Fostering growth of the rural non-farm sector in Africa: The case of Tanzania

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Abstract: We use a survey of small rural enterprises from Tanzania to demonstrate quantitatively the economic importance of this sector and to identify participants' characteristics and obstacles to the sector's expansion and productivity. In stark contrast to most of the findings for the formal sector where taxation and other regulatory constraints were identified as key constraints in most of the countries, infrastructure constraints (but not regulatory obstacles) pose a formidable barrier to rural households' participation in rural non-farm and to investment and increased productivity by existing ones. The fact that such constraints emerge as particularly harmful for small enterprises suggests that policies to improve delivery of the public services in question will be important to provide a basis for a flourishing rural non-farm sector which in turn will have an important role for poverty reduction.

Introduction

One of the most stylized facts in development economics is that as a country's economic condition progresses and per capita income increases, its share of agricultural population in total population and share of agricultural gross domestic product in total gross domestic product fall (Gills et al. 2001; Debraj Ray 1998). Theories of the transition, and of policies to manage it, have been critical in advancing our understanding of the development process. Initially, the discussion was framed in two-sector models (Fei and Ranis 1969) and a simple vent for surplus theory of agricultural development. Awareness of spatial distinctions between rural and urban sectors gave rise to models of migration (Todaro 1969, Harris and Todaro 1970) which subsequently evolved into a more elaborate consideration of household-level decision-making that incorporates, among others, risk, non-convexities, and fixed setup costs (Singh *et al.* 1986). As, in the initial stages of development, most of the economic actors are farm households, empirical analysis of their behavior using household-level data has helped to test and refine the predictions from such models, leading to insights of great policy relevance.

A large literature based on household survey data tends to suggest the importance of rural non-farm sector in developing countries (Haggblade *et al.* 1989, Reardon 2000, Reardon *et al.* 2001, Barrett *et al.* 2001, Lanjouw and Lanjouw 2001, Lanjouw et al. 2001, Ellis and Freeman 2004). A review of 25 Africa case studies found that share of rural income rural non-farm earnings is 45% ranging from 22% to 93% (Reardon 1997; 1998), on top of Latin America countries (40%) and Asia countries (32%). Haggblade et al. (1989) found that 15-65% of Africa farmers have secondary employment in the non-farm sector and 15-40% of total family labor hours are spent on non-farm related activities. Rural non-farm sector not only directly contribute to rural households' income and create employment opportunities for those who are directly involved, it also provide cheaper consumer goods for both rural and urban consumers, helps the growth of agricultural sector through input and output inter-linkage between the two sectors. Lanjouw et al.

(2001) suggest that non-farm income shares rise sharply and monotinically with the increase of per capital consumption. Similarly Readon (1997) also found a strong positive relationship between non-farm income shares and total household income. Non-farm opportunities also play other roles in the management of livelihood portofolios, risk and vulnerability (Daniel Stuart 2001). In normal year, it contributes to income and in harsh year acts as a buffer or safely net for the poor. Hence, it is generally believed that access to rural non-farm sector as a potential path way out of poverty (de Janvry and Sadoulet 2000, Lanjourw and Lanjouw 2001, Lanjouw et al. 2001) and lack of attention to rural non-farm sector is a key constraint to rural development (Mwabu and Thorbecke 2004).

Recognition of the importance of the rural non-farm sector has, however, not been backed by in-depth study. In fact, most of the information on the rural non-farm sector is derived from household samples which can provide information on the contribution of non-farm income sources to household welfare but may yield biased estimates of the aggregate size, the dynamics, and constraints facing the rural non-farm sector, especially if significant shares of the enterprises are operating their businesses away from their homes. Information from both the household-based and the non-household based (called standalone thereafter) is warranted for more complete understanding of rural-non-farm sector. Also in a typical household survey, detailed information about rural enterprises' performance, investment and the economic environment under which their business are operating is typically missed. To remedy these shortcomings, the World Bank has recently started a program of investment climate surveys that focus on rural enterprises including standalone enterprises. Contrary to traditional household-based surveys, these start out by drawing a sample that is representative of the universe of rural enterprises. In doing so, the surveys not only allow an assessment of the extent to which household-based information may be biased, but they also aim to improve understanding of the scope of the rural informal sector in reducing poverty, and identify regulatory policies, infrastructure and other public services more conducive to rural entrepreneurship enterprise productivity and growth of the sector. In this paper, we rely on Tanzania rural investment climate survey data to analyze the whole spectrum of the rural non-farm sector. In particular, we try to address 3 specific issues:

How big is the economic contribution of the rural non-farm sector? Although the literature demonstrates that non-farm sources make an important contribution to rural households' income portfolio the economic importance of the rural non-farm sector could be even larger to the extent that household surveys leave out a potentially large segment of enterprises. It is also interesting to have updated information about the nature of rural non-farm enterprises in terms of sector

distribution, size, age, etc. To our knowledge, the data used in the relevant literature are no later than 2000.

Who participated in the non-farm economy and what government can do to help?

While it is recognized the non-farm sector accounts for a significant share of rural income and employment, and access to rural non-farm self-employment could be a potential way out of poverty, it is not everyone has the same chance to participate the sector. It is interesting from policy point view to understand whether there are wealth or other endowment differences in non-farm participation. It is also interesting to understand the potential constraints of government regulatory and public infrastructure conditions on non-farm participation. Combination of data from households who are operating non-farm business and data from those who are not operating any business allows us to understand the potential contribution of rural non-farm employment to poverty reduction and the extent to which there are wealth or other barriers to becoming a rural entrepreneur.

What policies can increase productivity and growth of the rural non-farm economy? The main goal of surveys of the investment climate in the formal sector has been to identify policies constraining the sector's development, to quantify the magnitude of their impact, and to compare with other countries to illustrate how such policies can affect competitiveness. Even though our ability to compare with other countries is limited, the rather large sample allows us to explore the impact of regulatory interventions, and access to infrastructure on growth as well as productivity of the non-farm sector. In addition, we are able to test statistically whether some of these constraints are particularly harmful for specific firm size classes.

Non-farm Employment in the Context Tanzania

Tanzania is one of the poorest country in the world with majority of its population still in rural area with substantial proportion under poverty line. In 2000, its total per capita income was US$280 (rank 184 among all the countries in the world) and 68% of its total of 33.7 population living in rural area with 39% below absolute poverty line (Ellis and Freeman 2004). And the social indictors for the country are quite miserable as well; life expectancy was only 44.4 years and the infant mortality is 92.8 per 1000 infants born.

Although agriculture remains as the dominant sector with around half of the total GDP from agriculture, less dependence on agriculture is increasingly recognized as the pathway out of poverty in Tanzania as well as in other Africa countries. Recent Tanzania studies found that non-farm income shares in Tanzania rise sharply and monotonically with the quintiles defined

either in terms of income (Ellis and Freeman 2004) or in terms of per capita consumption (Lanjouw et al. 2001). Literature also pointed toward the importance of informal sector for the overall economy (Schneider, 2002). The informal sector contribute more than one third of total GDP and employment generation in developing countries. The informality level is much higher in Tanzania than in other sub-Saharan African countries; it is estimated that about 58% of gross national income (GNI) in Tanzania is from informal economy, compared to 43% for Uganda and 34% in Kenya. In spite of its importance in overall economy and as a potential way out of poverty, we have very little knowledge about Tanzania informal sector in terms of factors affecting participation and performance of the informal sector. The limited knowledge is typically only obtained from the limited number of studies based on household data, the results of which are likely to be biased due to the reasons discussed earlier. In-depth study on Tanzania rural informal sector will fill in this knowledge gap and also provide government with more specific guidance for development policy design and poverty reduction strategies.

