INFORMAL WAGE AND FORMAL SECTOR PRODUCTIVITY: THEORY AND EVIDENCES FROM INDIA

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Informal Wage and Formal Sector Productivity: Theory and Evidences from India[♦]

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Abstract

We express a doubt on the conventional wisdom namely, of a positive relationship between wage and productivity, of a formal sector firm in a developing economy where the firm can either go for subcontracting to the informal sector to minimize wage cost along with apprehension of extra-legal cost and/or investment in R&D for in-house production. We show that a rise of the formal wage does not necessarily ensure higher R&D and labour-productivity of the formal firm while a rise of the informal sector wage must improve R&D and the resultant labour-productivity in the firm. Thus countries with a vast segment of lowly-paid informal workers will also exhibit lowly-productive formal sector workers.

Key words: Informal Wage, Poverty, Labour Productivity, R&D Investment, Outsourcing

Jel Codes: D23, E26, J24, J42, L24

1. Introduction

It is understood that the ability of firms to avoid minimum wage laws, certain types of taxes and the livelihood needs for a vast majority of population leads to the formation of the unorganized sector whose significance can hardly be undermined if one is seriously interested in understanding the working of a typical developing economy. In the developing world 80-90% of the workforce is in the informal manufacturing sector that has direct or indirect production linkages to the formal producer and one such linkage is through subcontracting. Almost 90% of workforce in India is in the unorganized sector. An issue of particular concern is how informal workers can face the challenge of globalization posed by liberal policies of a reforming economy. Goldberg and Pavnick (2003) and Marjit, Biswas, and Ghosh (2007) argue that liberal trade and investment policies may expand or contract output and employment in the informal sector. Marjit, Biswas and Ghosh (2007) argue that if liberal trade policies lead to increased profitability, more output is likely to be produced in the formal segment. Marjit (2003) and Marjit, Kar and Beladi (2007) show that even if workers are laid off in the formal sector and fall upon casual jobs, informal wage and employment can still go up provided capital can be relocated easily from the formal to the informal sector. Several papers in Guha-Khasnobis and Kanbur (ed., 2006) analyse the state of informal enterprises in the developing world. It is more or less recognized and it should be universally accepted that the informal sector often survives on account of outsourcing by the formal sector.

There have been a few popular arguments for the existence and proliferation of the informal sector. One argument suggests that the informal transaction takes place in

order to bypass trade union activities in the formal sector (Basely and Burgess, 2004). Another view relates to the governance system of a state/country. The government of a development economy strategically chooses 'weak governance' and allows 'extra-legal' transaction to take place in a bid to tackle poverty and unemployment as also to lessen the possibility of social unrest (Marjit et al., 2007). In other words, the governance system will be effectively weak and will allow informal transaction to flourish in the presence of high poverty. As a result, a variety of low cost goods and services, which requires a little investment but provide employment to a large number of uneducated and otherwise jobless people, thrive in the informal sector. As a corollary, we argue that if the government allows 'extra-legal' activities in the informal sector at a low wage, a formal producer taking advantage of that will not go for more in-house production by cutting down R&D investment. This, in turn, would act as a binding condition for the productivity improvement of formal workers. As a result, a high correlation would hardly be observed between wage and productivity in a formal sector firm rather a correlation between informal wage and formal labour productivity must be apparent. This paper develops a framework to show this and also provides some empirical evidences from India. We develop our argument in detail in the next section.

We build on the framework of Marjit et al. (2007) to argue that lower wage in the informal segment hurts the productivity of the formal sector worker. The poorer a society, the lower is the informal wage likely to be and we argue that this may have a negative productivity impact. Usually in the efficiency wage models, which talk about the positive effect of a higher wage (Shapiro and Stigliz, 1984; Banerji and Gupta, 1998), there is direct nutritional incentive effect of higher wage. Hence, a decline in wage does

