

The Effects of Risk and Shocks on Non-Farm Enterprise Development in Rural Ethiopia

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Abstract: Using a matched household-enterprise-community dataset augmented with precipitation based measures of uncertainty, this paper assesses the impact of risk and shocks on non-farm enterprise development in rural Ethiopia. The likelihood of running a non-farm firm and the returns to running such firms covary with agricultural productivity shocks. Diversification into non-farm activities thus provides limited protection against fluctuations in agricultural performance. This may explain why ex-ante risk has no impact on the likelihood of running a non-farm firm. Uncertainty nonetheless hampers non-farm enterprise development by repressing investment and inducing sorting into less capital-intensive activities.

Key words: risk, rural, firms, Ethiopia, entrepreneurship, investment-climate

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1 Introduction

Risk is a prominent explanation for the persistence of rural poverty (see e.g. Alderman and Paxson (1992), Morduch (1995, 1999), Townsend (1995), Fafchamps (1999, 2003) and Dercon (2004)). In the absence of perfect insurance and credit markets risk averse households may choose activity portfolios that yield less volatile, but lower returns. Risk can discourage investment in fixed capital (e.g. equipment) by incentivizing households to keep assets in liquid form. In addition to these costly *ex-ante* risk mitigation mechanisms, strategies to cope with short-lived shocks may have lasting negative effects.¹

A parallel literature stresses the potential of rural non-farm enterprises to catalyze rural growth and structural transformation (see the discussions in Barret et al., 2001, Lanjouw and Lanjouw, 2001 and Haggblade et al., 2007). Despite competing theoretical predictions regarding the effects of uncertainty, which are discussed in section 2 below, the nascent literature on the determinants of non-farm enterprise performance (e.g. Deininger et al., 2007, Jin and Deininger, 2009, and Rijkers et al., 2010) has not examined the impact of risk on non-farm enterprise development. This may be considered surprising since the potentially deleterious effects of risk on poverty reduction and growth would appear particularly pertinent in rural areas, which are characterized both by high risk and by highly imperfect markets. Moreover, a lack of non-farm private sector development is synonymous with a lack of investment, and discouraging investment is precisely one of the key mechanisms by which risk is alleged to stunt growth. A major reason for the scarcity of research on the impact of uncertainty on rural non-farm private sector development is that information on rural non-farm enterprises is scant (Lanjouw and Lanjouw, 2001, World Bank, 2005). Another reason is that econometrically exogenous information on risk is notoriously difficult to collect.

To help redress this lacuna in the literature, this paper augments a novel matched household-enterprise-community dataset with objective precipitation based proxies for risk and shocks to examine the impact of risk and shocks on non-farm enterprise development in the Amhara region in Ethiopia. More specifically, the paper assesses the *ex-ante* impact of uncertainty and the *ex-post*

¹ Shocks may force households to sell productive assets, withdraw children from school (see e.g. de Janvry et al., 2006), invest less in health and nutrition (see e.g. Paxson and Schady 2005, Dercon and Krishnan, 2000) or reduce essential consumption, all of which compromise future income earning potential by reducing households' physical and human capital stocks.

impact of shocks on i) the likelihood that a household runs a non-farm enterprise and ii) firm performance in terms of productivity, investment and long-run capital accumulation.

In doing so, the paper contributes to the literature in a number of ways. To start with, the data enable us to distinguish between the impact of risk and shocks by virtue of containing historical information on predicted agricultural performance over a 12-year period, as well as on self-reported idiosyncratic shocks and coping capacity. This enables us to distinguish the ex-ante impact of being located in a highly insecure environment (risk) from the impact of negative events (shocks), issues which are often conflated in the literature (Dercon, 2008). Moreover, even though the ex-ante effects of risk are often emphasized in theoretical analyses of the impact of uncertainty on investment, the existing literature has predominantly analyzed the effects of shocks (Fafchamps, 2010).

Second, the paper focuses on the implications of risk and shocks on firms' productivity and investment rather than their impact on household-level consumption outcomes. As observed by Dercon (2008), while there is a great deal of evidence on the functioning and formation of mutual insurance mechanisms and coping strategies adopted by households, *firms have rarely been surveyed with a clear risk perspective, or the data from these surveys have rarely been analysed using risk and its consequences as the focal point* (pii16).

Third, the paper assesses the determinants of *rural* non-farm enterprise development. While a sizeable body of evidence attests to the importance of a good investment climate for private sector development and growth, most of the literature relies on surveys of relatively large urban-based manufacturing firms (see e.g. Bigsten and Söderbom, 2006). Consequently, it is not clear how the conclusions based on these studies generalize to urban areas, where firms tend to be smaller and enterprise performance is arguably more closely intertwined with household events and agricultural productivity. Our matched enterprise-household-community dataset allows us to examine the impact of such household factors and helps us analyze the relationship between local agricultural performance and non-farm enterprise development.

Fourth and related, it is not clear whether the recent expansion of the non-farm sector in developing countries (Haggblade et al, 2007) reflects the creation of productive employment opportunities or is driven by limited labor absorption by the agricultural sector and a lack of wage-labor opportunities in urban areas limiting incentives to migrate. By enabling us to document and analyze the returns to running non-farm firms, the data allow us to shed light on this issue.

Ethiopia provides an interesting context to examine the impact of study the impact of risk on non-farm enterprise development as more than 80% of the Ethiopian population lives in rural areas, where risks are rife (World Bank, 2005). With rapid population growth and limited absorption of labor in agriculture, diversification into non-farm sector activities features prominently in the government's poverty alleviation strategy. Since poverty is predominantly a rural phenomenon globally (Dercon, 2009, Chen and Ravallion, 2010), the relevance of our study extends beyond the Ethiopian context. Our findings are especially relevant for African countries, because the majority of them remain highly reliant on the rural sector and because Africa' poor growth performance in the past has often been attributed to its high-risk environment (see e.g. Collier and Gunning, 1999).²

The paper is organized as follows. The next section briefly reviews related literature and enumerates our key hypotheses. The third section describes how we constructed our dataset and how we measure risk and shocks. Participation patterns are analyzed in section 4, while section 5 analyzes the determinants of productivity. The impact of uncertainty on investment and long-run capital accumulation is analyzed in section 6. A final section concludes.

2 Related Literature and Hypotheses

The relationship between uncertainty, shocks, and non-farm entrepreneurship is theoretically ambiguous. If risk causes caution on the consumption side, it would simultaneously reduce both individuals' willingness to invest and local demand for non-farm products. Similarly, in poor rural contexts concerns about food security may induce excessive specialization in farming. Thus, one may postulate a negative correlation between risk and non-farm enterprise activity. On the other hand, consistent with the common view that diversification is a response to risk (see e.g. Rosenzweig and Binswanger, 1993), one could hypothesize that households living in risky environments are more likely to run a firm, although the extent to which non-farm enterprise activity can contribute to income smoothing will depend on the covariance between agricultural outcomes and non-farm enterprise returns as well as the relative riskiness of each activity. To our knowledge, only a handful of studies have attempted to address this issue and these have yielded mixed results. For example, Dercon and Krishnan (1996) study activity portfolio choices in rural Tanzania and find that risk mitigation considerations are not an important driver of activity choice. By contrast, Kurosaki and

² It should be noted, however, that Africa's growth performance in the recent past has been much stronger than during the 1980s and 1990s.

Fafchamps (2002) show that farmers' observed cropping patterns in rural Pakistan are consistent with their desire to reduce exposure to input price risk.

The relationship between shocks and non-farm entrepreneurship is similarly ambivalent, since shocks may force people to terminate their business (see e.g. Mead and Liedholm 1998), but could also force individuals to take up non-farm activities to generate additional income (see e.g. Rose, 2001). In short, the impact of uncertainty and shocks on participation in non-farm entrepreneurship is ultimately an empirical question.

Risk and shocks can have a strong effect on enterprise performance. Adverse weather shocks, for instance, can have large negative effects on the demand for both farm and non-farm products (Fafchamps, 1999). As pointed out by Sen (1981) in his analysis of the 1973 Ethiopian drought, shocks to agricultural productivity may hurt producers of non-agricultural products more than farmers; those hit hardest by the drought were not farmers but instead artisans and domestic workers, the demand for whose products declined dramatically.

In models of investment under uncertainty and irreversibility risk increases the option value of waiting, thereby discouraging investment (see e.g. Dixit and Pindyck, 1994). However, Abel and Elberly (1999) show that the impact of uncertainty on the long-run capital stock is theoretically ambiguous since there may be a so-called hangover affect working in the opposite direction if irreversibility prevents the firm from selling capital when its marginal revenue product is low. Empirical support for models of irreversible investment under uncertainty are provided by Patillo (1998), who shows that Ghanaian managers' subjective risk perceptions are negatively correlated with investment and by Vargas Hill (2010), who demonstrates that the decisions of coffee farming households in rural Uganda to investment in or abandon coffee trees are consistent with models of investment under uncertainty and irreversibility. Dercon and Christiaensen (forthcoming) show that uninsured consumption risk discourages fertilizer usage in rural Ethiopia.³ To our knowledge, no study has examined the impact of risk on rural non-farm enterprise performance.

