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Veblen effects, political representation, and the reduction in working time over the 20th century☆

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ABSTRACT

We explain the substantial decline in work hours over the 20th century by the joint influence of the employees' "pecuniary emulation" of the "conspicuous consumption" of top income earners and the balance of political power of employers and employees in the presence of conflicts of interest over the issue of working time. We present a new labor discipline model incorporating Veblen effects in which hours are determined by employers and subject to complete contracts but employee work effort is not. We show that while Veblen effects increase the hours sought by employees, the hours selected by profit-maximizing employers may exceed that preferred by employees, who may then seek to reduce work hours by means of collective bargaining or governmental intervention. We also identify conditions under which employees will prefer longer hours than offered by employers. Using newly available data on top income shares, and on work hours from 10 major industrial economies and covering the entire past century we test two hypotheses: that increases in the relative incomes of the very rich are associated with increased hours, while increases in the political representation of workers have the opposite effect. The estimated effects are large in economic magnitude, highly significant and robust to alternative econometric specifications, including country and time fixed effects. Using an alternative data set covering the last third of the past century we show that these results are robust to the inclusion of a measure of taxation and find that decentralized trade union bargaining (but not centralized bargaining) may raise working hours.

1. Introduction

At the turn of the 21th century (in the 9 industrial economies for which data are available) workers averaged 1232 fewer yearly hours on the job than they did a century earlier. At the now-standard US 35 h work week, that is equivalent to 35 weeks less work. The decline was dramatic in all countries, ranging from almost two-fifths of the working time in 1913 in the Netherlands to about a third in the US. As Fig. 1 shows, the decline was particularly steep early in the century, and it was not monotonic, workers in both the US and Sweden clocked increased hours at the end of the century. What accounts for these trends?

We provide a model and econometric estimates of the role of conflict between employers and employees in the determination of work hours and how this process is affected by both workers' political organization and Veblen effects, the latter

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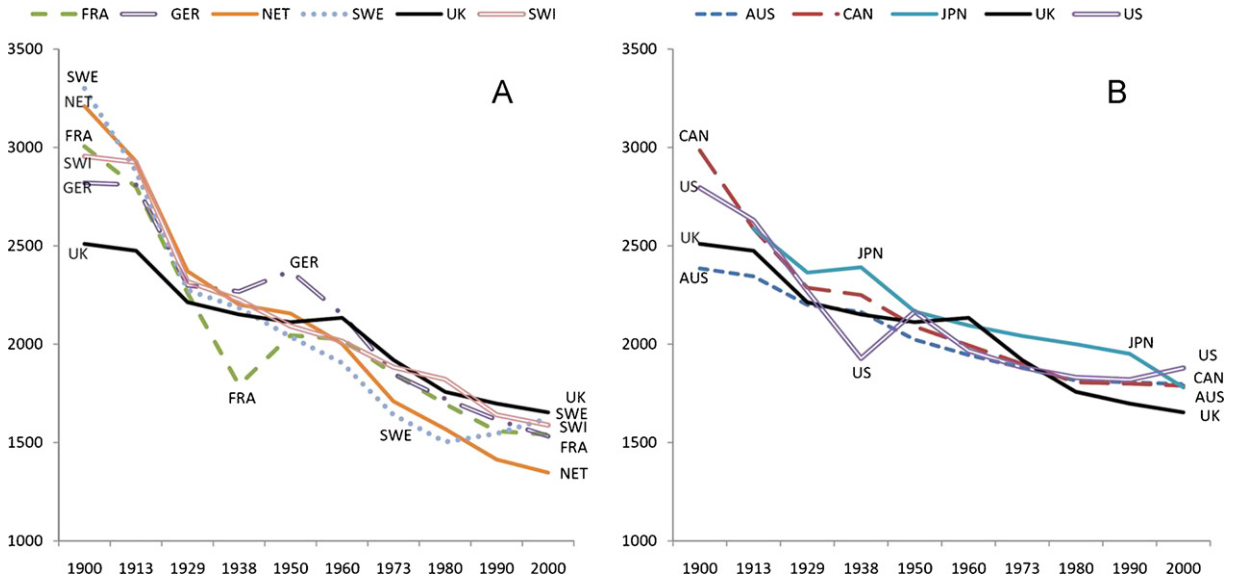


Fig. 1. Average annual work hours of production workers, 10 nations 1900–2000 (Huberman, 2004).

occurring when the employees' desire to emulate the consumption standards of the rich influences their desired allocation of time between labor and leisure. In contrast to most models and empirical studies of work hours (in which employees choose their hours) in our model hours are determined by employers and subject to complete contracts, but employee work effort is not. We identify the conditions under which Veblen effects increase the hours sought by employees, and under which the hours selected by profit-maximizing employers will nonetheless exceed that preferred by employees.

The Veblen pecuniary emulation effects occur in our model because even though the hours of work is selected by the employer, the employees' desire to emulate the rich increases their desired level of work hours. This influences the present value of the job at each of the employer's chosen hours levels. The result is to increase the employer's hours offer that minimizes the cost of satisfying a no-shirking constraint.

The conflict over work hours occurs because while the employer takes account of the worker' hours preferences, profit maximization constrained by the employee's best (effort) response function entails under-providing a workplace amenity, in this case the workers' optimal choice of hours (as in the case of other costly workplace amenities (Bowles, 2004)). The firm's profit maximizing choice of hours and wages is thus Pareto-inefficient, regardless of whether the workers would prefer fewer or more hours than the firm selects.

The model allows us to study the political economy of work hours, providing conditions under which policies to limit hours would be adopted by trade unions or political parties with varying degrees of scope (from local to centralized) and foresight (from myopic to cognizant of a zero profit general equilibrium condition). In this paper we consider two cases: an exclusive local union and far-sighted inclusive national union. A surprising result, but one consistent with empirical results heretofore found to be anomalous, is that where unions are localized, increasing union density may be associated with longer rather than shorter hours (Bowles and Park, 2005; Faggio and Nickell, 2007). We also discuss (like Besley and Burgess, 2004) how pro-worker employment regulation can adversely affect workers. These results motivate our empirical predictions that increased political representation of employees will explain fewer yearly hours while increased relative incomes of top income earners will have the opposite effect.

Other studies taking account of the fact that hours are chosen by employers, not employees, have demonstrated that inefficiently long work hours may occur when working time serves as a screening device for selecting workers with low disutility of work (Rebitzer and Taylor, 1995; Landers et al., 1996), or with high productivity (Sousa-Posa and Ziegler, 2003). Others show that employees' desired and actual work hours may differ due to rising age-earning profiles adopted by employers to reduce the incentive to shirk under mandatory retirement (Lazear, 1981; Lang, 1989). We differ from these papers in that neither preference heterogeneity nor screening play a role in our model. Rather work hours may be either shorter or longer than employees prefer, the difference arising from the fact that while work hours are subject to a complete contract, work itself is not and the employer's profit maximizing labor discipline strategy is constrained by the employees' effort incentive compatibility constraint, not by the employees participation constraint.

Veblen effects are derived from a class of social-comparison-based utility functions on which there is a growing literature and some empirical evidence (Easterlin, 1974; Hirsch, 1976; Scitovsky, 1976; Layard, 1980; Sen, 1983; Van Praag, 1993; Cole et al., 1995; Bagwell and Bernheim, 1996; Frank, 1997; Frey and Stutzer, 2002; Ferrer-i-Carbonell, 2005; Bertrand and Morse, 2012). Clark and Oswald (1996) for example found that the satisfaction levels reported by British workers (in the British Household Panel Survey) vary inversely with the wage levels of peers. Luttmer (2005), using National Survey of Family and

Household and the Current Population Survey in the US finds that, controlling for an individual's own income, higher earnings of neighbors are associated with lower levels of self-reported happiness. An explicitly Veblen-inspired study by Schor (1998) using a US sample asked respondents how their financial status compared to that of those in their reference group (primarily co-workers and friends). While a majority of her sample responded that they personally did not feel pressure to 'keep up with the Joneses', Schor found that, independently of the effects of annual and permanent income and other standard regressors, those whose financial status was below their reference group saved significantly less than those who were better off than their reference group. Interestingly, those who watched TV more saved less, conditional on the other regressors.

Applications to labor supply include Neumark and Postlewaite (1998), who using data from the US NLSY, found some evidence that women whose sister's husband had a higher income than their own husband were more likely to be employed. Park (2010) using CPS data found, after controlling for husbands' absolute income and other individual characteristics, that married women are more likely to be in labor force when their husband's relative income is low. Bowles and Park (2005) use a Veblen effects model to study the relationship between income inequality and work hours, finding evidence consistent with the pecuniary emulation hypothesis for a sample of OECD countries in recent decades. Clark et al. (2010), combining experimental evidence from a gift exchange game and analysis of multi-country survey data, show that workers' work effort is influenced by comparison income. Perez-Asenjo (2011) using the US General Social Survey identifies the reference groups that have most significant effect on individual's reported happiness. Then it shows that the social comparison with the reference group influences the hours an individual works. We differ from these contributions by exploring the workings of Veblen effects in a setting where the employer (not the employee) selects the hours of work and by explicitly modeling the possible conflict of interest between the two. Our estimates are also based on a new century-long data set.

In the next section we present the conflict over working hours, providing conditions under which workers will prefer shorter hours than those selected by a profit maximizing employer. Section 3 gives conditions under which increases in the income of the rich will increase equilibrium work hours. In Section 4 we study direct limits on working hours by political representations of workers, trade unions or leftist parties. Section 5 presents data on hours, top income shares and political representation of workers in 10 countries over the past century, and Section 6 presents estimates of the Veblen effect and the political representation effects identified by the model. Section 7 extends the empirical model of Section 6, testing alternative hypotheses.

2. Conflict over working hours

2.1. Workers

Workers derive utilities from consumption, leisure, but experience disutility from exerting effort. When employed, a worker spends h hours working at a wage rate w per hour, exerting per hour effort e. Workers do not save, so their own consumption is just income, wh. To model the effect of the conspicuous consumption of an individual's top-income reference group, following Bowles and Park (2005), we define effective consumption (x) as an individual's own consumption level minus the invidious consumption effect, namely a constant v (for Veblen) times the consumption level of the reference group ($\hat{c}$)[1]; $x = wh - v\hat{c}$. This form captures the fact that invidious comparisons with wealthier individuals both reduce one's own utility and raise the marginal utility of own consumption. The utility of effective consumption in a given time period takes the following form;

$$C(x) = \frac{1}{1-\rho}(x^{1-\rho} - 1), \quad \rho > 0$$

where the parameter ρ measures the degree of concavity of the function, namely the rate at which the marginal utility of effective consumption diminishes. Workers' utility of the leisure l is $L(l)$, where $l = 1 - h$, the time endowments are normalized to 1, and L is increasing and concave in its argument. Workers' disutility of work effort is increasing and convex in the total effort expended, $g(eh)$. We assume for simplicity that workers provide either $e = 0$ or $e = 1$. When employees shirk ($e = 0$), they do not experience disutility of work effort, $g(0) = 0$. When unemployed, a worker receives an unemployment benefit, b, so the effective consumption of the unemployed is $b - v\hat{c}$. The benefit is less than the income of the employed, $wh > b$, over the relevant ranges of w and h. We assume the worker's utility is separable, thus we have following instantaneous utility functions for non-shirking employees (U^N), shirking employees (U^S), and the unemployed (U^U).

$$U^N(w, h; \hat{c}) = C(wh - v\hat{c}) + L(1 - h) - g(h)$$

$$U^S(w, h; \hat{c}) = C(wh - v\hat{c}) + L(1 - h)$$

$$U^U(\hat{c}) = C(b - v\hat{c}) + L(1)$$

The employee will choose not to shirk if the utility from shirking is no greater than the utility from not shirking. The probability a shirking worker will be observed shirking is increasing in the hours on the job so we assume that employers

[1] We used top 1% income as $\hat{c}$ for the empirical study.

