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Inducing Political Action by Workers

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Inducing Political Action by Workers

Bruno De Borger and Amihai Glazer (*)

Abstract

A firm aiming to influence a governmental policy may benefit from political action by its stakeholders, such as workers. This paper studies the behavior of such a firm, showing that workers will have a greater incentive to engage in costly political activity against the governmental policy the greater their number and the higher the wage. The firm may therefore profit from paying above-market wages and from hiring what might appear to be an inefficiently large number of workers. And because unions may overcome free-rider problems of uncoordinated political effort, a firm may favor unionization, or be less opposed to unionization than it would otherwise be. The results of this paper can also explain why firms may little reduce wages in a recession, and why the higher wages paid by unionized firms do not reduce survival rates of these firms.

Keywords: political actions, union behavior, wage and employment policies

JEL-codes: D21, J31, J51, L51

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0. Introduction

A large literature suggests that firms attempt to influence public policy. Firms may pressure government by campaign contributions to politicians, through lobbying activities and, to reduce the threat of adverse regulations, by voluntary price or emission reductions. Empirical studies confirm the influence of firms on public policy through these various channels. An early survey of empirical work is provided by Potters and Sloof (1996). More recently, Chirinko and Williams (2010) study a tax competition model for the US states and convincingly show that business campaign contributions affect state governments' tax policies. The empirical evidence provided by Aisbett and McAusland (2013) suggests that especially large firms are likely to obtain subsidies and favorable tax treatment. Credit card firms facing a regulatory threat reduced the prices they charged consumers, and the reduced prices reduced the probability of regulation (see Stango (2003)). Evidence also suggests that the pharmaceutical firms most vulnerable to future price regulation moderated their price increases in an attempt to prevent regulation (Ellison, Fisher, and Wolfram (2006)). Lastly, firms threatened by regulation of emissions were found to voluntarily reduce emissions (Khanna and Damon (1999), and Maxwell, Lyon, and Hackett (2000)).

This paper focuses on another and largely unexplored channel that firms can use to affect government policy: a firm may induce its workers, or worker organizations such as labor unions, to pressure government. Pressure by workers can consist of lobbying against a regulation that hurts the firm, lobbying for protection against foreign competition, lobbying for a tax break in the face of a recession, or even lobbying for a cash infusion (as when the United Auto Workers lobbied in favor of a federal bailout for General Motors and Chrysler). Worker organizations also exercise political pressure via campaign contributions to politicians. In the United States the reliance of firms on this type of political action by their workers was quite explicit. Until the Citizens United Decision in 2010, corporations were forbidden to make contributions to political candidates. They could, however, establish Political Action Committees (as of 1976) which could make political campaign contributions; the money given had to be raised from employees of the firm. This allowed firms to pressure government through their workforce, suggesting that the greater the concern by employees about the future prospects of the firm, the greater the political influence the firm could have (see Vandegrift (1980)).

This paper studies the wage and employment decisions of a firm that wants to induce political action by its workers against the introduction of an adverse regulation that reduces its

profits. Of course, for such an analysis to be relevant, two assumptions must be satisfied. First, worker actions must be able to affect government policies. Second, both firms and workers must suffer from the potential regulation.

Casual observations and empirical studies offer strong support for the first assumption, that worker actions may affect government policies. Often unions coordinate such actions. One example is the New York City Sanitationmen's Union, which had as their slogan in the 1960s, "We strike through the ballot" (Spero and Capozzola (1973)). The union used their members and supporters to distribute campaign literature house to house, had an additional thousand members available for central services, and ostensibly ran the Sanitation Department. During the late 1960's and early 1970's unions in the public sector were sufficiently large to swing elections.¹ Another example is the recent bailout of two giant car manufacturers on the brink of collapse. Lobbying activities by the United Auto Workers were instrumental in obtaining financial support for Chrysler and General Motors. The decision by president Obama in 2009 to authorize an \$80 billion government bailout to rescue the two firms is widely believed to have affected the president's reelection campaign. Consider the following quote from the *Boston Globe*:²

Barack Obama's 2009 decision turned out to be pivotal not only for the auto industry and the Midwestern economy, but perhaps for the future of his presidency. Three years later as Obama campaigns for reelection, the controversial bailout has allowed him to secure Michigan and puts him within striking distance in Ohio, a critical battleground state where 1 in 8 jobs are auto-related.

More generally, statistical analysis shows that on issues that are of particular interest to the automobile industry, notably the 2008 auto bailout and the 2009 "cash for clunkers" program (though not on issues that affect multiple industries), the presence of many automobile workers in a congressional district increases the district's congressman's support for the industry (Moore, Powell, and Reeves (2012)). Regression analysis also shows that a union will hire more lobbyists at the federal level the greater the percentage of a union's primary industry's output is purchased by the federal government (Masters and Delaney (1985)).

¹ Building on this evidence relating to the power of workers, Babcock, Engberg, and Glazer (1997) claim that unions in the public sector want to increase the size of their membership, rather than only to increase wages, for the purpose of increasing their political influence. Indeed, unionized departments increased employment by 3.1 percent over non-unionized departments (Zax (1989)).

² "Auto bailout in '09 key to Obama's survival in Ohio" *Boston Globe*, October 30, 2012.

Evidence for the influence of workers on policy is also found in studies of environmental regulation. For example, an increase in the number of manufacturing employees reduces abatement of air pollution by the most pollution-intensive industries (see Becker (2004)).³ In Italy, a court ordered the closure of a Tarnato steel plant -- employing about 20,000 workers -- that was highly polluting. Following massive protests by workers, the Italian government took the unprecedented step of reversing the court order.⁴

Lastly, the influence of workers on governmental policy can explain some aspects of trade policy. Increased employment generated by import protection can induce an increase in the number of voters who would benefit from continued import protection (see the model by Cassing and Hillman (1986)). Because a sector that suffers large layoffs in an economic downturn is more likely to receive protection, firms in an import-competing industry have an incentive to over-hire labor in good times, making layoffs more visible in rough times, and so make protection more likely (Hillman, Katz, and Rosenberg (1987)). Trade protection is higher in recessions, when the loss of a job may be especially painful (see the evidence in Bohra and Kaempfer (1991)).

Our second assumption, that both firms and workers may suffer from regulation, is also widely documented. For example, some firms subject to local air quality regulation relocated (List, McHone, and Millimet (2003)). Other studies finding that environmental regulation affects plant location are Becker and Henderson (2000) and Greenstone (2002). In the fifteen years (1972-1987) following adoption of the Clean Air Act Amendments, non-attainment counties, subject to regulation, lost approximately 590,000 jobs, \$37 billion in capital stock, and \$75 billion of output (Greenstone (2002)). The 1990 Clean Air Act Amendments, which reduced employment in polluting industries, caused workers who had worked in newly regulated plants to lose more than \$9 billion in foregone earnings in the years after the change in policy, with the losses consisting mostly of non-employment and lower earnings in future employment (Walker (2012)). Lastly, firms may avoid investing in jurisdictions that impose costly regulations, as Keller and Levinson (2002) find in their study of direct foreign investment. Such responses imply declines in output and employment in the regulated industries, affecting both firms and workers.

³ He also reports that abatement at a plant increases with per capita income in the neighboring community, increases with homeownership, and increases with the number of Democratic voters.

⁴ "Italy Government Faces Test as Steel Plant Says Ruling Would Force It to Close," New York Times, November 27, 2012.

This paper models the wage and employment policies of a firm that wants to induce political action by its workers against an upcoming regulatory policy. Such actions can consist of workers or worker organizations lobbying congressmen, writing editorial letters to the press, making campaign contributions to politicians they believe support the firm, etc.⁵ We examine two extreme cases. The first one assumes that the political actions are coordinated by a worker organization such as a labour union. Each worker then exerts the level of political effort that maximizes the aggregate welfare of workers at the firm. The second case assumes uncoordinated actions whereby each worker decides on his own how much political effort to exert, ignoring the benefits of his own action on other workers.⁶ The advantage of considering both fully coordinated and uncoordinated action is that our results can be extended to look at employment and wages for intermediate coordination levels of the political efforts of workers.

Some of our results are straightforward implications of the assumptions; for example, we find that workers will exert greater political effort the higher the wage and the greater the number of workers. However, the answer to various other questions studied in this paper are not obvious, such as whether a firm will want to pay higher wages to unionized workers than to non-unionized ones, whether unionization will increase or reduce the firm's demand for labor at any given wage, whether raising the wage or employment is more effective in generating aggregate political activity by workers, whether an increase in a worker's reservation utility causes the firm to increase its wage or to increase employment, and whether an increase in the loss from regulation causes the firm to increase the wage, employment, or both. Moreover, the results of this paper offer a view of political influence by workers with several appealing features. First, it shows why firms may offer wages higher than necessary to attract workers, and so gives a different perspective on efficiency wages (Akerlof (1982, 1984), Stiglitz (1974)). High wages need not only increase the productivity of workers on the job; they also increase the effort workers exert on protecting the firm against regulatory threat. Second, the model can explain some of the effects of unions, particularly why the higher wages paid by unionized firms do not reduce their survival rates. Third, the results suggest that firms may favor unions; coordinated political action overcomes free-riding behavior of

⁵ It can even take the form of voting. Bombardini and Trebbi (2011) suggest that a special interest group can better affect congressional elections, a form of political influence, the greater the voting share of the interest group.

⁶ For an example of attempts by management to encourage lobbying by individual workers, consider the University of California. At an October 14, 2009 meeting of the Assembly of the Academic Senate, the President of the University asked faculty "to advocate for the University, and to rally their colleagues to do the same." He added "Write op-ed pieces and meet with your legislators" (www.universityofcalifornia.edu/news/article/22142).

individual workers and may therefore be more effective in influencing government. Fourth, by having workers influence government we extend the standard story that unions give voice to workers (Freeman and Medoff (1985)).

The remainder of this paper has the following structure. Section 1 describes our assumptions. Section 2 studies the effect of the firm's wage and employment choices on political activity by workers for the two different cases mentioned before. In the first, political activity by workers is coordinated by a labor union, in the second efforts are uncoordinated. Section 3 analyzes the effect of regulatory threat on firm behavior for coordinated and uncoordinated political actions by workers. Section 4 discusses implications of the model. Section 5 concludes.