To summarize, the first main hypothesis we intend to test is that risk and shocks discourage entrepreneurship, while the alternative hypothesis is that they encourage diversification. The second chief hypothesis is that risk hampers enterprise performance in terms of productivity and

³ In addition, Bliss and Stern (1982) argue that Indian farmers' limited usage of fertilizer, which is likely to raise expected farm profits, is probably best explained by their attitudes towards risk, which reduces their willingness to invest. In addition, Fafchamps and Pender (1997) show that Indian households' desire to keep some liquidities reduces their willingness to invest in nondivisible risk-reducing irrigation technology.

investment, while the alternative hypotheses are that risk has no, or possibly even a positive impact on productivity and entrepreneurs' willingness to invest.

3 The Data

3.1 The Rural Investment Climate Data

The Ethiopian Rural Investment Climate Survey Amhara (RICS-Amhara) was fielded by the World Bank in collaboration with Ethiopia's Central Statistical Agency (CSA) in December 2006 and January 2007 and yielded a unique matched dataset containing 2909 households, 729 enterprises, and 149 communities.⁴ The survey contains detailed information on rural households (including non-enterprise owning households), the non-farm enterprises they operate, and the investment climate in the communities in which they are located, as well as subjective information on shocks and coping ability. For the purposes of this survey, a rural nonfarm enterprise was defined as any income generating activity (trade, production, or service) not related to primary production of crops or livestock undertaken either within the household or in any nonhousing units. In addition, any value addition to primary production (i.e processing) was considered to be a rural nonfarm activity.⁵

The RICS-Amhara is representative of the Amhara region. Amhara's non-farm enterprise sector is in turn fairly representative for Ethiopia at large, even though participation rates and average enterprise profitability in Amhara are somewhat lower than in other parts of Ethiopia. In addition, the sectoral composition of Amhara's non-farm enterprise sector is skewed towards relatively unprofitable manufacturing activities (Loening et al., 2008).

3.2 Measuring Shocks and Risk

To obtain econometrically exogenous proxies for risk and shocks, the RICS-Amhara was augmented with wereda (i.e. district) level indicators of predicted agricultural performance based on rainfall information, using a subsample of the National Oceanic and Atmospheric Administration's Africa Rainfall Estimates Climatology dataset spanning the period from 1995 to 2006. As alluded to in

⁴ However, not all observations contained information on all variables of interest, which is why the numbers of observations used in our various analyses are lower than the number reported here.

⁵ Thus, in many cases the term "activity" might have been more appropriate than the term enterprise.

section 2, non-farm entrepreneurs in rural areas are affected by agricultural performance since the bulk of demand derives from customers making a living from agriculture. Rainfall could also induce relative price effects, but the empirical evidence we have at our disposal suggests these are not of first-order importance since prices for products produced by non-farm enterprises are not strongly correlated with agricultural performance (see Table 1).⁶

Measuring Shocks As a proxy for contemporaneous demand shocks, we use the 2006 Water Requirement Satisfaction Index (WRSI), which is an econometrically exogenous indicator of predicted crop performance based on water availability during the growing season, computed using rainfall information and measured at the wereda (i.e. district) level. WRSI is expressed as a percentage of maximum yield under ideal growing conditions. That predicted performance is measured relative to community-specific maximum yields aids identification as the WRSI measure essentially captures within-community variability in agricultural performance.

In addition to this objective proxy, self-reported reported illness, death and job-loss shocks serve as indicators of idiosyncratic household-level shocks. A household is considered to have suffered an illness (death/job-loss shock) if at least one household member suffered an illness (death/job loss) during the year preceding the survey. Finally, a household's risk-coping capacity is proxied by a dummy variable indicating whether the household considers itself capable of raising 100 Birr in case of an emergency. This variable also serves as a crude indicator for a household's access to finance. Since these self-reported measures are subjective, they have to be interpreted with caution.

Measuring risk To measure ex-ante uncertainty, we use the standard deviation of WRSI over the period from 1995 up until 2005. A key strength of our measure of risk is that it arguably captures the most important type of uncertainty facing Ethiopian farmers. In addition, it is econometrically exogenous and objective, while most previous literature has relied on potentially endogenous and often subjective measures of risk.

4 Participation

⁶ Out of 9 product-measurement unit combinations only kakitala, locally produced beer, is correlated with woreda-level WRSI in 2006. However, it should be noted that the number of observations is limited in most cases and that the definitions of local units of measurement, such as a goug, differ across localities, which limits the reliability of these correlations.

4.1 Rural life is risky

Table 2 presents summary statistics for households, distinguishing between those with and those without an enterprise. In Amhara, 23% of all households own a non-farm enterprise.⁷ Enterprise owning households on average derive about a third of their income from running a non-farm enterprise, but are not significantly better off than households which do not run a non-farm firm. The log of average household expenditure per capita is 7.3, or about \$163 (1480 Birr) in levels, which is a stark reminder of how poor the households in our sample are. The income earned by households running a non-farm enterprise on average comprises just over a third of the value of their total expenditure.

Prima facie, there is no strong link between ex-ante risk, vulnerability to shocks and enterprise ownership, even though life in rural areas is clearly risky. The standard deviation of predicted agricultural performance is about 7.6% for enterprise owning households and 7.4% for non-enterprise owning households. Shocks are prevalent; 24% of enterprise owning households reported having experienced an illness shock, 4% reported having experienced a death shock and 2% reported having suffered a job loss shock in the year preceding the survey. The incidence of shocks reported by non-enterprise owning households was very similar as 19% reported an illness shock, 2% a death shock and 4% a job loss shock. While the proportion of household reporting job loss shocks may seem low in absolute terms, is high when one considers that merely 10% of all working-age individuals have worked for a wage at some point during the year.

The descriptive statistics furthermore suggest that enterprise owning households are more likely to be headed by women, individuals who are divorced and migrants, defined here as those who are living in communities in which they were not born; these are local, not international migrants. Moreover, entrepreneurship appears strongly correlated with location; entrepreneurs are more likely to live in rural towns, closer to markets and roads, as well as more likely to live in communities where financial institutions are present. On the other hand, on average, enterprise owning household are neither headed by older or better educated individuals, nor are they better able to access emergency credit if necessary.

⁷ 4% of all households own more than one enterprise. The maximum number of enterprises owned by a single household is 4 (we found 2 such households in the data).

4.2 Modelling Participation

To assess the impact of shocks and uncertainty on the propensity to run a firm, we estimate a probit model for participation, P , using as explanatory variables household and community characteristics, H and C respectively, uncertainty, U , and indicators of shocks and coping capacity, S :

$$\Pr(P = 1) = \phi(\pi_H H + \pi_C C + \pi_U U + \pi_S S) \quad (1)$$

where π_i , $i \in \{H, C, U, S\}$, indicates a vector of parameters to be estimated. The key null hypothesis of interest is that diversification into non-farm activities is not motivated by the desire to mitigate risk i.e., that $\pi_U = 0$. In addition, we assess whether non-farm enterprise activity responds to shocks by testing whether $\pi_S = 0$.

Omitted variable bias and endogenous placement are two key threats to identification. Since our objective risk and shocks proxies are measured at the community level, being able to control for potentially confounding differences between locations is important. Our data enable us to control for a rich set of objective community characteristics by virtue of containing detailed information on the local investment climate, which should reduce omitted variable bias. To assess the importance of endogenous placement we present regressions where we control for whether or not the household migrated into the community, and assess whether risk has a disproportionate impact on the decision of such families to run a non-farm enterprise. If aspiring entrepreneurs choose to locate in less risky areas to set up firms, one would expect migrant households' propensity to set up non-farm firms to be more strongly correlated with risk than that of non-migrant households, *ceteris paribus*.

4.3 Results

Table 3 shows estimates from probit models of the likelihood that a household has at least one non-farm firm.⁸ The baseline specification presented in column 1 includes as regressors basic household demographics, characteristics of the household head, location dummies, distance variables, contemporaneous WRSI, and a measure of ex-ante uncertainty, the standard deviation of

⁸ We also examined the impact of risk and shocks on the number of households owned by each household using ordered probit and Poisson regression models. The results, which we do not present to conserve space, are qualitatively very similar to the results obtained using the simple probit.

