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Abstract

Though governmental officials often have far greater responsibilities and make far more consequential decisions than do CEOs of private firms, government officials often earn far less. We offer explanations for the differences, considering Nash bargaining with the head of a governmental agency or with the CEO of a private firm. In the benchmark case, with a governmental agency providing consumer surplus in addition to profits, a governmental official earns more than a private CEO. But if for a governmental agency one official sets price and a different official negotiates pay, then under some conditions the head of a governmental agency will be paid less than the head of a for-profit firm. And in the plausible case where a governmental agency produces a non-excludable public good, and the agency is financed by a distortionary tax, then even if the consumer surplus generated at the governmental agency is greater than the profits of a for-profit firm, the head of the governmental agency may be paid less.

Keywords: CEO pay, governmental officials, Nash bargaining, tax distortions, structure-induced equilibrium

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1 Introduction

Consider a CEO with firm-specific skills, so that he is not easily replaceable. The CEO engages in Nash bargaining with his employer about his compensation. A for-profit firm bargains over the division of profits. The CEO of a state-owned firm or the head of a governmental agency bargains over the share of consumer surplus and profits enjoyed by the decisive voter or his representative.

For many important positions, a governmental official's pay is set by statute, and is not subject to negotiation. The President of the United States is paid $400,000 a year, and we would find it strange indeed that after the election the winning candidate would say he would take the position only if paid more. Similarly, the Secretary of Defense is a Level I position of the Executive Schedule, and thus as of January 2015 earns a salary of $203,700 per year.

But the compensation of many other public officials is negotiated. That is true, for example, for the president of the University of California, or for the CEOs of public hospitals. The Los Angeles school district had negotiated with its superintendent to offer a pay package of $439,998.[1] We would expect bargaining to be more common for high-level positions, which we can take to mean positions with higher levels of education. And it is those positions which more closely resemble the position of a CEO at a private firm. For the federal government, among workers with a professional degree or doctorate, total compensation costs were 18 percent lower for federal employees than for similar private-sector employees. But that is not because the government always pays less. Among workers with a BA degree or less education, total compensation averaged 15 percent more for federal workers than for similar workers in the private sector. Among people with a high school diploma or less education, total compensation costs averaged 36 percent more for federal employees.[2] A similar pattern holds when comparing state government workers to private sector workers. Workers with only a high school diploma earn a 19% premium in the public sector over the private sector. But workers with M.A., professional, or PhD degrees earn less than in the private sector; for professionals the gap is 17%.[3]

[1] `http://www.dailynews.com/social-affairs/20150320/former-lausd-superintendent-deasys-pay-nearly-440000-last-year`

[2] See Congressional Budget Office (2012).

[3] See Biggs and Richwine (2014).

We will examine when governmental organizations pay less to CEOs than do private firms, by formulating a Nash bargaining model between a negotiator and a CEO. The following analysis of bargaining within a for-profit firm is standard. The analysis for governmental firms is novel.

We will consider four differences between governmental organizations and private firms. First, government values both profits *and* consumer welfare when evaluating the surplus generated by an agency's head, instead of valuing only profits. Second, a governmental organization may be less profitable than a for-profit firm due to bureaucratic inefficiencies, non-excludability of the product, or regulations on its activities. Third, government may have to impose distortionary taxes to pay a CEO. Fourth, instead of one negotiator, one official may set the good's price, and a different official may negotiate over the pay of the agency's head.

The results in this paper are as follows. First, if a governmental organization is potentially as profitable as a for-profit firm, and a single person sets both the price and CEO pay, then government pays more to a CEO than does a for-profit firm, even in the presence of tax distortions. Second, if a governmental organization is not sufficiently profitable to pay a CEO only out of profits, and if tax distortions are sufficiently large, then it pays a CEO less than would a for-profit firm. Third, if different officials are responsible for the price and for pay, and if the official in charge of price setting is sufficiently poorer than the official in charge of wage negotiation, then CEO pay is less at a governmental organization. Fourth, such a pair of a price setter and a wage negotiator is an outcome realized in a structure-induced equilibrium of a two-stage policy-making game.

1.1 Explanations for differences in pay

The pay differences between CEOs in government and in for-profit firms can appear for many reasons. CEOs in the government may have lower ability (though it is reasonably common for former partners in Goldman Sachs to take large pay cuts when entering government). The compensation from government service may come not during the period of service, but afterwards in the form of lobbying contracts or book royalties (though rarely does a former US president earn as much as a CEO of a large private firm). The compensation may come in the form of non-pecuniary benefits, be it in the accoutrements of power, or in the ability to determine important policies. Bureaucratic rules, the separation of powers, and rulings by courts may so limit the choices faced by a governmental official that it little matters who is that official, so that the marginal product of even a highly able official may be small. Government limits competition and job hopping within the government, and so a governmental official may find few competing governmental organizations that try to attract him with high compensation. We deny none of these, but instead want to focus on one aspect—bargaining outcomes, with the difference between for-profit and governmental organizations arising from differences in objectives, negotiating procedures, and costs of paying a CEO.

