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University of Michigan

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Monopsonistic Competition in Formal and Informal Labor Markets

Ted To

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Abstract

The workhorse of urban labor theory in development economics is the formal/informal model of labor market segmentation and its variants. A key prediction of the competitive theory of formal and informal labor markets is that if labor costs in the formal market increase, formal market employers lay off workers who move to the informal market, increasing informal labor supply and depressing informal market wages. However, there is considerable evidence that suggests that higher wages in the formal labor market are often associated with higher wages in the informal market. While it is possible to augment the standard theory to yield results consistent with this apparent inconsistency I choose instead to depart from the usual competitive framework. In particular, I consider the theory of formal and informal labor markets under oligopsony/monopsonistic competition.

1 Introduction

The workhorse of urban labor theory in development economics is the formal/informal model of labor market segmentation and its variants. The basic story is that the formal labor market is subject to regulation (e.g., payroll taxes, mandatory benefits, minimum wages, etc.), the informal market is not and perfect competition equilibrates labor supply and labor demand in each of these markets. Workers and/or firms may be mobile across markets. One of its key predictions is that if labor costs in the formal market increase, formal market employers lay off workers who move to the informal market, increasing informal labor supply and depressing informal market wages.

The evidence, however suggests that this is not necessarily the case. In particular, there is evidence that higher wages in the formal labor market are often associated with higher wages in the informal market. As one example, Gindling and Terrell (2005) look at formal and informal workers and find that formal and informal wages both increase with an increase in minimum wages.

Modifications can be made to the standard theory which yield results consistent with this apparent inconsistency. For example, if queuing up for more highly paid formal sector jobs requires being unemployed, then an increase in formal sector wages can lead to an increase in informal sector wages when formal sector labor demand is sufficiently inelastic (Gramlich, 1976; Hamermesh, 1993; Card and Krueger, 1995). Alternatively, in a small open economy an increase in formal sector wages raises wages in the informal sector while reducing the capital rental rate (Harrison and Leamer, 1997). But because it is a small open economy, the increase in labor costs cannot be passed on to consumers as higher prices. As a result, capital moves from the formal sector to the informal sector, driving up wages in the informal sector.

While these embellishments appear to be consistent with the co-movement of formal and informal wages, they rely on assumptions that may be less than believable. The former theory may be sensible in a rural (informal) to urban (formal) migration context (e.g., Harris and Todaro, 1970), however, the requirement that workers must be unemployed to queue for formal sector jobs is less satisfactory in a purely urban environment where it is not clear why workers currently engaged in informal work should be ineligible for formal sector jobs. Similarly, the latter theory requires capital to be mobile between the formal and informal sectors. While capital mobility from large, formal enterprises to informal enterprises may make sense in some cases, it is less plausible that small informal mom-and-pop businesses

have the same access to financing that large formal businesses have.

An alternative is to depart from the usual competitive framework. Within the realm of imperfectly competitive models of labor markets are efficiency wage models (Albrecht and Vroman, 1998), job search models (Mortensen and Burdett, 1998) and oligopsony/monopsonistic competition models (Bhaskar et al., 2002). Because they are dynamic models, efficiency wages and search involve a good deal of technical machinery and as such are more cumbersome for policy analysis.

Since, at the end of the day, development economists are interested in policy analysis, I model imperfectly competitive formal and informal labor markets using a "monopsony-type" model of labor markets. Spacial models like those used in Bhaskar and To (1999) and Bhaskar et al. (2002) are useful for certain types of analyses. However, because of the asymmetric nature of employer interactions in these models, they become less appealing when employers are heterogeneous (e.g., Bhaskar and To, 2003). For this analysis I will use an alternative formulation where employers interact with one another in a symmetric fashion, similar in flavor to a Dixit-Stiglitz model of monopolistic competition.

