Survival of Private Sector Manufacturing Firms in Africa: The Role of Productivity and Ownership*

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Abstract:

This paper uses panel data to estimate the probability of exit for privately-owned establishments in Ethiopian manufacturing. Although the sector is at an incipient stage of development, the selection of efficient producers is comparable to that of developed countries. Looking at the dynamics of firm ownership following the 1991 economic reform, the paper shows that belonging to multiunit firms reduces the risk of exit as compared to single-unit establishments suggesting the existence of information and risk sharing mechanisms within a group. Female ownership of establishments has also been increasing and they stand better chances of survival as compared to male-owned establishments.

JEL Classification: D21; L11

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1. Introduction

When firms close down, jobs are destroyed. However, their departure may also increase aggregate productivity if exiting firms are relatively inefficient. Firms' exit decision has therefore attracted a growing literature because of its implications on the trajectories of employment, productivity and growth at the aggregate level. Bernard and Jensen (2007) for instance show that about 58% of gross-job-destruction in the U.S. manufacturing during the 1990s was accounted for by plant closure. Geroski's (1995) review of firm dynamics in developed countries shows that most industries do not experience any shortage of entrants. In fact, overcoming entry barriers is relatively easier than surviving the market especially for small firms during their first few years in business (Bartelsman et al., 2003). In almost all cases surviving firms are larger, older and more efficient than exiting firms reflecting the existence of market forces that ensure the 'survival of the fittest'.

Understanding the processes of firm exit and survival is particularly relevant for countries in Sub-Saharan Africa where dysfunctional markets are believed to have stifled the entry and growth of small enterprises while tolerating inefficient large incumbents (Collier and Gunning, 1999). Since the mid 1980s, countries in the region have been implementing reform measures to build market economies where the private sector plays a leading role. How far they have gone in this direction is an interesting question to which firm level studies provide crucial insights. At present, only few studies have analysed firm survival in Sub-Saharan Africa. The first attempt was by McPherson (1995) who estimated a proportional hazard model to assess the risk of exit facing micro and small enterprises in four Southern African countries. He found that contrary to theoretical expectations, the risk of exit does not vary with firm size although growing firms stand better chances of survival. Recently, Frazer (2005) studied the survival of Ghanaian manufacturing firms using the RPED (Regional Program on Enterprise Development) dataset for the early 1990s while Söderbom, Teal and Harding (2006) carried out a similar study for Ghana, Kenya and Tanzania. These recent papers on African firms provide strong evidence that the exit risk declines in firm size and productivity. These findings are consistent with the predictions of market selection models as well as some of the evidence from industrialised countries[2]. For Ethiopian manufacturing firms, Shiferaw (2007) shows high degree of persistence at the top of the productivity distribution while the majority of firms at the bottom tail (about 60%) exited the market in a period of six years, revealing the existence of competitive markets.

The main thrust of survival analysis is to better characterise surviving firms and assess the nature of market selection. Doing so requires reliable measurement of firm specific productivity and the ability to identify the incidences of entry and exit. This paper investigates firm survival in Ethiopian manufacturing and its first contribution to this literature draws from a data advantage. Unlike previous studies on African firms, the current paper uses census-based panel data which are more likely to provide robust hazard estimates since they allow effective tracking of firm entry and exit than would be possible in sample surveys that are not always representative. As explained later, the censuses also captures a wider range of industries than in the RPED surveys (which cover only four industries) and permit a consistent estimation of industry specific production functions that would yield reliable indicators of firm level productivity.

[2] Following a non-parametric analysis of firm size distributions in nine Sub-Saharan African countries, Van Bieseboeck (2005) also found some support to the view that large firms are more likely to survive.

Since the onset of economic reform in 1991, Ethiopian manufacturing has gone through remarkable changes in the structure of firm ownership. The new investment law has not only removed caps on the level of investment but also allows entrepreneurs to run more than one line of business. Investors could thus decide to enlarge a single establishment by reinvesting their profits or run a multiunit firm with small establishments. The proportion of multiunit firms has been increasing during the study period and they account for about 41% of manufacturing sector employment and 33% of its value added. Similarly, the increase in the role of the private sector in Ethiopian manufacturing has been accompanied by a steady rise in female-owned establishments. The second contribution of the paper is therefore to go beyond the traditional covariates of hazard models and analyse the evolving structure of ownership and its implications on firm survival by comparing for instance multiunit versus single-unit firms, and female versus male-owned firms.

Thirdly, while previous studies on African firms controlled only for industry fixed effects, the survival analysis in this paper takes into account fixed as well as time varying industry effects. The latter include proxies for industry concentration, entry and exit barriers, business cycles and exposure to international competition. Finally, the paper estimates the probability of exit using discrete-time hazard models which are more effective than competing methods in handling right-censured duration data that are observed in discrete rather than continuous time (Cameron and Trivedi, 2005).

The paper is in seven sections. The following section briefly reviews the literature on firm survival. Section 3 outlines the empirical approach by highlighting the relevant duration models and the choice of covariates. Section 4 introduces the data and provides summary statistics. Section 5 presents the results of the survival analysis while section 6 checks the sensitivity of the results to unobserved heterogeneity. Conclusions are in section 7.

2. Theoretical Framework

Once in the market, firms operate under continuous but varying levels of exit risk. Theoretical models of industrial evolution like the passive learning model of Jovanovic (1982) and the active learning model of Pakes and Ericson (1998) predict that small firms are more likely to exit the market than their large counterparts. These models also predict that the risk of business failure declines over time as firms acquire new competitive skills or as they fully discover their innate efficiencies. However, the business strategies literature suggests that small firms do not need to grow in size in order to survive. The argument is that small firms have the advantages of flexibility and specialisation in niche markets that allow them to overcome business failures (Porter, 1990; Caves and Porter, 1977).

Most empirical studies, particularly for developed countries, find positive and statistically significant size and age effects on firm survival in line with market selection models (Geroski, 1995; Bernard and Jensen, 2007). The results are mixed for firms in developing countries. Estimates of production functions often do not find significant scale economies in manufacturing, suggesting that small firms may not be particularly at a disadvantage in most industries (Biggs et al., 1995; Little et al., 1987). Similarly, for micro and small enterprises in southern Africa, McPherson (1995) found no significant size effect on survival. However, Frazer (2005) and Soderbom et al. (2006) show clearly that large firms stand better chances of survival.

