

# MONITORING COSTS, CREDIT CONSTRAINTS AND ENTREPRENEURSHIP\*

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### Abstract

*Access to finance is seen as a binding constraint on the growth of household enterprises in developing countries. We develop a principal-agent model of a household enterprise and show that limited access to finance and monitoring costs constrain the firm size via both a direct and indirect effect. While greater access to finance has a positive direct effect on the hiring of paid labour, firms may not choose to expand and use paid labour, via an indirect route which operates through the monitoring costs of employing paid workers. We use large nationally representative surveys of household enterprises in Indian manufacturing and find support for the predictions of our theory.*

**Key-words:** entrepreneurship, monitoring costs, credit constraint, household enterprises, India.

**JEL Classification Codes:** D21, G10, O17.

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## I. INTRODUCTION

An important stylized fact in low income countries is the presence of a large number of very small household enterprises in the informal sector which mostly employ family labour. Such firms rarely make the transition to the formal sector or grow in size by hiring labour from the outside market (Gollin, 2008; Woodruff, 2012).<sup>1</sup> The presence of such a large number of micro sized household enterprises in developing countries along with their lack of growth is often attributed to credit constraints that do not allow these firms to increase in size (Hurst and Lusardi, 2004). For example, in the case of Vietnam, Rand (2007) shows that between 14 per cent and 25 per cent of enterprises are credit constrained. Similarly, Banerjee and Duflo (2008) and Paulson and Townsend (2004) also find the presence of credit constraints among small firms in India and Thailand. However, for very small owner-managed enterprises, rates of return to capital can greatly exceed borrowing costs (de Mel *et al.*, 2008; Cotler and Woodruff, 2008), and the relatively small amount of external funds that they require to grow may not be difficult to obtain from friends, family and business partners. Therefore, while credit constraints play an important role in determining the size of a firm, they cannot be the full explanation of why household enterprises in low income countries do not grow in size, and why owner-entrepreneurs do not become employers of wage labourers.<sup>2</sup>

In this paper, we argue that the frictions in labour market in the form of monitoring costs of employing non-family labour exacerbates the problems of credit constraints and create obstacles for a small firm to grow in size. We show that the frictions stemming from supervision of labour may divert precious entrepreneurial time away from more productive tasks like product innovation or service delivery to monitoring of a worker's activities. This leads to higher probability of failures of projects and increased wage costs of hired labour, thereby hindering the growth of family based firms.

The basic tenet of our argument is as follows: much of the entrepreneurial activities for the self-employed involve performing and coordinating multiple tasks. A successful entrepreneur, at least in the in the initial stages of the venture, gets involved in the development, design and marketing of the product as well as in the actual process of production.<sup>3</sup> These tasks become relatively easier when the unit itself is in the beginning stage when all stakeholders are family members. However, when the production unit starts expanding its operation, an entrepreneur needs to hire outside workers and secure finance beyond family ties (King and Levine, 1993a, 1993b). However, approaching both labour markets for recruiting workers and credit markets to secure funds simultaneously for financing wage bills and related costs could expose an entrepreneur to agency problems from dual sources. The banks or creditors may ration credit to a new firm run by an entrepreneur due to lack of information or track record about the project. On the other hand, an entrepreneur may face problems as labour recruited from an anonymous labour market may shirk, which may force the entrepreneur to divert time from productive activities to monitoring of workers. In addition, a larger incentive payment to incentivize outside workers tends to raise costs of recruitment and further tightens the credit constraints.<sup>4</sup>

Set in the context of such dual constraints originating from credit and labour markets, the paper addresses the following sets of questions: (a) how do financing constraints in the credit market and, costs of monitoring workers hired from the labour market affect the allocation of entrepreneur's time between productive activities and monitoring of non-family labour? (b) What is their joint impact on the size of the firm measured by the hiring of magnitude of non-family labour? In particular, to what extent do monitoring costs of outside workers constrain entrepreneurship in low income countries and the growth of household enterprises which also encounter rationing of credit?

First, we show that both monitoring costs and credit constraints unambiguously reduce the number of hired labour compared to the benchmark case where both frictions are absent. The same circumstances also reduce entrepreneurial time devoted to productive activities leading to more frequent failures of projects. More surprisingly, our model predicts that even with relaxation of credit constraint and greater access to finance, the firm may not hire more outside labour if the relative magnitude of the frictions in the labour market tends to be larger than the frictions emanating from the credit market and this may inhibit the growth of the firm. We show that whether the relaxation of the credit constraint would lead to an increase in the size of the firm would depend on the relative magnitudes of the productivity gains of hiring outside workers versus the higher monitoring costs of outside workers. We show that greater access to external finance has a positive direct effect on the hiring of paid labour. However, firms may not choose to expand and use outside workers, even with the relaxation of credit constraints via the indirect route which operates through the increased monitoring costs of employing paid workers.

We then use an unique data-set comprising large nationally representative surveys of small and micro-enterprises in Indian manufacturing which provides information on the use of hired and family labour and relevant firm characteristics for 2000-01 and 2005-06 and explore whether our argument on the importance of monitoring costs in influencing the relationship between the easing of credit constraints and the firm's demand for outside labour usage finds empirical support by pooling the data for these two years. We find evidence of a possible non-monotonic relationship between the firm's magnitude of borrowing and the hiring of non-family labour, and show that this relationship depends negatively on the inverse of productivity and on the wage premium of non-family workers (that is, what the firm pays to the worker over and above the reservation wage).

The remainder of the paper is in four parts. In the next section, we develop our theoretical model. Section III proposes the empirical specification, discusses the econometric methodology and describes the data. In Section IV, we provide some descriptive statistics and discuss the econometric results. Section V concludes.

## II. THE MODEL

Consider an entrepreneur who has a project which generates an uncertain outcome and the probability of success of the project depends on the amount of time devoted by the entrepreneur to tasks specific to prevent its failures. Let  $\lambda$  be the time allocated by an entrepreneur towards marketing, designing or setting quality standards of the product or anything that boosts directly the probability of success of the project. We denote  $\mu$  to be the time devoted to monitoring of hired labour from outside market. That is, once the design of the product is completed and is successful to some degree, the actual production, if carried out by the hired worker, needs supervision and monitoring and is captured by  $\mu$  such that  $\mu \equiv 1 - \lambda$ .

If  $p(\lambda)$  is the probability of success of the project, we assume that  $p'(\lambda) > 0$  and  $p''(\lambda) \leq 0$ . Let  $f(n)$  be the firm's production function that depends only on labour ( $n$ ). If the firm uses labourers exclusively from the family, then one can regard the number to be fixed in size, and without any loss of generality, we can assume that  $n$  is equivalent to the number of paid non-family workers.<sup>5</sup> We assume that the labour belonging to the family of the entrepreneur is motivated and need not require any monitoring of their activities. However, if the firm hires labour from the outside labour market, then entrepreneur must engage in monitoring.<sup>6</sup>

The cash strapped entrepreneur in household enterprises needs to borrow from the credit market in order to pay the wage bill so that the total costs of borrowing is wage rate ( $w$ ) times total employment ( $n$ ).

For the determination of the wage rate, we follow the efficiency wage model of Calvo and Wellisz (1978, 1979) and Shapiro and Stiglitz (1984). A worker obtains a wage rate ( $w$ ) from the employer if she does not shirk. Her net pay-off is the wage rate minus the disutility or costs ( $c$ ) associated with work and are equal to  $w - c$ . If the worker decides to shirk, then there is a probability  $q$  that she may get caught and fired, in which case she obtains a reservation wage rate  $\bar{w}$  outside the firm. However, if the worker shirks, the probability is  $1 - q$  that she is not caught and thus earns the wage rate  $w$ , without incurring costs of work. The probability of being monitored and caught upon shirking is not exogenous but it depends on the amount of time that an entrepreneur devotes to this activity. Hence,  $q = q(\mu)$ ,  $q'(\mu) > 0$ . Since  $\mu \equiv 1 - \lambda =$  the amount of time spent by the entrepreneur on monitoring activities, it follows that  $q'(\lambda) < 0$ .