Under oligopsony or monopsonistic competition, it is immediately apparent that typical policy exercises will yield different results from the competitive, formal/informal model of labor market segmentation. For example, under oligopsony, a decrease in payroll taxes that leads to an increase in formal sector wages will increase employment in the formal sector. This increase in formal sector employment and wages has a spillover effect on the informal labor market. With a decrease in payroll taxes, formal sector employment rises, decreasing informal sector labor supply, driving informal sector wages up. Similarly, a moderate increase in the minimum wage reduces the marginal labor cost (in contrast to average labor cost), resulting in an increase in employment in the formal sector and as a result, labor supply in the informal sector will fall, driving up informal sector wages. In both cases, there is co-movement between formal and informal wages. Similar analyses can be conducted for the case when employers can freely enter and exit both the formal and informal labor markets (i.e., monopsonistic competition).

Using a CES (constant elasticity of substitution) utility function, the establishment level elasticity of labor supply is approximately constant. I then respectively analyze the effect of changes in the payroll tax and a minimum wage on formal and informal market employment. In order to examine informal wage spillovers from these policy changes, I then dispense with the assumption of constant elasticity of labor supply and conduct some

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numerical computations.

2   The Model

To ensure that labor supply is imperfectly elastic, we assume that different jobs have different non-wage characteristics. These include the job specification, hours of work, distance of the firm from the worker's home, the social environment in the workplace, etc. The importance of non-wage characteristics has been recognized in the theory of compensating differentials, which is a theory of vertical differentiation. Some jobs are good while other jobs are bad, and wage differentials compensate workers for these differences in characteristics. We assume that jobs are *horizontally differentiated* so that workers have heterogenous preferences over these characteristics. Mc-Cue and Reed (1996) provide survey evidence of horizontal heterogeneity in worker preferences. Heterogeneous preferences over non-wage characteristics ensures that each employer has market power in wage setting, even if it competes with many other employers.

Suppose that a representative worker has utility function:

$$U = I^\alpha L^{1-\alpha} \tag{1}$$

where I is money income, L is the fraction of total time spent in leisure and α determines the representative worker's preferences between income and leisure. If w_j is the wage rate at job j and l_j is the time spent at job j, then total income is

$$I = \sum_{j=1}^{N} w_j l_j.$$

and total leisure is

$$L = 1 - \left(\sum_{j=1}^{N} l_j{}^\rho \right)^{\frac{1}{\rho}}$$

where $\left(\sum_{j=1}^{N} l_j{}^\rho \right)^{\frac{1}{\rho}}$ is aggregate labor supplied, N is the number of employers and ρ determines the elasticity of labor supply. Assume U is concave; sufficient conditions for concavity are $\rho > 1$.

Consider this to be the reduced form utility function for the labor market as a whole where workers have heterogenous preferences over jobs. For example, Anderson et al. (1992) have demonstrated for the product market that heterogenous consumers can be represented in aggregate with a representative utility function.

Given a set of wage offers, the worker maximizes utility by choosing how to allocate her work time amongst the N employers. Her first order condition is:

$$\frac{\partial U}{\partial l_k} = \alpha w_k \left(\frac{L}{I}\right)^{1-\alpha} - (1-\alpha)\left(\frac{I}{L}\right)^{\alpha}\left(\sum_{j=1}^{N} l_j{}^{\rho}\right)^{\frac{1}{\rho}-1} l_k^{\rho-1} = 0. \qquad (2)$$

Some straightforward manipulation shows that

$$L = 1 - \alpha \qquad (3)$$

That is, the fraction of time spent at leisure activities is fixed at $1-\alpha$. The representative worker's problem in this case becomes the simpler one of maximizing income subject to the condition that the labor quantity index, $(\sum l_i^{\rho})^{1/\rho} \leq \alpha$.

Using the methods in Dixit and Stiglitz (1977), it is straightforward to show that labor supply is given by:

$$l_k = \alpha \left(\frac{w_k}{\tilde{w}}\right)^{\frac{1}{\rho-1}} \qquad (4)$$

where $\tilde{w}$ is a wage index given by:

$$\tilde{w} = \left(\sum_{j=1}^{N} w_j{}^{\beta}\right)^{\frac{1}{\beta}} \qquad (5)$$

where $\beta = \rho/(\rho - 1)$. When N is relatively large, the effect of a change in w_k on $\tilde{w}$ is approximately zero. As such, the elasticity of labor supply is approximately

$$\varepsilon = \frac{1}{\rho - 1} \qquad (6)$$

Since $\rho > 1$, labor supply is not infinitely elastic at the establishment level, as under perfect competition.

