From Public Monopsony to Competitive Market

Josse Delfgaauw
Robert A.J. Dur

Dept. of General Economics, Faculty of Economics, Erasmus University Rotterdam, and Tinbergen Institute.

From Public Monopsony to Competitive Market: More Efficiency but Higher Prices[*]

Josse Delfgaauw and Robert Dur

Tinbergen Institute, Erasmus University Rotterdam[†]

This version: January 2005

Abstract

This paper examines the consequences of creating a fully competitive market in a sector previously dominated by a cost-minimising public firm. Workers in the economy are heterogeneous in their intrinsic motivation to work in the sector. In line with empirical findings, our model implies that firms in the competitive market provide stronger monetary incentives to workers, reach higher productivity, and employ less workers than the public firm. Allocative efficiency therefore increases. Nevertheless, prices of the sector's output rise as competition between private firms for the best motivated workers leads to higher wage cost than under the public monopsony. Political support for liberalisation may therefore be limited.

Keywords: liberalisation, monopsony power, incentive wages, intrinsic motivation.

JEL codes: H4, J3, J4, L2, L3, L5.

[†]Corresponding author: Josse Delfgaauw, Tinbergen Institute, Erasmus University, P.O. Box 1738, 3000 DR Rotterdam, The Netherlands. E-mail: delfgaauw@few.eur.nl, dur@few.eur.nl.

1   Introduction

The last decades have seen much debate about privatisation of public firms and liberalisation of markets. During the seventies and eighties, people became more and more sceptical about the performance of public companies. The lack of profit motive and the absence of competition would give public firms insufficient incentive to produce efficiently, resulting in too low productivity, too high employment, and, hence, excessively high cost. This debate has led to an ongoing wave of privatisation of public companies, usually accompanied by introducing or strengthening competition among firms in the market.

The empirical literature by and large supports the notion that privatisation and liberalisation may increase efficiency. Megginson and Netter (2001) provide an extensive survey of the empirical literature on privatisation. They conclude that privatisation leads to an increase in productivity. Employment usually falls, unless the firm is able to increase its sales substantially. Another recent survey, by Kikeri and Nellis (2002), reaches similar conclusions. To what extent the mere change of ownership (privatisation) or the strengthening of competition (liberalisation) is responsible for efficiency gains is still unclear. As privatisation and liberalisation often take place simultaneously, it is hard to disentangle the effects empirically (Kikeri and Nellis, 2002).

This paper develops a model to examine the consequences of creating a fully competitive market in a sector previously dominated by a cost-minimising public firm. Our model implies that firms in a competitive environment provide stronger monetary incentives for workers to exert effort than the public firm. Hence, productivity increases and the sector's employment decreases after liberalising the sector. Even though liberalisation thus improves allocative efficiency of the economy, prices of the sector's output rise. The reason is that liberalising the sector not only intensifies competition between firms in the product market, but also in the labour market.

An important element of our model is that workers in the economy are heterogeneous in their intrinsic motivation to work in the sector. Thus, we assume that working in this sector has some particular trait which is valued differently by different workers. Better motivated workers work harder and are willing to work for a lower wage. Besides intrinsic motivation, workers' effort depends on the monetary incentives provided by the firm. We show that the public firm can save on wage cost per unit of output by providing weak monetary incentives for workers. This way, the public firm extracts part of

the rents from motivated workers. When the sector is liberalised, competition among firms for the best-motivated employees leads to an increase in the incentive wage up to the point where each worker is paid his full marginal product. Wage cost per unit of output and, hence, prices increase after liberalisation.

The model's implications concerning productivity and employment are well in line with the empirical findings mentioned above. Moreover, and consistent with our model, the empirical literature often attributes the increase in productivity to an increase in monetary incentives for workers (e.g., Megginson, Nash, and Van Randenborgh, 1994). Kikeri and Nellis (2002) discuss several studies which find an increase in performance-based incentives for workers in privatised firms. Martin and Parker (1997) report similar evidence for several British firms. In line with these studies, Burgess and Metcalfe (1999, 2000) find, using British data, that firms in the private sector make far more use of incentive wages than in the public sector, and that incentive schemes are more common in competitive establishments than in non-competitive establishments, both for managers and non-managers. Moreover, they conclude that it is difficult to rationalise the relatively weak incentives in the public sector as being optimal on the basis of differences in the scope for performance measurement or multitasking. We argue that weak incentives in public firms may stem from exploitation of monopsonistic power, a power that firms in a competitive environment lack.