In equilibrium, the worker must be indifferent to the possibility of shirking and being fired and not shirking and being paid the wage rate,  $w$ , so that:

$$q(\mu)\bar{w} + (1 - q(\mu))w = w - c \quad (1)$$

By rearranging equation (1), we get the standard efficiency wage equation,

$$w = \frac{c}{q(\mu)} + \bar{w} \quad (2),$$

which simply suggests that wage rate is equal to a premium  $\frac{c}{q(\mu)}$ , which is paid to prevent workers from shirking, over the reservation ( market) wage rate  $\bar{w}$ . The equation (2) also indicates the trade-off between allocation of time between monitoring of outside labour and

productive activities that enhance success of the project. More time devoted to monitoring ( $\mu$ ) increases the probability ( $q(\mu)$ ) of apprehending the evasion of work and thus reduces the wage rate ( $w$ ) but also it reduces the probability of success  $p(\lambda)$  due to less available time for making the project successful as  $\mu \equiv 1 - \lambda$ .

In order to show the role of credit constraints and monitoring costs in influencing the firm's decision to hire outside labour, we first consider the benchmark case where there is no credit rationing and no monitoring costs.

### **Benchmark Case: No Credit Rationing and No Monitoring Costs**

We assume that the entrepreneur borrows money to pay for her wage costs and since the total amount of borrowing is  $L = \bar{w}n$ , she needs to pay back  $\bar{w}n(1 + r)$ , where  $\bar{w}$  = wage rate in the labour market in the absence of any monitoring costs, and  $r$  is the market interest rate.

The expected profit of the entrepreneur is:  $\pi = p(\lambda)[f(n) - \bar{w}n(1 + r)] - F$  and she chooses  $\lambda$  and  $n$  to maximize the profit. Here,  $F$  is the fixed cost of investment.

The first order conditions are:

$$p'(\lambda)[f(n) - \bar{w}n(1 + r)] \geq 0 \text{ and } f'(n) - \bar{w}(1 + r) = 0 \quad (3)$$

Since,  $p'(\lambda) > 0$ , the entrepreneur chooses  $\lambda = 1$ , and equation (3) determines both the optimal amount of labour and also determines the total borrowing  $\bar{w}n(\bar{w}, r)$ .

Therefore, the entrepreneur chooses all of her time towards productive activities ( $\lambda = 1$ ) so that the probability of success in her project is maximum and expected profit,  $[f(n) - \bar{w}n(1 + r)]$  is also maximum.

### **Introducing Credit rationing and Monitoring Costs:**

Now, suppose that firms are credit rationed and they also need to incur the monitoring costs in the form of paying a wage rate,  $w = \frac{c}{q(\mu)} + \bar{w}$ . The amount of loan is now fixed for the entrepreneur so that her budget constraint for hiring labour is  $L + a = wn$ , where  $a$  is the personal wealth or assets of the entrepreneur. Since the Left Hand Side ( $L + a$ ) is fixed due to rationing of funds and limitations of personal wealth, she can hire more labour and increase production only by reducing the wage rate. This immediately generates the following trade-off under the presence of monitoring costs and rationing of loans. If she spends more time in monitoring (by increasing  $\mu$ ), the probability of detection of shirking increases (since  $q(\mu)$  is an increasing function of  $\mu$ ) and results in a decrease of the wage rate  $w = \frac{c}{q(\mu)} + \bar{w}$ . Hence, output increases because she can hire more labour with her available funds which also increases her expected profit at the margin. But it also results in the decrease of time devoted to the project and the probability of success decreases, leading to a fall in the pay-off from engagement in entrepreneurial activities at the margin.

It is also easy to see credit constraints will have an impact on the hiring of outside labour. If the amount of credit received by the firm  $L + a < \bar{w}n(\bar{w}, r)$ , the amount that firm procures without rationing, given the wage rate, the optimal level of employment in a credit constrained firm is  $n < n(\bar{w}, r)$  so that  $f'(n) - \bar{w}(1 + r) > 0$ . That is, credit constraints prevent the entrepreneur to carry out production to the point where the expected surplus is also at maximum.

To sum up the discussion regarding monitoring costs and credit constraint:

(a) Monitoring cost takes the form of  $w - \bar{w} = \frac{c}{q(\mu)} > 0$  and (b) Rationing of credit

implies that  $f'(n) - \bar{w}(1 + r) > 0$ .



We next show the trade-off for the entrepreneur in spending time on entrepreneurial activities and on monitoring outside workers.

The entrepreneur's expected profit in the presence of credit constraints and monitoring cost is given by:

$$\pi = p(\lambda)[f(n) - L(1 + r)] - F \quad (4)$$

$$\text{Where, } n = \frac{L+a}{w} = \frac{L+a}{\frac{c}{q(\mu)} + \bar{w}}$$

$$\text{Hence, } \pi = p(\lambda) \left[ f \left( \frac{L+a}{\frac{c}{q(\mu)} + \bar{w}} \right) - L(1 + r) \right] - F \quad (5)$$

We define  $R = wn(1 + r) =$  the total principal and interest that needs to be paid to the bank.

The entrepreneur chooses  $\lambda$ , to maximize the expression and the first order condition is:

$$\frac{\partial \pi}{\partial \lambda} = 0 \Rightarrow p'(\lambda)[f(n) - R] + pf'(n) \frac{\partial n}{\partial \lambda} = 0 \quad (6)$$

By plugging  $\frac{\partial n}{\partial \lambda} = \frac{L+a}{\left[\frac{c}{q(\mu)} + \bar{w}\right]^2} \frac{c}{q} \frac{q'}{q} = -n \frac{(w-\bar{w})}{w} \frac{q'}{q}$  into above expression, we get:

$$p'(\lambda)[f(n) - R] = pf'(n)n \frac{(w-\bar{w})}{w} \frac{q'}{q} \quad (7)$$

Where  $q'(\mu) > 0$  and  $\mu = 1 - \lambda$

Equation (7) captures the tension of allocation of time between entrepreneurial activities because the Right Hand Side of the equation,  $p'(\lambda)[f(n) - R]$ , is the gains at the margin on entrepreneurial activities and the Left Hand Side of the equation is the costs of increased wages that results from less monitoring efforts at the margin (given by  $n \frac{(w-\bar{w})}{w} \frac{q'}{q}$ ) and the consequent loss of profit due to reductions in employment captured by the term  $pf'(n)$ .

Immediately, it follows from the first order condition, we get  $\lambda < 1$ . That is, entrepreneurial activities suffer due to monitoring costs.

We now capture the effect of a change in the financial variables,  $L$  and  $a$ , on the time spent on entrepreneurial activities,  $\lambda$ , and the hiring of outside labour,  $n$ , by the means of two propositions.

**Proposition 1:** *An increase in loans will increase the time devoted to entrepreneurial activities if the increase in profits resulting from greater time spent on entrepreneurial activities at the margin (measured by  $f'(n) - (1 + r)$ ] exceeds marginal monitoring costs  $\left(n \frac{(w-\bar{w})}{w} \frac{q'}{q}\right)$  by a proportion,  $p/p'$ .*

Proof: The straightforward differentiation of (7) yields,

$$\frac{\partial \lambda}{\partial L} = \frac{p f'(n) n \frac{(w-\bar{w})}{w} \frac{q'}{q} - p'(\lambda) [f'(n) - (1+r)] \frac{1}{w}}{\pi_{\lambda\lambda}} > < 0 \text{ according as } \frac{[f'(n) - (1+r)]}{f'(n) n \frac{(w-\bar{w})}{w} \frac{q'}{q}} > (<) \frac{p}{p'}$$

( $\pi_{\lambda\lambda} < 0$  due to the second order condition of profit maximisation).

