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Innovation and Microenterprises Growth in Ethiopia

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Abstract

This paper addresses two prominent issues on the development of small enterprises in Africa. Which factors inhibit or foster innovation activities in small enterprises? Do innovators create more jobs? We use a large set of microenterprises survey data from Ethiopia that comprise 1000 observations with ten and fewer workers. The analysis shows that firms larger in size and in manufacturing are more likely to engage in innovative activities. Among the human capital variables vocational training is found to have a strong effect on the innovation activity. However, firms owned by female and old entrepreneurs are less likely to get involved in innovation. In an extended model of firm growth determinants that includes innovation indicators we found strong evidence that innovators grow faster than non-innovators. Firm growth is also affected by other factors such as the firm's initial size, age, access to finance, sector, and owner character. Our estimation results provide supporting evidence to the stylized fact that the smaller, younger, and less capital constrained firms grow faster than their counterparts. Firms in manufacturing also grow faster than other sectors.

Keywords: micro and small enterprises, firm growth, innovation, developing countries, Ethiopia
JEL classification: L25, L26, O31, O55

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Abbreviations

CSA	Central Statistical Agency
DWH	Durbin-Wu-Hausman endogeneity test
EDRI	Ethiopian Development Research Institute
GMM	Generalized method of moments
ILO	International Labour Organization
IV	Instrumental variable
LIML	Limited information maximum likelihood
MSE	Micro and small enterprise
OLS	Ordinary least squares
R&D	Research and development
RHS	Right-hand side
SME	Small and medium enterprises
SSA	Sub-Saharan Africa

Tables appear at the end of this paper.

1 Introduction

In developing countries the informal sector that mainly constitutes microenterprises is the major source of employment and income for the urban population. According to ILO (2002) estimations, the share of informal employment (outside agriculture) to the total non-agricultural employment accounts for nearly half or more in all regions of the developing world and about 72 per cent in sub-Saharan Africa (SSA). They are also very important part of the developing world economy. For example, in SSA the contribution of the informal sector in non-agriculture GDP is about 41 per cent. Hence, their efficiency matters in determining overall economic performance and poverty reduction.

Despite their potential to improve economic growth, micro and small enterprises (MSEs) in developing countries lack expectations. They produce largely for the low income group and employ lower levels of techniques. Many microenterprises are the self-employed type with a low graduation rate into higher size categories and their innovative activities are limited (Kiggundu 2002). This is largely due to the harsher environment they operate in. Unreliable enforcement of contracts, excessive regulatory and administrative requirements, limited access to finance, and inadequate infrastructure services all impose disproportionately high transaction costs on MSEs for doing business generally, and for innovative activity in particular (Ernst 2004).

The promotion of MSEs is becoming a popular development tool. Accordingly, governments and donors in the developing countries have shown increasing interest in promoting innovations and entrepreneurship. They have initiated various support programmes with the aim to improve MSEs' competitiveness through enhancing technology and innovation capabilities such as upgrading product quality, improving design and packaging, and training to improve competitiveness (Pyke 1994). The notion is that innovation is essential for MSEs to become and remain competitive, move to higher return activities, and to grow and graduate to small and medium sized enterprise status, thus, creating new employment opportunities (Ernst 2004). Improving competitiveness is even more crucial in the context of liberalization and increasing integration into the world market. Lack of adaptation and upgrading spells defeat, while firms that keep up or even initiate their own original improvements can be expected to perform well (Romijn 2002).

The efficacy of such interventions, however, depends on identifying key factors that foster or inhibit innovation by MSEs and targeting the potentially successful entrepreneurs. Small business entrepreneurs are hardly homogeneous in objective and capability. Many are self-employed while others have high vigour to innovate and grow. They also differ in terms of socioeconomic background and access to resources such as financial capital. The type of activities they are in is also widespread. What types of entrepreneurs/firms are more likely to engage in innovative activity? Do innovators grow faster and create more jobs than non-innovators as it is claimed? Understanding the attributes of innovators and their impact on employment is crucial in order to formulate effective policies.

Despite the high profile of the issue in current policy formulations in Africa, there is little empirical evidence on innovativeness and its impact on firm performance in MSEs. The existing few studies in Africa mainly examined the determinants of innovative activity and attributes of

innovativeness (for example, Van Dijk 2002; Oyelaran-Oyeyinka 2006; Robson et al. 2008). Van Dijk (2002) examines the importance of enterprise clusters and cooperation on innovation in the informal sector in Ghana, Burkina Faso, and Zimbabwe. Oyelaran-Oyeyinka (2006) analyses the impact of inter-firm collaboration on innovation in Kenya, Nigeria, and Zimbabwe using 200 manufacturing firms. Robson et al. (2008) investigate the determinants of innovation in Ghanaian small enterprises that employ between four and 50 workers. The lack of empirical evidence is even more apparent when it comes to the effect of innovation activity on firm growth. Mahemba and de Bruijn (2003) reported only weak association between innovativeness in small firms and growth in Tanzanian manufacturing sector. Thus, innovativeness and small firms' growth relation has not yet empirically confirmed in Africa.

In this paper we seek to address two inter-related issues; the determinants of innovative activity and if innovative enterprises grow faster than non-innovators in African MSEs. We use a large set of microenterprises survey data from Ethiopia that comprise 1000 observations from six selected major towns including the capital city Addis Ababa. Like other developing countries, in Ethiopia, the informal sector plays a significant role in the economy. According to the 1999 survey by the Central Statistical Agency (CSA) the urban informal sector comprises about 50.6 per cent of the 2.88 million total urban employments.[1] Women employment accounts for about 58 per cent of the employment in the informal sector.

