Corruption, efficiency wage and union leadership

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Abstract

This paper develops a model of determination of unionized wage in the presence of both collective bargaining and efficiency wage. The efficiency of each worker is positively related to both the wage and the unemployment rate in the economy. The unionized wage is greater than the efficiency wage. The firm finds it profitable to keep the unionized wage as close as possible to the efficiency wage. The union leader who is entrusted with the task of determining the unionized wage charges a bribe from the firm to keep the wage close to this level. The corrupt trade union leader and the management of the firm play a two-stage Nash bargaining game from where equilibrium unionized wage and the bribe are determined. The analysis leads to some interesting results which are important for anticorruption policy formulation.

Keywords: Corruption, Collective Bargaining, Efficiency Wage, Union, Firms

JEL Classification: D21, D73, J5, J51, O17

1 Introduction

Yano (2009) notes that high quality markets are indispensable for the healthy growth of a modern economy. Many problems in emerging economies often arise due to the lack of high quality markets.

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Yano (2009) also observes that market quality is likely to be low if markets are characterized by coercive sales, fraud and shoddy goods.[1] In most emerging economies the phenomenon of coercive power and fraud can be attributed, either directly or indirectly, to some form of political corruption. Such a corruption is often responsible for poor quality of markets which results in significant welfare loss. In this paper we try to analyze a specific form of such political corruption that plagues the working of markets in many emerging economies. In particular, we will analyze a scenario where a corrupt leader of a labour union strikes a deal with the management of a firm.

Over the last few decades, corruption has become all-pervasive, especially in many developing countries, and is widely believed to be the single most important obstacle to development. Widespread corruption across organizations, both public and private, surely goes a long way in explaining the poor performance of developing countries. Corruption can take different forms and can occur on different scales. There is corruption that occurs as small favours between a small number of people (petty corruption), corruption that critically affects the government on a large scale (grand corruption), and corruption which is so prevalent that it is a part of the every day structure of society, including corruption as one of the symptoms of organized crime (systemic corruption).[2] There is a huge literature on corruption.[3] Below we review a few papers directly related to our exercise.

Following Becker and Stigler (1974), many of the theoretical papers e.g. Banfield (1975), Rose-Ackerman (1975, 1978) and Klitgaard (1988, 1991, 1998) focus on the principal-agent framework of corruption. These models deal with the relationship between the principal, i.e. the top level of the government (say, a minister) and the agent (an official) who takes a bribe from private individuals interested in some government-produced goods or services. These studies examine different ways of controlling corruption. Cadot (1987) and Basu et al. (1992) analyze bribery in a model with a hierarchical administration. In a very different context, Shleifer and Vishny (1992, 1993) show how corrupt practices in a socialist economies lead to reduction in production and welfare. Since the planners (bureaucrats in the ministries and managers of firms) in such economies cannot keep the official profits that public sector firms earn, it is in their interest to create shortages of output and

[1] These may be thought of as reflections of three primary factors that determine market quality. The primary factors are, "quality of competition", "quality of information", and "quality of products".

[2] Klitgaard (1998) postulates that corruption will occur if the corrupt gain is greater than the penalty multiplied by the likelihood of being caught and prosecute.

[3] See Mishra (2005) for an excellent collection of some important papers related to corruption.

to collect bribes from consumers. Chaudhuri and Dastidar (2014) has a similar approach as ours but this paper does not consider the effects of efficiency wage.[4]

Contributions of this paper In the present paper we deal with a the effects of the presence of a corrupt union leader in a unionized industry, who strikes a deal with the management of a firm. The presence of such forms of corruption often contributes to perpetuation of low wages among skilled workers in the formal sector, especially in emerging economies. Such corrupt practices are often observed in the functioning of the labour market in many developing economies. We develop a model about determination of unionized wage in the presence of a corrupt union leader who acts as an intermediary between workers and management of a firm.[5]

We consider two types of worker in our framework: skilled and unskilled. We assume that production in the firm requires only skilled labour earning the level of wage W. The skilled labour market is distorted due to efficiency wage and collective bargaining. The efficiency of each skilled worker is positively related to both the wage, W, and the unemployment rate, U, in the economy. U refers to the skilled unemployment rate. The unskilled workers are all in the informal sector. The labour market in the informal sector is perfectly competitive (i.e. free of efficiency wage and collective bargaining) so that it provides employment to all unskilled workers at the market clearing unskilled wage, $\underline{W}$. [6].

Subsequently, if not otherwise stated, by worker of the firm in our model we mean skilled worker. Similarly, if not otherwise stated, in the case of the informal sector, by worker we mean unskilled worker.

As noted earlier, the efficiency of a skilled worker is positively related to both the wage and unemployment rate in the economy. In the absence of collective bargaining, up to a certain level of wage (efficiency wage), the firm's profit and the wage rate are positively related and the profit maximizing firm chooses the unit-cost minimizing wage. However, in the presence of collective

[4] As per the theory of "efficiency wage" the efficiency of a worker is positively related to both the wage and unemployment rate in the economy.

[5] In many industrial sectors in India, corrupt deals between the union leader and the management are common and are often reported in newspapers.