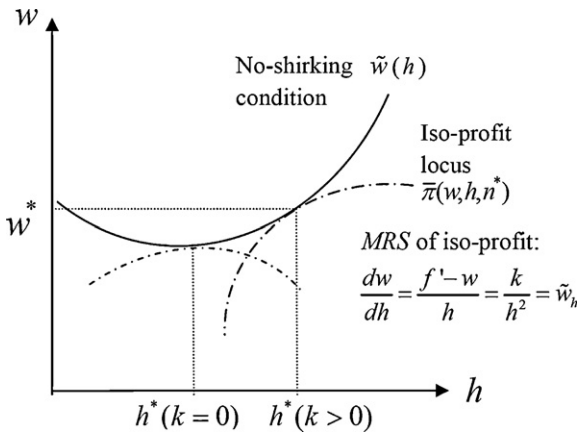


Fig. 2. The employer's profit maximizing choice of work hours subject to the No-shirking condition (NSC).

can detect and dismiss shirkers with termination probability t, which is linear in work hours ($t=\tau h$), where τ is a positive constant given by the nature of the production process. We derive the no-shirking condition (NSC) following Shapiro and Stiglitz (1984):

$$U^N - U^U \geq (r+\lambda+q)\frac{U^S - U^N}{t} \tag{1}$$

where $U^N - U^U = C(wh - v\hat{c}) + L(1-h) - g(h) - C(b - v\hat{c}) - L(1)$ and $U^S - U^N = g(h)$. The parameter q is the probability of per period job separation for exogenous reasons (including retirement), λ is the per period job acquisition rate, and r denotes the per period discount rate. See Appendix A.1 for the derivation of the NSC. The left-hand side of (1) is the per period job rent, that is, the benefit of not shirking; and the second term of the right-hand side is the expected benefit of shirking, namely the per period utility gain from shirking on the job multiplied by the expected duration of a shirker's employment ($1/t$). Thus the right hand side of (1) is the minimum per period job rent sufficient to deter shirking, which is the expected benefit of shirking ($(U^S - U^N)/t$) multiplied by the discount factor. We call the term simply the expected benefit of shirking and denote it by $\eta(h)$, i.e. $\eta(h) := (r+\lambda+q)((g(h))/(t(h)))$. Solving (1) as an equality for the wage, we get the no-shirking wage as a function of h and $\hat{c}$: $\tilde{w} = \tilde{w}(h, \hat{c})$. We call $\tilde{w}_h$, the partial derivative of $\tilde{w}$ with respect to h, the employer's marginal wage cost of increasing work hours. A no-shirking wage function appears in Fig. 2 above.

2.2. The firm

We assume that there is a large number of firms in the economy. An employer varies working hours, the number of workers (n), and the wage rate to maximize profits subject to the no shirking condition (NSC). The firm's production function is $f(nh)$, where $f' > 0, f'' < 0$. There is a positive employment cost (k) to employ a worker, independent of the number of hours, which consists of search, training, and related costs that do not vary with hours. Firm's profit maximization problem can be written as

$$\max_{w,n,h} f(nh) - n(wh+k)$$
$$s.t.\ w \geq \tilde{w}(h, \hat{c})$$

Let (n^*, h^*) be an interior equilibrium. The equilibrium h^* satisfies the following condition:

$$\tilde{w}_h h = \frac{k}{h} \tag{2}$$

See Appendix A.5 for the derivation of Eq. (2). The employer offers the equilibrium hours h^* such that the marginal effect on the wage bill of increasing hours (the left hand side of (2)) is equal to the average (employment) cost per hour (the right hand side of (2)).

Fig. 2 illustrates the profit-maximizing choice of work hours by the employer given by the tangency of the iso-profit locus to the no shirking condition. We also see that when $k=0$, at the equilibrium values w^* and h^* the slopes of the NSC and the iso-profit locus are zero, while they are positive when $k>0$. We now find $\tilde{w}_h$ the marginal wage cost of increasing work hours (namely, the slope of the NSC in Fig. 2). By differentiating (1) as an equality with respect to h and rearranging, we get

$$\tilde{w}_h = -\frac{\tilde{w}C' - L' - g'}{hC'} + \frac{\eta'}{hC'} \tag{3}$$

where $\eta'(h) = ((r+\lambda+q)/t)(g' - ((t')/t)g)$ is the marginal effect of an increase in hours on the expected benefit of shirking (namely the rate of increase in disutility of effort minus the rate of increase in the probability of termination). The first term

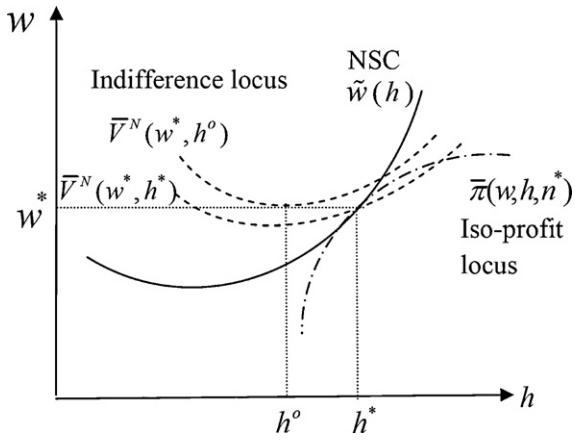


Fig. 3. Employees prefer shorter hours.

on the right hand side is the marginal rate of substitution between hours and wages on the employees' indifference locus $(-(V_h^N)/(V_w^N) = -(\tilde{w}C' - L' - g')/(hC'))$, meaning the wage increase required to compensate the non shirking workers for their increased hours. The second term is an additional wage increase to offset the increased incentive to shirk. Note that the term $\eta'(h)$ is positive[2] for all h because we have $((g')/g) > ((t')/t)$ from the assumptions of $t = \tau h$ and $g(0) = 0$, $g'' > 0$. Note also that the employer maximizes profits subject to the no shirking condition – an incentive compatibility constraint based on the employee's best response – rather than the employees' participation constraint. The resulting hours of work and wage cannot be Pareto efficient even in the case where there is no conflict over work hours (see Appendix A.3).

We now explore the conditions under which employees would prefer to work shorter hours than h^*.

2.3. Conflict over working hours

Employers have an interest in providing the hours that employees prefer, because by doing so they enhance the present value of the job rent and thereby reduce the no-shirking wage. But here are two sources of possible conflict over work hours. Shorter hours require paying the fixed employment cost (k) for more employees, so the interests of the employer and employee are not perfectly aligned when $k > 0$. Employer and employee interests diverge in a second way, one that may offset the first. Increases in hours raise the expected benefits of shirking ($\eta'(h)$ in Eq. (3)). This is because the effect of greater hours on the marginal disutility of not shirking exceeds the effect on the likelihood that a shirker will be detected. When expected-benefits-of-shirking effect exceeds the employment-cost effect, workers will prefer more hours than employers provide, conditional on the given wage. Here we consider the historically more relevant case in which employees prefer shorter hours than employers provide. Other cases are shown in Appendix A.4.

Suppose that for some arbitrary wage, employees were to choose their own working hours: they would vary h to maximize the present value of the job,[3] $V^N = ((\lambda + r)U^N + qU^U)/(r(\lambda + r + q))$. Let $h^o = h^o(w)$ be the worker's optimal working hours determined by equating the marginal utility of the increased consumption made possible by greater hours to the disutility of lost leisure and increased on the job effort, or

$$U_h^N(w, h^o(w)) = wC' - L' - g' = 0, \quad \text{for the given } w \tag{4}$$

When U_h^N is evaluated at the equilibrium (no shirking) wage and workers' optimal hours, we have $U_h^N(w^*, h^o(w^*)) = 0$. It is easy to check that h^o is a local maximum, satisfying the second order condition, $U_{hh}^N = (w^2C'' + L'' - g'') < 0$, because $C'' < 0$, $L'' \leq 0$, and $g'' > 0$.

By substituting (3) into (2), we get the employer's equilibrium condition from which h^* is determined:

$$k = h^2\tilde{w}_h = -\frac{h}{C'}(\tilde{w}C' - L' - g') + \frac{h}{C'}\eta' \tag{5}$$

If $k > (h/C')\eta'$, the term $(\tilde{w}C' - L' - g')$ will be negative at the equilibrium, $U_h^N(w^*, h^*) < 0$. In this case workers will prefer shorter hours than the equilibrium hours, $h^* > h^o$, because $U_h^N(w^*, h^*) < U_h^N(w^*, h^o(w^*)) = 0$ and the marginal utility is decreasing in h (that is, $U_{hh}^N < 0$) given the wage.

Fig. 3 shows employees' two indifference loci $\bar{V}^N$ that go through $(w^*, h^o(w^*))$ and (w^*, h^*) when $k > 0$. At given w^*, employees' utilities are higher at (w^*, h^o) than at (w^*, h^*), implying that workers prefer shorter hours than h^*. The economic

[2] The result $\eta'(h) > 0$ is not confined to the case of a linear termination technology. See Appendix A.2.

[3] Since workers will not shirk at the no shirking wage, we only consider no shirking workers.

intuition is the following. If the employment cost effect is greater than the effect on the benefit of shirking, it will be profitable for the employer to hire fewer workers with longer hours than that are preferred by employees at the no shirking wage.

We record this observation as Proposition 1.

Proposition 1 (Conflict over hours). *If $k > (h^*/C')\eta'$ at the equilibrium, the employer selects longer working hours than employees prefer.*

3. The Veblen effect

The conflict over work hours (Proposition 1) occurs because on the margin the firm evaluates the hours-wages trade off differently from workers. By contrast, the Veblen effect on work hours occurs because the firm responds to the changes in workers' preferences that result from an increase in consumption by a richer reference group($\hat{c}$), which alters the workers' wages-hours trade off, inducing them to prefer more hours. To see this we begin with the effect of $\hat{c}$ on worker's optimal working hours using (4):

$$\frac{dh^o}{d\hat{c}} = \frac{wvC''}{w^2C'' + L'' - g''} \geq 0$$

The increase in the consumption of the top reference group lowers the effective consumption of the worker ($wh - v\hat{c}$), raising the marginal utility of consumption (because the utility function is concave) and thus inducing the worker to desire longer working hours. Now we perform the comparative statics of the changes in $\hat{c}$ on equilibrium working hours, which we call the Veblen effect. The effect of an increase in $\hat{c}$ on the equilibrium h^* is

$$\frac{dh^*}{d\hat{c}} = \frac{f''nh^3\tilde{w}_{h\hat{c}}}{\left|H\right|} \tag{6}$$

where the denominator, $\left|H\right| = -f''nh^2(2\tilde{w}_h + h\,\tilde{w}_{hh})$, is positive for a profit maximum (see Appendix A.5 for the derivation). If the sign of $\tilde{w}_{h\hat{c}}$ is negative, then we have $(dh^*)/(d\hat{c}) > 0$. We then find $\tilde{w}_{h\hat{c}}$ using (3):

$$\tilde{w}_{h\hat{c}} = \underbrace{\frac{\tilde{w}_h}{C'}C''(v - h\tilde{w}_{\hat{c}})}_{\text{(i)}} + \frac{1}{hC'}\underbrace{\{v\tilde{w}C'' - \tilde{w}_{\hat{c}}(C' + \tilde{w}hC'')\}}_{\text{(ii)}} \tag{7}$$

We also find $\tilde{w}_{\hat{c}} = (v/(hC'))(C' - C'_U)$ from the NSC, where C'_U is the unemployed workers' marginal utility of consumption evaluated at $b - v\tilde{c}$; i.e. $C'_U = C'(b - v\hat{c})$. We have $\tilde{w}_{\hat{c}} < 0$ because the marginal utility of effective consumption of the unemployed is greater than that of the employed, $C' - C'_U < 0$, from the fact that $wh - v\tilde{c} > b - v\tilde{c}$ and $C'' < 0$. The increase in $\hat{c}$ reduces the utility of the unemployed more than the employed and so raises the value of the employment rent ($U^N - U^U$).

Proposition 2 provides an intuitive sufficient condition under which the increase in the consumption of the top reference group lowers the marginal wage cost of increasing work hours, so the employer offers longer work hours.

Proposition 2 (Veblen effect). *If the worker's utility function is sufficiently concave,*[4] *that is, $\rho > ((w^*h^* - v\hat{c})/(w^*h^*))$, then the increase in $\hat{c}$ raises the equilibrium working hours.*

Proof. We determine the sign of $\tilde{w}_{h\hat{c}}$. First, it is easy to check the term (i) in (7) is negative because $\tilde{w}_h > 0$ and $\tilde{w}_{\hat{c}} < 0$. From the assumption of CES consumption function, $C(x)$, we have the following property: $\rho = -(C''/C')x$. Thus at the equilibrium (w^*, h^*), we have

$$\rho = -\frac{C''}{C'}(w^*h^* - v\hat{c}) > \frac{w^*h^* - v\hat{c}}{w^*h^*}$$

Then $C' + w^*h^*C'' < 0$, so the term (ii) is negative. Thus we have $\tilde{w}_{h\hat{c}} < 0$, and we conclude that $(dh^*/d\hat{c}) > 0$ from Eq. (6). □

The increase in $\hat{c}$ lowers the marginal wage cost of increasing h ($\tilde{w}_h$) because (i) it lowers effective consumption, and so raises C', (ii) raises the job rent, so the firm can lower the wage, $\tilde{w}_{\hat{c}} < 0$. However, the increase in $\hat{c}$ also has an offsetting effect on $\tilde{w}_h$ because the lowered wage weakens the income effect of h that enables the employer to reduce the no-shirking wage. The first two effects, (i) and (ii), inducing the employer to offer longer working hours will dominate the second effect if workers' C'' is large relative to C' in absolute value, that is if the utility function is sufficiently concave.