**Proposition 2:** *The effect of a relaxed credit constraint on the use of hired labour depends on three components:*

(a) *The direct effect, that increases the demand for hired labour;*

(b) *An indirect effect, via the increase in production with greater access to finance, that tends to increase the demand for hired labour (the credit rationing effect).*

(c) *An indirect effect, via an increase in monitoring costs, which tends to reduce the demand for hired labour (the monitoring cost effect).*

Proof: Differentiating  $n = \frac{L+a}{\frac{c}{q(\mu)} + w}$  with respect to  $L$ ,

$$\text{we get } \frac{\partial n}{\partial L} = \frac{\left(\frac{c}{q(\mu)+\bar{w}}\right) - (L+a) \frac{cq' \partial \lambda}{q q \partial L}}{\left[\frac{c}{q(\mu)+\bar{w}}\right]^2}.$$

The first term is the direct effect of increasing the size of loan and is positive. The second effect is given by  $\frac{\partial \lambda}{\partial L}$ , and captures the indirect effect of L or a on  $n$ , as shown in Proposition 1. Its sign depends on the strength of two countervailing effects: the first, as given by statement (b) in Proposition 2, is the gains in profits due to the increased time that the entrepreneur can spend on entrepreneurial activities with the relaxation of the credit constraint. This effect is positive – that is, with an increase in L, the entrepreneur is able to increase the employment of outside labour, to increase production. We call it the credit rationing effect. The second, as given by statement (c) of Proposition 2, is the increase in the wage premium that the entrepreneur has to pay outside workers if she spends more time on entrepreneurial activities, leading to a fall in employment, for a given wage bill. We call it the monitoring cost effect.

Proposition 2 makes clear that the effect of an easing of the credit constraint on the firm's decision to employ outside labour usage is not necessarily positive, and could even be negative, if the monitoring cost effect is large enough to swamp the direct effect and the credit rationing effect. We see that whether the relationship between access to finance and the hiring of non-family labour is positive or negative would depend in part on whether gains in profits due to the easing of credit rationing is higher or lower than the increase in monitoring costs with the employment of such labour.

Our model also suggests that monitoring costs would tend to be very large with an increase in the size of the firm, so that the demand for labour may increase with an increase in access to finance, and then decrease beyond a certain point. Thus, it is possible that the relationship

between hired labour employment ( $n$ ) and loan amount ( $L$ ) may be inverted U shaped, as shown in Figure 1.

Propositions 1 and 2 together lead to the emergence of the following hypothesis that we plan to test with a unique data set in the next section.

*Hypothesis: While the direct effect of greater access to external finance on hired labour usage is expected to be positive, the indirect effect via greater monitoring costs can be negative. The indirect effect will depend positively on firm productivity (that is, negatively on the inverse of productivity) and negatively on the wage premium.*

**‘FIGURE 1 HERE’**

### **III. EMPIRICAL STRATEGY, ECONOMETRIC METHODOLOGY AND DATA**

Our main prediction is that the relationship between firm’s use of hired (non-family) labour and access to finance (as captured by the firm’s borrowing) is not necessarily positive and possibly non-monotonic. Whether this relationship is positive or not would depend on the relative strengths of two effects – the increase in the firm’s output (and consequently, profitability) with an increase in the time that the firm’s owner spends on entrepreneurship related activities and the increase in wage costs due to the less amount of time that the owner can spend on monitoring non-family workers when she spends more time on entrepreneurial activities. If the marginal gain to the firm that results from the increase in output with the hiring of more non-family workers is greater than the marginal cost originating from the higher wage costs, then the firm will increase hired labour usage to the point where marginal costs of wage premium offsets marginal gains from increased production. If the marginal costs of hiring more non-family workers outweigh the marginal benefit of hiring them, the firm may decrease the use of non-family labour, even with greater access to external finance.

## Empirical Strategy

To test for the possible non-monotonicity of the hired labour-access to finance relationship, we examine how this relationship depends on the two countervailing effects: the marginal gains of increasing the usage of hired labour, given by the expression:  $(f'(n) - (1 + r))$  and the marginal costs of increasing the usage of hired labour, given by the expression:  $((\frac{w - \bar{w}}{w}) \frac{q'}{q})$ . We capture the expression  $(f'(n) - (1 + r))$  by the average productivity of the firm (since the rate of interest  $r$  will not differ across firms for a given year), and we approximate the expression:  $((\frac{w - \bar{w}}{w}) \frac{q'}{q})$  by the firm-specific wage premium, where the wage premium = average wage rate of hired workers in the firm – reservation wage.<sup>7</sup> We take the wage premium to be the average wage rate that the firm pays to its workers minus the government-determined minimum wage rate set in the state in which the firm is located, divided by the average wage. We then test for the possible non-monotonicity of the hired labour-access to finance relationship by running regressions of hired labour usage on total loans and introducing interaction terms of the following type:

Interaction term (1) = LOAN  $\times$  INVPROD

Interaction term (2) = LOAN  $\times$  WAGEPREM

Where INVPROD is the inverse of labour productivity of the firm, and WAGEPREM is the difference between the average wage rate of hired workers in the firm minus the state-level minimum wage rate.

Our hypothesis will be that both interaction terms will be negative and significant, if the relationship between hired labour usage and the firm's borrowing is non-monotonic and

depended positively on firm productivity (that is, negatively on the inverse of productivity) and negatively on the wage premium.

Therefore, we test for the presence of a possible non-monotonic effect of finance constraints on hired labour usage by running a regression of the following generic form:

$$h_{j,i,t} = \alpha_0 + \alpha_1 LOAN_{jit} + \alpha_2 PRODINV_{jit} + \alpha_3 WAGEPREM_{jit} + \alpha_4 LOAN_{jit} * PRODINV_{jit} + \alpha_5 LOAN_{jit} * WAGEPREM_{jit} + \sum_{m>1} \gamma_m Z_t^F + \sum_{n>1} \gamma_n Z_{jit}^P + \sum_{k>1} \gamma_k Z_t^D + \theta_i + \delta_t + e_{jit} \quad (8)$$

where  $h$  is the number of hired non-family workers, the subscript  $j$  stands for firm,  $i$  stands for industry and  $t$  for time. We denote the firm's access to finance by  $LOAN$ , which is the firm's total borrowing.  $Z^F$ ,  $Z^P$  and  $Z^D$  are a set of control variables which we discuss later. Our unit of analysis is the firm, and we have data on the use of hired and family labour by firms in the Indian informal manufacturing sector from two cross-sectional surveys conducted by the Indian National Sample Survey Organisation (NSSO) for the entire country in 2000-01 and 2005-06.<sup>8</sup> We have over 12, 000 firms in this pooled data-set, across 21 industries, 429 districts and 15 Indian states.

**We hypothesise that  $\alpha_1$  is positive while  $\alpha_4$  and  $\alpha_5$  are both negative.**

According to our theoretical model, the signs of  $PRODINV$  and  $WAGEPREM$  are ambiguous.  $PRODINV$  is the inverse of labour productivity, and a lower  $PRODINV$  would imply higher profits for the firm with greater productivity, leading to higher demand for hired workers. In our model, lower productivity is also a function of lower entrepreneurial time for activities that increase the productivity of the firm, and more time for the monitoring of outside labour. This would imply that there could be a positive relationship between  $PRODINV$  and hired labour usage.

Similarly, a higher *WAGEPREM* would imply higher wage costs for the firm, and therefore, lower demand for hired labour. On the other hand, a higher wage premium would imply lower shirking by the worker, and thereby, higher productivity of the firm, increasing the demand for hired labour.

