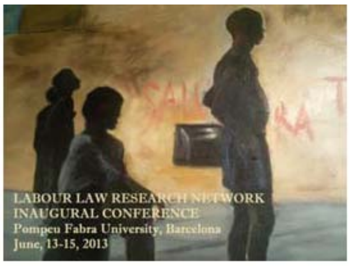

LABOR MARKETS AND THE POLITICS OF REDISTRIBUTION

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Abstract

The central theoretical insight drawn from median-voter models of redistributive voting is that greater inequality will lead to more redistribution. This paper reexamines this proposition. Using the standard median-voter framework, it shows that reductions in income inequality that nevertheless increase the skew of the income distribution will increase the difference between median and mean income, leading the median voter to favor more redistribution. Thus, contrary to the accepted interpretation, the median-voter theory makes no unique prediction about the relationship between inequality and redistribution. In addition, the workforce distribution of skills and productivity is modeled endogenously to explain when reductions in income inequality will lead to a redistribution-increasing skew of the income distribution. In particular, it highlights how different wage bargaining structures interact with investment in general human capital to explain why greater centralization in wage bargaining has a greater compressive effect on the lower-end of the distribution than on the upper-end, leading to greater skew. Extensions of the model to account for voter participation and more general voter preferences strengthen the main results. Finally, several additional insights flow from the model: it provides a novel explanation for the so-called "Robin Hood" paradox (Lindert, 2004), as well as alternative rationales for the positive associations between skew and redistribution (Lupu and Pontusson, 2011), vocational training and government transfers (Iversen and Soskice, 2001), and transfers and economic output (Bénabou, 2000).

Keywords: Redistribution, social spending, taxation, income inequality, labor market institutions, centralized wage bargaining
JEL codes: D31, E62, H2, J3, J51, P16

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1 Introduction

Does more inequality lead to greater redistribution? To answer this question, the median-voter models of inequality and redistributive voting developed by Romer (1975) and Meltzer and Richard (1981) (hereinafter RMR) are invariably cited for the proposition that increasing inequality will lead to greater redistribution (e.g., Alesina and Glaeser, 2004; Karabarbounis, 2011; Kenworthy and Pontusson, 2005; Milanovic, 2000; Moene and Wallerstein, 2001; Persson and Tabellini, 2000). This paper reexamines this interpretation of the RMR framework. Using the identical median-voter hypothesis, I argue that a *reduction* in inequality will just as plausibly lead to an increase in redistribution as will an increase in inequality.

The basic reasoning behind this argument is surprisingly simple. Consider three groups of voters: rich, middle class, and poor, where the median voter has middle-class income. In the dominant interpretation of the median-voter model of redistribution, a change in the distribution of income will lead to an increase in redistribution if it makes the rich richer, the middle class and poor poorer, and leaves the average level of income unchanged. Since the income of the middle class group decreases while mean income stays the same, middle class voters will now gain more from government transfers than they will lose from higher taxes. Since the median voter is politically decisive, the preferences of middle-class voters determine government policy. Thus an increase in inequality will lead to more redistribution. Consider now, however, an alternative scenario. Suppose a change in the income distribution makes the poor richer, but the middle class and the rich poorer, while again leaving mean income unchanged. (It may also be supposed that the rich are made poorer to a greater extent than the middle class.) Once again, because the median, middle-class voter has become poorer relative to the mean income, redistribution will increase. But in this case, income inequality has unambiguously decreased. Thus, the median-voter model makes no unique prediction about the relationship between inequality and redistribution.

To be sure, there are clear limits to this mechanism. For example, if inequality is completely eliminated, middle-class income will equal mean income, and there will be no redistribution.[1] Therefore, a second important question this paper addresses follows naturally from the first: when will income inequality be reduced in such a way that redistribution increases? The answer this paper proposes is centralized wage bargaining. Centralized wage bargaining compresses wage and income differences by encompassing firms and workers of differing productivities. Yet while lower-productivity workers clearly benefit from wage compression, higher-productivity workers are made worse off. Thus, the most productive workers will constrain, resist, or seek to opt out of the central agreement. The consequence is that centralized wage bargaining will have a greater impact on the lower end of the income distribution than on the higher end, increasing the skew of the income distribution. This outcome is critical for middle-class support for redistribution, since it is greater compression in the lower-half, relative to the upper-half of the wage distribution that will lead to an increasing divergence between median and mean income.

Three additional insights of the paper are worth highlighting. First, by emphasizing the

[1] Note that this observation does not diminish the force of the argument, since traditional interpretation of the RMR framework is also conditional on the kind of increase in inequality. For instance, suppose middle-class voters gain at the expense of poor voters: in this case, inequality increases, but redistribution will decrease (see, e.g., Persson and Tabellini, 2000).

fact that the RMR approach does not make a unique prediction about the relationship between inequality and redistribution, this paper resonates with the recent empirical findings of Lupu and Pontusson (2011), who argue that the structure of inequality, in particular the skew of the income distribution, is more important for redistribution than the level of inequality per se.[2] To explain the greater importance of skew over inequality, Lupu and Pontusson, citing the traditional interpretation, reject the median-voter model and instead propose a "social affinity" explanation. In this theory, middle-income voters will be inclined to ally with low-income voters and support redistributive policies when the distance between the middle and the poor is small relative to the distance between the middle and the rich. While this paper agrees with Lupu and Pontusson on the greater importance of the structure of inequality, it demonstrates in contrast that that increased skewness is in fact perfectly consistent with the median-voter model of redistributive voting. More fundamentally, the paper shows that the RMR framework is *precisely* a prediction about the structure of inequality—i.e., its skew—and not the level of inequality.

Second, critical to the success of centralized wage bargaining is its impact on productivity-enhancing investments in general and general human-capital investments in particular. Building on the central insight of Acemoglu and Pischke (1999), the paper argues that centralized wage bargaining increases the incentives for employers to invest in the general skills training of their employees and can increase the overall investment of human capital in the economy. The intuition is that compressed wage structures make employers residual claimants on the productivity increases of their employees. This result stands in stark contrast to the standard human capital model, wherein only employees, rather than employers have incentives to invest in general human capital (Becker, 1964). Increased training is also critical for enlisting the support of the median-productive worker for centralized bargaining. There are of course other ways unions can gain the support of relatively higher productivity workers, but productivity increases likely to be critical for wage-bargaining structures that compress wages across firms and workers of differing productivities. Thus the paper endogenously explains the distribution of skills in the economy and is therefore related to the broader literature on the political economy of skills. In particular, if centralized bargaining explains both the distribution of skills and the amount of redistribution, this constitutes an alternative to the hypothesis that the distribution of skills explains redistribution (Iversen and Soskice, 2001) or that redistribution explains the distribution of skills (Bénabou, 2000). In addition, if centralized wage bargaining increases the overall investment in employees' general skills, this will enhance the level of economic output which may offset the larger distortionary effects generated by higher taxation and redistribution. The model therefore offers a novel insight about the relationship (or non-relationship) between taxation, redistribution, and economic output and growth (Okun, 1975; Alesina and Rodrik, 1994; Persson and Tabellini, 1994; Pontusson, 2005; Kenworthy, 2007).