4

lead to declining productivity and the entrepreneurs might be reluctant to reduce the wage rate even in the face of unemployment. That is the key argument explaining the co-existence of unemployment and rigid wage. What we argue is different. A lower wage in the informal segment acts as a disincentive to go for productivity improvement efforts on the part of the formal sector entrepreneurs. Thus, a poor economy or an economy with substantially poor people will also be an economy where organized sector workers will be less productive. This shows that when a society has a lot of poor unorganized workers; those who are fortunate enough to obtain relatively high-wage jobs may not be as productive as they would be in a society where access to the low wage informal segment is banned or severely restricted. This will also mean that if two firms in two different countries face different institutional climate – i.e., one may not have any access to the unorganized workers either because there are none or because it is too costly to access extra legal means and the other faces a much more lack lustre environment, the institutionally more constrained one will have more productive workers. It is well recognized that formal sector jobs pay higher wage to a typical worker than what is usually offered in informal enterprises. Agenor (1996) and the paper cited therein corroborates such claims. Branson, Woodruff and Marcouiller (1997) have contradictory evidence for Mexico while reconfirming the wage gap for El Salvador and Peru. Earlier theoretical model of Carruth and Oswald (1981) and later by Esfahani and Salehi-Isfahani (1989) provide justifications of economic dualism between a unionized and non-unionized sector. The later paper uses effort observality and worker productivity as possible reasons responsible for wage-premium in the formal sector.

We start from a set-up with a given wage premium in the formal sector due to more active unionism. A formal-informal division easily occurs along the line of high-low wage. Typically a firm, facing an organized union and stringent labour laws, looks for workers who can be hired at lower than minimum wages without the promise of other fringe benefits. Such casual contracts are 'illegal', but firms can avoid punishment by increasing cost to influence the monitors. Such a system survives because poor people need jobs and the governance system turns out to be corrupt and reasonably weak. Dasgupta and Marjit (2006) and Marjit, Mukherjee and Kolmar (2006) argue that 'informal' sector may be the outcome of a deliberate strategy on the part of the government in a poor country either to exert pressure on trade unions and/or to avoid social unrest in the absence of a well designed and funded social welfare programme for the poor.

The existence of an informal sector allows some degree of labour market flexibility even at the cost of encouraging an environment where people are employed at a low wage and under poor working conditions. Social concern for workers in a disgraceful work environment will still concede the fact that without jobs the workers would be definitely worse off. The recent empirical evidence on wages in the informal manufacturing sector in India shows that real informal wages have been on the rise across states even in a situation when the organized sector has been lamenting jobless growth. This is available in Marjit and Maiti (2006). However, the existence of a low wage sector acts as if the firms have access to a low cost technology when they have to pay a higher wage to the formal workers. This reduces the incentive to search for a low cost alternative in the formal sector and eventually leads to a lower amount of productivity-augmenting

R&D expenditure. This in turn affects the average labour productivity in the formal sector. If our conjecture is right *ceteris paribus*, lower informal wage should imply lower productivity of formal sector workers. Since lower wage in the informal sector is generally reflective of labour productivity in the informal sector, improving labour productivity in the informal sector should lead to an improvement in the formal sector productivity as well.

We received some motivating results from the Indian economy. The database for such a study relating to informal sector is very poor in India. As per the Indian Factory Act, 1948, the firm that employs 10 workers or more with power and more than 20 without power can be described as an organized or formal sector unit. The Annual Survey of Industries (ASI), Government of India compiles detailed information of those firms on a regular basis. The firms that are not covered by the ASI, fall under the unorganized or informal sector. The information on those firms is procured by National Sample Survey Organization (NSSO), Government of India through the stratified random sample survey every five years since 1978-79. Those reports documented the extent of informality and it is noticeable that maintenance of registration, accounts and payments to labour is hardly observed as per industrial and labour laws. However, wage information is covered since 1989-90 and we find this information for three discrete time periods (i.e., 1989-90, 1994-95 and 2000-01). Firms, hiring more than five workers, are defined as directory manufacturing establishments (DME). Non-directory manufacturing establishments (NDME) and own-account manufacturing establishments (OAME) are those who hire 1-5 workers and do not hire workers, respectively. The present study considers annual emoluments of hired workers in NDME as informal wage and the annual emoluments of

factory workers as formal wage at 1993-94 prices. It should be noted that formal wage is on an average 2 to 6 times higher than the informal wage and this gap varies across regions over time.

Let us move to the analysis of wage and productivity. Given this limited observation, we run separately pooled OLS regression with state and time dummies and panel GLS regressions to estimate the relationship between informal wage-formal productivity and formal wage–formal productivity keeping the control variable as minimum as possible. While doing this, the regional openness index[1] (O_{it}) is taken as a control variable (Marjit et al., 2007). The way it has been constructed, all sorts of restrictions on factors including factor mobility, investment climate and resource abundance across, labour rigidity at the state level have been captured. However, one can take those state specific variables into the regression model, but it will consume certain degree of freedom.