There are three possible sources of omitted variable bias in the specification set out in equation (8). Firstly, the entrepreneur's decision to keep the firm small (and not hire outside workers) even when it is possible to expand the size of the firm may not only be due to monitoring costs but also could be related to her desire not to increase firm size so as to avoid registering the firm with official agencies (which is compulsory in India, once the firm employs ten workers if using electricity, and 20 workers if not using electricity). In this case, the decision to formalise (and hence, make the firm grow) would be related to the costs of formalization – both fixed (entry costs such as costs of registering business) and recurring (paying taxes and complying with regulations) – relative to the returns to formalization (Fajnzylber *et al.* 2011, Ulyssea 2010, Taymaz 2009, Dabla-Norris *et al.* 2005). To incorporate the determinants of the decision to formalise, we have added a vector of control variables,  $Z_t^F$ , that capture the costs and benefits of formalisation of units in the informal sector. In India, business regulations and costs of starting a business differ significantly across Indian states, and we use two state-specific variables to capture the costs of formalisation- days required to start a business (*DAYSBUS*), and taxes paid, as percentage of total profits (*TAXRATE*).<sup>9</sup> In addition, a significant deterrent to formalisation in India are state specific labour laws, which come into operation for firms in the formal sector, and which prevent firms to fire workers on permanent contracts without going through a costly judicial process. We use the commonly used Besley-Burgess (2004) measure of labour regulation (*LABREG*).<sup>10</sup> To capture the benefits of formalisation, we compute the difference in labour productivity between formal and informal sector for each Indian state

(*LABPRDDIF*) and use this variable as a proxy for the gain in profits that occur when firms move from the informal to the formal sector.

A second source of omitted variable bias would be in our construction of the wage premium variable, which is the relative difference between the firm specific wage rate and the reservation wage, and which is our proxy measure of monitoring costs. However, such a measure would be the true measure of monitoring costs if all labour in the firm was homogenous. If the production process required hiring workers of varying skills, then the difference between the average wage rate and the state-level minimum wage across firms will reflect heterogeneity in production technologies rather than the monitoring costs. In order to control for differences in production technologies across firms, we use a variety of firm-specific variables that approximate for the nature of the firm-specific production function, and its technological characteristics.

A third possible source of omitted variable bias is the innate ability of the entrepreneur, which would differ across firms – the ability of the entrepreneur has found to be a significant positive determinant of the firm’s ability to succeed (McKenzie and Woodruff, 2013), and therefore, can increase hired labour usage via higher profitability of the firm (we show in Appendix 1 that our model predicts that an increase in the ability of the entrepreneur unambiguously increases hired labour usage).

$Z_{ijt}^P$  is a vector that includes firm-specific variables to control for the influence of production technology and ability of entrepreneur in informal firms on the firm’s decision to hire outside workers. To control for the influence of production technology, we use firm-specific variables that capture the location of the firm (*LOCATION*), the registration status of the firm (*REGIS*), whether the firm is in a sub-contracting relationship with another firm (*LINKAGE*), the ownership status of the firm (*OWNERSHIP*) and whether the firm operates through the



year or seasonally (*NATOP*). We provide the justification of these variables as proxies of production technology below.

*LOCATION*: Firms located in and around cities and towns will have access to better infrastructure, and larger markets for skilled labour and raw materials and are more likely to have different production technologies that are more skilled labour intensive than firms located in rural areas. To control for the effects of a firm's location on its production technology (in particular, in the mix of skilled and unskilled labour it employs), we introduce *LOCATION* as a control variable, which takes the value 1 if the firm is located in urban areas and 0 if they are located in rural areas.

*REGIS*: Being a part of an act/authority could help the owner-manager to access and secure a range of financial and non-financial resources (information, knowledge, technology, and finance) that are otherwise mostly unavailable to the firms in the informal sector. Levenson and Maloney (1998) argue that registration of the firm with an authority grants legitimacy to the owners in terms of obtaining bank loans and access to legal systems, which are instrumental in fostering growth. This is also supported by a recent study by Sharma (2014) who finds that registration leads to a 32% gain in sales per employee and a 56% gain in value added per employee for firms in the small-scale sector in India. Therefore, firms registered under an act/authority are more likely to have more sophisticated production technologies than those firms which are not. We use registration status as a proxy for the firm's production technology by constructing a variable, *REGIS*, which takes the value 1 if they have registered under any act and 0 if they did not.<sup>11</sup>

*LINKAGE*: The NSSO in its surveys asks the firms whether they work solely for a contractor (that is, it sells all its output to the contractor, who usually in this tied arrangement supplies it with inputs). We name this variable *LINKAGE* and code it as 1 if they work for a contractor

and 0 if they do not. Firms that work for contractors are more likely to need workers with specialised skills as well as have access to better technology through the firms they work for than firms which do not work for contractors (Taymaz and Kilicaslan 2000; Yasuda 2005; Giunta *et al.* 2012).

*OWNERSHIP*: In the informal sector, there are two types of firms based on ownership: proprietary firms and partnership firms. Proprietary firms are those firms where an individual is the sole owner of the enterprise while partnership firms are owned by more than one individual who have agreed to share the profits of a business carried on by all or any one of them acting for all (NSSO, 2002). The ability to access a larger pool of entrepreneurial talent as well as to diversify risks among many owners differentiates partnership firms from proprietary firms, which suggest that the former set of firms are more likely to use more sophisticated and higher return technologies than the latter set of firms. We construct a variable *OWNERSHIP* that takes the value 1 if the firm is a partnership firm and 0 if the firm is owned by an individual, and use this variable as another measure of the firm's production technology.

*NATOP*: Some firms in the Indian informal sector operate throughout the year (we call these perennial firms) while others only operate for a few months of the year (we call seasonal firms). Perennial firms are more likely to invest in specialised capital and technology than seasonal firms as they face more stable and predictable demand than seasonal firms. Therefore, we include nature of operation (*NATOP*) as another measure of the firm's production technology (the variable assumes a value 1 if the firm is a perennial firm and 0 otherwise).

To control for the manager's innate ability, we do not have a direct measure of the entrepreneur's ability such as the Peabody-Picture-Vocabulary Test of cognitive skills

(Krishnan and Krutikova, 2013). Instead, we use the maintenance of accounts by the entrepreneur (*ACMAINT*) as a proxy for ability – as Raj and Sen (2015) show, entrepreneurs that maintain accounts tend to see their firms grow in size. The variable *ACMAINT* takes the value 1 if the entrepreneur maintains an account, 0 if not.

We also include controls on human capital, as previous studies on informal firm growth have shown that firms with more educated managers tend to grow faster (Mead and Liedholm 1998; Van der Sluis et al. 2005; Akoten and Otsuka 2007; McPherson, 1996). In addition, the greater the supply of skilled workers in local labour markets, the more likely will the firm's owner/manager be willing to hire outside workers. We do not have information on the educational level of the owner/manager in the NSSO data; instead we use data on primary and secondary school attainment for the district in which the informal firm is located (which we obtain from the 2001 Census of India). Thus,  $Z_t^D$  represents the vector that includes district specific human capital variables – *PRIMEDU* and *MIDGRADEDU*. *PRIMEDU* captures the proportion of individuals who are educated at primary level or below and *MIDGRADEDU* stands for the proportion of individuals educated at secondary level and above.

$\gamma_i$  are industry specific fixed effects and  $\delta_t$  is the year dummy (=1 if the survey is for 2005-06). Since some industries are more reliant on external finance than others (Rajan and Zingales, 1998), we include industry fixed effects as controls to capture industry-specific external finance requirements which may exert an independent influence on hired labour usage over and above that exerted by the finance constraint that the firm faces.<sup>12</sup> Inclusion of the year dummy for 2005-06 as a control variable expects to capture macro shocks that may have positive productivity effects, leading to an increase in hired labour usage. All financial variables, firm size and number of hired workers (our dependent variable) are transformed to their natural logarithmic values.

## Econometric Methodology

To estimate equation (8), we use Ordinary Least Squares (OLS) and Instrumental Variable (IV) estimation methods, with robust standard errors clustered at the district level, to account for possible non-independence of the error term across districts. The data is pooled, comprising two cross-sections for 2000-01 and 2005-06.