A recent Tanzania investment climate study by World Bank (2004) found that business constraints that are faced by formal enterprises are very different from those identified by enterprises of informal sector. 7 of the 10 major or very severe constraints on enterprise operation and growth that were identified by enterprises in the formal sector are related to government regulations with regard to tax rate and tax administration, licensing and customs, governance and macroeconomic stability. 73% of formal sector enterprises ranked tax rates as most important or severe constraints, as compared to 59% for electricity, 58% for cost of finance, 56% for tax administration, 51% for corruption, 48% for access to finance, 43% for macroeconomic instability, 31% each for customs regulations and regulatory uncertainty and 27% for business licensing. Compared to the formal enterprises, the study found that small informal enterprises are far less concerned about the tax and other regulatory issues. For example, 23% of informal enterprises perceived tax rates as major or most severe constraints, this is together with 17% perceived tax administration, and 18% corruption, and 20% macroeconomic instability as major or most severe constraints. On other hand, electricity, cost of finance, access to finance, access to land and transport become the top five constraints. Although the sample frame is less clear for the informal sector enterprises, the differences in perceived constraints between formal and informal sectors are intuitive. In fact, we would expect the differences are even more striking if the bias from over-sampling of informal sector enterprises from urban area is removed. Road access and quality and market conditions which are very relevant for the rural context are not at all included in the survey.

The paper is structured as follows: Section two discusses the methodology underlying the survey and the estimation strategy. Section three presents the data used for estimation and descriptive statistics. Section four presents empirical results on determinants of participation in rural non-farm employment, as well as impact of rural investment climate on rural enterprises' decision in making new investment and total factor productivity. Section five concludes with a number of policy implications.

Data and Descriptive Evidence

Data used in the descriptive and econometric analyses are based on a Tanzania rural investment climate survey (RIC) implemented by Tanzania Bureau of Statistics during January-March 2005. The RIC survey consists of three types of questionnaires, respectively administered at community, household and enterprise level. The community module collects the government regulations, access to infrastructure, and other business environment that are common in the same locality. The household module collects household level demographic and economic variables as well as factors affecting household's decision in participating non-farm employment. The enterprise module collect detailed data on assets, employment, production, finance as well as perceived constraints of doing business. Questions on constraints to operation of the enterprises were elicited in greater detail from a long list of issues (including public utilities, transportation, financial infrastructure, marketing, registration, licenses and permits, taxation, labor, access to land, non-agricultural trade policy, environmental policy, and governance) and respondents were also asked to rank the four most important overall constraints to enterprise development.

As mentioned in the previous section, one of the main advantages of the RIC survey compared to standard household survey is the representativeness of its sample because it was drawn based on the a frame with the universe information of the rural non-farm sector. To ensure the sample is representative for the Mainland Tanzania,[1] a multi-stage sample selection process was adopted for the selection of communities, households and enterprises. In the first stage, seven regions – Morogoro, Kilimanjaro, Tabora, Kagera, Kigoma, Mtwara and Mbeya were selected respectively to represent one of the seven agro-geographical zones, namely the East, Northern Highland, Central, lake Victoria, West, Southern and Southern Highland Zones. In the second stage, a random cumulative selection was used to pick the appropriate number of enumeration areas from the seven selected regions with the probably of selection for the EAs proportional to population size. Once the EAs to be included in the sample were selected, a listing of households (with and

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[1] Zanzibar is excluded from the survey due to the budgetary constraint.

without enterprises) as well as standalone non-farm establishments in each selected EA was conducted. About 10 non-farm enterprises (both household-based and standalone) were randomly drawn from the list of enterprises in each of the selected EAs. In addition, six households who are not operating any non-farm business were randomly selected from the list of non-enterprise households from each of the selected EAs. After eliminating non-responses, the survey ended up with a total of 1239 enterprise questionnaires and 1610 household schedule from a total of 149 communities across Mainland of Tanzania.

The resulting descriptive statistics provide interesting evidence on the characteristics of rural enterprises and the contribution of the sector to the national economy, the differences between households with and without an enterprise, and the constraints to expansion perceived by entrepreneurs.

Characteristics of rural non-farm enterprises

Value added and employment generation: Table 1 illustrates characteristics of enterprises in the rural non-farm sector for the whole Mainland and by region. It shows that rural non-farm enterprises are small; the average number of workers including household members is 2.1 and almost 83% employ less than three workers and only 4% have more than five workers. We also noticed that there are some variations across regions. While average number of workers is only 1.44 and none of the enterprises hired more than 5 employees in Mtwara, an average number of employees is 3.18 and more than 12% of the enterprises in Morogoro (a region next to the Dar Las Salam) hired more than 5 workers.

Sectoral distribution and age: The rural non-farm sector is dominated by trading; as high as 58% of all enterprises are engaged in trading whereas 21% engaged in production (manufacturing related activities) and another 21% in trading. While the trading appears to be most important in almost all the regions, there is variation in sectoral distribution across regions. For example, 37% and 41% of all enterprises in Morogoro are engaged in production and trading respectively, only 4% of enterprises in Kagera are related to production and 80% related to trading. While the mean age of non-farm enterprises is slightly more than 9 years, a little less than half the firms in the sample are under 5 years of age. The age profile, with 19% younger than 2 years and 26% between 2 and 5 years old suggests a high rate of new startups as well as failures. However, there is considerable variations across regions with share of enterprises younger than 2 years much smaller in Tabora and Kilimanjaro (12% and 14% respectively) than in Kagera (32%). On the other hand, Tabora and Kilimanjaro also have much larger proportion of older firms with 42%

and 48% respectively, of enterprises older than 10 years, compared to only 32% on average and 22% in Kagera.

Income, assets and investment: Average total value added varies between Tshs 489,000 in Morogoro and Tshs 1504,000 in Tabora. Average value added per worker, a measure of partial productivity, is Tshs 532,000, ranging from Tshs 213,000 in Morogoro to 904,000 in Kagera. The mean value of enterprise assets amounts to almost Tshs 1290,000, with large variation across regions and sectors. Our data also indicate that half of the enterprises made new investments in 2004 with great variations across regions. The share of enterprises that made new investments was highest in the Morogoro and Kigoma regions (72% and 89%, respectively) and smallest in Tabora (only 32%). The average investment by those investing amounted to Tshs 1009,000 although there was considerable variation across regions ranging from Tshs 310,000 in Mtwara region to Tshs 1941,000 for Tabora region.