[6] So, there is no unemployment of unskilled labour in the economy. This scenario is common in a country like India. Typically, the unskilled workers flock to the informal sector and earn a comeptitive wage. The skilled workers, on the other hand, operate mainly in the formal sector where formal labour laws are applicable. The formal sector is characterised by unemployment.

bargaining, the unionized wage is higher than the efficiency wage and the profitability of the firm and the wage rate are negatively correlated. In this scenario, the management of the firm finds it profitable to negotiate with the union leader so as to keep the unionized wage as close as possible to the efficiency wage. This gives the union leader an opportunity to charge a bribe from the firm for keeping the unionized close to that desired level. The workers of the firm are unsure about whether a shady deal has been struck between the two parties (the management and the union leader). However, the workers are watchful and can smell a rat if the wage is set too low and consequently, there is a risk associated with bribe-taking. The lower the wage agreed upon by the two parties (management and the union leader), the higher would be the probability that the bribery on the part of the leader would be detected by the union members. If the union leader is detected as having resorted to bribe taking, he will be removed from his post and will have no other option but to seek employment in the informal sector offering a low competitive wage, $\underline{W}$.

As this corrupt practice (negotiation on a bribe to keep the wage low) is mutually beneficial to both the parties, the management of the firm and the union leader play a cooperative game. To model such a scenario, we consider a two-stage game. In the first stage the union leader and the management play a Nash bargaining game where the two players jointly determine the unionized wage and the bribe. In the second stage the firm decides on the number of workers to be employed. We compute the equilibrium levels of employment, unionized wage and the bribe. Thereafter, we conduct some comparative static exercises.

The analysis leads to some interesting results. (i) An increase in the price of the final output or an increase in the economy-wide unemployment rate lead to increases in both the unionized wage and bribe. However, there is a reduction in the equilibrium level of employment. (ii) Similar effects are observed when there is an increase in the reservation income of the leader or a decrease in the fixed cost of the firm. (iii) Policies that raise the informal sector wage lead to reduction in both the unionized wage and bribe and an increase in equilibrium employment. Thus we advocate policies like strict implementation of the minimum wage law and employment guarantee programs for the poorer section as such policies are likely to raise the informal sector wage.

2 The Model

Consider a scenario where there is a corrupt union leader who intermediates between the workers and a firm in a unionized competitive industry. The reservation wage of the workers is $\underline{W}$ (informal

sector wage). The union leader does all the bargaining with the firm as the sole representative of the workers. He receives a bribe, Z, from the firm for keeping the wage, W, as close as possible to $\underline{W}$. Production depends on labour (L) and on the efficiency of the worker, $h(W,U)$, where U is the unemployment rate in the economy. U is exogenously given. Following efficiency wage theory we assume that $h(.)$ is increasing in W and increasing in U. That is, $h_W, h_U > 0$. The reasons are as follows. As W rises, the worker's morale increases that raises his efficiency. If the unemployment rate, U, rises, the worker feels that he is lucky enough to be employed. Hence, with an increase in U, the worker values his job more and this raises his efficiency. Alternatively, an increase in U means that the probability that any worker will be fired (if found shirking) increases.[7] This means that in case of rising U a typical worker will put in more effort in order to lower the probability of getting fired.[8]

We model the production function in the following way. Let $g(W,U,L) = h(W,U)L$. Production function is given by $Q = Q(g)$. Note that we consider this formulation as we take labour as the only input. Although, L (number of workers in physical unit) is determined separately, $h(.)$ is determined when a decision on W is made (U is given exogenously). Essentially, a firm determines the quantity of labour input (in efficiency unit), $g(.) = h(.)L$, to employ so as to maximize the profit. We assume $Q' > 0$ and $Q'' < 0$. This simply means that the marginal product of efficiency unit, $g(.)$, is positive and this marginal product diminishes with increases in output. This assumption is justified when the firm has a fixed stock of physical capital.

We assume that there exists $a \geq 0$ s.t. $Q(g) > 0$ for all $g > a$. This essentially means that a critical minimum amount of labour input (in efficiency units) is required to start production. We also assume that that $Q''(g)\, g + Q'(g) \leq 0$ for all $g > a$. Since $Q'' < 0$ this assumption will hold true when the absolute value of $Q''(.)$ is high enough. This will be true when the production function displays highly decreasing returns. In many poor economies this is likely to be the case because of smaller scales of production and prevalence of outdated technology.[9]

[7] The employer has a better chance of finding a suitable replacement (possibly at a lower wage) for any sacked worker as the number of unemployed men rises.

[8] The efficiency function of labour is a simplified version of that available in Agell and Lundborg (1992, 1995). Mathematical derivation of the efficiency function from the rational behavior of a representative worker and explanations of the mathematical restrictions on the partial derivatives are available in these works. For applications of this type of efficiency function in simple general equilibrium models one may look at Chaudhuri (2011) and Chaudhuri and Banerjee (2010a, b).

[9] We now provide an example where both these assumptions hold true. Take $Q(g) = A - g^{-\alpha}$ where $\alpha > 0$. Let

The labour market facing the industry is unionized. Each firm in the industry has a separate trade union. Such a scenario is very common in emerging economies. In such a framework we analyze the equilibrium levels of unionized wage, W, employment L and bribe Z.

We model this as a simple two-stage game. In stage 1, the corrupt leader and the firm play a Nash bargaining game and determine the unionized wage, W, and the amount of bribe, Z. In stage 2, the firm takes W and Z as given and chooses the level of employment L.

2.1 Second Stage

The firm can sell any amount at price P. It essentially acts as a competitive firm in the output market. This may be possible when the firm is an export oriented firm in a small open emerging economy like India. Such a firm acts as a price-taker at the international market. It can sell as much quantity as it wants in the world market at the internationally determined price. The unionized wage, W, is paid out of realized sales proceeds. If L denotes the number of workers employed by the firm its total wage cost is WL. $Q\left(g\left(W,U,L\right)\right)$ is the amount of output produced. T is the fixed cost that the firm has to incur in its production and marketing processes. For example, if the firm is an export oriented unit, typically it must undergo certain procedures e.g. obtaining an export license, processing of shipping bill etc.[10] All these bureaucratic processes are very time-consuming and also involve lots of costs (including petty bribery at all levels). These costs are here captured by T. Export-promotional measures are aimed at simplifying these procedural formalities and such measures lower T.