Before presenting the regression results, the simple correlations reported in Table 1 reveal an interesting trend. While the correlation coefficient between formal wage and formal productivity weakens from 1989-90 to 2000-01, it seems to be gradually stronger between informal wage and formal productivity. Productivity is measured as simply gross value added per workers.

Let us move to the regression results. We regress separately formal wage and informal wage on formal labour productivity using pooled OLS and GLS panel models. The regression coefficient between formal wage and formal productivity is not significant

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[1] Openness index (O_{it}) of *i-th* state at *t-th* period is weighted average of export and import intensities for the state. These intensities are ranks of the state on correlation of its production share at the 2-digit industry level with the country's export and import shares of these industries.

in the OLS pooled model controlling for all the states and years, while it is more-or-less significant between the formal labour productivity and informal wage at the 10% level. Similar results also appear in the GLS panel regression (Table 2). The regression coefficients between informal wage and formal productivity come out as significant the 1% level, but not between formal wage and formal productivity. These results essentially suggest that formal productivity is highly influenced by the informal wage which is market determined. The formal wage may not influence its productivity to the extent that the informal wage does. The rest of the chapters are as follows. Section III proposes the model and the last section concludes.

Section II: The Model

Suppose a firm produces a good *X,* which can be produced by using organized or formal workers. These workers earn a pre-determined negotiated wage rate w_1 and/or by accessing informal units which employ labour at a wage rate $w_2 < w_1$. While in the absence of any noticeable productivity gap, the firm will be inclined to hire only informal workers, there are other kinds of costs. Hiring informal workers is not legal. Therefore, there are potential regulatory problems faced by the firm. We model the auditing/monitoring/bribery issues explicitly for a producer who outsources X_2 amount of *X* to the informal sector. In a true sense it is 'illegal' because of its violation of existing industrial and labour laws and hence calls for bribe from the industrial officers who are reasonably corrupts. If a firm subcontracts to the informal sector, the probability of being detected and fined will be apprehended and the probability depends on the size of informal employment. In our model, the probability of being detected is given by $p(L_2; g)$ with $p' > 0$ and $p'' > 0$. In other words, the probability of getting caught will be

less if the size of informal employment is low given a level of governance. In the case of strong governance, $g = \bar{g}$ and $p(L_2; g) = \bar{p}(L_2)$. While in case of weak governance, $g = \underline{g}$ and $p(L_2; g) = \underline{p}(L_2)$. If $\underline{g} \le g \le \bar{g}$, then $\underline{p}(L_2) \le p(L_2; g) \le \bar{p}(L_2)$. If the firm hires L_2, the cost would be – wage bills for informal wage $(w_2 L_2)$ and the amount of bribes given to the industrial officers as a percentage of the value of informal employment $(bw_2 L_2)$. In total this is as follows: $C = (1 + pb)w_2 L_2$ where b is the bribe or punishment cost set by the government as a percentage of value of informal employment. Then, one can write, $C = (1 + p(X_2)b)w_2 X_2 = w_2 c(X_2; g, b)$. $\hspace{1cm}$ (1)

Now, $c' = (1 + pb) + bp'X_2 > 0$ and $c'' = 2bp' + bp''X_2 > 0$

Marginal Cost for $X_2 = w_2 c'(X_2)$. The basic intuition is that the larger is the size of the informal segment, greater the threats inviting regulators. We allow for labour productivity augmenting expenditure F only in the formal sector which can be thought of as a technology that reduces the marginal cost of production. It is possible that such a venture will be difficult to set up in an extra-legal segment. Also as we shall see later that even if the firm can potentially promote such initiative in the informal segment, it might not be optimal for the firm to do so if w_2 is really low. Now in order to optimize surplus a firm faces a trade-off – either an increase of R&D for in-house production or outsourcing to low paid informal workers, or both. If $R(X_1 + X_2)$ is the standard revenue function facing the firm, the firm's optimization problem looks as follows:

$$\text{Max}_{X_1, X_2, F} \pi = R(X_1 + X_2) - w_1 \alpha(F)X_1 - w_2 c(X_2) - Z(F) \hspace{1cm} (2)$$

To produce one unit of X (or X_1) in the formal sector $\alpha(F)$ unit of labour is required. $Z(F)$ is a kind of R&D cost. We assume that the decision on F is taken first and then on