Assume that there are n_f and n_i employers (where $n_f + n_i = N$) in the formal and informal labor markets where formal sector employers are numbered $k = 1, 2, \ldots, n_f$ and informal sector employers are numbered $k = n_f + 1, n_f + 2, \ldots, N$. In the formal labor market, in addition to the wage, employers are subject to a payroll tax of t_f per dollar per hour. Employers have marginal revenue products of ϕ_f and ϕ_i where $\phi_f/(1 + t_f) > \phi_i$ so that, net of payroll taxes, employers in the formal labor market are more productive.

Employer k chooses w_k to maximize its profit:

$$\pi_k = (\phi_k - (1 + t_k)w_k)l_k \tag{7}$$

where $t_k = t_f$ if employer k is a formal market employer and $t_k = 0$ if employer k is an informal market employer. Employer k's first order condition is:

$$(\phi_k - (1 + t_k)w_k)\frac{\partial l_k}{\partial w_k} - (1 + t_k)l_k = 0$$

implying an equilibrium wage of

$$w_k^* = \frac{\phi_k}{(1 + t_k)\rho}. \tag{8}$$

Since $\rho > 1$, workers are paid less than their marginal product, net of t_k and since $\phi_f/(1 + t_f) > \phi_i$, workers in the formal labor market are paid more than those in the informal labor market (i.e., $w_f^* > w_i^*$). Since all formal market employers pay wage w_f^* and informal market employers pay w_i^*, establishment level employment is given by:

$$l_t^* = \alpha \left(\frac{w_t^*}{(n_f w_f^{*\beta} + n_i w_i^{*\beta})^{\frac{1}{\beta}}} \right)^{\frac{1}{\rho - 1}} \tag{9}$$

where $t = f$ for a formal market employer and $t = i$ for an informal market employer.

3 Payroll taxes

Since equilibrium wages are a decreasing function of the rate of payroll taxation (i.e., $\partial w_f^*/\partial t_f = -\phi_f/\rho(1 + t_f)^2 < 0$), a decrease in the payroll tax will lead to an increase in the formal sector wage rate. To examine the effect of a payroll tax decrease, I compute the effect of a formal sector wage increase.

3.1 No entry or exit

Although not necessarily realistic, it is useful and instructive to first consider the case when entry and exit is not prohibited. A decrease in payroll taxes or an increase in the minimum wage both serve to increase w_f. Differentiating (9) with respect to w_f yields:

$$\frac{\partial l_f^*}{\partial w_f^*} = \frac{l_f^*}{w_f^*(\rho - 1)} \frac{n_i w_i^{*\beta}}{n_f w_f^{*\beta} + n_i w_i^{*\beta}} > 0 \tag{10}$$

and

$$\frac{\partial l_i^*}{\partial w_f^*} = -\frac{l_i^*}{w_i^*(\rho - 1)} \frac{n_f w_f^{*\beta}}{n_f w_f^{*\beta} + n_i w_i^{*\beta}} < 0 \qquad (11)$$

Since there is no entry or exit, if establishment level formal employment increases then total formal employment increases. Similarly since establishment level informal employment falls, total informal employment must fall.

3.2 Free entry and exit

Now consider free entry, so that n_f and n_i adjust to eliminate profits. Assume that because of limited capital available for formal enterprises, formal employers have a fixed production cost of $c_f(n_f)$ that is increasing in n_f. On the other hand, that informal employers' capital requirements are much more flexible and as a result, they have constant fixed production cost of c_i. Free entry and exit imply equilibrium employment:

$$l_t^* = \frac{c_t}{\phi_t}\beta. \qquad (12)$$

Note that this implies that under monopsonistic competition with free entry and exit, establishment sizes remain constant.

