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Industrial Development through Takeovers and Exits: the Case of the Cut Flower Exporters in Ethiopia

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Yukichi Mano and Aya Suzuki

Abstract

The exit and takeover of firms influence the structure and economic efficiency of an industry. The existing literature suggests that firms gradually learn about their own productivity. Some stagnate and ultimately exit if they encounter unfavorable prospects; others survive and grow. This selection process implies that the probability of firm exit initially *increases* with firm age as learning progresses before it eventually falls as learning is completed. We use a firm-level panel of Ethiopia's cut flower industry to confirm this theoretical implication. The empirical results also suggest that takeover improves productivity and profitability of average firms endowed with a favorable business environment.

1. Introduction

Industries evolve in size, accompanied by changing market structure through the exit and takeover of existing firms, as much as their growth and contraction, and the entry of new firms. Many theoretical studies deal with the evolutionary process of an industry (Gort and Klepper, 1982; Utterback and Suarez, 1993).[1] In particular, Jovanovic (1982) proposed that industry evolution is a selection process, in which firms gradually learn about their own productivity; some stagnate and ultimately exit if they encounter unfavorable prospects and others survive and grow (see also Hopenhayn, 1992; Ericson and Pakes, 1995; Pakes and Ericson, 1998).

Both firm exit and ownership change associated with replacement of management team and changes in business strategies can improve the economic efficiency of an industry. Efficient firms survive and inefficient firms either exit from the industry or are taken over. The threat of takeover also encourages managers to maximize profits (Manne, 1965; Meade, 1968; Jensen, 1988; Harris *et al*., 2005; Jovanovic and Rousseau, 2008). Precisely speaking, theoretical studies predict that the probability of firm exit initially increases with firm age, before it eventually falls, because it takes time for firms to sufficiently learn of their own business prospects and decide to exit.

[1] See also Jovanovic and McDonald (1994), Klepper (1996, 2002), and Klepper and Simons (2005).

But existing empirical studies on industry evolution virtually neglect this initial tendency and mainly report that long-surviving firms are more efficient and less likely to exit (Dunne *et al*., 1989; Tveteras and Eide, 2000; Salvanes and Tveteras, 2004). This is at least partly because all the evidence comes from mature industries in the U.S. and Europe (Klepper and Graddy, 1990; Agarwal and Gort, 1996; Plehn-Dujowich, 2009), where the market selection of firms has long been in action. The early stage of industrial development is beyond the focus of those studies.

Understanding how the early stage of industry evolution improves economic efficiency of an industry is important in formulating industry and development policies for developing economies (Sonobe and Otsuka, 2006, 2011). To learn the process of firm exit and takeover and their effect on economic efficiency of an industry at the early stage of development, we analyze our primary panel of producers in the cut flower industry in Ethiopia and examine its ongoing process of firm selection and ownership change.[2] Though the first farm was established in 1996, the number of farms did not exceed 10 until year 2003. From the mid-2000s, Ethiopia's cut flower industry has grown remarkably, with its total value of export increasing from a negligible amount in 2005 to 131 million USD in 2009. It is 8% of the total value of export from Ethiopia

2 See Mano *et al*. (2011) for the early development of the employment process in the cut flower industry in Ethiopia. Furthermore, Mano and Suzuki (2013) measured the effect of technological externalities on the farm's productivity and profitability.

(Table 1). In fact, Ethiopia has become the second largest cut flower exporter in Africa, following Kenya. We have detailed primary information on all the 68 farms operating in 2007. By 2009, seven farms were taken over by new investors and eight other farms left the industry. Our empirical analysis reveals that relatively old and less profitable farms tend to exit from the industry. Furthermore, relatively old farms located in a favorable production environment tend to be taken over, and business performance improves thereafter.

The current paper documents the ongoing improvement in economic efficiency through exit and takeover of firms at the early stage of industrial development in a non-manufacturing sector in a developing economy. Methodologically, to properly address the censoring problem in the analysis of exit and takeover process, we used the competing risk model (CRM) by taking exit and takeover as risks competing with each other.[3] We confirmed the robustness of our results by estimating standard single-risk duration models. Furthermore, we also analyzed the effect of takeover on the productivity and profitability of farms by using a differences-in-difference (DID) matching method to take account of a selection process associated with takeover. The positively estimated takeover effect suggests that new investors improve business

[3] The CRM is best designed to account for the censored nature of data with multiple distinct risks (Fine and Gray, 1999).

performance by replacing the management team and introducing superior business strategies.

The rest of this paper is organized as follows. Section 2 provides the conceptual framework and proposes our main hypotheses, while we document the cut flower industry in Ethiopia in Section 3. Section 4 describes our dataset and analyzes the descriptive statistics. Our estimation strategy is presented in Section 5. The estimation results are examined in Section 6, and Section 7 concludes this paper.