Since $g\left(W,U,L\right)=h\left(W,U\right)L$ we can write firm's payoff as follows.

$$\pi = PQ\left(h(W,U)L\right) - WL - Z - T - - - - (1).$$

Note that W and Z are determined in the first stage. Given this, the firm chooses L to maximize π. The first and second order conditions are as follows.

$$\begin{aligned}\frac{\partial \pi}{\partial L} &= PQ'\left(h\left(W,U\right)L\right)h\left(W,U\right) - W = 0 - - - - (2)\\ \frac{\partial^2 \pi}{\partial L^2} &= PQ''\left(h\left(W,U\right)L\right)\left[h\left(W,U\right)\right]^2 < 0 - - - - (3)\end{aligned}$$

$a=\left(\frac{1}{A}\right)^{\frac{1}{\alpha}}$. Note that $Q\left(g\right)>0$ for all $g>a$. If A is high enough and α is small enough then $a=\left(\frac{1}{A}\right)^{\frac{1}{\alpha}}$ is very small and so the restriction is not much. For example, if $A=10000$ and $\alpha=\frac{1}{10}$ then $a=\left(\frac{1}{A}\right)^{\frac{1}{\alpha}}=\frac{1}{10000^{10}}=1.0\times10^{-40}$ which is almost zero. Here $Q'=\alpha g^{-\alpha-1}$ and $Q''=-\alpha\left(\alpha+1\right)g^{-\alpha-2}$. Note that $gQ''+Q'=-\alpha^2 g^{-\alpha-1}<0$.

[10] For the details of such export procedure in a country like India see <<http://business.gov.in/taxation/export_procedure.php>>

Since $Q''(.) < 0$ the second order condition (3) is always satisfied. From (2) we get the profit maximizing amount of employment. We denote it by $L^*(W, P, r, U)$. We assume that L^* is such that $g = h(W, U) L^* > a$. This ensures a non-trivial equilibrium where $Q(g) > 0$. Routine computations yield the following.[11]

$$L^*_W < 0,\ L^*_P > 0 \text{ and } L^*_U \leq 0. ----(4)$$

L^* is decreasing in W, increasing in P and non-increasing in U.

Let $\underline{Y}$ denote the reservation income of the union leader (say from directly joining politics). Let $\underline{W}$ denote the wage rate prevailing in the informal sector of the economy. It may be noted that any changes in the parameters of the system affect L^* both directly and indirectly (through changes in the formal sector wage rate, W). In (4) we capture only the direct effects.[12]

Let Π denote the profit of the firm when $L = L^*$ and is given by

$$\Pi = PQ(h(W, U) L^*) - WL^* - Z - T ----(5)$$

Using the envelope theorem from (5) the following results can be easily derived.[13]

$$\Pi_W,\ \Pi_Z,\ \Pi_T < 0;\ \Pi_P,\ \Pi_U > 0 \text{ and } \Pi_{\underline{Y}}, \Pi_{\underline{W}} = 0 ----(6)$$

We now proceed to solve the first stage of the game.

2.2 First Stage

In the first stage the firm and the corrupt union leader play a cooperative game and determine W and Z jointly through a Nash Bargaining process. Let $p(W)$ be the probability that the union leader will be detected by other workers for his unethical practice and be removed from his post[14]. Note that $W \geq \underline{W}$. We assume the following.

$$\begin{aligned} p(.) &: [\underline{W}, \infty) \longrightarrow [0, 1] \\ p'(W) &< 0,\ p''(W) \leq 0 \text{ and } p(\underline{W}) = 1 \end{aligned}$$

[11] See Appendix 1 for the derivations.

[12] L^* independent of Z, $\underline{Y}$, T and $\underline{W}$.

[13] See Appendix 1 for the computations. The result that $\Pi_W < 0$ follows from (8a), (8b) and (12).

[14] Typically in emerging economies such as India, the workers (or a substantial fraction of them) revolts againts such a leader and he is removed forcibly.

If the leader (along with the firm) sets a wage equal to $\underline{W}$, then the workers will clearly realize that there has been a deal struck between the firm and the leader (with kickbacks being paid) and in this case the leader will be removed from his post with certainty. If the chosen W is strictly higher than $\underline{W}$ then the workers are not certain whether such a deal has taken place or not and consequently the probability that the leader will be caught is less than one. Higher is the chosen wage W, the lower will be the probability of getting caught since with higher wages the workers become less suspicious. If the union leader is detected in resorting to bribe-taking, he will be summarily removed from his post and will loose his formal sector job. Any political party in a democratic set-up will think twice before including him in its organization because it may badly affect its image and harm its political prospects. In this case the union leader has to fall back upon an informal sector job where the wage rate is $\underline{W}$.[15] The union leader is assumed to be risk-neutral and his expected income is therefore given by

$$Y = (1 - p(W))(W + Z) + p(W)\underline{W} = W + Z - p(W)(W + Z - \underline{W}). \quad ----(7)$$

From (7) the following may be noted.

$$\begin{aligned}
Y_W &= \frac{\partial Y}{\partial W} = 1 - p'(W)(W + Z - \underline{W}) - p(W) > 0 \quad ----(8a)\\
Y_Z &= \frac{\partial Y}{\partial W} = 1 - p(W) > 0 \quad ----(8b)\\
Y_{\underline{W}} &= \frac{\partial Y}{\partial \underline{W}} = p(W) > 0 \quad ----(8c)\\
Y_P &= Y_{\underline{Y}} = Y_U = Y_T = 0 \quad ----(8d)
\end{aligned}$$

The firm's payoff is $\Pi = PQ(h(W,u)L^*) - WL^* - Z$. We assume that if the bargaining process breaks down no production will take place and consequently the firm's profit in this case would be zero. As noted before, the union leader has a reservation income, $\underline{Y}$. He will not be engaged in union leadership unless $Y \geq \underline{Y}$. The disagreement payoff vector is thus $(\underline{Y},\ 0)$.