While we present OLS estimates of equation (8) in the paper, the use of OLS is problematic in that we are implicitly assuming that the *LOAN* variable that we include on the Right Hand Side is capturing finance constraints. However it is quite likely that *LOAN* may be demand determined and not supply determined – that is, as firms increase their hiring of outside labour, they increasingly borrow from external sources to pay for their wages. To address endogeneity concerns with *LOAN*, we employ instrumental variables (IV) methods, where we use two instrumental variables that capture the supply side of financial intermediation. First, we use a direct measure of the firm's finance constraint, as has been used by Rand (2007). The NSSO asks the firms in its surveys if they have faced any constraint on its borrowing in the last year. We denote this variable *BORRCN* and code this variable equal to 1 if the firm states that it faced a constraint and 0 if it answers that it did not face a borrowing constraint. Second, we use the level of financial development in the district where the firm is located, as measured by bank credit per capita (credit amount outstanding divided by total population at the district level).<sup>13</sup> We denote this variable *BKCRDT*. We believe that both *BORRCN* and *BKCRDT* will meet the necessary exclusion criterion as instrumental variables as they are not expected to influence the firm's decision to hire outside workers except through the borrowing constraint that the firm faced. We test for the suitability of *BORRCN* and *BKCRDT* as instruments in the first stage regressions of the Two Stage Least Squares estimation method.

## **Data and Variables**

We use unit level data for the informal manufacturing sector for two years, 2000-01 and 2005-06. Data on the informal manufacturing sector is drawn from the Government of India's National Sample Survey Organization (NSSO) surveys on the informal manufacturing sector, which is undertaken quinquennially using a stratified sampling procedure. The surveys contain information on the number of hired/outside labour as well as family labour for each firm. The surveys also provide information on total loans outstanding for the firm, and total fixed assets owned by the firm. All financial variables are deflated by the wholesale price index for capital goods. In our study, we consider only those firms that have completed at least three years since inception. Our data is in the form of repeated cross-sections, and not in panel form, as the NSSO does not reveal the identity of the firm/plant in the unit level data, and the same firms may not be surveyed in each round. The lack of availability of panel data is a limitation of our analysis.

## **IV. DESCRIPTIVE STATISTICS AND RESULTS**

We begin the empirical analysis by presenting the summary statistics, and an exploratory graphical analysis of the possible non-monotonicity of the relationship between access to finance and hired labour usage. We then present the main results of the econometric analysis.

### **Descriptive Statistics**

We present summary statistics of the key variables used in the empirical analysis in Table 1. We see that the average number of hired labour per firm is 3.71 (exponential of 1.310), and 54.7 per cent of the firms state that they face borrowing constraints.<sup>14</sup>

**'TABLE 1 HERE'**

## Results

Table 2 presents the OLS estimates of equation (8). In Cols. (1) and (2), we test for the two interaction effects separately, and in Col (3) we include both the interaction effects. We begin with a basic specification (with no industry or year dummies, control variables for production technology, ability of entrepreneur and costs and benefits of formalisation and district specific control variables), where we regress the number of hired workers against loans, inverse productivity and wage premium and the interaction effects. The coefficient on loans is significant at the 1 per cent level and of the right sign – greater access to finance (as captured by a higher amount of loans taken by the firm) leads to a higher use of outside workers. In Cols. (1) and (2), the interaction terms  $LOAN*INVPROD$  and  $LOAN*WAGEPREM$  are negative as hypothesised, and statistically significant. When we introduce the interaction terms together in Col. (3), both the interaction terms  $LOAN*INVPROD$  and  $LOAN*WAGEPREM$  are negative and statistically significant at the 1 per cent level. In Cols. (4), we re-do the same specification as in col (3) with industry and year dummies included. We then introduce control variables for costs and benefits of formalisation, production technology and ability of entrepreneur in col (5). We bring in district specific controls in col (6). The coefficients retained the same sign and significance in these estimations too. Therefore, the OLS estimates provide clear evidence of a non-monotonicity in the relationship between the firm's hiring of non-family labour and firm's total borrowing. For sufficiently low levels of firm productivity and/or sufficiently high levels of the wage premium, the firm may actually use less non-family labour, with greater borrowing. We also find that the coefficients on all the control variables have the right signs and are statistically significant (Table 4 in Appendix II).

Next, we address endogeneity concerns with  $LOAN$  – the positive relationship between  $LOAN$  and hired labour use may be driven by the fact that firms who use more outside labour

are more likely to borrow from external sources to pay for their wages. To address these concerns, we use Two Stage Least Squares (2SLS) with *BORRCN* and *BKCRDT* as an instrument for *LOAN*, and estimate the full specification - industry and year dummies, controls for costs and benefits of industrialisation, production technology and ability of entrepreneurs and district specific controls. We present the IV results in col. (7) and (8) of Table 2, with the first stage results and tests for the validity of the instrument presented in the lower panel of the Table. We find that both the interaction terms are negative and significant at the 1 per cent level for the IV estimations. The first stage results show that *BORRCN* has a negative and significant relationship with *LOAN* while *BKCRDT* has a positive and significant relationship with *LOAN*. The various test statistics show that the IV procedure works well for our estimations. The instrument passes the test for weak instruments, implying it is strongly correlated with our finance variable. This is important since weak instruments can lead to severely biased estimates. Further, the Hansen J Statistic for overidentification is insignificant for all the models, confirming that the instrumental variable is indeed exogenous and correctly excluded from the performance equation. Thus, the IV results reinforce the main finding of the OLS estimates that there is a non-monotonic relationship between the firm's employment of non-family labour and total borrowing.<sup>15</sup> We also re-run our regressions using *ASSET* as an alternate measure of the firm's financial constraint since our model is symmetric in its prediction of a non-monotonic relationship between use of non-family labour and the total assets of the firm (denoted by *a* in our model). We find identical results for both OLS and IV estimates when we use *ASSET* instead of *LOAN*.<sup>16</sup>

**'TABLE 2 HERE'**

Finally, we test for one more prediction of our model – that the firm may try and decrease non-family labour once a certain threshold of firm size has been reached with greater access to finance as beyond a certain size of the firm, the monitoring costs of non-family labour may

exceed the benefit of greater economies of scale through a larger firm size.<sup>17</sup> We introduce an interaction term *FIRM SIZE\*LOAN*, and test for its sign and significance. We call these regressions Auxiliary Regressions. We first estimate the basic regression with no industry and year dummies as controls and then including industry and year dummies. We present the OLS and IV estimates in Table 3. We find clear and unequivocal non-monotonicity in the hired labour-loan relationship. That is, beyond a certain size of the firm, an increase in loans seems to lead to a decline in the use of non-family labour. Overall, our results suggest that monitoring costs of non-family labour play an important role in discouraging owner-managed firms to increase their size and to hire more non-family labour, and that the easing of credit constraints do not automatically lead to the growth of the firm.

**‘TABLE 3 HERE’**

## **V. CONCLUSIONS**

For an owner-managed small firm, the hiring of a non-family worker is a non-trivial decision and involves a trade-off between the greater profits and productivity benefits that the firm can enjoy with a larger size and the opportunity cost of the firm’s owner in monitoring the worker’s effort and as a consequence, increasing wages of non-family workers to provide greater incentive for them to be productive. In this context, we show that the availability of external finance can have a perverse effect – while the direct effect of the easing of credit constraints will always be positive on the hiring of non-family labour, it is possible that if the increase in the wage premium to be paid to non-family workers is so high, or if the productivity benefits of the increase in size not large enough, the owner-manager may actually decrease the amount of non-family workers to spend more time on entrepreneurship activities. We develop a model that captures this trade-off and which shows that under certain conditions, greater access to external finance may actually lead to a fall in hired labour usage.



We then explore the empirical implications of our model using an unique data-set comprising large nationally representative surveys of small and micro-enterprises in Indian manufacturing which provides information on the use of hired and family labour and relevant firm characteristics for 2000-01 and 2005-06.