Formalization and infrastructure access: We note that the degree of formality of Tanzania rural non-farm enterprises is very low with only 18% of total enterprises registered, in stark contrast to 53% for Sri Lanka's rural non-farm enterprises in spite of the fact that the enterprise size is very similar between the two countries. The variation of the share of enterprises that are registered is also small across regions. The fact that so few enterprises are registered may be something to do with the cost and process of the registration. The average registration fee and license fee are Tshs 66,293 and Tshs 71,680 respectively, close to 10% of annual value added. An average registration process takes about 19 days. We also note that 35% of enterprises are operated as a stand-alone unit that is separate from the home of the owner or manager. Even though income generated by them may show up with their owners, such enterprises are often not covered adequately in household-based surveys.[2]

Incidence of enterprise ownership and its relation to household welfare

Table 2 uses the fact that our sample contains an almost equal number of households with and without an non-farm enterprise to perform comparisons between these two groups to identify initial hypotheses on the possible impact of enterprise ownership (by comparing incomes) as well as determinants of participating in non-farm sector (by looking at differences in household and community characteristics). We note that ownership of a non-farm enterprise is associated with a significantly higher level of household welfare; households operating a non-farm

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[2] A recent review of the information non enterprises in four of the better LSMS surveys (Ghana, Guatemala, Kyrgiz Republic, Vietnam) suggests that even though proprietorships and partnerships in which the household has a stake should be captured in principle, this is often not the case. Also, significant shortcomings in terms of data quality in almost all of these surveys reduce the ability to make inferences and the confidence in the representativeness of the results (Vijverberg, 2005).

enterprise have total incomes that are 26% higher than those who do not and the difference is statistically significant at the 1% level. Average earnings from non-farm enterprises for participants contributed to 36% of total income. The fact that households with non-farm enterprises still earn 41% (30% from crop and 11% from livestock) suggests non-farm sector provides households with more income opportunities to diversify economic activities. Meantime, households with non-farm enterprises are significantly wealthier in terms of non-land asset holdings. Average value of total assets for households with enterprises is Tshs. 3229,000, almost twice as big as that for those households who do not own any enterprise (1706,000). This provides strong evidence against the argument that the rural non-farm sector would act as a refuge of poverty for those lacking opportunities elsewhere. To the contrary, our findings tend to support some of the earlier studies (Lanjouw et al. 2001; Ellis and Mdoe 2003) that access to rural informal non-farm sector provides a potential pathway out of poverty. Whether or not it makes a contribution to poverty reduction will depend on the presence of barriers to participation to which we will return below.

Comparing households' initial endowments between the two groups of households (with or without a non-farm enterprise) reveals a number of systematic and in most cases statistically significant differences between the two groups. While the total land endowment is about the same for the two groups, households operating a non-farm enterprise tend to have bigger household sizes, younger household heads (41 years versus 45 years) who have more years of education (7.62 years compared to 5.39 years) and whose parents were more likely to operate non-farm enterprises in the main part of their lives (15% compared to 9%). Households operating non-farm enterprises also tend to have significantly higher level of education overall as indicated by the fact that maximum years of education for any member in households with enterprises is 8.8 years, 2.5 years more than the comparing group. Female headed households are significantly less likely to Households without self-employment.

Descriptive data also suggest that access to community infrastructure and financial institutions play an important role in households' participation in non-farm activities although the significant level is not always as significant as the comparison of household characteristics. The fact that 44% of enterprises are reported to be located in communities with electricity supply and only 32% of households without enterprises did so suggests the importance role of electricity in non-farm opportunities. Households with enterprises are more likely to be located in communities which are significantly closer to city and market. Even though the distance to commercial bank is a little shorter for self-employed as compared to non-enterprise households the differences are

not statistically significant. We also note that availability of public transport to market is positively correlated with non-farm participation and poor quality of road (mud external road) tends to be negatively correlated with non-farm sector participation. It is interesting to note that tax rate, time taken to complete registration process and time taken to complete electricity connection which are often cited as key factors of business operation in the formal sector are not significantly different between the two groups.

Constraints to enterprise establishment and expansion

In view of the economic benefits rural households can derive from participating in the non-farm sector, identifying factors to promote its development will have far-reaching implications for economic performance and poverty reduction. To do so, we report the most important constraints to entrepreneurial development as identified by respondents in table 3. As expected, finance and infrastructure-related constraints are the key constraints faced by rural non-farm enterprises. Overall, 30% of enterprises list finance as the most important constraint, followed by electricity (12%), disorder (10%), road (9%) and access to market information (7%).[3] We also note that although the relative importance of each individual constraint varies considerably across regions, finance and other infrastructure-related constraints are always in the top list of overall main constraints in all the regions, on the other hand, taxes, licenses, and other regulatory constraints that are usually identified as key constraints in the urban and formal sector studies are perceived as only minor constraints. For example, only 4% (and 3%) of enterprises perceived taxes (and licenses) as the overall most important constraint.

The perceived constraints are intuitive and can be presented at more disaggregated level because the same constraint may have different effects on different enterprises (e.g., by size, type and sector differences) which in turn is likely to be reflected in the managers and owner's perception. On the other hand, due to the subjective nature of these questions, the answers are largely depending on enterprise owners and managers' interpretations of the questions and their subjective views of each constraint; the reliability of the perceived constraints is often questionable and their impacts are hard to quantify. To check the reliability of the perceived

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[3] Each of the perceived constraints was broken down into several sub-categories in the questionnaire. For example, we say finance is the most important overall constraint if one of the following is perceived as most important overall constraint: (1) access to formal sources of finance, (2) high interest rate of loan or (3) the tedious loan process. Electricity is said to be the most important overall constraint if either access to electricity or poor quality of electricity supply is perceived as most important overall constraints. Road is said to be the most important overall constraint if either road access, or road block or road quality is selected as most important constraint. Market is identified as most important overall constraint if either market access or market information is perceived as most important overall constraint.

constraints and in order for us to test the impact of identified constraints in multivariate analyses, the survey also collected data on a set of objective constraints (i.e., infrastructure conditions) at community level.

Comparing the perceived constraints with the data on access and quality of infrastructure collected at community level which is reported in Table 4, we note that the perceived infrastructure-related constraints are consistent with the poor infrastructure conditions in rural Tanzania. Overall half of the communities are not connected with electricity supply and about 70% of the communities do not have a commercial bank nearby in rural Tanzania. The road and transportation conditions are also poor as only 14% of communities have public transport to take them to market and 73% of internal and about half of the external roads are mud roads. Pair-wise correlation coefficients suggest that the perceived infrastructure-related constraints and the objective infrastructure conditions at community level tend to be significantly correlated each other.[4] While the significant correlation with correct signs between the perceived constraints and objective constraints for all the cases provided some justification for reliability of using perceived constraints, the small magnitude of the correlation coefficient in most of the cases however, suggests for caution is using only the perceived constraints.

The descriptive findings on constraints of operating business may suggest that improving infrastructure conditions is among the top priority of poverty reduction efforts in rural Tanzania. To quantify the magnitude of impact of each type of key constraints on rural non-farm sector, multivariate analyses on impact of constraints on participation, expansions and performance are warranted.

Estimation strategy

This section discusses the empirical approach that we will use to analyze factors affecting rural households' opportunity in participating rural non-farm sector as well as the determinants of rural non-farm enterprises' expansion and total factor productivity.