1. Assumptions

To be concrete, to simplify the modeling, and to highlight the main effects, we shall consider one particular but transparent case. Specifically, we study a potential governmental regulation that would cause the firm to shut down, causing it to lay off all its current workers. We analyze the wage and employment policies of the firm that faces this threat and wants to induce political effort by its workers against implementation of the regulation. To do so, we consider a simple two-period setting. In period 1, the firm sets the wage (w) and determines the number of workers (L) it hires. It offers a two-period (i.e., a long-term) contract, committing to employ the L workers and pay w also in period 2, provided the adverse regulation is avoided. Workers respond by exerting political effort and engaging in political action against the regulation, raising the probability that it can be avoided. In period 2, the regulation may or may not be implemented. If it is, workers lose their jobs and the firm shuts down. If it is not, the firm executes the labour contracts it has committed to.

Note from this discussion that the model is best suited to describe a firm facing a permanent threat of regulation, such as a regulated utility or a firm operating in a highly polluting industry. It is less realistic for a firm facing a potential idiosyncratic regulatory intervention because, in that case, it is not obvious that the firm would structurally adapt its wage and employment policies.

The regulation affects both workers and the firm. If the firm shuts down and fires its current workers, persons who had worked at the firm will earn the alternative wage w_0 . We can think that the firm in question is not unionized, but has to pay at least this reservation wage of w_0 to attract workers; alternatively, we can think that the firm has unionized workers

but – to induce political action by the union – is willing to pay a wage higher than is paid at other firms.⁷ The adverse regulatory policy further implies that the firm loses the revenue R it would generate if the policy were avoided. We assume for simplicity that this revenue loss is fixed. Of course, the model could be modified to consider more general conditions. For example, instead of assuming a fixed loss R , it could be assumed that the adverse policy increases the marginal cost of production, causing the firm to reduce output and employment. The generalization, however, would only complicate the technical analysis without affecting the insights derived in this paper.

With minor adjustments the model can be given several other interpretations. For example, it can be interpreted as dealing with a regulation that forces firms to move their activities abroad. Alternatively, the regulation could be interpreted as a severe environmental regulation that imposes a large compliance cost on the firm. It can be shown that the minor adjustments needed to allow these different interpretations lead to identical qualitative results as those reported in this paper.⁸ Moreover, note from the discussion in the Introduction that our assumption that governmental policy can cause firms to lay off its current workers is consistent with evidence on how firms may respond to government regulation (List, McHone, and Millimet (2003), Becker and Henderson (2000), Greenstone (2002)). Crucial to our model is that both the firm and its workers are affected by government policy, and that the firm wants workers to take actions that favor the firm.

The probability π of successful political action against the policy depends on the aggregate political activity by workers, equal to individual effort x per worker times employment L . We therefore have $\pi(xL)$, where the first derivative is positive by assumption, $\pi' > 0$. At this point no explicit restrictions are imposed on higher-order derivatives. The cost of political effort x per worker is denoted by a convex cost function $C(x)$, hence $C' > 0, C'' > 0$. Assuming increasing marginal cost of effort to affect the political outcome is not uncommon in the literature, and it has been shown to have relevant policy

⁷ One could also interpret some of our results as having the wage and the employment represent the results of bargaining between management and the union, with each recognizing that the wage and employment will affect political effort. To avoid excessively complicating the analysis, we do not, however, explicitly consider the agreement that will be reached under such sophisticated bargaining. See Section 2.1 below.

⁸ Details are available from the authors. These alternative interpretations yield the same qualitative results, but the model setup used in this paper facilitates the technical derivations.

implications; for an example, see Esteban and Raj (2001).⁹ As will become clear below, it drives many of the results to be derived in the current paper.

The timeline is as follows: (i) In period 1, the firm decides on the wage w and the number of workers L . Moreover, it commits to pay w to the L workers in period 2 if the political efforts by the workers are successful and the adverse policy is rejected; (ii) Conditional on (w, L) , workers engage in political activity; (iii) In period 2, the government either adopts the adverse policy or does not, and (iv) payoffs to workers and to the firm are realized. If the adverse policy is adopted, the firm shuts down, saving the wage bill but incurring a revenue loss R ; workers earn the alternative wage w_0 . If the adverse policy is rejected, each of the L workers at the firm earns w .

In the next sections, we first study the behavior of workers, conditional on the wage and employment decisions by the firm. Next we analyze the firm's choice of labour market policies.

2. Coordinated versus uncoordinated action

To study how wages and employment affect the political activity of workers, consider first coordinated efforts by workers; they act as a group, for example, through a labor union. We then consider uncoordinated, individual, effort by workers, thus allowing for free riding.

2.1. Coordinated action

Suppose the political activities of workers are coordinated by a labor union, in the sense that the union determines the political activity of each worker at the firm. Of course, organizing political action by its workers is not the union's main activity. But, in line with Olson's (1965) discussion of the role of unions, political lobbying can be seen as a by-product of their primary activities, viz., organizing the workplace. Our goal in this paper is not to explain all aspects of union behavior (for example, wage bargaining), but to focus on how political activity by workers, coordinated by a union, can affect a firm's decisions. The model assumes that the firm strategically determines wages, employment, or both to induce political activity by the workers; the union chooses political effort as a function of the firm's decisions.

⁹ Esteban and Raj (2001) develop a model of collective action with convex effort costs. They show that a sufficiently fast rising marginal effort cost may overturn Olson's (1965) thesis that larger groups may be less successful in furthering their interests.

The analysis below demonstrates how a firm may favor unionization, or be less opposed to unionization than it would otherwise, and why unions might have higher wages even if the union has no bargaining power over the firm.¹⁰ Moreover, our analysis predicts when a firm may be most open to unionization---when it needs political effort.

Given the wage w paid by the firm and for given employment L , the union cannot affect the wage bill in period 1. However, by exerting political effort it raises the probability of avoiding the potential adverse regulation in period 2. The union determines political effort x per worker so as to

$$\begin{aligned} \text{Max}_x \quad & L[\pi(Lx)(w) + (1 - \pi(Lx))(w_0)] - LC(x) \\ \text{s.t.} \quad & x \geq 0 \end{aligned}$$

To understand the union's objective function, note that with probability π political activity succeeds; in period 2, each worker will then earn w .¹¹ With probability $(1 - \pi)$ political activity fails, and government adopts the adverse policy; each worker would then earn the alternative wage w_0 . The non-negativity constraint allows for a corner solution with zero effort. Of course, if the firm faced no threat of an adverse policy, it would pay its workers the alternative wage w_0 , and no worker would exert political effort.

As, by assumption, the union takes w and L as given, the union's objective boils down to maximizing the welfare of the representative worker at the firm, or to

$$\begin{aligned} \text{Max}_x \quad & \pi(Lx)(w - w_0) - C(x) \\ \text{s.t.} \quad & x \geq 0 \end{aligned}$$

¹⁰ A more general setting could have wage bargaining between the union and the firm, with the firm setting employment and the union deciding on political effort. Alternatively, one could assume Nash bargaining over wages and employment, with the union determining political effort conditional on the wage and employment. In both cases, however, the results would confound the role of bargaining and of the firm's specific policies to induce workers to take political action; it would make it more difficult to isolate the latter effect, which is the main interest of this paper.

¹¹ The model assumes that the firm pays above-market wages (in period one) and commits to do so in the future (in period two) if the adverse policy is not imposed and the threat of imposing the policy disappears. Union coordination may then have an additional advantage, in the sense that it may make it easier for the firm to credibly commit, even in the absence of enforceable contracts. In contrast, absent an enforceable contract, individual workers who engage in political action may fear that even if their political activity is successful, in the following period the firm will cut wages back to market levels.

The examples given in the Introduction suggest that workers indeed often undertake political action. We therefore focus on internal solutions¹². The first-order condition for an internal solution is

$$\pi' L(w - w_0) - C' = 0. \quad (1)$$

The union chooses political effort per worker such that the marginal benefit of extra effort equals the marginal cost. The second-order condition requires that

$$\pi'' L^2(w - w_0) - C'' < 0. \quad (2)$$

Examination of (1) shows that utility-maximizing effort by union workers depends on the wage paid, on the alternative wage, and on employment. Using the implicit function theorem we find:

$$\frac{dx}{dw} = -\frac{\pi' L}{\pi'' L^2(w - w_0) - C''} > 0; \quad \frac{dx}{dw_0} = \frac{\pi' L}{\pi'' L^2(w - w_0) - C''} < 0 \quad (3)$$

$$\frac{dx}{dL} = -\frac{(w - w_0)[\pi' + \pi'' Lx]}{\pi'' L^2(w - w_0) - C''} > or < 0 \quad (4)$$

Political effort by workers increases with the wage. Similarly, political effort declines with the alternative wage, because workers suffer less if the firm fails. The effect of higher initial employment is ambiguous; it depends on the shape of the probability function and on aggregate effort. If aggregate effort is small, the first derivative of the probability function dominates; increasing employment increases aggregate effort. At high employment and individual effort levels, further increasing employment induces the union to reduce political effort by each worker. Lastly, note that aggregate political effort necessarily increases with the number of workers:

$$\frac{\partial(Lx(w, w_0, L))}{\partial L} = x + L \frac{\partial x}{\partial L} = -\frac{[L\pi'(w - w_0) + xC'']}{\pi'' L^2(w - w_0) - C''} = -\frac{[C' + xC'']}{\pi'' L^2(w - w_0) - C''} > 0. \quad (5)$$

The last equality follows from using (1). That is, though an increase in the number of workers has an ambiguous effect on effort per worker, increased employment necessarily increases aggregate political effort. This effect is consistent with the evidence cited in Babcock, Engberg, and Glazer (1997) that teacher unions, and school boards, may favor high employment because that increases political support for local education.