2.2.1 The Nash Bargaining Solution

To arrive at the Nash Bargaining solution we maximize $B = (Y - \underline{Y})\Pi$ w.r.t W and Z.

[15] Even if he is able to gain entry in another smaller (and insignificant) party, having very little prospects of coming to power, the ousted union leader is likely get an unimportant position in the new party with low payoffs. This scenario is common in a country like India.

The first order conditions are given as follows.

$$B_W = \Pi Y_W + (Y - \underline{Y})\,\Pi_W = 0 - - - - (9)$$

$$B_Z = \Pi Y_Z + (Y - \underline{Y})\,\Pi_Z = 0 \; - - - - (10)$$

The second order condition for maximization requires the determinant D to be negative definite where

$$D = \begin{vmatrix} B_{WW} & B_{WZ} \\ B_{ZW} & B_{ZZ} \end{vmatrix}$$

From the second order conditions it follows that

$$B_{WW}, B_{ZZ} < 0 \text{ and } D = B_{WW}B_{ZZ} - (B_{WZ})^2 > 0 - - - - (11)$$

From equations (9) and (10) we get

$$\frac{\Pi_W}{\Pi_Z} = \frac{Y_W}{Y_Z} - - - - (12)$$

Let $\varepsilon_{h,W} = \left(\frac{\partial h(.)}{\partial W}\frac{W}{h(.)}\right)$ be the wage elasticity of the efficiency of each worker.

Proposition 1 *In equilibrium, the wage elasticity of the worker's efficiency function is less than unity. That is,* $\varepsilon_{h,W} < 1$.

Proof Given in Appendix 2.■

Comment In the standard efficiency wage model where the efficiency of each worker is positively related to both wage rate and unemployment rate and there is no collective bargaining the price-taker firm is free to maximize its profit with respect to both wage and level of employment. It chooses the wage that minimizes its unit cost of labour i.e. $\left(\frac{W}{h(.)}\right)$. This happens at the point where the wage elasticity of the efficiency function is exactly equal to unity.[16] This is the standard Solow condition in the efficiency wage literature. Let this unit cost-minimizing wage be W_e and this is constant. Once W_e is determined the profit-maximizing firm then equates the value of marginal product of labour to W_e for determining the number of workers to be employed in production. However, in the presence of collective bargaining the optimal wage, say W^*, is greater than the

[16] See Basu (1998) and Chaudhuri (2011) in this context.

efficiency or unit-cost minimizing wage, W_e.[17] Naturally, at W^* the wage elasticity of the efficiency function would be less than unity. More interestingly, the algebraic value of this elasticity would increase with a decrease in the bargaining power of the labour union resulting from the policy of labour market reform. However, it is not visible in the present case as we have assumed the bargaining powers of the two parties to be equal.

Solving equations (9) and (10) the equilibrium values of W and Z, denoted W^* and Z^*, respectively are obtained as functions of the parameters of the system, P, $\underline{Y}$, U, T and $\underline{W}$. In general forms these are written as follows.

$$W^* = W^*\left(P, \underline{Y}, U, T, \underline{W}\right) \text{ and } Z^* = Z^*\left(P, \underline{Y}, U, T, \underline{W}\right) - - - - (13)$$

3 The Main results

We now analyze the effects of changes in P ,$\underline{Y}$, U, T and $\underline{W}$ on the equilibrium levels of wage (W^*), bribe (Z^*) and employment (L^*). Although different parameters may change concurrently, to fix our ideas we consider their effects one by one.

We will throughout assume that P (and hence Π) to be sufficiently high and $(Y - \underline{Y})$ to be low. We now provide some plausible reasons as to why P (and hence Π) could be high and $(Y - \underline{Y})$ could be low.

Remark 1 Consider the case where the firm is an export oriented unit. For example, in India there are export promotion zones where firms primarily designed for exports operate. Such firms often act as price takers in the export market. Such a firm typically receive a very high price (P) for its product in the international market. If the income elasticity for such a product is very high in the international market, then also P can be very high. Since such a firm operates in the formal sector it can derive different benefits that the government provides to exporting firms to boost

[17] Here each skilled worker has a reservation wage $\underline{W}$, which is the unskilled informal sector wage. As there is skilled unemployment in the economy, the skilled worker in our firm may not get a job and in that case he has to recourse to an unskilled job in the informal sector because the latter sector is perfectly competitive and can absorb all workers including unemployed skilled ones. So the reservation income constraint of each skilled worker in our firm is $W \geq \underline{W}$. In the absence of any collective bargaining, and reservation wage constraint the firm is free to choose the efficiency wage, W_e . However, in the presence of the constraint the actual wage, W_a, must be $W_a = Max\left\{W_e, \underline{W}\right\}$ (see Basu (1998)). However, in our paper because we have assumed P (and hence Π) to be high and $\underline{W}$ to be low (see Remarks 1 and 2), W_e must be greater than $\underline{W}$.

exports.[18] This reduces T which in turn can push up Π. On the other hand, if the firm produces an import good, it is often protected by protectionist policies like an import tariff. Even after trade liberalization the tariff rate has remained quite high on many commodities across countries.[19] The domestic or tariff inclusive price of the good then can become very high which results in high Π.