WRSI over the period 1995-2005. The second specification, which is our preferred specification, adds further community controls for the opportunity cost of labour, the quality of infrastructure and access to credit. While these variables are potentially endogenous to participation, their inclusion serves to reduce potential omitted variable bias. Column 3 adds subjective idiosyncratic shocks variables and a dummy for whether or not the household would be able to generate 100 Birr in case of an emergency, referred to as emergency credit. The final column adds an interaction term between our proxy for uncertainty and being a migrant household to test for the importance of endogenous placement.

The main finding is that non-farm entrepreneurship is not correlated with uncertainty. The finding is robust to including additional controls for community characteristics (column 2) and idiosyncratic shocks and coping capacity (column 3), which are not significantly correlated with participation. The results presented in column 4 furthermore suggest that endogenous placement does not play a major role. While migrant households are much more likely to run a non-farm firm (perhaps because they lack other income earning options) *ceteris paribus*, their decision to run non-farm firms does not seem correlated with uncertainty, as is indicated by the fact that the coefficient on the interaction term between the standard deviation of WRSI and being a migrant household is close to zero and statistically insignificant.⁹ Overall, these findings suggest that that risk mitigation considerations cannot explain the decision to run a non-farm firm and provide empirical evidence for Dercon et al.'s proposition that households' activity portfolio choice *cannot be explained by their behaviour towards risk as is usually suggested* (Dercon et al., 1996, p1.).

By contrast, predicted agricultural performance is positively correlated with participation at the 10% level. The effect of better agricultural performance is significant and non-negligible; a one percent increase in predicted agricultural output is associated with an increase in the participation rate of 0.9%.

The results furthermore suggest that entrepreneurship is more important for women than for men. Female-headed households are much more likely to run a firm and participation is also positively correlated with the number of women in the household. A possible explanation for this finding is that cultural preferences inhibit women from working on the farm. For instance, many households in Amhara believe that the harvest will be bad if women work on the farm (Zwede and

⁹ Similar robustness checks were run for the production function, investment and capital stock regressions presented below. In none of these models did we find evidence of bias associated with endogenous placement. Results are omitted to conserve space, but available from the authors upon request.

Associates (2002) and Bardasi and Getahun (2007)). Moreover, the results underscore the importance of location; households located in a rural town are some 21 to 24 percentage points more likely to engage in non-farm enterprise activities. Households living further away from food markets are significantly less likely to run a non-farm firm. Entrepreneurship is concavely related to the age and education of the household head,¹⁰ more prevalent amongst divorcees, and significantly higher in areas with better access to electricity. Participation rates are also correlated with the ability to use land as collateral when requesting a loan from a financial institution.

5 Performance

5.1 Enterprises are small and sales are low

Table 4 summarizes key enterprise characteristics. Enterprises are very small, highly labor-intensive and not very productive.¹¹ Seventy-seven percent of enterprises in our sample employ only one worker and a mere 0.4% of all enterprises employ more than 5 workers. The mean of log sales is 7.38, or about \$173 (or approximately 1600 Birr) in levels. There is a lot of heterogeneity across firms, as is evidenced by the high standard deviation of sales. On average, the returns to running a non-farm enterprise seem lower than the returns to having a wage job. The average of log value added per day worked in a non-farm enterprise is 1.22, equivalent to roughly 3 Birr or about \$0.37. By comparison, male agricultural workers typically receive a daily wage per day of 8 Birr, while women receive 7 Birr per day.

¹⁰ The probability of running a firm is concavely related to the age of the household head. This may be picking up lifecycle effects or the fact that older individuals are usually wealthier and consequently better capable of raising the capital required to set up a profitable firm. The likelihood of participating is also concavely associated with the educational attainment of the household head, with the turning point at around 4 years of education. The fact that the probability of running an enterprise decreases as schooling increases beyond 4 years is driven by the fact that education provides better access to wage jobs, which tend to be better paid. The regressions also suggest that divorced individuals are much more likely to run a firm. Perhaps these individuals lack alternative income earning options, assets, and support from their family and friends.

¹¹ Only 3 out of our 729 enterprises in the entire RICS-dataset employed more than 10 employees. However, these enterprises are all household-based and we might have missed out on fully commercial enterprises owned or managed by individuals not living in these communities. However, from the community level dataset one can infer that there are not more than a dozen firms with more than 20 employees in a radius of 1-hour commuting distance from the 179 surveyed communities. It thus seems safe to conclude that there are very few large firms in rural areas.

The low average output of non-farm firms is in part due to low capital intensity and material inputs usage; the average log value of the capital stock is 5.10, which corresponds to about \$18 (164 Birr), in levels, while the mean log of material inputs is 5.76, corresponding to about \$351 (317 Birr). Turning to the sectoral composition of the non-farm sector, most (56%) of the non-farm enterprises in the sample are manufacturing firms. In addition, 29% of the non-farm enterprises engage in trade and the remainder in services, e.g. operating a hotel or restaurant.

5.2 Modelling Strategy

In order to describe and explain productivity differentials across different types of enterprises and localities, we use a simple augmented Cobb-Douglas production function framework which models output, Y , as a function of capital, K , labour inputs, L , material inputs, M , and TFP, which is in turn modelled to be a function of the characteristics of the entrepreneur, E , and the firm, F , such as its sectoral affiliation, community characteristics, C , uncertainty, U , and subjective shocks and coping capacity, S . We try to correct for possible selection bias in the production function, an endogeneity problem that has received surprisingly little attention in the literature, (Akerberg et al., 2007), by including a Heckman selection correction term $\delta\theta$ based on the extended participation regression presented in column 2 of Table 3.¹² Thus, the exclusion restrictions on which this selection correction relies are household demographics and marital status, which are assumed to affect activity portfolio choice through their impact on the opportunity cost of labour (and capital), but not the returns to different activities conditional on choosing them.¹³ Selection bias may arise because the amount of time spent running a non-farm firm may be correlated with entrepreneurial ability; those running a non-farm enterprise might be better at it than those who do not, causing a spurious correlation between inputs usage and TFP.¹⁴ Alternatively, those running an enterprise might simply

¹² We also experimented with selection correction terms based on an ordered probit model for the number of non-farm enterprises. The results, which are not presented to conserve space but available from the authors upon request, were qualitatively similar to those obtained using the Heckman selection correction term.

¹³ It is clearly possible that these exclusion restrictions are violated, for example if there is sorting by ability in the marriage market.

¹⁴ We also experimented with the more flexible translog production function, which can be interpreted as a second-order Taylor approximation to a more general production function. Based on this framework, we did not reject the Cobb-Douglas restrictions for any of our estimations. We therefore proceed with the Cobb-Douglas framework, which is remarkably robust across African firm-level data. This facilitates interpretation of the results, and retains comparability

lack alternative options, perhaps because they are not very able. A priori, it is thus difficult to sign the selection bias. Augmenting the production function with this selection correction term yields the estimable equation;

$$\ln Y = \beta_K \ln K + \beta_L \ln L + \beta_M \ln M + \beta_E E + \beta_F F + \beta_C C + \beta_U U + \beta_S S + \delta \vartheta + \varepsilon \quad (2)$$

where ε is a zero-mean normally distributed error term, assumed to be uncorrelated with the regressors in the model. The key null hypotheses of interests are that risk and shocks do not impact firm performance, i.e. that: $\beta_U = \beta_S = 0$.

We estimate this production function by means of OLS. A well-documented concern in the literature on production function estimation is that the resulting parameter estimates will be biased since the residual will be correlated with inputs. In principle, one might be able to solve this problem using instrumental variables, provided good instruments are available. Unfortunately, in our dataset such instruments are not available.¹⁵ However, a large set of control variables may go a long way towards controlling for unobserved productivity. Söderbom and Teal (2004), for example, use a sample of predominantly small manufacturing firms from Ghana to show that instrumental variable estimates of production function parameters are very similar to their OLS counterparts. Furthermore, in the rural context where there is limited economic integration, it would seem plausible to assume that factor prices vary quite a lot across villages (the low correlations between product-specific prices reported in Table 1 are consistent with this argument), which would generate exogenous variation in the factor inputs. Moreover, firms do not invest or change their labor input very much, despite facing frequent shocks. For these reasons, endogeneity bias may be limited.

To assess whether this is indeed the case, we adopt a proxy variable approach and estimate the production function with and without our precipitation based measures of predicted agricultural performance and uncertainty, which serve as crude proxies for local demand. If endogeneity of inputs is a major concern, one would expect the inclusion of these measures to lead to very different

with both micro- and macro-approaches that have been used to assess the impact of the investment climate (see e.g. Dollar et al., 2005) on firm performance.

¹⁵ We attempted to exploit information on prices to instrument factor choices, but the difficulties associated with constructing comparable price indicators were prohibitively formidable since units of measurement for different goods varied substantially across villages. Moreover, enterprises located in different villages produced different products, leaving us with a very small subsample of observations for which price variation could be identified.

parameter estimates on factor inputs. By contrast, if such parameter estimates do not change very much, endogeneity bias is likely more limited.