Our result on the level of wages seems to square less well with common belief. Indeed, it is often claimed that workers bear the burden of privatisation and liberalisation through job losses and lower wages. The empirical literature, however, suggests otherwise as regards wages. Kikeri and Nellis (2002) observe that "in many instances, and contrary to popular perception, those who retain their jobs in privatised firms receive higher wages, sometimes substantially so" (p. 18). For the UK, effects on wages appear to be mixed (Haskel and Szymanski, 1993, Martin and Parker, 1997). The most comprehensive study is by La Porta and López-de-Silanes (1999) for Mexico, where a massive process of privatisation and liberalisation has taken place. They report large increases in real wages of the privatised firms while overall real wages throughout Mexico stagnated.[1] In addition, they asked firms why

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[1]The increase in wages is not confined to executive compensation: real wages of blue-collar workers rose even more than those of white-collar workers. Moreover, only a small part of the increase in wages can be attributed to composition effects. See Section V in La Porta and López-de-Silanes (1999).

they increased worker's pay. Interestingly, "matching the conditions offered by similar firms" was listed as an important reason for the increase in wages after privatisation. La Porta and López-de-Silanes (1999) also examine the effect of privatisation on prices. Prices tend to increase, albeit modestly. There is surprisingly little other evidence on how privatisation and liberalisation affect prices (cf. Megginson and Netter, 2001).

Our study relates to a number of recent papers which stress the importance of workers' intrinsic motivation for optimal incentive schemes and effort, particularly in public service occupations (see, among others, Francois, 2000, Dixit, 2002, Benabou and Tirole, 2003, Prendergast, 2003, Besley and Ghatak, 2004, Glazer, 2004). As in these papers, we assume that workers' effort choices are partly driven by non-pecuniary benefits. More specifically, we assume that some of the economy's workers enjoy exerting effort or intrinsically value their contribution to output, if working in a particular occupation.[2] There is lots of evidence for such motivations. Marsden and French (1998) find that intrinsic rewards of the work are important for many public sector workers in the UK across a wide range of types of occupational activity. For instance, they report that many headteachers "derive a lot of satisfaction from the nature of their activity" (p. 111) and that the staff of trust hospitals "appear highly motivated in their work, find it intrinsically interesting and worthwhile" (p. 100). Other studies include Antonazzo et al. (2003) on nursing workers, Edmonds et al. (2002) on teachers, and Frank and Lewis (2004) on employees in these and several other areas of the public sector. These studies also indicate that there exists substantial variation in occupational preferences among workers (see also Daymont and Andrisani, 1984, and Harper and Haq, 2001).

Commonly used examples of sectors where workers' intrinsic motivation plays an important role are health care and education (Besley and Ghatak, 2003). Our model's predictions are well in line with recent experiences in these sectors. For instance, in Sweden, wages in the health-care sector have risen at three times the earlier rate, and have become more closely tied to individual performance, since private companies began competing with public units (Hjertqvist, 2001). Likewise, Hoxby (1994), Merrifield (1999), and Vedder and Hall (2000) show that competition from private schools

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[2]This assumption corresponds to Dixit (2002), Benabou and Tirole (2003), Besley and Ghatak (2004), and Glazer (2004). In contrast, Francois (2000) and Prendergast (2003) assume that workers have an altruistic motivation, that is, workers care about the provision of public services, but do not derive utility from their personal involvement in production.

increases teacher salaries at public schools in the US. Hoxby (2002) finds that school competition creates a more high-powered incentive environment within the teaching profession and concludes that under increased competition "less skilled or motivated incumbent teachers might find themselves earning smaller salary increases than some of their peers" (p. 883).[3] Empirical studies also show that competition among schools raises school productivity substantially (Hoxby, 1994 and 2000) and enhances the work effort of teachers (Rapp, 2000).

The paper is organised as follows. Section 2 discusses related literature. Next, Section 3 presents the basic features of our model. In Section 4, we derive the sector's employment, the wage scheme, and the output price in the competitive equilibrium. Next, we show in Section 5 that a public monopsony produces output at a lower price by setting weaker work incentives and expanding employment compared to the competitive equilibrium. We also discuss the distributional consequences of moving from public monopsony to competitive market in Section 5. Section 6 generalises the model to a continuum of worker types. We show that our results hold as long as workers in the neighbourhood of the marginal worker do not differ too much in motivation. Section 7 concludes.

2   Related Literature

Our setup and results deviate from other theoretical work on privatisation and liberalisation. There is a large literature on public versus private ownership given the degree of competition. One strand focuses on incomplete contracting problems; see in particular Laffont and Tirole (1991) and Hart, Schleifer, and Vishny (1997). We abstract from these kind of problems: firm's output and worker's effort are fully contractible in our model. This implies that ownership as such does not matter: public ownership of the firm and public regulation of a private firm yield identical outcomes. For convenience, we use the label 'public firm' in the monopsony case and 'private firms' in the competitive case, but it should be stressed that the monopsony analysis applies to a regulated private firm as well.