Enterprise participation: In view of descriptive evidence suggesting a positive welfare impact for households operating a rural enterprise, enterprise participation regressions can help explore whether participation barriers might partly or totally cancel out what could be a rather favorable equity impact of enterprise ownership. It could also shed light on the types of policies that would

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[4] The pair wise correlation coefficients between dummy for community with electricity connection and share of enterprises in the same community perceiving electricity as most important overall constraints , between dummy for community with mud external road and share of enterprises perceiving road as most important constraints, between the dummy for community with access of public transport to markets and share of enterprises perceiving road as most important overall constraint, and between distance from community center to nearest bank and share of enterprises perceiving finance as most important overall constraint are -0.13, 0.12, -0.07 and 0.06, respectively. All the correlation coefficients are significant at 1% level.

potentially help remove obstacles that stand in the way of would-be entrepreneurs. Letting i index households and j communities, the equation to be estimated is

$$Z_i = \alpha_0 + \alpha_1 (H_i) + \alpha_2 (C_j) + \alpha_3 (D_j) + \varepsilon_i \qquad (1)$$

where Z_i is a dummy variable equaling one if household i operated a non-farm enterprise and zero otherwise. Right hand side variables include vectors of households' endowment with physical and human capital (H_i), local endowments of infrastructure and the regulatory environment for starting up an enterprise (C_j). α_1 to α_3 are coefficient vectors to be estimated, and ε_i is an *iid* error term. Specifically, H_i includes household size, initial asset and land endowments, the household head's age and education, a dummy variable for whether the head's parents operated a non-farm enterprise. The variables in C_j include a dummy whether the community is electrified or not, distances to the nearest city and nearest bank, a dummy for whether public transportation is available between the community and market, and a dummy for external mud road. Finally, D_j denotes provincial dummies included to control unobservable factors at this level. Comparing the magnitude of the estimated coefficients α will allow an assessment of the relative importance of endowments as compared to policy variables, with clear policy implications.

Expansion of existing enterprises Although the impact of policy factors and infrastructure constraints on participation opportunity of rural non-farm is important, literature has long emphasized the importance of asset accumulation of existing firms. To explore the determinants of new investment by existing enterprises (indexed by k) and to make a comparison with enterprise participation decisions, we estimate

$$Z_k = \alpha_0 + \alpha_1(E_k) + \alpha_2 (C_j) + \alpha_3 S_k (C_j) + \alpha_4 (D_j) + \varepsilon_k \qquad (2)$$

where Z_k is either a dummy that equals 1 if firm k invested within a given period (probit regressions) or a variable taking the amount of such investment (tobit regressions), C_j is a vector of community-level characteristics and constraints as discussed above, E_k is a vector of enterprise characteristics, and S_k. is a dummy for enterprise size that equals one for enterprises with more than 2 full-time workers and zero otherwise.[5] Sample weights are used throughout. In addition to assessing determinants of net investment in terms of the variables discussed earlier, the coefficients α_2 and α_3 can be used to test statistically whether specific elements of the vector

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[5] Splitting the sample along this dimension yields 824 small (enterprises with 2 full time workers) and 503 large enterprises (those with more than two full time workers). In each of the regressions, we also used dummies to differentiate between stand-alone and household based enterprises as well as enterprises who use hired workers and those who relied only on the household's own labor endowment. As these classifications are very similar to each other, results did not differ much from those from the "large-small" distinction. While we refer to them in the discussion, we therefore do not report them separately.

of investment climate constraints C_j affect large and small enterprises equally or whether there are differences based on enterprise size. Most of the variables included in C_j have been discussed above.

To explore the consistency between the objective constraints and the perceived constraints, we also run the same regression of equation (2) by replacing all the objective constraints in C_j with a set of perceived most important overall constraints. The new C_j includes 5 perceived constraint variables (e.g., electricity, transportation, road, finance, and market). Each of the 5 variables is measured as share of enterprises in community j that perceived a specific constraint as the most important overall constraint.

Determinants of total factor productivity: A Cobb-Douglas production function can be expressed as :

$$lnY_k = \gamma_0 + \gamma_1 (lnL_k) + \gamma_2 (lnK_k) + \gamma_3 (E_k) + \gamma_4 (D_k) + \mu_k \qquad (3)$$

where Y_k is value added, L_k is the number of workers and K_k the value of fixed assets, E_k a vector of enterprise characteristics such as type and age, and D_k a set of provincial dummies. To the extent that all observable inputs are properly accounted for, the "residual" μ_k can be interpreted as a measure of total factor productivity, i.e. the difference between actual and predicted value added or output (Griliches 1996) for firm k. Regressing μ_k on the investment climate variables C_j as defined earlier according to

$$\mu_k = \beta_1 + \beta_2 (C_j) + \beta_3 \ S_k(Cj) + \eta_k \qquad (4)$$

will measure the impact of these variables on total factor productivity, thereby measuring the extent to which investment climate constraints reduce the efficiency of resource use in the economy. Again, sample weights are applied in the regression. Value added is constructed by subtracting expenses on material inputs, charges to utilities, transportation cost and other variable costs from the total sales in the same year. Total sales, material inputs, and utilities (e.g., fuel) are all adjusted for stock change between two continuous years.

Like in the case of new investment, we also run the same regression of equation (3) by replacing all the objective constraints in C_j with a set of perceived most important overall constraints. Again, the new C_j includes 5 perceived constraint variables (e.g., electricity, transportation, road, finance, and market) with each of the 5 variables being measured as share of enterprises in community j that perceived a specific constraint as the most important overall constraint.

Econometric evidence

The regressions on determinants of enterprise participation, determinants of new investment, and total factor productivity reported below suggest that the local "investment climate" poses significant constraints to economic performance of the informal rural sector. While large firms seem to generally find ways around such constraints, small ones are most affected, suggesting that, even though we find an inverted U-shaped relationship between inequality and the level of informal enterprise development at the local level, infrastructure constraints will hurt the poor disproportionately by reducing the potential for new enterprise startup, making it more difficult for small informal enterprises to be established, to expand, and to compete with others.

Determinants of enterprise participation

Results from regressions for enterprise participation are presented in table 4. We note that the descriptive evidence discussed above (Table 2) is borne out squarely in the multivariate analysis. Both household characteristics and household's access to infrastructure and services play significant roles in households' decision in enterprise participation. Improving such access appears to have the potential to give a significant boost to entrepreneurial development in rural areas.

Most of the household characteristics are clearly of relevance. Consistent with the literature on formal sector, we find that there is some evidence for intergenerational persistence whereby households whose parents had a non-farm business are by 11 percentage points more likely to operate a non-farm enterprise of their own. Household's propensity to participate in non-farm enterprise is also positively associated with the years of education that head's father received. One extra year of education of head's father would increase the likelihood of a household to participate non-farm enterprise by close to 1% though only at 10% significant level. The positive coefficient on household size and negative coefficient on total land endowment suggest the presence of factor market imperfections as households rely on and use family labor and land as determinants for non-farm self-employment. This point is further supported by the fact that households with head at his most productive age are more likely to participate in non-farm self-employment; the positive coefficient of head age and negative coefficient of its squared term implies that the probability of operating a non-farm increases with head's age and maximizes at the age of 34. Tendency of participation in non-farm self-employment is also positively correlated with head's years of education but negatively correlated with female heads.

Based on the regression results, access to electricity, market and city are the key community determinants for household's participation in non-farm enterprises. Electricity connection in a community alone could increases the probability of households to participate non-farm enterprises by 12-13%, depending on the specification. Distance to city (in km) at the community level has a very significant and negative coefficient, implying that households nearby cities are more likely to operate a non-farm enterprise. To interpret the coefficient in terms of probability, every 10 km away from city would decrease the likelihood of households to participate in non-farm enterprise by 1%. Having public transportation connecting the community and nearest market would increase the probability of operating non-farm enterprise by 8%. However, distance to the commercial bank does not affect non-farm participation. It is unexpected because finance was identified as number one constraint by existing enterprises. One explanation could be that while finance is the most important constraint for existing enterprises (which will be identified in the next two regressions), it might be less so for participation. It could also be true that households rely on alternative informal borrowing to substitute formal credit. It would be certainly helpful if we could include informal borrowing capacity in the regression. Unfortunately, enumerators did not administer the question of informal borrowing capacity to the households who don't have non-farm enterprises.