2 Literature

The literature attempting to explain pay at governmental agencies, and comparing that to pay at private firms is sparse. Hadley (2016) looks not at for-profit and governmentally-controlled firms, but at the degree to which for-profit firms are the most politically sensitive, that is federal contractors with government contracts that are most visible and constitute large portions of their revenue. CEO pay declines with political sensitivity. In comparing CEO pay under a for-profit firm and a governmentally controlled firm, empirical work has considered the effects of privatization. The general pattern is that CEO pay increases following privatization. Wolfram (1998) finds that on average CEOs at Britain's twelve regional electricity distribution companies had nearly a threefold salary increase in the two years following the industry privatization in 1990. The increased pay did not appear attributable to increases in managerial talent, because privatization little changed personnel at the top rank. Salary increases are highly correlated with firms' potential profits (as measured by the administratively assigned price cap). That is consistent with our assumption that Nash bargaining with a for-profit firm concerns the allocation of profits between the owners and the CEO. Similarly, in a study of British building societies that converted from a mutual to a proprietary form, Shiwakoti, Ashton, and Keasey (2004) find that the CEO and directors of the firms may earn higher pay after the conversion.

A difference which can matter for the differences in pay lies in the lower profits, or even losses, earned by state-owned enterprises. That may reflect deliberate governmental policy, as Boycko, Shleifer, and Vishny (1994) claim that politicians use state-owned enterprises to favor their political supporters through excessive employment, regionally targeted investments, and deliberate underpricing of products or overpricing of purchased inputs (from politically-connected suppliers). In empirical work, Boardman and Vining (1989) examine the economic performance of the 500 largest non-U.S. industrial firms in 1983. Using four profitability ratios, and two measures of X-efficiency, they document that state-owned and mixed (state and private ownership) enterprises are significantly less profitable than privately-owned firms.

3 Assumptions

We shall consider a for-profit firm and a governmental organization. The governmental organization could be a state-owned enterprise, such as the Amtrak railroad in the United States, or the U.S. Postal Service. Or it could be an agency which provides a service which a private firm could also provide, such as education, but at a zero price. Alternatively, the agency could engage in an activity in which private firms could not, say environmental protection. The analysis below is sufficiently general to apply to all these cases. But for brevity, we shall speak of a governmental agency. And we shall say the head of that agency is that agency's CEO.

Consider a monopolistic firm facing the demand function $Q(p)$ and the cost function $C(Q)$. The functions satisfy $Q' < 0$, $C' > 0$, and $C'' \geq 0$. When the price is given at p, the firm's profit is

$$\Pi(p) = pQ(p) - C(Q(p)).$$

The consumer surplus is

$$S(p) = \int_p^{+\infty} Q(x)dx.$$

Let the CEO under consideration have firm-specific skills which make him more productive at the organization than anyone else. For simplicity, we shall mostly suppose that the CEO under consideration is uniquely skilled, so that if he does not lead the organization, it must shut down, producing nothing. That assumption is not at all necessary. Similar results hold if negotiations are held with a CEO who has a higher marginal product than his replacement would. That is, negotiations are held with the person who would generate the greatest profits or the greatest surplus. If no agreement is reached with him, then a market exists for less talented executives, who would avoid shutdown but generate a smaller surplus.

We shall speak of the negotiator and of a CEO. For a private, for-profit, firm, the negotiator is the owner of the firm who pays the CEO and gets all profits. For a governmental agency the interpretation should be that the negotiator is the decisive voter, an elected mayor, a cabinet secretary, or the like. The CEO could be a school superintendent, the chief of police, the head of a state hospital, and so on.

The CEO and the negotiator engage in Nash bargaining to set the CEO's compensation, w, which is paid as a lump sum, and to set the product's price, p. The CEO's reservation utility is zero; the negotiator's reservation utility is also zero. Nash bargaining results in a lump-sum payment to the CEO and in the good's price, with the values maximizing the product of the CEO's income and the negotiator's utility.

4 For-profit firm

At a for-profit firm, the profit, $\Pi(p)$, is shared between the negotiator and the CEO. The solution to Nash bargaining maximizes $w(\Pi(p) - w)$. From the first-order conditions, the solution satisfies

$$p_F = \arg\max \Pi(p) \tag{1}$$

and

$$w_F = \frac{\Pi(p_F)}{2}. \tag{2}$$

Of course, p_F is the monopoly price satisfying

$$\Pi'(p_F) = 0. \tag{3}$$

That is, the price is the profit-maximizing one under monopoly. The CEO gets half of the profits. We assume that $\Pi''(p) < 0$.

5 Governmental agency

At a governmental agency, suppose that some negotiator bargains with the CEO over the salary and over the good's price. We can think that the negotiator is, or represents, the preferences of a decisive voter, who may be the median voter. Any one voter's surplus is then small—he gets only a small share of aggregate profits, and the consumer surplus of any one voter may be small. That may suggest that the CEO of a governmental agency could bargain for only a small salary. Not so. Though the per capita profits and consumer surplus are small, the cost to any one voter of paying a large salary is also small.

We shall also allow for a distortionary tax. The distortion may suggest that a governmental CEO will earn less than a CEO at a for-profit firm, because any increased pay to the CEO requires an increase in taxes, which reduces a voter's utility by more than the amount of the tax. But, as we shall see, that intuition is misleading.

5.1 Outcomes when organizations face same profit opportunities

Let citizen-voters have the same quasi-linear utility function but differ in incomes. A voter with income $y \geq 0$ is called voter y. For notational simplicity, normalize average income to 1.

Let $s(p)$ be the voter's consumer surplus from the good the governmental agency provides. Let the tax he pays be $t(y)$, with the tax proportional to income. Then, voter y's indirect utility is

$$u(p, y) = s(p) - (1 + \lambda)t(y). \tag{4}$$

The multiplier, $1 + \lambda$, represents the marginal cost of public funds, where $\lambda \geq 0$ captures the degree of marginal tax distortions. Because every voter demands an equal quantity of the good at a given price, the individual consumer surplus is related to aggregate demand: $s(p) = S(p)/N$, where N is the total population (or measure) of citizen-voters.