We illustrate the Veblen effect in Fig. 4. For any given h, the increase in the income of the top reference group lowers the no-shirking wage ($\tilde{w}_{\hat{c}} < 0$) and lowers the cost of increasing hours ($\tilde{w}_{h\hat{c}} < 0$), which rotates $\tilde{w}(h, \hat{c})_1$ clockwise to $\tilde{w}(h, \hat{c})_2$. Intuitively, if the increase in $\hat{c}$ lowers the marginal wage cost of increasing h, i.e. $\tilde{w}_{h\hat{c}} < 0$, then given the concavity of the

[4] Note that the condition $\rho > ((w^*h^* - v\hat{c})/(w^*h^*))$ does not require an implausible level of concavity of the workers' utility function; a logarithmic function ($\rho \to 1$) satisfies the condition for example, and for a substantial Veblen effect considerably less concave functions do as well.

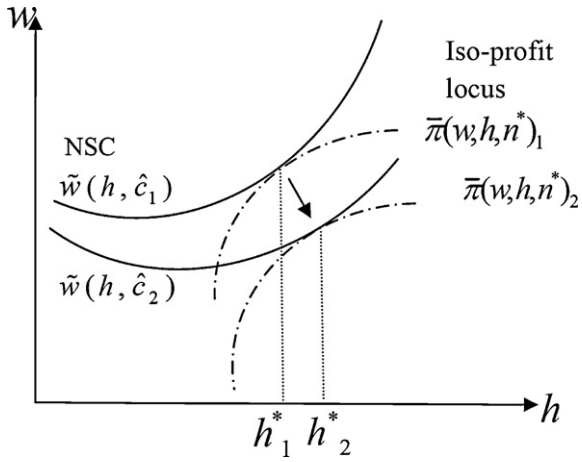


Fig. 4. The Veblen effect (increase in $\hat{c}$).

production function, the firm in response will raise working hours to satisfy the first order condition. This gives us the Veblen effect.

4. Political representations of workers

The work hours observed in any economy are determined in part by the competitive and non-cooperative interactions of workers and employers, as we have modeled them above. But work hours are typically also influenced by collective action by workers and their employers and by governments. If employers offer longer hours than the work hours desired by employees, trade unions may bargain directly with employers to limit the length of the working day, and political parties representing workers may advocate government interventions to reduce work hours. We might then expect to observe an inverse relationship between observed hours of work and the strength of unions and worker based political parties. However, workers' organizations may not advocate for hours reduction if this does not make workers better off. The mandated or bargained hours reductions may harm workers or at least some workers if they operate through firm responses or general competitive effects in the economy as a whole.

First, hours reductions could adversely affect some workers in the long-run if adopted on an economy-wide basis in a competitive market. Such an intervention would reduce firms' profits and lead to the exit of some firms, and as a result would reduce the fallback position of employed workers due to the higher unemployment rate and corresponding lower job acquisition rate (to restore the competitive equilibrium zero profit condition). Thus we need to examine the conditions under which national organizations of workers – a political party or centralized union aware of these economy wide effects and taking account of them in evaluating an intervention – would demand hours limitations.

Second, the degree of inclusiveness and centralized bargaining of a union also matters. The decision making process of a firm level or highly decentralized exclusive trade union dominated by employees with sufficient seniority or other protection that they will not be among those adversely affected should the firm reduce the number of employees it hires, will be different from that of an inclusive national union that weighs equally the interests of all workers whether employed or not and takes account of the general equilibrium effects of an hours limitation. Contemporary examples of an exclusive and inclusive union, respectively, are the International Union of Operating Engineers in the US and the Swedish Landsorganisationen (LO). We will see in this section that the effects of trade unions and political representation of workers on observed hours will depend on the extent to which workers take these indirect effects into account when they design public policies or bargain with employers.

4.1. An inclusive national workers' organization

Most of the demands for work hours limitations historically have taken the form of fewer hours at the going wage, or even more commonly, fewer hours for the same daily pay (i.e. an hourly wage increase accompanied by an hours reduction). In this section we examine whether the political representations of workers would bargain for imposing an hours limitation while preserving the current hourly wage. We consider the economy-wide union or leftist party representing workers that is aware of the effects of its demands on the profitability of firms and hence on their hiring decisions.[5] We treat the political party or the centralized national trade union as a single actor, attributing to it an objective function that might be the outcome

[5] We use the terms national centralized trade union, leftist political party and workers' representatives interchangeably.

of a plausible political processes within the relevant organization.[6] As a counterpart we assume a representative firm which aggregates all identical competitive firms.

Our benchmark is a general equilibrium $(h^*, n^*, w^*, \lambda^*)$ in which given a fixed cost of employment, the employer chooses working hours (h), total number of employment (n), wage (w) subject to NSC, and the job acquisition rate (λ) is determined by the steady state of the labor market. Let N be the total number of workers (both employed and unemployed), then the number of unemployed workers is $N-n$. In a steady state the flow into the unemployment pool is equal to the flow out, $qn = \lambda(N-n)$, so $\lambda = (qn)/(N-n)$, where q is the job separation rate, from which we get the unemployment rate, $u := ((N-n)/N) = (q/(\lambda+q))$.

We assume that the national union or the leftist party cares equally about employed and unemployed workers. The party's objective function, V^T, is the weighted average of the utility of employed and unemployed workers, the weights being the fraction of the labor force with and without jobs; $V^T = (n/N)V^N + ((N-n)/N)V^U$. The party may value expanding employment more highly than this "sum of worker utility" approach because they have pro-poor distributional values (Alesina et al., 2005). But we adopt this formulation here for simplicity, and because it could arguably be the objective function of a utilitarian social planner maximizing social welfare. We can express V^T as the employment rent enjoyed by the employed workers plus the utility of the unemployed:

$$V^T = \frac{1+r}{r}\left\{\frac{n}{N}(U^N - U^U) + U^U\right\}$$

We first examine how the firm responds to the reduction in work hours given the wage w^*. We denote the maximum hours limit by $\hat{h}$ which is less than h^*. The employer will choose the maximum hours $\hat{h}$ because $\pi_h\big|_{h<h^*} > 0$. With exogenously given $\hat{h}$ and w^*, the firm will choose the number of workers which maximizes profits. Let $\hat{n} = n(\hat{h})$ be an interior equilibrium employment satisfying, $\pi_n = \hat{h}f'(\hat{n}\hat{h}) - (w^*\hat{h} + k) = 0$.

What is the condition under which hours limitation results in "job-spreading", that is, $(dn/dh) < 0$, so the reduction in hours can actually increase the number of workers hired? We find (dn/dh) from the first order condition, $\pi_n = 0$:

$$\frac{dn}{dh} = \frac{\pi_{nh}}{-\pi_{nn}} = \frac{f' - w^* + nhf''}{-h^2 f''} \tag{8}$$

If we have the condition, $\pi_{nh}\big|_{w=w^*} = f' - w^* + nhf'' < 0$, then $(dn/dh) < 0$. The intuition behind this condition is that the reduction in hours of work has two opposite effects on the number of workers hired. First, it raises the cost per hour of work (due to the fixed cost now being spread over fewer hours). Note that we have $f' - w^* = k/h$ from $\pi_n = 0$, where k/h is the fixed cost per hour of work. But second, the reduction in hours also raises the marginal product of labor for a given number of employees hired because the sum of labor provided to production is reduced and the production function is concave. This second effect is captured in the term, nhf'' in (8), so if the production function is sufficiently concave, this reduction in labor input will result in a large enough increase in the marginal product of labor to offset the increased cost[7] (the first effect).

The workers' representations are aware of the effects of its demands on the hiring decisions, so the number of employment (n) comes in the union's objective function. As we have seen from the previous paragraph, the level of employment is a function of the maximum hours limit, so we rewrite V^T as follows:

$$V^T(h) = \frac{1+r}{rN}[n(h)\{U^N(w^*, h) - U^U\} + NU^U]$$

By differentiating $V^T(h)$ with respect to h, we get

$$\frac{dV^T(h)}{dh} = \frac{1+r}{rN}\left\{\frac{dn}{dh}(U^N - U^U) + nU_h^N\right\} \tag{9}$$

where $U_h^N = w^*C' - L' - g' < 0$ because employees prefer shorter hours. The first term in the curly brackets on the right hand side of (9) is the effect on the total job rent by the changes in n caused by the hours reduction, and the second term is the effect on each employee's utility by the reduction in hours. The leftist party or national union will bargain for reduction in work hours if $((dV^T(h))/dh) < 0$, which in turn depends on the sign of (dn/dh). There are two possible cases, depending on the sign of (dn/dh). First, suppose that the maximum hours limit policy increases the total number of employees n $((dn/dh) < 0)$, then obviously we have $((dV^T(h))/dh) < 0$. In this case the reduction in hours has a job spreading effect as well as increases the employed workers' utility, so the workers' representatives will implement it if they can. But, suppose that the maximum

[6] Deriving the objective function formally would add no additional insights.

[7] An example illustrates this. Let $f(x) = x^\beta$, $0 < \beta < 1$ be the production (or revenue) function. Then the condition for $(dn/dh) < 0$ can be expressed as $f' + nhf'' < w^*$, which in the example is $\beta^2(nh)^{\beta-1} < w^*$. Note that the condition holds for sufficiently low β (sufficiently concave) because the term $\beta^2(nh)^{\beta-1}$ is increasing in β, and lower values of β make the function more concave. Thus the employer hires more workers in response to the restriction on work hours, if the production function is sufficiently concave.

hours limit policy reduces the total number of employees n ($(dn/dh) > 0$). Then we need the following condition to have $((dV^T(h))/dh) < 0$:

$$\frac{dn}{dh}(U^N - U^U) < -nU_h^N$$

If the positive effect on the utility of the employed workers (right hand side) exceeds the per period job rents lost by the workers who become unemployed as a result of the intervention (left hand side), then the union or the party will pursue the hours limitation policy even though the total number of employees is reduced.

Proposition 3 (National union bargaining). *In a competitive market equilibrium in which employees prefer shorter work hours than offered by employers, a policy imposing a binding hours limitation at a given wage makes the leftist party or the national union better off, if (i) the production function is sufficiently concave(so that $\pi_{nh} < 0$) or (ii) the policy effect on the utility of the employed workers exceeds the lost job rents of the workers who lose their jobs: $dn/dh < -nU_h^N/(U^N - U^U)$.*

4.2. An exclusive local union

The exclusive local union, representing the interests of its members only, interacts with a single firm (one of many in the economy) and is only a small part of the labor market. As a result the union does not take account of the effect of an hours limitation that it may impose on its firm's hiring decision and the fallback position of workers or the welfare of the unemployed workers (they assume that V^U is exogenously given). However, the union is aware that should it impose shorter working hours than the firm's profit maximizing choice, this will lower the firm's wage offer. Note that we have $\tilde{w}_h > 0$ at the equilibrium, so shorter working hours induce the firm to offer lower wage. And conversely should the union impose higher wages, this will increase the firm's hours of work decision. The objective function of the exclusive local union is simply the same as employed worker's utility function. Since V^U and λ are considered to be exogenous, from (A.1) in Appendix A.1, we define V^T as follows.

$$V^T(w,h) := V^N(w,h) = \frac{(1+r)U^N(w,h) + qV^U}{r+q}. \tag{10}$$

First, suppose the exclusive local union bargains for shorter hours and the wage is determined by the NSC, $w = \tilde{w}(h)$, then we can rewrite (10) as

$$V^T(h) := V^N(\tilde{w}(h),h) = \frac{(1+r)U^N(\tilde{w}(h),h) + qV^U}{r+q}$$

The immediate result is that the exclusive local union is worse off by the reduction in hours;

$$\left.\frac{dV^T(h)}{dh}\right|_{h=h^*} = \frac{dV^N(\tilde{w}(h),h)}{dh} = \frac{1+r}{r+q}\frac{dU^N(\tilde{w}(h),h)}{dh} > 0$$

because $((dU^N(\tilde{w}(h),h))/dh) = C'(\tilde{w} + h\tilde{w}_h) - L' - g'$ and from Eq. (3) in Section 2.2, we know $C'(\tilde{w} + h\tilde{w}_h) - L' - g' = \eta' > 0$.