The equilibrium number of employers in free entry, n_f^* and n_i^*, is given by the solution to equations (9) and (12), i.e., n_f^* and n_i^* solve:

$$(n_f w_f^{*\beta} + n_i w_i^{*\beta}) \left(\frac{c_f(n_f)\beta}{\phi_f \alpha}\right)^\rho = w_f^{*\beta} \qquad (13)$$

and

$$(n_f w_f^{*\beta} + n_i w_i^{*\beta}) \left(\frac{c_i \beta}{\phi_i \alpha}\right)^\rho = w_i^{*\beta} \qquad (14)$$

These can be straightforwardly solved for n_i as a function of n_f:

$$n_i^f(n_f) = \left[\left(\frac{\phi_f \alpha}{c_f(n_f)\beta}\right)^\rho - n_f\right] \left(\frac{w_f^*}{w_i^*}\right)^\beta$$

and

$$n_i^i(n_f) = \left(\frac{\phi_i \alpha}{c_i \beta}\right)^\rho - n_f \left(\frac{w_f^*}{w_i^*}\right)^\beta$$
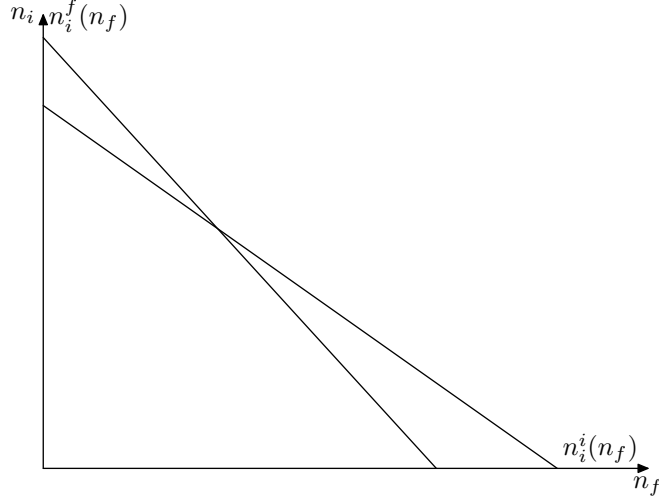
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Figure 1: Equilibrium number of employers

To consider conditions under which a solution exists, differentiate each of these with respect to n_f,

$$\frac{\partial n_i^f}{\partial n_f} = -\left[\left(\frac{\phi_f \alpha}{c_f(n_f)\beta}\right)^\rho \frac{c_f'(n_f)\rho}{c_f(n_f)} + 1\right]\left(\frac{w_f^*}{w_i^*}\right)^\beta$$

and

$$\frac{\partial n_i^i}{\partial n_f} = -\left(\frac{w_f^*}{w_i^*}\right)^\beta$$

Note first that $\partial n_i^f \partial n_f < \partial n_i^i \partial n_f < 0$. Thus a necessary condition for a solution is that $n_i^f(0) > n_i^i(0)$ for which $\phi_f/c_f(0) > \phi_i/c_i$ is sufficient. Next note that in order that there is an intersection, it must be that $c_f'(n_f)/[c_f(n_f)]^{\rho+1}$ should not fall too quickly. One such example is

$$c_f(n_f) = \rho\left(\frac{1}{K - n_f}\right)^{\frac{1}{\rho}}$$

for some constant K and $n_f < K$. In this case, $c_f'(n_f)/[c_f(n_f)]^{\rho+1}$ is constant at 1. Finally, it must be that the difference between $n_i^f(0)$ and $n_i^i(0)$ is not too large. These ideas are illustrated in Figure 3.2.