Recognizing the significance of this sector, the Ethiopian government issued the National Micro and Small Enterprises Strategy in 1997 and established the Federal Micro and Small Enterprises Development Agency in 1998. The country's industrial policy in 2003 and the poverty reduction strategy in 2006 have singled out MSEs as major instruments to create a productive and vibrant private sector and reduce poverty among urban dwellers. These documents reiterated the importance of MSEs promotion through the provision of finance, training, and infrastructure services among others. However, in our data there are only a few enterprises (no more than eight per cent) reported that have received some support from government or NGOs. This implies that the innovation activity of the microenterprises is expected to be a result of the decision of the owner. Our analysis will, therefore, emphasize upon the entrepreneurs behaviour and resource availability to the enterprises as a major determinant of innovativeness and firm growth.
This paper contributes to the thin literature on innovations in African MSEs in the following ways. First, it analyses not only the determinants of innovation but also the impact of innovation on firm employment growth. Second, it exclusively relies on the lower bottom of size category, firms with ten and fewer workers usually termed as microenterprises. By doing so, this study tries to address the bias that might arise from pooling a heterogeneous group in the previous studies as a result of broader definition of small enterprises, i.e. up to 100 or so workers. Third, unlike to most previous studies it covers not only manufacturing but also other major sectors such as service and trading activities.

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1 CSA defines urban informal activity as those unincorporated enterprises with fewer than ten employees, no book accounts, and no license—basically microenterprises. Enterprises with less than ten workers are also customarily classified as microenterprises in other countries, for example the European Community defines micro as firms that have zero to nine workers and small firms with 10-99 workers.

This paper is structured as follows. The next section gives data and some descriptive analysis. Section 3 discusses the determinants of innovative activities. Section 4 examines the relation between innovation and firm growth, and the last section concludes.

2 Data

The data source of this study is a survey conducted in 2003 by the Ethiopian Development Research Institute (EDRI) on a 1000 microenterprises with 10 and fewer workers. The survey was done in six selected major town: Addis Ababa, Awassa, Bahir Dar, Jimma, Mekelle, and Nazreth. A total sample of 974 enterprises was interviewed whereby 25 per cent of them are from Addis Ababa and almost 15 per cent each in the other cites.[2] Table 1 gives the distribution of the enterprises and characteristics of the owners in our sample. The enterprises cover a wide variety of non-agricultural activities such as trade, service, and manufacturing. The majority of them are engaged in trade and service constituting 45 per cent and 36 per cent respectively. Manufacturing is also an important component (19 per cent) of the microenterprises mainly covering production activities such as wood and metal work, bakeries, and tailors.

Measuring the number of workers as the sum of working owners, paid and unpaid workers in 2002 (one year before the survey), 69 per cent of the businesses have less than five workers of which one-worker establishments constitute about 18 per cent.[3] Firms that have 5–10 workers account for 30 per cent. Most of the enterprises are young, whereby 45 per cent of them are five or less years old and 36 per cent 6–12 years old. Male-headed businesses account for 74 per cent, while only 22 per cent are female-headed. The female-headed businesses tend to concentrate on activities such as retail trading, beauty salon, bars and restaurants, and local drink brewing. The majority of the owners are young, 59 per cent of them are less than 35 years old. The survey instrument also includes the owners' educational achievement. 32 per cent of the owners have completed high school and 15 per cent have some college years, while 12 per cent are illiterate. About 15 per cent of the owners have also reported that they had vocational training.

Our innovation indicator is a dichotomous variable that takes value one if the respondent said *yes* for the question *Did you make an important improvement/change to your product/service recently?.* As shown in the Table 2, about 34 per cent of the enterprises said *yes*. Those, who responded *yes* were then asked to disclose what type of improvement was involved. The lists of activities showed about 20 types. We categorized them into main type of innovative activities such as product/service innovation (providing new/quality/better design or an increasing variety of products), process innovation (machinery investment, improving or increasing business premises, furniture, and equipment), organizational and skill improvement (improving the skill of workers and managers), and marketing (more advertisement, shorter delivery time). These

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2 The sampling frame was stratified by location and sector. Based on the population of microenterprises six major cities were first chosen then the sample was distributed to the cities. Similar stratification across sectors was also made based on the intensity of the sector activities such as manufacturing, service, and trade. At last, a sample was taken randomly from each sector at each location.

3 In our calculation of employment we did not include causal workers, as about 80 per cent of the establishments reported that they do not normally hire casual workers.

activities are more or less incremental and consistent with the observation made by Van Djik and Sandee (2002) on innovation in African small firms.[4]

The magnitude of innovativeness differs slightly by sector. The manufacturing sector has a higher propensity to innovate than the service sector and trade as shown by the ratio of firms that reported had improved their products/services to the total number of firms in each sector. But more importantly the sectors differ in the type of innovative activity. The manufacturing sector is distinctive from trade and service in this context. The innovation activities in the manufacturing sector are machinery improvement (investment), better design, skill improvements. Service and trade sectors, on the other hand, tend to concentrate on the improvement of business premises, provision of quality and variety of products/service, and marketing.