Remark 2 Although in this model, there is only one union leader doing all the wage bargaining with the firm, in real life often there are a number of labour unions affiliated to different political parties and a quite a number of people in the race within each union. The race for the union leadership in emerging economies is often for the appropriation of bribe from wage bargaining. Competition among union leaders ultimately keeps Y as close to $\underline{Y}$ (payoff to the union leader from directly joining politics and getting elected in any civic body). The more intense the competition the smaller would be the gap between Y and $\underline{Y}$. At the same time, the informal wage, $\underline{W}$, in many areas of a developing country like India is also very low and sometimes well below the minimum wage as stipulated by the government. This is because the informal sector is completely unregulated and the enforcement machinery in charge of implementing the minimum wage law is inefficient and often itself corrupt. This is another factor that may be responsible for both Y and $(Y - \underline{Y})$ to be low. Furthermore, it may be noted that the reservation income, $\underline{Y}$, is the income of the union leader received from directly joining politics. This figure may in fact be quite high, which is presently the case in India, so that the difference, $(Y - \underline{Y})$ is likely to be sufficiently low.[20]

We now provide the main results of our exercise. The proofs appear in Appendix 2.

Proposition 2 *W^* increases following (i) an increase in P, (ii) an increase in U and (iii) an increase in $\underline{Y}$. On the other hand, W^* decreases with (i) an increase in $\underline{W}$ and (ii) an increase in T.*

Proposition 3 *Z^* increases following (i) an increase in P, (ii) an increase in U and (iii) an increase in $\underline{Y}$. On the other hand, Z^* decreases with (i) an increase in $\underline{W}$ and (ii) an increase in T.*

[18] Such export promotion policies are common in countries like India and China.

[19] For many essential food items (example, sugar) the tariff rate on imports are very high in countries like India. Very recently India raised its import duty on sugar to 40 percent from 15 percent, to revive business at sugar mills .

[20] Anecdotal evidences from newspaper expose show that income from directly joining politics in India may indeed be very high.

Proposition 4 *L^* decreases following (i) an increase in U and (ii) an increase in $\underline{Y}$; and, (iii) a decrease in T. On the other hand, L^* increases with (i) an increase in $\underline{W}$ and (ii) an increase in T. However, the effect of an increase in P on L^* is ambiguous.*

Comment We now provide the intuition behind the above propositions.

An increase in the product price, P, raises profit of the firm, Π, at a given level of output and gives an opportunity to the union leader to reap a part of the benefit and increase his expected income, Y, by raising both bribe (Z^*) and the unionized wage (W^*) . Note that Y is increasing in both Z^* and W^*. So, the firm in the process cannot reap the entire benefit of the price increase. On the employment front, there are both direct and indirect (induced) effects. As the firm equates the value of marginal product of labour (VMPL) to wage it would hire more labour than before. This is the direct effect on L^*. On the other hand, the increase in W^* raises the efficiency of each worker (since $h_w > 0$) and makes it possible to produce a higher level of output with the same number of workers. However, as the wage elasticity of the worker's efficiency function is less than unity in equilibrium due to presence of collective bargaining, diminishing marginal productivity of labour ensures that the level of employment goes down as W^* rises. This is the indirect effect. Hence, due to presence of two opposite forces, the net effect of an increase in P on L^* is ambiguous.

An increase in the economy-wide unemployment rate (U) raises the efficiency of each worker (since $h_U > 0$) which makes it possible for the firm to produce a higher (same) level of output with the same (a lower) number of workers. This raises its profitability given other things. However, the union leader will grab this opportunity to increase his expected income by raising both Z^* and W^*. This lowers the increased profit of the firm somewhat. The direct effect on L^* would either be negative or zero because in either of the two cases the profitability of the firm rises.[21] However, the indirect effect would be a decrease in employment as W^* rises. Hence, the overall effect on L^* would be negative.

On the other hand, a reduction in fixed cost (T), arising from export-promotional measures, raises the profit of the firm. The trade union leader again takes this opportunity to increase both Z^* and W^* to increase his expected income. A change in T does not have any direct effect on L^*. However, the equilibrium employment, L^*, falls due to induced effect that works through the increase in W^*.

[21] Note that $L_U^* \leq 0$. See Appendix 1 in this context.

Then, if the reservation income of the union leader, $\underline{Y}$, rises say due to an increase in the return to directly joining politics, both Π and Y would not initially be affected although $(Y - \underline{Y})$ falls. However, as his opportunity income rises the union leader will be interested to remain in his present post only if it becomes more rewarding than previously. This is possible only when both Z^* and W^* increase. Consequently, Y rises although Π falls. The employment level of the firm, L^*, unequivocally falls as W^* rises.

Finally, if the informal sector wage, $\underline{W}$, rises, at given W^* and Z^*, the expected income of the union leader (given by (7)) rises as $Y_W > 0$ (see (8)). The risk-neutral leader will find it profitable to lower both W^* and Z^*. Both the players would likely to be benefitted in the process. The equilibrium employment, L^*, also increases as W^* has fallen.

4 Conclusion

Market quality is a measure for the efficiency of allocation and the fairness of dealing and pricing (Yano, 2009). Corruption severely affects the fairness of dealing and pricing in markets and consequently reduces the quality of markets.