X_1 and X_2 and those can be solved by the backward induction method. The following curvature restrictions are assumed:

$$R' > 0, R'' < 0, \alpha' < 0, \alpha'' > 0, Z' > 0, Z'' > 0, c' > 0, c'' > 0, c''' = 0, X = X_1 + X_2$$

We are not really interested in finding a solution to the level of governance. But in case of strong governance, $g = \bar{g}$ and $b = \bar{b}$, then $\pi = \pi(X_1, F) = \bar{\pi}$. In case of the weak governance, $g = \underline{g}$ and $b = \underline{b}$, then $\pi = \pi(X_2) = \underline{\pi}$. If $\bar{\pi} > \pi > \underline{\pi}$, there exists a solution of a set of X_1, X_2, F where $\underline{g} < g < \bar{g}$ and $\underline{b} < b < \bar{b}$.

From (2) the first order conditions are

$$R' = w_1 \alpha(F). \tag{3}$$

$$R^{/} = w_2 c^{/}(X_2). \tag{4}$$

$$-w_1 \alpha' X_1 = Z'. \tag{5}$$

While solving for (X_1, X_2), F is taken as given. Then we internalize that in equation (5) to determine optimal F. (see Appendix)

From (3) and (4),

$$w_1 \alpha(F) = w_2 c'(X_2). \tag{6}$$

Let $\tilde{X} = c'^{-1}(w_1 \alpha(F)/w_2) = f(w_1 \alpha(F)/w_2)$. $\tag{7}$

Check that for $X < \tilde{X}$, the firm will not employ any formal worker as $w_1 \alpha(F) > w_2 c'(X_2)$. If $X > \tilde{X}$, $X - \tilde{X}$ must be produced in the formal sector as $w_1 \alpha(F) < w_2 c'(X_2)$ for $X > \tilde{X}$. We assume that the size of the market is large enough to accommodate both in-house production as well as outsourcing (Fig. 1). Technically, this implies a $\bar{X}$ such that,

$$R'(\overline{X}) = w_1\alpha(F).\tag{8}$$

With $\overline{X} > \widetilde{X}$.

This also implies that if the market size is not large enough only informal workers will be hired. Therefore, the firm will outsource $\widetilde{X} = X_2$ units to the informal sector and produce $(\overline{X} - \widetilde{X})$ in-house. Note that in presence of good governance, the probability of being caught by the industrial officer and/or the punishment cost will be higher and the $w_2 c'(X_2)$ curve will be shifted upward. As a result, X_2 will shrink and X_1 will rise.

Figure 1: Allocation of formal-informal production (given *F)*
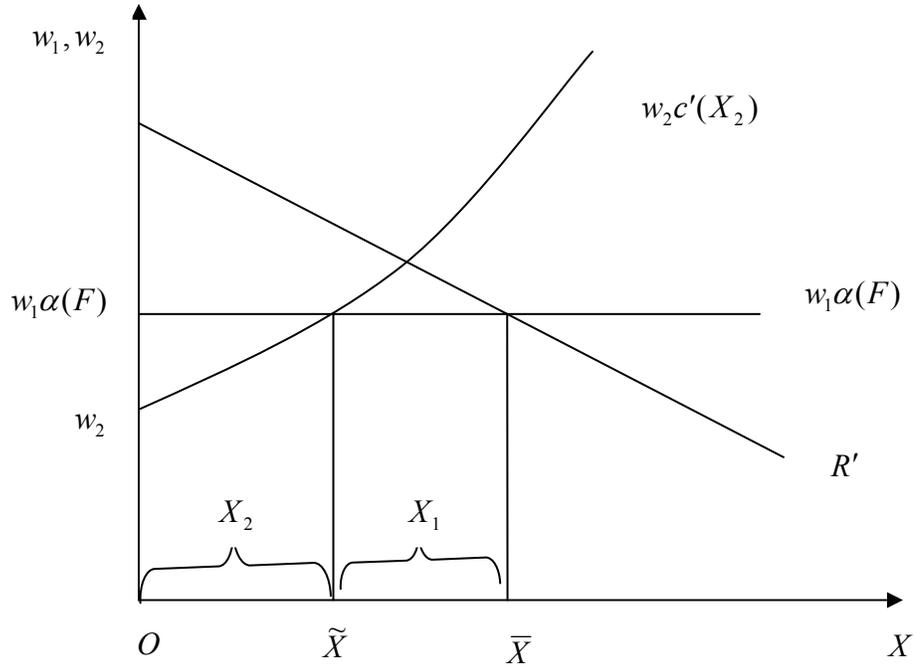
Note that these solutions are derived for a given value of *F.* We are following a backward induction method by which $\overline{X}$ and $\widetilde{X}$ are solved as functions of *F*, then $(\overline{X} - \widetilde{X}) = X_1$ is substituted in (8) to solve for *F*.