Having established conditions for the existence of an equilibrium where both n_f^* and n_i^* are positive, we can now consider how n_f^* and n_i^* change in

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response to a change in the rate of payroll taxation. Totally differentiating (13) and (14) with respect to n_f^*, n_i^* and w_f^* and rewriting in matrix notation:

$$
\begin{bmatrix} w_f^{*\beta} \left(\frac{c_f(n_f^*)\beta}{\phi_f \alpha} \right)^\rho \left(1 + \frac{n_f^* w_f^{*\beta} + n_i^* w_i^{*\beta}}{n_f^* w_f^{*\beta}} \rho \xi_f \right) & w_i^{*\beta} \left(\frac{c_f(n_f^*)\beta}{\phi_f \alpha} \right)^\rho \\ w_f^{*\beta} \left(\frac{c_i \beta}{\phi_i \alpha} \right)^\rho & w_i^{*\beta} \left(\frac{c_i \beta}{\phi_i \alpha} \right)^\rho \end{bmatrix} \begin{bmatrix} \frac{dn_f^*}{dw_f^*} \\ \frac{dn_i^*}{dw_f^*} \end{bmatrix}
$$
$$
= \begin{bmatrix} -\beta w_f^{*\beta-1} \left[n_f^* \left(\frac{c_f(n_f^*)\beta}{\phi_f \alpha} \right)^\rho - 1 \right] \\ -\beta w_f^{*\beta-1} n_f^* \left(\frac{c_i \beta}{\phi_i \alpha} \right)^\rho \end{bmatrix} \quad (15)
$$

where ξ_f is the formal-employer, fixed-production-cost elasticity with respect to n_f^*. Let D be the determinant of the first matrix; after some simplification,

$$
D = w_f^{*\beta} \left(\frac{c_f(n_f^*)\beta}{\phi_f \alpha} \right)^\rho w_i^{*\beta} \left(\frac{c_i \beta}{\phi_i \alpha} \right)^\rho \left(\frac{n_f^* w_f^{*\beta} + n_i^* w_i^{*\beta}}{n_f^* w_f^{*\beta}} \right) \rho \xi_f > 0
$$

Using Cramer's rule and simplifying, an increase in the formal-employer wage rate (e.g., from a payroll tax decrease) will have the following effects on the number of employers in the formal and informal labor markets:

$$
\frac{dn_f^*}{dw_f^*} = \frac{n_f^* \beta w_f^{*\beta-1}}{\left(\frac{c_f(n_f^*)\beta}{\phi_f \alpha} \right)^\rho (n_f^* w_f^{*\beta} + n_i^* w_i^{*\beta}) \rho \xi_f} > 0 \quad (16)
$$

and

$$
\frac{dn_i^*}{dw_f^*} = -\frac{n_f^* \beta w_f^{*\beta-1} \left[\left(\frac{c_f(n_f^*)\beta}{\phi_f \alpha} \right)^\rho (n_f^* w_f^{*\beta} + n_i^* w_i^{*\beta}) \rho \xi_f + w_f^{*\beta} \right]}{w_i^{*\beta} \left(\frac{c_f(n_f^*)\beta}{\phi_f \alpha} \right)^\rho (n_f^* w_f^{*\beta} + n_i^* w_i^{*\beta}) \rho \xi_f}
$$
$$
< -\frac{n_f^* \beta w_f^{*\beta-1}}{w_i^{*\beta}} < 0 \quad (17)
$$

Since establishment level employment in the formal and informal sectors are constant and the formal (informal) number of employers increases with an increase in the formal sector wage rate, total formal (informal) employment increases (decreases). By extention, since a decrease in the payroll tax leads to an increase in the formal sector wage, a payroll tax decrease results in an increase in formal sector employment and a decrease in informal sector employment.

3.3 Wage effects

To be done.

4 Minimum wages

4.1 No entry or exit

For a moderately chosen minimum wage, a minimum wage reduces the marginal cost of labor (Stigler, 1946) and formal market employers will hire as many additional workers as are willing to work for them at the minimum. Thus without entry or exit, the analysis is idential to that for payroll taxes and a minimum wage will increase formal sector employment while reducing informal sector employment.

4.2 Free entry and exit

With minimum wages, the profit maximizing calculus changes and as a result, free entry instead implies:

$$(\phi_f - (1 + t_f)w_m)l_f = c_f(n_f)$$

or

$$l_f^m = \frac{c_f(n_f^m)}{\phi_f - (1 + t_f)w_m} \tag{18}$$

In constrast to the analysis of payroll taxes, a minimum wage will increase the size of formal sector establishments under free entry and exit.