5.3 Results

Results from the production function regressions are shown in Table 5. Column 1 presents the “bare” specification, using factors of production, characteristics of the manager, location dummies, distance measures, firm age and sub-sector dummies as explanatory variables. In column 2, which presents our baseline specification, selection bias is controlled for by means of the Heckman procedure. In addition, precipitation-based measures of ex-ante uncertainty and local demand are added. Column 3, which is our preferred specification, adds community controls for infrastructure, local wages rates, access to credit and competition. Though they are potentially endogenous to performance, the inclusion of these variables should reduce omitted variable bias. Column 4 includes subjective shocks measures and an indicator of self-reported coping capacity.

The models shown in Table 5 explain a substantial part of the variation in sales. The factors of production – labour days, capital and materials - are all significant. While the assumption of constant returns to scale is never rejected by the data, our production function estimates hint at the existence of very mildly increasing returns to scale since the sum of the coefficients on capital, labour and material inputs is always larger than 1. The estimated coefficient on labour is about 0.7, which though high is in line with the literature on microenterprises (see e.g. Deininger et al. (2007) and Jin and Deininger (2009) for comparable estimates for Sri Lankan and Tanzanian rural microenterprises). The coefficients on capital and inputs are rather modest.

Comparison of columns 1 and 2 suggests endogeneity bias is limited. The coefficient estimates on Heckman’s lambda are very small and statistically insignificant except in column 2 where it is marginally significant. In addition, the coefficient estimates in columns 1 and 2 are very similar, even though we include a control for unobserved demand and uncertainty in column 2. Recall that one would anticipate precipitation-based measures of agricultural performance to be strongly correlated with inputs usage if endogeneity of inputs were a major concern. The fact that this is not the case, while the contemporaneous WRSI measure enters strongly significantly suggests that the likely impact of endogeneity of inputs bias is minimal as well. These results are robust to including additional community and investment climate controls (column 3) and self-reported

shocks (column 4). The impact of uncertainty and other shocks on enterprise performance is statistically negligible.

The positive and significant coefficient on contemporaneous WRSI is a key finding of this paper since it implies that (the prospect of) a good harvest raises productivity among non-farm enterprises, probably because of higher local demand. An alternative explanation would be that rainfall induces price effects. Recall, however, that the results presented in Table 1 suggest that such price effects are not large. The high covariance between non-farm enterprise sales and agricultural outcomes is consistent with the finding that risk mitigation does not explain non-farm enterprise participation since it indicates that diversification into non-farm enterprise activity is of limited use when attempting to mitigate weather-risk.

Turning to other results of interest, male-operated enterprises are more productive than enterprises managed by women and firms located in rural towns are more productive than other firms. The relationship between enterprise profitability and the education of the manager is convex.¹⁶ The manager's age and its square are neither individually nor jointly significantly correlated with higher productivity. The coefficients on the industry dummies suggest that manufacturing activities are among the least productive activities while trading activities, such as wholesale and retail, are very productive. The high profitability of trading activities could reflect arbitrage opportunities due to limited economic integration, which may also explain why enterprises engaging in transport activities are very profitable.

Finally, it is worth pausing to consider the implied marginal productivity of capital. The estimated median marginal productivity of capital is 77%. Our estimates are in line with the very high returns to capital in microenterprises documented by McKenzie and Woodruff (2006) and de Mel et al. (2007), who estimate that the average annual returns to capital in Sri Lankan microenterprises are at least 68% per year.

¹⁶ Of course, this does not imply that education necessarily boosts productivity. Education may be endogenous. For example, it could be the case that more able individuals are both more productive and more likely to set up a firm. Furthermore, the convex relationship between education and non-farm enterprise profitability may be driven by selection. For example, suppose that enterprise productivity is randomly distributed and that the likelihood of being offered a wage job increases with educational attainment. Suppose furthermore that wage opportunities are on average better paid than self-employment in non-farm enterprises. Most educated managers will take up wage jobs. However, those with particularly productive enterprises might prefer to reject wage job offers, since they do not yield a higher income stream. Such a selection process could thus cause a spurious convex correlation between education and profitability.

6 Investment and long-run capital accumulation

6.1 Modelling Strategy

Despite very high marginal returns to capital, only 18% of firms in our sample record any investment in fixed capital. In addition, the firms that do, typically invest only very small amounts and average capital stocks are very low.¹⁷ To examine to what extent uncertainty accounts for such low levels of capital accumulation, we estimate a simple investment probit. Our most general investment model uses as explanatory variables initial conditions, B , enterprise characteristics, E , community characteristics, C , uncertainty, U , covariate and individual shocks and coping capacity, S and the inverse Mills ratio θ to correct for selection bias:¹⁸

$$\Pr(I > 0) = \Phi(\tau_B B + \tau_E E + \tau_C C + \tau_U U + \tau_S S + \tau_\theta \theta) \quad (3)$$

where I denotes investment.

The investment probit identifies the short-term impact of uncertainty on capital accumulation. To examine the impact of uncertainty on long-run capital accumulation we model the capital stock and the capital labor ratio as a function of the same set of explanatory variables:

$$\ln K = k_B B + k_E E + k_C C + k_U U + k_S S + k_\theta \theta + w \quad (4)$$

$$\ln \frac{K}{L} = c_B B + c_E E + c_C C + c_U U + c_S S + c_\theta \theta + z \quad (5)$$

where w and z are exogenous, zero-mean, normally distributed error terms.

We present regressions without and with controls for initial conditions. In addition, in our models of the long-run capital stock and capital intensity we present regressions that do not control for sector since activity choice and capital intensity are closely intertwined.

¹⁷ The average of the log of investment for firms which invested is 4.77, corresponding to about 118 Birr, or about \$13.

¹⁸ We also ran regressions in which we used a selection correction based on an ordered probit model for the number of enterprises owned. The results, which are not presented to conserve space but available from the authors upon request, are qualitatively similar to those obtained using the Heckman procedure.

6.2 Results

6.3.1 Investment

Table 6 shows results from probit regressions modelling the likelihood of buying equipment (investment). The baseline specification, presented in column 1, controls for firm age, sectoral affiliation, characteristics of the manager, location dummies, distance measures, uncertainty, as well as contemporaneous predicted rainfall. In the second column additional community and investment climate controls are added. The third column adds subjective shocks measures and a dummy indicating whether or not the household is able to generate 100 Birr in case of an emergency. In the final column, labor usage and capital at startup, proxied by the answer to the question “how much money did you pay to set up the firm?”, are added to control for initial conditions.¹⁹

Our principal result is a clear and very strong negative relationship between uncertainty and investment, consistent with conventional models of investment under uncertainty. By contrast, shocks are not statistically significant predictors of investment in any of the specifications. In the risky rural context, where insurance is imperfect and access to credit is limited, precautionary motives provide incentives for households to store wealth in the form of liquid savings rather than make irreversible investments in illiquid assets. This suggests that market failures in insurance markets may hamper enterprise performance by suppressing investment.

Indeed, the household’s ability to raise credit in an emergency is strongly positively correlated with investment (see columns 3 and 4). While this variable is likely endogenous, this suggests that households who are better capable of mitigating shocks are more willing to assume risk. This finding might also be interpreted as indicating that access to credit is an important determinant of investment. Yet, the coefficient on the financial institution dummy is anomalously negative and significant at the 10% level. Overall then, the evidence for the idea that access to credit is a major impediment to investment is weak.

The initial capital stock of the enterprise (column 4) is strongly positively associated with the probability of investment, indicating that larger firms are more likely to invest. Older firms are also more likely to invest. This could be because, as time goes on, upgrading the capital stock becomes more important. Alternatively, it could be that young firms are faced with higher uncertainty regarding the prospects of the enterprise, which may lead to caution on the investment side. The propensity to invest also varies significantly across sectors, and male managers seem more likely to

¹⁹ Thus our measures of the long-run capital stock and capital at startup are defined differently.

invest than female ones. In addition, firms that face more competitors are somewhat more likely to invest. On the other hand, there is no evidence that firms located in remote areas invest less, nor for the idea that investment behaviour varies with the age or education of the manager. Selection bias does not appear to play a major role, as is evidenced by the small and insignificant coefficients on the inverse Mills ratio.

6.3.2 Long Run Capital Accumulation

Although uncertainty is negatively correlated with investment, its impact on long-run capital accumulation is theoretically ambiguous (see e.g. Abel and Eberly, 1999, for a theoretical analysis of a model in which investment is fully irreversible). Table 7 presents models of the capital stock. Columns 1 through 4 mimic the specifications for investment, except that they do not include controls for sector. Instead we add separate specifications where we replicate specification 3 and control for sector choice (column 5), and both sector choice and initial conditions (column 6).