The gap between the payment to the CEO and the firm's profit, $T = w - \Pi(p)$, is filled by additional taxes when T is positive, and used to reduce existing taxes when it is negative.[4]

Voters pay taxes or receive tax reductions proportionally to their income, so that voter y's tax or subsidy is $t(y) = yT/N$. Making this substitution into the utility function $u(p, y) = s(p) - (1+\lambda)t(y)$ and noting that $s(p) = S(p)/N$,

[4] We need to assume that if $T < 0$, voters incur tax distortions; otherwise, the choice set of the Nash bargaining is non-convex, and our simple solution does not hold.

rewrite voter y's indirect utility function as[5]

$$v(p, w, y) = \frac{1}{N}\Big\{S(p) - y(1+\lambda)(\Pi(p) - w)\Big\}. \tag{5}$$

Suppose now that voter y is the negotiator in the Nash bargaining with the governmental CEO. The CEO's wage and the price then maximize $w \cdot v(p, w, y)$. From the first-order conditions, the solution satisfies

$$p_G = \arg\max S(p) + y(1+\lambda)\Pi(p) \tag{6}$$

and

$$w_G = \frac{1}{2}\Big\{\frac{S(p_G)}{y(1+\lambda)} + \Pi(p_G)\Big\}, \tag{7}$$

for which we assume the second-order condition is satisfied.[6]

With the second-order condition satisfied, comparing the first-order conditions, $\Pi'(p_F) = 0$ and

$$\Pi'(p_G) = \frac{Q(p_G)}{y(1+\lambda)}, \tag{8}$$

yields the following proposition. (The proof of this and the other propositions are in the Appendix.)

Proposition 1 *If the for-profit firm and the governmental agency face the same profit opportunities, then (i) the price at the governmental agency is less than at the for-profit firm ($p_G < p_F$); (ii) the CEO's pay is higher at the governmental agency ($w_G > w_F$); (iii) $\partial p_G/\lambda > 0$, where $1+\lambda$ is the marginal cost of public funds; (iv) $\partial w_G/\partial\lambda < 0$; and (v) as λ tends to infinity, p_G converges to p_F and w_G converges to w_F.*

[5] Rewriting the indirect utility function as

$$v(p, w, y) = \frac{y}{N}\Big\{\frac{S(p)}{y} - (1+\lambda)(\Pi(p) - w)\Big\},$$

allows us to interpret the model as having voters heterogeneous not in income but in preferences for the good. That is, voter y is an individual whose demand for the good is $1/(yN)$ of the market demand. This interpretation does not alter the results.

[6] If the elasticity of demand, ε, is constant, a sufficient condition for the second-order condition is $\varepsilon > 1 - 1/[y(1+\lambda)]$.

The reason for the higher pay is as follows. If the negotiator enjoys some consumer surplus from the good, then at a given price the pie to be divided between the negotiator and the CEO is larger under a governmental agency than under a for-profit firm. This results in higher pay to the CEO. As the cost of public funds increases, on the other hand, the governmental negotiator favors paying the CEO more out of profits and charging a higher price to avoid the tax distortions. Nonetheless, it harms the CEO in a governmental agency by reducing the pay, though he is still paid more than at a for-profit firm.

5.2 Outcomes when a governmental agency has poorer profit opportunities

We see that if a governmental agency faces the same profit opportunities as a for-profit firm, and it lets a single negotiator determine both the price and pay, a governmental CEO would be paid more than a CEO at a for-profit firm, irrespective of how small are profits at the governmental agency, and irrespective of the size of tax distortions.

Matters can differ, however, if a governmental agency is less profitable. In particular, governmental agencies are commonly subsidized, in part because they provide non-excludable public goods, or because fixed costs may be high while marginal costs are low. To compare the compensation of CEOs at a for-profit firm and a governmental agency, suppose that a for-profit firm sells an excludable good, making a profit of Π, and that a governmental agency provides a public good, at a price of zero, generating aggregate consumer surplus of S. And, for purposes of comparison, suppose $\Pi = S$. That is, ignoring compensation for the CEO, a firm's owner enjoys the same benefit of having the CEO rather than having zero production as do voters from having the CEO rather than shutting down.

As seen above, pay for a CEO at a for-profit firm is $w_F = \Pi/2$. But at a governmental agency, if $w_G = S/2$, the distortionary tax means that a \$1 increase in a CEO's pay requires an aggregate tax increase of \$1, and imposes a cost on taxpayers of more than \$1. Under Nash bargaining, that would reduce the bargained wage for the governmental CEO to $w_G = S/[2(1 + \lambda)]$, which is smaller than w_F.

Proposition 2 *Suppose that, ignoring CEO pay, a for-profit firm has profits* Π_F *and a governmental agency has profits* Π_G*, with* $\Pi_F > \Pi_G$*. Let aggregate* *consumer surplus from consuming the good produced by the governmental agency be S_G; let $1 + \lambda$ be the marginal cost of public funds. Then, CEO compensation at the for-profit firm (w_F) exceeds CEO compensation at the governmental agency (w_G) if and only if*

$$\frac{S_G}{\Pi_F - \Pi_G} \leq 1 + \lambda. \tag{9}$$

Condition (9) implies that if $\lambda > 0$, $\Pi_G = 0$ and $S_G = \Pi_F$ (that is a governmental agency has zero profits, but produces a consumer surplus equal to the profits at a for-profit firm), then a tax distortion causes the head of a governmental agency to be paid less than the CEO of a for-profit firm.