Identifying the role of productivity has been at the centre of firm survival analysis. If markets work properly, competition would purge industries of inefficient producers. While this might be generally the case, efficiency does not seem to explain the entire survival story. For a group of five African countries, quite a large proportion of exiting firms closed down for non-business reasons, such as the death of the owner or opening up of better opportunities elsewhere (Liedholm et al., 1994). As in McPherson (1995) this finding is based on a sample of micro and small enterprises only. For Ethiopian manufacturing, Shiferaw (2007) shows that the proportion of exiting firms increases as one goes down the productivity ladder; yet, about a quarter of firms in the top productivity quintile have also exited the market over a period of six-years. Despite methodological differences in the estimation of productivity, the studies by Frazer (2005) and Soderbom et al. (2006) provide evidence that productivity reduces the risk of exit significantly.

Factor intensity is often used as an indicator of firms' choice of technology. Standard trade theory claims that capital-intensive industries in economies abundantly endowed with labour would contract or even disappear unless they are protected. However, more capital per person could enhance labour productivity and reduce the hazard of failure. The latter is a view espoused by theories of industrial evolution that relate firm survival and growth to investment in productivity-enhancing activities (Pakes and Ericson, 1998). Firms' choice of skill intensity may also affect their prospects of success. This could in fact be more relevant than capital intensity particularly for technologically advanced products that require continuous upgrading. The empirical evidence is again mixed. Frazer (2005) found that for Ghanaian firms capital intensity raises the risk of exit after controlling for industry fixed effects while Soderbome et al. (2006) find no significant effect. For U.S. manufacturing Bernard and Jensen (2007) found that both capital and skill intensity reduce the risk of exit.

Another dimension of firm survival relates to the structure of ownership. Reform measures in Ethiopia and other African economies have allowed and at times promoted local and foreign private investment even in sectors formerly reserved only for public enterprises. In Ethiopia, the investment law has removed caps on the size of investment as well as restrictions on how many lines of business entrepreneur can engage in. These measures bring about changes in the structure of ownership which have implications for survival. For instance, firms partly or fully owned by foreigners may survive longer because of preferential treatments at the policy level or simply because of better access to superior technology. However, one would also expect foreign firms to exit the market if the location-advantages that attracted them such as natural resources or cheap labour are eroded. Gender is another dimension of ownership worth exploring as female entrepreneurs often face more hurdles to establish and successfully run businesses than their male counterparts (Loscocco et al., 1991). McPherson (1995) found that in two out of four African countries that he studied, female-owned small firms exhibited higher risk of firm closure. A third aspect of ownership is whether or not an establishment is part of a multi-establishment operation. The latter style of organization often seems to enhance performance because of a pool of resources at the company level such as knowledge, experience and finance that can be shared by individual plants. For UK manufacturing, for instance, Disney, Haskel and Heden (2003) show that being part of a group increases the survival probability as compared to single firms. Dunne, Roberts and Samuelson (1989) also found a positive effect on firm growth in the US manufacturing. The recent paper by Bernard and Jensen (2007) shows that although the unconditional probability of exit is much lower for multiunit firms, this advantage turns out to be statistically insignificant once plant level characteristics are taken into account. Apparently, no other paper that I am aware of addresses the significance of this relationship in the context of African manufacturing firms.

Other forces that influence firm survival operate at the industry level. If an industry is on the upswing with a growing demand, survival might be easier even for inefficient firms, while a downswing might threaten even the well established ones. Ignoring inter industry variation in output growth could therefore undermine the identification of firm level traits of survival. In theory, more competition is expected to induce productivity growth by intensifying the exit threat. Accordingly, if trade liberalization exposes industries to direct competition from imports, some producers will be forced to improve productivity or lose market shares leading eventually to closure (Ballasa, 1988). Competition could also be rife even in protected industries if the domestic market is not dominated by few players. Industries with high concentration are therefore expected to have lower risks of exit because of weak competition. A related issue is inter-industry variation in entry and exit barriers that would influence the risk of firm closure. Hopenhayn (1992) shows that high entry barriers, due to government policy or collusion among large firms, could reduce the minimum level of productivity needed to stay in the market thereby protecting incumbents. Similarly, costs associated with firm exit such as employee compensation or difficulty to recover fixed assets may delay firm closure although they may not prevent it.

The preceding discussion has highlighted key firm and industry characteristics that could determine firm survival. The existing firm level studies on African manufacturing are beginning to show that firm size, age and productivity are inversely related with the risk of exit which is expected in functional markets. This paper provides further evidence on the process of market selection by using more reliable productivity estimates and controlling for a number of industry effects that could influence the probability of exit. Most importantly the paper provides new evidence on two emerging aspects of firm ownership, i.e. female ownership and multiunit firms, which have not been addressed adequately in previous studies of firm survival in African manufacturing.

The following section outlines the empirical approach that would allow us to put together and give empirical content to the preceding discussion.

3. The Empirical Approach

3.1. Duration Models

The analysis of survival time has a long tradition in biometrics and material sciences. Its application for firm demographics is rather recent starting with the works of Troske (1989) and Audretsch and Mahmood (1994). The subject of analysis is the population distribution of time under risk - firm exit in this case. The cumulative density function $F(t)$ of time under risk or survival time (*T*) is expressed as:

$$F(t) = P(T \leq t), \quad t \geq 0 \qquad (1)$$

where *t* is a specific value of *T*.

The survivor function (S) is defined as the probability of surviving past time t:

$$S(t) \equiv 1 - F(t) = P(T > t) \qquad (2)$$

Because of the right-censoring on survival time, in most applications the prime interest is in the hazard function which is the probability of failure in a short time interval Δt conditional on survival until *t*. The hazard function $\lambda(t)$ is expressed as:

$$\lambda(t) = \lim_{\Delta t \to 0} \frac{P\left(t \le T < t + \Delta t \middle| T \ge t\right)}{\Delta t} = \frac{f(t)}{S(t)} \qquad (3)$$

where $f(t)$ is the density of *T*.