The determinants of the long-run capital stock and the determinants of investment are similar. Uncertainty is strongly negatively correlated with investment and this effect is robust to controlling for community characteristics (column 2), as well as shocks and the household's ability to raise emergency credit (column 3). However, the negative association between uncertainty and capital usage becomes insignificant when we include controls for initial conditions (column 4) sector (column 5) or both (column 6). Thus, it appears that uncertainty induces sorting into less capital intensive activities: once this sorting effect is accounted for, the negative association between uncertainty and capital vanishes.

Households which have the ability to generate 100 Birr in case of an emergency also run firms with higher capital stocks, *ceteris paribus*. Though supportive of the hypothesis that household that are better able to cope with risk are more likely to invest and accumulate capital, this finding may reflect reverse causation; having more collateral may make it easier to obtain credit and invest. Self-reported illness, death and job-loss shocks are not correlated with the long-run capital stock.

One might be concerned that the capital stock is merely proxying for the determinants of firm-size, rather than reflecting capital intensity. As a robustness check, table 8 presents specifications that are identical to those presented in table 7, but now using the capital labour ratio as the dependent variable. The results are very similar to those obtained using the log of the capital stock as the dependent variable; uncertainty is negatively correlated with capital intensity, but this effect becomes statistically negligible once initial conditions or sector are controlled for.

A related concern is that the productivity and investment regressions presented in sections 4 and 5 obfuscate an impact of uncertainty since they all control for sector. To alleviate this concern we have also examined the impact of uncertainty on investment and productivity not controlling for sector. The results which are not presented to conserve space but available from the authors upon request, remain qualitatively unchanged.

To sum up, our results suggest that uncertainty represses investment and induces sorting into less capital intensive activities.

7 Conclusion

The proposition that risk perpetuates rural poverty by repressing investment and inducing households to forsake potentially more profitable income-earning opportunities to have a more stable income-stream features prominently in current development debates. A parallel and growing literature emphasizes the potential of small rural non-farm enterprises to catalyze rural poverty reduction and growth. Despite competing theoretical predictions about the impact of uncertainty on rural non-farm enterprise development, the empirical evidence on the impacts of risk and shocks on rural non-farm enterprise performance remains very sparse. This is surprising since rural life is rife with risks and since the repercussions of high uncertainty are likely most severe when insurance and credit markets are imperfect or incomplete, as is often the case in rural areas. The lack of empirical evidence on the relationship between risk and non-farm enterprise development reflects data-limitations, as information on both rural non-farm enterprises and risk is sparse.

To help redress this lacuna in the literature, this paper augments a novel matched household-enterprise-community dataset from the Amhara region in Ethiopia with precipitation based measures of uncertainty to examine the impact of risk and shocks on the decision to become an entrepreneur and on firm performance in terms of productivity, investment and long-run capital accumulation. Our risk and shocks proxies have the advantage of being econometrically exogenous and arguably capture (one of) the most important type(s) of uncertainty faced by rural households.

Participation in non-farm enterprise activity is positively correlated with predicted contemporaneous agricultural performance. By contrast, risk does not affect the decision to diversify per se. A plausible explanation for these findings is that diversification into non-farm enterprise activity is not an effective ex-ante means of mitigating fluctuations in agricultural performance since non-farm enterprise sales covary strongly with predicted agricultural performance. However, ex-post

the returns to running a non-farm firm are higher when agricultural performance is stronger, which may explain why participation rates are responsive to shocks.

This does not mean, however, that risk does not act as a drag on rural non-farm private sector development. Risk is negatively correlated with investment and appears to induce sorting into less capital intensive activities: it helps explain why investment rates are low even though the implied returns to capital are very high. Alternative, potentially complementary, explanations for this paradoxical coexistence of high marginal returns and low investment are high discount factors (see e.g. Bluffstone and Yesuf, 2007) and prohibitively high transaction costs associated with supplying markets outside the perimeter of one's locality. The data lend some support to the latter explanation as non-farm enterprise activity is concentrated in rural towns, where the returns to running a non-farm firm are significantly higher. In conjunction with the fact that most enterprises are very small and enterprise productivity is highly dispersed, this suggests that market fragmentation is a(nother) key culprit of the poor performance of Ethiopia's rural non-farm sector.

Although they do not appear very suitable instruments for mitigating agricultural output risk, non-farm enterprises nonetheless fulfill an important safety net function as they generate income for those with limited income earning opportunities, such as widows, women and migrants. Although the returns to running a non-farm firm are low on average, and much lower than prevailing local agricultural wage rates, participation rates are considerable, suggesting that many of the non-farm entrepreneurs lack better options. In other words, despite high heterogeneity in firm performance, the non-farm sector is not as yet a major engine of productive employment creation.

While our findings are suggestive of the impacts by which risk and shocks affects non-farm enterprise development, the analysis is limited to very specific risks. Collecting data on other types of risk, such as those related to governance, transactions and labor exchange, and tracing enterprises and households over time would facilitate better identification of the impact of risk on uncertainty and permit a richer characterization of non-farm enterprise dynamics and how they are impacted by risk and shocks.

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Table 1: Correlation Matrix – Predicted Agricultural Performance (WRSI 2006) and prices of individual products

		WRSI 2006 local	Tella (can)	Kakitala (goug)	Sugar (goug)	Tella (goug)	Coffee (kg)	Cereal (kg)	Soap	Scarfs
WRSI 2006	ρ	1								
	Sig									
	obs	672								
Tella (can)	ρ	0.15	1							
	Sig	0.28								
	obs	52	54							
Kakitala (goug)	ρ	-0.32		1						
	Sig	0.02								
	obs	49		63						
Sugar (goug)	ρ	0.11			1					
	Sig	0.64								
	obs	22			23					
Tella (goug)	ρ	-0.10				1				
	Sig	0.56								
	obs	33				37				
Coffee (kg)	ρ	0.30			-0.12		1			
	Sig	0.27			0.67					
	obs	16			15		16			
Cereal (kg)	ρ	-0.07						1		
	Sig	0.81								
	obs	13						14		
Soap	ρ	-0.05			0.24		-0.10		1	
	Sig	0.79			0.30		0.75			
	obs	27			19		12		29	
Scarfs	ρ	0.01								1
	Sig	0.98								
	obs	28								30

Note:

- Tella and kakitala are locally brewed alcoholic beverages
- Goug is a local measure. However, the precise quantity of a goug varies across villages, which makes the price comparisons somewhat unreliable
- Because of measurement issues, we have decided to consider each product-measurement unit combination as a separate product instead of attempting to convert different units into comparable quantities, which explains why a can of tella is not considered the same product as a goug of tella
- Many rows are empty because not all products were produced in each wereda

Table 2: Household Characteristics by Enterprise Ownership

	Households owning an enterprise		Households without enterprise	
	Mean	SD	Mean	SD
<i>Household Characteristics</i>				
Age of the Head	42.87	14.47	43.60	16.69
Years of Schooling	1.72	2.79	1.88	3.77
Gender (1=male)	0.52	0.50	0.75	0.43
Married	0.55	0.50	0.70	0.46
Divorced or separated	0.28	0.45	0.10	0.30
Widowed	0.14	0.34	0.14	0.35
Migrant	0.46	0.50	0.30	0.46
Household size	4.01	2.23	4.25	2.19
Adult men	1.11	1.03	1.32	1.08
Adult women	1.49	0.91	1.33	0.84
Children (<5 years)	0.51	0.68	0.64	0.74
Elderly (>65 years)	0.13	0.36	0.16	0.40
Distance to the nearest market (log)	1.37	0.95	1.91	0.78
Distance to the nearest all-weather road (log)	1.54	1.32	2.12	1.16
<i>Community Characteristics</i>				
Remote	0.37	0.48	0.65	0.48
Rural Town	0.45	0.50	0.13	0.34
Credit Institution	0.72	0.45	0.57	0.50
Land usable as collateral	0.15	0.35	0.12	0.32
Daily wage (log) (ETB)	2.24	0.35	2.17	0.32
Lack of electricity access	0.34	0.25	0.39	0.28
<i>Uncertainty</i>				
σ WRSI 1995-2005	7.57	6.46	7.38	5.95
<i>Shocks and Coping Capacity</i>				
WRSI 2006	98.27	2.58	98.28	2.68
Illness shock	0.19	0.39	0.24	0.43
Job-loss shock	0.01	0.11	0.02	0.16
Death shock	0.04	0.19	0.04	0.19
Emergency credit	0.55	0.50	0.60	0.49
<i>Household Expenditure</i>				
Log total household expenditure (ETB)	8.21	0.74	8.26	0.71
Log annual expenditure per adult (ETB)	7.33	0.62	7.30	0.63
Ratio total enterprise value added to total hh expenditure	0.33	0.35		
Observations	523		1486	
Participation Rate (weighted)			23%	

