-tied		Weighted		Right-lead	
	Generosity Coef./se	Inequality Coef./se	Generosity Coef./se	Inequality Coef./se	Generosity Coef./se	Inequality Coef./se
Inequality	−.6315***		−.4346*		−.7550***	
	(.1247)		(.1869)		(.1114)	
Trend	−.0199***		−.0219***		−.0178***	
	(.0029)		(.0034)		(.0030)	
Right tied	−.0348***					
	(.0101)					
Right cab.[0,1]			−.0342**			
			(.0107)			
Right lead					.0066	
					(.0085)	
Generosity		−.5234***		−.5024***		−.4359***
		(.0730)		(.0696)		(.0853)
Barg. Coordination		−.0204**		−.0218**		−.0302***
		(.0066)		(.0074)		(.0069)
Conflict(pct)		.0015***		.0008		.0015***
		(.0004)		(.0005)		(.0003)
Tertiary (pct pop)		−.0020*		−.0004		−.0017
		(.0010)		(.0012)		(.0010)
Empl.pct. 16-64		.0024***		.0034***		.0026***
		(.0006)		(.0008)		(.0006)
Constant	−.7955	1.4359***	−1.3337*	1.3974***	−.4380	1.3534***
	(.5187)	(.1896)	(.6175)	(.1869)	(.4874)	(.2028)
Equality multiplier	1.4936		1.2793		1.4905	
E.m l.t. 1:p-value	.0018		.0389		.0016	
No. of cases	356		337		307	

Number of countries: 18. Dependent variables: ln(Overall Generosity Index) and ln(Wage dispersion). Specifications as in table 7, only endogenous variables and instruments displayed. In the first model Right Government is weighted by the Tie-variable. In the second model, the full model is weighted by the Tie-variable. In the third model, Right government is replaced by it's 5 year lead.