[2] Lupu and Pontusson (2011) define skew as the ratio of the dispersion in the upper half of the distribution to the dispersion in the lower half. Specifically, they define the 50–10 ratio as the earnings of the median-income worker as a share of a worker in the 10th percentile of the earnings distribution. Similarly, the 90–50 ratio is the earnings of a worker in the 90th percentile as a share of the earnings of the median-income worker. Skew is thus (90/50)/(50/10), the ratio of the 90/50 ratio to the 50/10 ratio. In this paper, I loosely rely on this definition of skew, rather than to the more precise mathematical definition, wherein skew is the third central moment of a distribution.

Finally, by identifying a causal mechanism for the positive association of lower inequality and greater redistribution, this paper proposes a resolution to the so-called "Robin Hood" paradox (Lindert, 2004). The paradox is that empirically there appears to be no significant or, if anything, an opposite relationship between inequality and redistribution to the one predicted by the traditional interpretation of the RMR framework.[3] Since reduced inequality is consistent with greater redistribution, this paper demonstrates that there is no real paradox. This insight can also explain why it has been difficult to establish empirically a clear link between inequality and redistribution, as well as why the median-voter hypothesis is empirically supported only after the structure of inequality is taken into account (Karabarbounis, 2011).

The paper proceeds in the following order. Section 2 presents a basic version of the model to clarify the main result regarding the impact of centralized wage bargaining on the demand for redistribution. To underscore this result, simplify matters, and also to demonstrate the generality of the claims being main, the basic model explores the role of physical capital—rather than human capital—investments and their impact on centralized wage bargaining and redistribution. Section 3 presents the full version of the model, which gives central attention to the role of skills training, who pays for these skills, and their impacts on the formation of central wage negotiations and redistributive incentives. Section 4 explores applications and extensions of the main model. In particular, I show how the model is consistent with much of the recent empirical literature that investigates the relationship between inequality and redistribution. Furthermore, this section proposes two extensions of the model to account for an important empirical anomaly. These extension relax the overstrong assumptions about both preferences and political participation made by the workhorse RMR framework, where all citizens vote (and only vote) and have only self-regarding preferences. In each, case the paper's main insight is preserved—greater bottom-half compression increases median-mean differences—and centralized wage bargaining is shown to have additional effects on redistributive incentives and policy. Section 5 concludes.

2 The basic model

Consider a static economy with a continuum of firms of measure one. Firms are divided into three groups distinguished by their productivity type, a_i, $i \in \{1, 2, 3\}$, and $a_1 > a_2 > a_3 > 0$. Each firm employs one worker. The population share of each firm-type i is p_i, with $\sum_i p_i = 1$. In addition, I assume that $p_1 < \frac{1}{2}$ and $p_3 < \frac{1}{2}$, which ensures that the median voter is employed by a type-2 firm. Taxes are levied only on labor income and not on capital income. Firms, as frequently construed in economics, are mere "black boxes" and do not vote. In a manner that depends on whether the wage setting regime is individual or collective, both of which will be described below, each worker receives a wage associated with her job-type, w_i. The timing of events proceeds in the following manner. In the individual wage-

[3] Karabarbounis (2011, 627 n.10) cites several studies finding an insignificant and sometimes negative relationship between inequality and redistribution: Persson and Tabellini (1994, 617), Perotti (1996, 170), Persson and Tabellini (2003, 43), and Alesina and Glaeser (2004, 58). Bénabou (2000, 97), citing Rodriguez (1998), finds that among advanced economies the relationship between inequality and the share of transfers or government expenditures in GDP is negative.

bargaining regime, workers vote, firms make investments, and then wages are negotiated. In the collective wage-bargaining regime, workers vote, workers decide whether to join the union, firms make investments, and then the collective wage is negotiated.

The government levies a flat-rate, linear tax $\tau, \tau \in [0, 1]$, on income and then redistributes the collected taxes to all individuals as lump-sum transfers T. Consumption, or disposable income, c of a type-i matched worker can then be written as

$$c_i = (1 - \tau)w_i + T. \tag{1}$$

In this basic version of the model, I assume the the administration of taxes and transfers is costly, as in, for example, Okun's "leaky bucket" metaphor (Okun, 1975; Acemoglu and Robinson, 2006). In the more developed version of the model presented below, the costs of taxation will be modeled by explicitly modeling the disincentive effects of taxation as is common in many other models of redistributive voting. Given the "leaky bucket" approach used in this section, we can build up to the government's budget constraint in the following way. First define average income as $\bar{w}$:

$$\bar{w} = \sum_i p_i w_i. \tag{2}$$

Then define the cost of taxation as $C(\tau)\bar{w}$, where average income is included as a normalization. The standard assumptions on this cost function are adopted. Thus, $C(0) = 0$, $C'(\cdot) > 0$, $C''(\cdot) > 0$, and finally $C'(0) = 0$ and $C'(1) = 1$. Hence, the revenue generated by the government is $\tau\bar{w} - C(\tau)\bar{w} = (\tau - C(\tau))\bar{w}$. Imposing a balanced budget requirement on government spending implies that transfers payments to individuals must equal average tax revenue. Then the government's budget constraint can be written as:

$$T = (\tau - C(\tau))\bar{w}. \tag{3}$$

In words, transfer payments to individuals must equal average tax revenue, less the deadweight costs of taxation.

Wages and investments are determined in one of two different wage-bargaining scenarios. The first is individual firm-worker wage bargaining. The second is a centralized wage-setting process whereby, for example, a union bargains wages with an employer's association for all workers who join the union. In either case, a key assumption is that there is some kind of market imperfection that generates rents over which workers and firms (or the union and employer's association) bargain. In this basic model, one could interpret these rents as deriving from oligopolistic competition in the firms' goods market or from search frictions in the labor market provide another source of rents. Total *marginal* output for a firm/worker pair is denoted by $Y_i = a_i k_i$ and is equal to the combination of job-productivity type and the firm's investment, k_i, which can be thought of in this initial version as capital or some other productivity-enhancing investment. The more developed model will explore the role of skills and human capital investment.

In the individual-bargaining scenario, individual workers and firms bargain over rents; this process is modeled using the generalized or asymmetric Nash bargaining solution. In this situation, a worker receives a wage w if an agreement is reached; otherwise she obtains her outside option, which we will denote as v and is the (taxed) wage the employee can obtain in her next best employment option. (Since workers receive the government transfer regardless of employment status or which employer they work for, it drops out of the bargaining problem.) Firms earn profits, receiving $\pi_i = a_i k_i - w$ in case of an agreement and zero in the case of a breakdown in negotiations. (Firms also make investments in capital k_i, but at the wage-bargaining stage those costs are sunk and so those costs drop out of the bargaining problem.) The Nash problem can then be described as

$$\max_w [(1-\tau)(w-v)]^\beta [a_i k_i - w]^{1-\beta}$$

where $\beta \in (0,1)$ denotes the worker's bargaining advantage. Taking k_i as given, maximization of the joint worker and firm surplus gives:

$$w_i^* = v + \beta[a_i k_i - v] \tag{4}$$

Given this determination of the wage, we can now address the level of the firm's investment. The crucial assumption is that wages are bargained after the firm makes its investment. Substituting the bargained wage in equation (4) in the the firm's profit function, we obtain $(1-\beta)(a_i k_i - v) - r(k_i)$, where $r(k_i)$ represents the cost of the firm's investment and is an increasing and convex function of the level of investment; specifically, $r(0) = 0$, $r'(\cdot) > 0$, and $r''(\cdot) > 0$. An interior solution is assumed. The first-order condition for the firm's investment is

$$(1-\beta)a_i - r'(k_i^*) = 0 \tag{5}$$

where k_i^* denotes the equilibrium level of investment under the individual bargaining regime. The firm's investment will therefore be increasing in the firm's productivity-type a and decreasing in the worker's bargaining power β. In fact, note that the first-best level of investment is achieved, i.e., $a_i = r'(k_i)$, only when the worker's bargaining power is zero. Denote this first-best level of investment as k_i^{FB}. Finally, we specify a participation constraint for firms. Firms will only operate when $(1-\beta)(a_i k_i - v) - r(k_i) \geq 0$. In the individual case, this constraint can typically be satisfied for any β by assuming v sufficiently small. In the basic model, I will assume that the participation constraint never binds, which helps to simplify the analysis. This assumption will be dropped in the elaborated version of the model presented in the next section.