Looking at the association between the innovative indicator and other variables defining the characteristics of the owners and perceptions might give some guidance to the empirical framework on the determinants of innovation. The survey instruments include number of innovations related to owner perceptions particularly the relative status of his/her business in terms of innovation. For example, how do you compare your main product/services with that of your competitors in terms of quality material and model/design? How do you characterize the enterprise's machinery/equipment? The survey instruments also include business environment perception and variety of owner-firm attributes.

Table 3 presents the correlation coefficient between the innovation indicator and other variables. Stars represent significance at 5 per cent or better. The innovative indicator is positively associated with the owner perceptions such that his/her business has better quality material and design than the competitors' and use advanced machinery. The innovators subgroup perception on business environment is also more optimistic than the non-innovators group. The innovators' indicator is positively associated (and significant) with the current size, employment growth, investment, revenue increased, have no market problem, and have planned to expand the business in the future. Among the demographic characters (owner age, gender, and marital status), only gender is found to be significantly associated with innovation activity and indicates women owners are less likely to engage in innovative activity relative to male owners. We have also tested for association between innovation activity and owner education and experience. Owners with vocational training and some college years are more likely to innovate, while illiterate owners less likely do so.

4 'It was found that in the African case studies, everything the researcher did not expect, given the traditional context and way of doing things can be called an innovation in the local context. This means making a different product or a product of slightly better quality. "Innovation" would include all the following: using different raw materials, or economizing on the use of raw materials or energy; improving the design or introducing a new way to finance, distribute or stock products and changing the management of a small business'.

3 Determinants of innovation activities

3.1 The framework

Innovation was seen as a breakthrough or *radical change* characterized by marketing and technological discontinuity and primarily produced by large firms and concentrated markets as argued in the early works of Schumpeter. However, innovation is rarely a dramatic breakthrough, rather small improvement in a new process or product—*incremental innovation* (Blaug 1999). The realization of economic benefits from 'radical' innovations in most cases requires a series of incremental improvements. Thus, the bulk of economic benefits come from incremental innovations and improvements (Fagerberg 2005). Broadly defined innovative activities include introducing new products/services, new design, and improved quality of products/services, installed new equipment, changed sales methods, and improved working conditions. An innovation in a small enterprise in the developing countries context is largely an adoption of a product, process, or method that have already been adopted elsewhere but new to the firm and not necessarily new to the world, region, country, or industry (Van Dijk 2002).

What factors determine innovativeness and innovation activities in small firms? Hyvärinen (1990) identifies three broad (sometimes overlapping) determinants: entrepreneurial attributes, firm level resources, and the environment in which the firm operates.

Entrepreneurial character: In small businesses decisionmaking is concentrated in the hands of owner-manager (Dyer and Handler 1994). Innovation activities of individuals (owner-manager) form an important part of the innovation activities in small enterprises. Thus, the smaller the enterprise, the nearer its innovative behaviour is to that of an individual's (the owner-manager) behaviour (Hyvärinen 1990). Any attempt to investigate the innovation needs to consider an analysis of the characteristic of the entrepreneur (Donckels and Fröhlich 1991; Hausman 2005). Rogers (1995) summarizes characteristics of innovative entrepreneurs into three headings; socioeconomic status, personality, and communication behaviour of which education, social status, age, attitude toward risk and science, and density of social network in which the individual participates, are among the long list of variables.

Various empirical studies have tested the effect of human capital and demographic factors on innovation. Khan and Manopichetwattana (1989) and Hausman (2005) showed that in the USA innovative firms are led by more educated executives or owners. In Ghana, Robson et al. (2008) found that educated owners are more likely to innovate. The experience of owners (level of skill and knowledge) is also an important factor and has been found to affect innovation activities (Hausman 2005). Mahemba and de Brujn (2003) and Robson et al. (2008) have also shown that training of workers is associated with higher innovation. Khan and Manopichetwattana (1989) found that firms led by in average younger owners, are proactive, risk taking, and more innovative. So far, the relation between the owner's gender and innovation activities has not been empirically established. In the entrepreneur literature, however, there are a number of evidences showing that women-headed firms grow slower than male-headed ones (Liedholm and Mead 1993; McPherson 1996).

Firm level factors: Innovation activity occurs at firm level and the firm is a central actor in processes of technological change (Romijn 2002). In the empirical literature these resources are

captured by firm size, age, access to finance, and network. The relation between firm size and innovative activity is a longstanding debate since the work of Schumpeter 1939.[5] However, the empirical results so far are not conclusive (Nootebom 1994; Ernst 2004). In this paper we are not pursuing this debate as our data covers only the lower segment of firm size with 10 and fewer employees. But the size of a firm could still impact innovative activities even within the microenterprises, capturing differences in access to resources. Rogers (1995) indicated that early adopters are the wealthier and have large sized units (farms, schools, companies, and so on). Innovative spirit could be associated with the age of a firm in the sense that small firms have higher innovative capacity in the first stage of a life cycle. In contrast, firm age could also represent accumulated resource, market knowledge, and developed network thus older firms are more likely to be involved in innovation activities. The empirical evidence in Africa so far is mixed. Wignaraja (2002), Deraniyagaa and Semboja (1999) found supporting evidence of positive relation between firm age and innovation, and technological capability. Robson et al. (2008), however, found no significant relation between firm age and innovation.

Innovation activities would take place more easily in clusters and networks (Van Djik and Sandee 2002). Effective network that comprises lateral and vertical linkages raises capacity for each node in the network by increasing exposure to ideas and opportunities. They also reduce the transaction of developing and adopting innovations (Ernst 2004). A voluminous empirical literature supports the role of clusters and networks on innovation in Africa (Sverisson 1997; Oyelaran-Oyeyinka 2006; Chipika and Wilson 2006). Unfortunately, we do not have good approximation of network in our data thus have not included a network variable in the empirical analysis. We believe that if such effects exist then firm age might partly capture the impact of the network.