Corruption takes different forms. In this paper we have analyzed corrupt practices in the labour market in the presence of both efficiency wage and collective bargaining. Here corrupt practices are pursued by a trade union leader who is entrusted with the task of bargaining with the firm to decide on the unionized wage in a competitive industry. The efficiency of a worker is positively related to both the wage and unemployment rate in the economy. In the absence of collective bargaining a profit-maximizing firm chooses the unit-cost minimizing wage (efficiency wage). However, in the presence of collective bargaining the unionized wage is higher than the efficiency wage so that the profitability of the firm and the wage rate are negatively associated. In this situation, the firm finds it profitable to negotiate with the union leader so as to keep the wage as close as possible to the efficiency wage. The union leader charges a bribe from the firm for keeping the unionized wage close to the efficiency wage level. There is a positive risk involved in bribe-taking. The lower the wage the higher would be the possibility that the bribery on the part of the leader would be detected by his union members and will be removed from his post. In that case the leader has to accept a job in the informal sector offering a low wage. The leader is risk-neutral. As this corrupt practice is mutually beneficial the firm and the union leader play a cooperative game.

We considered a two-stage Nash bargaining game. In the first stage the two players jointly

determine the unionized wage and bribe while in the second stage the firm decides on the level of employment. We then went on to carry out some comparative statics and obtained a few interesting results. For example, an improvement in the demand conditions in the international market for the commodity resulting in an increase in product price or an economic recession culminating in a higher unemployment rate in the economy or a higher number of financial scams leading to a higher expected return from joining direct politics or an export promotional scheme that lowers the fixed cost of the firm raises the equilibrium values of both unionized wage and bribe and consequently lowers employment level chosen by the firm. Hence, in such cases not only the degree of corruption (bribe money) rises but also the employment situation worsens. Both of these seriously affect market quality and social welfare.

Significantly, our analysis also shows that policies that raise the informal sector wage would be successful not only in bringing down the degree of corruption but also in increasing employment through reduction in the unionized wage. For example, strict implementation of the minimum wage act and policies like the Mahatma Gandhi National Rural Employment Guarantee Programme (MGNREGP), introduced in India in 2005, that significantly increases the informal wage can combat corruption, improve market fairness and the employment situation in emerging economies.[22]

In short, our exercise provides a very simple framework for analyzing a particular form of political corruption that afflicts many emerging economies. Our analysis also shows a way for designing appropriate policies to fight against corruption in trade union leadership.

[22] Several studies like Zimmermann (2012) and Berg et al. (2012) have found that informal wages have increased significantly since the inception of such schemes.

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Appendix 1

The production function that we have considered is

$$\begin{aligned} Q &= Q(g),\ Q'(g) > 0 \text{ and } Q''(g) < 0 ----(A1) \\ \text{where } g &= hL \text{ and} \\ h &= h(W,L);\ h_W, h_U > 0 ----(A2) \end{aligned}$$

We define $\varepsilon = \left(\frac{\partial Q'(.)}{\partial g}\frac{g}{Q'(.)}\right)$ as the elasticity of the marginal product of labour (in efficiency unit). As the marginal product of labour is diminishing we have $\varepsilon < 0$.

$$|\varepsilon| \geq 1 \Longleftrightarrow \left[\frac{Q''(g)\,g}{Q'(g)} \leq -1\right] \Longleftrightarrow \left[Q''(g)\,g + Q'(g)\right] \leq 0 ----(A3)$$

Since we have assumed that $[Q''(g)\,g + Q'(g)] \leq 0$ (for $g \geq a$) we must have $|\varepsilon| \geq 1$ for $g \geq a$.

Totally differentiating equation (2) we can easily derived the following results.

$$\left.\begin{array}{c} L^*_W = \frac{\partial L^*}{\partial W} = \frac{1 - Ph_W(.)[Q''(h(.)L^*)h(.)L^* + Q'(h(.)L^*)]}{PQ''(h(.),L^*)[h(.)]^2} < 0 \text{ if } |\varepsilon| \geq 1 \\ L^*_P = \frac{\partial L^*}{\partial P} = \frac{-Q'(h(.),L^*)h(.)}{PQ''(h(.),L^*)[h(.)]^2} > 0 \\ L^*_U = \frac{\partial L^*}{\partial U} = -\frac{Ph_U(.)[Q''(h(.)L^*)h(.)L^* + Q'(h(.)L^*)]}{PQ''(h(.),L^*)[h(.)]^2} < (=)\,0 \text{ iff } |\varepsilon| > (=)\,1 \\ L_Z = L_{\underline{Y}} = L_T = L_{\underline{W}} = 0 \end{array}\right\} ----(A4)$$

Now using proposition 1 and (A.2) and applying the envelope theorem from equation (5) we can derive the following expressions.

$$\left.\begin{array}{c} \Pi_W = \frac{\partial \Pi}{\partial W} = PQ'(h(.)L^*)L^* h_W(.) - L^* \\ \Pi_Z = \frac{\partial \Pi}{\partial Z} = -1 \\ \Pi_P = \frac{\partial \Pi}{\partial P} = Q(h(.)L^*) > 0 \\ \Pi_U = \frac{\partial \Pi}{\partial U} = PQ'(h(.)L^*)L^* h_U(.) > 0 \\ \Pi_T = \frac{\partial \Pi}{\partial T} = -1 \\ \Pi_{\underline{Y}} = \Pi_{\underline{W}} = 0 \end{array}\right\} ----(A5)$$

Partially differentiating different expressions in (A.5) we find the following expressions.