Together (18) and (9) imply:

$$(n_f^m w_m{}^\beta + n_i^m w_i{}^\beta)\left(\frac{c_f(n_f^m)}{\alpha}\right)^\rho = w_m{}^\beta(\phi_f - (1 + t_f)w_m)^\rho \tag{19}$$

Totally differentiating (19) and (14) with respect to n_f^m, n_i^m and w_m and evaluating at $w_m = w_f^*$:

$$\begin{bmatrix} w_m{}^\beta \left(\frac{c_f(n_f^m)}{\alpha}\right)^\rho \left[1 + \frac{n_f^m w_m{}^\beta + n_i^m w_i^{*\beta}}{n_f^m w_m{}^\beta}\rho\xi_f\right] & w_i{}^\beta \left(\frac{c_f(n_f^m)}{\alpha}\right)^\rho \\ w_m{}^\beta \left(\frac{c_i\beta}{\phi_i\alpha}\right)^\rho & w_i{}^\beta \left(\frac{c_i\beta}{\phi_i\alpha}\right)^\rho \end{bmatrix} \begin{bmatrix} \frac{dn_f^m}{dw_m} \\ \frac{dn_i^m}{dw_m} \end{bmatrix}$$

$$= \begin{bmatrix} -n_f^m \beta w_m{}^{\beta-1}\left(\frac{c_f(n_f^m)}{\alpha}\right)^\rho \\ -\beta w_m{}^{\beta-1}n_f^m\left(\frac{c_i\beta}{\phi_i\alpha}\right)^\rho \end{bmatrix} \tag{20}$$

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Again, we can use Cramer's rule to derive the effect of a change in the minimum wage on the equilibrium number of firms. After simplifying:

$$\left.\frac{dn_f^m}{dw_m}\right|_{w_m=w_f^*} = 0 \tag{21}$$

and

$$\left.\frac{dn_i^m}{dw_m}\right|_{w_m=w_f^*} = -\frac{n_f^m \beta w_m^{\beta-1}}{w_i^{*\beta}} < 0 \tag{22}$$

That is, an increase in a just binding minimum wage results in no exit of formal employers but induces exit among informal employers. Although at an individual level, a minimum wage reduces profitability and induces exit, in aggregate, a minimum wage results in an increase in labor supply to the formal sector, increasing profitability. In net, these opposing effects cancel with the result that there is no extry or exit to the formal labor market. However, this result must be kept in perspective. Similar to the envelope theorem arguments used in Card and Krueger (1995) and Rebitzer and Taylor (1995), at the margin, a minimum wage will have a negligible effect of formal employer profitability—a large increase in the minimum wage will undoubtedly result in the exit of formal sector employers. Since some informal sector workers move to the formal sector, labor supply in the informal sector falls, reducing profitability of informal sector employers, resulting in firm exit in the informal sector.

Using these results, consider total employment:

$$E = n_f^m l_f^m + n_i^m l_i^*$$

Differentiating this with respect to w_m and simplifying,

$$
\begin{aligned}
\left.\frac{\partial E}{\partial w_m}\right|_{w_m=w_f^*} &= n_f^m \frac{\partial l_f^m}{\partial w_m} + l_i^* \frac{dn_i^m}{dw_m} \\
&= \frac{n_f^m l_f^m}{(\rho-1)w_m}\left[1 - \rho \frac{l_i^*}{l_f^m}\frac{w_m^\beta}{w_i^{*\beta}}\right] \\
&= \frac{n_f^m l_f^m}{(\rho-1)w_m}\left[1 - \rho \left(\frac{w_m}{w_i^8}\right)^{-\frac{1}{\rho-1}}\left(\frac{w_m}{w_i^*}\right)^\beta\right] \\
&= \frac{n_f^m l_f^m}{(\rho-1)w_m}\left[1 - \rho \frac{w_m}{w_i^*}\right]
\end{aligned}
$$

Since $w_f^* > w_i^*$ and $\rho > 1$, $\partial E/\partial w_m < 0$ and in aggregate, employment falls.

4.3 Wage effects

To be done.

5 Conclusions

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