Based on this brief survey, the descriptive analysis in the previous section, and availability of data we forward the following hypotheses for test.

- *Hypothesis 3.1: Entrepreneurs with more formal education, technical/vocational training, and/or longer previous experience are more likely to take up innovative activity.*
- *Hypothesis 3.2: Younger entrepreneurs are more likely to take up innovative activity.*
- *Hypothesis 3.3: Male entrepreneurs are more likely to take up innovative activity than female entrepreneurs.*
- *Hypothesis 3.4: Larger firms are more likely to innovate than smaller firms.*

[5] The debate mainly surrounds whether small or large firms are more innovative. Some argue innovations are primarily produced by large firms and concentrated markets, while others claim that small firms are more likely to innovate. The advantage of large firms on innovation is their deeper level of specialization, science-based knowledge, economy of scale, larger and cheaper financial resources, spread of risks. The strength of small firms on the other hand, lies on their flexibility, greater motivation, tacit knowledge in unique skills, more informal communication along shorter lines, less bureaucracy, greater proximity to market and to own production (Nooteboom 1994).

- *Hypothesis 3.5: Older firms are more likely to innovate than younger firms.*

3.2 Estimation and results

The discriminant analysis and logistic regression are widely applied for identifying the attributes of innovative and non-innovative entrepreneurs/firms (e.g. Ostlund 1974; Kim and Kim 1985; Oyelaran-Oyeyinka 2006; Moreno and Casillas 2007; Koellinger 2008; Robson et al. 2008). The discriminant analysis, however, is based on a number of assumptions that sometimes are difficult to justify. It requires assumptions such as normal distribution, linear and homoscedastic relationships, untrancated interval or near interval data, proper model specification, and if the dependent variable is a true dichotomy among others. In contrast, the logistic regression requires no assumptions regarding the distribution of the explanatory variables. It is relatively robust, flexible and easily used, and it lends itself to a meaningful interpretation. Logistic regression is preferred when data are not normal in distribution or group sizes are very unequal (Pohar et al. 2004; Garson (undated)). Thus, in this paper we applied the logistic regression to test the above hypotheses on the determinants of innovative activity.

The dependent variable 'innovativeness' is defined here as a categorical variable indicating that the firm made important improvements/changes to its product/service recently. The independent variables include firm size, firm age, and owner attributes such as age, gender, previous business experience, general education and vocational training. The size of the firm is measured by the current number of employees. Firm age is the number of years since start and in logarithmic form. Business experience represents the experience of the owner in business before starting the current business, measured in number of months and in logarithmic form. The owner's age is also in logarithmic form. We made a distinction between general education and vocational technical training. The general education is represented by a high school certificate and some years of college education. This means the owner who did not complete high school and the illiterate serve as the control category. Vocational training is a dummy capturing if the owner had access to vocational training before or after the start of the business. Two sectoral dummies representing manufacturing and service are included, with trade as control category. Regional difference is also controlled with Addis Ababa as a reference city.

Table 4 reports the logit estimation results. The size of the firm is positive and highly significant. This means larger firms are more likely to participate in innovation activity. The positive effect of size indicates the resource advantage of larger firms over smaller ones and it is consistent with the theory of resource-based view and previous studies (for example, Robson et al. 2008). Firm age is also positive and significant. But when we include age square into the model we find a non-linear relationship (i.e. positive at the first level and negative squared term, both significant) between innovation and firm age (see Table 4, column 2). The concave relationship between firm age and innovativeness suggests that innovative activity increases at an early age but tends to decline beyond a certain age. The positive relation between age and innovation activity at an early age might be due to accumulated business experience and market knowledge. However, this advantage might not last long. The manufacturing dummy is positive and significant, suggesting that manufacturing firms are more likely to engage in innovative activity compared to the trade sector.

The coefficient of female owners is negative and significant suggesting female owned enterprises are less likely to innovate in contrast to those owned by male. This is usually explained by the fact that women owners are more family oriented and interested in long term stability of the business, thus, tending to take less risk (Brush 1992), and as a result less likely to engage in innovation activity. Women entrepreneurs also face more operational and strategic impediments compared to male in their entrepreneurial pursuit (Rutshobya 2001). Owner age is also negative and significant; the older the age of the entrepreneur, the less likely they are to innovate. This is consistent with the Khan and Manopichetwattana (1989) finding and might be explained by the fact that older entrepreneurs are also more risk averse than young entrepreneurs. Among the human capital variables only vocational training is found to affect innovation activity positively and significant but neither general education nor previous experience. This lends support to the belief that vocational (technical) training is more important than the general education in promoting entrepreneurship.

In the last column of Table 4, we introduced employment growth measured by cumulative change of employment in the firm between 2001 and 2003. This was to test if there is any causation from growth to innovation. However, firm growth is not significant while the effect of other variables remain the same. Robson et al. (2008) have also found no clear relation from firm growth to innovation in their estimation of innovation equation that includes firm growth. The effect might be the other way round, i.e. from innovation to firm growth? This is the task of the next section.