A higher cost of public funds effectively reduces the consumer surplus that constitutes part of the pie to be divided in wage negotiation in a governmental agency. The reduction cannot be compensated by price adjustments, as opposed to Proposition 1, when a governmental agency has inferior profit opportunities.

This argument, however, has at least two limitations. First, typical estimates of the marginal cost of public funds, $1 + \lambda$, are less than 2, which may put stringent restrictions on the range of values for S_G, Π_G, and Π_F that support a smaller CEO pay at a governmental agency when the governmental agency cannot earn as large profits as a for-profit firm.[7] Second, the argument requires that a governmental agency cannot earn as high profits as does a for-profit firm. The difference may arise because governments often provide merit goods (such as schooling) and non-excludable public goods at a low or even zero price. But the next section shows that when one official sets price, and a different official negotiates over pay, then even in the absence of such a difference in profit opportunities the head of a governmental agency may be paid less.

6 Different officials set price and compensation

This section examines outcomes when one official sets the good's price, and a different official negotiates over the CEO's pay. Specifically, we will assume

[7] Much literature estimates the marginal cost of public funds. For a recent estimate, see Barrios, Pycroft, and Saveyn (2013) and the papers cited there.

that the price is chosen by an elected official and the pay is determined through negotiation between another elected official and the CEO. Or one can think that the state government sets the fees at schools, while locally elected school boards set compensation.[8]

Suppose that the distribution of income among voters has a compact interval $[\underline{y},\ \overline{y}]$ as its support with $0 < \underline{y} < \overline{y}$. The poorest voter has income $\underline{y}$; the richest has income $\overline{y}$. Denote the median income by y_M.

Consider a model of policy making with two sequential stages; the election stage and the policy choice stage.

In the election stage, the official who sets the price and the negotiator over CEO compensation are elected out of all the citizen-voters through separate majority voting. These elections take place simultaneously. We suppose that the voter with income y_p is elected as the official for price setting and the voter with income y_w is for wage bargaining.

In the policy choice stage, given the outcome in the election stage, the pay w is determined through bargaining between the official with income y_w and the CEO; the price p is set by the official with income y_p. Each official chooses a policy taking the other as given. We will solve this two-stage game by backward induction.

6.1 Policy choice stage

6.1.1 Equilibrium price and pay

Consider first bargaining over w. Given p, the pay w maximizes the Nash product

$$w \cdot u(p, w, y_w) = \frac{w}{N}\Big\{S(p) + y_w(1+\lambda)(\Pi(p) - w)\Big\}.$$

[8] For example, the state government in California sets the price for schooling, but each local school board sets the compensation of the school district superintendent. Thus, in regard to the price, Article IX, Sec. 5 of California's Constitution states that "The Legislature shall provide for a system of common schools by which a free school shall be kept up and supported in each district," and legislation enacted in 2012 (AB 1575) forbids schools from charging any fee that students and their families must pay "as a condition for registering for school or classes, or as a condition for participation in a class or an extracurricular activity, regardless of whether the class or activity is elective or compulsory, or is for credit."

Then, for a given price p_G, the bargaining results in CEO pay of

$$w_G = \frac{1}{2}\max\left\{\frac{S(p_G)}{y_w(1+\lambda)} + \Pi(p_G),\ 0\right\}. \tag{10}$$

Consider next the good's price, p_G. Because the official has income y_p and takes w as given, the price is

$$p_G = \arg\max \quad S(p) + y_p(1+\lambda)\Pi(p). \tag{11}$$

The corresponding first-order condition is

$$\Pi'(p_G) = \frac{Q(p_G)}{y_p(1+\lambda)}, \tag{12}$$

for which we assume the second-order condition holds.

The equilibrium price and CEO pay satisfy both (10) and (12). Denote them by p_G^e and w_G^e, each of which can be seen as a function of y_p, y_w, and λ. We assume that the parameter values of the model, in particular for y_p, y_w and λ, guarantee that in equilibrium $w_G^e > 0$. Let $\underline{p}_G$ be the price that would be chosen by an official with the lowest income, $\underline{y}$. That is,

$$\underline{p}_G = \max S(p) + \underline{y}(1+\lambda)\Pi(p). \tag{13}$$

Then more specifically we assume that

$$\frac{S(\underline{p}_G)}{\overline{y}(1+\lambda)} + \Pi(\underline{p}_G) > 0. \tag{14}$$

Because the price $\underline{p}_G$ is the lowest possible price realized in equilibrium, condition (14) means that given this price, the lowest possible equilibrium wage is strictly positive.

6.1.2 Comparative statics

Examining comparative statics on the equilibrium policy variables is useful in understanding the nature of the equilibrium in the policy choice stage, and for solving for the equilibrium in the election stage.

With respect to the equilibrium price, (12) shows that $p_G^e < p_F$. As observed in Proposition 1, consideration of consumer surplus makes the price lower than the monopoly price.

It also follows from (12) that $\partial p_G^e / \partial y_p > 0$, which shows that appointing a richer official to set the price increases the equilibrium price in the policy choice stage. The richer voter prefers the higher price because it enables him to reduce taxes needed to pay the CEO, allowing the governmental agency to increase its profit. Also note that a change in y_w does not affect p_G^e at all, that is, $\partial p_G^e / \partial y_w = 0$.

With respect to the equilibrium pay, on the other hand, because $\partial p_G^e / \partial y_w = 0$ as was mentioned above, it is clear from (10) that $\partial w_G^e / \partial y_w < 0$. Having a richer negotiator reduces the pay to the CEO because payment to the CEO imposes a larger burden on the richer negotiator through proportional income taxes.