Determinants of new investment

Results from probit and tobit regressions for new investment (defined in equation 2) are reported in table 6 (when objective constraints are used) and appendix table 2 (when perceived constraints are used). We note that the results reported in table 6 and those in appendix table 2 are largely consistent. We will begin with our discussion for the results where objective constraints are used and briefly compare these results with those when perceived constraints are used.

For each type of regression (probit or tobit), results for two specifications are reported. Column 1 and column 3 are the base specifications without any interaction terms. Column 2 and 4 are the augmented specifications with interaction terms of infrastructure and financial variables and enterprise size dummy. Our discussions will focus on the probit results (columns 1 and 2) since the results from the probit and tobit are largely consistent. We note that new investment increases in the value of pre-existing assets at lower level and then decreases after certain level. Enterprises with more workers are more likely to invest and invest more; doubling the number of workers would lead to a 10-12 percentage point increase in the probability of new investment. At the same time, older firms are less likely to invest and invest less if they did invest than those that have started more recently although the significant level is small. Owner's years of

experience prior to this business is positively correlated with enterprise's propensity to invest; 5 years of previous experience would increase the probability of making new investment by 3%.

The most striking results are the significant and expected impact of a set of infrastructure variables on enterprises' new investment decisions. Access to electricity, finance, road quality and market that were identified by managers and enterprise owners as key constraints all significant reduced the enterprises' probability of new investment although the relative importance of individual constraint does not necessarily match the rank of perception. Access to electricity not only increases the probability of participation, it also increases the probability of making new investment by 10%. Having public transport increases the probability of making new investment by another 19% but mud external road could cut back the probability of investment by almost 10%. As the perceived number one constraint, the magnitude of impact of finance is moderate and also only marginally significant in the probit model; doubling the informal borrowing capacity would increase the probability of new investment by 1%, and reducing the distance to commercial bank by 10km would increase by another 2%.

In fact, the augmented model (column 2 and 4) suggests that small enterprises suffer disproportionately from infrastructure-related constraints at the local level. In fact, joint test for impact of infrastructure-related constraints on new investment by enterprise size (bottom rows of table 5) indicate that none of these variables are significant for bigger enterprises. On the other hand, all the infrastructure variables have significant impacts on small enterprises. These findings are important from policy point of view as the smaller and probably the younger enterprises are likely to benefit more with the reduction or removal some of the infrastructure-related constraints.

Finally, the results based on the perceived constraints (appendix table 2) are in general consistent with those in table 6. Except for the perceived electricity in the probit model, all the perceived constraints significantly reduced the probability of existing firms' decision to make new investment and also decreased the amount of new investment for those who made new investment. What is also consistent is that when the model was further augmented with the inclusion of the interaction terms of size dummy and the perceived constraints, the coefficients for linear terms of the perceived constraint variables remain more or less the same, but the joint test of zero value for the addition of the linear term and the interaction term between size dummy and perceived constraints can not rejected in most cases. This finding further supports our earlier argument based on objective constraints that the small enterprises are more likely to be affected by infrastructure constraints.

Determinants of total factor productivity

Results for determinants of total factor productivity (equation 4) are reported in Table 6 (for objective constraints) and appendix table 3 (subjected constraints). We will concentrate our discussion on table 6 and make some comparison to those in appendix table 2 toward the end. The estimates of production function (equation 3) are reported in appendix table 1. Due to the fact that too many production enterprises have negative value-added and illogical estimates of labor and capital in the production function (either of them are significant), in our analysis we only use the trade and service enterprises which leaves us with roughly 80% of the total enterprise sample.

The production function performs well in general with the coefficient for labor and capita are significant and of large magnitude (Appendix Table 1). No matter whether allowing the coefficient of labor and capital to vary by sector, the economies of scale hypothesis can not be rejected. Also, we note that marginal return of labor is much higher for trade enterprises than for service enterprises (with elasticity of 0.64 and 0.48 respectively) and the opposite for the marginal return of capital (with elasticity of 0.17 and 0.34 respectively). Given the fact that the coefficients of labor and capital are significantly different, we calculate our TFP which is the residue of the production function based on the specification that interact labor and capital with sector dummies (column 2 of appendix table 1).

In line with what had been observed earlier and similar to the results on new investment, key local infrastructure constraints emerge as having a very important impact on enterprise productivity (Table 6). Again, access to electricity, formal and informal finance, and market and transport all have significant effect on enterprises' TFP. Access electricity alone would increase enterprises' TFP by 43% and having public transport to market by 68%. Doubling the informal borrowing capacity would lead to 8% increase in TFP and reduce the distance to formal financial bank by 1 km would reduce the TFP by almost 8% (although only marginally significant). The results suggest that elimination of constraints of electricity (currently 50% of the total sample constrained) and public transport to market (85% of the total sample constrained) together would have enhanced the total productivity by around 80%.

Running the regression with the interaction of large enterprise dummies and key local constraints as discussed earlier illustrates that the latter suffer disproportionately from most of the infrastructure constraints except for the formal financial constraint which has more impact on large enterprises. Like in the case of new investment, electricity access could enhance small enterprises' TFP by almost 50% but it has no significant impact on the bigger enterprises. This

might be correlated with the fact that many of the bigger enterprises have their own electricity generators therefore less affected by public electricity supply. Although availability of public transport has similar magnitude of impact on both the small and large enterprises, it is much more significant for small enterprises than for small ones (at 1% significant level for small ones and only 10% for large ones). It is also interesting to note that while informal borrowing capacity only affect the TFP of small enterprises (but no effect on large ones), access to formal commercial bank on the other hand significantly affect small enterprises (but no effect on large ones). This makes intuitive sense because the amount of borrowing from small enterprises tend to be smaller and large enterprises usually require larger amount of loan often time beyond the lending capacity of informal sources.

Finally, by comparing the results based on subjective constraints (appendix table 3) to those we just discussed, we found that the results are consistent for certain variables but less so for the other variables. As found in table 6, we also that TFP is significantly lower in community where more enterprises perceived electricity as main constraints. However, we also note that perceived road and markets constraints significantly reduced enterprises TFP although the level of the latter only at 10%. These are in contrast to the results in table 6 where public transport to market rather than road and market affect TFP significantly. On the other hand, given the fact that the definition of the perceived market and road constraints are broadly defined, it might be true that perceived market and road constraints are negatively correlated with the existence of public transport to market. Including the interaction terms of perceived constraints and size dummy again indicates that the smaller enterprises are suffering more loss in TFP due to the perceived infrastructural constraints than the bigger counterparts.