The shape of the hazard function conveys an important message about the underlying distribution of survival time. If the derivative of the hazard function with respect to time is positive, i.e., $\lambda'(t) > 0$, the hazard is said to follow a positive duration dependence, meaning that the risk of failure increases with time. If the derivative is less than zero, there is negative duration dependence and agents will be more likely to survive as time goes by. The event being studied is said to be "memoryless" if the derivative of the hazard is equal to zero.

Our interest is in estimating a conditional hazard model with firm and industry characteristics:

$$\lambda(t; x) = \frac{f(t|x)}{1 - F(t|x)} = \frac{f(t|x)}{S(t|x)} \qquad (4)$$

There are several parametric and non-parametric approaches to estimate (4). Proportional hazard models like that of Cox (1972) for instance analyse the shift in a baseline hazard function due to a unit change in an explanatory variable. The baseline hazard function $\lambda_0(t)$ is common to all subsamples and not a function of covariates. The hazard of each group $\lambda_i(t)$ is assumed to be a certain proportion of the baseline hazard which is expresses as:

$$\frac{\lambda_i(t)}{\lambda_0(t)} = \exp(\beta' x_i) \tag{5}$$

Or equivalently as:

$$\log \lambda_i(t) = \log \lambda_0(t) + \beta' x_i \tag{6}$$

The coefficients can be expressed as hazard ratios in which case a value of $\beta = 1$ represents a covariate that does not affect the hazard rate. A coefficient greater than one implies that the variable increases the risk of exit while a value less than one reduces the hazard of failure or prolongs survival time[3].

The proportional hazard model discussed so far is ideal for durations that are observed on continuous time. However, in most cases we only know the interval during which transition between states has occurred but not the exact moment of transition for each individual. Such observations are said to be grouped-durations (although the underlying process may still be continuous) and the hazard within an interval is assumed to be constant. Such data are better analysed with Discrete-time proportional hazard models (Cameron and Trivedi, 2005).

The panel data for this paper contain grouped-durations as observations are taken annually. The results presented in sections 5 and 6 are therefore based on variants of a discrete-time hazard model shown in equation (7). The discrete-time hazard function is defined as the probability of transition at discrete time t_j, $j = 1, 2, \ldots$, given survival to time t_j:

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[3] In applications where the actual regression coefficients are reported, a covariate with a negative (positive) coefficient reduces (increases) the risk of exit.

$$\lambda\left(t_a \middle| x\right) = \Pr\left[t_{a-1} \le T < t_a \middle| T \ge t_{a-1}, x\left(t_{a-1}\right)\right], \text{ a=1,2...A.} \quad (7)$$

The corresponding discrete-time survivor function is obtained from the discrete-time hazard function in a recursive manner as:

$$\begin{aligned} S\left(t_a \middle| x\right) &= \Pr\left[T \ge t_{a-1} \middle| x\right] \\ &= \prod_{s=1}^{a-1}\left(1-\lambda\right) \end{aligned} \quad (8)$$

3.2. Choice of Covariates

Drawing on the discussion in section 2, equation (7) will be estimated on the following covariates:

$$\lambda_i = f\left(\text{size,duration,productivity,factor intensity,ownership,industry characteristics, location}\right)$$

Firm size will be measured by the logarithm of the number of employees. Duration dependence will be measured directly by including the logarithm of duration, i.e., time since a firm is first observed in this data set[4].

Firm level productivity is calculated based on industry level production functions rather than using a single equation with industry dummies as in previous studies on African firms. A well known problem with estimation of production functions is the correlation between input levels and unobserved productivity that renders input coefficients biased and inconsistent. An innovative solution to this problem has been suggested by Olley and Pakes (1996) using investment as a proxy for unobserved productivity. Levinsohn and Petrin (2003) developed this approach further in which a variety of intermediate

[4] Firm age can also be used to measure duration dependence. However, due to the cut-off point in the census and the difficulty to establish the date of entry for establishments that belong to multi-establishment firms, some entrants are much older than others by the time they appear for the first time in the census. To avoid complications that may arise from this situation, in this paper we use time since an establishment is first observed, i.e. duration during the study period, rather than reported age.

inputs can be used as proxies for productivity with the extra advantage of overcoming the problem of discontinuity in firm level investment as a valid proxy. Both approaches follow a two-stage procedure in which the first stage provides consistent estimates for variable inputs and the second stage identifies the coefficient of capital. Ackerberg et al. (2005) criticised this approach by arguing that the first stage estimation especially in the case of Levinsohn and Petrin (2003) does not provide consistent estimates for variable inputs and hence the whole procedure fails to resolve the endogeneity problem. They proposed an alternative approach which also has two-steps but does not require identification of variable input coefficients in the first stage[5].

The current paper however uses the systems GMM estimator, which has been developed in parallel with the proxy variables approach, to estimate value added production functions for nine industries. This estimator resolves the endogeneity problem by using instrumental variables whereby first differences are instruments for input levels and lagged levels are instruments for differences (Arellano and Bover,1995; Blundell and Bond, 1998). Unlike the proxy variable approaches, the systems GMM estimator has the advantage of allowing for firm fixed effects. See for instance the comparisons of these methods in Ackerberg et al. (2005). The industry level production function is given as:

$$y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + w_{it} + \eta_{it} \qquad (9)$$

Where y_{it} is log of value added, k_{it} is log of capital and l_{it} is log of labour input. The unobserved elements w_{it} represent productivity shocks that are potentially observable by the or predictable by the firm when making decisions on input levels while

[5] Frazer (2005) for instance used a productivity term derived from this procedure while Soderbom et al. (2006) used value added per person.

η_{it} represent white noise. The input coefficients based on the GMM estimator are provided in Appendix Table 2 which also reports the p-values of the Hansen test for overidentification. The test shows that the instruments are not correlated with the equation errors for each industry. Firm level productivity terms are calculated as residuals from these production functions. Since monetary values of output and input are deflated by firm specific price indices, the productivity terms are not tainted by differences in mark-up pricing (see section 4 for details).

The hazard model also includes two indictors of factor intensity. The first one is capital intensity measured as the logarithm of capital per worker. For lack of a direct measure of skill differences, skill intensity is proxied by the logarithmic deviation of a firm's average real wage (real wage bill divided by the number of workers) from the industry average real wage. The idea is that other things being equal, hiring more skilled workers would push a firm's average wage above the industry mean.