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[3]In line with our model, her interpretation of the evidence is based on heterogeneity in intrinsic motivation to perform job-specific tasks, e.g. working with school-aged children. Unlike our model, she assumes that competition affects a school's production function.

Another group of studies emphasizes that the objectives of the management may change after privatisation. Whereas private firms care only about profit, public firms are supposed to be concerned also about wages, employment, and (sometimes) consumer surplus. In Boyco, Schleifer, and Vishny (1996), these concerns stem from politicians' desire to preserve jobs and keep wages high in public firms. Privatisation raises the cost to politicians of influencing the firms' decisions and, hence, results in lower wages and lower employment. Corneo and Rob (2003) argue that public firms set weaker work incentives than private firms, because a public firm incorporates workers' utility of socializing at the workplace into its own objective function. Haskel and Szymanski (1993) model privatisation as a shift to more commercial objectives. Privatisation affects production, employment, and wages negatively as a private firm places less weight on consumer surplus and workers' welfare than a public firm.

In contrast to these papers, we abstract from differences in managerial objectives between public and private firms. In our model, both private firms and the public firm maximise profits. In the competitive equilibrium, private firms' profits are driven to zero because of free entry and exit of firms. Under the public monopsony, profits are zero because the government extracts all of the public firm's rents by designing an appropriate contract. As for the government's objectives, we assume that politicians represent the interest of consumers of the good produced in the sector. Therefore, the government induces the manager of the public firm to minimise cost. Alternatively - but in our view less plausibly - we could assume that the government is a social planner which seeks to maximise the sum of utilities of all individuals in the economy. In that case, the government would choose the competitive equilibrium. The public at large would lose from this policy (as it has to pay a higher price for the good) but this welfare loss would be more than offset by wage increases of the workers who remain employed in the sector and by an increase in national output as the dismissed workers find employment somewhere else in the economy. Insofar as politicians want to please the public at large, our analysis can thus be viewed as a positive theory of distortionary regulation.[4]

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[4]In this respect, the paper relates to the optimal taxation literature where the government redistributes income from high-ability workers to low-ability workers at the cost of distortions in work incentives (Mirrlees, 1971). In the present paper, the government abstains from liberalisation and distorts work incentives in the public firm so as to extract rents from highly motivated workers. As in the optimal taxation literature, we assume

The paper by Haskel and Szymanski (1993) is the only theoretical study that examines the consequences of both privatisation and liberalisation. It shows that liberalisation decreases the output price and increases the sector's employment, because firms can exploit product market power to a lesser extent. In the presence of trade unions, liberalisation reduces wages, as trade unions find themselves with less surplus to bargain over. Note that these results are exactly opposite to ours. Whereas Haskel and Szymanski analyse the consequences of a decrease in power of the firm in the product market, we focus on the effects of a decrease in firm's power in the labour market. In practise, liberalisation will affect employment and wages through both channels. The empirical evidence discussed in the Introduction, particularly the evidence on wages, suggests that the effects arising from a decrease in monopsony power may dominate, at least in some important cases.

Lastly, our paper closely relates to the literature on monopsonistic power of employers. It has long been recognised that employer's power in wage determination may drive wages below marginal productivity. Bhaskar, Manning, and To (2002) and Manning (2003) review a number of intriguing implications of monopsonistic power of employers, among others for interfirm wage dispersion, for employer's incentive to pay for general training, and for the effect of minimum wages on employment. We contribute to this literature by examining the implications of monopsonistic power for the optimal design of pay-for-performance schemes. In our model, monopsonistic power arises because workers differ in the extent to which they intrinsically value working in a particular sector. We could as well assume that workers differ in an ability which is particularly valuable in one sector of the economy. Recently, Booth and Zoega (2002) have developed a model along these lines and argue that increased labour market competition may explain why wage inequality has risen in some countries.[5]

3 The Model

The model revolves around production in a particular sector of the economy. Production takes place either in one public organisation or in private firms

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that the government can not identify workers' types.

[5] In Booth and Zoega's model, workers' effort is exogenous. For our results to hold in a model where workers differ in ability instead of motivation, effort must be endogenous and complementary to ability.

which compete with each other. For convenience, we assume a very simple production technology and very simple product demand characteristics. All firms in the sector have the same technology and labour is the only production factor. Output depends linearly on workers' effort e. The marginal product of effort is denoted by κ. Introducing (dis)economies of scale in production does not affect the results as long as it does not preclude competition. Demand for the sector's product is assumed to be perfectly price inelastic and denoted by Q^d. Assuming, instead, a downward-sloping demand curve does not affect the results qualitatively.[6]