Turn now to the case of collectively bargained wages. A single union now bargains with an employer's association that represents all firms whose workers choose to join the union. Wages now become a function of average productivity, which is denoted $\bar{Y}$ and is determined by the average productivity of firms whose workers join the union. I will return to the determination of who joins the union momentarily. First we can now write the bargaining problem as

$$\max_w [(1-\tau)(w-v)]^\beta [\bar{Y} - w]^{1-\beta}$$

Solution to this problem gives the following collectively bargained wage

$$w^{**} = v + \beta[\bar{Y} - v] \tag{6}$$

Turning now to the problem of the firm's investment under centralized wage bargaining, note that the firm's investment will now be independent of the wage bargain and will achieve its first-best level, i.e., $k_i^{**} = k_i^{FB}$. More intuitively, because of the large number of firms bargaining with the central union through an employer's association, a firm's investment has only a very small, or zero effect, on the outcome of the collectively bargained wage, which is a function of average productivity of all firms. Knowing this will have only a slight or zero effect on the wage, the firm has maximum incentive to invest.

Finally, we can address the workers' decision to join the union. Throughout the game, workers are paired with a firm, and workers observe the productivity of the firms with which they are matched. Prior to investments and wage bargaining, workers decide whether to join the union. Very simply, a worker will join the union if the anticipated collectively-bargained wage is greater than the individual wage. This condition can be stated as $w^{**} \geq w_i^*$. Let $\mathbb{1}_i(x)$ be an indicator variable representing the decision to join the union, with $x \in \{x_0, x_1\}$, and where $\mathbb{1}_i(x_0) = 0$ represents a decision not to join the union and $\mathbb{1}_i(x_1) = 1$ indicates the decision to join the union. Then we can define average productivity as

$$\bar{Y} = \sum_i \mathbb{1}_i(x) p_i a_i k_i. \tag{7}$$

Depending on the parameters of this simple model, many different outcomes for collective bargaining coverage are possible. For instance, suppose that β is sufficiently close to one (so that investment is low) and productivity differences not too large. Then, even workers at the most productive firms will choose to join the union (alternatively, refrain for renegotiating their wage contracts), and receive only the average wage across all types of establishments, as long as the increased investment delivers an average, collective wage higher than what they can receive in individual negotiations. Given the assumption that participation constraints for firms do not bind, three classes of outcomes are generally plausible: first, an outcome where all three groups of workers join the union; second, an outcome where the middle or poor, but not the rich, classes join the union; and third, an outcome where only the poor class joins the union.

Consider now the determination of the political economic equilibrium. The median voter is a type-2 voter and casts the decisive vote. The median voter chooses τ to maximize disposable income in equation (1) subject to the government's budget constraint given in equation (3). Making the standard assumption that there is some skewness in the distribution of income, i.e., that $w_2 \leq \bar{w}$, the first-order condition is:

$$(1 - C'(\tau))\bar{w} - w_2 = 0 \tag{8}$$

Note that this equation reproduces the canonical result that an increasing difference (or ratio) between mean and median income will lead to a higher tax rate and therefore higher social spending. For instance, as w_2 becomes smaller and $\bar{w}$ remains fixed (say because w_1 becomes larger), τ will increase in order to satisfy the constraint. Also note that in the case where all workers of all types join the union, we will have perfect income equality, $w_2 = \bar{w}$, and therefore $\tau = 0$.

Other cases of union formation are more interesting. For instance, suppose that only type-3 workers join the union. Then because investment under multiemployer bargaining is higher than under individualized bargaining, i.e., $k_3^{**} = k_3^{FB} > k_3^*$, collective wages will be higher than individually-bargained wages, i.e., $w^{**} > w_3^*$. This in turn implies from the average income equation (2) that average income when type-3 workers collectively bargain, denoted $\bar{w}^{**}$ is greater than average income when all workers bargain individually, denoted $\bar{w}^*$. Given $\bar{w}^{**} > \bar{w}^*$ then from equilibrium tax equation (8), the tax under collective bargaining for type-3 workers will be *higher* than the tax when all workers bargain individually. Note that this outcome occurs although income inequality has decreased, at least as between type-2 and type-3 workers.

The tax rate and social spending may increase even if type-2 workers find it in their interest to join the union and median income rises. This outcome will occur whenever

$$\bar{w}^{**} - \bar{w}^* \geq w^{**} - w_2^*; \tag{9}$$

or, in words, whenever average income increases more than the income of the median worker. The specific factors affecting this outcome can be observed if we examine this condition in more detail. Rewriting inequality (9) gives:

$$p_3(w^{**} - w_3^*) \geq (1 - p_2)(w^{**} - w_2^*) \quad \text{or} \quad \frac{p_3}{1 - p_2} \geq \frac{w^{**} - w_2^*}{w^{**} - w_3^*}.$$

(Since income for type-1 workers does not change, it drops out of the condition.) This condition is more likely to be satisfied (1) when type-2 workers make up a larger proportion of the population (p_2 larger); (2) when type-3 workers make up a larger proportion of the population (p_3 larger), which may be more important than a larger p_2 inasmuch as $w_2^* > w_3^*$ implies $(w^{**} - w_3^*) > (w^{**} - w_2^*)$; and (3) when the difference between the collectively bargained wage and the individual type-2 wage is smaller. As long as this condition is satisfied, the increase in the median wage will be less than the increase in mean income and thus again from equation (8) the tax rate and social spending will increase. This final example is particularly interesting because equilibrium tax and redistribution is higher than when only individual bargaining occurs even though inequality unambiguously *decreases between all productivity groups*. I now collect these examples and state them in the form of a proposition:

Proposition 1. *Denote the equilibrium tax rate under individual-bargaining regime as τ^*, and under the collective-bargaining regime, τ^{**}. Then the following statements hold for appropriate productivity distributions in each case:*

(A) If workers at only type-3 firms join the union, then $\tau^{**} > \tau^*$

(B) If workers at type-2 and 3 firms join the union, and $\bar{w}^{**} - \bar{w}^* \geq w^{**} - w_2^*$, then $\tau^{**} \geq \tau^*$; if $\bar{w}^{**} - \bar{w}^* < w^{**} - w_2^*$, then $\tau^{**} < \tau^*$

(C) If workers at all firm types join the union, then $\tau^{**} < \tau^*$

There are two important observations to make. First, the differences between equilibrium tax rates in the individual and collective bargaining regimes appear to be driven by changes in mean income. However, changes in mean income are not essential to the finding that reduced inequality is consistent with higher redistribution. Rather, one can make identical distributional changes, holding mean income constant as in the examples above. The cases where collective bargaining increases the tax rate are identical to a mean-preserving reduction in inequality where the income of type-3 workers increases at the expense of both type-1 and type-2 (i.e., median) incomes.