The effect of y_p on the equilibrium pay is obtained as follows, by differentiating (10) and making use of (12):

$$\frac{\partial w_G^e}{\partial y_p} = \frac{Q(p_G)}{2(1+\lambda)} \frac{\partial p_G^e}{\partial y_p} \left(\frac{1}{y_p} - \frac{1}{y_w} \right) > 0 \text{ if and only if } y_p < y_w, \tag{15}$$

where the signs follow from $\partial p_G^e / \partial y_P > 0$. Thus, appointing a richer price-setter increases the equilibrium pay to the CEO if and only if he is poorer than the official appointed to negotiate pay. The reason is as follows. Suppose that $y_p < y_w$ and a (marginally) richer price setter is appointed. Then, he chooses a higher price. This benefits the wage negotiator more than the price setter: the wage negotiator's income is greater than the the price setter's income, and so the higher profits generated by a higher price allow for a greater reduction in his tax burden. The resulting increase in the total pie divided between the wage negotiator and the CEO leads to a higher pay to the CEO.

6.1.3 How pay varies with officials

Now compare w_G^e with w_F given the types of officials in the two positions. Using (6) and (7), define the income of a wage negotiator who would pay the CEO as much as a for-profit firm when the price is set at $\underline{p}_G$ (which is the lowest possible equilibrium price introduced in (13)):

$$\overline{y}_F = \frac{S(\underline{p}_G)}{(1+\lambda)(\Pi(p_F) - \Pi(\underline{p}_G))}. \tag{16}$$

This value is well defined because $\underline{p}_G < p_F = \arg\max \Pi(p)$. From (10), it is clear that having a wage negotiator with $y_w \leq \overline{y}_F$ and a price $\underline{p}_G$ leads to $w_G^e \geq w_F$.

Proposition 3 *Define $\overline{y}_F$ as the income of a wage negotiator who would pay the CEO as much as would a for-profit firm when the price is set by an official with the lowest income. Let the wage negotiator have income y_w. (i) If $y_w \leq \overline{y}_F$, then for any y_p $w_G^e \geq w_F$. (ii) If $y_w > \overline{y}_F$, there exists a threshold, $\underline{y}_F$ ($\underline{y}_F > \underline{y}$), such that $w_G^e < w_F$ if and only if $y_p < \underline{y}_F$.*

Proposition 3 identifies two key factors to smaller CEO pay at a governmental agency. One is that the wage negotiator has sufficiently high income, and the other is that the price setter has sufficiently low income.[9] The reason is that a higher-income official enjoys a smaller consumer surplus that matters in the negotiation, and a lower-income official more sharply reduces the price, and so the profits that matter in the negotiation.

6.2 Election stage

The analysis thus far takes as given the types of the two officials who set policy, yielding results that differ from those when only one official is in charge. Of course there is no assurance that such types of officials are elected in equilibrium. We will examine this issue in this section.

The election stage has two candidates, with one elected to set p_G and the other negotiating over w_G. Plugging the equilibrium outcomes at the policy choice stage into (5), voter y's utility at the election stage is

$$v(p_G^e, w_G^e, y) = \frac{1}{N}\Big\{S(p_G^e) + y(1+\lambda)(\Pi(p_G^e) - w_G^e)\Big\}, \tag{17}$$

where p_G^e and w_G^e depend on y_p and y_w through (10) and (12). Following the literature on strategic delegation (See e.g. Persson and Tabellini (2000, Ch.12)), we assume that voters vote sincerely in each election, taking account of how their own choices affect the equilibrium policy variables that will be realized in the policy choice stage. Further, assume that each voter takes as given the type of citizen-voter who will be elected in the other election and consider a subgame-perfect structure-induced equilibrium of this policy-making game.[10]

[9] Because Proposition 1 implies that $w_G^e > w_F$ if $y_p = y_w$, the two thresholds must satisfy $\overline{y}_F > \underline{y}_F$.

[10] For this equilibrium concept, see Conde-Ruiz and Galasso (2005) and Shepsle (1979).

6.2.1 Structure-induced equilibrium

Consider first an election in which voters elect the official who will negotiate with the CEO about pay. At this election each voter takes y_p as given. As we see from (12), p_G is independent of y_w, and hence we find from (17) that a negotiator with $\overline{y}$, the highest-income citizen-voter, is the most-preferred candidate for every voter in this election. He will be the toughest negotiator to minimize the CEO's pays. Thus, in equilibrium, the income of the negotiator over wages has the upper income in the population, or $y_w = \overline{y}$.

Consider next an election in which voters elect the official with authority to set the price. Recall that p_G^e and w_G^e increase with y_p if and only if $y_p < y_w$; because $y_w = \overline{y}$, that inequality holds in equilibrium in the election stage, so that we assume it in what follows.

Now, using (11) and (17), we notice that voter y will vote for his own type if this choice does not affect w_G^e. From (15), however, given $y_p < y_w$, w_G^e increases with y_p, implying that each voter has a strategic incentive to vote for a candidate with smaller income than his own.

To determine voter y's most-preferred type, differentiate (17) with respect to y_p taking account of how it affects p_G and w_G through (10) and (12). Then, using (15),

$$\begin{aligned} \frac{dv(p_G^e, w_G^e, y)}{dy_p} &= \frac{1}{N}\Big[-Q(p_G^e) + y(1+\lambda)\Big(\Pi'(p_G^e) - \frac{\partial w_G}{\partial p_G}\Big)\Big]\frac{\partial p_G^e}{\partial y_p} \\ &= \frac{Q(p_G^e)}{N}\frac{\partial p_G^e}{\partial y_p}\Big[\frac{1}{2}\Big(\frac{1}{y_p} + \frac{1}{y_w}\Big) - \frac{1}{y}\Big]. \end{aligned} \tag{18}$$

Accordingly, the first-order condition implies that voter y prefers a candidate with y_p such that

$$y_p = \max\Big\{\underline{y},\ \frac{y}{2 - (y/y_w)}\Big\}, \tag{19}$$

which if $\underline{y} < y < y_w$ is smaller than y, showing a voter's strategic delegation motive.