2. Conceptual framework

The conceptual framework of this study is based on Jovanovic’s (1982) theory of industry dynamics. The theory assumes that firms gradually learn from operation experience their initially unknown production efficiency and predicts that firms eventually leave the industry when sufficiently accumulated information indicate that their productivity is not adequate for the business. We additionally incorporate takeover into this framework and derive testable implications.

2.1. Selection and industry dynamics

Jovanovic (1982) considered profit-maximizing firms in a competitive industry. Importantly, the firm owners do not initially know the true productivity of their firms, but they infer their efficiency from the realized costs associated with their output. However, since production costs can also be affected by other factors not directly observable to firm owners, the realized costs serve as noisy signals of true productivity at most. Still, if the firm has low productivity, it is likely that the evidence is adverse, and noises in signals only lengthen the learning process. Starting with the same prior belief about their productivity, the owners keep updating their beliefs as new evidence comes in. In the event that accumulated evidence suggests that its productivity is not adequate for the business, firms tend to contract and eventually decide to exit from the industry. By contrast, if prospects are favorable, firms may survive and grow.

This consideration implies that large firms have already discovered that they are relatively productive, whereas small firms are likely to be still in the middle of learning. Some small firms survive and grow while others contract and exit. As a result, small firms are less likely to survive than large firms and have more variable growth rates. This implication is consistent with previous empirical findings from mature industries in developed economies.[4]

[4] Jovanovic argued that his model could explain Mansfield's (1962) findings that smaller firms have higher and more variable growth rates in the U.S. and Du Rietz's (1975) findings that smaller firms grow

In the emerging cut flower industry in Ethiopia, firm exit started to take place in 2005. In the current conceptual framework, most firms are still assessing their own productivity, and only relatively old firms have accumulated enough evidence to decide terminating the business. As a result, it is predicted that firm exit is positively associated with firm age in this young industry.

It is possible to draw a similar implication from the vintage capital theory (Solow, 1956). This theory predicts that firms equipped with relatively old vintages of capital are less likely to survive than firms with new and more efficient capital. The vintage capital theory is relevant especially when the technology is significantly improving and when the difference in capital age is substantial enough that the old capital is worn and torn (Salvanes and Tveteras, 2004). But, even the oldest farm in our sample entered the industry in 2000, and there was no significant technological improvement in the quality of capital. We thus expect that Jovanovic's learning model can better explain the mechanism of firm exit under our study than can the vintage capital model.

In the Jovanovic learning model, productivity is solely determined by the ability of firm owners. Because new owners have nothing to inherit from former owners, there is no incentive for takeover. We thus modify the model's settings so that we can

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faster and are less likely to survive in Sweden.

consider the takeover mechanism.

In the cut flower industry, local production conditions, including climate and availability of water, are complementary to farm owners' business ability and are important determinants of business performance (Mano *et al.*, 2011; Mano and Suzuki, 2013). Our interviews with farm managers revealed that the local water supply for irrigation is particularly indispensable to flower production, but that it is increasingly becoming scarce in several locations because of heightened competition with other users. The quality of the local production environment is not perfectly known or predictable in the beginning, but it is gradually revealed as firms continue operation. Firms operating in a favorable production environment will more likely grow large and attain optimal production size eventually. By contrast, firms constrained by unfavorable local production environments find it difficult to expand and attain optimal business size, especially when firm owners are capable of operating large and profitable businesses. Thus, the value of firms located in a favorable production environment is relatively high. Consequently, farms located under such an environment are more likely to receive takeover offers.

We summarize the above conceptual framework with a simple mathematical model. Consider a farm's per-period profit $\pi(a, e; \varepsilon) = \min\{a, e\} + \varepsilon - F$, where the period-specific shock ε is distributed with average 0 and a finite variance, the owner's business ability is denoted as $a \in [0, \bar{a}]$, the quality of local production environment $\mathrm{e} = \{e_L, e_H\}$ with $e_L \in (F, \bar{a})$ and $e_H \geq \bar{a}$, and the fixed cost F. The owner does not directly observe a, e or ε, but observes π. From the observed value of π, the values of a and e are imperfectly inferred. If the owner has $a < F$, this farm makes a loss on average and eventually leaves the market, and the value of e stays hidden. If the owner's ability satisfies $a > e_L$ and the environment quality $\mathrm{e} = e_H$, this farm earns on average $a - F$ and the values of both a and e become gradually revealed in public. In this case, investors with expected ability exceeding the current owner's a make takeover offers to this farm.

2.2. Hypotheses

We draw three empirical hypotheses from the conceptual framework. The abovementioned consideration suggests that the business ability and the quality of local production environment are gradually learned through operation. Firms continue operation until they accumulate enough evidence indicating that their productivity is not adequate for the business and decide to exit from the industry or they find that they are endowed with an attractive local production environment and decide to accept a takeover offer. In sum, older firms are less likely to stay in the industry than newly entering firms. We postulate the following hypothesis.