The structure of ownership is represented by a set of dummy variables. In this paper, an establishment is considered to be female-owned if all or the majority of the proprietors are women. The variable Female-Owned will take the value one for such firms and zero otherwise. This distinction is based on the number of entrepreneurs rather than their contribution to equity. However, since 75% of female-owned firms have only one owner, the distinction does not make a big difference. The criterion is a bit different regarding foreign ownership. A non-zero foreign direct investment signals foreign presence and will be represented by an FDI dummy that takes the value one for such ventures and zero otherwise. Establishments which belong to a multi-establishment firm are also identified by a dummy variable that takes the value one for such firms and zero if they are standalones.

As said, certain aspects of the exit hazard are equally shared by all firms in an industry while varying across industries. For instance, industries may face different rates of change in demand at different points in time with implications on firm survival. Such business cycles will be captured by including annual growth rates of real output at the industry level. Another variable of interest is the degree of exposure to competition from imports. To account for this, import penetration rates are calculated for each industry by merging import values obtained from the Ethiopian Customs Authority with values of domestic manufacturing output from the manufacturing censuses. For some industries the main source of competition could be domestic and following the practice in industrial economics, the Herfindahl Concentration Index is calculated to capture the intensity of such competition. This index is simply the sum of squared market shares of all firms in an industry[6]. The closer the index gets to zero the higher the degree of competition and the closer it gets to one it indicates monopoly.

Entry barriers are also likely to vary across industries and the heftier they are the lower the expected rate of exit. Since a direct measure of entry barriers is hard to come by, it is approximated by the observed rate of entry, i.e., the ratio of the number of entrants to the total number of firms in an industry. Similarly, the process of exit may not go smoothly in all industries. The theoretical literature on exit decisions (Ericson and Pakes, 1995) is built around firms' assessment of the present value of expected profits against the current value of fixed assets in second-hand markets. The existence of

[6] Although the sample excludes state-owned enterprises, the market shares and the Herfindahl index are calculated taking into account all firms – both public and private.

second-hand markets is therefore assumed although it is not very crucial for the theory. Such markets might be thin or missing for some industries in developing countries. The scope of the second-hand market is therefore our proxy for exit barriers assuming such markets would facilitate the process of exit by allowing firms to recover at least part of their fixed assets. The proxy is a dummy variable that takes the value one if more than 10% of the firms in an industry participated in the second hand market, and zero if the share of participants is less than 10%.

Finally the variation of the exit risk across space will be captured by a location dummy. In this case a dummy variable will identify firms located in the capital city Addis Ababa to find out if the relatively better transport and financial infrastructure in the capital tend to reduce the risk of exit.

4. Data and Descriptive Statistics

This study uses establishment level panel data for the period 1996 to 2002. The panel are based on annual censuses of manufacturing carried out by the Central Statistics Authority (CSA) of Ethiopia and cover all establishments that employ at least 10 persons. Each establishment is identified by a unique ID number in combination with region and four digits Standard Industrial Classification (SIC) codes. The total number of establishments increases from 608 in 1996 to 823 in 2006.[7] The analysis in this paper however focuses on privately-owned manufacturing firms whose number increases from 471 in 1996 to 686 in 2002.

[7] The annual average exit rate among public-owned enterprises, excluding privatized firms, is about 3% as compared to 16% exit rate among privately-owned firms.

The data contain all relevant information for productivity and survival analysis. Firm level prices reported by firms are used to construct firm specific price indices. Output and input values are deflated by the firm level price indices so that unobserved variation in mark-up pricing does not undermine productivity measurements. A new series on capital stock has been generated using the perpetual inventory method. Table 1 provides summary statistics[8] for the variables of interest both at the industry and sectoral levels while Table 2 gives the average characteristics of surviving and exiting firms. Time trends of variables are summarized in Appendix Table 2.

The rate of entry(exit) is defined as the ratio of entrants(exiters) to the total number of firms in given year in an industry[9]. About 16% of privately-owned firms on average exit the manufacturing sector every year while another 20% of firms join the sector[10]. Industries with rapid exit rates are also the ones with high entry rates. The metal and light machineries industry, for instance, exhibits the highest firm exit rate at 24% followed by the wood and furniture industry at 19%.

Table 2 shows that exiting firms are less than half the size of surviving firms on average. Across industries, the average size of private-owned firms in Ethiopian manufacturing has been increasing modestly during the study period (Appendix Table 2) although it should be noted that for the manufacturing sector as a whole, the average firm size has been decreasing due to downsizing among large public enterprises. Figure 1 plots the survivor functions for small (with less than 30 employees), medium (30 to

[8] Although some of the variables appear in logarithms in the regression, the summary statistics are not in logs to facilitate a straightforward description of the manufacturing sector.
[9] However, because of the cut-off point in the census, it is difficult to isolate firms that recently crossed the 10-person employment threshold from new establishments joining an industry for the first time. Neither do the data distinguish firms that have closed down from those that have slipped below the cut-off point or those that switched to another industry within manufacturing or to other sectors outside of manufacturing. There is a tendency therefore for firm turnover to be overstated.
[10] World Bank (2005) documents comparable rates of turnover for other developing countries.

100 employees) and large (more than 100 employees) firms. The upper, middle and lower lines correspond to the survivor functions for large, medium and small firms, respectively, showing the positive association between size and survival. For large firms, the slop of the survivor function is essentially flat at any point in time while it declines with firm age particularly for small firms. This indicates that the risk of exit is conditional on duration for small and medium size firms as compared to large firms.

There is wide variation in capital intensity across industries with the wood and furniture being the least capital intensive and the chemical and leather industries being the most capital intensive. The capital intensity of private sector manufacturing has more than doubled over the 1996 to 2002 period. According to Table 2, exiting private firms are on average less capital intensive (about 60%) than survivors. Similarly, while the average wage in the private sector is below the industry average (which also includes state-owned firms) surviving private firms are much closer to the industry average than exiting firms. Both capital and skill intensity therefore seems to be positively associated with better chances of survival. Table 2 also shows that total factor productivity is slightly above the industry average for surviving firms while for exiting ones it is below the industry average.