Since $\alpha(F)$ denotes the inverse of labour productivity in the formal sector, our task is to check how F responds to changes in w_1 and w_2 - the formal and informal wage rate. Rewriting and assuming F^* is the optimal R&D to start with we have, therefore,

$$\frac{dF^*}{dw_1} = \frac{1}{\Delta}\left[\alpha'(\overline{X} - \widetilde{X}) + w_1\alpha'\frac{d(\overline{X} - \widetilde{X})}{dw_1}\right], \tag{9}$$

and

$$\frac{dF^*}{dw_2} = \frac{1}{\Delta}\left[w_1\alpha'\frac{d(\overline{X} - \widetilde{X})}{dw_2}\right], \tag{10}$$

Where $\Delta = -w_1\alpha''X_1 - Z'' < 0$ (by the second order condition guaranteeing the optimality of F^*).

Now, $R'(\overline{X}) = w_1\alpha(F)$, $\tag{11}$

Given $R'' < 0$, $\overline{X} = \phi(w_1\alpha(F))$ with $\phi' < 0$ $\tag{12}$

Similarly, $\widetilde{X} = f\left(\frac{w_1\alpha(F)}{w_2}\right)$, $f' > 0$ $\tag{13}$

Therefore, $\dfrac{d(\overline{X} - \widetilde{X})}{dw_1} = \phi'\alpha - f'\dfrac{\alpha}{w_2} < 0$ $\tag{14}$

and $\dfrac{d(\overline{X} - \widetilde{X})}{dw_2} = f'\dfrac{w_1\alpha(F)}{w_2^2} > 0$ $\tag{15}$

Hence, from (9) and (10), we can write

$$\frac{dF^*}{dw_1} = \frac{1}{\Delta}\left[\alpha'(\phi - f) + \alpha w_1\alpha'(\phi' - \frac{f'}{w_2})\right]\underset{<}{\overset{>}{=}}0 \tag{16}$$

$$\frac{dF^*}{dw_2} = \frac{1}{\Delta}\left[w_1\alpha'(f'\frac{w_1\alpha}{w_2^2})\right] > 0 \tag{17}$$

Therefore, we can write down the following propositions:

Proposition I: *A rise of informal wage, not formal wage, must improve R&D and labour-productivity in the formal sector.*

Proof: From (16), we find that $\dfrac{dF^*}{dw_1}$ could be positive or negative depending on the conditions of the right-hand side of the expression. Therefore, the change in labour productivity in the formal sector is given by,

$$\frac{d\left(\dfrac{1}{\alpha(F)}\right)}{dw_1} = -\frac{1}{\alpha^2}\alpha'(F^*)\frac{dF^*}{dw_1} \underset{>}{\overset{<}{=}} 0 \qquad \text{QED.}$$

So, the higher wage in formal sector is not highly correlated to the labour productivity of the sector. A rise of formal wage has two counteracting effects on F. It pushes up to go for more informal workers cutting down in-house production and F. At the same time, expensive labour will be substituted by F. Therefore, the net effect on F and the resultant productivity of formal sector workers are ambiguous.

Proof: From (17), we find that $\dfrac{dF^*}{dw_2} > 0$. Therefore, the change in labour productivity in the formal sector is given by,

$$\frac{d\left(\dfrac{1}{\alpha(F)}\right)}{dw_2} = -\frac{1}{\alpha^2}\alpha'(F^*)\frac{dF^*}{dw_2} > 0 \qquad \text{QED.}$$

A higher w_2 induces greater production in the formal sector increasing the marginal benefit from R&D. F increases and $\alpha(F)$ drops making labour more productive in the formal sector.

Labour Market and Wage

Yet we have not considered labour markets for the determination of wages. In this case, the stages of the game will be a little different from the earlier one. Here, F and the sectoral outputs will be determined respectively, at first and third stage and wages will be determined separately in respective labour markets at the second stage. As earlier, the objective function of a formal producer is eq. (1) and as per backward induction method, sectoral outputs, wages and R&D will be solved, respectively.