Together, these insights allow us to draw three policy conclusions: First, local infrastructure constraints have a large impact on productivity, implying that high financing costs affect enterprise startups and new investment by existing firms, exploring in more detail the transaction costs involved in providing financing would be an issue to warrant attention of policy makers. Second, infrastructure constraints are clearly an obstacle to starting up new firms but, by reducing new investment by existing small ones, may also be responsible for a higher than necessary rate of failure, an issue on which we unfortunately do not have sufficient information and which should be strengthened in future surveys of this type. Finally, even if existing large firms may be able to cope with the challenges imposed by bad infrastructure better than small ones, such constraints could still have an impact on productivity to the extent that they might

affect the overall composition of the sector, something that can, however, not be tested with our data.

Conclusion and Policy Implications

By noting the potential bias associated with the existing household-based study on rural non-farm sector, our study based on a data set drawn from a frame with the universe information on rural non-farm sector in rural Tanzania will provide more accurate and updated information on Tanzania rural non-farm enterprises. In terms of substantive conclusions, it is worth mentioning three areas. First, the fact that the rural non-farm industry in Tanzania makes significant contribution to rural economy provides a strong justification for more intensive study of this sector and its dynamics. Especially in view of the fact that the importance of rural enterprises is likely to increase in the future, greater focus on this segment of the economy would be warranted. Second, we find that the poverty-reducing impact of self employment in the local non-farm economy is unambiguously positive, i.e. those with enterprises have significantly higher incomes than those without. The finding that most of the infrastructure-related constraints are particularly relevant for the expansion and productivity of small firms would imply that removing these constraints may in itself be a very important strategy to facilitate pro-poor growth. Third, pre-existing endowments are found to be much less important than policy-related infrastructure constraints, suggesting that addressing these constraints will not only help foster establishment of non-farm businesses in rural areas but also enable those that already exist to make the transition from family-based ventures to enterprises that, by hiring local staff, will make a direct contribution to economic growth and poverty reduction.

We also note that more careful study of enterprises in the informal sector is warranted in view of the fact that current household-based surveys appear to be not adequately capture all the relevant information and thus fail to do justice to the economic importance of this sector – and even in the best of cases are unlikely to be able to bring out the marked differences between large and small enterprises emerging from our analysis. As comparable data on small and micro-enterprises in the urban sector are currently not available, it would make sense to expand the sample frame to include small and micro enterprises including those operating informally in urban areas. Not only would this allow a better appreciation of the economic contribution of this sector but this will also help construct a more complete picture of the difficulties faced by potential entrepreneurs in a given country and the design of policy responses. Finally, in view of differences in the relative weight of constraints for enterprise expansion and participation, our analysis demonstrates the relevance of having a household sample complement the one of firms

will be appropriate to improve understanding of factors conducive to formation of new enterprises. In fact, to fully appreciate the impact of policy-related factors on the dynamics of the informal sector, it may be necessary to pay more attention to the factors that lead to disappearance of enterprises, something that could be accomplished through appropriate modification of the sample frame.

Table 1. Profiles for Rural Non-farm Enterprises in Tanzania

	Total	Kilimanjaro	Morogoro	Mtwara	Mbeya	Tabora	Kigoma	Kagera
Number of employees	2.10	2.72	3.18	1.44	1.60	2.68	1.95	2.27
1-2 employees	0.83	0.72	0.79	0.94	0.91	0.72	0.80	0.81
3-5 employees	0.13	0.21	0.09	0.06	0.07	0.23	0.19	0.16
> 5 employees	0.04	0.07	0.12	0.00	0.02	0.06	0.01	0.03
Owners experiences (years)	4.80	5.93	5.05	4.43	3.46	4.41	7.55	5.28
Education of managers or owners	7.99	8.36	7.69	7.61	7.96	8.74	6.79	8.95
Age < 2 years	0.19	0.14	0.22	0.25	0.16	0.12	0.14	0.32
Age 2-5 years	0.26	0.24	0.32	0.23	0.33	0.18	0.19	0.24
Age 5-10 years	0.23	0.20	0.17	0.27	0.24	0.22	0.25	0.22
Age > 10 years	0.32	0.42	0.29	0.24	0.27	0.48	0.41	0.22
Production sector	0.21	0.32	0.37	0.33	0.03	0.16	0.35	0.04
Trade sector	0.58	0.50	0.41	0.50	0.70	0.57	0.49	0.80
Service sector	0.21	0.18	0.22	0.17	0.27	0.28	0.17	0.16
Household-based enterprises	0.65	0.97	0.48	0.50	0.49	0.98	0.50	0.93
Value added (000 Tshs)	882.85	1005.12	489.21	491.09	766.14	1504.53	1246.01	1430.47
Value added per worker (000 Tshs)	531.77	579.26	213.00	369.53	537.33	393.11	800.93	903.97
Total assets	1290.19	1513.23	1073.91	542.92	1156.89	1481.40	1096.95	3338.85
Total assets in 2003	773.86	975.99	326.41	379.14	687.86	854.97	263.68	2677.93
Investment made in 2004	0.51	0.49	0.72	0.53	0.39	0.32	0.89	0.50
Amount of new investment (those who made investment)	1009.61	1094.18	1041.37	309.79	1211.56	1940.65	934.04	1323.73
Registered	0.18	0.19	0.15	0.12	0.19	0.27	0.15	0.24
Registration fee (Tshs)	66293.83	54014.36	62025.03	35030.04	31686.98	38333.84	23183.70	291038.23
License fee	71679.83	121674.90	53050.76	52348.18	48872.00	56106.66	22375.27	145812.71
Average tax rate	18.96	16.76	20.34	26.82	13.58	24.66	16.62	19.56
Days to complete registration	19.04	21.05	20.03	17.64	19.57	20.70	18.62	12.88
Days to get electri. connected	60.64	81.11	85.34	20.52	94.59	29.22	10.98	38.47
Informal borrowing capacity (1000 Tshs)	893.77	781.24	341.85	788.08	759.15	888.31	1403.49	2187.63

Data sources: 2004 RIC Survey.

Table 2. Household and Community Characteristics by Employment Status (with or without RNFE)

	Total	Non-enterprise households	Enterprise households	Test for mean differences
Household income (1000 Tshs)	1226.49	1038.98	1397.68	***
Share from crop production	0.41	0.55	0.30	***
Share from livestock	0.15	0.18	0.11	***
Share from non-farm self-emp.	0.21	0.05	0.36	***
Share from wage	0.12	0.10	0.15	***
Share from transfer	0.10	0.13	0.08	
Per capita income (1000 Tshs)	288.73	256.83	317.85	**
Per capita income (adjusted) (1000 Tshs)	329.39	291.44	364.04	**
Total household assets (1000 Tshs)	2502.68	1706.87	3229.05	***
Total area endowed	4.67	4.61	4.72	
Household size	4.98	4.71	5.22	***
Head's parents operated self-employment	0.12	0.09	0.15	***
Head's years of education	6.55	5.39	7.62	***
Head's age	43.11	45.05	41.33	***
Female headed	0.16	0.22	0.11	***
Max. years of education	7.63	6.34	8.80	***
Share electrified	0.38	0.32	0.44	***
Share with public transport to market	0.15	0.14	0.16	*
Share no market	0.13	0.14	0.11	***
Share with bank	0.24	0.22	0.26	
External mud road	0.52	0.55	0.50	**
Distance to city	18.54	19.84	17.36	***
Distance to market	7.16	7.90	6.48	***
Distance to bank	45.33	47.97	42.91	
Average tax rate	18.74	18.12	19.33	***
Days completion of registration	21.10	21.67	20.58	***
Days electricity connection	49.80	46.00	53.26	

Note: the last column reported test results for the mean differences between non-enterprise households (column 2) and enterprise households (column 3). *, ** and *** denote for significant at 10%, at 5% and at 1% respectively.
Data sources: 2004 RIC Survey.