So the local union will not bargain for shorter hours; instead it may bargain for higher wages ($w > w^*$). If the union is bargaining for higher wages, we can write the union's objective function as $V^T(w) := V^N(w, \tilde{h}(w))$, where $h = \tilde{h}(w)$ is the inverse relation of $w = \tilde{w}(h)$ for only the packages $\{w,h\}$ along the positive sloped NSC ($(d\tilde{w}/dh) > 0$). The effect of a wage increase and the accompanying hours increase to remain on the NSC on the union's utility is

$$\left.\frac{dV^T(w)}{dw}\right|_{w=w^*} = \frac{dV^N(w,\tilde{h}(w))}{dw} = V_w^N + V_h^N\frac{d\tilde{h}}{dw} > 0$$

By the inverse function theorem, we have $(d\tilde{h}/dw) = 1/((d\tilde{w})/(dh))$. The sign of $((dV^T(w))/dw)$ is positive because we know from Eq. (3) that the slope of the NSC curve in $w-h$ plane is greater (steeper) than the slope of the worker's indifference locus: $(d\tilde{w}/dh) > -((V_h^N)/(V_w^N))$. The employed workers gain as a result (abstracting from general equilibrium effects), and firm level profits are lower. Note that even though the firm's response to the union's demands is to reduce the number of employees, the exclusive union is likely to bargain for higher wages (rent seeking). We summarize the result in the following proposition.

Proposition 4 (Local union bargaining). *If employed members would prefer a reduction in work hours at the current wage, an exclusive local union that places no value on the utility of the unemployed but recognizes that the firm will respond to its demands by implementing the no shirking condition will favor an increase in the wage with longer hours as the result.*

5. Top incomes, political representation, and work hours

The importance of both society-wide interpersonal comparison-based utilities (the Veblen effect) and national-level political representation in the determination of work hours in our model suggests that studying work hours averaged over individuals using a historical data set may be the proper way to test the model. The historical data on work hours for

the whole 20th century is provided by Huberman (2004) (the alternative measure of work hours by Huberman and Minns (2007) yields similar results in Appendix B.4). These figures are annual average work hours for full-time production workers. Because significant long run changes in work hours are driven by work week related legislation such as the minimum annual paid leave provisions (Faggio and Nickell, 2007), it is important to use a work hours measure that covers variations in both weeks worked and hours per week.

To implement the idea (demonstrated in earlier work (Bowles and Park, 2005)) that the reference group of the comparison based utility function is the rich (Veblen's leisure class), we chose the income share of the richest 1 percent of the population as our measure of income inequality. Beginning with the work by Piketty (2003) on the long-run distribution of top incomes in France, researchers have used taxation-based data to estimate the share of total income received by the richest groups (Atkinson et al., 2011). Since taxes were levied only on the richest portion of each country in the earlier years of 20th century, only the top 1% share provides a long enough series to cover the entire 20th century for the 10 advanced economies in the data set. Our inequality measure avoids a possible confound between the Veblen effect reference group hypothesis and the rat-race hypothesis (Bell and Freeman, 2001; Landers et al., 1996) that wage inequality provides an incentive for working long hours as an effective signal of a difficult to observe quality likely to result in promotion. One may question if the very rich, represented by the top 1% share is the proper reference group for the Veblen effect. In a model with many income groups, each of which takes the next richest group as its reference group, we can show that an increase in consumption by the rich generates a downward cascade of Veblen effects, increasing work hours throughout the income distribution. Levine et al. (2010) provide a more sophisticated model of it. However, our hypothesis does not depend on there being a cascade (as opposed to direct effects) or any other particular mechanism by which the rich are emulated. Rather, our objective is to test the specifically Veblen version of the relative standing hypotheses that the best-off members of a community – the leisure class – establish the consumption standards for the rest. In an earlier paper, Bowles and Park (2005) found that inequality is associated with longer hours (using late 20th century data) and showed that the magnitude and statistical significance of this Veblen effect was robust to three different measures of inequality (the P90/P50 ratio, the Gini, and the Theil). Leigh (2007) provides measures for these countries that are adjusted to make them more comparable; we use this adjusted measure (Overtime changes of the top 1% income share for each country are in Appendix B.2).

For the political representation through which employees may reduce the gap between their preferred hours and employer determined hours, we measure two political elements. First, given that democratically implemented reforms take time, we measured the cumulative effect of democratic governance measured in terms of the number of years from the start of general male suffrage (similar to the 'stock of democracy' in Gallagher and Thacker (2008)). The second dimension affecting the political representation of employees is the total vote shares of social democratic and leftist parties in each country. The start year of democracy is that date of universal male suffrage is constructed from Therborn (1977). The data on vote share of social democratic and leftist parties are from Von Beyme (1985) for pre-1980 and we used the same party distinction for the periods after 1980. The data on which our measures are based and further measurement information appears in Appendix B.3. We construct the political representation variable as a product of the two variables so as to capture the complementarity between the democracy and political representation of employees (the marginal effect of each is assumed to be increasing in the level of the other).

Since the marginal contribution of maturity of a regime of universal suffrage to the degree of democracy is expected to decrease as citizens and their political parties move up a learning curve we use the natural logarithm of the years from the general male suffrage (results are not qualitatively different if we use simply years). The political representation measure and its overtime changes appear in Appendix B.2.

6. Estimates

Fig. 5 presents the top income share and political representation data along with annual hours. The simple correlations ($r = 0.77$ for top income share and $r = -0.67$ for political representation) are substantial.

But this may arise from cross country cultural and institutional differences that are not part of our model. We therefore estimate the following, a more complete time and country fixed effects model.

$$h^{it} = a + bV^{it} + cR^{it} + dX^{it} + \lambda^{i} + \delta^{t} + \mu^{it}$$

where h^{it} is the natural logarithm of work hours in country i in time t, V^{it} is the measure of top income share, R^{it} is the measure of political representation, and X^{it} is a vector of other possible exogenous influences on hours (with d its vector of estimated coefficients), λ^{i} is a country fixed effect, δ^{t} is a year fixed effect, and μ^{it} is an error term. The country fixed effects will take account of cultural and institutional differences and other country-specific unobserved influences on hours. For control variables we considered real gross domestic product per capita (to measure possible influences of income levels on consumption and leisure preferences) and the deviation of real per capita GDP from its 5 year moving average as a measure of variations in the demand for labor over the business cycle. The GDP variables are expressed in common units.

Union density is added to see if it had an independent effect on work hours that was not captured by our key variables. We would like to be able to control for the changes in demographic structure capturing the effect of women's labor force

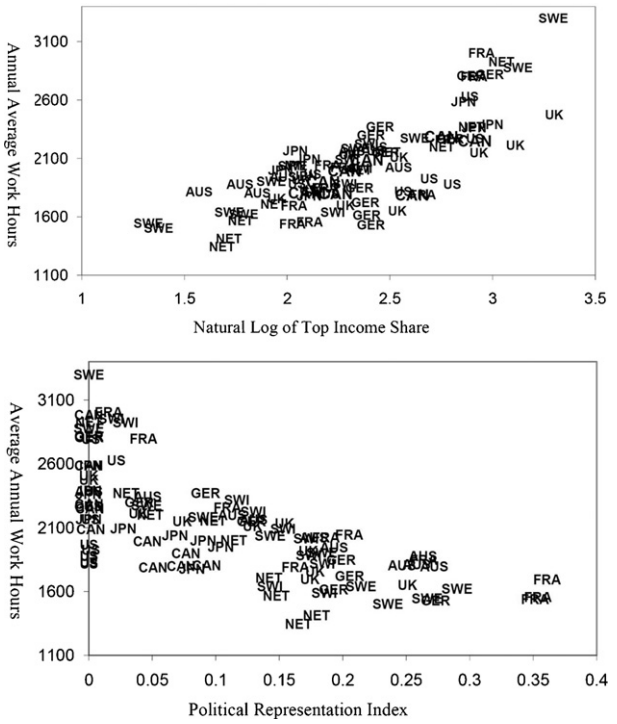


Fig. 5. Scatter plots for work hours, top income shares and political representation.

participation, aging on labor supply and child care demands on labor supply, but the required data do not exist for the countries and time period under consideration. As indirect measures of these influences on work hours we introduce measures of the share of population in the labor force and the rate of population growth. We included year fixed effects to capture the possible influences of changes in preferences due to the advent of time-using leisure goods on the value of non-working time (Greenwood and Vandenbroucke, 2005). In contrast to other measures of income inequality, the top 1% income share is unlikely to be affected by the work hours of full time production workers, so we assume that variations in top shares are not endogenous.

Our estimates in Table 1 indicate significant positive effects of top incomes shares on work hours and significant negative effects of political representation on work hours. The estimated coefficients of the two key variables remain stable in magnitude and statistically significant when fixed effects for each country and year are added (column II) and additional controls for union density (column III) and demographic structure (column IV) are added.

Moreover, these effects are large. Based on estimates in column II (our preferred estimate), a 10 percent increase in top share increases work hours by 1.3 percent, while a standard deviation increase in the political representation of employees decreases work hours by 4.5 percent.

A substantial fraction of the observed decline in work hours is due to the effect of changes in these two variables. To see this, suppose hypothetically that neither of the two changed over the course of the century. Without the historically observed changes in average values of political representation and top income shares over the 20th century (an increase from 0.01 to 0.19 for political representation and a decrease from 3.08 to 2.24 for top share) the reduction in work hours would have been a third less (a decrease from 3041 to 2120 instead of the observed fall from 3041 to 1660). For the pre 1980 period during which the most rapid decline in hours occurred, we account for about 40 percent of the total reduction.

Per capita GDP has the predicted sign in equation I but in the country and year fixed-effects equations its coefficient is small and insignificant, suggesting that the fixed-effects may be capturing the income effect of common income growth of the 10 advanced economies that Huberman (2004) reported. GDP deviation also has predicted positive effect that economic boom tends to increase overall work hours.

Interestingly, union density does not have any significant effect on work hours independently of the level of political representation of workers. This may sound surprising given that micro-empirical research (Blanchflower, 1996; Ebbinghaus and Visser, 2000) suggests a negative union effect on work hours. Burgoon and Baxandall (2004) also find that union density may even increase annual work hours per employee or annual hours per working-age person due to union efforts to limit part-time work and to promote high levels of employment. However, our model shows that trade union's effect on work hours can vary depending on the degree of centralized bargaining: exclusive local unions may focus on raising wages (thus increasing work hours) while an inclusive economy-wide union with foresight may prefer job-spreading and thus seek to

Table 1
Baseline regressions.

Variables	I	II	III	IV	V
Ln(top income share)	0.120***	0.130***	0.112***	0.115***	−0.0573
	(0.0275)	(0.0315)	(0.0388)	(0.0404)	(0.0913)
Political representation	−0.322***	−0.453***	−0.449**	−0.467**	−1.507***
	(0.1110)	(0.1670)	(0.1870)	(0.2170)	(0.516)
Ln(top income share) × time+					0.0265**
					(0.0116)
Political representation × time					0.123**
					(0.0556)
Ln(GDP per capita)	−0.133***	0.0122	0.0147	0.0122	0.0460
	(0.0156)	(0.0364)	(0.0462)	(0.0456)	(0.0457)
GDP deviation	0.0103***	0.0083**	0.0089**	0.0093**	0.0106***
	(0.0036)	(0.0037)	(0.0038)	(0.0038)	(0.0037)
Ln(union density)			−0.0013	−0.00002	0.00635
			(0.0252)	(0.0251)	(0.0245)
Population growth				−0.0261*	−0.0325**
				(0.0146)	(0.0143)
Labor force as % of population				−0.134	−0.0603
				(0.2320)	(0.233)
Country and time fixed effects	No	Yes	Yes	Yes	Yes
Observations	88	88	83	83	83
R-squared	0.825	0.927	0.917	0.922	0.931

The dependent variable is the natural logarithm of working hours. Time+ is defined as (year − 1900)/10. Standard errors in parentheses.
See Table B.6-1 for full results with country and year fixed effects in Appendix.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

reduce work hours. We do not have measures of trade union structure over the period in question, but we are able to test this hypothesis in the next section using more recent data.

Changes in the composition of the labor force are unlikely to account for our results. According to Huberman and Minns (2007), part-time work in the period before the interwar years was minimal and only in the 1970s did a sizeable proportion of the labor force in certain countries begin to work less than full-time. As for women's hours, these tended to be close to those of men prior to the rise in female labor force participation in the 1960s. Note that in column IV hours vary inversely with the rate of population growth as expected if child care demands compete with paid employment; but including this measure has virtually no effect on the estimates of interest. The fact that our estimates are insensitive to the inclusion of demographic variables suggests that the biases in the coefficients of interest due to the absence of gender specific data may be modest.