Workers in the economy differ in their intrinsic motivation to work in the sector, otherwise they are identical. Outside the sector, workers obtain utility U^o. If worker i is employed in the sector, his utility is described by:

$$U_i = w\left(e_i\right) + \gamma_i e_i - \frac{1}{2}\theta e_i^2 \tag{1}$$

where w is the wage, which depends on worker's effort e_i, γ_i measures the degree to which worker i is intrinsically motivated to work in this sector, and θ measures the cost of effort (the value of foregone leisure, tiredness). A worker with $\gamma = 0$ is a 'standard neoclassical worker' who dislikes effort and only works to make a living, see e.g. Lazear (1995). The higher is γ, the more a worker values exerting effort at work and, therefore, the higher his effort given the power of the incentive scheme. Equation (1) captures in a simple way the ideas that workers differ in the extent to which they are motivated to work in the sector and that motivation matters for workers' effort. The sector-specificity of motivation is important for the results as it gives the public firm monopsonistic power. In contrast, differences between workers' general work motivation would not give the public firm monopsonistic power as general motivation is valuable in many different jobs in the economy.

While worker's motivation is private information, firms observe worker's effort. For simplicity, we assume a linear wage scheme:[7]

$$w(e) = \alpha e + \beta \tag{2}$$

Substituting (2) into (1) and maximising with respect to e gives worker i's optimal level of effort, if employed in the sector:

$$e_i^* = \frac{\alpha + \gamma_i}{\theta} \tag{3}$$

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[6] Price elastic demand enlarges the real effects of liberalisation in the sector and reduces the price effects.

[7] In Appendix A, we allow firms to offer separating contracts.

Clearly, optimal effort increases in the incentive wage and in intrinsic motivation, and decreases in the cost of exerting effort.

Worker i is willing to work in the sector if:

$$U_i \geq U^o \tag{4}$$

For simplicity, we initially assume that there are only two types of workers in the economy, high-motivation workers (h) with $\gamma = \gamma_h > 0$ and low-motivation workers (l) with γ_l normalised to 0. In Section 6, we generalise the model to allow for any distribution of motivation over the work force. Substituting (1), (2), and (3) into (4), it easily follows that for any combination of α and β, the participation constraint of low-motivation workers is more binding than that of high-motivation workers:

$$\frac{1}{2} \frac{(\alpha + \gamma_i)^2}{\theta} + \beta \geq U^o \tag{5}$$

Together with the result that high-motivation workers exert more effort, this implies that when product demand is low, the public firm optimally attracts only high-motivation workers by setting α and β such that the participation constraint for high-motivation workers binds. We assume that product demand Q^d is sufficiently high (or that the number of high-motivation workers in the economy is sufficiently low) such that the sector also employs some low-motivation workers. Obviously, in the more general case of a continuum of worker types, no restriction on demand is required, see Section 6. Denoting the number of high-motivation workers in the economy by H and the number of low-motivation workers employed in the sector by L, total employment in the sector is given by:

$$Q^d = \kappa \left(e_h^* H + e_l^* L \right) \Leftrightarrow H + L = \frac{1}{\alpha} \left(\frac{\theta Q^d}{\kappa} - \gamma_h H \right) \tag{6}$$

4 Competitive Market

In the competitive equilibrium, firms compete in both the product market and the labour market. Free entry and exit of firms guarantees zero profit. Given the linear production technology, profit on every single job is zero in equilibrium:

$$\pi_i = p\kappa e_i^* - (\alpha e_i^* + \beta) = 0 \text{ for } i = l, h \tag{7}$$

where p is the equilibrium price of the sector's output, which is an endogenous variable. Using (3) with $i = l$ and $i = h$ respectively, it follows that:

$$\alpha = p\kappa$$
$$\beta = 0$$

Hence, we obtain the familiar result that under perfect competition each worker earns his full marginal product and does not receive a fixed wage.

The participation constraint of the low-motivation workers must bind in equilibrium. If this is not the case, low-motivation workers who are employed outside the sector underbid the insiders. Hence, condition (5) must hold with equality for $i = l$. Substituting $\alpha = p\kappa$ and $\beta = 0$ into (5), we obtain the equilibrium price:

$$p = \frac{\sqrt{2\theta U^o}}{\kappa}$$

The price of the sector's output increases in workers' cost of effort and in workers' outside opportunity, and decreases in the productivity of effort. Note that in the competitive equilibrium, firms' cost and the price of the sector's output depend neither on the degree to which high-motivation workers are motivated (γ_h) nor on the number of high-motivation workers in the economy (H). The reason is that high-motivation workers receive all of the rents of their motivation.

Lastly, employment is found by substituting the equilibrium value of α into (6):

$$H + L = \frac{1}{\sqrt{2\theta U^o}} \left(\frac{\theta Q^d}{\kappa} - \gamma_h H \right)$$

Employment increases in demand for the sector's product and worker's cost of effort, and decreases in productivity of effort and the workers' outside option. While motivation of the labour force does not affect the price, it does affect the level of employment: the higher the number of high-motivation workers and the better their motivation, the lower is total employment.