Since the objective function is the same, the optimum output in the formal and informal sector are as earlier, i.e., $X_2 = \tilde{X} = f(\dfrac{w_1\alpha}{w_2})$ and

$$X_1 = X - \tilde{X}_2 = \phi(w_1\alpha) - f(\frac{w_1\alpha}{w_2}).$$

We assume that wage in the formal sector is set by the trade union and formal firm takes it at $w_1 = \overline{w}$. So it is exogenously fixed to the firm. However, the wage can vary across the regions or states depending upon the strength of labour market institutions and government attitude towards workers, etc. So, the labour employed at the formal sector will be ,

$$L_1 = \alpha X_1 = \alpha\left[\phi(w_1\alpha) - f(\frac{w_1\alpha}{w_2})\right]. \tag{18}$$

Now, the workers, who do not find employment in the formal sector, will crowd into the inform sector and labour supply to the informal sector is residual, i.e., $L^s{}_2 = \overline{L} - \alpha X_1$,

where $\dfrac{\partial L^s{}_2}{\partial w_2} = \alpha f'\dfrac{w_1\alpha}{w_2{}^2} > 0$. So, the supply function of informal labour is positively sloped.

Let us assume that the production for one unit of X_2 requires one unit of informal labour, i.e., $L_2 = X_2$. Therefore, one can write the demand function of informal workers as

$$L^d{}_2 = f(\frac{w_1\alpha}{w_2}) \tag{19}$$

Where $\frac{\partial L_2^d}{\partial w_2} = -f'\frac{w_1\alpha}{w_2} < 0$. So, the demand function is negatively sloped. Note that the absolute value of the slope of supply is less than that of the demand function which is precondition for the stability condition. The equilibrium wage will be determined by equating demand and supply equation as follows:

$$L_2^s = L_2^d \text{ or } \overline{L} - \alpha\left\{\phi(w_1\alpha - f(\frac{w_1\alpha}{w_2}))\right\} = f(\frac{w_1\alpha}{w_2}).$$

From this relation, we solve w_2, which is a function of w_1:

$$w_2 = \frac{w_1\alpha}{g\left\{\dfrac{\overline{L} - \alpha\phi(w_1\alpha)}{1-\alpha}\right\}}, \quad g' > 0 \text{ as } f' > 0. \tag{20}$$

Proposition II: *Even if we endogenise the informal wage, (i) a rise of formal wage does not necessarily influence the informal wage, (ii) R&D and labour productivity in the formal sector firm would not necessarily be positively related to formal wage.*

Proof: Differentiating eq. (20) with respect to w_1, we get,

$$\frac{\partial w_2}{\partial w_1} = \alpha h - w_1\alpha h'(.)\frac{(1-\alpha)\alpha^2\phi'(w_1\alpha)}{\left\{\overline{L} - \alpha\phi(w_1\alpha)\right\}^2} \underset{>}{\overset{\leq}{=}} 0. \tag{21}$$

Both the first and second term of (21) is positive and hence the direction is ambiguous. Therefore, a rise of formal wage does not necessarily push up the informal wage. The basic intuition is that the rise of formal wage influences both supply and demand for informal workers in different directions. If the trade union sets higher w_1, the formal

16

sector firm will substitute formal for the informal worker and demand for informal workers must rise. On the other hand, those workers, who will be released from the formal sector, will crowd informal sector and increase supply of the informal workers. So, the relative strength of the supply and demand for the informal workers will determine the informal wage depending upon the quality of governance, rigidity of trade unions and extra-legal cost for hiring informal workers.

We have already derived w_2 and in order to derive F, we have to replace w_2 on (1) using (20). Because, w_2 is now no longer an exogenous variable, rather it is dependent upon w_1. Now, our task is to solve F in order to see the effect of wage on it. In stead of solving (1), simply it can be written as a product of two effects, i.e., $\frac{dF}{dw_1} = \frac{dF}{dw_2}\frac{dw_2}{dw_1}$. The first part of right hand side relates the effect of w_2 on F when w_2 is exogenous and that is positive (see 17). The second part of that relates the effect w_1 on w_2 and this is ambiguous. So, the resultant effect of w_1 on F is also ambiguous, i.e., $\frac{dF}{dw_1} \gtrless 0$. We can also write the effect of w_1 on labour productivity as follows:

$$\frac{d\left(\frac{1}{\alpha(F)}\right)}{dw_1} = -\frac{1}{\alpha^2}\alpha'(F^*)\frac{dF^*}{dw_1} \lessgtr 0 \, (\text{QED})$$

Looking at these results, one can argue that if the formal wage pushes up the informal wage, both R&D and labour productivity in the formal sector can increase and only the rise of formal wage does not ensure the increase of R&D and labour productivity of the sector.