A second important observation to note is how the structure of inequality is related to redistribution incentives. Even though inequality is reduced, the skewness of the income distribution—using that concept casually—increases whenever the distance between median and mean income also increases. In particular, whenever the median-mean distance increases, the income distance between type-2 and type-3 workers decreases by a greater amount than the distance between type-1 and type-2 workers. Since the median-mean relationship is often referred to as skewness, this is a somewhat tautological statement. Nevertheless, highlighting this relationship shows the close relation between skewness in the income distribution—regardless of its impact on overall inequality—and self-interested incentives for redistribution.

3 Wage structure, general training, and redistribution

This section now considers a more elaborate version of the previous model that includes a continuum of "ability" types and where the critical investment is general human capital, rather than physical capital. [More]

There is now a measure-one continuum of agents—voters, workers—that are indexed by $i \in [0, 1]$. Each agent is characterized by their "innate" labor productivity, a. This characteristic has cumulative distribution $F(a)$ and continuous density $f(a)$ on the support $[a_0, a_1]$ with $0 \leq a_0 < a_1 \leq \infty$. In addition, let an agent's income now be denoted y_i, which is composed of earnings from labor and capital income:

$$y_i = w_a + \alpha_i \bar{\pi} \tag{10}$$

where $\bar{\pi} = \int_{a_0}^{a_1} \pi(a) da$ is aggregate profits from firms and α_i is the individual agent's ownership share of a diversified portfolio of corporate shares, which has cumulative distribution $\Phi(\alpha)$ and continuous density $\phi(\alpha)$ on the support $[0, 1]$.

Agents receive disposable income with the tax rate being linear and transfers being lump sum, as before, but with total income now reflecting both labor and capital income.

$$c_i = (1 - \tau) y_i + T. \tag{11}$$

The government's budget constraint can then be written as

$$T = \tau \bar{y} \tag{12}$$

where $\bar{y}$ is average income, defined in this case as:

$$\bar{y} = \int_{a_0}^{a_1} (w_a + \pi_a) dF(a). \tag{13}$$

The timing of the model is

1. Citizens vote, choosing the tax rate, τ, $\tau \in [0,1]$, to maximize their disposable income given by equation (11) subject to the government's budget constraint in equation (12).

2. Workers are trained in general skills; the costs of training are born either by workers or employers.

3. Wages are set either by individual firm-worker bargaining or by collective negotiation between a union and employers' association

4. Wages and dividends are paid and transfers accrue to agents.

In the individual wage bargaining regime, workers receive the wage if bargaining is successful. Otherwise, workers seek employment elsewhere and receive their next best option, denoted $v(h)$, which is a function of the level of investment in human capital h. In this version of the model, firms are identical and homogeneous, with productivity differences derived entirely from the differing abilities of workers. In this case, the marginal output of the worker is denoted by $Y = ah$, where, in contrast to the previous model, h represents the investment in general training or human capital. Firms therefore earn pretax profits $\pi = ah - w$ if bargaining is successful; as before, in the case of a disagreement, production does not occur and the firm earns nothing. Asymmetric Nash bargaining implies that the individually-negotiated wage w_a^* at the current firm is

$$w_a^* = v(h) + \beta[ah - v(h)]. \tag{14}$$

As with the investment of capital in the basic model, investment costs are sunk at the wage bargaining stage. As a result, the equilibrium wage rate is independent of the costs of human capital investment.

To model the incentives to invest in human capital training, I follow Acemoglu and Pischke (1999). In that paper, Acemoglu and Pischke reverse the usual prediction that firms will invest only in firm-specific human capital and never in general human capital. They show that under a more compressed wage structure, employers become residual claimants on the general skills of their employees and thereby acquire an incentive to invest in even the general human capital of their employees.

Both the worker and firm may simultaneously choose the amount of money they wish to spend on general training, with these amounts designated as, respectively, t_e and t_f. The total amount of training is h such that the total cost of training is $r(h) = t_e + t_f$ or $h = r^{-1}(t_e + t_f)$. Taking worker's disposable income in equation (1) and the bargained wage in equation (14), the worker maximizes $(1-\tau)\{v(h) + \beta[ah - v(h)]\} - t_e$ by choosing $t_e \geq 0$ while taking t_f as given. The first-order condition for the worker's contribution is

$$\begin{aligned}(1-\tau)\{v'(h^*) + \beta[a - v'(h^*)]\} - r'(h^*) &= 0 \quad \text{if} \quad t_e > 0 \\ &\leq 0 \quad \text{if} \quad t_e = 0.\end{aligned} \tag{15}$$

The employer's choice is similar. Substituting the bargained wage in equation (14) into the firm's profit function, the firm maximizes $(1-\tau)(1-\beta)[ah - v(h)] - t_f$ by choosing $t_f \geq 0$ and taking t_e as given. The first-order condition for the employer is

$$\begin{aligned}(1-\tau)(1-\beta)[a - v'(h^*)] - r'(h^*) &= 0 \quad \text{if} \quad t_f > 0 \\ &\leq 0 \quad \text{if} \quad t_f = 0.\end{aligned} \tag{16}$$

Comparison of these two equations show that only one of them holds with equality, so only one of the parties bears the full cost of training. The reason for this is that contributions of the firm and the worker are perfect substitutes. More precisely, if h_e^* is the level of training that satisfies equation (15) as an equality and h_f^* the level of training that satisfies equation (16) as an equality, then we can state the following lemma:

Lemma 1. *In the individual wage-setting regime, if $h_f^* > h_e^*$, then the firm bears all the cost of training, $h_e^* = 0$, and $h^* = h_f^*$. Conversely, if $h_e^* > h_f^*$, then the worker bears all the cost of training, $h_f^* = 0$, and $h^* = h_e^*$.*

As in the basic model, we can specify the optimal level of training, which is denoted h^{FB} and is defined by the equation $a = r'(h)$. Comparing this optimal level of training with the level of training chosen by either workers or firms in equations (15) and (16) reveals several insights. First, as before, the level of training under individual wage negotiations will only reach its optimal level when the employer enjoys all of the bargaining advantage, i.e., $\beta = 0$. However, unlike the previous case, increasing the employee's bargaining advantage does not necessarily worsen investment incentives. For instance, note from equation (15) that human capital training will reach its optimal level when $\beta = 1$ and $\tau = 0$. Thus, when the bargaining advantage is sufficiently large, the incentive to invest in training will shift to workers rather than firms. Obviously, the existence of any positive tax rate diminishes these incentives, and so in general the level of training will remain suboptimal, as in the previous model.

In addition to the role of the bargaining advantage, also note the importance of the workers' outside option. In particular, when labor markets are perfect, the employee obtains her marginal product in any employment situation, which implies $ah = v(h)$ and $a = v'(h)$. Thus, when labor markets are sufficiently competitive, the incentives to invest in training shift toward the worker for this additional reason. On the other hand, when labor markets are sufficiently uncompetitive, employers acquire the incentive to invest in general human capital training.