Now consider a subgame-perfect structure-induced equilibrium of this game, the condition for which is that each of y_w and y_p is a majority-voting outcome taking the other as given. From $y_w = \overline{y}$ and (19), application of the median voter theorem leads to the following proposition that characterizes the equilibrium.

Proposition 4 *Let $\overline{y}$ be the highest income in the population; let y_M be the median income in the population. In the unique subgame-perfect structure-induced equilibrium the official who voters choose to negotiate over pay has income $y_w^e = \overline{y}$. The official they choose to set price has income*

$$y_p^e = \max\left\{\underline{y},\ \frac{y_M}{2 - (y_M/\overline{y})}\right\}. \tag{20}$$

In the equilibrium voters choose the highest-income citizen to bargain over the pay with the CEO, aiming to minimize that pay. On the other hand, they generally select an official with income lower than the median as the price-setting official. (The exception appears for an extreme case where the majority has the highest income and the highest-income citizen is appointed for the position.) Specifically, (20) implies that $\underline{y} \leq y_p^e \leq y_M$ with

$$y_p^e = y_M \ \text{ if and only if } y_M = \overline{y}, \tag{21}$$

and

$$y_p^e = \underline{y} \text{ if and only if } y_M \leq \frac{2\underline{y}}{1 + (\underline{y}/\overline{y})}. \tag{22}$$

Thus, if y_M is sufficiently close to $\underline{y}$ the lowest-income citizen is selected as the price setter .

Proposition 4 also has an important implication about how an unequal income distribution affects the types of elected officials; the less equal is the income distribution, the larger the differences between the incomes of the elected officials. More specifically, y_p decreases with $\overline{y}$, while y_w increases with $\overline{y}$. The reason is as follows. With a higher-income official serving as a wage negotiator, an increase in consumer surplus will be passed less on to the CEO pay, as we can see in (10). This induces voters to delegate a lower-income citizen as the price setter: he would set a lower price, generating a larger consumer surplus and a smaller profit.

Lastly, it is also worth noting that the cost of public funds, λ, does not affect voters' choices of the price setter and of the wage negotiator.

6.2.2 Effect of income distribution

Combining Propositions 3 and 4 lets us compare CEO pay between two organizational forms, a governmental agency and a for-profit firm, taking account of who is chosen as the price setter and as the wage negotiator. In particular, we will examine the effect of the income distribution by varying the median income within a given support of the distribution. In contrast to the previous results, we show that even with the same profit opportunities, if the income distribution is sufficiently unequal, a governmental agency pays the CEO less than a for-profit firm.

Proposition 5 *(i) If $\overline{y} \leq \overline{y}_F$, then $w_G^e \geq w_F$. (ii) If $\overline{y} > \overline{y}_F$, there exists a threshold for the median income, $\overline{y}_M$ (with $\overline{y}_M > \underline{y}$), such that $w_F > w_G^e$ if and only if $y_M < \overline{y}_M$.*

This proposition states that when the income distribution is sufficiently wide, then for a wider range of parameters does a governmental CEO earn less than a CEO at a for-profit firm as the income distribution becomes more unequal.[11]

More precisely, Figure 1 shows the shaded area of $(y_M, \overline{y})$ that is necessary and sufficient for $w_F > w_G^e$. In this figure BC is the schedule that depicts the upper limit of y_M that satisfies the inequality for each $\overline{y} > \overline{y}_F$, approaching the 45^o line.

As seen from Proposition 4, the median voter prefers a negotiator with a higher income for high values of $\overline{y}$, and prefers a negotiator with a lower income for low values of y_M. A higher-income wage negotiator weighs consumer surplus less and a lower-income price setter wants to cut the price more for a further reduction in the profit, both of which lead to a lower pay to the CEO.

6.3 The effects of the cost of public funds on CEO pay

Next consider the effect of a higher cost of public funds on the pay to a governmental CEO when one official sets price and another official negotiates pay. As seen in Proposition 4, neither y_w^e nor y_p^e depends on the tax distortion (λ), so that we can take the types of the two officials as given.

As seen from (10) and (12), a higher cost of public funds has two counteracting effects on the equilibrium pay to the CEO in a governmental agency. First, from (10), given p_G^e, a higher λ reduces w_G^e by making only a smaller part of consumer surplus taken into consideration in the bargaining. This is

[11] Because the model normalizes the average income to 1, the changes in the income distribution discussed here refer to a class of mean-preserving spreads that also reduce the median.