We find evidence of a possible non-monotonic relationship between the firm's borrowing and the hiring of non-family labour, and show that this relationship depends negatively on the inverse of productivity and on the wage premium of non-family workers (that is, what the firm pays to the worker over and above the reservation wage). Our results suggest that the relaxation of credit constraints in itself may not be enough in contributing to small firm growth in developing countries. Our paper shows both theoretically and empirically the importance of monitoring costs of non-family labour in explaining why few family firms in the informal sector make the transition to the use of non-family labour, limiting the growth of family owned micro enterprises in the economy.

From a policy perspective, the findings of the paper suggest that skill training programmes that increase the productivity of non-family workers relative to the costs of monitoring them would induce entrepreneurs of small informal firms more likely to employ them, and make the firm grow. In addition, strengthening of the capabilities of entrepreneurs to run their enterprises efficiently (such as financial literacy initiatives) would allow them to spend more time on activities that are important for the firm's growth such as identifying new markets and investing in technology as well as able to monitor the workers that they employ from outside.

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**Table 1**  
**Summary Statistics**

Variable	No of Observations	Mean	Standard Deviation	Min	Max
<i>HIRED WORKERS</i>	12614	1.3097	0.8917	0	5.9965
<i>LOAN</i>	12614	10.5790	1.8417	3.4693	18.3303
<i>INVPROD</i>	12614	0.15828	1.07874	0.00004	106.66670
<i>WAGEPREM</i>	12611	0.0098	0.0123	0	0.4852
<i>DAYSBUS</i>	12614	34.0752	3.4781	30	41
<i>TAXRATE</i>	12614	68.7481	1.0577	66.5	70.3
<i>LABREG</i>	12614	0.5745	0.2561	0	0.8571
<i>LABPRDDIF</i>	12614	13.9572	14.4192	6.6431	127.8028
<i>ACMAINT</i>	12614	0.2745	0.4463	0	1
<i>OWNERSHIP</i>	12614	0.1701	0.3758	0	1
<i>LOCATION</i>	12614	0.7653	0.4238	0	1
<i>NATOP</i>	12614	0.9337	0.2488	0	1
<i>LINKAGE</i>	12614	0.2332	0.4229	0	1
<i>REGIS</i>	12614	0.6819	0.4658	0	1
<i>PRIMEDU</i>	11248	0.1596	0.0350	0.0599	0.8752
<i>MIDGRADEDU</i>	11248	0.2694	0.1050	0.0723	0.9646
<i>BORRCN</i>	12611	0.5467	0.4978	0	1
<i>BKCRDT</i>	11248	7.3036	1.0472	5.2388	11.4857
<i>SIZE</i>	12614	1.7624	0.6734	0	6.0064

**Note:** All financial variables, *HIRED WORKERS* and *SIZE* are in natural logarithms. All financial variables are in real terms.

Source: Authors' estimates.

**Table 2**  
**Regression Results**  
**Dependent Variable = Log of Hired Labour**

Variables	OLS						IV	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>LOAN</i>	0.2528*** (0.0036)	0.2635*** (.0048)	0.2668*** (0.0054)	0.2468*** (0.0048)	0.1991*** (0.0057)	0.2036*** (0.0061)	0.3079*** (0.0506)	0.3517*** (0.0564)
<i>INVPROD</i>	0.1792*** (0.0691)		0.2631*** (0.0658)	0.2755*** (0.0688)	0.1950*** (0.0632)	0.2055*** (0.0631)	0.7158** (0.3096)	0.9204*** (0.3762)
<i>LOAN*INVPROD</i>	-0.0215*** (0.0072)		-0.0301*** (0.0069)	-0.0314*** (0.0072)	-0.0224*** (0.0067)	-0.0233*** (0.0067)	-0.0772** (0.0330)	-0.0989*** (0.0402)
<i>WAGEPREM</i>		18.0548*** (3.8781)	18.3529*** (4.2161)	11.1178*** (3.6820)	7.9310** (3.9118)	10.8904*** (4.1486)	35.0097** (14.9621)	44.5174*** (17.7107)
<i>LOAN*WAGEPREM</i>		-1.4425*** (0.3283)	-1.4886*** (0.3620)	-0.9219*** (0.2887)	-0.7798** (0.3199)	-0.9796*** (0.3427)	-3.0450** (1.3150)	-3.8692*** (1.5727)
Constant	-1.3612*** (0.0393)	-1.4958*** (0.0506)	-1.5250*** (0.0569)	-1.4692*** (0.0545)	-2.5929*** (0.4629)	-2.1874*** (0.5329)	-3.1013*** (0.7715)	-3.8621*** (0.8276)
<b>Controls</b>								
Industry Dummy	N	N	N	Y	Y	Y	Y	Y
Year Dummy	N	N	N	Y	Y	Y	Y	Y
Costs and Benefits of Formalisation	N	N	N	N	Y	Y	Y	Y
Production Technology/Ability of Entrepreneur	N	N	N	N	Y	Y	Y	Y
District Specific Controls	N	N	N	N	N	Y	N	Y
N	12614	12611	12611	12611	12611	11245	11243	11243
R squared	0.2710	0.2722	0.2733	0.3551	0.3957	0.4005	-	-
F/chi Test	1778.93	1824.04	1099.95	268.11	233.00	203.75	148.95	135.71
<b>Presence of Endogeneity (Durbin-Wu-Hausman test)</b>								
chi2							4.46944 (0.0345)	7.37071 (0.0066)
F							4.46457 (0.0346)	7.34725 (0.0067)
<b>Coefficient Value of Instrument</b>								
<i>BORRCN</i>							-0.1855*** (0.0299)	-0.1848*** (0.0302)
<i>BKCRDT</i>							0.1211*** (0.0143)	0.1314*** (0.0180)
<b>Tests for Validity of the Instrument</b>								
Underidentification test:								
Kleibergen-Paap rk LM statistic							133.462 (0.000)	111.850 (0.000)
(Chi2 P-value)								
Weak identification test:								
Kleibergen-Paap rk Wald F statistic							67.787	57.944
Hansen J Statistic								
(overidentification of all instruments)							1.471 (0.2252)	0.421 (0.5165)
(Chi2 P-value)								

Notes: (a) \*\*\* and \*\* stand for significant at 1 per cent and 5 per cent level or more; (b) N=No, Y=Yes.  
(c) We have also estimated the model with only BORRCN as an instrument. Our findings did not change, indicating the robustness of the results to different specifications.  
See Table 4 in Appendix II for the full version of the table with all coefficients.  
Source: Authors' estimates.



**Table 3**  
**Auxiliary Regressions: OLS and IV estimates**

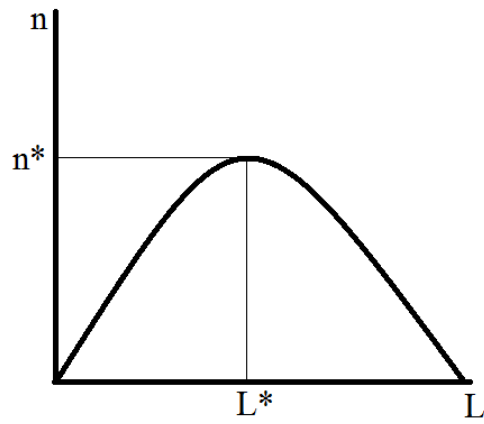
**Dependent Variable = Log of Hired Labour**