4 Innovativeness and firm growth

4.1 The framework

The second objective of this study is to investigate if innovative firms grow faster than non-innovative firms, in other words, if innovators create more jobs. Theoretically, new technologies and processes are associated with a better utilization of resources, higher quality of routine tasks and higher productivity. Companies that use innovative technologies and processes can often offer qualitatively superior and/or cheaper products, thereby enjoying higher growth potential (Minitti et al. 2006). McDaniel (2000) also argues that those firms successfully master the timing and placement of innovation development and innovation implementation in their respective industries will be set to lead in profits market share and industry dominance. In the context of new firms Geroski (1995) argues that the growth and survival prospects of firms will depend on their ability to learn about their environment, and to link changes in their strategy choices to the changing configuration of that environment.

Although, there are also counter-arguments that innovation might replace employment most empirical studies in the developed world show that innovative firms are more likely to grow, i.e. higher market share, profit, or employment, regardless of industry, size, or other characteristics. Mansfield (1962) compared average annual growth rates of innovators and non-innovators with comparable initial size in USA manufacturing and found that the growth rate of innovators is about 4–13 percentage points higher than the control group. Jones-Evans et al. (1996) found technologically innovative small and medium enterprises (SMEs) in the UK have growth rates above the average regarding assets, and expropriations. Moreover, such companies tend to have

minor bankruptcy rates. Koellinger (2008) examines the relationship between the usage of internet-based technologies, different types of innovation, and performance at the firm level based on a sample of 7302 European firms. He found that all considered types of innovation, including internet-enabled and non-internet enabled product or process innovations, are positively associated with turnover and employment growth but innovative activity is not necessarily associated with higher profitability. Cho and Pucik (2005) conducted research using data from the Fortune Reputation Survey and the Research Insight Global Vantage. They found significant relationship between innovativeness and firm growth and profitability. There is not much empirical work in Africa on the impact of innovation on firm growth. Mahemba and de Bruijn (2003) found no clear relation between innovativeness and firm growth of small manufacturing firms in Tanzania.

Besides innovative activity a number of other factors could also influence firm growth. The stochastic theory of Gibrat's law relates size distribution and firm growth and argues growth is independent on size. However, the growing empirical literature shows the contrary, i.e. a negative relationship between growth and firm size (Evans 1987; Dunne and Hughes 1994; Bigsten and Gebreeyesus 2007). The inverse relation between firm growth and size can be explained through the availability of slack resources suggested by Penrose (1959). Such idle resources arise as a consequence of their indivisibility. The extent to which a firm can employ the most advantageous division of labour depends on the scale of its operations; the smaller its output the less can resources be used in a specialized manner. The smaller the firm, the greater the indivisibility of resources and availability of slack resources, thus higher the incentive to expand.

In a life-cycle theory of firm Jovanovic's (1982) passive learning model predicts negative relation between firm age and growth. This is supported by several empirical studies (for example Evans 1987; Dunne and Hughes 1994; Mcpherson 1996; Bigsten and Gebreeyesus 2007). The active learning model by Ericson and Pakes (1995), on the other hand, argue that firms investing in R&D and human and physical capital will be more efficient and grow faster. Lack of access to financial resources hinders firms from growing to their optimal size (Holtz-Eakin et al. 1994; Elston 2002; Cabral and Meta 2003). Micro and small enterprises are more likely to face liquidity problems as they are considered expensive to be served thus less attractive to formal banks. Lack of finance is the most referred complaint among entrepreneurs in Africa (for example Biggs and Srivastava 1996; Bigsten et al. 2003). Other studies have also related firm growth to entrepreneurial attributes such as owner age and gender (for example Liedholm and Mead 1993; Mcpherson 1996; Davidson 1991; Davidson and Hoing 2003). The literature briefly reviewed above leads to the following testable hypotheses.

- *Hypothesis 4.1: Innovative firms grow faster.*

- *Hypothesis 4.2: Growth is inversely related with the size and age of the firm.*

- *Hypothesis 4.3: Businesses with less access to finance grow slower.*

- *Hypothesis 4.4: Businesses owned by educated people grow faster than those owned by the ones with lesser or no education.*

- *Hypothesis 4.5: Businesses whose owners had longer previous business experience exhibit higher growth than those who did not have such experience.*

- *Hypothesis 4.6: Businesses run by younger owners grow faster than those run by older owners.*

In modelling the relation between innovation and firm growth, we start with the Evans (1987) firm growth equation that relates growth with initial size, and age but augmented by innovation indicator and other variables:

$$\Delta S = \beta_0 + \beta_1 \ln(S_0) + \beta_2 \ln A_t + \beta_3 INN + \sum \gamma_i X_i + u_t \qquad (1)$$

where ΔS and S_0 represent the change of firm size and beginning size respectively, A denotes firm age, INN innovation indicator (a dichotomy variable), and X indicates other control variables (for example, owner characteristics such as education, experience, age, and financial constraint), and u is the log-normally distributed errors term with mean zero.

In the literature there are different measures of firm performance, such as growth in sales, profits, market share, assets, and employment. In this analysis we confined ourselves to employment growth basically due to the absence of sufficient sales and assets variable in our data. The dependent variable employment growth is defined here as the net change of employment between 2001 and 2003. The timing fairly matches with our main explanatory variable, i.e. innovativeness that captures if the firm made significant change/improvement in its product/service in recent years. On the right hand side of the equation, size is measured by employment at initial year. Credit constraint is defined as =1 if the firm reported that it needs credit but is unable to borrow due to different reasons, and 0 otherwise. The other explanatory variables are defined in the previous section.