Table 1 also provides some information on the structure of ownership. About 18% of the private establishments in this sample belong to multi-establishment firms while the rest are single-units. Table 2 shows that the fraction of multi-establishment firms among surviving firms is more than twice that of exiting firms. The unconditional rate of exit among single-unit firms is 18% which is three times the exit rate among multiunit firms. Looking along gender lines, women proprietors have either full or majority ownership in about a quarter of private establishments. Women are also playing a growing role in

Ethiopian manufacturing with the fraction of female-owned establishments rising from 22% in 1996 to about 30% in 2002. While 28% of surviving firms are female-owned, this share goes down to 22% among exiting firms suggesting that female-ownership is associated with better chances of survival. Confirming the same point, the exit rates among female- and male-owned establishments are 13% and 17%, respectively. Only 5% of private establishments have a non-zero FDI and there has been no significant increase during the study period. According to Table 2, about 5% of surviving firms have FDI as compared to 2% among exiting firms. The exit rate for firms with no FDI is 14% which is higher than 6% for firms with some FDI. This preliminary analysis suggests that female-ownership and being part of a multiunit or multinational firm tend to reduce the risk of exit.

About 66% of all private sector manufacturing establishments are located in and around the capital city Addis Ababa. In some industries such as leather, printing and chemical, the city hosts more than 80% of the establishments. This dominance of the capital is however declining gradually as other major cities become important industrial centres. Location also seems to matter for survival. Looking at exiting firms as a group, about 60% of them were from the capital while 67% of the survivors operate in the capital. The average rates of exit for firms located in the capital city is 14.5% which compares favourably with the 18% exit rate for other locations.

All industries have experienced output growth with across sector expansion of about 10% per annum. Fast growing industries include the chemical, metal and leather industries at 18%, 15% and 13%, respectively. The degree of exposure to import competition varies across industries with some industries such as the chemical, light machineries and wood industries apparently bearing the brunt of it. Nonetheless, it is interesting to see that these are the same industries that exhibited rapid output growth during the study period. The Herfindahl concentration index shows across sector average of 0.12. According to this index the food and textile industries are at the bottom of the rank with very little concentration and hence more competition while the non-metal industry is at the other extreme.

5. Results of Discrete Time Hazard Models

Table 3 reports hazard ratios based on two variants of the discrete-time proportion hazard model. Column 2 shows the coefficients from a simple model that includes only firm level characteristics while column 3 reports the results from an extend model that includes industry characteristics.

The first and perhaps familiar observation is that the risk of exit decreases with firm size. Small firms therefore exit the market more frequently than large ones. The relationship between size and survival appears to be non-linear as indicated by the coefficient of the quadratic term which is greater than one. Most importantly, the results indicate that productivity increases the survival probabilities of firms. It reveals the existence of an underlying selection process that weeds away less productive producers from the manufacturing sector. The size and productivity effects on firm survival in Ethiopia manufacturing are thus consistent theories of market selection and with the findings of Frazer (2005) and Soderbom et al. (2006) for other African countries.

The hazard ratio corresponding to log duration is less than one and statistically significant indicating that the hazard rate exhibits negative duration dependence. This implies that recent entrants are more likely to exit but the hazard declines over time for survivors. Since the model controls for firms size and productivity, the negative duration dependence points to other survival skills that take time to build, such as networking and the capability to diversify by introducing new and better products.

The choice of factor proportions does not appear to influence the survival of manufacturing firms in this sample. The coefficient of capital intensity is very close to one and statistically insignificant implying that both capital and labour intensive firms face comparable risks of exit. However, firms with wage rates above the industry average have better chances of survival. This suggests that skill differences are more pertinent than capital intensity for firm survival. Caution is need in this interpretation since skill upgrading, say through training of workers, involves sunk costs, and hence only surviving firms would engage in skill upgrading.

As said, nearly a quarter of private establishments in Ethiopian manufacturing belong to multi-establishment firms and contribute significantly to value added and employment. The hazard ratio corresponding to the dummy variable indicating affiliation to a multiunit firm reveals that the risk of exit declines to one-half of the hazard facing single-unit firms. Similar results were reported for UK manufacturing firms in Disney et al. (2003). As firms grow through branching out, it seems that the survival skills are passed on to the new establishments. The cost of learning for such firms is therefore expected to be much lower than that of single-unit entrants. It could also mean that establishments under a multiunit firm can ride over negative business shocks by sharing financial resources among themselves which is not possible for standalones. In both instances expansion through branching out seems to be a response to uncertain business environment. This observation is consistent with research findings on investment behaviour of African manufacturing firms. Studies show that more than 50% of African firms have zero investment at any point in time and the rate of investment (the ration of investment to capital stock) is very low despite exceptionally high profit rates (Bigsten et al., 1999). Investment also tend to be bulky and intermittent, a pattern consistent with uncertain investment climates (Bigsten et al., 2005; Shiferaw, 2006). The key point is that entrepreneurs are responding to uncertainty by opening new businesses rather than plough back their profits to enlarge an existing establishment and this paper shows that such a strategy indeed reduces the risk of exit. See also Fafchamps (1997, 2004) for similar remarks. These developments however compromise scale economies, investment and innovation, features that are strongly associated with large firm size and very crucial for success in manufacturing. The second aspect of ownership, foreign presence, has the expected sign in the sense that it tends to reduce the hazard of exit but the coefficient is insignificant.

It is interesting to discover that female-owned firms in Ethiopian manufacturing are more likely to survive as compared to male-owned firms. The coefficient of the gender dummy suggests that the risk of exit among female-owned firms is about three quarters of that of male-owned firms. This differs markedly from McPherson (1995) where in two out of four countries that he studied (Swaziland and Botswana) there had been no gender differences in the probability of exit while for the other two countries (Malawi and Zimbabwe) women proprietors were at a disadvantage. The fact that women account for less than a third of privately-owned manufacturing establishments most of which are in the small and medium size categories suggests that women still face higher, albeit gradually declining, entry barriers as compared to male entrepreneurs. Similarly, while the average size of male-owned enterprises grew by about 10% per annum, the corresponding rate for female-owned firms was about 5.5%. The literature on female entrepreneurs points that these are often related to lack of education, experience and poor access to financial resources. However, the results in Table 3 suggest that once they enter the market they have higher chances staving off firm closure. The census does not have data on entrepreneur characteristics which would have clarified whether such positive outcomes are due to better managerial skills and access to resources. The latter is very unlikely to be the case given for instance the prevailing gender disparity in literacy and school enrolment rates in Ethiopia[11]. However, well documented factors such as gender based discrimination in the labour market could play a role by undermining the attractiveness of wage employment for women as an alternative to running a small firm or to self-employment for that matter(Loscocco et al., 1991; Hisrich and Brush, 1984) . Women would therefore be extra cautious in making business decisions, a view supported by micro-finance and cash transfer programs that prefer to target women[12].