While for the period as a whole both the Veblen effect and the political representation effect are substantial; they differ markedly in their time pattern. This is shown in column V in Table 1 where we interact the two measures with time. The Veblen effect is insignificant at the beginning of the period, rising over time so that by the end of the period a standard deviation difference in the top income share is associated with a nine percent difference in working hours (see Fig. 6). By contrast, the political representation effect is substantial at the beginning of the period (a standard deviation difference in political representation being associated with a 15 percent difference in work hours) but it declines to only two percent at the turn of the present century.

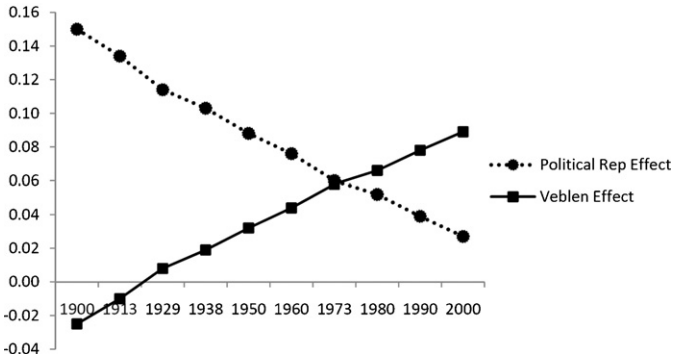


Fig. 6. Trends in the Veblen effect and the political representation effect. The vertical axis is the derivative of Ln(hours) with respect to the two independent variables taking account of the time interactions (column V of Table 1).

Table 2
Recursive regression results.

Variables	I Ln(work hours)	II Ln(top share)	III Ln(work hours)
Ln(top income share)			0.130***
			(0.0315)
Political representation	−0.613***	−1.230*	−0.453***
	(0.1810)	(0.6340)	(0.1670)
Ln(GDP per capita)	0.0214	0.071	0.0122
	(0.0405)	(0.1420)	(0.0364)
GDP deviation	0.00645	−0.0144	0.0083**
	(0.0041)	(0.0144)	(0.0037)
Constant	7.849***	2.655**	7.503***
	(0.3240)	(1.1340)	(0.3020)
Country and time fixed effects	Yes	Yes	Yes
Observations	88	88	88
R-squared	0.908	0.809	0.927

Standard errors in parentheses.
See Table B.6-2 for full results with country and year fixed effects in Appendix.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

The secular decline in the political representation effect is readily explained by the fact that as the century progressed workers and their political representatives shifted their focus away from the work hours question (partly in response to their early success in limiting hours). The increasing Veblen effect may be (as Veblen himself suggested would be the case) the result of the spread of mass communication (radio, TV and other) which made the consumption standards of the very rich an increasingly visible target of emulation. The blurring of class distinctions with the spread of a democratic culture may also have contributed as employees who had once compared their status only with other workers came increasingly to regard the rich as a relevant reference group. This too was anticipated by Veblen over a century ago.

> Especially in any community in which class distinctions are quite vague, all canons and reputability and decency and all standards of consumption are traced back by insensible gradations to the usages and thoughts of the highest social and pecuniary class, the wealthy leisure class (Veblen, 1934, p. 81).

So far we have implicitly assumed that our two key variables are independent. However, it is likely that the political strength of leftist parties indirectly affected the work hours by limiting the share of top 1%. We examine this possibility using a set of recursive regressions in Table 2. The first equation measures the effect of political representation without the top share variable capturing the total (direct and indirect) effect of political representation on work hours. The second regression shows the effect of political representation on the income share of top 1%. The third equation, which is identical to the one in the second column in Table 1, shows how the total effect of political representation in the first column is divided into direct effect – the coefficient of political representation variable – and the indirect effect.

Based on the estimates in Table 2, a standard deviation change in political representation (0.1 change in the variable) decreases work hours by 6.13 percent in the first column, while the same change decreases the top percentile income share by 12.3 percent in the second column. In turn, a 12.3 percent decrease in top share would decrease the work hours by about 1.6 ($=12.3 \times 0.13$) percent. When we add that to the 4.53 percent reduction that a standard deviation change in political representation may directly cause in the third column, we can see that the political representation has both direct and indirect effect on work hours and its sum is exactly 6.13 percent. Thus about a quarter of the total effect on work hours of the increase in the political representation of workers is indirect, operating via a reduction in the top income shares.

7. Unions, centralized bargaining and taxes: a further test

One of the surprising predictions of our model is that stronger unions may increase equilibrium work hours, depending on the degree of centralized bargaining. In this section, we provide a further test of the model using a new, shorter-term data (Labor Market Institutions Database, LMID by Nickell and Nunciata (2001)), which provides information on the degree of centralized bargaining that the longer term data lacked.

To implement the idea that the degree of centralized bargain might play a key role on the effect of union on work hours, we generated a dummy variable (CB) based on the degree of centralized bargaining variable in LMID. In the second set of regressions that are presented in Table 3, we show how union density has differential effect on work hours depending on the value of CB.

The new data set also allows us to control for the tax effect on work hours. In his seminal work, Prescott (2004) argues that "virtually all of the large differences between US labor supply and those of Germany and France are due to differences in tax systems." Notwithstanding the challenges by Alesina et al. (2005) on the possible omitted variable problem, the tax incentive argument became a primary competing hypothesis against institutional arguments on work hour decrease in Europe.

Table 3
Estimates when tax and union effects are added for the period of 1967–1995.

Variables	I Soc/poli	II Tax	III Both	IV PlusUnion	V PlusFemale
Tax share in $GDP_{(t-1)}$		−0.0291**	0.0230	0.0146	0.0134
		(0.0141)	(0.0148)	(0.0129)	(0.0131)
Ln(top income share)$_{(t-1)}$	0.148***		0.167***	0.192***	0.177***
	(0.0206)		(0.0237)	(0.0213)	(0.0227)
Political representation$_{(t-1)}$	−0.0262**		−0.0255**	−0.0325***	−0.0327***
	(0.0109)		(0.0109)	(0.0101)	(0.0103)
Ln(GDP per capita) $_{(t-1)}$	0.00296	0.0266	−0.00016	0.0952***	0.0724*
	(0.0324)	(0.0348)	(0.0324)	(0.0321)	(0.0408)
Unemployment rate$_{(t-1)}$	−0.0437***	−0.0508***	−0.0379***	−0.0282**	−0.0275**
	(0.0133)	(0.0147)	(0.0137)	(0.0126)	(0.0129)
Centralized bargaining (CB) $_{(t-1)}$				0.0402*	0.0094
				(0.0242)	(0.0275)
Union density$_{(t-1)}$				0.0221***	0.0178***
				(0.0058)	(0.0062)
Union density$_{(t-1)}$ when CB = 1				−0.0145***	−0.0106**
				(0.0046)	(0.0049)
Female share in labor force$_{(t-1)}$					−0.0129
					(0.0164)
Country and time fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	295	295	295	290	280
Adjusted *R*-squared	0.901	0.877	0.902	0.926	0.927

Standard errors in parentheses.
See Table B.6-3 for full results with country and year fixed effects in Appendix.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

To examine the tax incentive effect we chose the sum of income tax and employee's social security contribution (measured as a share of GDP). While this is not the marginal tax rate that Prescott's model is based on, it is still based on the direct tax that employees pay and therefore is closely aligned with the marginal tax rate.[8]

Other than these two new variables, the same variables are used for both the Veblen effect and political representation of workers[9] and GDP per capita and unemployment rate variables are used as controls as well as time and country fixed effects. Because LMID are annual data, we are able to lag all the independent variables to address how the effects of social and political variables may percolate through an expenditure cascade and party interactions to produce change in work hours. The lagged independent variables may also address any concern on the possible feedback of work hours change on the variables.

The estimates in Table 3 show that our key findings in Table 1 are confirmed in the new sample and are not driven by the omission of the tax variable. The first regression reproduces the result in Table 1 for the new data set: the top share and the vote share of leftist parties both have expected effects on work hours. The coefficients are significant both statistically and economically. A standard deviation increase in the top income share and political representation would change work hours by 2.86 percent (increase) and 1.72 percent (decrease) respectively. Compared to the estimated marginal effect in Table 1, the magnitude of Veblen effect has increased while that of political representation effect has decreased. This result is consistent with the century long trend in effect sizes shown in Fig. 6.

In regression II, we show that there is also a robust negative relationship between the tax share of GDP and hours worked across countries, consistent with Prescott (2004). A standard deviation increase in tax share would decrease work hours by 1.73 percent. Regression III, however, shows that when top share and political representation variables are added, the tax variable becomes positive and insignificant. This suggests that the tax incentive argument put forth by Prescott (2004) may be overestimating the true effect of tax rates because of omitted variables problems. The standard errors of top share and tax share coefficients increased only slightly in regression III, suggesting that multicolinearity is not the reason behind the change in the significance of tax coefficient. In contrast to the tax variable, the Veblen effect and political representation of workers effects are robust to inclusion of measures of taxation and remain highly significant, showing that their correlations with the tax rate is not what drove the results in Table 1 and regression I in Table 3.

Regression IV shows equally interesting results. As predicted in Proposition 4, in a decentralized bargaining and conditional on a given level of strength of leftist parties, stronger unions in fact increase work hours. Moreover, as anticipated by our analysis of the nationally inclusive workers organization in Proposition 3, this positive effect on work hours of union

[8] Our estimates are not sensitive to this specification of tax burden. The qualitative implications of Table 3 remain unchanged when a similar measure in the Labor Market Institution Database is used as an alternative.
[9] Results do not change when we use vote shares for leftist parties alone as the political representation variable.

density disappears under centralized bargaining structure. The estimated coefficient of union density under centralized bargaining statistically is not different from zero (p-value for the test of the null hypothesis is 0.451). This finding provides an explanation on why researchers have found conflicting evidence of unions on work hours (see Faggio and Nickell, 2007 and Bowles and Park, 2005, for example) Regression IV is consistent with the hypothesis that the primary effects on work hours of large centralized trade unions are not direct results of the bargaining process but instead are indirect, operating through effects on the top income shares and the vote shares for leftist parties.[10] Eq. IV suggests that trade unions may have three effects on hours: (a) supporting leftist parties whose legislation makes longer hours illegal or very costly; (b) reducing the top income share (thereby attenuating the Veblen effect that raises work hours); and (c) raising wages at the firm level, inducing the firm to increase hours (which it can do without violating the no shirking condition because of the higher wages).

Finally, regression V shows that our results are not driven by differences in female labor force participation which also covaries with the share of part-time workers in the labor force.

Of course this confirmation of the robustness of our results is based on data for the final third of the past century and may not hold for the earlier period, for which data are not available. But we think this is unlikely.

Concerning the tax variable, it is important to note that only a small and very high-income fraction of the general public paid income tax before the Second World War and the tax rate itself was too low to have a significant impact on work hours. For example, according to estimates of Barro and Shahasakul (1983) the average marginal tax rate of the US before the Second World War is around 5 percent and then it went through a significant increase for funding the war and remained high (around 30 percent) afterwards. Given that the most rapid decrease in work hours happened mostly before the Second World War in Fig. 1, it is unlikely that the tax was the key factor for the decrease.

8. Conclusion

We have provided a new model of equilibrium work hours in which competitive profit maximizing employers select hours as well as a wage rate to satisfy a no shirking condition. Unlike the standard model of labor supply in which the employee faces a parametric wage and trades off leisure and goods to maximize utility, here the employee's leisure-labor trade-offs affect hours indirectly by altering the cost to the employer of satisfying a labor discipline condition necessitated by the incomplete nature of the employment contract.

In addition to institutional realism – the employer not the worker chooses the hours offer – there are five attractive features of the model. First, by embedding it in a principal agent model, we extend the analysis of the comparison-based utility that produces Veblen effects when employees seek to emulate the consumption standards of the well to do "leisure class". Second we provide a model – the first to our knowledge – of one of the most important social conflicts from the beginning of the industrial revolution until the great depression: the opposing interests of workers and their employers concerning hours of work. Third, we identify conditions in this setting under which employees would prefer to work longer (as well as less) than the hours selected by the employer. Forth, and perhaps surprisingly, we can show that the equilibrium hours that result from the interaction of the profit maximizing employer and the utility maximizing employee are Pareto-inefficient even if the equilibrium hours selected by the employer do not differ from those that maximize the present value of employee utility. Finally, our use of a labor discipline model (rather than the conventional labor supply setup) provides important insights about union behavior. If effort were contractible, as in the standard model, the employee's participation constraint would be satisfied as an equality, instead of the no shirking condition, as our model. In this case there would be no distinction between the employed workers and the unemployed workers (workers would be indifferent between having a job and being out of work). As a result, in such a model we would have two theoretical results that would be anomalous in light of our empirical evidence: (i) there would no distinction between exclusive and inclusive unions; and (ii) the inclusive national union or leftist party will not bargain (either directly or through its political representatives) for reduction in hours to increase the number of jobs because there would be no difference in utility between the employed and the unemployed.