Table 1 summarises the results for the competitive equilibrium.

Table 1: The Competitive Equilibrium

α	$\sqrt{2\theta U^o}$
β	0
p	$\dfrac{\sqrt{2\theta U^o}}{\kappa}$
$H + L$	$\dfrac{1}{\sqrt{2\theta U^o}}\left(\dfrac{\theta Q^d}{\kappa} - \gamma_h H\right)$

5 Public Monopsony

Let us now consider the case of a public firm (or regulated private firm) which is the sole supplier of output Q^d. Entry of firms is blocked by government regulation. The government induces the public firm to minimise cost.[8] The public firm's optimisation problem is:

$$\min_{\alpha,\ \beta,\ L}\ \alpha\left(e_h^* H + e_l^* L\right) + \beta\left(H + L\right) \tag{8}$$

subject to the production constraint (6) and the low-motivation worker's participation constraint (5), and where e_i^* is given by (3). The solution is summarised in Table 2.

Table 2: Public Monopsony

α	$\sqrt{\dfrac{1-\mu}{1+\mu}}\sqrt{2\theta U^o}$
β	$\left(\dfrac{2\mu}{1+\mu}\right)U^o$
p	$\sqrt{1-\mu^2}\,\dfrac{\sqrt{2\theta U^o}}{\kappa}$
$H + L$	$\sqrt{\dfrac{1+\mu}{1-\mu}}\,\dfrac{1}{\sqrt{2\theta U^o}}\left(\dfrac{\theta Q^d}{\kappa} - \gamma_h H\right)$

$$\text{where } 0 < \mu = \frac{\kappa \gamma_h H}{\theta Q^d} < 1$$

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[8]In the absence of information problems, the government can offer a contract to the manager of the public firm to deliver Q^d at the minimum price p, which is derived below. Profit maximisation by the public firm then results in cost minimisation, as in (8).

The public firm sets weaker incentives for workers, pays a fixed wage, and employs more workers than private firms do in a competitive market. Yet, the public firm supplies output at a lower price than results in a competitive market. The intuition is straightforward. As the public firm reduces the incentive wage α, it has to increase the fixed wage β so as to keep the low-motivation workers' participation constraint satisfied. Low-motivation workers need to be compensated for a reduction in α to a relatively small extent because they exert little effort. High-motivation workers, who exert more effort, therefore lose income. They face a reduction in their performance-related pay which is only partly compensated for by the increase in the fixed wage. Thus, by providing weak monetary incentives, the firm extracts part of the motivational rents of high-motivation workers. The cost of reducing the incentive wage is that workers reduce their effort, which necessitates an increase in employment so as to keep production at Q^d. Starting from the competitive equilibrium, a marginal increase in employment entails no additional cost because the fixed wage is zero. However, as α decreases, the increase in employment becomes more and more costly as the fixed wage β goes up along with the reduction in α. In the optimum, the cost of employing an additional worker exactly equals the marginal benefit of extracting rents from the high-motivation workers. Comparing Table 1 and Table 2, it is easy to see that the extent to which the wage scheme, employment, and output price differ between competitive market and public monopsony depends only on $\kappa\gamma_h H/\theta Q^d$, which is the share of motivation-induced effort in total effort.

Note that the opportunity to extract motivational rents stems from the monopsonistic power of the public firm. The positive fixed wage implies that total pay per unit of effort is higher for low-motivation workers than for high-motivation workers. Thus, the public firm makes a loss on the input of low-motivation workers, while it makes a profit on the input of high-motivation workers. In a competitive environment, a competing firm would offer a slightly lower fixed wage and a higher incentive wage so as to attract the profitable high-motivation workers. In equilibrium, competitive firms pay the full marginal product and no fixed wage, as we have derived in the previous section.[9]

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[9]None of the results changes if high-motivation workers also derive some constant intrinsic benefits from working in the sector (e.g. stemming from pride to work in the sector). As both high-motivation and low-motivation workers are needed in the sector, the participation constraint of high-motivation workers is never binding, implying that neither the public firm nor the private firms can extract any of these constant benefits

The implications of the model square well with the empirical observations mentioned in the introduction. Incentive wages and productivity are higher in a competitive environment, while total employment is lower than under a public monopsony. The wage of all retained workers increases after liberalisation. The wage of the low-motivation workers is higher because stronger incentives induce them to work harder. High-motivation workers' pay increases even more, as their motivational rents are no longer expropriated by the public firm. Hence, the relative wage of low-motivation workers decreases after liberalisation.[10] This is in line with empirical evidence that wages are more compressed in the public sector than in the private sector (Gregory and Borland, 1999, Borjas, 2003, Grout and Stevens, 2003).