Next, we define the wage determined under the collective bargaining regime. To add both realism and some variability to the impact of centralized wage bargaining, I consider a two-tier wage bargaining regime, following Moene, Wallerstein, and Hoel (1993). In this setting, the centrally negotiated wage, denoted q, is settled first and taken as given in individual wage negotiations. The wage increase obtained at the individual level is denoted d, which can also be termed "wage drift." The final wage is then $w = q + d$. If a breakdown in negotiations occurs, a worker receives only the centrally negotiated wage while the firm suffer a drop in output, which is construed as a proportional loss λah, where $0 \leq \lambda \leq 1$. The justification for this is that centralized bargaining frequently entails efforts to control or limit the extent of local bargaining. For instance, central agreements will contain terms that forbids strikes, lockouts, or work slowdowns from occurring while the central agreement is in force (Moene, Wallerstein, and Hoel, 1993, 102). Centralized bargaining is also supported by a higher degree of centralization within union and employer organizations, which prevent local organizations or workers from taking independent action. For instance, a union's control of strike funds at the central level inhibits local organizations from engaging in strikes (Ahlquist, 2010). Of course, these measures may never be completely successful at arresting local action. Workers may engage in work-to-rule practices where they comply strictly with the necessary minimum requirements of productivity or other employment rules and refuse to work overtime, cooperate, or work flexibility with employers. Thus, the variable λ supplies a measure that gives a sense of how effective central union or employer organizations have been at containing local bargaining. To state this more clearly then, the payoffs in individual bargaining under a centralized agreement are

$$\pi_a = \begin{cases} ah - (q+d) & \text{if there is an agreement} \\ \lambda ah - q & \text{if there is a conflict} \end{cases} \tag{17}$$

for the firm, and

$$w_a = \begin{cases} q+d & \text{if there is an agreement} \\ q & \text{if there is a conflict} \end{cases} \tag{18}$$

for the worker. Applying asymmetric Nash bargaining gives the following solution to the local wage differential

$$d_a^{**} = \beta(1-\lambda)ah \tag{19}$$

Prior to the determination of the local wage increase, bargaining between a union and an employer's association determines a collective wage schedule. The central negotiators bargain for all workers that join the union, given by the condition $w_a^{**} \geq w_a^{*}$. Define the level of productivity at which this condition is satisfied with equality as $\bar{a}$. This threshold establishes an upper bound on the collective wage schedule. As in the basic model firms are subject to a participation constraint, so firms will only operate under the following condition: $(1-\tau)(ah - w_a) - r(h_f) \geq 0$. Setting this condition at equality defines a threshold level of worker ability at which firms choose to exit the market as:

$$\underline{a} = \frac{1}{h}\left(\frac{r(h_f)}{1-\tau} + w_{\underline{a}}\right) \tag{20}$$

recalling that under the collective-bargaining regime for workers, $w_a = q_a + d_a$. Having now both a lower and upper bound on the characteristics of participating firms and workers, we can now define average marginal productivity of workers employed at firms as:

$$\bar{Y} = \int_{\underline{a}}^{\bar{a}} ah(a)dF(a) \tag{21}$$

Bargaining over the collective wage schedule, q_a, between the union and the employer's association then takes place in the following way. In the case of agreement, firms earn profits and pay the collective wage to the workers. In the case of disagreement, profits are zero and workers receive their productivity-related outside option, which under collective bargaining is denoted $\upsilon(h)$ (note the subtle difference between the external wage under individual bargaining, denoted by the roman letter v, and that under collective bargaining, denoted by the greek symbol υ). Following Acemoglu and Pischke (1999), the crucial assumption here is that the external wage structure is more compressed under central bargaining than under individual wage bargaining, meaning formally that $v'(h) > \upsilon'(h)$. On these assumptions, asymmetric Nash bargaining then implies the following collective wage schedule:

$$q_a^{**} = \upsilon(h) + \beta[\bar{Y} - \upsilon(h)] \tag{22}$$

Denote the final wage under collective bargaining as $w_a^{**} = q_a^{**} + d_a^{**}$.

As in the individual setting, I will continue to assume that firms and workers make human capital investments anticipating subsequent wage negotiations. As in the basic model, I also continue to assume that individual firms and workers are too small to take into account the effects of their investment decisions on average productivity. Substituting the collective wage (22) and wage drift (19) equations into the worker's income function, the worker maximizes $(1-\tau)\{\upsilon(h) + \beta[\bar{Y} + (1-\lambda)ah - \upsilon(h)]\} - t_e$ by choosing $t_e \geq 0$ while taking t_f as given. The first-order condition for this problem is:

$$\begin{aligned}(1-\tau)\{\upsilon'(h^{**}) + \beta[(1-\lambda)a - \upsilon'(h^{**})]\} - r'(h^{**}) \;&=\; 0 \quad \text{if} \quad t_e > 0\\ &\leq\; 0 \quad \text{if} \quad t_e = 0.\end{aligned} \tag{23}$$

Similarly, placing the collective wage and drift functions into the firm's profit function, the firm's problem is to maximize $(1-\tau)\{[1-\beta(1-\lambda)]ah - \beta\bar{Y} - (1-\beta)\upsilon(h)\} - t_f$. The firm's first-order condition is then:

$$\begin{aligned}(1-\tau)\{[1-\beta(1-\lambda)]a - (1-\beta)\upsilon'(h^{**})\} - r'(h^{**}) \;&=\; 0 \quad \text{if} \quad t_f > 0\\ &\leq\; 0 \quad \text{if} \quad t_f = 0.\end{aligned} \tag{24}$$

Just as under the individual-bargaining regime, only one of these equations holds with equality, so only one of the parties bears the full cost of training. Making definitions for the collective-bargaining regime that are analogous to the individual regime, if h_e^{**} is the level of training that satisfies equation (23) as an equality and h_f^{**} the level of training that satisfies equation (24) as an equality, then we can state the following lemma:

Lemma 2. *In the collective wage-setting regime, if $h_f^{**} > h_e^{**}$, then the firm bears all the cost of training, $h_e^{**} = 0$, and $h^{**} = h_f^{**}$. Conversely, if $h_e^{**} > h_f^{**}$, then the worker bears all the cost of training, $h_f^{**} = 0$, and $h^{**} = h_e^{**}$.*

Comparing employee investment in general human capital under individual (equation (15)) and collective (equation (23)) wage bargaining, it is clear that the employee's incentives to invest in general human capital are smaller under centralized wage bargaining than under individual wage bargaining. Comparing employer investments under the two regimes, i.e., equations (15) and (23), the reverse is true for employers: central bargaining increases the optimal choice of investment for employers. The reason for this is twofold. First, constraints on local wage bargaining (i.e., λ) prevent employees from capturing a greater proportion of the surplus produced by the firm-worker pair. And second, centralized wage bargaining constrains the external wage structure (i.e., $v'(h) > \upsilon'(h)$), meaning that training investments have a smaller impact on the external wage structure.

Using these two lemmata, I can now state a proposition about the prevalence and impact of centralized wage bargaining.