This model has motivated analysis of the interaction of Veblen effects and conflict between employers and employees using a new centuries-long data set, yielding results suggesting that the increasing political representation of employees and (partly as a result) the reduced top income shares combined to reduce work hours over the 20th century.

Our results are consistent with the following explanation of the deceleration and even reversal of the fall in work hours during the last quarter of the past century. As equilibrium hours approached those preferred by workers, further reductions in work hours dropped in importance on the agendas of the organizations and parties representing workers; and due to the Veblen effect the increase in top income shares (in some countries) led employees to place a higher value on longer hours. The response by employers to these new conditions resulted in a deceleration or reversal of the historic 20th century decline work hours.

[10] Without the time dummies, the coefficient of GDP per capita is consistently negative and significant. Also, in regressions without the GDP per capita, the estimates for other independent variables are not much affected and the overall fit of the regression decreases only slightly, indicating that the most of the variations in GDP are captured by time trend dummies.

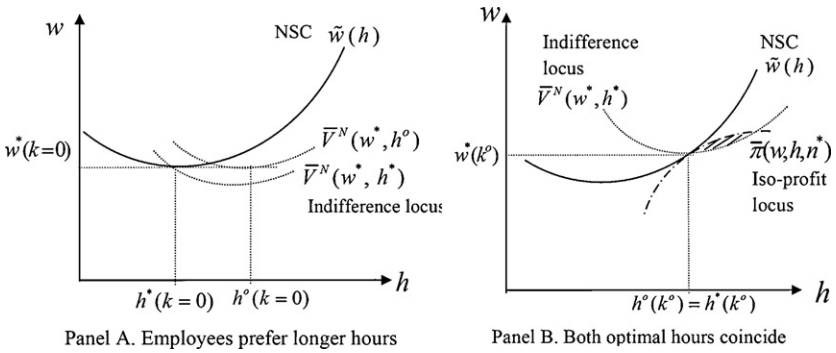


Fig. A.1. Optimal hours for employers and employees.

Appendix A. Model sections

A.1. Derivation of NSC

The present value of the job for an employed shirker (V^N), employed non-shirker (V^S), and the present value of the unemployed (V^U) are

$$V^N = U^N + \frac{qV^U + (1-q)V^N}{1+r} \Leftrightarrow V^N = \frac{(1+r)U^N + qV^U}{r+q} \tag{A.1}$$

$$V^S = U^S + \frac{(q+t)V^U + (1-q-t)V^S}{1+r} \Leftrightarrow V^S = \frac{(1+r)U^S + (q+t)V^U}{r+q+t} \tag{A.2}$$

$$V^U = U^U + \frac{\lambda V + (1-\lambda)V^U}{1+r} \Leftrightarrow V^U = \frac{(1+r)U^U + \lambda V}{r+\lambda} \tag{A.3}$$

where V is the expected utility of an employed worker, which equals V^N at the equilibrium. By solving (A.1) and (A.3), we get

$$\frac{r}{1+r}V^U = \frac{\lambda U^N + (r+q)U^U}{\lambda + r + q} \tag{A.4}$$

$$\frac{r}{1+r}V^N = \frac{(\lambda+r)U^N + qU^U}{\lambda + r + q} \tag{A.5}$$

The worker will choose not to shirk if $V^N \geq V^S$. Substituting (A.3) into (A.1) and (A.2), we get the no shirking condition (NSC).

$$\frac{U^N - U^U}{r+\lambda+q} \geq \frac{U^S - U^N}{t}$$

where $U^N - U^U = C(wh - v\hat{c}) + L(1-h) - g(h) - C(b - v\hat{c}) - L(1)$, and $U^S - U^N = g(h)$.

A.2. The sign of $\eta'(h)$ and the termination probability

We have $\eta(h) = (r+\lambda+q)(g/t)$ and. Let $g(h) = h^\alpha$, $t(h) = h^\beta$, where $\alpha > 1$, and $\beta > 0$. If the termination probability is linear, then $((t')/t) = (1/h)$, thus $g' > ((t')/t)g = (g/h)$, which implies $\eta'(h) = (((r+\lambda+q)/t))(g' - ((t')/t)g) > 0$ for all h. If $t(h)$ is concave, $0 < \beta < 1$, then $\eta'(h) = (r+\lambda+q)(\alpha-\beta)h^{\alpha-\beta-1} > 0$. Finally, if $t(h)$ is convex, $\beta > 1$, then $\eta'(h)$ can be either positive or negative. Thus any type of monitoring technology can imply $\eta' > 0$.

A.3. Pareto inefficiency

For any equilibrium wage and hours offer by the employer $\{w^*, h^*\}$, there exists some Pareto-improving increase in both w and h, but the change cannot be implemented as a Nash equilibrium because it violates the NSC. The economic intuition is clear from Panel B in Fig. A.1, where the shaded lens indicates the set of Pareto improvements over $\{h^*, w^*\}$. The figure also shows that the equilibrium is *not* Pareto efficient even when there is no conflict over the equilibrium working hours between employees and employers. We illustrate Pareto inefficiency. Let $(w, h) = (h^* + \Delta h, w^* + \Delta w)$ be a pair of wages and hours near the equilibrium (h^*, w^*) with sufficiently small $(\Delta h, \Delta w)$ such that $-((V_h^N)/(V_w^N))(h^*, w^*) < (\Delta w/\Delta h) < \tilde{w}_h(h^*)$, then both workers and the employer can be better off by the small increases in h and w.

First, we evaluate V^N at $(h^* + \Delta h, w^* + \Delta w)$, then

$$V^N(h^* + \Delta h, w^* + \Delta w) \simeq V^N(h^*, w^*) + V_w^N \Delta w + V_h^N \Delta h > V^N(h^*, w^*) + V_w^N \left(-\frac{V_h^N}{V_w^N} \Delta h \right) + V_h^N \Delta h = V^N(h^*, w^*)$$

Second, we evaluate the iso-profit function, $\overline{\pi}(n, h, w) = f(nh) - n(wh + k)$ at $(n^*, h^* + \Delta h, w^* + \Delta w)$, then we have

$$\overline{\pi}(n^*, h^* + \Delta h, w^* + \Delta w) \simeq \overline{\pi}(n^*, h^*, w^*) + \overline{\pi}_w \Delta w + \overline{\pi}_h \Delta h > \overline{\pi}(n^*, h^*, w^*) + \overline{\pi}_w \Delta w + \overline{\pi}_h \frac{\Delta w}{\tilde{w}_h}$$

$$= \overline{\pi}(n^*, h^*, w^*) + (\overline{\pi}_w \tilde{w}_h + \overline{\pi}_h) \frac{\Delta w}{\tilde{w}_h} = \overline{\pi}(n^*, h^*, w^*)$$

The last equality holds because from the employer's first order condition we have $\pi_h(n^*, h^*) = \overline{\pi}_w \tilde{w}_h + \overline{\pi}_h = 0$. Thus both workers and the employer are better off.

A.4. Two other cases

If we evaluate U_h^N at the equilibrium hours and wages selected by the employer, (w^*, h^*), there are three possibilities: $U_h^N(w^*, h^*) < 0$, $U_h^N(w^*, h^*) > 0$, or $U_h^N(w^*, h^*) = 0$. The sign of $U_h^N(w^*, h^*)$ indicates whether workers prefer shorter $(U_h^N(w^*, h^*) < 0)$ or longer $(U_h^N(w^*, h^*) > 0)$ hours than h^*. Here we show two

When $k = 0$, we have $U_h^N(w^*, h^*) = \tilde{w}C' - L' - g' > 0$ because $\eta'(h) > 0$ for all h. If there is no employment cost, the fact that an increase in h raises the benefit of shirking and therefore requires a higher no shirking wage will induce the employer to offer shorter working hours than workers prefer (panel A in Fig. A.1). In this case the slope of the employees' indifference locus $(-(\tilde{w}C' - L' - g')/(hC'))$ will be negative at (h^*, w^*).

If $k = (h/C')\eta'$ at the equilibrium, then from (5), $(\tilde{w}C' - L' - g')$ will be zero, so workers' optimal hours and the equilibrium hours at the wage w^* will coincide (panel B in Fig. A.1).

A.5. Comparative statics of Veblen effect

The equilibrium condition (2) is derived from the two first order conditions:

$$\pi_n = hf' - (\tilde{w}h + k) = 0 \Leftrightarrow f' - w = \frac{k}{h}$$

$$\pi_h = nf' - n(\tilde{w}_h h + \tilde{w}) = 0 \Leftrightarrow f' - w = h\tilde{w}_h$$

where $\pi(n, h) = f(nh) - n(\tilde{w}h + k)$ and subscripts denote partial derivatives. The Hessian matrix is given as

$$H = \begin{pmatrix} \pi_{nn} & \pi_{nh} \\ \pi_{hn} & \pi_{hh} \end{pmatrix}$$

where the second derivatives are

$$\begin{aligned} \pi_{nn} &= f''h^2 \\ \pi_{nh} &= f''nh + f' - (\tilde{w} + h\tilde{w}_h) = f''nh \\ \pi_{hh} &= f''n^2 - n(2\tilde{w}_h + h\tilde{w}_{hh}) \end{aligned} \tag{A.6}$$

The second equation in (A.6) holds because $\pi_h = f'n - n(\tilde{w} + h\tilde{w}_h) = 0$. For h^* to be the strict maximum of the profit function, the Hessian matrix must be negative definite. We have $\pi_{nn} < 0$, and the condition for $|H| > 0$ is

$$|H| = \begin{vmatrix} \pi_{nn} & \pi_{nh} \\ \pi_{hn} & \pi_{hh} \end{vmatrix} = \pi_{nn}\pi_{hh} - \pi_{nh}^2 > 0 = -f''nh^2(2\tilde{w}_h + h\tilde{w}_{hh}) > 0$$

Since we have $f'' < 0$, the sufficient condition for the maximum is $2\tilde{w}_h + h\tilde{w}_{hh} > 0$.

Let z be an exogenous variable. Applying Cramer's rule and the implicit function theorem, we get

$$\frac{dh^*}{dz} = \frac{\pi_{nh}\pi_{nz} - \pi_{nn}\pi_{hz}}{|H|} \tag{A.7}$$

$$\frac{dn^*}{dz} = \frac{\pi_{nh}\pi_{hz} - \pi_{hh}\pi_{nz}}{|H|} \tag{A.8}$$

Let $\hat{c}$ be an exogenous variable of the no shirking wage, $\tilde{w} = \tilde{w}(h, \hat{c})$. We have

$$\pi_{n\hat{c}} = -h\tilde{w}_{\hat{c}}$$

$$\pi_{h\hat{c}} = -n(\tilde{w}_{\hat{c}} + h\tilde{w}_{h\hat{c}})$$

Thus we get the following result from (A.6) and (A.7)

$$\frac{dh^*}{d\hat{c}} = \frac{-f''nh^2\tilde{w}_{\hat{c}} + f''nh^2(\tilde{w}_{\hat{c}} + h\tilde{w}_{h\hat{c}})}{|H|} = \frac{f''nh^3\tilde{w}_{h\hat{c}}}{|H|} \tag{A.9}$$

$$\frac{dn^*}{d\hat{c}} = \frac{-f''n^2h^2\tilde{w}_{h\hat{c}} - nh\tilde{w}_{\hat{c}}(2\tilde{w}_h + h\tilde{w}_{hh})}{|H|} \tag{A.10}$$

Appendix B. Empirical sections

B.1. Data source

Top income share data

Leigh, Andrew, 2007. "How closely do top income shares track other measures of inequality?". Economic Journal 117, 619–633.

Main work hours data

Huberman, Michael, 2004. "Working hours of the world unite? New international evidence of worktime, 1870–1913". The Journal of Economic History 64, 964–1001 (Cambridge University Press).

Work hour data for Japan is from Maddison, Angus, 2007. The World Economy: Historical Statistics. OECD.

Alternative work hours data

Huberman, Michael, Minns, Chris, 2007. "The times they are not changin': days and hours of work in Old and New Worlds, 1870–2000". Explorations in Economic History 44(4), 538–567 (Elsevier).

Work hour data for Japan is from Maddison, Angus, 2007. The World Economy: Historical Statistics. OECD.