Note:

- Statistics are unweighted, with the exception of the participation rate
- Exchange rate USD-Ethiopian Birr: 1:9.1

Table 3: Participation Probit

Participation Probit – Marginal Effects				
Dependent Variable: Participation indicator				
	1	2	3	4
	coef/se	coef/se	coef/se	coef/se
<i>Uncertainty</i>				
σ WRSI 1995-2005	0.003 (0.002)	0.001 (0.002)	0.002 (0.002)	0.002 (0.002)
<i>Shocks and cobine capacity</i>				
WRSI 2006	0.009** (0.004)	0.007* (0.004)	0.008* (0.004)	0.008* (0.004)
Emergency credit			0.022 (0.022)	0.022 (0.022)
Illness shock			0.024 (0.026)	0.024 (0.026)
Job loss shock			-0.028 (0.069)	-0.028 (0.069)
Death shock			-0.045 (0.047)	-0.045 (0.047)
<i>Household Characteristics</i>				
Head's Age	0.014*** (0.004)	0.015*** (0.004)	0.015*** (0.004)	0.015*** (0.004)
Head's Age ²	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)
Head's Schooling	0.060*** (0.010)	0.060*** (0.010)	0.060*** (0.010)	0.060*** (0.010)
Head's Schooling ²	-0.008*** (0.001)	-0.008*** (0.001)	-0.008*** (0.001)	-0.008*** (0.001)
Gender of the Head	-0.130*** (0.041)	-0.142*** (0.042)	-0.144*** (0.042)	-0.143*** (0.042)
Married	0.076 (0.053)	0.071 (0.053)	0.067 (0.054)	0.067 (0.054)
Divorced or separated	0.216*** (0.081)	0.197** (0.081)	0.200** (0.081)	0.200** (0.081)
Widowed	0.000 (0.067)	-0.017 (0.065)	-0.014 (0.066)	-0.014 (0.066)
Migrant	0.044* (0.023)	0.046** (0.023)	0.046* (0.024)	0.059* (0.035)
Share adult men	-0.012 (0.012)	-0.012 (0.012)	-0.013 (0.012)	-0.013 (0.012)
Share adult women	0.038*** (0.013)	0.037*** (0.013)	0.036*** (0.013)	0.036*** (0.013)
Share children (< 5 yrs)	-0.023 (0.015)	-0.023 (0.015)	-0.023 (0.015)	-0.023 (0.015)
Share elderly (>65 yrs)	0.045 (0.040)	0.051 (0.040)	0.050 (0.040)	0.050 (0.040)
Distance to food market (log)	-0.221*** (0.053)	-0.245*** (0.054)	-0.241*** (0.054)	-0.240*** (0.054)
Distance to food market (log) ²	0.058*** (0.014)	0.063*** (0.014)	0.062*** (0.014)	0.062*** (0.014)
Distance to nearest road (log)	-0.018 (0.037)	-0.027 (0.038)	-0.028 (0.038)	-0.028 (0.038)
Distance to nearest road (log) ²	0.005 (0.008)	0.006 (0.008)	0.007 (0.008)	0.007 (0.008)
<i>Community Characteristics</i>				
Remote	-0.055 (0.036)	-0.052 (0.036)	-0.053 (0.036)	-0.053 (0.036)
Town	0.240*** (0.053)	0.207*** (0.054)	0.214*** (0.055)	0.215*** (0.055)
Credit Institution		0.012 (0.024)	0.010 (0.024)	0.011 (0.024)
Land usable as collateral		0.073** (0.036)	0.075** (0.036)	0.074** (0.036)
Lack of electricity access		-0.105*** (0.038)	-0.102*** (0.038)	-0.101*** (0.038)
Daily wage (log)		-0.013 (0.032)	-0.018 (0.032)	-0.020 (0.032)
Migrant* σ WRSI 1995-2005				-0.002 (0.003)
Number of observations	2,009	2,009	2,009	2,009
chi2 (df)	479 (21)	494 (25)	497 (29)	497 (30)
Pseudo R2	0.208	0.215	0.216	0.216

Note: *** p<0.01, ** p<0.05, * p<0.1. Standard errors are heteroscedasticity robust and clustered at the community level

Table 4: Enterprise Characteristics

Descriptive Statistics Enterprises			
	Mean	Sd	USD³
Firm age	8.88	9.90	
<i>Sales (Y) & Value-Added (V)¹</i>			
Ln Y (ETB)	7.36	1.78	\$173
Ln V (ETB)	6.48	2.10	\$72
Ln (V/L) (ETB/day)	1.22	1.83	\$0.37
<i>Factors of production¹</i>			
Ln M (ETB)	5.76	2.31	\$35
Ln K (ETB)	5.10	2.41	\$18
L (labor days per year)	297.38	398.67	
Ln(K/L) (ETB/day)	-0.15	2.13	
<i>Competition¹</i>			
1-5 competitors	0.11	0.31	
> 5 competitors	0.27	0.44	
<i>Investment²</i>			
Any investment	0.18	0.39	
Log investment (if invested)	4.77	1.83	\$13
<i>Initial Conditions²</i>			
Ln K – initial (ETB)	4.14	2.10	\$6.90
Ln L – at startup (days)	5.06	1.11	
<i>Size Distribution²</i>			
One worker only		76.5%	
Two workers		19.2%	
3 or 4 workers		3.2%	
5 and more		0.4%	
<i>Sectoral Composition²</i>			
<i>Manufacturing</i>		56.1%	
Manufacturing (excl: grain milling, food and beverages)		30.0%	
Food and beverages, brewing/distilling		24.8%	
Grain milling		1.2%	
<i>Trade</i>		29.0%	
Retail via stalls and markets		4.9%	
Retail (not stalls/mkts)		18.0%	
<i>Services</i>		15.0%	
Services		4.9%	
Transport services		1.2%	
Hotels and restaurants		8.4%	
Other (specialized services)		0.4%	

Note:

¹ Based on the sample on which the production function regressions presented in Table 5 are based, unweighted

² Based on the sample on which the investment probits presented in Table 6 are based, unweighted

³ ETB-Dollar exchange rate: 9,1:1

Table 5 Production functions

	Production Function			
	Dependent Variable: Log sales			
	1	2	3	4
	OLS	Heckman FIML	Heckman FIML	Heckman FIML
	coef/se	coef/se	coef/se	coef/se
<i>Uncertainty</i>				
σ WRSI 1995-2005		0.001 (0.018)	0.001 (0.018)	-0.001 (0.018)
<i>Shocks</i>				
WRSI 2006		0.098*** (0.031)	0.096*** (0.031)	0.096*** (0.031)
Emergency credit				-0.136 (0.150)
Illness shock				0.053 (0.163)
Job loss shock				-0.620 (0.429)
Death shock				-0.197 (0.383)
<i>Factors of Production</i>				
ln K	0.128*** (0.044)	0.118*** (0.039)	0.116*** (0.039)	0.116*** (0.039)
ln L	0.654*** (0.120)	0.669*** (0.096)	0.693*** (0.096)	0.700*** (0.096)
ln M	0.283*** (0.044)	0.295*** (0.036)	0.298*** (0.036)	0.300*** (0.035)
<i>Firm characteristics</i>				
Food and beverages	0.152 (0.239)	0.111 (0.216)	0.090 (0.216)	0.132 (0.217)
Grain milling	-1.104 (1.027)	-1.254* (0.723)	-1.187* (0.717)	-1.103 (0.719)
Whole sale trade	1.067*** (0.263)	1.197*** (0.384)	1.084*** (0.388)	1.083*** (0.387)
Retail via stalls and markets	0.850*** (0.299)	0.761* (0.428)	0.742* (0.424)	0.776* (0.423)
Retail (not stalls/mkts)	0.643** (0.257)	0.682** (0.268)	0.658** (0.271)	0.696** (0.272)
Services	0.303 (0.312)	0.252 (0.345)	0.316 (0.348)	0.309 (0.346)
Hotels and restaurants	0.353 (0.293)	0.336 (0.270)	0.307 (0.270)	0.340 (0.270)
Transport services	1.226* (0.660)	1.163 (0.777)	1.387* (0.786)	1.455* (0.786)
Others(specialized services)	0.854*** (0.246)	0.919 (1.292)	1.130 (1.292)	1.235 (1.290)
Firm age	0.010 (0.006)	0.009 (0.007)	0.008 (0.007)	0.008 (0.007)
Distance to food market (log)	-0.012 (0.289)	0.231 (0.386)	0.288 (0.381)	0.267 (0.382)
Distance to food market (log) ²	-0.006 (0.110)	-0.052 (0.108)	-0.051 (0.107)	-0.052 (0.107)
Distance to nearest road (log)	0.378 (0.254)	0.402 (0.257)	0.370 (0.254)	0.365 (0.253)
Distance to nearest road (log) ²	-0.066 (0.062)	-0.084 (0.063)	-0.069 (0.063)	-0.065 (0.063)