Proposition 2. *(1) Collective bargaining prevails only to the extent that the level of human capital investment for workers participating in the collective regime is strictly greater than under individual bargaining, i.e., $h^{**} > h^*$; (2) for (1) to be true, employer's must bear the costs of training for workers participating in the collective bargaining, i.e., $h_f^{**} > h_e^{**}$.*

The intuition for this proposition is straightforward and extends the reasoning of the basic model. To illustrate it, consider the case where human capital investments are fixed and independent of the bargaining regime. Next suppose the central wage negotiators bargain a wage or wage schedule for the entire workforce. If there is any degree of compression in the wage structure set by the central bargainers, at a minimum the highest productivity workers (i.e., with a_1.) will choose to renegotiate their wage contracts with their individual employers. Such workers, and their firms, will therefore, not be represented in central wage negotiations. The consequence of this is to lower the central wage by lowering the average productivity of the workers and firms involved in wage negotiations. Yet this simply ensures that workers just below the highest productivity workers will themselves choose to renegotiate their wages, further lower the collective wage. This process continues until the central agreement includes only the lowest productivity workers, who are indifferent between the collective wage and their individual wage. For centralized wage bargaining to embrace workers above the lowest productivity, it must raise average productivity by having a positive impact on human capital investment. The next step in this argument is that, for central bargaining to increase the level of training, employers must provide it. Since the effect of central bargaining is to increase the incentives of employers to bear the costs of training, but to decrease the incentives of employees to bear them, central bargaining will raise human capital investments only when employers pay for them.

In the determination of the collective wage schedule in equation (22), I implicitly assumed that the central bargainers ignored the effect of wage bargaining on the productivity threshold in equation (20). Yet this effect is something the central bargainers are likely to take into account. If they do, the central wage schedule becomes

$$q_a^{**} = \frac{\beta \bar{Y} + (1-\beta)[1 + \underline{a} f(\underline{a})]\upsilon(h)}{1 + (1-\beta)\underline{a} f(\underline{a})} \tag{25}$$

This effect was ignored earlier in the interest of facilitating the comparison of training investments under individual and collective bargaining. By taking into account the effect of the central wage schedule on the productivity threshold, the consequence is to *lower* the wage for every given productivity level. It can further be shown that this effect furnishes yet another incentivize for employers to undertake the cost of skills training under central bargaining.

Given that the centralized wage schedule allows for some degree of wage variation, it will be useful to understand the effects of the level of centralization on the wage structure. Most clearly, a greater level of centralization (higher λ) will reduce wage drift, as in equation (19). It is also reasonable to assume that greater centralization will also compress the external wage structure, such that $\upsilon'(h, \lambda') > \upsilon'(h, \lambda'')$ where $\lambda'' > \lambda'$. However, if employers' pay for general training, greater centralization will increase investment incentives, and this will raise average productivity, which raises wages. In addition, note greater compression is also likely to raise the productivity threshold $\underline{a}$, which also lowers the collective wage. I ignore this effect for the time being in the interest of simplicity. This reasoning leads to the following proposition:

Proposition 3. *If $\partial d_{\bar{a}}^{**}/\partial\lambda + \partial\upsilon/\partial\lambda \geq \partial\bar{Y}/\partial\lambda$, then given $\lambda'' > \lambda'$, $w_{\bar{a}}(\lambda') \geq w_{\bar{a}}(\lambda'')$; otherwise, $w_{\bar{a}}(\lambda'') \geq w_{\bar{a}}(\lambda')$.*

This proposition states that as long as the wage-lowering effects of greater centralization outweigh the wage-increasing effects, then greater centralization will lower the wage of the highest wage-earner that joins the union. Otherwise, the wages of all union members will continue to rise as centralization increases. The first case is more interesting and important, since it suggests a kind of discontinuity between centralization and inequality. Some level of centralization will reduce overall inequality, but it may benefit middle-income earners more then lower-income earners. In contrast, further centralization will cause greater compression between middle-income and lower-income earners, but increase dispersion between the top and the middle. This effect will be empirically important when extensions of the model are considered in the next section.

We turn now to the determination of the political equilibrium tax and transfer policy; as in the basic model, transfers are uniquely determined by the tax rate, so the political equilibrium is determined by the decisive voter's choice of tax rate. This equilibrium is found by maximizing the median worker's disposable income, denoted y_m, given by equation (11), subject to the budget constraint (12) and average income equation (13).

Proposition 4. *In the general model, with human capital investment and where all citizens vote, the equilibrium tax rate, which uniquely determines the size of government transfers, is given by:*

$$\bar{y} + \tau \frac{\partial \bar{y}}{\partial \tau} - y_m = 0 \tag{26}$$

We now address the question of how different wage bargaining regimes influence taxation and redistribution:

Proposition 5. *If $\bar{y}^{**} - \bar{y}^{*} \geq y_m^{**} - y_m^{*}$, then $\tau^{**} \geq \tau^{*}$; otherwise $\tau^{**} < \tau^{*}$. In particular, for all $\bar{y}^{**} \geq \bar{y}^{*}$, if $y_{\bar{a}} \leq y_m^{*}$ then $\tau^{**} \geq \tau^{*}$.*

Similar to Proposition 1, redistribution will increase under centralized bargaining, as long as the average income under centralized bargaining exceeds average income under individual wage bargaining, and this difference exceeds any positive difference between the median wage under centralized and individual wage bargaining. In the particular case, this will always be true when centralized bargaining raises mean income and the highest income earner to accept the collective wage schedule is less than or equal to the median income earner under individual wage bargaining.

Before closing this section, I state a couple of remarks that relate the model to closely-related issues in the literature.

Remark 1. *If $h^{**} > h^{*}$ and $\tau^{**} > \tau^{*}$, then vocational training and government transfers will be positively associated.*

This remark observes that if general human capital training and taxes and transfers are both higher under centralized wage bargaining than under individual wage bargaining, via propositions and , then we should observe empirically a positive correlation between training and social spending. In fact, Iversen and Soskice (2001) provide evidence in support of such an association. In their explanation, this association exists because workers with more specific—i.e., riskier—skills, indicated by a higher level of vocational training activity, demand higher levels of social insurance from the government. By contrast, this paper proposes that the associations between higher training and government transfers can both explained by the structure of wage bargaining. One piece of evidence in support of the latter interpretation is the observation that much of the higher level of vocational training in countries such as Germany are not in fact for specific skills, but fairly general skills.

Remark 2. *If $\bar{y}^{**} > \bar{y}^{*}$ and $\tau^{**} > \tau^{*}$, then the relationship between taxation and economic output will be ambiguous*

A clear implication of the RMR framework, pursued more extensively in Alesina and Rodrik (1994) and Persson and Tabellini (1994), is that higher taxes and transfers will be associated with lower economic output and growth. Yet empirical research has struggled to find any robustly inimical effect of income equality on economic output (see, e.g., Pontusson, 2005; Kenworthy, 2007). To the contrary, egalitarianism appears if anything to enhance efficiency and in particular economic growth: in some empirical studies the coefficients on transfers in growth regressions are most often significantly positive (see, e.g., Perotti, 1994, 1996). As in Bénabou (1996) and Iversen and Soskice (2001), the positive association between output and transfers may very well exist because social insurance encourages investment in risky assets, such as specific skills and education. The arguments above propose an additional reason, namely that centralized wage bargaining encourages greater investment in human capital, particularly where individuals are credit constrained. In turn, the greater productivity from higher training offsets the distortionary effects of taxation.