Section III: Concluding Remarks

This short paper is a follow up to some of the earlier analysis of formal-informal interaction when either there is a vertical link between outputs produced in two segments or a part of the produce is contracted out to the informal enterprises. Empirically we observe a high correlation between informal wage and formal productivity, but not between formal wage and productivity both in the pooled and panel regressions.

It is argued that a developing economy with a higher rate of poverty strategically chooses 'weak governance' to bypass the labour and industrial laws and allows 'extra-legal' transaction and a thriving informal sector in order to tackle the poverty and unemployment problem which assuages the possibility of social unrest. If so, we develop a framework to argue that, given the level of weak governance and labour market rigidity of formal workers, a formal sector firm strategically subcontracts to the informal sector in order to minimize wage cost and cut down in-house R&D investment. And, this acts as a binding condition of the productivity improvement of formal workers. The higher the difference of wages between the two segments the greater will be the subcontracts to the informal sector and hence a relatively low informal wage hurts the R&D and resultant productivity in the formal sector. In other words, a relatively prosperous informal worker raises the amount of output produced in-house within the organized sector. This tends to increase labour saving R&D in the formal sector as the operation expands there and we have a higher productivity of formal workers. This goes against the conversional belief of a positive relationship between wage and productivity of a formal sector firm. One policy message can be drawn from this result - if informal wage can be raised, not only it will

18

promote the welfare of the informal sector workers but it also will promote the productivity growth of the formal sector.

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Appendix

$$\pi = R(X) - w_1\alpha(F)X_1 - w_2C(X_2) - Z(F) \tag{1A}$$

Backward induction method

$$\frac{\partial\pi}{\partial X_1} = 0 \Rightarrow R' = w_1\alpha \tag{2A}$$

$$\frac{\partial\pi}{\partial X_2} = 0 \Rightarrow R' = w_2C' \tag{3A}$$

$[X_1(F), X_2(F)]$ solve the system given w_1, w_2 and other parameters.

$$\pi(F) = R[X_1(F) + X_2(F)] - w_1\alpha(F)X_1(F) - w_2C(X_2(F)) - Z(F) \tag{4A}$$

$$\frac{d\pi}{dF} = 0 \Rightarrow \frac{\partial\pi}{\partial X_1^0}\frac{dX_1^0}{dF} + \frac{\partial\pi}{\partial X_2^0}\frac{dX_2^0}{dF} - w_1\alpha'X_1 - Z' = 0 \tag{5A}$$

Envelope property ensures $\dfrac{\partial\pi}{\partial X_1^0} = \dfrac{\partial\pi}{\partial X_2^0} = 0$

Yielding (5) in the text.

Table

Table 1: Correlation coefficients across major states of India

Year	Between formal wage and formal labour productivity	Between informal wage and informal labour productivity	Between informal wage and formal labour productivity
1989-90	0.56	0.57	0.17
1994-95	0.55	0.76	0.49
2000-01	0.38	0.84	0.55

Source: NSS (National Sample Survey) reports on unorganised enterprise (46th, 51st and 56th Report) for informal sector data and ASI (Annual Survey of Industries), CSO (Central Statistical Organisation) for formal sector data. Sixteen major states of India have been considered.

Table 2: Regressions on formal productivity

Variables	OLS pooled regression		GLS Fixed Effect Model		GLS Random Effect Model	
Formal wage	0.94		1.14	3.04*		
Informal wage		6.63*			11.8***	12.1***
Openness Index	3372	2640	3429	1327	1990	2423
statistics	F= 9.79 p=0.000	F=9.98 p=0.000	2.15 p=0.04	Rho=0.32 Hausman=0.95	F=6.69 p=0.000	Rho=0.68 Hausman=0.50

Source: NSS (National Sample Survey) reports on unorganised enterprise (46th, 51st and 56th Report) for informal sector data. Sixteen major states in India have been considered. Year = 1989-90, 1994-95, 2000-01. Openness Index of the states is taken from Marjit et al. (2007).

Note: * represents significant at 10% level, ** represents significant at 5%, *** represents significant at 1% level

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