¹² Given the convex cost function $C(x)$, the required conditions for an internal solution depend on the shape of the probability function and on the wage and employment policies of the firm. If the probability function is concave throughout, a sufficient condition for an internal maximum is $\pi'(0)L(w - w_0) > C'(0)$. An S-shaped probability function implies an internal solution given sufficiently high wage and employment levels.

2.2. Uncoordinated action by workers

Consider next uncoordinated political activity by workers, with each worker taking individual action. Workers can contact congressmen or local political representatives, write editorial letters to the press, make campaign contributions to (or vote for) parties they believe will support the firm, and so on.¹³ For a given number of workers L at the firm, we assume an individual worker will choose his effort so as to maximize the expected wage premium minus the cost of his political effort. That is, we are considering a Nash equilibrium with the private provision of a public good. We assume all workers are identical and focus on symmetric equilibria. A worker's problem in period 1 is to choose the level of effort that maximizes his expected income in period 2 minus his cost of effort in period 1. We have:

$$\begin{aligned} \underset{x_i}{\text{Max}} \quad & (\pi)(w - w_0) - C(x_i) \\ \text{s.t.} \quad & x_i \geq 0 \end{aligned}$$

where now

$$\pi = \pi((L-1)x_{-i} + x_i).$$

The value of x_{-i} is the political effort of any worker other than i . The first-order condition for an internal solution is¹⁴

$$\pi'(w - w_0) - C' = 0. \quad (6)$$

This equation determines the i -th worker's political activity as a function of his wage, the alternative wage, and aggregate effort by all other workers. Denoting aggregate effort by T (so $T = (L-1)x_{-i}$), political activity can be written as $x_i(w, w_0, T)$. We then have

$$\left. \frac{dx_i}{dw} \right|_T = - \frac{\pi'}{\pi''(w - w_0) - C''} > 0; \quad \left. \frac{dx_i}{dw_0} \right|_T = - \frac{dx_i}{dw} \Big|_T < 0 \quad (7)$$

$$\frac{dx_i}{dT} = - \frac{(w - w_0)\pi''}{\pi''(w - w_0) - C''} < 0 \quad (8)$$

The notation $\Big|_T$ emphasizes that aggregate political effort by all other workers is assumed constant when calculating the relevant effect. Expression (7) says that, conditional on others'

¹³ In the case where the firm is creating rents for stakeholders other than workers (for example, multiple suppliers to a firm, or multiple independent retailers of the firm's product; see the concluding section), the assumption of uncoordinated action is especially plausible.

¹⁴ The second-order condition requires $\pi''(w - w_0) - C'' < 0$.

effort, a higher wage increases political effort by an individual worker. More effort by other workers, however, reduces any one worker's effort, reflecting free-riding (see (8)).

Under our assumptions, in equilibrium we have $x = x_i$. Differentiating $x = x_i(w, w_0, T)$, we then find

$$\begin{aligned}\frac{dx}{dw} &= \frac{dx_i}{dw}\bigg|_T + \frac{dx_i}{dT}(L-1)\frac{dx}{dw} & \frac{dx}{dw_0} &= \frac{dx_i}{dw_0}\bigg|_T + \frac{dx_i}{dT}(L-1)\frac{dx}{dw_0} \\ \frac{dx}{dL} &= \frac{dx_i}{dT}\left[x + (L-1)\frac{dx}{dL}\right]\end{aligned}$$

Using (7)-(8) into these expressions yields

$$\frac{dx}{dw} = -\frac{\pi'}{\pi''L(w-w_0)-C''} > 0 \quad \frac{dx}{dw_0} = \frac{\pi'}{\pi''L(w-w_0)-C''} < 0 \quad (9)$$

$$\frac{dx}{dL} = -\frac{(w-w_0)\pi''x}{\pi''L(w-w_0)-C''} < 0 \quad (10)$$

When $L > 1$, the effect of wages on equilibrium effort is much smaller than the direct effect (compare (9) with (7)). The difference arises from the free-riding behavior mentioned above. Furthermore, increased employment necessarily reduces individual effort, in contrast to behavior under coordinated action. But it follows from (10) that aggregate political activity necessarily increases with the number of workers at the firm:

$$\frac{d(xL)}{dL} = x + L\frac{dx}{dL} = \frac{-C''x}{\pi''L(w-w_0)-C''} > 0. \quad (11)$$

So as with coordinated action, the firm will induce greater political effort by its workers the greater their number. This result is consistent with the general result in models of private provision of public goods that an increase in the number of agents reduces provision by each agent, but increases aggregate effort.¹⁵ Note the relevance of convexity of the effort cost function here. Absent this assumption, higher employment would not increase total worker effort. For example, a linear cost function would imply that total worker effort is independent of the size of the labor force L .

¹⁵ In those models, however, both the number of agents and the benefit to an agent from the public good is exogenously fixed. This is not the case in the current paper; in Section 3.2, we let the firm choose both the wage and employment.

2.3. Comparing coordinated to uncoordinated action

Not surprisingly, free-rider behavior implies that effort per worker to engage in political activity against the regulation is higher under union coordination than when actions are uncoordinated. Denoting political effort per worker under coordinated and uncoordinated actions by x_c and x_u , respectively, and assuming $L > 1$, we have $x_c > x_u$. This directly follows from the analysis above. To see this, note that for $L=1$, the first order conditions (1) and (6) obviously imply $x_c = x_u$. Moreover, it follows from (4) and (10) that evaluated for low employment ($L=1$) an increase in L raises individual effort under coordinated actions, while reducing it when actions are not coordinated. Hence, as expected, we have $x_c > x_u$.

Will wage or employment increases by the firm increase aggregate political activity by workers more under coordinated action by the union, or under uncoordinated actions by workers? Stated otherwise, we are interested in the signs of

$$\frac{d(Lx_c)}{dw} - \frac{d(Lx_u)}{dw} \quad (12)$$

and

$$\frac{d(Lx_c)}{dL} - \frac{d(Lx_u)}{dL} . \quad (13)$$

Of course, these expressions depend on the properties of the functions describing the probability of successful political action $\pi(Lx)$ and the cost of political effort $C(x)$; studying the signs of (12)-(13) in general is not very informative (see Appendix 1 for details). To make the results more concrete, we shall therefore use particular specifications of the probability function and the cost function of political effort throughout the paper. Although we shall refer to other specifications when appropriate, consider the following probability function:

$$\pi(xL) = \frac{xL}{1 + xL} . \quad (14)$$

This specification implies the plausible assumption that the probability of successful political action is increasing and concave in aggregate activity. It is straightforward to show that:

$$\pi' = (1 - \pi)^2 > 0; \quad \pi'' = -2(1 - \pi)^3 < 0 .$$

We further assume a quadratic cost function of political effort:

$$C(x) = \alpha x + (\beta / 2)x^2 . \quad (15)$$

This convex cost function implies that:

$$C' = \alpha + \beta x > 0; \quad C'' = \beta > 0$$

Using (14)-(15), we then show in Appendix 1 that

$$\frac{d(Lx_c)}{dw} - \frac{d(Lx_u)}{dw} > 0; \quad \frac{d(Lx_c)}{dL} - \frac{d(Lx_u)}{dL} > 0.$$

Union coordination is more effective than individual initiatives in transforming both higher wages and a larger labor force into additional political action. This result was robust for various other concave probability functions and convex cost functions. Although firms may be opposed to unions for a variety of other reasons, it identifies one important reason why the firm may benefit from unions. They overcome the free-rider behavior of individual workers, so that a smaller wage or employment increase suffices to generate the same extra political effort by workers in support of the firm.

We summarize the main findings of this section in the following proposition.

Proposition 1. The determinants of political effort

- a. **Higher wages and higher employment lead to greater aggregate political activity by workers, both under coordinated and uncoordinated action. A higher alternative wage reduces political effort by workers.**
- b. **A firm benefits from unionization, ceteris paribus: by overcoming free-rider behavior, unions raise the effectiveness of wages and employment in stimulating political effort by workers**

3. Behavior of the firm

Consider next the firm's behavior. It chooses wages and employment, knowing that this choice affects political actions by workers and, hence, the probability that the regulation can be avoided. As explained in Section 1, the firm makes its wage (w) and employment (L) decisions in period 1, but commits to paying w to the L workers also in period 2, provided the regulation is avoided. Moreover, we assume that, ex ante, the firm's objective is to maximize expected profits over the two periods. The discount rate is set equal to zero; this does not affect the qualitative results to be derived from the model.

We proceed in two steps. We first take employment as exogenously fixed, so that the firm chooses only the wage. The constraint can apply in the short run when, for example, space constraints may restrict employment. Alternatively, the supply of workers may be inelastic after some point, with the solution in the absence of labor constraints having the firm hire a greater number of workers. The second part of this section lets the firm choose both the wage and employment.

3.1 Fixed employment

The firm is assumed to maximize expected profits. Writing the firm's objective function in general as $Z(w; L, w_0, R)$, we formulate the firm's problem as

$$\underset{w}{\text{Max}} \quad Z(w; L, w_0, R) = [1 + \pi(Lx(w, w_0, L))](R - wL) \quad \text{subject to } w \geq w_0$$

To understand the objective function, note that profit in period 1 is given by $(R - wL)$. With probability π , the union's political action is successful and the regulation is avoided, so that expected profits in period 2 are $\pi(R - wL)$. Our assumption of a zero discount rate then immediately leads to the objective function specified above. Note that with probability $(1 - \pi)$ the firm shuts down and makes zero profit. Lastly, the constraint reflects the requirement that the firm must pay at least the alternative wage to attract workers.

The solution to the firm's problem determines the profit-maximizing wage offered by the firm to induce workers to take action on behalf of the firm. We are interested in several questions. First, how will the wage offered by the firm differ under coordinated and uncoordinated political action by workers? Second, how do changes in the reservation wage w_0 and in the firm's potential loss R affect the wage? We expect a higher w_0 to lead the firm to pay a higher wage: the higher the alternative wage, the less workers suffer from layoffs caused by adverse policy, and, therefore, the firm must pay a higher wage to induce a given level of political activity. An increase in R will imply that the firm wants to induce higher aggregate political effort from its workers; therefore, one expects the firm to pay a higher wage to induce such behavior. Lastly, we ask how employment L affects the wage. Higher employment raises the probability of successful political activity, but for any wage rate also raises the wage bill.