Column 3 of Table 3 expands the model by including industry specific covariates. In addition to the potentially time-varying industry level covariates, this version of the hazard model includes industry dummies (coefficients not reported here) to control for industry fixed effects. A likelihood ratio test rejects the exclusion of the industry dummies. While the performance of the model has improved due to the inclusion of industry effects, the size and significance of the coefficients of firm specific covariates in column 3 are very similar to those in column 2. If any thing, the expanded model magnifies the degree of negative duration dependence and the benefits of affiliation with a multi-establishment firm. The discussion in the next two paragraphs will therefore focus only on the coefficients of industry characteristics.

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[11] Female and male adult literacy rates are 32.4 % and 48.1%, respectively while combined enrollment rates are 27% and 41%, respectively (UNDP, 2003).

[12] The coefficient of the gender dummy may also suffer from a selection bias if unobserved entry barriers to the manufacturing sector are higher than in other sectors such as services. In that case, the gender effect is likely to be exaggerated since only women with superior entrepreneurial skills would be able to break into the manufacturing sector.

One would normally expect exit rates to rise during a recession. In that sense it is intriguing to find that in the Ethiopian context higher output growth at the industry level is associated with higher risks of exit at the micro-level. It suggests markets are strongly competitive and less efficient establishments do not survive longer even during periods of industry expansion. Data show that the variance of entry rate across industries is greater than its variance across time for individual industries. The coefficient of entry rate is less than one and highly significant indicating that industries with low entry barriers tend to have low exit rates as well. If entrants really challenge incumbents for market share, one would expect higher entry rates to increase the exit hazard, not to reduce it. Nonetheless, even for developed countries, Geroski (1995) observed that entrants do not pose a significant threat to incumbents and concluded that entry is generally a poor substitute for active competition among incumbents in a given market. Industry dynamics in Ethiopia is very similar to this observation and it has largely to do with the small size of entrants.

The coefficient of the Herfindahl index measuring the degree of domestic competition is not statistically significant although it has the expected sign, i.e. more concentration (i.e. less competition) tends to reduce the risk of exit. However, the hazard ratio corresponding to import penetration is greater than one and statistically significant suggesting that exit probabilities are higher for firms belonging to industries with high import competition. Shiferaw (2007) also shows, for the same sample of firms, that the tolerance of inefficient firms declines with the degree of exposure to international competition.

Exit barriers proxied by the scope of the second hand market do not seem to vary with the probability of exit. The model also fails to detect any association between the location decision and the likelihood of exit.

6. Sensitivity Analysis

It is reasonable to expect that the hazard models discussed so far may suffer from incomplete specification. For linear models, unobserved heterogeneity leads to biased estimates if the omitted variables are correlated with explanatory variables. For duration models however unobservables undermine the identification of hazard parameters as well as duration dependence even when they are not correlated with covariates. For instance, negative duration dependence could be observed in a given sample if firms with high unobserved probabilities of exit leave the market first, leaving behind a group of firms that are very likely to stay longer (Cameron and Trivedi, 2005). Such duration dependence resulting from unobserved heterogeneity is difficult to distinguish for true negative duration dependence whereby the risk of exit declines over time for all firms. A careful analysis of hazard rates should therefore take into account the effect of unobservables.

Several approaches have been proposed to incorporate unobserved heterogeneity in duration models since the early work by Elbers and Ridder (1982). The standard practice is to assume that unobservables are multiplicative and independently distributed with well know functional forms such as the Gamma or log-normal distributions. However, Heckman and Singer (1984) demonstrate, both in theory and empirically, that structural parameters of duration models are very sensitive to the choice of a functional form for unobservables. Instead of an ad hoc choice of distribution functions, they proposed a consistent non-parametric maximum likelihood estimator in a general class of proportional hazard models with censored durations and time varying covariates (ibid). In this section therefore the Heckman-Singer procedure will be followed to re-estimate the discrete-time proportional hazard model with unobserved heterogeneity.

Table 4 column 3 reports the coefficients based on a discrete mixing distribution in accordance with the Heckman-Singer proposition. Column 2 reproduces the estimates from Table 3 for ease of comparison. Aside few exceptions, the qualitative patterns of exit documented previously are still recognizable in the revised results in column 3. The differences are restricted to the quadratic term of (log) firm size and skill intensity both of which turned out to be statistically insignificant once we take into account unobserved heterogeneity. Other than that the revised estimates reveal similar behaviour in the sense that the risk of exit declines with firm size and productivity while the hazard rate continues to show negative duration dependence. The coefficient of the gender dummy is significant at 5% suggesting that the reduction in firm exit rate associated with female ownership is not driven by unobserved heterogeneity. The revised estimates also confirm that single unit establishments are more likely to exit as compared to those that belong to a multi-establishment firm.

Similar conclusions can be drawn about industry specific effects. Industry growth and entry rate remain to be significant at the same level of significance and comparable hazard ratios as in Table 3 while second-hand market and location are still statistically insignificant. Import competition once again tends to raise the risk of exit but the coefficient is significant just below the conventional rates. A clear difference from column 2 is the coefficient of the Herfindahl index which is now significant at 10% suggesting that concentration reduces the risk of exit.

7. Conclusions

The paper takes in to account firm and industry level characteristics to understand the probability of firm survival in Ethiopian manufacturing. While the manufacturing sector is still at an incipient stage of development, the manner in which firms are selected into the sector is very similar to what is observed in mature market economies. Large firms are more likely to survive than small firms as has been the case in developed and few other African countries. The fact that surviving firms face hazard rates that decline over time reveals that firms learn survival skills by staying in the market. Improving firm level productivity significantly reduces the risk of exit confirming that there is an underlying process of market selection that eliminates inefficient producers. The paper shows that the weeding of inefficient firms is not attenuated even during periods of industry expansion.