Political representation data

(1) Leftist party definition

Von Beyme, Klaus, 1985, Political Parties in Western Democracies. St. Martin's Press.

More recent data are acquired from each country's government statistics based on Von Beyme's categorization.

(2) Date of universal male suffrage

Therborn, Goran, 1977. The Rule of Capital and the Rise of Democracy. New Left Review.

Union density data

Friedman, Gerald, 2007. Reigniting the Labor Movement: Restoring Means to Ends in a Democratic Labor Movement. Routledge.

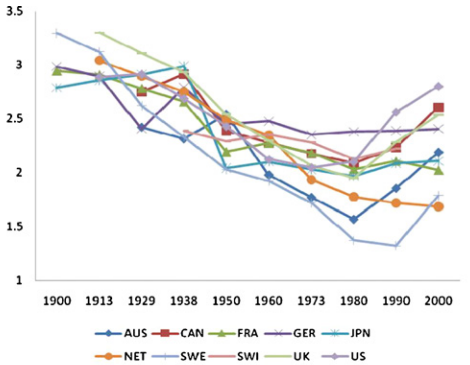
Japanese data before 1960 is provided by ILO, 2000. Japanese Economic History 1930–1960 Volume V. Industrial Labour in Japan, Routledge.

Per capita GDP data & demographic change data

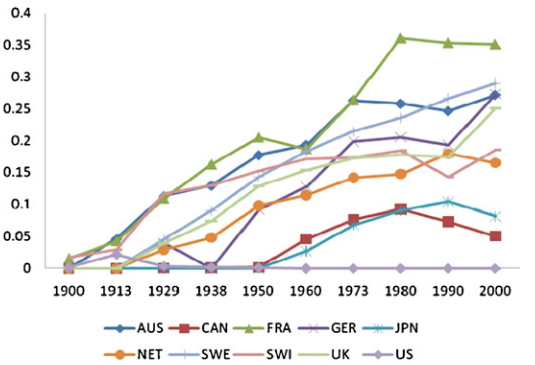
Maddison, Angus, 2007. The World Economy: Historical Statistics. OECD.

GDP deviation is calculated as deviation from 5-year moving average of per capita GDP.

B.2. Overtime changes of top income share and political representation index



Panel A. Top Income Share



Panel B. Political Representation Index

B.3. Summary statistics of key variables by country and by year

Variable	Country	Obs	Mean	Std. dev.	Year	Obs	Mean	Std. dev.
Average annual work hours	All	88	2041.9	375.9				
Ln(top income share)		88	2.37	0.43				
Political representation		88	0.11	0.1				
Average annual work hours	Australia	8	1953.75	160.72	1900	3	3041.67	242.09
Ln(top income share)		8	2.08	0.34		3	3.08	0.19
Political representation		8	0.21	0.06		3	0.01	0.01
Average annual work hours	Canada	8	1989.25	201.72	1913	7	2730	167.33
Ln(top income share)		8	2.43	0.3		7	3	0.16
Political representation		8	0.04	0.04		7	0.01	0.02
Average annual work hours	France	10	2057	500.36	1929	9	2282.22	58.2
Ln(top income share)		10	2.41	0.37		9	2.76	0.24
Political representation		10	0.2	0.13		9	0.04	0.04
Average annual work hours	Germany	10	2144	460.7	1938	10	2155.6	172.86
Ln(top income share)		10	2.55	0.24		10	2.68	0.25
Political representation		10	0.11	0.1		10	0.06	0.06
Average annual work hours	Japan	9	2153	252.39	1950	10	2126	101.2
Ln(top income share)		9	2.34	0.44		10	2.34	0.19
Political representation		9	0.04	0.04		10	0.1	0.08
Average annual work hours	Netherlands	9	1966.44	511.8	1960	10	2023.4	80.72
Ln(top income share)		9	2.29	0.53		10	2.22	0.18
Political representation		9	0.1	0.06		10	0.12	0.07
Average annual work hours	Sweden	10	2089.4	598.65	1973	10	1855.2	110.72
Ln(top income share)		10	2.15	0.68		10	2.05	0.21
Political representation		10	0.15	0.11		10	0.16	0.09
Average annual work hours	Switzerland	6	1946.33	208.37	1980	10	1752.2	140.99
Ln(top income share)		6	2.28	0.09		10	1.94	0.29
Political representation		6	0.16	0.02		10	0.18	0.1
Average annual work hours	UK	9	2012.56	273.77	1990	10	1684.8	160.59
Ln(top income share)		9	2.56	0.47		10	2.08	0.36
Political representation		9	0.13	0.08		10	0.17	0.1
Average annual work hours	US	9	2041.44	268.93	2000	9	1660	168.8
Ln(top income share)		9	2.51	0.35		9	2.24	0.38
Political representation		9	0	0.01		9	0.19	0.12

B.4. Alternative measure of work hours by Huberman and Minns (2007)

Variables	I	II	III	IV
Ln(top income share)	0.104***	0.0936***	0.124***	0.117***
	(0.0298)	(0.0337)	(0.0404)	(0.0419)
Political representation	−0.408***	−0.467**	−0.377*	−0.484**
	(0.1200)	(0.1790)	(0.1950)	(0.2250)
Ln(GDP per capita)	−0.127***	0.0347	0.0037	−0.0007
	(0.0169)	(0.0390)	(0.0482)	(0.0473)
GDP deviation	0.0125***	0.0109***	0.0131***	0.0140***
	(0.0039)	(0.0040)	(0.0039)	(0.0039)
Ln(union density)			0.0159	0.0194
			(0.0263)	(0.0260)
Population growth				−0.0238
				(0.0152)
Labor force as % of population				−0.314
				(0.2410)
Germany		−0.029	−0.0409	−0.066
		(0.0310)	(0.0372)	(0.0418)
Netherlands		−0.0483	−0.0495	−0.0669
		(0.0352)	(0.0375)	(0.0474)
Switzerland		−0.0367	−0.0252	−0.0153
		(0.0365)	(0.0367)	(0.0369)
UK		−0.0015	−0.00433	−0.0255
		(0.0325)	(0.0401)	(0.0417)
Australia		0.0550*	0.0571	0.0804*
		(0.0300)	(0.0347)	(0.0413)
Canada		−0.0169	−0.00101	−0.00639
		(0.0443)	(0.0453)	(0.0604)
US		−0.0646	−0.0352	−0.0439
		(0.0491)	(0.0525)	(0.0605)

Variables	I	II	III	IV
Sweden		−0.0103	0.00515	−0.00636
		(0.0309)	(0.0408)	(0.0416)
Japan		0.0607	0.0694	0.0706
		(0.0460)	(0.0473)	(0.0500)
Year = 1913		−0.0773*	−0.166**	−0.145**
		(0.0441)	(0.0682)	(0.0677)
Year = 1929		−0.284***	−0.356***	−0.343***
		(0.0486)	(0.0710)	(0.0700)
Year = 1938		−0.271***	−0.343***	−0.339***
		(0.0524)	(0.0748)	(0.0737)
Year = 1950		−0.238***	−0.298***	−0.275***
		(0.0602)	(0.0797)	(0.0799)
Year = 1960		−0.267***	−0.315***	−0.300***
		(0.0701)	(0.0858)	(0.0849)
Year = 1973		−0.366***	−0.403***	−0.394***
		(0.0855)	(0.0989)	(0.0972)
Year = 1980		−0.385***	−0.413***	−0.394***
		(0.0923)	(0.1050)	(0.1040)
Year = 1990		−0.457***	−0.480***	−0.446***
		(0.0957)	(0.1090)	(0.1090)
Year = 2000		−0.490***	−0.512***	−0.482***
		(0.1010)	(0.1150)	(0.1150)
Constant	8.541***	7.423***	7.612***	7.810***
	(0.1940)	(0.3230)	(0.3450)	(0.3750)
Observations	88	88	83	83
R-squared	0.799	0.918	0.915	0.921

The dependent variable is the natural logarithm of working hours compiled by Huberman and Minns (2007). Standard errors in parentheses.

* $p < 0.1$.

** $p < 0.05$.

*** $p < 0.01$.

B.5. Alternative results with panel-corrected standard error

Variables	I	II	III	IV	V
Ln(top income share)	0.120***	0.130***	0.112***	0.115***	−0.0573
	(0.0214)	(0.0251)	(0.0227)	(0.0208)	(0.0774)
Political representation	−0.322***	−0.453***	−0.449***	−0.467***	−1.507***
	(0.0587)	(0.117)	(0.0939)	(0.142)	(0.458)
Ln(top income share) × time					0.0265**
					(0.0107)
Political representation × time					0.123***
					(0.0459)
Ln(GDP per capita)	−0.133***	0.0122	0.0147	0.0122	0.0460
	(0.0136)	(0.0224)	(0.0284)	(0.0263)	(0.0309)
GDP deviation	0.103***	0.0832***	0.0891***	0.0931***	0.106***
	(0.0327)	(0.0265)	(0.0261)	(0.0275)	(0.0303)
Ln(union density)			−0.0013	−0.0002	0.00635
			(0.0172)	(0.0166)	(0.0189)
Population growth				−0.0261*	−0.0325**
				(0.0141)	(0.0146)
Labor force share				−0.134	−0.0603
				(0.177)	(0.195)
Germany		−0.0165	−0.0054	−0.0152	−0.0484
		(0.0293)	(0.0247)	(0.0285)	(0.0335)
Netherlands		−0.0518	−0.0651***	−0.0605*	−0.0676**
		(0.0349)	(0.0242)	(0.0326)	(0.0330)
Switzerland		−0.00178	−7.72e−05	0.0125	−0.0154
		(0.0364)	(0.0225)	(0.0225)	(0.0297)
UK		−0.0239	−0.0159	−0.0270	−0.0476*
		(0.0236)	(0.0195)	(0.0224)	(0.0287)
Australia		0.0647*	0.0625**	0.0951***	0.0911***
		(0.0334)	(0.0292)	(0.0312)	(0.0325)
Canada		−0.0341	−0.0297	−0.0071	−0.0371
		(0.0341)	(0.0219)	(0.0387)	(0.0451)
US		−0.0677**	−0.0620**	−0.0484	−0.0967**
		(0.0314)	(0.0263)	(0.0374)	(0.0480)
Sweden		0.0219	0.0169	0.0141	−0.00104
		(0.0357)	(0.0324)	(0.0328)	(0.0378)

Variables	I	II	III	IV	V
Japan		0.0469	0.0485**	0.0619**	0.0480
		(0.0346)	(0.0226)	(0.0266)	(0.0322)
Year = 1913		−0.0946***	−0.134***	−0.117***	−0.201***
		(0.0278)	(0.0301)	(0.0335)	(0.0510)
Year = 1929		−0.245***	−0.270***	−0.260***	−0.491***
		(0.0297)	(0.0315)	(0.0339)	(0.0990)
Year = 1938		−0.240***	−0.266***	−0.266***	−0.559***
		(0.0317)	(0.0342)	(0.0369)	(0.125)
Year = 1950		−0.203***	−0.232***	−0.205***	−0.593***
		(0.0355)	(0.0371)	(0.0402)	(0.163)
Year = 1960		−0.229***	−0.261***	−0.243***	−0.715***
		(0.0401)	(0.0392)	(0.0391)	(0.195)
Year = 1973		−0.303***	−0.341***	−0.333***	−0.915***
		(0.0474)	(0.0453)	(0.0430)	(0.235)
Year = 1980		−0.325***	−0.364***	−0.353***	−0.986***
		(0.0507)	(0.0479)	(0.0486)	(0.254)
Year = 1990		−0.391***	−0.429***	−0.410***	−1.131***
		(0.0524)	(0.0499)	(0.0530)	(0.286)
Year = 2000		−0.418***	−0.454***	−0.443***	−1.265***
		(0.0557)	(0.0541)	(0.0577)	(0.324)
Constant	8.553***	7.503***	7.555***	7.632***	7.841***
	(0.160)	(0.209)	(0.226)	(0.221)	(0.272)
Observations	88	88	83	83	83
R-squared	0.825	0.927	0.917	0.922	0.931

Panel-corrected standard errors are calculated based on Beck and Katz (1995). Time$^+$ is defined as (year − 1900)/10. Panel corrected standard errors in parentheses.

* $p < 0.1$.

** $p < 0.05$.

*** $p < 0.01$.

B.6. Regression results for country and time fixed effects

See Tables B.6-1–B.6-3

B.6-1
Baseline regression.