We have the following first-order condition for an internal solution (a corner solution yields no interesting insights: if the firm pays $w = w_0$, political effort $x = 0$, see Section 2.1)

$$Z_w = \left(\pi' L \frac{\partial x}{\partial w} \right) (R - wL) - (1 + \pi)L = 0. \quad (16)$$

In this expression, Z_w denotes the first derivative of the objective function Z with respect to the wage w . The second-order condition requires that the second derivative $Z_{ww} < 0$. Of course, (16) requires equality of the expected marginal cost of a wage increase and the expected marginal benefit (a higher wage increases political activity and increases the

probability of avoiding the regulation). Note that (16) also implies that the wage bill at the optimal wage is less than the revenue lost if the regulation were adopted, i.e., $(R - wL) > 0$.

What does (16) imply for the wage under coordinated versus uncoordinated political activity? We showed before that, at a given (w, L) combination, the effect of the wage on political effort per worker x (captured by $\frac{\partial x}{\partial w}$) is larger when activity is coordinated (see expression (12)). It follows that the expected marginal profit of a wage increase is higher under coordinated activity, so that the wage will be higher under coordinated activity by the union than under individual action.

Applying the implicit function theorem to (16), the effect of the exogenous parameters (w_0, R, L) on the (expected) profit-maximizing wage can be written in general as

$$\frac{dw}{dw_0} = -\frac{Z_{ww_0}}{Z_{ww}}; \quad \frac{dw}{dR} = -\frac{Z_{wR}}{Z_{ww}}; \quad \frac{dw}{dL} = -\frac{Z_{wL}}{Z_{ww}}.$$

In principle, both the sign and the magnitude of these effects may differ between coordinated and uncoordinated political activity, because the effects of wage and employment changes on political effort were found to differ. In Appendix 2 we show, however, that subject to a very minor technical condition, for both coordinated and uncoordinated actions

$$0 < \frac{dw}{dw_0} < 1; \quad \frac{dw}{dR} > 0 \tag{17}$$

Consistent with intuition, both a higher alternative wage and a higher potential revenue loss R from the adverse policy increase the wage.

Higher employment raises the probability of successful political activity, but at a given wage it also raises the wage bill. Not surprisingly, as shown in Appendix 2, the effect of higher employment on the wage is therefore ambiguous in general. However, using (14)-(15) we find it to be negative, both for coordinated and uncoordinated actions:

$$\frac{dw}{dL} < 0. \tag{18}$$

The lower wage reduces political effort per worker, but in firms with high employment aggregate political activity is higher, and the lower wage reduces the increase in the wage bill. Note that the negative relation between employment and the wage is similar to a downward sloping demand curve, but the interpretation differs fundamentally: here the firm reduces the wage because it does not need to induce as much effort from workers.

We summarize findings in Proposition 2.

Proposition 2. Inducing political effort from a given labor force

- a. **A higher alternative wage and a larger potential loss R to the firm lead it to pay a higher wage. This result holds for coordinated and for uncoordinated political action.**
- b. **The wage offered by the firm is higher when political activity is coordinated, ceteris paribus.**
- c. **The firm views employment and the wage as substitutes: the higher employment, the lower the wage.**

3.2. The firm sets both wage and employment

Consider more generally a firm which chooses both the wage and employment to induce political activity by workers. Its problem is to

$$\begin{aligned} \text{Max}_{w,L} \quad Z(w, L; w_0, R) &= [1 + \pi(L x(w, L; w_0))] (R - wL) \\ \text{subject to} \quad w &\geq w_0 \end{aligned} \quad (19)$$

The first-order conditions for an interior solution are:

$$\left(\pi' L \frac{\partial x}{\partial w} \right) (R - wL) - (1 + \pi)L = 0 \quad (20)$$

$$\pi' \left(x + L \frac{\partial x}{\partial L} \right) (R - wL) - (1 + \pi)w = 0. \quad (21)$$

Note that an internal solution requires the cost function for political effort to be convex, as we assumed.¹⁶ The second-order conditions associated with (19) are given in Appendix 3.

It will be instructive to consider coordinated and uncoordinated political action sequentially.

Coordinated actions

Appendix 3 derives the effect of changes in the parameters w_0 and R on the endogenous variables w and L . We find that a higher alternative wage reduces employment, and it raises the wage paid by the firm. We have

$$\frac{dw}{dw_0} > 0 \text{ and } \frac{dL}{dw_0} < 0. \quad (22)$$

¹⁶ To see this, note that combining expressions (20)-(21) implies $x + L \frac{\partial x}{\partial L} = w \frac{\partial x}{\partial w}$. Substituting expressions (3) and (5) in this equation yields the condition $\pi' L w_0 - x C'' = 0$. This implies $C'' > 0$.

These effects are intuitive. Workers who can earn a higher alternative wage suffer less from the adverse governmental policy. To induce them to act against the policy, the firm has to increase the wage. To moderate the effect of a higher wage on the wage bill, the firm hires fewer workers.

We find the following general results for the effect of the potential loss to the firm R on the wage and on employment (see Appendix 3):

$$\frac{dw}{dR} = \left[\frac{(\pi')^2(R - wL)}{\Delta} \right] \left(\frac{1}{(M)^3} \right) \left\{ (\pi' + \pi''Lx) [C'(C'''x + C'') - x(C'')^2] \right\} \quad (23)$$

$$\frac{dL}{dR} = \left[\frac{(\pi')^2(R - wL)}{\Delta} \right] \left(-\frac{\pi' L^2}{(M)^3} \right) [C''(\pi' - \pi''xL) + C''' \pi' x]. \quad (24)$$

In these expressions,

$$\Delta \equiv (Z_{ww}Z_{LL} - Z_{Lw}Z_{wL}); \quad M \equiv \pi'' L^2(w - w_0) - C''. \quad (25)$$

Note that $\Delta > 0$, $M < 0$ by the second-order conditions for the optimization problems of the firm and the union, respectively (see Appendix 3 for details).

Not surprisingly, (23)-(24) imply that the effects of a higher potential loss on the wage and employment choices of the firm depend on the characteristics of the probability function and the cost function of political action. In what follows, we proceed in two steps. We first interpret the general expressions (23)-(24); next we use the specific functional forms used before to obtain additional insight.

Consider expression (23). Note that both the sign of $(\pi' + \pi''Lx)$ and of $[C''(C' - xC'') + C'C''']$ can be positive or negative. However, both terms have a clear interpretation. The first term $(\pi' + \pi''Lx)$ determines whether raising employment increases or reduces political effort per worker. Indeed, it follows from (4) that $(\pi' + \pi''Lx) > 0$ implies that $dx/dL > 0$. The positive effect will typically apply at low aggregate effort Lx . When employment rises but aggregate effort is low, a union which has to protect a larger labor force may call for higher effort by each worker. At high employment and aggregate effort, further expansion of the labor force allows effort per worker to decline. The second term $[C'(C'''x + C'') - x(C'')^2]$ appearing on the right hand side of (23) only depends on the characteristics of the cost function. We can show that the term is positive when a percentage

increase in political effort x has a larger percentage effect on the marginal cost of political effort at high than at low effort; it will be negative if the opposite holds.¹⁷ Given this interpretation, one intuitively expects this second term to be non-negative. It follows then from (23) that a higher revenue loss R leads the firm to offer higher wages if aggregate political effort by workers is fairly low, and lower wages if the opposite holds.

Next look at the effect of a larger revenue loss R on employment, as given by (24). A sufficient condition for the term $[C''(\pi' - \pi''xL) + C''' \pi' x]$ to be positive is that the probability function is concave and the marginal cost of political activity is a convex function. Under these conditions, (24) tells us that a larger revenue loss R induces the firm to hire more workers.

To illustrate our findings, let us return to the probability and cost functions specified before, see (14)-(15). Using these results in (23)-(24) we show in Appendix 3 that:

$$\frac{dw}{dR} < 0 \quad \text{if } \pi < \frac{1}{2}; \quad \frac{dw}{dR} > 0 \quad \text{if } \pi > \frac{1}{2}; \quad \frac{dw}{dR} = 0 \quad \text{if } \pi = \frac{1}{2} \quad (26)$$

$$\frac{dL}{dR} > 0 \quad (27)$$

Interpretation is straightforward. We know that a higher potential loss R means that the firm will want to encourage political activity by workers. Expression (27) then implies that, to do this, the firm increases employment. However, the effect on the wage depends on the probability of successful action (which depends on total political action Lx). Wages will decrease when this probability is small (less than $\frac{1}{2}$), they will increase if the probability of success exceeds $\frac{1}{2}$.

¹⁷ To prove this, we proceed in two simple steps. First, the sign of $[C''(C' - xC'') + C' C''' x]$ is the

same as the sign of $\frac{\partial \left(\frac{x C''}{C'} \right)}{\partial x}$. Observe the similarity of the sign of this expression and the question of increasing or decreasing relative risk aversion in the economics of uncertainty. Second, we note that this last expression captures the effect of an increase in x on the elasticity of the marginal cost with respect to x , measuring the effect of a one percent increase in political effort x on marginal cost. To see this, observe that this elasticity is given by $\frac{\partial(C')}{\partial x} \frac{x}{C'} = \frac{x C''}{C'}$. Therefore, the term $[C''(C' - xC'') + C' C''' x] > 0$ when a percentage increase in political effort x has a larger effect on the marginal lobbying cost at high than at low effort.

The intuition for (26) is easy. Observe that the probability function (14) implies that if the probability of successful political action $\pi < \frac{1}{2}$, then more employment raises effort per worker. To see this, simple algebra shows that (14) implies that $[\pi' + \pi'' Lx] = (1 - 2\pi)$; it then follows from (4) that

$$\pi < \frac{1}{2} \Leftrightarrow \frac{dx}{dL} > 0.$$

In that case, (26) tells us that a larger potential loss to the firm induces it to pay a lower wage: $dw/dR < 0$. This result makes sense. If raising employment increases individual political effort (and a higher R leads to more employment, see above), the effect on aggregate effort is large and the firm ‘can afford’ to reduce the wage. The lower wage reduces the higher wage bill associated with a large labor force. If, however, aggregate effort is large so that the probability of successful action is large (exceeding $\frac{1}{2}$), then individual effort per worker declines with employment ($dx/dL < 0$). In that case, the overall effect of more employment on total effort is limited, and the firm raises the wage so as to induce political effort further, despite the increase in the wage bill: we then have $dw/dR > 0$.