Variables	OLS Results		IV Results	
	(1)	(2)	(3)	(4)
<i>LOAN</i>	0.0503*** (0.0035)	0.0579*** (0.0037)	0.3345*** (0.0671)	0.9048*** (0.2610)
<i>SIZE</i>	1.2986*** (0.0193)	1.3752*** (0.0199)	2.6382*** (0.3190)	5.2495*** (1.2006)
<i>LOAN*SIZE</i>	-0.0090*** (0.0017)	-0.0149*** (0.0018)	-0.1392*** (0.0309)	-0.3890*** (0.1160)
Constant	-1.3391*** (0.0348)	-1.5114*** (0.0399)	-4.2037*** (0.6768)	-10.2621*** (2.6908)
Industry dummy	N	Y	N	Y
Year dummy	N	Y	N	Y
State dummy	N	Y	N	Y
N	12614	12614	11245	11245
R squared	0.89	0.90	-	-
F/chi Test	43282.04	3729.04	14825.15	309.14
<b><i>Presence of Endogeneity (Durbin-Wu-Hausman test)</i></b>				
chi2			136.599 (0.000)	64.705 (0.000)
F			142.333 (0.000)	65.575 (0.000)
<b><i>Coefficient Value of Instrument</i></b>				
<i>BORRCN</i>			-0.0572*** (0.0117)	-0.0423*** (0.0117)
<i>BKCRDT</i>			0.0512*** (0.0068)	0.0078 (0.0081)
<b><i>Tests for Validity of the Instrument</i></b>				
Underidentification test:				
Kleibergen-Paap rk LM statistic (Chi2 P-value)			58.460 (0.000)	13.614 (0.0011)
Weak identification test:				
Kleibergen-Paap rk Wald F statistic			29.483	6.792
Hansen J Statistic (overidentification of all instruments) (Chi2 P-value)			5.139 (0.0234)	0.335 (0.5629)

Notes: (a) \*\*\* and \*\* stand for significant at 1 per cent and 5 per cent level or more; (b) N=No, Y=Yes.

Source: Authors' estimates.

**Figure 1: The Possible Non-Monotonicity in the Relationship between Demand for Outside Labour ( $n$ ) and Access to Loans ( $L$ )**



□

## APPENDIX I

In this Appendix, we explore two further extensions of the model that we present in the paper. Firstly, we examine the implications of higher ability of the entrepreneur on the use of hired labour. Secondly, we relax the assumption that hiring family labour has no costs, by introducing training costs for family labour.

### Extension 1: Higher Ability of Entrepreneurs

Let us represent  $\theta$  to measure ability which affects the probability of success and  $p'(\theta) > 0$ .

Then we have the following proposition:

**Proposition 3: The abler the entrepreneur, the lower the costs of monitoring and the larger is the labour hired by the firm.**

**Proof:** Differentiating the first order condition (7), we get:

$$\frac{\partial \lambda}{\partial \theta} = \frac{p'(\theta) f'(n) n \frac{(w-\bar{w})q'}{w}}{\pi_{\lambda\lambda}} < 0 \text{ and}$$

And using the above result in the equilibrium number of labour employed by the firm, we

get:  $\frac{\partial n}{\partial \theta} = - \frac{\frac{-cq'}{q}}{[\frac{c}{q(\mu)} + W]^2} \frac{\partial \lambda}{\partial \theta} > 0$ . That is, firms and managed by entrepreneurs of higher ability will

employ higher hired labour.

### Extension 2: Training Costs of Family Labour

Consider the firm's expected profits function, when we explicitly introduce family labour in the firm's production function:

$$\pi = p(\lambda)[f(n) - L(1 + r)] - F$$

where  $n = \beta n^h + n^0$  and  $n^h =$  number of fixed household labourer,  $\beta > 1$  is the relative productivity level between home and outside workers which depends on training of hours chosen endogenously by the household and  $n^0 =$  hired labourers from the outside market.

Let the training cost be  $C(\beta n^h)$  and  $C'(\beta n^h) > 0$  and  $C''(\beta n^h) \geq 0$ . The higher level of skill acquisition involves larger training costs. The total budget need to be accommodated between training the household labours and hiring outside workers with a fixed skill level normalized to unity.

$$\text{Where, } n^0 = \frac{L+a-C(\beta n^h)}{w} = \frac{L+a-C(\beta n^h)}{\frac{c}{q(\mu)} + \bar{w}}$$

$$\text{Hence, } \max_{\{\lambda, \beta\}} \pi = p(\lambda) \left[ f \left( \beta n^h + \frac{L+a-C(\beta n^h)}{\frac{c}{q(\mu)} + \bar{w}} \right) - L(1 + r) \right] - F$$

First order conditions are:

$$\lambda: p'(\lambda)[f(n) - R] = p f'(n) n^0 \frac{(w-\bar{w})}{w} \frac{q'}{q}$$

$$\beta: C'(\beta n^h) = w = \frac{c}{q(\mu)} + \bar{w}$$

The optimal level of training ( $\beta$ ) and  $\lambda = 1 - \mu$  are determined jointly by these two equations. The first equation is identical to equation (7) in the paper. The interpretation of the second equation is that at the optimum the marginal costs of inside training must be equal to marginal cost of hiring outside workers, which is,  $w$ .

We can obtain the following two implications, when we include training costs for family labour:

**Implication1: More training leads to a less number of hired workers if family and non-family workers are substitutes. Therefore, a firm with more skilled family workers will tend to hire lesser outside (non-family) workers.**

**Implication 2: The higher level of market wage increases the opportunity costs of hiring workers from outside and the household will devote more time in training.**

## APPENDIX II

**Table 4**  
**Regression Results**  
**Dependent Variable = Log of Hired Labour**

Variables	OLS				IV			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>LOAN</i>	0.2528*** (0.0036)	0.2635*** (.0048)	0.2668*** (0.0054)	0.2468*** (0.0048)	0.1991*** (0.0057)	0.2036*** (0.0061)	0.3079*** (0.0506)	0.3517*** (0.0564)
<i>INVPROD</i>	0.1792*** (0.0691)		0.2631*** (0.0658)	0.2755*** (0.0688)	0.1950*** (0.0632)	0.2055*** (0.0631)	0.7158** (0.3096)	0.9204*** (0.3762)
<i>LOAN*INVPROD</i>	-0.0215*** (0.0072)		-0.0301*** (0.0069)	-0.0314*** (0.0072)	-0.0224*** (0.0067)	-0.0233*** (0.0067)	-0.0772** (0.0330)	-0.0989*** (0.0402)
<i>WAGEPREM</i>		18.0548*** (3.8781)	18.3529*** (4.2161)	11.1178*** (3.6820)	7.9310** (3.9118)	10.8904*** (4.1486)	35.0097** (14.9621)	44.5174*** (17.7107)
<i>LOAN*WAGEPREM</i>		-1.4425*** (0.3283)	-1.4886*** (0.3620)	-0.9219*** (0.2887)	-0.7798** (0.3199)	-0.9796*** (0.3427)	-3.0450** (1.3150)	-3.8692*** (1.5727)
Constant	-1.3612*** (0.0393)	-1.4958*** (0.0506)	-1.5250*** (0.0569)	-1.4692*** (0.0545)	-2.5929*** (0.4629)	-2.1874*** (0.5329)	-3.1013*** (0.7715)	-3.8621*** (0.8276)
<b>Controls</b>								
Industry Dummy	N	N	N	Y	Y	Y	Y	Y
Year Dummy	N	N	N	Y	Y	Y	Y	Y
<b>Costs and Benefits of Formalisation</b>								
<i>DAYSBUS</i>	N	N	N	N	0.0010 (0.0020)	0.0038 (0.0024)	0.0073*** (0.0029)	0.0105*** (0.0036)
<i>TAXRATE</i>	N	N	N	N	0.0252*** (0.0070)	0.0192 (0.0083)	0.0154** (0.0077)	0.0206** (0.0085)
<i>LABREG</i>	N	N	N	N	0.0260 (0.0264)	0.0047 (0.0276)	-0.0479 (0.0340)	-0.0497 (0.0353)
<i>LABPRDDIF</i>	N	N	N	N	0.0006 (0.0005)	0.0002 (0.0007)	0.0007 (0.0006)	0.0002 (0.0007)
<b>Production Technology/Ability of Entrepreneur</b>								
<i>ACMAINT</i>	N	N	N	N	0.1923*** (0.0170)	0.1984*** (0.0181)	0.1080** (0.0485)	0.0663 (0.0538)
<i>OWNERSHIP</i>	N	N	N	N	0.2556*** (0.0185)	0.2714*** (0.0193)	0.2162*** (0.0333)	0.1941*** (0.0366)
<i>LOCATION</i>	N	N	N	N	0.0838*** (0.0170)	0.1003*** (0.0181)	0.0683*** (0.0232)	0.0577** (0.0243)
<i>NATOP</i>	N	N	N	N	-0.4685*** (0.0328)	-0.5112*** (0.0349)	-0.5246*** (0.0368)	-0.5344*** (0.0374)
<i>LINKAGE</i>	N	N	N	N	0.0667*** (0.0159)	0.0687*** (0.0168)	0.0864*** (0.0193)	0.0937*** (0.0202)
<i>REGIS</i>	N	N	N	N	0.1515*** (0.0163)	0.1255*** (0.0174)	0.0403 (0.0438)	0.0089 (0.0474)
<b>District Specific Controls</b>								
<i>PRIMEDU</i>	N	N	N	N	N	-0.5035* (0.2883)	N	-0.5112* (0.2970)
<i>MIDGRADEDU</i>	N	N	N	N	N	-0.0202 (0.0880)	N	-0.1960** (0.1000)
N	12614	12611	12611	12611	12611	11245	11243	11243
R squared	0.2710	0.2722	0.2733	0.3551	0.3957	0.4005	-	-
F/chi Test	1778.93	1824.04	1099.95	268.11	233.00	203.75	148.95	135.71
<b>Presence of Endogeneity (Durbin-Wu-Hausman test)</b>								
chi2							4.46944 (0.0345)	7.37071 (0.0066)
F							4.46457 (0.0346)	7.34725 (0.0067)
<b>Coefficient Value of Instrument</b>								
<i>BORRCN</i>							-0.1855*** (0.0299)	-0.1848*** (0.0302)
<i>BKCRDT</i>							0.1211*** (0.0143)	0.1314*** (0.0180)
<b>Tests for Validity of the Instrument</b>								
Underidentification							133.462	111.850