<i>Manager Characteristics</i>				
Manager's age	-0.031 (0.024)	-0.034 (0.025)	-0.037 (0.025)	-0.036 (0.025)
Manager's age ² /100	0.212 (0.222)	0.233 (0.256)	0.268 (0.256)	0.251 (0.256)
Manager's gender	0.565*** (0.187)	0.672*** (0.190)	0.605*** (0.189)	0.637*** (0.192)
Manager's schooling	-0.191** (0.094)	-0.244*** (0.093)	-0.231** (0.092)	-0.215** (0.092)
Manager's schooling ² /100	21.513* (12.999)	27.809** (11.748)	26.750** (11.651)	24.557** (11.710)
Migrant	-0.163 (0.144)	-0.244 (0.148)	-0.218 (0.148)	-0.219 (0.148)
<i>Community Characteristics</i>				
Remote	0.293 (0.365)	0.269 (0.329)	0.070 (0.334)	0.106 (0.336)
Rural town	0.963*** (0.237)	0.732** (0.302)	0.622** (0.305)	0.652** (0.305)
Lack of electricity access			-0.337 (0.297)	-0.362 (0.296)
Daily wage (log)			0.422* (0.238)	0.440* (0.237)
1-5 competitors			-0.277 (0.227)	-0.253 (0.230)
>5 competitors			0.142 (0.166)	0.148 (0.166)
Constant	1.158 (0.906)	-7.994** (3.285)	-8.814** (3.431)	-8.836*** (3.429)
λ		-0.483* (0.261)	-0.395 (0.262)	-0.355 (0.263)
R ²	0.469			
Adjusted R ²	0.431			
N	374	1,877	1,877	1,877
Chi ² (df)		347(27)	364(31)	370 (35)

Note: - *** p<0.01, ** p<0.05, * p<0.1

-Computed using Heckman's two-step procedure, using the specification presented in table 3 column 2 as the participation equation.

- The omitted competition category is "no competition"; the omitted sector is "Manufacturing"

- Standard errors are heteroscedasticity robust and clustered at the community level

Table 6 Investment

Selection Corrected Investment Probit				
Dependent Variable: Investment indicator				
FIML Heckman selection correction				
No marginal effects				
	1	2	3	4
	coef/se	coef/se	coef/se	coef/se
<i>Uncertainty</i>				
σ WRSI 1995-2005	-0.052*** (0.015)	-0.053*** (0.014)	-0.054*** (0.015)	-0.056*** (0.016)
<i>Shocks</i>				
WRSI 2006	-0.034 (0.034)	-0.037 (0.034)	-0.038 (0.034)	-0.050 (0.034)
Emergency credit			0.590*** (0.165)	0.561*** (0.167)
Illness shock			0.138 (0.166)	0.181 (0.168)
Job loss shock			0.301 (0.412)	0.351 (0.415)
Death shock			0.026 (0.360)	0.024 (0.358)
<i>Firm Characteristics</i>				
Food and beverages	0.102 (0.197)	0.023 (0.196)	-0.069 (0.197)	-0.248 (0.206)
Grain milling	1.111** (0.514)	1.073** (0.516)	0.814 (0.498)	0.108 (0.621)
Whole sale trade	-0.331 (0.320)	-0.500 (0.323)	-0.535* (0.311)	-1.016*** (0.339)
Retail via stalls and markets	0.246 (0.302)	0.168 (0.302)	0.194 (0.310)	0.108 (0.340)
Retail (not stalls/mkts)	0.060 (0.217)	-0.019 (0.216)	-0.148 (0.220)	-0.509** (0.256)
Services	-0.176 (0.296)	-0.301 (0.300)	-0.299 (0.287)	-0.296 (0.302)
Hotels and restaurants	0.567** (0.268)	0.546** (0.262)	0.433 (0.267)	0.259 (0.272)
Transport services	0.479 (0.506)	0.345 (0.520)	0.136 (0.517)	-0.511 (0.540)
Firm age	0.016** (0.007)	0.014* (0.007)	0.012 (0.008)	0.014* (0.008)
Distance to food market (log)	-0.490 (0.411)	-0.300 (0.547)	-0.147 (0.493)	-0.141 (0.516)
Distance to food market (log) ²	0.194* (0.111)	0.171 (0.140)	0.144 (0.130)	0.142 (0.136)
Distance to nearest road (log)	-0.061 (0.244)	-0.085 (0.260)	0.025 (0.251)	0.142 (0.254)
Distance to nearest road (log) ²	-0.004 (0.063)	-0.003 (0.063)	-0.033 (0.062)	-0.062 (0.063)
<i>Manager characteristics</i>				
Manager's age	0.029 (0.030)	0.016 (0.032)	0.013 (0.032)	0.008 (0.032)
Manager's age ² /100	-0.341 (0.299)	-0.199 (0.328)	-0.166 (0.328)	-0.103 (0.325)
Manager's gender	0.369* (0.216)	0.434* (0.230)	0.275 (0.228)	0.145 (0.248)
Manager's schooling	0.038 (0.098)	0.005 (0.110)	-0.027 (0.100)	-0.055 (0.105)
Manager's schooling ² /100	-0.082 (12.023)	3.566 (13.001)	8.011 (11.638)	11.586 (12.181)
Migrant	0.116 (0.146)	0.111 (0.159)	0.099 (0.156)	0.061 (0.162)
<i>Community Characteristics</i>				
Remote	-0.148 (0.326)	-0.167 (0.334)	-0.259 (0.332)	-0.173 (0.340)
Rural town	0.050 (0.306)	0.134 (0.317)	0.138 (0.324)	0.078 (0.322)
Lack of electricity access		-0.145	-0.065	-0.205

	(0.289)	(0.290)	(0.302)
Daily wage (log)	0.045	0.009	0.020
	(0.232)	(0.232)	(0.236)
1-5 competitors	-0.018	-0.011	-0.044
	(0.221)	(0.228)	(0.230)
>5 competitors	0.303*	0.257	0.163
	(0.160)	(0.157)	(0.157)
Credit Institution	-0.438**	-0.430**	-0.424**
	(0.199)	(0.200)	(0.204)
Land usable as collateral	-0.098	-0.075	-0.170
	(0.253)	(0.242)	(0.253)
<i>Initial Conditions</i>			
Ln K – initial			0.184***
			(0.048)
ln L – at startup			0.089
			(0.072)
Constant	1.982	2.797	2.679
	(3.766)	(3.743)	(3.735)
/athrho	-0.090	-0.270	-0.343
	(0.373)	(0.461)	(0.380)
N	2,085	2,085	2,085
chi2 (df)	50(23)	67(29)	81(33)
	102(35)		

Note: - *** p<0.01, ** p<0.05, * p<0.1

-Computed using Heckman's two-step procedure, using the specification presented in table 3 column 2 as the participation equation.

- The omitted competition category is "no competition"; the omitted sector is "Manufacturing". The category "Other" dropped out because of multicollinearity.

- Standard errors are heteroscedasticity robust and clustered at the community level