The welfare consequences of liberalisation are straightforward in the two-type case. Total production in the economy increases as a result of liberalisation because more workers become available for other sectors of the economy. Social welfare also increases, see Appendix B. Low-motivation workers throughout the economy nevertheless lose, as their job-related utility remains at U^o while they have to pay a higher price for the sector's output.[11] High-motivation workers gain all of the surplus from liberalising the sector. As high-motivation workers in a particular sector are a small group, the distributional consequences of liberalisation may well hinder its political viability.

6   A Continuum of Worker Types

This section relaxes the assumption that there are only two types of workers in the economy. We assume that intrinsic motivation of workers is distributed according to the cumulative distribution function $F(\gamma)$, where $F(0) = 0$ and $F(\bar{\gamma}) = 1$. The upper boundary $\bar{\gamma}$ is introduced to rule out the case that one worker produces all output. The sector's employment as a share of the economy's labour force equals $F(\bar{\gamma}) - F(\underline{\gamma})$, where $\underline{\gamma}$ denotes the motivation of the least motivated employee in the sector.

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from the high-motivation workers.

[10]The relative wage under the public monopsony is: $w_l/w_h = \sqrt{2\theta U^o}/(\sqrt{2\theta U^o} + \gamma_h\sqrt{1-\mu^2})$, while in a competitive market: $w_l/w_h = \sqrt{2\theta U^o}/(\sqrt{2\theta U^o} + \gamma_h)$.

[11]The low-motivation workers who remain employed in the sector earn a higher income but the utility gain from higher income is annuled by the utility loss of exerting more effort.

6.1 Competitive Market

In the competitive equilibrium, the zero-profit condition (7) holds for all $\gamma \in \left[\underline{\gamma}, \overline{\gamma}\right]$. Hence, as in the two-type model, competition between firms implies that all workers earn their full marginal product: $\alpha = p\kappa$, $\beta = 0$. The price of output is such that the participation constraint of the sector's least motivated employee is just satisfied:

$$\frac{\left(p\kappa + \underline{\gamma}\right)^2}{2\theta} = U^0 \tag{9}$$

The production constraint reads:

$$Q^d = \kappa \int_{\underline{\gamma}}^{\overline{\gamma}} f(\gamma)e^* d\gamma = \kappa \int_{\underline{\gamma}}^{\overline{\gamma}} f(\gamma)\frac{p\kappa + \gamma}{\theta} d\gamma \tag{10}$$

Constraints (9) and (10) together implicitly define the equilibrium values of the price p and employment $F(\overline{\gamma}) - F(\underline{\gamma})$. The comparative static results are qualitatively the same as in the two-type case and are, therefore, not discussed here.

6.2 Public Monopsony

Total cost of the public firm is:

$$C = \int_{\underline{\gamma}}^{\overline{\gamma}} f(\gamma)(\alpha e^* + \beta)d\gamma$$

Substituting optimal effort (3) to eliminate e^*, and the least-motivated worker's participation constraint (5, with $\gamma = \underline{\gamma}$) to eliminate β, yields after some rewriting:

$$C = \alpha\frac{Q^d}{\kappa} + \left[U^o - \frac{(\alpha + \underline{\gamma})^2}{2\theta}\right][F(\overline{\gamma}) - F(\underline{\gamma})] \tag{11}$$

where we have simplified the first term on the right-hand side by using the production constraint:

$$Q^d = \kappa \int_{\underline{\gamma}}^{\overline{\gamma}} f(\gamma)e^* d\gamma \tag{12}$$

13

The public firm's optimisation problem is to minimise (11) with respect to α and γ_l, subject to (12). Combining the first-order conditions results in:

$$-\frac{\alpha+\underline{\gamma}}{\theta}[F(\overline{\gamma})-F(\underline{\gamma})]+\int_{\underline{\gamma}}^{\overline{\gamma}}\frac{\alpha+\gamma}{\theta}f(\gamma)d\gamma+ \tag{13}$$

$$-\frac{[F(\overline{\gamma})-F(\underline{\gamma})]}{(\alpha+\underline{\gamma})f(\underline{\gamma})}\left\{\left[U^o-\frac{(\alpha+\underline{\gamma})^2}{2\theta}\right]f(\underline{\gamma})+\frac{\alpha+\underline{\gamma}}{\theta}[F(\overline{\gamma})-F(\underline{\gamma})]\right\}=0$$

We can not derive explicit solutions for the optimal values of α and $\underline{\gamma}$. However, we can characterise the properties of the optimal wage scheme by using the results for the competitive equilibrium described in the previous subsection. Condition (13) describes four effects of a change in the incentive wage α on total cost. The first term is the increase in the fixed wage necessary to keep the least-motivated worker's participation constraint satisfied. This increase in β, by $\frac{\alpha+\underline{\gamma}}{\theta}$, must be paid to all workers, $[F(\overline{\gamma})-F(\underline{\gamma})]$. The second term describes cost savings as a result of a decrease in α: all units of effort are rewarded less when the incentive wage decreases. Because the average effort level is higher than the effort level of the least-motivated worker, the first two terms are positive in sum. This is the cost-saving effect of giving weaker incentives for workers.