We evaluated (23)-(24) for a variety of alternative functional forms and found the result $dL/dR > 0$ to be robust: a larger revenue loss induces the firm to hire more workers. However, (23) and (26) clearly indicate that the effect on the wage offered by the firm is not unambiguous; dw/dR can be positive, negative or zero. Interestingly, the loss will not affect the wage at all for the class of homogeneous cost function specifications. For a cost function that is positive homogeneous of degree k (so $C(\delta x) = \delta^k C(x)$ for any positive δ), Euler’s theorem implies $xC' = kC$, $xC'' = (k-1)C'$, $xC''' = (k-2)C''$. Using these properties and straightforward substitution yields $[C'(C'''x + C'') - x(C'')^2] = 0$. It then follows from (23) that a higher potential loss R does not affect the wage at all ($\frac{dw}{dR} = 0$)¹⁸.

¹⁸ We considered a variety of alternative cost functions. Consider just two examples. First, let $\ln C(x) = \gamma + \delta x$, $\gamma > 0$, $\delta > 0$. We then find the same result as for the linear marginal cost case given in the text, see (26)-(27). As another example, let $C(x) = x^\rho$, $\rho > 0$. This cost function is homogeneous; we then find $\frac{dw}{dR} = 0$; $\frac{dL}{dR} > 0$.

To conclude the analysis of the coordinated case, we derive the effect of a higher potential loss R on the total wage bill – rather than on w and L separately -- and on aggregate political activity. We have

$$\frac{d(wL)}{dR} = w \frac{dL}{dR} + L \frac{dw}{dR}$$

Using (23)-(24) shows that, in general

$$\frac{d(wL)}{dR} = w \frac{dL}{dR} + L \frac{dw}{dR} = \left[\frac{(\pi')^2 R}{\Delta} \right] \left(\frac{Lx}{(M)^3} \right) \left[(C' \pi'' L - C'' \pi') (2C''' + C'''' x) \right]. \quad (28)$$

Using the specifications (14)-(15) suggested before yields that a larger loss R raises the wage bill of the firm:

$$\frac{d(wL)}{dR} > 0 \quad (29)$$

Lastly, the effect of R on total political action can be written as

$$\frac{d[(x(w, L))L]}{dR} = L \frac{dx}{dw} \frac{dw}{dR} + \left(x + L \frac{dx}{dL} \right) \frac{dL}{dR} = \frac{dx}{dw} \left[L \frac{dw}{dR} + w \frac{dL}{dR} \right]. \quad (30)$$

The final equality follows from using (20)-(21). Hence, a larger loss from regulation to the firm raises overall political activity.

Uncoordinated actions

Appendix 4 derives the effect of exogenous changes in the alternative wage and in the potential loss R on wages and employment when workers act individually. As before, as workers have less to lose, a higher alternative wage raises the wage the firm pays; moreover, it leads to lower employment:

$$\frac{dw}{dw_0} > 0 \text{ and } \frac{dL}{dw_0} < 0.$$

A larger potential loss R to the firm induces the following wage and employment effects

$$\frac{dw}{dR} = \left[\frac{(\pi')^2 (R - wL)}{\Delta} \right] \left[\frac{\pi'' x}{(K)^3} \right] \left[C'(C''' x + C'') - x(C'')^2 \right] \quad (31)$$

$$\frac{dL}{dR} = \left[\frac{(\pi')^2 (R - wL)}{\Delta} \right] \left[-\frac{\pi'}{(K)^3} \right] \left[\pi'' L(C' - C'' x) + \pi' C''' x \right] \quad (32)$$

where Δ was defined before, and $K = \pi' L(w - w_0) - C'' < 0$ (for details see Appendix 4). As before, the results are ambiguous, depending on the properties of the cost and probability functions. Note that the effect of the potential loss R on the wage depends on the same property of the cost function as under coordinated action (compare (31) with (23)).

Free-rider behavior implies that, unlike in the coordinated case, it is not at all obvious that the firm will respond to a higher revenue loss by raising employment. The reason is that more employment reduces individual effort ($\frac{dx}{dL} < 0$, see (10)), making employment a less effective instrument to induce political action. For example, employing the specifications (14)-(15) we find, see Appendix 4, the following unambiguous results:

$$\frac{dw}{dR} > 0 \text{ and } \frac{dL}{dR} < 0. \quad (33)$$

If workers do not coordinate political action, the firm raises the wage but it reduces employment. Surprising as this may seem, the intuition for this finding is straightforward. Although reducing employment reduces aggregate political effort (see (11)), this effect is limited because the increase in individual effort partly offsets the effect of the reduction in employment. Moreover, reducing employment saves on the wage bill. Lastly, reducing employment L necessarily reduces the effectiveness of paying a higher wage: one easily shows that (14)-(15) imply $\frac{d^2 x}{dw dL} < 0$. Hence, lower employment causes a wage increase to more greatly affect effort per worker. The firm therefore benefits from reducing employment: the reduction in political action is small, it saves on the wage bill, and less employment makes wage increases more productive in increasing political effort.

Of course, for the class of homogeneous cost functions a different result must hold. For these specifications, we know that $[C'(C'''x + C'') - x(C'')^2] = 0$, so that (31) immediately implies that an increase in the potential loss to the firm does not affect the wage. Consequently, the only instrument the firm has to stimulate overall political effort by its workers is to enlarge the labor force. We have

$$\frac{dw}{dR} = 0 \text{ and } \frac{dL}{dR} > 0. \quad (34)$$

Lastly, we find the effect of R on the total wage bill as:

$$\frac{d(wL)}{dR} = w \frac{dL}{dR} + L \frac{dw}{dR} = \left[\frac{(\pi')^2 R}{\Delta} \right] \left(\frac{1}{(K)^3} \right) [C''' x^2 (C' \pi'' L - C'' \pi')]. \quad (35)$$

Given convex marginal effort costs and a concave probability function, this effect is positive. For linear marginal costs, the effect is zero: the firm raises the wage but the employment decline exactly compensates this so as to keep the wage bill constant. In that case, neither the wage bill nor the probability of success are affected by the firm's policies, but the value of its objective function declines.

Coordinated versus uncoordinated political action

The firm's response differs substantially between coordinated and uncoordinated actions. To illustrate this, consider our findings for a common specification of cost and probability functions, as given by (14)-(15). Under coordinated actions, the response to a larger potential loss is to stimulate union action by raising employment (see (27)). At low initial employment the firm offers a low wage (because then employment is highly effective at inducing effort, allowing the firm to save on the wage bill by lowering wages); higher wages are offered at high levels of L . When effort is uncoordinated, a different picture emerges. Now free-riding makes wages relatively more effective than employment. Higher employment reduces individual effort, making such a policy less effective than under coordinated action. The firm therefore induces political effort by hiring fewer workers at a higher wage (see (33)).

We summarize our findings in Proposition 3.

Proposition 3. Stimulating political action

- a. A higher alternative wage leads the firm to pay a higher wage, but to hire fewer workers. The effects hold both for coordinated and uncoordinated efforts.**
- b. If political efforts are coordinated, an increase in the potential loss from an adverse policy induces the firm to increase employment. Whether it raises the wage depends on the characteristics of the effort cost and probability functions.**
- c. If political actions are not coordinated, free riding behavior by workers may lead the firm to hire fewer workers at a higher wage.**

4. Implications

The model has several implications, some of which may be subject to empirical testing. First, the model offers an alternative to standard efficiency wage arguments to explain why firms pay high wages. They may not only do so to increase the productivity of workers on the job, but also to increase the effort workers exert on protecting the firm from unfavorable policies. Second, the model points out an important potential role for unions.

Coordinated political action implies that for given stimuli offered by the firm workers exert more political effort. The union overcomes free-rider behavior, making the firm's employment policies more effective. Third, relatedly, the response of firms to a threat of adverse policy may depend on whether workers are unionized. As argued in the previous section, when the firm is unionized, for a large class of cost functions raising employment was found to be more effective than raising wages in inducing workers' political effort. When workers' efforts are uncoordinated, wage increases were found to be more effective than employment increases in inducing political effort. A higher potential loss R may then lead the firm to raise the wage, but to hire fewer workers.

Fourth, and related to the previous point, our model can explain why the failure rate of unionized firms is no greater than of non-unionized firms. Indeed, despite the positive effect of unionization on wages – implying, *ceteris paribus*, larger failure rates -- the data show that unions do not increase the failure rate (see, for example, Kleiner and Freeman (1999)). The model would argue that the political action undertaken by unionized workers to support the firm will counteract the direct effect of higher wages on the failure rate.¹⁹

Lastly, the model makes some predictions on issues that were, strictly speaking, not explicitly captured by the analysis. For example, to the extent that coordinated action via unions will have workers exert greater political effort, wage and employment policies of firms may differ under interventionist ('left-wing') and non-interventionist ('right-wing') governments. To see this, make the extreme assumption that right-wing governments do not threaten to regulate, whereas left-wing governments do. An unthreatened firm has little need to induce political action of its workers by increasing wages or employment. Under left-wing governments, however, the firm may favor unionization because, for given wage and employment, unions imply more political activity against the adverse policy. As another example, firms that care about the political influence of their workers may avoid hiring non-citizens. Similarly, firms may limit outsourcing abroad, because foreign workers have less political influence. As a final example, we would expect unionization to more greatly affect profits than stock values ---the high wages a union may demand will reduce observed profits, but the greater political action that occurs under unions increases the survival rate of unionized firms, thus mitigating the effects of annual profits on stock values²⁰.

¹⁹ A different explanation, given by Friedman (1950), is that workers would reject substantially above-market wages, worrying that high wages could hurt job security.