Table 3. Perceived Most Import Overall Constraints for Operating Non-farm Enterprises

	Finance	Electricity	Road	Market	Disorder	Water	Land	Tax	License	Other
All	0.30	0.12	0.09	0.07	0.10	0.07	0.04	0.04	0.03	0.14
By Regions										
Kilimanjaro	0.20	0.14	0.05	0.04	0.21	0.03	0.10	0.03	0.01	0.18
Morogoro	0.42	0.18	0.04	0.13	0.07	0.01	0.01	0.02	0.03	0.10
Mtwara	0.33	0.04	0.11	0.12	0.02	0.18	0.00	0.01	0.08	0.10
Mbeya	0.33	0.08	0.07	0.06	0.15	0.03	0.05	0.08	0.02	0.13
Tabora	0.37	0.23	0.03	0.06	0.02	0.02	0.00	0.05	0.02	0.19
Kigoma	0.23	0.15	0.25	0.08	0.03	0.02	0.04	0.03	0.02	0.16
Kagera	0.19	0.21	0.07	0.04	0.03	0.18	0.08	0.00	0.03	0.17
By size										
Small	0.30	0.12	0.09	0.08	0.09	0.07	0.04	0.03	0.04	0.14
Large	0.32	0.13	0.07	0.03	0.14	0.02	0.05	0.09	0.01	0.15
By sector										
Production	0.29	0.11	0.13	0.10	0.06	0.05	0.04	0.03	0.05	0.14
Service	0.35	0.11	0.06	0.04	0.08	0.11	0.05	0.04	0.02	0.14
Trade	0.29	0.13	0.08	0.08	0.12	0.06	0.04	0.04	0.03	0.14
By age										
Less than 2 years	0.32	0.12	0.08	0.08	0.13	0.06	0.01	0.03	0.05	0.12
2-5 years	0.24	0.12	0.07	0.08	0.08	0.08	0.05	0.06	0.04	0.17
5-10 years	0.29	0.10	0.11	0.07	0.12	0.04	0.04	0.05	0.03	0.15
>10 years	0.34	0.13	0.08	0.07	0.08	0.08	0.05	0.02	0.02	0.13
By location										
Non-enterprise HHs	0.35	0.10	0.10	0.08	0.07	0.06	0.02	0.04	0.04	0.13
Enterprise HHs	0.27	0.13	0.08	0.07	0.11	0.07	0.05	0.04	0.03	0.15

Data sources: 2004 RIC Survey.

Table 4. Perceived Most Import Overall Constraints for Operating Non-farm Enteprrises

	Total	Kilimanjaro	Morogoro	Mtwara	Mbeya	Tabora	Kigoma	Kagera
Electrified	0.50	0.79	0.40	0.21	0.67	0.49	0.15	0.43
Public trans. to market	0.14	0.45	0.27	0.03	0.08	0.00	0.00	0.10
Commercial bank nearby	0.31	0.39	0.45	0.07	0.41	0.27	0.25	0.29
Mud internal road	0.73	0.74	0.89	0.73	0.70	0.74	0.75	0.57
Mud external road	0.48	0.50	0.37	0.77	0.31	0.45	0.75	0.33
Distance to city	15.51	12.17	19.40	16.49	12.74	21.06	11.91	20.50
Distance to market	6.13	6.92	7.67	7.56	5.77	6.61	3.17	2.81
Distance to bank	39.09	18.36	84.01	59.15	19.33	27.14	53.32	46.85

Data sources: 2004 RIC Survey.

Table 4. Determinants for Participating in Non-farm Enterprises

	(1)	(2)	(3)
Log of head's age	2.058**	2.049**	2.003**
	(2.17)	(2.16)	(2.10)
Log of head's age squared	-0.294**	-0.293**	-0.287**
	(2.31)	(2.30)	(2.24)
Head's years of education	0.023***	0.023***	0.022***
	(5.23)	(5.22)	(5.11)
Years of education of head's father	0.008*	0.008*	0.008*
	(1.88)	(1.88)	(1.92)
Head's parents operated business	0.114**	0.111**	0.114**
for most of their lives	(2.55)	(2.46)	(2.52)
Dummy for female head	-0.161***	-0.162***	-0.167***
	(3.84)	(3.85)	(3.96)
Household Size	0.024***	0.024***	0.024***
	(3.48)	(3.43)	(3.42)
Total land endowment	-0.045**	-0.046**	-0.045**
	(2.05)	(2.08)	(2.01)
Dummy for Electrification	0.121***	0.126***	0.121***
	(3.43)	(3.55)	(3.43)
Distance to the City	-0.001**	-0.001**	-0.002***
	(2.48)	(2.57)	(2.95)
Public transportation accessible to	0.083*	0.083*	0.082*
market	(1.79)	(1.79)	(1.77)
Dummy for mud external road	0.031	0.030	0.043
	(0.93)	(0.89)	(1.25)
Distance to the nearest bank		0.001	0.001
		(1.04)	(0.97)
Dummy for no market			-0.091*
			(1.72)
Observations	1593	1593	1593

Robust z statistics in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 5. Determinants of Enterprises' New Investment (Probit and Tobit Models)

		Dprobit Model		Tobit Model	
Total assets in 2003 (log)		0.096***	0.097***	0.544***	0.553***
		(4.86)	(4.87)	(3.29)	(3.35)
Log of total assets in 2003 squared		-0.012***	-0.012***	-0.067***	-0.068***
		(4.49)	(4.50)	(3.10)	(3.12)
Number of workers (log)		0.097***	0.120**	1.002***	1.390***
		(2.64)	(2.19)	(3.86)	(3.48)
Enterprise age		-0.029	-0.028	-0.335*	-0.312*
		(1.33)	(1.28)	(1.86)	(1.73)
Dummy for service sector		0.022	0.024	0.623	0.651
		(0.34)	(0.38)	(1.27)	(1.31)
Dummy for trade sector		0.007	0.002	0.403	0.340
		(0.12)	(0.03)	(0.96)	(0.80)
Manager's Education		0.025	0.024	0.155	0.140
		(0.65)	(0.61)	(0.46)	(0.42)
Years of exp. of owner prior to this business		0.006**	0.006**	0.059**	0.063***
		(1.96)	(2.06)	(2.50)	(2.63)
Dummy for electrification	(α)	0.104**	0.101**	0.974**	1.066**
		(2.24)	(2.08)	(2.48)	(2.57)
Public transportation to market	(β)	0.192***	0.207***	1.621***	1.752***
		(3.18)	(3.18)	(3.44)	(3.37)
Log of Informal borrowing capacity	(γ)	0.010*	0.011*	0.133**	0.156***
		(1.68)	(1.93)	(2.56)	(2.90)
Distance to bank	(δ)	-0.021	-0.028*	-0.316***	-0.352***
		(1.53)	(1.85)	(2.75)	(2.87)
Dummy for mud external road	(η)	-0.095**	-0.105**	-0.882**	-0.986***
		(2.20)	(2.29)	(2.55)	(2.60)
Dummy for electrification*size dummy	($\alpha1$)		0.071		-0.268
			(0.54)		(0.28)
Public Transp. to market*size dummy	($\beta1$)		-0.072		-0.326
			(0.50)		(0.31)
Informal borrowing capacity*size dummy	($\gamma1$)		-0.021		-0.157
			(1.54)		(1.49)
Distance to bank*size dummy	($\delta1$)		0.055		0.315
			(1.45)		(1.06)
Dummy for mud external road*size dummy	($\eta1$)		0.077		0.837
			(0.65)		(0.92)
Test for size effect:					
$\alpha+\alpha1=0$			(1.90)		(0.74)
$\beta+\beta1=0$			(1.15)		(2.27)
$\gamma+\gamma1=0$			(0.49)		(0.00)
$\delta+\delta1=0$			(0.59)		(0.02)
$\eta+\eta1=0$			(0.06)		(0.03)
Observations		1085	1085	1085	1085