The terms on the second line of (13) describe the marginal cost of reducing the incentive wage. The term outside the brackets is the increase in employment necessary to keep production at Q^d. The first term inside the brackets describes the increase in cost of enhancing employment as the new hires need to be paid the fixed wage. Starting from the competitive equilibrium outcome in which the fixed wage is zero, this term is zero. The second term inside the brackets is the increase in the fixed wage necessary to attract outsiders to work in the sector. The increase in the fixed wage must be paid to all workers. This effect was absent in the previous section. In the two-type model, the firm could hire additional employees from the pool of equally motivated workers of type l. In the model with a continuum of worker types, increasing employment necessitates to increase the wage because outsiders are less motivated than insiders.

This additional cost implies that we can not be certain about whether the incentive wage under the public monopsony is higher or lower than in the competitive market. The same holds for the level of employment and the fixed wage. Much depends on the specific distribution of motivation over

14

workers. When individuals in the neighbourhood of the competitive sector's marginal worker differ a lot in intrinsic motivation, the public firm may optimally give stronger monetary incentives for workers than in a competitive market. The fixed wage then becomes negative, and employment becomes lower. If, instead, workers close to the marginal worker differ little in their intrinsic motivation, the increase in the wage cost to attract new employees is small and dominated by the cost-saving effect described on the first line of condition (13). Then, as in the two-type model, the public firm gives weaker incentives, and hence liberalisation leads to lower employment and higher wages for all retained workers. Obviously, if (13) implies that deviating from the competitive market's optimal incentive wage is optimal, the public firm is more cost-efficient than firms in a competitive market.

The welfare effects of liberalisation are more dispersed than in the two-type model. The reason is that with a continuum of workers, all those employed in the sector obtain a rent except for the marginal worker, who is just indifferent between working inside and outside the sector. When liberalisation entails stronger work incentives and less employment, the workers who are laid off lose this rent. Also, some of those who remain employed in the sector (the ones with relatively low motivation) lose as the increase in disutility from effort more than offsets the increase in total wage. The other workers in the sector - those who are relatively highly motivated - gain. Workers outside the sector lose as a consequence of the price increase, as in the two-type model.

7   Conclusion

This paper has developed a model which can explain the empirical observations that firms in a competitive market provide stronger monetary incentives to workers, reach higher productivity, employ less workers, and pay higher wages than a public monopsony. We have argued that weak incentives for workers in public firms may stem from exploitation of monopsonistic power, a power that firms in a competitive environment lack. Our model implies that strengthening competition between firms may raise wage cost and, thus, output prices. Hence, liberalisation of a sector may particularly favour the workers who remain employed in the sector at the expense of the public at large. Political support for liberalisation may therefore be limited, even though liberalisation improves allocational efficiency of the economy.

We have compared two extreme cases, a competitive market without any market failures and a publicly owned or regulated monopolist without any government failures. Clearly, allowing for market failures and government failures could alter the results. For instance, if the government could not perfectly regulate the public firm, e.g. due to information asymmetries, then the public firm may limit production (and hence employment) so as to raise the price of output. Creating a competitive market may then lead to lower prices and higher employment as the public firm can no longer exploit its monopoly power. In practice, it seems likely that liberalisation of a sector reduces both the monopoly power and the monopsony power of the public firm, implying that the effect of liberalisation on prices and employment is ambiguous. Allowing for monopoly power of the public firm does not affect our conclusions on incentive pay and wages, as it is also in the interest of a public monopolist to exploit its monopsony power so as to reduce wage costs. This may explain why the empirical evidence on the effect of liberalisation on wages and incentive pay is more conclusive than the evidence on prices and employment.

A Separating Contracts

This appendix relaxes the assumption that firms offer a single wage scheme. Obviously, in the case of a competitive market, none of the results change: the participation constraint of the low-motivation workers binds, and the high-motivation workers receive all of the rents of their motivation as each worker is paid his full marginal product in equilibrium. In the case of a public monopsony, the results are in the same spirit as we will show now.