$$\left.\begin{array}{c} \Pi_{WW} = \frac{\partial^2 \Pi}{\partial W^2} = PQ'[L^* h_{WW} + L^*_W h_W] + PL^* h_W Q''[L^* h_W + L^*_W h] - L^*_W \\ \Pi_{WZ} = 0 \\ \Pi_{WP} = \frac{\partial^2 \Pi}{\partial W \partial P} = Q'[L^* h_W + L^* h] \\ \Pi_{WU} = \frac{\partial^2 \Pi}{\partial W \partial U} = PQ'[L^* h_{UW} + L^*_W h_U] + PL^* h_U Q''[L^* h_W + L^*_W h] \\ \Pi_{W\underline{Y}} = \Pi_{WT} = \Pi_{W\underline{W}} = 0 \\ \Pi_{ZZ} = \Pi_{ZW} = \Pi_{ZP} = \Pi_{ZU} = \Pi_{Z\underline{Y}} = \Pi_{ZT} = \Pi_{Z\underline{W}} = 0 \end{array}\right\} --(A6)$$

Note that $\varepsilon_{h,W} = \left(\frac{\partial h(.)}{\partial W}\frac{W}{h(.)}\right) > 0$. Define $\varepsilon_{L^*,W} = \left(\frac{\partial h(.)}{\partial W}\frac{W}{h(.)}\right)$. From our previous findings we have $\varepsilon_{L^*,W}$. Now, from (A6) we have the following:

$$\begin{aligned} \Pi_{WP} &= \left(\frac{Q'(.)\,h(.)\,L^*}{W}\right)[\varepsilon_{h,W} + \varepsilon_{L^*,W}] < (=) > 0 \\ \text{iff } \varepsilon_{h,W} &< (=) > |\varepsilon_{L^*,W}| \end{aligned}$$

Besides, partially differentiating the expressions for Y_W and Y_Z, as presented in (8), we find

$$\left.\begin{array}{c} Y_{WW} = \frac{\partial^2 Y}{\partial W^2} = -p''(W)(W + Z - \underline{W}) - 2p'(W) > 0 \\ Y_{ZW} = -p'(W) > 0 \\ Y_{WP} = Y_{W\underline{Y}} = Y_{WU} = Y_{WT} = 0 \\ Y_{W\underline{W}} = p'(.) < 0 \\ Y_{ZW} = -p''(.) > 0 \\ Y_{ZZ} = Y_{ZP} = Y_{Z\underline{Y}} = Y_{ZU} = Y_{ZT} = Y_{Z\underline{W}} = 0 \end{array}\right\} - - (A7)$$

Appendix 2

Proof of Proposition 1 Using (6) and (8) from equations (2) and (12) it can computed that

$$\left.\begin{array}{c} \frac{[PQ'(.)h_W(.)-1]L^*}{-1} = \left[\frac{1-p'(W+Z-\underline{W})-p(.)}{1-p(.)}\right] \\ \Longrightarrow [PQ'(.)\,h_W(.)-1]\,L^* = -\left[\frac{1-p'(W+Z-\underline{W})-p(.)}{1-p(.)}\right] < 0 \end{array}\right\} --(A8)$$

The L.H.S. of (A8) is equal to Π_W (see the previous appendix). This implies $\Pi_W < 0$.

Note that $\varepsilon_{h,W} = \frac{\partial h(.)}{\partial W}\frac{W}{h(.)} = h_W \frac{W}{h(.)}$.

From (2) we get $PQ'(.) = \frac{W}{h(.)}$. This means $\varepsilon_{h,W} = h_W PQ'(.)$. From (A8) it now follows that

$$PQ'(.)\,h_W(.) - 1 < 0$$

The above implies that $\varepsilon_{h,W} < 1$. This completes proof of proposition 1.■

Proofs of Propositions 2, 3 and 4 Totally differentiating equations (9) and (10) we obtain the following two expressions.

$$B_{WW}dW + B_{WZ}dz = -\left(B_{WP}dP + B_{W\underline{Y}}d\underline{Y} + B_{WU}dU + B_{WT}dT + B_{W\underline{W}}d\underline{W}\right) - - - - (A9)$$

$$B_{ZW}dW + B_{ZZ}dz = -\left(B_{ZP}dP + B_{Z\underline{Y}}d\underline{Y} + B_{ZU}dU + B_{ZT}dT\right) - - - - (A10)$$

where

$$\left.\begin{array}{c} B_{WW} = 2\Pi_W Y_W + \Pi Y_{WW} + (Y - \underline{Y})\,\Pi_{WW} < 0 \text{ (follows from (11))} \\ B_{WZ} = \Pi_Z Y_W + \Pi Y_{WZ} + Y_Z \Pi_W > 0 \text{ (since } \Pi \text{ is sufficiently high)} \\ B_{ZZ} = 2\Pi_Z Y_Z < 0 \\ B_{WP} = \Pi_P Y_W + (Y - \underline{Y})\,\Pi_{WP} > 0 \\ B_{W\underline{Y}} = -\Pi_W > 0 \\ B_{WU} = \Pi_U Y_W + (Y - \underline{Y})\,\Pi_{WU} > 0 \left(\begin{array}{c} \text{since } Y_W > 0,\ \Pi_U > 0 \text{ and} \\ \Pi_U \text{ is sufficiently high as } P \text{ is sufficiently high} \\ \text{and } (Y - \underline{Y}) \text{ is sufficiently low} \end{array}\right) \\ B_{WT} = -Y_W < 0 \text{ (note that } \Pi_T = -1) \\ B_{W\underline{W}} = \Pi_W Y_W + \Pi Y_{W\underline{W}} + (Y - \underline{Y})\,\Pi_{W\underline{W}} < 0 \\ B_{ZP} = \Pi_P Y_Z > 0 \\ B_{Z\underline{Y}} = -\Pi_Z > 0 \\ B_{ZU} = \Pi_U Y_Z > 0 \\ B_{ZT} = -Y_Z < 0 \\ B_{Z\underline{W}} = \Pi_{\underline{W}} Y_Z + \Pi Y_{Z\underline{W}} + (Y - \underline{Y})\,\Pi_{Z\underline{W}} = 0 \end{array}\right\} - - (A11)$$

It should be pointed out that in order to find out the signs of the above expressions we have used (A.5) – (A.7). Before proceeding further we substitute W^* and Z^* for W and Z, respectively which are obtained by solving equations (9) and (10) simultaneously.