It has been observed that belonging to a multi-establishment firm significantly prolongs survival time of individual establishments. This suggests that business skills are passed on from to new establishments in the group cutting significantly the cost of learning. It could also reflect the possibility for such establishments to overcome unfavourable business shocks by transferring financial resources among themselves. While risk sharing among establishments in a multiunit firm may improve their chances of survival, it does not necessarily imply better performance at the industry/sector level. Capital adjustment patterns in African manufacturing firms reveal an investment behaviour that is consistent with uncertainty and irreversibility. If uncertainty induces entrepreneurs to prefer opening another small business instead of ploughing back their profits to enlarge a single establishment there would be very slow transition of firms from small to medium and large size categories. The sector at large would thus fail to benefit from scale economies and innovation. Historically, the latter two factors have played a centre role for industrial success in developed and newly industrializing countries. Given such indications on the role of uncertainty on firm behaviour, further research is needed to identify the major sources of uncertainty and how to tackle them. At least in the Ethiopian case the growing tension in the political process and lack of cooperation/thrust between the private and public sector are obvious suspects since the macroeconomic indicators have by and large been stable during the study period.

As said, the growth in private sector participation in Ethiopian manufacturing has been accompanied by rising female ownership and the hazard estimates show that women are better able to stave off firm closure as compared to their male counterparts. While further analysis is needed to understand the personal characteristics of women entrepreneurs, the gender disparities in literacy and enrolment rates in the country do not seem to suggest that the observed positive performance is due to superior skills and experiences of women entrepreneurs in Ethiopia. The fact that female-owned firms are smaller than male-owned firms point to the difficulties facing female entrepreneurs. This makes their achievement in terms of firm survival even remarkable and business support services that target women entrepreneurs may have better chances of furthering this success story which at the moment seems to derive from extra caution in their business decisions.

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Table 1: Summary Statistics (Average Values at Industry and Sectoral Levels)

	Food & Beverage	Textile & Garments	Leather & Footwear	Wood & Furniture	Printing & Paper	Chemical & Plastics	Non-Metal	Metal & Machinery	All Industries
Exit Rate	0.17	0.14	0.17	0.19	0.06	0.08	0.15	0.24	0.16
Average Firm Size	45.5	117.5	62.7	30.5	30.8	52.2	23.1	27.3	44.3
Productivity	0.98	0.93	1.45	1.04	1.13	0.98	0.97	1.135493	1.04
Capital Intensity ('000 Birr per worker)	48.8	36.97	79.49	15.63	32.63	79.92	24.69	48.47	43.33
Relative Wage	0.77	0.90	0.87	0.93	0.92	0.89	0.71	0.86	0.85
Female-Owned	0.29	0.24	0.34	0.13	0.41	0.36	0.27	0.22	0.27
Multi-Establishment	0.19	0.35	0.23	0.16	0.18	0.15	0.07	0.18	0.18
FDI	0.02	0.12	0.06	0.03	0.04	0.05	0.03	0.11	0.05
Industry Growth Rate	0.077	0.045	0.13	0.057	0.11	0.18	0.083	0.15	0.096
Import Penetration Rate	0.23	0.55	0.41	0.59	0.54	0.72	0.32	0.72	0.46
Concentration Index	0.06	0.05	0.09	0.08	0.17	0.11	0.33	0.24	0.12
Entry Rate	0.23	0.11	0.14	0.26	0.15	0.14	0.16	0.28	0.20
Second Hand Market	0.10	0.03	0.23	0.00	0.00	0.16	0.03	0.50	0.12
Capital City	0.62	0.77	0.88	0.47	0.82	0.90	0.43	0.75	0.66

Source: Author's computation based on CAS's manufacturing census.

Table 2: Average Characteristics of Surviving and Exiting Private Firms

	Survivors	Exiting Firms
Firm Size	48.57	21.57
Productivity	1.06	0.89
Capital Intensity (‘000 Birr)	46.7	27.4
Firm Age	12.17	8.98
Relative Wage	0.89	0.63
Female-Owned	0.28	0.22
Multi-Establishment	0.20	0.07
FDI	0.05	0.02
Located in Addis Ababa	0.67	0.61

Source: Author’s Computation Based on CSA’s Manufacturing Census.
A test for equality of means shows that the differences are statistically significant at 1% for all variables.

Table 3: Results of Discrete Time Proportional Hazard Model (Hazard Ratios)

1	2	3
Ln(Labour)	0.1611*** (-3.24)	0.1456*** (-3.33)
$(Ln(Labour))^2$	1.1911** (2.25)	1.2110** (2.42)
Ln(Duration)	0.5978*** (-3.69)	0.2704*** (-6.14)
Ln(Productivity)	0.9006 ** (-1.97)	0.8862** (-2.20)
Ln(Capital Intensity)	0.9778 (-0.74)	0.9872 (-0.42)
Ln(Relative Wage)	0.8139** (-2.56)	0.8281** (-2.15)
Female Owned	0.7440* (-1.97)	0.7475* (-1.88)
Multi-Establishment	0.5201*** (-3.16)	0.4645*** (-3.59)
FDI	0.5458 (-1.33)	0.5367 (-1.36)
Industry Growth Rate		1.0117*** (4.26)
Import Penetration Rate		1.0213** (2.01)
Herfindahl Concentration Index		0.0613 (-1.35)
Entry Rate		0.9062*** (-7.47)
Second Hand Market		0.5929 (-1.47)
Capital City		1.2002 (1.27)
Observations (firm-years)	2209	2185
Log-Likelihood	-762.26	-697.92