test:	(0.000)	(0.000)
Kleibergen-Paap rk LM statistic (Chi2 P-value)		
Weak identification test:		
Kleibergen-Paap rk Wald F statistic	67.787	57.944
Hansen J Statistic (overidentification of all instruments)	1.471 (0.2252)	0.421 (0.5165)
(Chi2 P-value)		

Notes: (a) \*\*\* and \*\* stand for significant at 1 per cent and 5 per cent level or more; (b) N=No, Y=Yes.  
Source: Authors' estimates.

## Notes:

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<sup>1</sup> The role that firms in the informal sector play in job creation among poor unskilled workers has been increasingly recognised in the policy literature – see Naudé (2010) and World Bank (2013).

<sup>2</sup> It should be noted that the empirical evidence on whether financial development has a strong positive effect on entrepreneurial activity is fairly limited. Among the few studies that have studied the effect of financial development on entrepreneurship, Paulson and Townsend (2004) find that liquidity constraints play an important role in determining who becomes an entrepreneur, using data from rural Thailand. In the case of Africa, Baliamoune-Lutz et al (2011) find that policies aimed at easing the binding credit constraints would stimulate productive entrepreneurship and private sector employment. For India, Bell and Rousseau (2001) find a positive relationship between financial development and industrialisation using time-series data from 1950 to 1990 but do not directly study the effect of financial development on entrepreneurial activity.

<sup>3</sup>Such as the management of product innovation and the development of marketing skills that enhance the probability of success of the investment project.

<sup>4</sup> Several empirical studies have found the problem of shirking among workers an important problem for managers of firms, especially in the context of developing country labour markets where labour contracts are difficult to enforce. These studies have also found that efficiency wages increase with firm size, as monitoring costs increase (Ewing and Payne 1999; Fafchamps and Soderbom 2006).

<sup>5</sup> In our model, we do not consider the opportunity cost of family labour, which would be the wage foregone in the labour market, as a full treatment of the endogenous occupational choice of the self-employed would take us from our current focus, which is the size of the family firm. See Kanbur (1979) and Banerjee and Newman (1993) among others, which have discussed an individual's choice to become entrepreneur or a worker in the context of financial market imperfections.

<sup>6</sup> Our results will not change if we allow monitoring costs for both family and non-family labour, as long as the monitoring costs of non-family labour are higher.

<sup>7</sup> If we use the production function  $Y = An^\alpha$  the average productivity of labour (AP) is  $\frac{Y}{n} = An^{\alpha-1}$  and the marginal productivity of labour (MP) is  $\frac{dY}{dn} = \alpha An^{\alpha-1}$ . Hence,  $AP = \alpha MP$  and we can use AP as a proxy for MP for empirical purposes .

<sup>8</sup> We restrict our sample to the fifteen major Indian states, where over 90 per cent of firms in our data-set are located.

<sup>9</sup> As an illustration of the differences on the costs of formalisation across Indian states, it takes 31 days to start a business in Rajasthan and 41 days in Kerala. We obtain the data on DAYSBUS and TAXRATE from the World Bank (2009).

<sup>10</sup> The national level Industrial Disputes Act (IDA) been extensively amended by state governments during the post-independence period. Besley and Burgess (2004) code each state amendment to labour laws as neutral, pro-worker or pro-employer. For neutral amendments, they assign a score of zero, for a pro-worker amendment a score of +1 and for a pro-employer amendment a score of -1. They then cumulate the scores over time for the period 1947-1997. In their sample, the state of West Bengal has the most pro-worker labour institutions with a score of +4 in 1997, and Andhra Pradesh and Tamil Nadu the most pro-employer labour institutions, each with a score of -2 in 1997. We use the Besley-Burgess measure for the last year for which the measure has been calculated – that is, 1997.

<sup>11</sup> Note that the registration with acts/authorities of the state and municipal governments is not the same as registering with the official agency under the Factories Act (that is, when the firm becomes a formal entity). State and municipal governments and cooperative authorities provide bespoke support to informal firms (or certain categories of them, such as enterprises making traditional crafts and handicrafts) in their jurisdiction or



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require them to pay fees or limited insurance benefits to their employees, for which these firms need to register under the relevant act/authority.

<sup>12</sup> We use National Industries Classification (NIC) three digit industry dummies in our regressions.

<sup>13</sup> Indian banks have to follow mandatory directed credit lending programmes set by the Reserve Bank of India where about forty per cent of their credit allocation has to go to the so-called priority sector, which includes agriculturalists and small manufacturing firms. Given these mandatory lending requirements, bank credit to the informal sector (as well as to other “priority” sectors) is supply-determined to a large extent.

<sup>14</sup> Our model predicts that the number of non-family workers a firm will hire will depend on a) credit constraints which prevent it from borrowing to pay the outside workers’ wages, and b) the returns to hiring an additional outside worker as compared to the higher wage premium to be paid for monitoring. Firms may either be constrained and remain small due to difficulty in accessing external finance and/or may choose to remain small if the returns to increase in size is not justified due to higher monitoring costs. The low number of hired workers (less than four) that an average informal firm in India employs may suggest that these firms face quite severe credit constraints and/or the returns to increasing firm size for an average informal firm in India may not be large enough to justify the higher wage premium to be paid to hired workers as firm size increases.

<sup>15</sup> We have also re-estimated the regressions, using only BORRCN as the instrument, since it can be argued that BKCRDT may not meet the exclusion restriction if greater financial development leads to the growth of informal firms. We do not find any change in our IV results when we use BORRCN as the only instrument.

<sup>16</sup> Results are not presented but available from authors on request.

<sup>17</sup> We define firm size as the number of total workers, which include both non-family and family workers.