For convenience, assume that each contract specifies a fixed wage and an effort level: (β_l, e_l) and (β_h, e_h). We could as well assume that contracts consist of a fixed and an effort-related component, as above, but this unnecessarily complicates the analysis. The first contract must satisfy the low-motivation workers' participation constraint:

$$\beta_l \geq U^o + \frac{1}{2}\theta e_l^2$$

The second contract must satisfy the high-motivation workers' revelation constraint:

$$\beta_l + \gamma_h e_l - \frac{1}{2}\theta e_l^2 \leq \beta_h + \gamma_h e_h - \frac{1}{2}\theta e_h^2$$

Using these two constraints and the production constraint $[Q^d = \kappa (Le_l + He_h)]$, we can write the cost of production as:

$$C = \beta_l L + \beta_h H \Longleftrightarrow$$
$$C = \left(U^o + \frac{1}{2}\theta e_l^2\right)\left(\frac{Q^d - \kappa H e_h}{\kappa e_l}\right) + \left(U^o - \gamma_h (e_h - e_l) + \frac{1}{2}\theta e_h^2\right) H$$

Minimising C with respect to e_l and e_h results in the following two first-order conditions:

$$\left(\frac{1}{2}\theta - \frac{U^o}{e_l^2}\right)\frac{Q^d - \kappa H e_h}{\kappa} + \gamma_h H = 0 \qquad (14)$$

$$-\frac{U^o + \frac{1}{2}\theta e_l^2}{e_l} + (-\gamma_h + \theta e_h) = 0 \qquad (15)$$

We can not derive explicit solutions for the optimal values of e_l and e_h. We can, however, compare them with the effort levels in the competitive equilibrium. Recall that the effort of low-motivation workers in the competitive equilibrium equals $\frac{\sqrt{2\theta U^o}}{\theta}$. Substituting this into first-order condition (14), the first term becomes zero. Hence, as the second term is positive, the public firm sets e_l below the competitive level so as to increase the rents that can be extracted from the high-motivation workers, just as in the case of a single wage scheme. Using this result, it follows from first-order condition (15) that e_h is larger than the effort level of high-motivation workers in the competitive equilibrium. The intuition is straightforward. As the reduction in e_l entails an increase in the cost of output that is produced by the marginal worker, it is profitable to let the high-motivation workers work harder. Total employment is higher and average productivity is lower in a public monopsony compared to the competitive equilibrium if:

$$(\theta Q - \kappa\gamma_h H)\left[\left(\theta Q - \kappa\gamma_h H - \kappa H\sqrt{2\theta U}\right)^2 - \kappa^2\gamma_h H^2\sqrt{2\theta U}\right] + \kappa^3\gamma_h H^3\theta U > 0 \qquad (16)$$

This follows from rewriting and combining first-order conditions (14) and (15) and using the results for the competitive case. A sufficient condition is that the term in square brackets is positive, which can be rewritten as:

$$\alpha_c L_c^2 > \gamma_h H^2$$

where α_c and L_c are the incentive wage and the number of low-motivation workers in the competitive equilibrium, respectively; see Table 1. Hence,

when the public firm can offer separating contracts, employment may be lower than in the competitive equilibrium if the number of high-motivation workers and their motivation are high relative to the contribution of low-motivation workers to production. Note, however, that if $\gamma_h H$ becomes sufficiently high, only high-motivation workers will be employed in the sector, both in the competitive equilibrium and in the case of a public monopsony. Then, competition and monopsony yield identical outcomes. A numerical analysis suggests that if both low-motivation and high-motivation workers are hired, condition (16) is almost always satisfied and, hence, employment is lower in the competitive equilibrium. Finally, prices are always lower in the case of a public monopsony. If this would not be the case, the public monopsony would offer the same contracts as those that result in the competitive equilibrium.

B Maximising Social Welfare

Suppose the public firm maximises the sum of utilities of all workers in the economy. Since utility is linear in income, we can write the social welfare function as:

$$\Psi = (K - L)U^o + LU_l + HU_h - C \tag{17}$$

where K is the total number of low-motivation workers in the economy, C is the cost of production of the sector's output, and we have imposed that Q^d is sufficiently large such that it is optimal for the public firm to hire also low-motivation workers, as in the main text. Our assumption of price-inelastic demand implies that the utility from the sector's output is a constant, so we can safely ignore it. Substituting total cost C, described in (8), and the workers' utility function (1) with $i = l$ and $i = h$, respectively, into (17) gives after some rewriting:

$$\Psi = (K - L)U^o - L\left(\frac{1}{2}\theta e_l^{*2}\right) + H\left(\gamma_h e_h^* - \frac{1}{2}\theta e_h^{*2}\right) \tag{18}$$

Note that the fixed wage β paid by the public firm does not affect social welfare, but must satisfy the low-motivation workers' participation constraint (5). Substituting optimal effort (3) into (18) and maximising with respect to α and L, subject to the production constraint (6), yields after some rewriting that optimal $\alpha = \sqrt{2\theta U^o}$, the same as in the competitive equilibrium.

Consequently, the level of employment is also the same and the fixed wage $\beta = 0$.

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