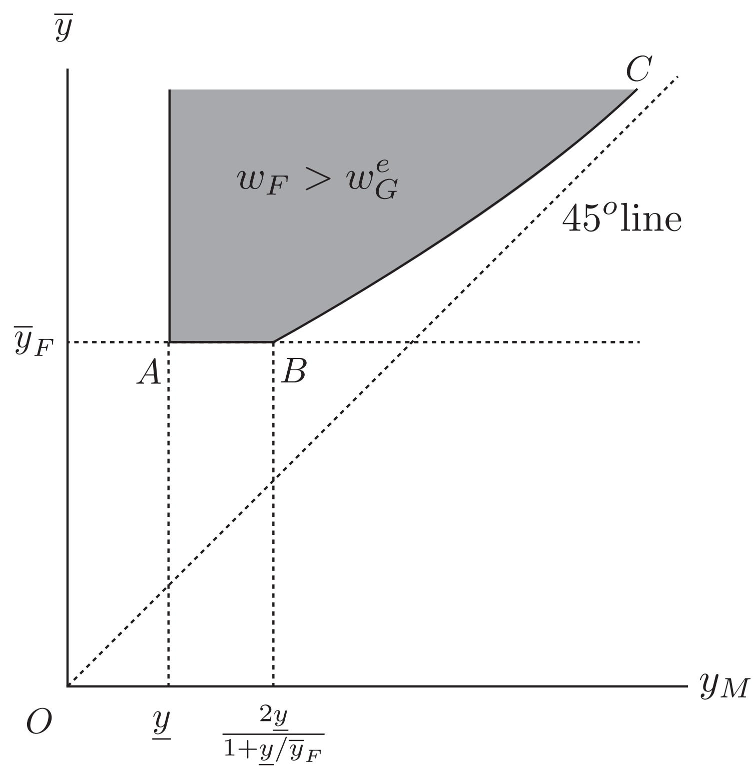

Figure 1: Comparison between w_F and w_G^e

because the CEO's pay imposes a higher opportunity cost. Second, however, as we observed in Proposition 1, because the price-setting official wants to reduce the tax burden by increasing the profits, a larger λ increases p_G^e. A higher price leads to a higher w_G^e if and only if $y_p < y_w$, since changes in λ and y_p have qualitatively the same effects on the equilibrium conditions, (10) and (12).

Notice that if the two elected officials have the same incomes, the second effect on the equilibrium pay is negligibly small and dominated by the first. This is why we established in Proposition 1 (where a governmental agency and a for-profit firm face the same profit opportunities) that the pay is higher under a governmental agency irrespective of λ. But the conclusions differ if the officials differ in incomes.

Because of the counter-acting effects, the effect of a higher λ on w_G^e is generally ambiguous. To obtain definite results, specify the demand function to have a constant price-elasticity, $\varepsilon > 1$, so that it is written as $Q(p) = Ap^{-\varepsilon}$, with A a positive constant. We will also assume that the marginal cost of production is constant at $c > 0$.

Under the specification, the equilibrium pay in the policy choice stage satisfies

$$\frac{w_G^e}{w_F} = \left(1 + \frac{k_p}{\varepsilon - 1}\right)^{\varepsilon} \left(1 - \frac{\varepsilon(k_p - k_w)}{\varepsilon - 1 + k_p}\right), \tag{23}$$

where $k_w = 1/[(1+\lambda)y_w]$ and $k_p = 1/[(1+\lambda)y_p]$. This condition shows that w_G^e is less than w_F if and only if

$$k_w < \frac{(\varepsilon - 1)^{\varepsilon}}{\varepsilon}(k_p - 1 + \varepsilon)^{1-\varepsilon} + \frac{\varepsilon - 1}{\varepsilon}(k_p - 1). \tag{24}$$

Based on this condition, the following figure illustrates how a higher λ affects the equilibrium CEO pay at a governmental agency.

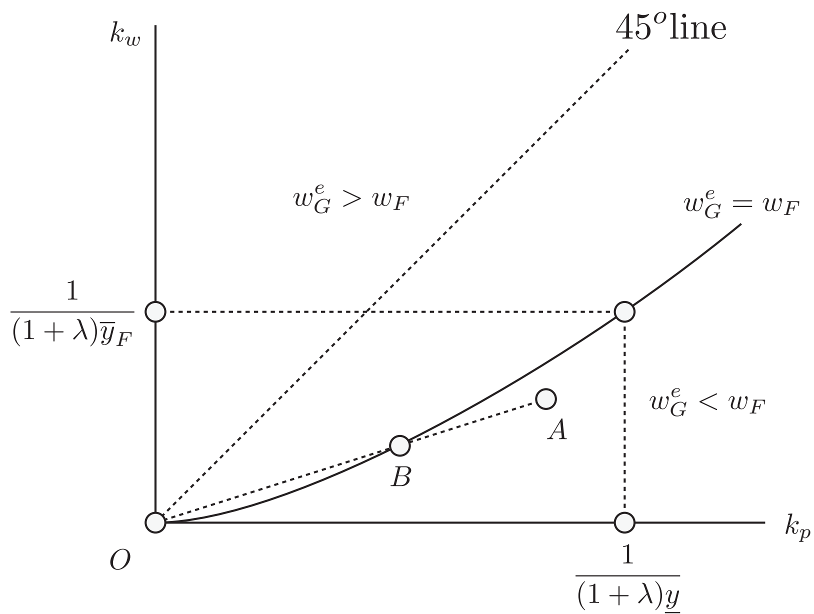

Figure 2: Effects of a higher λ

This figure shows that w_G^e is less than w_F if and only if (k_p, k_w) lies in the area below the convex-shaped schedule of $w_G^e = w_F$. If we take account of the structure-induced equilibrium analyzed in the previous section, this is identical to the situation where, for a given λ, the set $(y_M, \overline{y})$ lies in the shaded area in Figure 1 .

Start with an initial situation where (k_p, k_w) is located at point A in Figure 2. Here we have $w_G^e < w_F$. Then, consider an increase in λ, which moves (k_p, k_w) toward O on the line segment OA. If it approaches O beyond B, then $w_G^e > w_F$. Lastly, as (k_p, k_w) converges to O, w_G^e converge to w_F. The following proposition summarizes these observations.