Table 7: The determinants of the long-run capital stock

Capital Accumulation						
Dependent Variable: ln K						
FIML Heckman selection correction						
	1	2	3	4	5	6
	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se
<i>Uncertainty</i>						
σ WRSI 1995-2005	-0.051*	-0.058**	-0.058**	-0.040	-0.027	-0.021
	(0.028)	(0.028)	(0.027)	(0.027)	(0.024)	(0.026)
<i>Shocks</i>						
WRSI 2006	0.032	0.022	0.017	0.021	0.033	0.023
	(0.053)	(0.053)	(0.053)	(0.047)	(0.045)	(0.042)
Emergency credit			0.956***	0.624***	0.486**	0.365*
			(0.245)	(0.227)	(0.210)	(0.199)
Illness shock			-0.141	-0.053	-0.103	-0.072
			(0.296)	(0.247)	(0.238)	(0.209)
Job loss shock			-0.539	-0.296	-0.538	-0.276
			(0.628)	(0.558)	(0.396)	(0.390)
Death shock			1.156	1.186	0.581	0.688
			(0.990)	(0.731)	(0.630)	(0.501)
<i>Firm Characteristics</i>						
Grain milling					5.526***	3.781***
					(0.797)	(0.640)
Whole sale trade					1.071*	0.487
					(0.560)	(0.662)
Retail via stalls and markets					-0.760	-0.878*
					(0.473)	(0.524)
Retail (not stalls/mkts)					0.565	-0.169
					(0.360)	(0.358)
Services					-0.531	-0.615
					(0.574)	(0.468)
Hotels and restaurants					2.592***	2.160***
					(0.328)	(0.306)
Transport services					3.585***	1.882***
					(0.404)	(0.448)
Food and beverages					2.338***	1.944***
					(0.283)	(0.258)
Firm age	0.007	0.005	0.002	0.017*	0.019*	0.023***
	(0.011)	(0.011)	(0.011)	(0.009)	(0.010)	(0.009)
Distance to food market (log)	-1.670**	-0.645	-0.522	-1.089*	-0.953*	-1.117**
	(0.672)	(0.901)	(0.760)	(0.577)	(0.506)	(0.451)
Distance to food market (log) ²	0.337*	0.148	0.178	0.303**	0.343**	0.369***
	(0.191)	(0.223)	(0.198)	(0.154)	(0.142)	(0.124)
Distance to nearest road (log)	0.068	0.163	0.266	0.317	-0.323	-0.132
	(0.431)	(0.473)	(0.461)	(0.378)	(0.364)	(0.325)
Distance to nearest road (log) ²	-0.061	-0.090	-0.121	-0.140	0.015	-0.037
	(0.103)	(0.111)	(0.109)	(0.089)	(0.088)	(0.078)
<i>Manager Characteristics</i>						
Manager's age	0.002	-0.024	-0.038	-0.038	-0.020	-0.028
	(0.041)	(0.046)	(0.041)	(0.036)	(0.034)	(0.031)
Manager's age ² /100	-0.212	0.056	0.237	0.289	0.149	0.259
	(0.412)	(0.470)	(0.417)	(0.356)	(0.340)	(0.315)
Manager's gender	0.164	0.429	0.181	-0.238	0.890***	0.583**
	(0.311)	(0.377)	(0.334)	(0.275)	(0.245)	(0.230)
Manager's schooling	0.375**	0.229	0.156	0.093	0.057	0.027
	(0.153)	(0.184)	(0.162)	(0.136)	(0.125)	(0.120)
Manager's schooling ² /100	-32.615*	-17.056	-8.174	-5.588	-2.999	-1.226
	(19.072)	(22.910)	(20.525)	(17.983)	(15.827)	(15.637)
Migrant	0.165	0.070	0.055	0.022	0.207	0.152
	(0.255)	(0.283)	(0.259)	(0.226)	(0.198)	(0.187)
<i>Community Characteristics</i>						
Remote	0.325	0.128	-0.217	0.165	-0.645	-0.428
	(0.537)	(0.561)	(0.563)	(0.504)	(0.477)	(0.458)
Rural town	-0.226	-0.107	-0.061	-0.418	-0.329	-0.577
	(0.545)	(0.538)	(0.538)	(0.474)	(0.459)	(0.406)
Lack of electricity access		-0.837*	-0.655	-0.687	-0.122	-0.300
		(0.505)	(0.511)	(0.445)	(0.436)	(0.408)
Daily wage (log)		0.056	0.044	0.270	0.245	0.322

	(0.386)	(0.365)	(0.312)	(0.304)	(0.284)
1-5 competitors	-0.007	-0.135	-0.268	0.117	0.039
	(0.439)	(0.407)	(0.341)	(0.359)	(0.327)
>5 competitors	0.259	0.211	0.008	0.269	0.170
	(0.251)	(0.244)	(0.220)	(0.203)	(0.189)
Credit Institution	-0.709**	-0.708*	-0.619*	-0.722**	-0.667**
	(0.358)	(0.369)	(0.318)	(0.312)	(0.287)
Land usable as collateral	-0.579	-0.518	-0.623*	-0.170	-0.290
	(0.515)	(0.448)	(0.361)	(0.302)	(0.277)
<i>Initial Conditions</i>					
Ln K – initial			0.589***		0.456***
			(0.068)		(0.066)
ln L – at startup			0.178**		0.095
			(0.078)		(0.076)
Constant	3.335	5.468	5.834	1.988	1.572
	(5.447)	(5.544)	(5.412)	(4.759)	(4.646)
/athrho	0.095	-0.208	-0.270	-0.223	-0.070
	(0.246)	(0.358)	(0.284)	(0.204)	(0.158)
N	1,909	1,909	1,909	1,909	1,909
chi2 (df)	51 (15)	71 (21)	94 (25)	210 (27)	431(33)
	500(35)				

Note: - *** p<0.01, ** p<0.05, * p<0.1

-Computed using Heckman's two-step procedure, using the specification presented in table 3 column 2 as the participation equation.

- The omitted competition category is "no competition"; the omitted sector is "Manufacturing". The category "Other" dropped out because of multicollinearity.

- Standard errors are heteroscedasticity robust and clustered at the community level

Table 8 The determinants of the capital-labour ratio

Capital Accumulation						
Dependent Variable: ln (K/L)						
FIML Heckman selection correction						
	1	2	3	4	5	6
	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se
<i>Uncertainty</i>						
σ WRSI 1995-2005	-0.052*	-0.061**	-0.062**	-0.044	-0.031	-0.025
	(0.030)	(0.029)	(0.028)	(0.028)	(0.026)	(0.027)
<i>Shocks</i>						
WRSI 2006	0.027	0.012	0.007	0.003	0.024	0.007
	(0.052)	(0.052)	(0.051)	(0.047)	(0.044)	(0.042)
Emergency Credit			0.781***	0.578**	0.306	0.307
			(0.242)	(0.226)	(0.211)	(0.199)
Job loss shock			-0.218	-0.170	-0.172	-0.187
			(0.283)	(0.245)	(0.235)	(0.208)
Death shock			-0.507	-0.209	-0.557	-0.208
			(0.750)	(0.585)	(0.528)	(0.414)
Illness shock			0.854	1.271*	0.334	0.760
			(0.934)	(0.724)	(0.612)	(0.505)
Basic Controls	Yes	Yes	Yes	Yes	Yes	Yes
Additional IC controls	No	Yes	Yes	Yes	Yes	Yes
Shocks	No	No	Yes	Yes	Yes	Yes
Initial Capital	No	No	No	Yes	No	Yes
Subsector Dummies	No	No	No	Yes	Yes	Yes
/athrho	0.056	-0.218	-0.258	-0.248	-0.103	-0.095
	(0.212)	(0.240)	(0.209)	(0.208)	(0.145)	(0.141)
N	1,909	1,909	1,909	1,909	1,909	1,909
chi2 (df)	46(15)	65(21)	79(25)	564 (25)	229 (27)	564 (24)

Note: - *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

-Computed using Heckman's two-step procedure, using the specification presented in table 3 column 2 as the participation equation.

- Standard errors are heteroscedasticity robust and clustered at the community level

Appendix A: Selected Variable Definition

Credit Institution: dummy variable that takes the value one if a credit institution is present in the village (and zero otherwise)

Daily wage (log): daily wage of a male agricultural casual laborer – distracted from the community survey.

Emergency credit: dummy variable that takes the value 1 if the household indicated it was able to access 100 Birr in case of an emergency, and zero otherwise.

Lack of electricity access: proportion of firms (excluding firm i) in the community who indicate that they are not using electricity because it is unavailable.

Land usable as collateral; dummy variable that takes the value 1 if there is a credit institution in the village and land can be used as collateral

Ln K: the log of the replacement value of all machinery and equipment used by the firm

Ln K – initial: initial capital, measured as the answer to the question “how much money did you pay to set up the firm?”

Ln L: log total labor usage measured in labor days.

Ln L - startup: log total labor usage at startup measured in labor days.

Ln M: the log of the sum of the value of all material inputs used and the value of all products purchased for resale.

Ln Y: log total enterprise sales over the year preceding the survey

Migrant: dummy value that takes the value 1 if the household head was not born in the community he/she is currently living in and zero otherwise

Remote: a dummy that takes the value 1 if the household/enterprise located in a remote rural area, following Andersson et al. (2007)'s discrete urbanization index,

Rural town: a dummy that takes the value 1 if the household/enterprise is located in a rural town.

Shock (Job-loss /Death /illness): dummy variable taking the value 1 if one of the household members suffered a shock (i.e. suffered a job loss/died /suffered a severe illness) in the year preceding the survey.

WRSI 2006: The Water Requirement Satisfaction Index (WRSI) in 2006 is an econometrically exogenous indicator of predicted crop performance based on water availability during the growing season, computed using rainfall information and measured at the wereda (i.e. district) level. WRSI is expressed as a percentage of maximum yield under ideal growing conditions. WRSI data were obtained from National Oceanic and Atmospheric Administration's Africa Rainfall Estimates Climatology

σ WRSI 1995-2005: Standard deviation of wereda WRSI (see above) over the period 1995-2005.

1-5 competitors; dummy variable that takes the value 1 if the firms faces between 1-5 competitors in the community in which it operates

>5 competitors: dummy variable that takes the value 1 if the firms faces more than 5 competitors in the community in which it operates