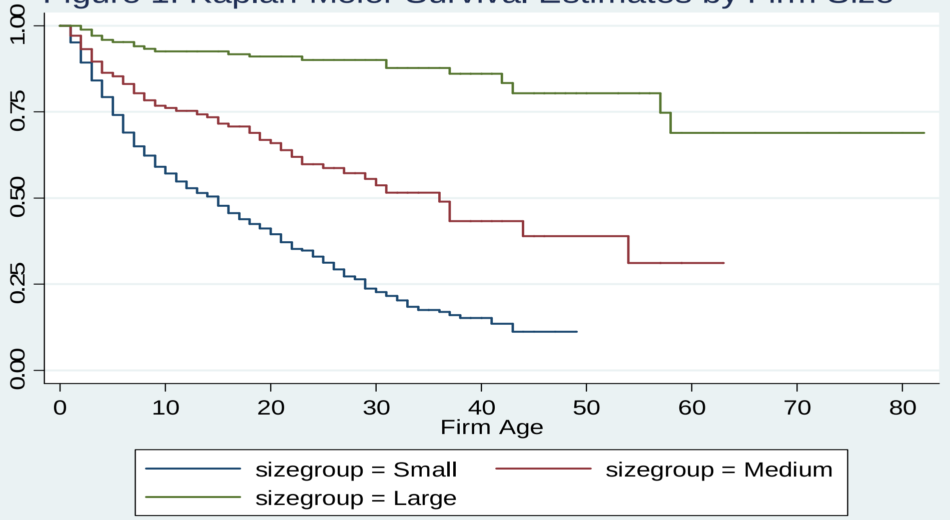
Note: *, **, *** represent statistical significance at 10%, 5%, and 1%. Figure in parenthesis are z-statistics from the underlying regression.

Table 4: Hazard Ratios with Unobserved Heterogeneity

1	2	3
Ln(Labour)	0.1456*** (-3.33)	0.1658** (-2.26)
$(Ln(Labour))^2$	1.2110** (2.42)	1.1751 (1.50)
Ln(Duration)	0.2704*** (-6.14)	0.4113*** (-3.20)
Ln(Productivity)	0.8862** (-2.20)	0.8126*** (-2.60)
Ln(Capital Intensity)	0.9872 (-0.42)	0.9408 (-1.17)
Ln(Relative Wage)	0.8281** (-2.15)	0.8432 (-1.41)
Female Owned	0.7475* (-1.88)	0.6608** (-2.05)
Multi-Establishment	0.4645*** (-3.59)	0.3818*** (-3.66)
FDI	0.5367 (-1.36)	0.6571 (-0.78)
Industry Growth Rate	1.0117*** (4.26)	1.0152*** (4.42)
Import Penetration Rate	1.0213** (2.01)	1.0218 (1.57)
Herfindahl Concentration Index	0.0613 (-1.35)	0.0177* (-1.76)
Entry Rate	0.9062*** (-7.47)	0.9033*** (-7.17)
Second Hand Market	0.5929 (-1.47)	0.5418 (-1.27)
Capital City	1.2002 (1.27)	1.0303 (0.12)
Observations (firm-years)	2185	2185
Log-Likelihood	-697.92	-688.48

Authors computation based on Ethiopian manufacturing census.
*, **, *** represent statistical significance at 10%, 5%, and 1%. Figure in parenthesis are z-statistics from the underlying regression.

Figure 1: Kaplan-Meier Survival Estimates by Firm Size



Appendix Table 1: GMM Estimates of Value Added Production Functions

Industry	Lag Value Added	Labour	Capital	Constant	Sample Size	Hansen test (p-value)
Food & Beverage	0.2924 (0.2048)	0.5980 (0.2471)	0.2643 (0.1427)	3.6836 (1.4749)	850	0.353
Textile & Garments	0.1637 (0.1459)	0.9049 (0.32060	-0.0726 (0.2060)	8.3720 (3.2248)	295	0.254
Leather & Footwear	-0.2107 (0.1905)	1.6401 (0.5121)	0.3252 (0.1823)	5.4584 (2.5870)	198	0.448
Wood & Furniture	-0.2130 (0.2094)	1.6341 (0.2835)	0.0909 (0.1202)	8.3966 (1.9155)	555	0.715
Printing & Paper	0.0889 (0.2152)	1.0364 (0.3147)	0.0477 (0.0705)	7.7119 (2.0049)	257	0.254
Chemical & Plastics	0.4829 (0.2343)	0.0542 (0.3084)	0.4627 (0.2468)	0.4906 (3.1665)	311	0.378
Non-metal	0.2065 (0.1127)	1.0668 (0.2719)	0.0215 (0.0901)	6.0826 (1.3569)	320	0.306
Metal & machinery	0.2928 (0.1434)	0.8201 (0.3015)	0.3554 (0.1885)	1.7816 (1.7936)	282	0.419

Note: Figures in parenthesis are standard errors. The Hansen test is a chi-square test for overidentification and it shows that the instrument sets are not correlated with the equation errors.

Appendix Table 2: Descriptive Statistics with Time Trends (Averages over the entire manufacturing sector)

	1996	1997	1998	1999	2000	2001	2002	Average
Exit Rate	0.18	0.21	0.16	0.24	0.16	0.19	na	0.16
Firm Size	42.17	41.20	41.74	43.83	45.63	49.22	45.44	44.33
Relative Efficiency	Na	1.08	1.09	1.03	1.06	0.98	1.05	1.04
Capital intensity	28.55	30.77	36.18	44.67	45.50	52.79	57.96	43.34
Relative Wage	0.82	0.84	0.83	0.84	0.87	0.85	0.86	0.85
Female Owned	0.22	0.24	0.24	0.26	0.26	0.35	0.29	0.27
Multi-Establishment	0.16	0.16	0.19	0.18	0.20	0.20	0.18	0.18
FDI	0.05	0.04	0.03	0.05	0.04	0.06	0.06	0.05
Industry Growth	14.13	13.97	3.03	12.65	9.04	16.65	0.18	9.60
Import Penetration	45.90	36.56	37.84	39.15	39.17	44.35	42.95	46.49
Concentration	0.15	0.14	0.14	0.11	0.13	0.11	0.10	0.12
Entry Rate	.	27.17	22.68	15.26	20.85	12.86	25.04	20.65
Second Hand	0.07	0.07	0.09	0.09	0.10	0.11	0.09	0.09
Capital City	0.72	0.68	0.68	0.65	0.66	0.64	0.63	0.66

Source: Author's computation based on CSA's manufacturing census.

Na: not available. In the case of exit it is due to truncation while for productivity it is because of the lag structure in the production function.