4 Applications and Extensions

4.1 Relation to Empirical Literature

Based on the accepted interpretation of the RMR framework, a large number of empirical studies have tested whether higher inequality leads to more redistribution. At best, support for this proposition is weak. It is safer to conclude that no relationship exists between inequality and redistribution or that, at least among developed countries, higher inequality is associated less redistribution.

The theory proposed in this paper is consistent with the evidence that greater equality is associated with more redistribution, as well as the evidence presented in two more recent papers that explore in greater depth the relationship between inequality and redistribution. First, Lupu and Pontusson (2011) find that greater skew—which they define as the ratio of inequality in the top-half of the income distribution to inequality in the bottom-half—is associated with more redistribution. To explain this association, Lupu and Pontusson reject the median-voter framework and instead propose a “social affinity” explanation. In this alternative, the preferences of middle-class voters converge with those of social groups they are closer to in the income scale. Hence redistribution increases with greater inequality in the top-half of the income distribution, but also with lower inequality in the bottom-half of the distribution. However, as this paper has shown, Lupu and Pontusson’s empirical findings are consistent with the arguments made in the previous section. Thus, Lupu and Pontusson are correct that the structure of inequality—specifically, skew—is more important than the level of inequality, but they are incorrect in claiming that the median-voter hypothesis is inconsistent with their empirical finding. As this paper has shown, the median-voter hypothesis is precisely a hypothesis about the relationship between skew and redistribution rather than between inequality and redistribution.

In another recent paper, Karabarbounis (2011) finds support for the RMR hypothesis and demonstrates that redistribution is negatively associated with the ratio of median to mean income, but only after one controls for the structure of the larger income distribution. Specifically, redistribution increases when the incomes of the 90th percentile and median earners decrease, but also when the income of the 10th percentile increases. Karabarbounis interprets this empirical finding as a consequence of voters' unequal influence on the political process—"one dollar, one vote," rather than one person, one vote. However, Karabarbounis' empirical findings are exactly consistent with the predictions made by the model in this paper, which are obtained even under a perfectly equal, one person, one vote voting rule.

Another observation made by this paper is that lower inequality can be consistent with an increasing difference between median and mean incomes. This assertion implies a negative relationship between inequality and the median-mean ratio. Empirically however, inequality and an increasing difference between median and mean incomes appear to be positively correlated. For instance, Lupu and Pontusson (2011, 322 n.14) find from OECD data that the correlation between the 90–10 and median-mean ratios is 0.59 (from 272 observations).

The next two subsections each propose a distinct generalization of the model that separately or together can account for this empirically anomaly. The first generalization relaxes the one-person, one-vote voting rule and analyzes how income affects the different citizens' voting probabilities, brining the model closer to a one-dollar, one-vote rule. The second generalization considers a more expansive set of preferences, where voters are motivated not only by self-interest, but by "fairness" concerns as well. Both generalizations substantially enrich the model. However, in either case, the paper's central insight about wage compression, skew, and median-mean differences is preserved. In essence, increasing differences in median and mean incomes still increases redistribution, but this effect is stronger at lower levels of inequality. Further, these generalizations show how centralized wage bargaining has additional effects that favor higher levels of redistribution, beyond the impact on median-mean differences generated by skew. In sum, these generalizations strengthen the model, without loosing any of the core insights of the simpler version.

4.2 Participation

In the general model, all citizens vote, which drives the result that the equilibrium tax rate is a function of the difference between median and mean income. However, a large body of research shows that the propensity to participate in electoral or governmental politics is strongly influenced by the income of the citizen. How do the results of the general model change when political participation, or the probability of voting, is a function of income?

To address this question, let each agent's probability of voting be a function of her income. Recalling that each agent's income is y_i, let $\bar{F}(y)$ be the cumulative distribution function for the society's income. In addition, denote as $\sigma_i = s(y_i)$ the "political weight" assigned to an agent with income y_i. The proportion of votes cast by agents with $y_i \leq y$, or more generally the total political weight of all such voters, is $S(y) = \int_{y_0}^{y} s(y)d\bar{F}(y)$. For an ordinal, or relative weighting scheme that assesses each voter's influence relative to other agents', $s(y) = \sigma(\bar{F}(y))$, so $S(y) = \int_0^{\bar{F}(y)} \sigma(\rho)d\rho$, where $\rho = \bar{F}(w)$. Following Bénabou (2000), the agent with income $\tilde{y}_i$ and rank $\tilde{\rho} = \bar{F}(\tilde{y})$ defined by $S(\tilde{y}) = \frac{1}{2}$ is the pivotal, or decisive, voter. It follows form this straightforwardly that for a weighting scheme that favors richer agents (e.g., one dollar, one vote), that $\tilde{y}_i \geq y_m$: the decisive voter has higher income than the median income agent.

Defining $y_\Delta = \bar{y} - y_m$, the above reasoning leads to the following proposition:

Proposition 6. *If $\bar{y}^{**} - \bar{y}^* \geq \tilde{y}_i^{**} - \tilde{y}_i^*$, then $\tau^{**} \geq \tau^*$. This result holds for some $y_\Delta^* \geq y_\Delta^{**}$. Furthermore, τ^{**} is still increasing for some y_Δ^{**}.*

In words, this proposition states first that as long as the decisive agent under either centralized or individual wage bargaining prefers at least some redistribution, the decisive agent has lower income under centralized bargaining than under individual bargaining. This result occurs because centralized bargaining raises the wages and productivity of workers who join the union. Since these workers are in the lower part of the productivity distribution, greater income in the lower part of this distribution shifts political influence in favor of lower income workers. Hence, the income of the decisive agent shifts downward. An immediate implication of this shift is that the tax rate and redistribution increase. Another implication is that the median-mean difference may actually narrow, and yet redistribution will still increase. Note that this is an additional effect of centralized wage bargaining on the political equilibrium, independent of its effect on the median-mean difference.

Nevertheless, the main result in the general model—namely, the impact of centralized bargaining on the median-mean difference—still holds in this model of income-influenced voting participation. To see this, compare the equilibrium in the individualized wage-setting regime with the outcomes in two different centralized regimes, where centralization is less in the first than in the second: $\lambda' < \lambda''$. Furthermore, suppose there are three different groups, as in the basic model, but that wage setting and investment occur as modeled in the general model. In an ordinal weighting scheme, let the rich have weight $(p_1 y_1)/\bar{y} \geq \frac{1}{2}$, so that the preferences of the rich determine policy and there is no redistribution. Now consider the first case of a centralized wage-setting regime in which type-2 and -3 workers join the union and where median-mean difference actually decreases: $y_\Delta^* > y_\Delta^{**}(\lambda')$. Since mean income increases but the income of the rich stays the same, their political weight will decrease: suppose $(p_1 y_1)/\bar{y} < \frac{1}{2}$ and that the middle-income voter is now decisive. Provided that $\tilde{y}_i < \bar{y}$, taxes and transfers will increase, $\tau^{**}(\lambda') \geq \tau^*$. Now consider the third case, with greater centralization $(\lambda'' > \lambda')$ that raises mean income further and reduces the income of middle-income workers relative to the mean, as in Proposition 3. If rich agents were not decisive in the second case, they will not be decisive in the third. Even if the median-mean difference is still narrower than in the first case, the lower income of type-2 workers raises redistribution even further. We therefore obtain $\tau^{**}(\lambda'') \geq \tau^{**}(\lambda') \geq \tau^*$, even though $y_\Delta^* > y_\Delta^{**}(\lambda'')$. This also clarifies the argument that wage centralization has two distinct impacts on the political equilibrium: both through its impact on the median-mean difference and by influencing political participation.