Proposition 6 *Suppose that $w_G^e < w_F$ for given y_p and y_w, that the cost of public funds is $1+\lambda_0$, that the demand function has a constant price elasticity, and that the marginal cost of production is constant. Then, (i) there exists a threshold, $\overline{\lambda} > \lambda_0$, such that $w_G^e > w_F$ if and only if $\lambda > \overline{\lambda}$, and (ii) as λ tends to infinity, w_G^e converges to w_F.*

This proposition has contrasting implications about the effects of a higher cost of public funds on the CEO pay at a governmental agency, as compared to the claims in the previous propositions.

First, unlike Propositions 1 and 2, a higher cost of public funds no longer reduces the pay in a monotone way. Rather, in the range of $w_G^e < w_F$, it increases the pay until $w_G^e > w_F$. After that such an upward effect is reversed: an increased cost of public funds reduces pay, finally making it converge to w_F. Thus we can say that a higher cost of public funds benefits CEOs at governmental agencies especially whey they are paid less than their for-profit counterparts.

Second, in sharp contrast to Proposition 2, the cost of public funds has to be sufficiently small, such as those that place (k_p, k_w) on the segment AB in Figure 2, for a CEO's pay to be smaller at a governmental agency. The reason is that (as we can see from the equilibrium conditions, (10) and (12)) a sufficiently large cost of public funds mostly eliminates the effect of the difference between y_p and y_w in the choices of the price and pay .

7 Conclusion

We considered negotiations with the CEO. A similar analysis could apply for negotiations between an employer and unionized workers, suggesting that unionized workers would do worse under a governmental employer than under a for-profit employer. But evidence suggests otherwise. One reason may be that, at least at the local level, union members constitute many of the voters, and so unions effectively negotiate with themselves, thereby earning high salaries. Furthermore, union members may vote for officials who will increase their wages (their number is much greater than the number of high-level governmental executives). And with firm-specific capital less important for lower-level jobs, and so wages determined more by market demand than by personal negotiations, voters may want government to increase the wage it pays or the number of workers it hires because such an increase will also increase the market wage in the private sector.

8 Appendix: Proofs of Propositions

Proof of Proposition 1: From (3) and (8), invoking the mean value theorem reveals that there exists p_0 between p_M and p_G such that

$$\Pi'(p_M) - \Pi'(p_G) = \Pi''(p_0)(p_M - p_G) = -\frac{Q(p_G)}{y(1+\lambda)} < 0.$$

Because $\Pi''(p) < 0$, we have $p_M > p_G$. On the other hand, (6) and (7) imply that

$$w_G = \max\left\{\frac{S(p)}{y(1+\lambda)} + \Pi(p)\right\} > \max \Pi(p) = w_F,$$

where the strict inequality follows from $S(p) > 0$ and the second-order condition for (8). The effects of a higher λ on p_G and w_G are also straightforward from (6) and (7). ||

Proof of Proposition 2: In equilibrium a for-profit firm pays the CEO $w_F = \Pi_F/2$. On the other hand, from (7), a governmental agency pays the CEO

$$w_G = \frac{1}{2}\left\{\frac{S_G}{y(1+\lambda)} + \Pi_G\right\}.$$

Comparing these two payments shows that $w_F \geq w_G$ if and only if $\lambda \geq S_G/(\Pi_F - \Pi_G) - 1$. ||

Proof of Proposition 3: Suppose first that $y_w \leq \overline{y}_F$. Then, because $\underline{p}_G$ is the lowest price possibly achieved in equilibrium, it is clear from (16) that w_F is never greater than w_G^e. Suppose, conversely, that $y_w > \overline{y}_F$. Then, because $\partial p_G^e/\partial y_p > 0$ and p_G^e converges to $\underline{p}_G$ as y_p tends to $\underline{y}$, we can find a unique $\underline{y}_F$ that establishes $w_G^e = w_F$ when $y_p = \underline{y}_F$, and w_G^e is necessarily greater than w_F if and only if $y_p < \underline{y}_F$. It is clear by construction that $\underline{y}_F > \underline{y}$. ||

Proof of Proposition 4: Because $\partial p_G^e/\partial y_p > 0$, the second-order condition for (18) is satisfied, and we can apply the median voter theorem to solve the equilibrium in the election for y_p by substituting y for y_M and y_w for $\overline{y}$. The inequalities $\underline{y} \leq y_p^e \leq y_M$ follow from $y_M \leq \overline{y}$. ||

Proof of Proposition 5: (i) $w_G^e \geq w_F$ follows straightforwardly from proposition 3(i), because $y_w^e = \overline{y}$. (ii) Suppose that $\overline{y} > \overline{y}_F$. Then, proposition 3(ii) implies that $y_p^e < \underline{y}_F$ is necessary and sufficient for $w_G^e < w_F$. From (20), as y_M tends to $\underline{y}$, y_p^e decreases and converges to $\underline{y}$. Hence, $\overline{y}_M$ can be defined as the unique median income staisfying $y_p^e = \underline{y}_F$, and so $w_G^e < w_F$ if and only if $y_M < \overline{y}_M$. Lastly, $\overline{y}_M > \underline{y}$ follows because $\underline{y}_F > \underline{y}$ from proposition 3(ii). ||

Proof of proposition 6 (i) Because $\varepsilon > 1$, the right hand side of (24) is a convex function of k_p. Further, its derivative at $k_p = 0$ is zero, and hence, as in Figure 2, we have a critical value, $\overline{\lambda}$, such that $w_G^e \geq w_F$ for any $\lambda \geq \overline{\lambda}$ when y_p and y_w are given. (ii) This statement follows straightforwardly from (2), (10), and (12). ||

9 References

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