4.2 Estimation and results

Estimating the above equation with ordinary least squares (OLS) might lead to inconsistent results if one or more of right-hand side (RHS) variables are not exogenous to the model. As we have shown in the previous section innovation is determined by many of the variables in the model, such as entrepreneurial characteristics. We performed a test for endogeneity of the innovation indicator using an augmented regression test (DWH) and found that the innovation indicator is correlated with the error term which makes OLS results inconsistent. There are different methods in controlling the endogeneity problem; simultaneous equation, fixed effect, instrumental variable (IV) method, etc. Given that our data is cross-section we use the IV method, specifically the two-stage least square (2SLS). The disadvantage of the IV method is that identifying a proper instrument is not easy. The requirement for proper instrument is that it should be correlated with the instrumented (i.e. included endogenous regressors) and at the same time uncorrelated with the error term.

Based on some experimentation of the data vocational training and owner gender are found to satisfy the requirement for proper instrument. The first stage regression results and test results are reported in Appendix table 1. First, the instruments are highly correlated with the innovation variable. F-tests that the owner female and owner with vocational school equals zero are also rejected. However, simply having an F-statistic that is significant at the typical 5 per cent or 10 per cent level is not sufficient. Stock et al. (2002) suggest that the F-statistic should exceed 10 for inference based on the 2SLS estimator to be reliable when there is one endogenous regressor.[6] The F-test statistic from the first regression is 12.58 and exceeds 10—the rule of thumb (see Appendix table 1). Hence, the instruments are strongly correlated with the endogenous regresssor. We have also conducted a test overidentifying restriction (see Table 5).[7] The Sargan statistic of overidentification restriction can not be rejected implying the instruments are valid. Confirming that our instruments are valid we now proceed to discuss the results. Table 5 reports OLS, 2SLS, GMM, LIML estimation results. The 2SLS denotes a two-stage least square estimation. GMM represents a generalized method of moment's estimator and generates efficient estimates of the coefficients as well as consistent estimates of the standard error. LIML stands for limited information maximum likelihood and the estimator may yield less bias and confidence intervals with better coverage rates than 2SLS estimations. The OLS was included for comparison although we showed that the innovation coefficient might be inconsistent due to its endogeneity. The OLS result is, however, not qualitatively different from the others except the magnitude of the innovation indicator is lower. The other estimation results are almost identical even in terms of magnitude.

The innovativeness indicator is positive and significant in all the estimations. This suggests that innovative firms grow faster than non-innovators, thus, innovative activity predicts higher job creation. Other variables have also impacted employment growth. Initial size and age of the firm are negative and significant in all estimations suggesting that smaller and younger firms grow faster than their counterpart. Size and age often have a non-linear relationship with firm growth. Of course, a non-linear relationship between size and growth might not make sense in a small range of size such as the data we have of firms with 10 and less workers. Thus, we estimated a non-linear relationship between age and growth by introducing square of log firm age into the equation. The results are reported in the last column of Table 5. There is indeed a convex relationship between age and growth of employment with the first level taking negative sign and the squared term positive, both significant. This means firm age is related with growth negatively, but the negative relation diminishes with age. The negative segment captures evidence of a learning process that was proposed by Jovanovic (1982) whereby as a firm ages and grows more confident about its costs, the mean and variance of its growth rate should decrease. This is also consistent with the previous findings. Bigsten and Gebreeyesus (2007) found a convex relation in the Ethiopian manufacturing sector. Evans (1987) reported that firm growth decreases with age for younger firms but is roughly independent of age for older firms in US manufacturing.

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6 For more discussion and examples on this see StataCorp Release 10, Reference I-P: 49.

7 The test of overidentifying restriction tests two things simultaneously: whether the instruments are correlated with the error term and if the equation is mis-specified, i.e. one or more of the excluded exogenous variables should in fact be included in the structural equation. Thus, a significant test statistic could represent either an invalid instrument or incorrectly specified equation (StataCorp Release 10, Reference I-P: 52).

Credit constraint is highly significant and negatively related with firm growth. This is obvious given that 85 per cent of the firms in our sample have never received credit from the formal market, such as banks and microfinance institutions. Consequently, they largely depend on the informal network such as relatives and friends, and trade credit. In all the estimations manufacturing is positive and highly significant. Hence, manufacturing enterprises are more likely not only to innovate but also grow faster than other sectors. Service gives positive coefficient but not significant.

Among the attributes of the entrepreneurs only owner age is found to be positive and significant. However, the human capital variables such as owner previous experience and owner education as measured by the dummy of high school certificate and above are positive but not significant. Vocational training was also found to be insignificant (not reported here).

5 Summary and conclusions

The aim of this paper was to address two prominent issues on the MSEs development in Africa. The first is to show the factors that foster or constrain innovation and the second examining if innovative enterprises create more jobs than non-innovators. We estimated separate models of innovation and growth determinants. We used a logit estimation method for the innovation model. In the growth equation we applied IV method to address the endogeneity of innovation in the model. Appendix table 2 summarizes the signs and significance level of the variables in both models.

Innovation activity is related with a number firm and entrepreneur attributes. Current size is related positively with innovation activity. This means the larger in size the more likely to involve in innovative activity. Resource advantage could explain why larger firms are more innovative than smaller firms. This is consistent with most previous studies. We found a non-linear (concave) relationship between firm age and innovation activities. Innovative activity increases at early age but tends to decline beyond a certain age. Our interpretation of the results is that the positive relation between firm age and innovation activity at early age might be due to accumulated business experience and market knowledge. However, this advantage might not last long, for example the innovative sprit of firms might decline with age.