4.3 Preferences

In addition to electoral influence and participation, we should also reconsider the preferences of the voters. It may be reasonable to assume that individuals act primarily self-interestedly in market activities, where citizens participate as consumers or sellers (or purchasers) of labor services, the idea that self-interest dominates decision-making is reasonable. In contrast, political participation, and in particular voting, are quintessentially "public" acts. Voters may indeed have self-interested reasons for voting over specific policies, but it would also be reasonable to expect citizens to have preferences over "states of the world," and so take into account the consequences of their voting decisions on criteria other than individual welfare (see, e.g., Edlin, Gelman, and Kaplan, 2007).

Suppose that in addition to utility over consumption, individuals also have preferences over the level of inequality itself in society. Individual preferences are now denoted

$$u_i = c_i - z\Omega \tag{27}$$

where c_i is the disposable income of worker i, Ω represents the common disutility experienced by the existence of *unfair* levels of inequality, and $z \geq 0$ parameterizes the strength of the social demand for fairness. In this case, pretax income is defined as

$$y_i = w_a + \alpha_i \bar{\pi} + l_i \tag{28}$$

which is identical to equation (10), expect with the addition of the term l_a, which captures "unearned" income or income from "luck," including income grain from socially unworthy activities such corruption or theft. I assume that l_a is independently distributed across agents and has zero expected value. Taxation, transfers, and the government budget constraint are the same as before, with disposable income as in equation (11).

"Fairness" preferences, captured by the Ω term, can take a wide variety of forms. I follow Alesina and Angeletos (2005) and define fairness preferences as

$$\Omega = \int_i (u_i - \hat{u}_i)^2 \tag{29}$$

where u_i denotes the actual level of utility while $\hat{u}_i$ captures the "fair" level of utility. This quadratic form essentially captures the idea that there is some "ideal" level of inequality. For instance, inequality may be tolerated as long as such differences are the result of differential effort or hard work, but divergences of either more *or less* than this fair level will be considered unfair. Thus, the "fair" utility level is defined as the utility the agent deserves based on her her own ability and effort, i.e., absent luck:

$$\hat{c}_i = \hat{y}_i = w_a + \alpha_i \bar{\pi} \tag{30}$$

Note that the residual $y_i - \hat{y}_i = l_i$ measures the unfair component of income.

Because income is quasi-linear in consumption, $u_i - \hat{u}_i = c_i - \hat{c}_i$ for every i, and therefore $\Omega = Var(c_i - \hat{c}_i)$, where Var denotes variance in the cross section of the population. Substituting (28) into (11), and using (30) along with the property that l_i is independent of a, one can write fairness preferences as a weighted average of the "variance decomposition" of income inequality:

$$\Omega = \tau^2 Var(\hat{y}_i) + (1-\tau)^2 Var(y_i - \hat{y}_i). \tag{31}$$

To give a sense for how fairness preferences influence voters demands for redistribution, assume briefly that minimizing Ω was the only policy goal, taxation is not distortionary, and income distribution is exogenous. In this case, the optimal tax rate would be

$$\frac{1-\tau}{\tau} = \frac{Var(\hat{y}_i)}{Var(y_i - \hat{y}_i)}. \tag{32}$$

The right-hand side of the equation represents the *signal-to-noise ratio* in the income distribution. The signal is the measure of "earned" income, while the noise is the measure of luck or "unearned" income. Critically, the optimal tax rate is decreasing in the signal-to-noise ratio: As the variance in earned income increases (or the variance in unearned income decreases), the optimal tax falls. Conversely, the larger is the luck component relative to the work component of inequality, the tax rate increases. Thus, the more that luck contributes to income, or the less that earned income contributes, higher taxes correct for this greater unfairness.

Proposition 7. *The equilibrium tax rate with fairness preferences as in equation (29) is given by:*

$$\bar{w} + \tau\frac{\partial \bar{w}}{\partial \tau} - w_m - z\frac{\partial \Omega}{\partial \tau} = 0 \tag{33}$$

where

$$\Omega^*_\tau \geq \Omega^{**}_\tau. \tag{34}$$

Therefore, τ will be higher under centralized bargaining than under individualized bargaining whenever $\bar{w}^{**} - w^{**}_m - z\Omega^{**}_\tau \geq \bar{w}^* - w^*_m - z\Omega^*_\tau$.

From the discussion of the signal-to-noise ratio, displayed in equation (32), it should be clear why $\Omega^*_\tau \geq \Omega^{**}_\tau$. By reducing income inequality, centralized bargaining reduces the variance in the measure of earned income inequality. Relatively more inequality is then determined by luck, which is more normatively amendable to correction. This difference increases the incentives for higher taxation and redistribution under centralized bargaining. In this way, centralized bargaining again has a direct effect on increasing demands for redistributive transfers.

Furthermore, as the last part of the proposition states, redistribution may still increase even if the median income rises relative to mean income, as long as this reduced difference is offset by the change in fairness preferences. To see this most simply, if we write w_Δ for the median-mean ratio or difference, this condition can be rewritten as: $z(\Omega^*_\tau - \Omega^{**}_\tau) \geq w^*_\Delta - w^{**}_\Delta$. Since $\Omega^*_\tau \geq \Omega^{**}_\tau$ implies that the left hand side is positive, the condition can be true even if the median-mean difference decreases under centralized bargaining (i.e., $w^*_\Delta - w^{**}_\Delta \geq 0$). Nevertheless, notice again that the equilibrium tax rate is still increasing in the median-mean difference. This again is a way of saying that, even if the median-mean difference is smaller under the centralized regime than under the individual regime, between centralized regimes, those with a greater median-mean difference will redistribute more.

5 Conclusion

This paper has argued that differences between countries in their wage-setting institutions play a significant role in influencing not only the pretax, pretransfer distribution of income but also the demand for redistribution that impacts the posttax, posttransfer income distribution. The main argument is that centralized wage bargaining reduces income inequality, but it ways that tend to increase the skewness of the income distribution. This increased skewness can in fact increase the difference between mean and median incomes, which in the classic argument of Romer (1975) and Meltzer and Richard (1981), leads the decisive voter (who has median income) to favor a higher tax rate and more redistribution. Furthermore, although empirical evidence suggests that inequality is positively correlated with an increasing mean-median difference, simple generalizations of the model can accommodate this empirical challenge. Indeed, when the political participation and fairness preferences are added to the model, centralized wage bargaining then plays three roles in increasing incentives for redistribution: centralized wage bargaining increases both the political participation of poorer citizens and the demand for "fairness" redistribution, as well as the demand for simple self-interest redistribution through its impact on the wage structure and the median-mean difference.

These conclusions hold some broader implications worth mentioning. Most importantly, it highlights the way an institution affecting "predistribution" influences redistribution. In this sense, centralized wage bargaining and the size of the welfare state are complements rather than substitutes. More critically, it suggests that interventions to address inequality through redistribution may be more dependent on interventions that influence the distribution of pretax income than previously recognized. Finally, as in Lupu and Pontusson (2011), this argument suggests that wage bargaining institutions and the structure of inequality may be more important than political partisan determinants of redistribution and the welfare state.

A Appendix

This section to be completed

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