Robust z statistics in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 6. Determinants of Total Factor Productivity

		(1)	(3)
Dummy for electrification	(α)	0.426**	0.488***
		(2.52)	(2.74)
Public transportation to market	(β)	0.678***	0.712***
		(3.06)	(2.86)
Maximum informal borrowing (log)	(γ)	0.080*	0.097**
		(1.73)	(2.03)
Distance to formal bank	(δ)	-0.077	-0.049
		(1.55)	(0.91)
Mud external road	(η)	0.109	0.077
		(0.59)	(0.39)
Dummy for electrification*size dummy	(α1)		-0.441
			(0.96)
Public transportation to market*size dummy	(β1)		-0.011
			(0.03)
Informal borrowing capacity*size dummy	(γ1)		-0.016
			(0.43)
Distance to formal bank*size dummy	(δ1)		-0.207
			(1.63)
Mud external road*size dummy	(η1)		0.082
			(0.18)
Test for size effect:			
$\alpha+\alpha1=0$			(0.01)
$\beta+\beta1=0$			(3.71)*
$\gamma+\gamma1=0$			(2.30)
$\delta+\delta1=0$			(4.86)**
$\eta+\eta1=0$			(0.13)
Observations		917	917
R-squared		0.03	0.04

Robust t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Appendix Table 1. Estimation of Cobb-Douglass Production Function

	(1)	(2)
Log of number workers	0.610***	
	(4.71)	
Log of total assets	0.231***	
	(4.60)	
dnoasst	1.451***	
	(4.27)	
Log of number of workers*service sector		0.475**
		(2.08)
Log of number of workers*trade sector		0.640***
		(4.10)
Log of total assets*service sector		0.337***
		(3.20)
Log of total assets*trade sector		0.173***
		(3.15)
Dummy for zero assets*service sector		2.219***
		(3.23)
Dummy for zero assets*trade sector		1.176***
		(3.09)
Household-based enterprises	-0.091	-0.093
	(0.58)	(0.60)
Dummy for service sector	-0.055	-0.985
	(0.36)	(1.47)
Dummy for age 2-5 years	-0.029	0.021
	(0.13)	(0.10)
Dummy for age 5-10 years	0.175	0.220
	(0.82)	(1.03)
Dummy for age > 10 years	0.001	0.066
	(0.00)	(0.30)
How many years of working experience did the general manager	0.015	0.004
	(0.66)	(0.17)
Years of exp. of owner prior to this business	-0.003	0.006
	(0.13)	(0.29)
Morogoro	-0.794**	-0.704**
	(2.50)	(2.15)
Mtwara	-0.025	0.040
	(0.07)	(0.12)
Mbeya	0.288	0.321
	(0.96)	(1.06)
Tabora	0.736**	0.731**
	(2.26)	(2.20)
Kigoma	0.383	0.497
	(1.15)	(1.47)
Kagera	-0.114	-0.070
	(0.33)	(0.20)
Constant	3.783***	3.994***
	(8.26)	(7.93)
Observations	917	917
R-squared	0.11	0.12

Robust t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Appendix Table 2. Determinants of Enterprises' New Investment (Perceived Constraints)

	Probit Model		Tobit Model	
	(1)	(2)	(3)	(4)
Total assets in 2003 (log)	0.088***	0.087***	0.513***	0.497***
	(4.41)	(4.31)	(3.11)	(3.01)
Log of total assets in 2003 squared	-0.011***	-0.011***	-0.064***	-0.063***
	(4.21)	(4.12)	(2.96)	(2.87)
Number of workers (log)	0.118***	0.091*	1.202***	1.022***
	(3.04)	(1.71)	(4.65)	(2.85)
Enterprise age	-0.024	-0.026	-0.245	-0.281
	(1.05)	(1.15)	(1.35)	(1.54)
Dummy for service sector	0.013	0.019	0.590	0.663
	(0.21)	(0.29)	(1.20)	(1.35)
Dummy for trade sector	0.035	0.036	0.790*	0.776*
	(0.62)	(0.63)	(1.89)	(1.85)
Manager's Education	0.012	0.010	0.081	0.072
	(0.29)	(0.24)	(0.24)	(0.21)
Years of exp. of owner prior to this business	0.007**	0.006**	0.054**	0.050**
	(2.28)	(2.12)	(2.27)	(2.09)
Electricity as overall major constraint	-0.050	-0.076	-1.682**	-2.056**
	(0.49)	(0.73)	(2.08)	(2.42)
Road access and quality as overall major constraint	-0.312**	-0.302*	-3.761***	-3.879***
	(2.05)	(1.87)	(2.68)	(2.61)
Transport as overall major constraint	-0.467*	-0.457*	-5.079**	-5.034**
	(1.95)	(1.82)	(2.29)	(2.16)
Finance as overall major constraint	-0.172**	-0.166**	-1.737***	-1.562**
	(2.28)	(2.12)	(2.80)	(2.42)
Market as overall major constraint	-0.400***	-0.475***	-5.126***	-5.713***
	(2.73)	(3.06)	(4.04)	(4.24)
Electricity as overall major constraint*size dummy		0.315		3.448
		(1.02)		(1.63)
Road access and quality as overall major constraint*size dummy		-0.001		1.567
		(0.00)		(0.39)
Transport as overall major constraint*size dummy		-0.207		-1.280
		(0.45)		(0.24)
Finance as overall major constraint*size dummy		-0.056		-1.365
		(0.29)		(0.96)
Market as overall major constraint*size dummy		0.817*		5.047
		(1.90)		(1.50)
Observations	1062	1062	1062	1062

Robust z statistics in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Appendix Table 3. Determinants of Total Factor Productivity (Perceived Constraints)

	(1)	(2)
Electricity as overall major constraint	-1.026***	-1.053***
	(2.80)	(2.74)
Road access and quality as overall major constraint	-3.898***	-3.357***
	(4.53)	(4.32)
Transport as overall major constraint	0.000	-0.338
	(0.00)	(0.54)
Finance as overall major constraint	0.041	-0.001
	(0.13)	(0.00)
Market as overall major constraint	-0.783*	-0.493
	(1.67)	(1.07)
Electricity as overall major constraint*size dummy		0.120
		(0.17)
Road access and quality as overall major constraint*size dummy		-2.681
		(0.93)
Transport as overall major constraint*size dummy		1.379*
		(1.77)
Finance as overall major constraint*size dummy		0.316
		(0.76)
Market as overall major constraint*size dummy		-2.627
		(1.22)
Observations	897	897
R-squared	0.04	0.04

Robust z statistics in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

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