We now write equations (A.9) and (A.10) in the following matrix form.

$$\begin{vmatrix} B_{WW} & B_{WZ} \\ B_{ZW} & B_{ZZ} \end{vmatrix} \begin{vmatrix} dW^* \\ dZ^* \end{vmatrix} = - \begin{vmatrix} B_{WP}dP + B_{W\underline{Y}}d\underline{Y} + B_{WU}dU + B_{WT}dT + B_{W\underline{W}}d\underline{W} \\ B_{ZP}dP + B_{Z\underline{Y}}d\underline{Y} + B_{ZU}dU + B_{ZT}dT \end{vmatrix} - - (A12)$$

Effects on W^* Solving (A12) for dW^* we get

$$dW^* = -\frac{1}{D}\begin{vmatrix} B_{WP}dP + B_{W\underline{Y}}d\underline{Y} + B_{WU}dU + B_{WT}dT + B_{W\underline{W}}d\underline{W} & B_{WZ} \\ B_{ZP}dP + B_{Z\underline{Y}}d\underline{Y} + B_{ZU}dU + B_{ZT}dT & B_{ZZ} \end{vmatrix} - - (A13)$$

With the help of (A.11) from (A.13) the following results easily follow.

$$\left.\begin{array}{c} \frac{dW^*}{dP} = -\frac{1}{D}\left[B_{WP}B_{ZZ} - B_{WZ}B_{ZP}\right] > 0 \\ \frac{dW^*}{d\underline{Y}} = -\frac{1}{D}\left[B_{W\underline{Y}}B_{ZZ} - B_{WZ}B_{Z\underline{Y}}\right] > 0 \\ \frac{dW^*}{dU} = -\frac{1}{D}\left[B_{WU}B_{ZZ} - B_{WZ}B_{ZU}\right] > 0 \\ \frac{dW^*}{dT} = -\frac{1}{D}\left[B_{WT}B_{ZZ} - B_{WZ}B_{ZT}\right] < 0 \\ \frac{dW^*}{d\underline{W}} = -\frac{1}{D}\left[B_{W\underline{W}}B_{ZZ}\right] < 0 \end{array}\right\} - - (A14)$$

The results in (A.14) have been verbally stated in proposition 2.

Effects on L^* For finding out the consequences of any policy changes on the equilibrium level of employment, L^*, we consider equation (4) where we find that the net effect consists of both direct effects and indirect effects through changes in equilibrium level of wage, W^*.

Totally differentiating equation (4) and using (A.14) we can derive the following results.

$$\left.\begin{array}{c} \frac{dL^*}{dP} = \frac{\partial L^*}{\partial P} + \frac{\partial L^*}{\partial W}\frac{dW}{dP} = ? \\ \frac{dL^*}{d\underline{Y}} = \frac{\partial L^*}{\partial \underline{Y}} + \frac{\partial L^*}{\partial W}\frac{dW}{d\underline{Y}} < 0 \\ \frac{dL^*}{dU} = \frac{\partial L^*}{\partial U} + \frac{\partial L^*}{\partial W}\frac{dW}{dU} < 0 \\ \frac{dL^*}{dT} = \frac{\partial L^*}{\partial T} + \frac{\partial L^*}{\partial W}\frac{dW}{dT} > 0 \\ \frac{dL^*}{d\underline{W}} = \frac{\partial L^*}{\partial \underline{W}} + \frac{\partial L^*}{\partial W}\frac{dW}{d\underline{W}} > 0 \end{array}\right\} - - (A15)$$

Proposition 3 describes the results as presented in (A.15).

Effects on Z^* Finally, solving (A.12) for dZ^* we find

$$dZ^* = -\frac{1}{D}\begin{vmatrix} B_{WW} & B_{WP}dP + B_{W\underline{Y}}d\underline{Y} + B_{WU}dU + B_{WT}dT + B_{W\underline{W}}d\underline{W} \\ B_{ZW} & B_{ZP}dP + B_{Z\underline{Y}}d\underline{Y} + B_{ZU}dU + B_{ZT}dT \end{vmatrix} - - (A16)$$

With the help of (A.11) from (A.16) the following results readily follow.

$$\left.\begin{array}{c} \frac{dZ^*}{dP} = -\frac{1}{D}\left[B_{WW}B_{ZP} - B_{ZW}B_{WP}\right] > 0 \\ \frac{dZ^*}{d\underline{Y}} = -\frac{1}{D}\left[B_{WW}B_{Z\underline{Y}} - B_{ZW}B_{W\underline{Y}}\right] > 0 \\ \frac{dZ^*}{dP} = -\frac{1}{D}\left[B_{WW}B_{ZU} - B_{ZW}B_{WU}\right] > 0 \\ \frac{dZ^*}{dT} = -\frac{1}{D}\left[B_{WW}B_{ZT} - B_{ZW}B_{WT}\right] < 0 \\ \frac{dZ^*}{d\underline{W}} = \frac{1}{D}\left[B_{ZW}B_{W\underline{W}}\right] \end{array}\right\} - - (A17)$$

The results presented in (A.17) are verbally stated in terms of proposition 4.