Among the human capital variables vocational training is found to have a strong effect on the innovation activity. Unlike other studies (for example Hausman 2005), neither general education (a measured by high school certificate and above) nor previous business experience are affecting innovation in our data. This gives support to the notion that technical skill is more important than general education in promoting entrepreneurship and innovation.

Female owned firms are less likely to be involved in innovation activity. This might be explained by the fact that women entrepreneurs are risk averse. Previous studies indicated that women entrepreneurs are more family oriented thus less interested in expansion of their businesses (Brush 1992). In developing countries women entrepreneurs also face more constraints comparing to male in their entrepreneurial pursuit. We have also found a negative relation between innovativeness and owner age suggesting that younger owners are more likely to innovate than older ones. This is usually an indication of the owners' risk attitude.

The main contribution of this study to the MSEs literature in Africa is its extension in examining the effect of innovativeness on firm growth while controlling a range of other potential variables that could have an effect on firm growth (e.g. size, age, financial constraint). We found strong evidence that innovators are more likely to grow than non-innovators. On the other hand, we found no evidence of the reverse causation (i.e. from growth to innovativeness). This supports the claim that innovations lead to expansion of business and creation of more jobs. A focus on promoting innovation and technological capability will, therefore, pay off not only through increasing MSEs competitiveness but also by their ability to create more jobs.

Credit constraint affects negatively firm growth. This is obvious given that the financial markets in Ethiopia are underdeveloped and most of the small firms rely on the informal market for external finance. Policymakers, therefore, need to facilitate alternative channels of access to finance for small firms. In both the innovation and growth estimations a manufacturing dummy is found to be positive and highly significant. This gives evidence of the superiority of the manufacturing sector as an engine of growth.

Other firm characteristics such as size and age of the firm have also been found to affect growth. We found a negative relation between initial size (employment) and growth, suggesting smaller firms at start tend to grow faster than larger ones. This is consistent with the availability of the slack resources view suggested by Penrose (1959) and most previous empirical findings. We found a non-linear (convex) relation between firm age and firm growth. This means growth decreases with age until a certain point while the relation turns positive beyond that. The negative segment captures evidence of the learning process that was proposed by Jovanovic (1982) whereby as a firm ages and grows more confident about its costs, the mean and variance of its growth rate should decrease. This is also consistent with the previous findings (for example Bigsten and Gebreeyesus 2007 in Africa, and Evans, 1987 in US manufacturing).

Appendix

Appendix table 1: Results of the first stage instrumental variables (2SLS) regression

Dependent variable dummy for innovative firms	Coef.
log employment current	0.064***
log age	0.044***
log previous experience	0.002
log(owner age)	-0.103**
Credit constrained	0.026
High school and above	0.001
Manufacturing	0.156***
Service	0.054*
Owner female	-0.085***
Owner have vocational training	0.183***
_cons	0.409**
Adj. R-square	0.1267
F (2, 950)	12.58
Prob > F	0.00

Notes: regional location is controlled in the estimation. ***, **, and * denote level of significance at 1%, 5%, and 10% respectively.

Appendix table 2: Summary of the estimation results of innovation and growth equations

Variables	Innovation	Growth
Firm growth	Insignificant	Not included
Innovative firm dummy	Not included	+
log(initial employment)	+	-
log(firm age)	+	-
log(firm age)^2	-	+
log(previous experience)	Insignificant	Insignificant
log(owner age)	-	+
Female owned	-	Not included
Credit constrained	Insignificant	-

High school and above	Insignificant	Insignificant
Vocational training	+	Insignificant
Manufacturing	+	+
Service	Insignificant	Insignificant

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Table 1: Some characteristics of the microenterprises and owners

		N	%
Sector	Trade	439	45
	Service	349	36
	Manufacturing	186	19
Firm size category	1 worker	172	18
	2–4 workers	493	51
	5–10 workers	302	31
	>10 workers	6	0.6
Firm age category	<= 5 years	439	45
	6–12 years	347	36
	13–29	141	14
	above 29	47	5
Owner gender	Female	226	22.3
	Male	722	74
Owner age group	<=25	185	19
	26–35	392	40
	36–50	247	25
	50 & above	150	15
Owner education	Illiterate	113	12
	Elementary	287	29
	Some high school	119	12
	High school complete	310	32
	Some college years	145	15
	Have vocational training	182	19

Table 2: Type of innovative activities by sector

If yes, what improvements/changes?	Broad category of innovation	Frequency by sector			
		Trade	Service	Manufacturing	All
Improve quality product/service	Product/service	20	20	6	46
Provide new products/service	Product/service	9	13	3	25
Better design	Product/service	9	12	18	39
Increase variety of products/services	Product/service	12	5		17
Install additional machinery	Process	1	4	9	14
Introduce modern machinery	Process	6	7	15	28
Additional business premises/house	Process	5	4	2	11
Additional utensils/furniture/equipment	Process	15	16	3	34
Renovation	Process	13	14	3	30
Improved production capacity	Process	12	3	5	20
More advertisement	Marketing	11	3	4	18
Shorten delivery time	Marketing	1	3	1	5
Discount	Marketing		2		2
Accounting system	Organization & skill			1	1
Managerial skill	Organization & skill	3	2		5
Hired skilled worker	Organization & skill		1		1
Skill improvement	Organization & skill	2	7	9	18
Additional business partner	Organization & skill		1		1
Expanded the business	Organization & skill	12	1	5	18
Total number of firms reported recent important improvement		131	118	84	333
Total number of firms in the survey		439	349	186	974
% of firms reported recent important improvement		0.30	0.34	0.45	0.34