²⁰ See Lee and Mas (2012) for recent evidence on the impact of unions on financial markets.

Two final remarks are in order. First, this paper emphasized the role of unions in affecting political action by the workforce, and it identified one positive aspect of unionization for the firm threatened by government regulation. However, politicians themselves may have preferences in favor or against unionization; the model did not capture this attitude of politicians towards unionization at all. Second, note that we discussed situations in which a firm wants workers to lobby. But in some situations the opposite holds---the workers lobby government to take action that the firm opposes. Consider a firm that intends to close a plant soon, but is afraid that workers will lobby to keep the plant open. Such a situation appears to have arisen in 2012 in France, where the steelmaker ArcelorMittal intended to close a facility; the government, aiming to protect jobs, threatened to nationalize the plant to avert its closure.²¹ Anticipating such a situation, a firm may want to offer low wages and small employment to reduce political activity by its workers.

5. Conclusion

Firms are commonly viewed as influencing policy by spending money, perhaps in the form of campaign contributions. But the political influence of a firm may be indirect, through its workers: as shown above, a firm that wants to influence government may behave as a principal, with workers as its agents, and so the firm adopts choices that will induce workers to lobby for policies that favor the firm. This view of political influence has several appealing features. It shows why firms offer wages higher than necessary to attract workers, and so gives a different potential explanation for high wages than efficiency wage theories. In our stylized model, high wages increase the effort workers exert on protecting the firm. This view explains why firms may little reduce wages in a recession: the firm's greater need for governmental protection induces firms to give greater incentives to workers to lobby for such protection. The results of this paper can also explain why the higher wages paid by unionized firms do not lead to lower survival rates. Higher wages raise political effort against policies that might lead firms to shut down operations.

Though we analyzed a firm's choice of the wage and of employment in view of workers' efforts to influence governmental decisions in favor of the firm, the analysis can apply more generally to other cases where the firm can be viewed as creating rents for its

²¹ "Hollande Minister's Mittal Nationalization Call Sparks Furor", *Business Week*, November 27, 2012.

stakeholders. For example, an automobile manufacturer may want its dealers to make high profits, so that the dealers have a strong incentive to lobby for policies that increase sales of vehicles made by the firm. A recent example is lobbying effort of the National Dealers Association (NADA) against tougher fuel economy rules proposed by the Obama administration.²² Consumers can also be effective political actors. Through much of 2012, the Stop Online Piracy Act introduced in the US House of Representatives had overwhelming bipartisan support and had provoked little scrutiny. But then Wikipedia made its English-language content unavailable, and Google's home page was scarred by a black swatch that covered the search engine's label. Phone calls and e-mail messages by consumers opposing the bill poured in to Congressional offices, and the bill was essentially dead.²³

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²² The Wall Street Journal (see "Dealers oppose gas rules", The Wall Street Journal, September 15, 2011 (<http://online.wsj.com/article/SB10001424053111903927204576571023117932788.html>)) writes: "More than 400 dealers are set to fly to Washington in coming days to press legislation that would block the automobile rules for at least a year. They argue the new rules—which would raise the average fuel economy of new cars and light trucks to 54.5 miles a gallon over the next 14 years—would be too costly and lead to job losses."

²³ Jonathan Weisman, "In Fight Over Piracy Bills, New Economy Rises Against Old," *New York Times*, January 18, 2012

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Appendix 1

We compare the impact of a higher wage and more employment on political action under coordinated and uncoordinated conditions. To avoid confusion, we denote the values of effort and the associated probabilities and costs with subscripts ‘c’ and ‘u’ to refer to the coordinated and uncoordinated cases, respectively. For example, x_c, x_u give the political effort under coordination and individual action, respectively. Similarly, the notation

$$\pi_j = \pi(Lx_j), C_j = C(x_j) \quad j = c, u$$

is used to distinguish the probabilities and costs under the two systems studied.

First, consider

$$\frac{d(Lx_c)}{dw} - \frac{d(Lx_u)}{dw} \quad (\text{A1.1})$$

Using (3) and (9), we have

$$\begin{aligned} \frac{d(Lx_c)}{dw} &= -\frac{(\pi_c') L^2}{(M)}; & (M) &= (\pi_c'') [L^2(w - w_0)] - C_c'' \\ \frac{d(Lx_u)}{dw} &= -\frac{(\pi_u') L}{(K)}; & (K) &= (\pi_u'') [L(w - w_0)] - C_u'' \end{aligned}$$

It then easily follows that (A1.1) can be written as

$$\left[\frac{1}{(M)(K)} \right] \left\{ L^3(w - w_0) [(\pi_u')(\pi_c'') - (\pi_c')(\pi_u'')] + L[L(\pi_c')(C_u'') - (\pi_u')(C_c'')] \right\} \quad (\text{A1.2})$$

Using (14)-(15), it is straightforward to show that this expression is positive. To see this, first use the properties of the probability function (14) to show

$$[(\pi_u')(\pi_c'') - (\pi_c')(\pi_u'')] = -2[(1 - \pi_u)(1 - \pi_c)]^2 (\pi_u - \pi_c) > 0 \quad (\text{A1.3})$$

This expression is positive, given concavity of the probability function and $x_c > x_u$. Then, noting that the first-order conditions (1) and (6) imply

$$\pi_c' = \frac{C_c'}{L(w - w_0)}; \quad \pi_u' = \frac{C_u'}{(w - w_0)} \quad (\text{A1.4})$$

and using the cost specification (15), we find after simple algebra:

$$[L(\pi_c')(C_u'') - (\pi_u')(C_c'')] = \left(\frac{1}{w - w_0} \right) [\beta^2(x_c - x_u)] > 0 \quad (\text{A1.5})$$

Together, (A1.3) and (A1.5) show that (A1.2) is positive, hence

$$\frac{d(Lx_c)}{dw} - \frac{d(Lx_u)}{dw} > 0$$

Second, we are also interested in the sign of

$$\frac{d(Lx_c)}{dL} - \frac{d(Lx_u)}{dL} \quad (\text{A1.6})$$

Using (5) and (11) in the main body of the paper, we have

$$\begin{aligned} \frac{d(Lx_c)}{dL} &= -\frac{(C_c') + x_c(C_c'')}{(M)} \\ \frac{d(Lx_u)}{dL} &= -\frac{(C_u'') x_u}{(K)} \end{aligned}$$

Some algebra then allows us to rewrite (A1.6) as follows

$$\left[\frac{1}{(M)(K)} \right] \left\{ L(w-w_0) \left[Lx_u C_u'' \pi_c'' - x_c C_c'' \pi_u'' \right] + (C_c'' C_u'') (x_c - x_u) + C_c' [C_u'' - L\pi_u'' (w-w_0)] \right\} \quad (A1.7)$$

Note that the terms

$$\begin{aligned} & (C_c'') (C_u'') (x_c - x_u) \\ & (C_c') \left[(C_u'') - L(\pi_u'') (w-w_0) \right] \end{aligned}$$

are both positive in general. The former because $x_c > x_u$ and given the convexity of the cost function, the latter due to the second-order condition associated with the worker's optimal choice of individual effort.

Finally, although ambiguous in general, for the specifications (14)-(15), the term

$$L(w-w_0) \left[Lx_u (C_u'') (\pi_c'') - x_c (C_c'') (\pi_u'') \right] \quad (A1.8)$$

is easily shown to be positive as well. To see this, we use (A1.4) to rewrite (A1.8) as

$$\frac{LC_u'' \pi_c'' x_u C_c'}{\pi_c'} - \frac{LC_c'' \pi_u'' x_c C_u'}{\pi_u'} \quad (A1.9)$$

Then note that (14) implies that

$$\pi_j'' / \pi_j' = -2(1 - \pi_j) \quad j = c, u \quad (A1.10)$$

Substituting this expression in (A1.9) and using cost specification (15) yields

$$-2\beta L \left[x_u (\alpha + \beta x_c) (1 - \pi_c) - x_c (\alpha + \beta x_u) (1 - \pi_u) \right]$$

Using the definition of π_c, π_u and working out we find that (A1.8) can finally be reformulated as

$$\frac{-2\beta L(x_u - x_c)}{(1 + Lx_c)(1 + Lx_u)} \left\{ \alpha + L[\alpha(x_u + x_c) + \beta x_u x_c] \right\} > 0$$

This is necessarily positive. It follows that the expression in (A1.7) is positive and, hence, that

$$\frac{d(Lx_c)}{dL} - \frac{d(Lx_u)}{dL} > 0.$$

Appendix 2

This appendix analyzes the effects of the exogenous parameters on the profit-maximizing wage under both coordinated and uncoordinated political effort.

Coordinated actions

To derive the effects of the alternative wage and of the regulatory loss R on the wage offered by the firm, substitute (3) in (15) and use the implicit function theorem to obtain

$$\begin{aligned} \frac{dw}{dw_0} &= - \frac{Z_{ww_0}}{Z_{ww}} \\ \frac{dw}{dR} &= - \frac{1}{Z_{ww}} \frac{(\pi')^2 L}{\pi'' L^2 (w - w_0) - C''} \end{aligned} \quad (A2.1)$$

Note that the impact of a higher potential loss to the firm on the wage is unambiguously positive. Straightforward algebra further shows that the effect of the alternative wage on the wage can be rewritten as

$$\frac{dw}{dw_0} = \frac{\left[\pi' \left(\frac{\partial^2 x}{\partial w^2} \right) + \pi'' L \left(\frac{\partial x}{\partial w} \right)^2 \right] (R - wL) - \pi' L \left(\frac{\partial x}{\partial w} \right)}{\left[\pi' \left(\frac{\partial^2 x}{\partial w^2} \right) + \pi'' L \left(\frac{\partial x}{\partial w} \right)^2 \right] (R - wL) - 2\pi' L \left(\frac{\partial x}{\partial w} \right)}$$

It is easily confirmed that the right hand side is highly plausibly positive (the denominator is negative by the second order condition) and that, if it is, it is necessarily less than one. Then (A2.1) implies

$$0 < \frac{dw}{dw_0} < 1; \quad \frac{dw}{dR} > 0.$$

The effect of higher employment on the wage depends on Z_{wL} . Differentiate (15) and use the first order condition to find

$$Z_{wL} = \left[\pi' L \left(\frac{\partial^2 x}{\partial w \partial L} \right) + \pi'' L \left(\frac{\partial x}{\partial w} \right) \left(x + L \frac{\partial x}{\partial L} \right) \right] (R - wL) - wL \pi' \frac{\partial x}{\partial w} - \pi' L \left(x + L \frac{\partial x}{\partial L} \right) \quad (\text{A2.2})$$

In general, it is difficult to sign this term, and further manipulation produces no further insight. Considering several probability and cost function specifications, we find (A2.2) to be negative. For example, let the probability and cost functions be given by (14)-(15). For these specifications we have

$$\frac{\partial^2 x}{\partial w \partial L} < 0; \quad \pi'' = -2(1 - \pi)^3 < 0$$

Directly using these findings in (A2.2), we see that $Z_{wL} < 0$ under these conditions. Hence, we then have $\frac{dw}{dL} < 0$.