Variables	II	III	IV	V
Germany	−0.0165	−0.0054	−0.0152	−0.0484
	(0.0290)	(0.0356)	(0.0403)	(0.0411)
Netherlands	−0.0518	−0.0651*	−0.0605	−0.0676
	(0.0329)	(0.0360)	(0.0457)	(0.0445)
Switzerland	−0.00178	−0.00008	0.0125	−0.0154
	(0.0341)	(0.0352)	(0.0356)	(0.0360)
UK	−0.0239	−0.0159	−0.027	−0.0476
	(0.0304)	(0.0384)	(0.0402)	(0.0414)
Australia	0.0647**	0.0625*	0.0951**	0.0911**
	(0.0281)	(0.0333)	(0.0398)	(0.0382)
Canada	−0.0341	−0.0297	−0.0071	−0.0371
	(0.0414)	(0.0434)	(0.0583)	(0.0574)
US	−0.0677	−0.062	−0.0484	−0.0967
	(0.0459)	(0.0504)	(0.0583)	(0.0592)
Sweden	0.0219	0.0169	0.0141	−0.00104
	(0.0288)	(0.0391)	(0.0402)	(0.0399)
Japan	0.0469	0.0485	0.0619	0.0480
	(0.0430)	(0.0453)	(0.0482)	(0.0475)
Year = 1913	−0.0946**	−0.134**	−0.117*	−0.201***
	(0.0412)	(0.0654)	(0.0653)	(0.0748)
Year = 1929	−0.245***	−0.270***	−0.260***	−0.491***
	(0.0454)	(0.0681)	(0.0675)	(0.127)
Year = 1938	−0.240***	−0.266***	−0.266***	−0.559***
	(0.0489)	(0.0717)	(0.0710)	(0.157)
Year = 1950	−0.203***	−0.232***	−0.205***	−0.593***
	(0.0562)	(0.0764)	(0.0770)	(0.200)
Year = 1960	−0.229***	−0.261***	−0.243***	−0.715***
	(0.0655)	(0.0823)	(0.0819)	(0.234)
Year = 1973	−0.303***	−0.341***	−0.333***	−0.915***
	(0.0799)	(0.0948)	(0.0937)	(0.278)
Year = 1980	−0.325***	−0.364***	−0.353***	−0.986***
	(0.0863)	(0.1010)	(0.0998)	(0.298)

B.6-1 (*Continued*)

Variables	II	III	IV	V
Year = 1990	−0.391***	−0.429***	−0.410***	−1.131***
	(0.0894)	(0.1040)	(0.1050)	(0.330)
Year = 2000	−0.418***	−0.454***	−0.443***	−1.265***
	(0.0947)	(0.1100)	(0.1110)	(0.368)
Constant	7.503***	7.555***	7.632***	7.841***
	(0.3020)	(0.3300)	(0.3610)	(0.388)
Observations	88	83	83	83
R-squared	0.927	0.917	0.922	0.931

Standard errors in parentheses.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

B.6-2
Recursive regression results.

Variables	Ln(work hours)	Ln(top share)	Ln(work hours)
Germany	−0.0117	0.0368	−0.0165
	(0.0323)	(0.1130)	(0.0290)
Netherlands	−0.0776**	−0.198	−0.0518
	(0.0360)	(0.1260)	(0.0329)
Switzerland	−0.00515	−0.0259	−0.00178
	(0.0380)	(0.1330)	(0.0341)
U.K.	−0.0124	0.0892	−0.0239
	(0.0337)	(0.1180)	(0.0304)
Australia	0.0362	−0.219**	0.0647**
	(0.0303)	(0.1060)	(0.0281)
Canada	−0.0444	−0.0794	−0.0341
	(0.0461)	(0.1610)	(0.0414)
U.S.	−0.0841	−0.127	−0.0677
	(0.0510)	(0.1790)	(0.0459)
Sweden	−0.0228	−0.344***	0.0219
	(0.0298)	(0.1040)	(0.0288)
Japan	0.0215	−0.195	0.0469
	(0.0474)	(0.1660)	(0.0430)
Year = 1913	−0.103**	−0.0616	−0.0946**
	(0.0459)	(0.1610)	(0.0412)
Year = 1929	−0.279***	−0.26	−0.245***
	(0.0498)	(0.1750)	(0.0454)
Year = 1938	−0.293***	−0.409**	−0.240***
	(0.0526)	(0.1840)	(0.0489)
Year = 1950	−0.293***	−0.697***	−0.203***
	(0.0577)	(0.2020)	(0.0562)
Year = 1960	−0.335***	−0.818***	−0.229***
	(0.0671)	(0.2350)	(0.0655)
Year = 1973	−0.425***	−0.942***	−0.303***
	(0.0827)	(0.2900)	(0.0799)
Year = 1980	−0.464***	−1.068***	−0.325***
	(0.0885)	(0.3100)	(0.0863)
Year = 1990	−0.513***	−0.939***	−0.391***
	(0.0941)	(0.3300)	(0.0894)
Year = 2000	−0.517***	−0.759**	−0.418***
	(0.1020)	(0.3580)	(0.0947)
Constant	7.849***	2.655**	7.503***
	(0.3240)	(1.1340)	(0.3020)
Observations	88	88	88
R-squared	0.908	0.809	0.927

Standard errors in parentheses.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

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B.6-3
Estimates when tax and union effects are added.

Variables	I Sci/poli	II Tax	III Both	IV PlusUnion	V PlusTax
Canada	−0.0596***	0.0321***	−0.0742***	−0.0862***	−0.0909***
	(0.0182)	(0.0113)	(0.0204)	(0.0227)	(0.0231)
France	−0.105***	−0.0415***	−0.128***	−0.0762***	−0.0900***
	(0.00945)	(0.0146)	(0.0177)	(0.0256)	(0.0268)
Germany	−0.152***	−0.0414**	−0.182***	−0.174***	−0.177***
	(0.0139)	(0.0162)	(0.0236)	(0.0245)	(0.0247)
Japan	0.0232	0.0833***	0.0141	0.0354	0.0250
	(0.0151)	(0.0117)	(0.0162)	(0.0218)	(0.0223)
Netherlands	−0.183***	−0.109***	−0.218***	−0.197***	−0.218***
	(0.0114)	(0.0226)	(0.0252)	(0.0261)	(0.0281)
Sweden	−0.140***	−0.105***	−0.174***	−0.195***	−0.179***
	(0.00926)	(0.0243)	(0.0239)	(0.0284)	(0.0310)
Switzerland	−0.157***	−0.0845***	−0.164***	−0.179***	−0.184***
	(0.0189)	(0.0144)	(0.0194)	(0.0233)	(0.0238)
UK	−0.0614***	0.0117	−0.0791***	−0.0863***	−0.0897***
	(0.0119)	(0.0124)	(0.0164)	(0.0164)	(0.0166)
US	−0.0699***	0.0443***	−0.0835***	−0.0894***	−0.0913***
	(0.0267)	(0.0133)	(0.0280)	(0.0330)	(0.0346)
Year = 1967	−0.00363	−0.00619	−0.00413	−0.00635	−0.00429
	(0.0142)	(0.0157)	(0.0142)	(0.0131)	(0.0142)
Year = 1968	−0.0104	−0.0117	−0.0126	−0.0174	−0.0141
	(0.0144)	(0.0159)	(0.0144)	(0.0133)	(0.0147)
Year = 1969	−0.0160	−0.0184	−0.0189	−0.0289**	−0.0240
	(0.0147)	(0.0164)	(0.0148)	(0.0137)	(0.0157)
Year = 1970	−0.0273*	−0.0297*	−0.0319**	−0.0466***	−0.0406**
	(0.0152)	(0.0170)	(0.0154)	(0.0143)	(0.0170)
Year = 1971	−0.0284*	−0.0335*	−0.0331**	−0.0523***	−0.0434**
	(0.0154)	(0.0172)	(0.0156)	(0.0145)	(0.0181)
Year = 1972	−0.0334**	−0.0417**	−0.0376**	−0.0599***	−0.0510***
	(0.0158)	(0.0177)	(0.0160)	(0.0150)	(0.0191)
Year = 1973	−0.0373**	−0.0478**	−0.0422**	−0.0674***	−0.0586***
	(0.0165)	(0.0184)	(0.0167)	(0.0158)	(0.0206)
Year = 1974	−0.0520***	−0.0650***	−0.0577***	−0.0858***	−0.0753***
	(0.0173)	(0.0195)	(0.0177)	(0.0167)	(0.0224)
Year = 1975	−0.0630***	−0.0745***	−0.0717***	−0.0995***	−0.0883***
	(0.0175)	(0.0203)	(0.0184)	(0.0173)	(0.0232)
Year = 1976	−0.0562***	−0.0693***	−0.0658***	−0.0952***	−0.0798***
	(0.0180)	(0.0209)	(0.0189)	(0.0180)	(0.0239)
Year = 1977	−0.0582***	−0.0730***	−0.0687***	−0.100***	−0.0841***
	(0.0188)	(0.0220)	(0.0199)	(0.0189)	(0.0256)
Year = 1978	−0.0605***	−0.0773***	−0.0715***	−0.105***	−0.0875***
	(0.0194)	(0.0227)	(0.0206)	(0.0196)	(0.0269)
Year = 1979	−0.0627***	−0.0814***	−0.0734***	−0.109***	−0.0909***
	(0.0200)	(0.0233)	(0.0211)	(0.0202)	(0.0284)
Year = 1980	−0.0729***	−0.0923***	−0.0837***	−0.121***	−0.101***
	(0.0206)	(0.0239)	(0.0217)	(0.0207)	(0.0296)
Year = 1981	−0.0811***	−0.0987***	−0.0933***	−0.131***	−0.113***
	(0.0209)	(0.0246)	(0.0223)	(0.0214)	(0.0305)
Year = 1982	−0.0845***	−0.102***	−0.0979***	−0.135***	−0.117***
	(0.0214)	(0.0254)	(0.0230)	(0.0219)	(0.0316)
Year = 1983	−0.0810***	−0.0958***	−0.0958***	−0.133***	−0.114***
	(0.0220)	(0.0264)	(0.0239)	(0.0227)	(0.0326)
Year = 1984	−0.0782***	−0.0931***	−0.0928***	−0.132***	−0.113***
	(0.0230)	(0.0274)	(0.0248)	(0.0236)	(0.0342)
Year = 1985	−0.0864***	−0.0992***	−0.102***	−0.143***	−0.122***
	(0.0235)	(0.0281)	(0.0254)	(0.0242)	(0.0353)
Year = 1986	−0.0973***	−0.108***	−0.112***	−0.166***	−0.145***
	(0.0239)	(0.0284)	(0.0257)	(0.0245)	(0.0362)
Year = 1987	−0.100***	−0.109***	−0.116***	−0.170***	−0.149***
	(0.0243)	(0.0291)	(0.0263)	(0.0251)	(0.0374)
Year = 1988	−0.103***	−0.106***	−0.120***	−0.176***	−0.153***
	(0.0246)	(0.0297)	(0.0270)	(0.0257)	(0.0389)
Year = 1989	−0.118***	−0.113***	−0.136***	−0.195***	−0.170***
	(0.0251)	(0.0303)	(0.0276)	(0.0263)	(0.0403)
Year = 1990	−0.134***	−0.125***	−0.152***	−0.212***	−0.186***
	(0.0257)	(0.0306)	(0.0280)	(0.0268)	(0.0413)
Year = 1991	−0.142***	−0.135***	−0.160***	−0.221***	−0.194***
	(0.0261)	(0.0309)	(0.0283)	(0.0270)	(0.0420)
Year = 1992	−0.146***	−0.138***	−0.163***	−0.226***	−0.199***

B.6-3 (*Continued*)

Variables	I Sci/poli	II Tax	III Both	IV PlusUnion	V PlusTax
	(0.0266)	(0.0312)	(0.0286)	(0.0274)	(0.0432)
Year = 1993	−0.144***	−0.136***	−0.160***	−0.224***	−0.197***
	(0.0271)	(0.0316)	(0.0290)	(0.0277)	(0.0440)
Year = 1994	−0.135***	−0.128***	−0.152***	−0.215***	−0.188***
	(0.0276)	(0.0322)	(0.0295)	(0.0282)	(0.0447)
Year = 1995	−0.137***	−0.130***	−0.153***	−0.217***	−0.189***
	(0.0282)	(0.0328)	(0.0300)	(0.0287)	(0.0457)
Constant	7.548***	7.396***	7.542***	6.558***	6.853***
	(0.304)	(0.332)	(0.303)	(0.313)	(0.431)
Observations	295	295	295	290	280
R-squared	0.913	0.895	0.914	0.937	0.939

Standard errors in parentheses.

* $p < 0.1$.

** $p < 0.05$.

*** $p < 0.01$.

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