Table 3. Correlation coefficients between innovativeness and owner attributes

Correlation with improve/change products/services recently			
Variable	Correlation coefficient	Variable	Correlation coefficient
1) Perception on innovativeness		3) Demography	
Higher quality than competitors	0.1795*	Owner female	-0.0643*
Higher design than competitors	0.0744*	Owner age	-0.0174
Advanced machinery	0.0992*	Married	-0.0025
2) Perception on business environment		4) Education/experience	
Revenue increased	0.0930*	Illiterate	-0.0750*
Have no market problem	0.1500*	Elementary	-0.0249
Have plan to expand	0.1610*	High school	0.0127
Need credit but did not get any from formal source	-0.0029	High school complete	0.0087
Employment change 2001–03	0.1035*	Some College	0.0770*
Current size category	0.1383*	Received vocational training	0.1465*
Cumulative investment 2001–03	0.0866*	Experience in business	0.0211

Note: * denote significance at 5% or better.

Table 4: Determinants of innovation activities logit estimation

	Dependent variable dummy for innovation activity		
	(1)	(2)	(3)
Firm attributes			
∆employment (2001–03)			0.012
			(0.057)
Current employment	0.153***	0.155***	0.153***
	(0.0340)	(0.034)	(0.036)
log(firm age)	0.194**	0.682***	0.687***
	(0.0886)	(0.198)	(0.199)
log(firm age)^2		-0.100***	-0.100***
		(0.037)	(0.037)
Owner attributes			
log(owner age)	-0.706***	-0.851***	-0.851***
	(0.268)	(0.274)	(0.274)
Owner female	-0.388**	-0.383**	-0.381**
	(0.184)	(0.185)	(0.185)
log(previous business experience)	-0.00943	-0.002	-0.002
	(0.0430)	(0.043)	(0.043)
Owner high school complete and above	-0.0505	-0.032	-0.032
	(0.168)	(0.169)	(0.169)
Owner have vocational training	0.871***	0.872***	0.870***
	(0.204)	(0.205)	(0.205)
Sector (control category trade)			
Manufacturing	0.678***	0.687***	0.682***
	(0.202)	(0.203)	(0.204)
Service	0.223	0.265	0.265
	(0.172)	(0.174)	(0.174)
Constant	0.262	0.266	0.264
	(0.931)	(0.938)	(0.938)
Region controlled	Yes	Yes	Yes
	966	966	966
Observations			
Pseudo R2	0.13	0.136	0.136

Note: figures in parentheses are standard errors, and *** p<0.01, ** p<0.05, * p<0.

Table 5: Firm growth and innovation

Variables	Dependent variable net change of employment (2001–03)				
	(1)	(2)	(3)	(4)	(5)
	OLS	IV-2SLS[8]	IV-LIML	IV-GMM	IV-2SLS
Innovative firm dummy	0.209**	1.297**	1.322**	1.371**	1.352**
	(0.0973)	(0.644)	(0.653)	(0.664)	(0.658)
log(initial employment)	-0.0984	-0.163**	-0.164**	-0.172*	-0.174**
	(0.0694)	(0.0820)	(0.0824)	(0.0942)	(0.0834)
log(firm age)	-0.123**	-0.166***	-0.167***	-0.166**	-0.427***
	(0.0502)	(0.0592)	(0.0595)	(0.0742)	(0.140)
log(firm age)^2					0.0566**
					(0.0250)
log(previous experience)	0.0491**	0.0434	0.0433	0.0427	0.0393
	(0.0250)	(0.0267)	(0.0268)	(0.0263)	(0.0270)
log(owner age)	0.320**	0.429**	0.432**	0.432**	0.503***
	(0.154)	(0.175)	(0.176)	(0.192)	(0.184)
Credit constrained	-0.423***	-0.451***	-0.452***	-0.452***	-0.462***
	(0.0990)	(0.106)	(0.107)	(0.119)	(0.107)
High school and above	0.151	0.107	0.106	0.0959	0.0961
	(0.0958)	(0.105)	(0.105)	(0.0996)	(0.105)
Manufacturing	0.659***	0.489***	0.485***	0.469***	0.479***
	(0.121)	(0.166)	(0.167)	(0.169)	(0.167)
Service	0.236**	0.165	0.163	0.153	0.146
	(0.100)	(0.112)	(0.113)	(0.109)	(0.114)
Constant	-0.448	-0.871	-0.881	-0.881	-0.882
	(0.552)	(0.641)	(0.644)	(0.679)	(0.644)
Regions controlled	yes	yes	yes	yes	yes
Observations	974	966	966	966	966
Overidentification test					
Sargan statistics (Chi-square)		0.551 [a]	0.550 [b]	0.611 [c]	0.599 [a]
p-value		0.458	0.459	0.434	0.439

Notes: Figures in parentheses are standard errors, and ** p<0.01, ** p<0.05, * p<0.1

[a] The reported Chi-square and p-value are of Sargan-statistic

[b] The reported Chi-square and p-value are of Anderson-Rubin-statistic

[c] The reported Chi-square and p-value are of Hensen's J-statistic.

8 Instrumented: innovation indicator; included instruments: log(size), log(age), log(experience), log(owner age), credit constraint, education, sector, and regions; excluded instruments: owner female, vocational training.

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