Uncoordinated action

Substituting (9) into (15), using the implicit function theorem, and repeating the analysis as described for coordinated action, we find analogously:

$$0 < \frac{dw}{dw_0} < 1; \quad \frac{dw}{dR} = -\frac{1}{Z_{ww}} \frac{(\pi')^2}{\pi'' L(w - w_0) - C''} > 0$$

To find the effect of employment on the wage we need the sign of the term (A2.2), but now evaluated for the wage and employment effects in the uncoordinated case. Again, the sign of this expression is ambiguous in general. To get further insight we use the specifications (14)-

(15) suggested before. We then know $\frac{\partial^2 x}{\partial w \partial L} < 0$. Furthermore, as before $\pi'' = -2(1 - \pi)^3 < 0$.

As in the coordinated case, it then follows that $\frac{dw}{dL} < 0$.

Appendix 3

The first-order conditions are

$$\begin{aligned} Z_w(w, L; w_0, R) &= \pi' L \frac{\partial x}{\partial w} (R - wL) - (1 + \pi)L = 0 \\ Z_L(w, L; w_0, R) &= \pi' \left(x + L \frac{\partial x}{\partial L} \right) (R - wL) - (1 + \pi)w = 0 \end{aligned} \quad (\text{A3.1})$$

In these expressions, expressions for $\frac{\partial x}{\partial w}$, $\frac{\partial x}{\partial L}$ have been derived in the main body of the paper. For coordinated action by the union, they were given as (3) and (4).

To analyze the effect of the parameters w_0, R on the wage and on employment, differentiate the system of first-order conditions (A3.1) and write in matrix notation as

$$\begin{bmatrix} Z_{ww} & Z_{wL} \\ Z_{Lw} & Z_{LL} \end{bmatrix} \begin{bmatrix} dw \\ dL \end{bmatrix} = \begin{bmatrix} -Z_{ww_0} dw_0 - Z_{wR} dR \\ -Z_{Lw_0} dw_0 - Z_{LR} dR \end{bmatrix} \quad (\text{A3.2})$$

Note that the second-order conditions for a maximum require

$$\begin{aligned} Z_{ww} &< 0, Z_{LL} < 0 \\ \Delta &= (Z_{ww} Z_{LL} - Z_{Lw} Z_{wL}) > 0 \end{aligned} \quad (\text{A3.3})$$

Solving (A3.2), the effects of the reservation wage and of the loss to the firm R on the wage and on employment are given by

$$\begin{aligned} \frac{dw}{dw_0} &= \frac{1}{\Delta} (-Z_{ww_0} Z_{LL} + Z_{Lw_0} Z_{wL}); & \frac{dw}{dR} &= \frac{1}{\Delta} (-Z_{wR} Z_{LL} + Z_{LR} Z_{wL}) \\ \frac{dL}{dw_0} &= \frac{1}{\Delta} (-Z_{ww} Z_{Lw_0} + Z_{ww_0} Z_{Lw}); & \frac{dL}{dR} &= \frac{1}{\Delta} (-Z_{ww} Z_{LR} + Z_{Lw} Z_{wR}) \end{aligned} \quad (\text{A3.4})$$

where $\Delta > 0$ by (A3.3).

Straightforward algebra applied to (A3.1) further establishes the following relations:

$$\begin{aligned} Z_{ww_0} &= -Z_{ww} - \frac{(1 + \pi)L^2}{R - wL} \\ Z_{Lw_0} &= -Z_{Lw} - \frac{(1 + \pi)R}{R - wL} \end{aligned}$$

Using these results, (A3.4) can be rewritten as

$$\begin{aligned}\frac{dw}{dw_0} &= 1 + \frac{(1+\pi)(L^2 Z_{LL} - RZ_{Lw})}{\Delta(R-wL)}; & \frac{dw}{dR} &= \frac{1}{\Delta}(-Z_{wR}Z_{LL} + Z_{LR}Z_{wL}) \\ \frac{dL}{dw_0} &= \frac{(1+\pi)(RZ_{ww} - L^2 Z_{Lw})}{\Delta(R-wL)}; & \frac{dL}{dR} &= \frac{1}{\Delta}(-Z_{ww}Z_{LR} + Z_{Lw}Z_{wR})\end{aligned}\quad (\text{A3.5})$$

To establish the sign of the effect of a higher potential loss R to the firm on the wage and on employment, differentiate (A3.1) to find

$$\begin{aligned}Z_{ww} &= \left[\pi' L \left(\frac{\partial^2 x}{\partial w^2} \right) + \pi'' \left(L \frac{\partial x}{\partial w} \right)^2 \right] (R-wL) - 2\pi' L^2 \left(\frac{\partial x}{\partial w} \right) \\ Z_{LL} &= \left[\pi' \left(2 \frac{\partial x}{\partial L} + L \frac{\partial^2 x}{\partial L^2} \right) + \pi'' \left(x + L \frac{\partial x}{\partial L} \right)^2 \right] (R-wL) - 2w\pi' \left(x + L \frac{\partial x}{\partial L} \right) \\ Z_{wL} = Z_{Lw} &= \left[\pi' L \left(\frac{\partial^2 x}{\partial w \partial L} \right) + \pi'' L \left(\frac{\partial x}{\partial w} \right) \left(x + L \frac{\partial x}{\partial L} \right) \right] (R-wL) - 2wL\pi' \left(\frac{\partial x}{\partial w} \right) \\ Z_{wR} &= \pi' L \frac{\partial x}{\partial w} \\ Z_{LR} &= \pi' \left(x + L \frac{\partial x}{\partial L} \right)\end{aligned}\quad (\text{A3.6})$$

Substituting (A3.6) in the relevant expressions of (A3.5) yields

$$\frac{dw}{dR} = \left[\frac{(\pi')^2 (R-wL)}{\Delta} \right] \left\{ \left(x + L \frac{\partial x}{\partial L} \right) \left(\frac{\partial^2 x}{\partial w \partial L} \right) - \left(\frac{\partial x}{\partial w} \right) \left[2 \frac{\partial x}{\partial L} + L \frac{\partial^2 x}{\partial L^2} \right] \right\} \quad (\text{A3.7})$$

$$\frac{dL}{dR} = \left[\frac{(\pi')^2 (R-wL)}{\Delta} \right] \left\{ \left(L \frac{\partial x}{\partial w} \right) \left(\frac{\partial^2 x}{\partial w \partial L} \right) - \left(x + L \frac{\partial x}{\partial L} \right) \left(\frac{\partial^2 x}{\partial w^2} \right) \right\} \quad (\text{A3.8})$$

First, let us work out (A3.7). Rewrite (3) and (5) as

$$\frac{\partial x}{\partial w} = -\frac{\pi' L}{(M)}; \quad x + L \frac{\partial x}{\partial L} = -\frac{(N)}{(M)} \quad (\text{A3.9})$$

where

$$N = [L\pi'(w-w_0) + xC'']; \quad M = \pi'' L^2 (w-w_0) - C'' \quad (\text{A3.10})$$

Differentiating (A3.9) yields

$$\left(\frac{\partial^2 x}{\partial w \partial L} \right) = -\frac{1}{(M)^2} \left\{ (M)\pi' - (N)\pi'' L - \pi' L \frac{\partial(M)}{\partial L} \right\} \quad (\text{A3.11})$$

$$\left[2 \frac{\partial x}{\partial L} + L \frac{\partial^2 x}{\partial L^2} \right] = \frac{\partial \left(x + L \frac{\partial x}{\partial L} \right)}{\partial L} = -\frac{1}{(M)^2} \left\{ (M) \frac{\partial N}{\partial L} - (N) \frac{\partial M}{\partial L} \right\} \quad (\text{A3.12})$$

$$\frac{\partial^2 x}{\partial w^2} = \frac{1}{(M)^2} \left\{ \pi' L \left[\pi'' L^2 + \frac{\partial M}{\partial w} \right] \right\} \quad (\text{A3.13})$$

Substituting (A3.11-A3.12)) in (A3.7) and rearranging, we find

$$\frac{dw}{dR} = \left[\frac{(\pi')^2 LR}{\Delta} \right] \left(\frac{1}{(M)^3} \right) \left\{ N [M \pi' - N \pi'' L] - \pi' LM \frac{\partial N}{\partial L} \right\} \quad (\text{A3.14})$$

Use the definitions of N and M given in (A3.10) above to obtain

$$\begin{aligned} [M \pi' - N \pi'' L] &= -C'' (\pi' + \pi'' Lx) \\ M \frac{\partial N}{\partial L} &= -(w - w_0) (\pi' + \pi'' Lx) (2C'' + xC''') \end{aligned}$$

Substituting in (A3.14) we then ultimately find

$$\frac{dw}{dR} = \left[\frac{(\pi')^2 (R - wL)}{\Delta} \right] \left(\frac{1}{(M)^3} \right) \left\{ (\pi' + \pi'' Lx) [C' (C''' x + C'') - x(C'')^2] \right\} \quad (\text{A3.15})$$

This is (23) in the paper.

Next turn to the impact of the potential loss R to the firm on employment L . Substituting (A3.11) and (A3.13) in (A3.8) yields

$$\frac{dL}{dR} = \left[\frac{(\pi')^2 (R - wL)}{\Delta} \right] \left(\frac{\pi' L}{(M)^3} \right) \left\{ LM \pi' + N \frac{\partial M}{\partial w} - \pi' L^2 \frac{\partial M}{\partial L} \right\} \quad (\text{A3.16})$$

Using the definitions of N and M , noting that $\frac{\partial x}{\partial w} = \frac{\pi' L}{N} (x + L \frac{\partial x}{\partial L})$ and $\pi' L(w - w_0) = C'$ (see the first order condition (1) of the workers) yields

$$N \frac{\partial M}{\partial w} - L^2 \pi' \frac{\partial M}{\partial L} = -[\pi'' L^2 (C' - xC'') + C''' \pi' xL]$$

Using this result in (A3.16) we find, again using the definition of M :

$$\frac{dL}{dR} = \left[\frac{(\pi')^2 (R - wL)}{\Delta} \right] \left(-\frac{\pi' L^2}{(M)^3} \right) [C'' (\pi' - \pi'' xL) + C''' \pi' x] \quad (\text{A3.17})$$

This is expression (24) in the paper.

As a more detailed interpretation of (23)-(24) is difficult in general, we use of specific functional forms to derive further insights. Using our earlier specifications (25)-(26) for the cost and probability functions as example, we derive:

$$\begin{aligned} [C' (C''' x + C'') - x(C'')^2] &= \alpha \beta > 0 \\ (\pi' + \pi'' Lx) &= (1 - \pi)^2 (1 - 2\pi) \end{aligned}$$

$$\left[C''(\pi' - \pi''xL) + C''' \pi' x \right] = \beta(1 - \pi)^2(1 + 2\pi) > 0$$

Substituting these expressions in (A3.15)-(A3.17) we find

$$\frac{dw}{dR} > 0 \quad \text{if } \pi > 0.5; \quad \frac{dw}{dR} < 0 \quad \text{if } \pi < 0.5$$

$$\frac{dL}{dR} > 0$$

Observe that $\pi > 0.5$ is equivalent to $\frac{dx}{dL} < 0$ (see (4)); the result provided in the main body of the paper follows.

Appendix 4

The problem for the firm is the same as in Appendix 3; the only difference is that the function describing political effort by workers differs. The analysis of Appendix 3 can be repeated to show that the effect of the potential loss R on the wage and employment can be written as in expressions (A3.7) and (A3.8), repeated here for convenience.

$$\frac{dw}{dR} = \left[\frac{(\pi')^2(R - wL)}{\Delta} \right] \left\{ \left(x + L \frac{\partial x}{\partial L} \right) \left(\frac{\partial^2 x}{\partial w \partial L} \right) - \left(\frac{\partial x}{\partial w} \right) \left[2 \frac{\partial x}{\partial L} + L \frac{\partial^2 x}{\partial L^2} \right] \right\} \quad (\text{A4.1})$$

$$\frac{dL}{dR} = \left[\frac{(\pi')^2(R - wL)}{\Delta} \right] \left\{ \left(L \frac{\partial x}{\partial w} \right) \left(\frac{\partial^2 x}{\partial w \partial L} \right) - \left(x + L \frac{\partial x}{\partial L} \right) \left(\frac{\partial^2 x}{\partial w^2} \right) \right\} \quad (\text{A4.2})$$

It will be instructive to rewrite (9), (10) and (11) as

$$\frac{\partial x}{\partial w} = - \frac{\pi'}{(K)} \quad (\text{A4.3})$$

$$\frac{\partial x}{\partial L} = - \frac{(w - w_0)\pi''x}{(K)} \quad (\text{A4.4})$$

$$x + L \frac{\partial x}{\partial L} = - \frac{C''x}{(K)} \quad (\text{A4.5})$$

where $K = \pi' L(w - w_0) - C''$.

First, we work out the effect of the potential loss R on the wage. Differentiating (A4.3) we have

$$\frac{\partial^2 x}{\partial w \partial L} = - \frac{1}{K^2} \left[K \pi'' \left(x + L \frac{\partial x}{\partial L} \right) - \pi' \frac{\partial K}{\partial L} \right] \quad (\text{A4.6})$$

Differentiating (A4.5) further yields

$$\left[2 \frac{\partial x}{\partial L} + L \frac{\partial^2 x}{\partial L^2} \right] = \frac{\partial \left(x + L \frac{\partial x}{\partial L} \right)}{\partial L} = -\frac{1}{(K)^2} \left\{ (K) \left[(C'' + C'''x) \frac{\partial x}{\partial L} \right] - C''x \frac{\partial K}{\partial L} \right\}$$

Substitute these results in the last large expression on the right hand side of (A4.1) to find

$$\begin{aligned} & \left(x + L \frac{\partial x}{\partial L} \right) \left(\frac{\partial^2 x}{\partial w \partial L} \right) - \left(\frac{\partial x}{\partial w} \right) \left[2 \frac{\partial x}{\partial L} + L \frac{\partial^2 x}{\partial L^2} \right] \\ &= -\frac{1}{(K)^2} \left\{ \left(x + L \frac{\partial x}{\partial L} \right) \left[K \pi'' \left(x + L \frac{\partial x}{\partial L} \right) - \pi' \frac{\partial K}{\partial L} \right] - \frac{\partial x}{\partial w} \left[(K) (C'' + C'''x) \frac{\partial x}{\partial L} - C''x \frac{\partial K}{\partial L} \right] \right\} \end{aligned}$$

To proceed, note from (A4.3) and (A4.5) that

$$\pi' \left(x + L \frac{\partial x}{\partial L} \right) = C''x \frac{\partial x}{\partial w}$$

This yields

$$\begin{aligned} & \left(x + L \frac{\partial x}{\partial L} \right) \left(\frac{\partial^2 x}{\partial w \partial L} \right) - \left(\frac{\partial x}{\partial w} \right) \left[2 \frac{\partial x}{\partial L} + L \frac{\partial^2 x}{\partial L^2} \right] \\ &= -\frac{1}{(K)^2} \left\{ \left[K \pi'' \left(x + L \frac{\partial x}{\partial L} \right)^2 \right] - \frac{\partial x}{\partial w} \left[(K) (C'' + C'''x) \frac{\partial x}{\partial L} \right] \right\} \end{aligned}$$

Lastly, using (A4.3)-(A4.4)-(A4.5) and the first-order condition of the individual worker's choice of political activity (6), we have

$$\begin{aligned} & \left(x + L \frac{\partial x}{\partial L} \right) \left(\frac{\partial^2 x}{\partial w \partial L} \right) - \left(\frac{\partial x}{\partial w} \right) \left[2 \frac{\partial x}{\partial L} + L \frac{\partial^2 x}{\partial L^2} \right] \\ &= -\frac{\pi''x}{(K)^3} [C''(C''x - C') - C'C'''x] \end{aligned}$$

Substituting this result in (A4.1) we find expression (31) in the main body of the paper:

$$\frac{dw}{dR} = \left[\frac{(\pi')^2(R - wL)}{\Delta} \right] \left[\frac{\pi''x}{(K)^3} \right] [C'(C'''x + C'') - x(C'')^2] \quad (\text{A4.7})$$

Lastly, the effect of the potential loss on employment given in (A4.2) can be calculated in a similar way. Differentiate (A4.3) to find

$$\frac{\partial^2 x}{\partial w^2} = -\frac{1}{(K)^2} \left(K \pi'' L \frac{\partial x}{\partial w} - \pi' \frac{\partial K}{\partial w} \right)$$

Using this expression and (A4.6) yields

$$\begin{aligned}
& \left(L \frac{\partial x}{\partial w} \right) \left(\frac{\partial^2 x}{\partial w \partial L} \right) - \left(x + L \frac{\partial x}{\partial L} \right) \left(\frac{\partial^2 x}{\partial w^2} \right) \\
& = -\frac{\pi'}{(K)^2} \left[\left(x + L \frac{\partial x}{\partial L} \right) \frac{\partial K}{\partial w} - L \frac{\partial x}{\partial w} \frac{\partial K}{\partial L} \right]
\end{aligned} \tag{A4.8}$$

Differentiation of the definition of K further yields

$$\begin{aligned}
\frac{\partial K}{\partial w} &= \pi'' L + \pi''' L^2 (w - w_0) \frac{\partial x}{\partial w} - C''' \frac{\partial x}{\partial w} \\
\frac{\partial K}{\partial L} &= \pi'' (w - w_0) + \pi''' L (w - w_0) \left(x + L \frac{\partial x}{\partial L} \right) - C''' \frac{\partial x}{\partial L}
\end{aligned}$$

Substituting these expressions in (A4.8) and using earlier results yields

$$\begin{aligned}
& \left(L \frac{\partial x}{\partial w} \right) \left(\frac{\partial^2 x}{\partial w \partial L} \right) - \left(x + L \frac{\partial x}{\partial L} \right) \left(\frac{\partial^2 x}{\partial w^2} \right) \\
& = -\frac{\pi'}{(K)^3} [\pi'' L (C' - C'' x) + \pi' C''' x]
\end{aligned}$$

Lastly, substitute in (A4.2) to find expression (32) in the main body of the paper:

$$\frac{dL}{dR} = - \left[\frac{(\pi')^2 (R - wL)}{\Delta} \right] \left[\frac{\pi'}{(K)^3} [\pi'' L (C' - C'' x) + \pi' C''' x] \right] \tag{A4.9}$$

As an example, reconsider the probability of political success and the cost of political effort as specified before (see (25)-(26)). We then derive:

$$\begin{aligned}
\pi'' &= -2(1 - \pi)^3 < 0 \\
[C' (C''' x + C'') - x (C'')^2] &> 0 \\
[\pi'' L (C' - C'' x) + \pi' C''' x] &< 0
\end{aligned}$$

Substitution in (A4.9) then immediately gives

$$\frac{dw}{dR} > 0; \frac{dL}{dR} < 0$$