Hypothesis 1: The probabilities of exit and takeover of firms tend to increase with firm age.

Firms exit from the market when they learn that their productivity is inadequate for the business on the basis of evidence accumulated through continuous operation. Poor business performance in the past is likely to predict firm exit. This consideration is stated in the following hypothesis.

Hypothesis 2: The probability of exit of firms is negatively associated with their past business performance.

According to the conceptual framework, investors make takeover offers to firms located in favorable local production environment but operated by not particularly capable owners. Investors making takeover offers expect to better utilize the local production environment, and these takeover attempts tend to improve business performance (Lichtenberg and Siegel, 1987). Therefore, we postulate the following hypothesis.

Hypothesis 3: Incumbent firms under favorable production environment tend to be taken over. Furthermore, takeover tends to improve business performance of firms.

We test these three hypotheses on the cut flower industry in Ethiopia. The next section describes this industry in detail.

3. The cut flower industry in Ethiopia

Ethiopia is a country of agriculture, which accounts for about 80% of the population living in rural areas as subsistence farmers and more than 50% of its GDP (Embassy of Japan in Ethiopia, 2008), and the economy has so far depended on coffee as the primary export product (Table 1). Ethiopia is said to have an agroclimatic condition that is well-suited for flower cultivation, including wide underdeveloped highlands near the international airport, a climate of high daily temperature and cool nights, and sufficient sunlight and rainfall (Mano and Suzuki, 2013). In addition, Ethiopia has an abundant labor supply with a low wage rate.[5] Enjoying these advantages, domestic and foreign farms gradually started flower export to Europe, the U.S., and the Middle East, mainly through the world's largest auction market held in Holland and increasingly through direct sales (Hughes, 2000; Wijnands 2005).[6]

The export value of cut flowers has exponentially increased since the mid-2000s (Column 3 of Table 1). This rapid development in the sector may be partly due to government support starting in late 2002 (Embassy of Japan in Ethiopia, 2008; Getu, 2009), including exemptions of taxes for inputs, the revised investment law for foreign investors, leased land with basic utilities at low prices,[7] and special loans provided through the Development Bank of Ethiopia. Table 1 also presents the export value of cut flowers from Kenya, which is the largest cut flower exporter in Africa, and is indeed the fourth largest cut flower exporter in the world, after the Netherlands, Colombia, and Ecuador. Kenya’s export value increased from 91 million USD in 2000 to 421 million USD in 2009. The export value of Ethiopia’s cut flowers was initially negligible, but it has drastically increased since the mid-2000s, attaining 131 million USD in 2009.

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[5]The monthly wage of an average production worker in the cut flower industry was about USD 29 as of 2008 (Mano *et al*. 2011).

[6]There is virtually no domestic market for flowers in Ethiopia.

[7]While land sales are prohibited in Ethiopia, Pender and Fafchamps (2005) find that the land lease market operates relatively efficiently. The Ethiopian government leased land to the cut flower farms at around USD 4 per hectare per annum on average, and land near the international airport in the capital city of Addis Ababa at less than USD 20 per hectare per annum (Embassy of Japan in Ethiopia, 2008).

Its export value is now one-third of Kenya's, and Ethiopia has become the second largest cut flower exporter in Africa and the sixth largest in the world, following Belgium and the aforementioned four countries.

4. Data and descriptive analyses

Data

The primary data used in this paper come from two rounds of census surveys on the cut flower farms in Ethiopia. The first round of the survey was conducted from November 2007 to January 2008 by the Ethiopian Development Research Institute (EDRI), in collaboration with the National Graduate Institute for Policy Studies (GRIPS). The second round was conducted from November 2010 to February 2011 by the Foundation for Advanced Studies on International Development (FASID) with EDRI. Because there is virtually no domestic market for this industry, all the cut flower farms are necessarily registered enterprises to be eligible for exporting.

Descriptive analyses

To understand the evolution of the cut flower industry in Ethiopia, Figure 1 presents the changing number of new entrants, operating farms, exiting farms, and farms that were taken over. Although the number of operating farms used to be less than 10 farms until 2003, the number of new entrants surged in the mid-2000s. The incidence of exit and takeover of existing farms started taking place in 2005 and 2006 respectively, and is matched against the declining number of new entries toward the end of the 2000s. In consequence, the number of operating farms was gradually stabilized toward the end of the 2000s.

Recall that the export value of Ethiopia's cut flowers kept increasing at the annual growth rates of more than 20% toward the end of the 2000s (Table 1), when the number of operating farms began to stabilize (Figure 1). This phase of industrial development may be characterized by expansion of each farm. We examined whether such development was made possible at least partly by improved efficiency due to reallocation of resources brought about by the exit of less efficient firms and by productivity enhancement as a result of takeover (Hirschman, 1970; Lichtenberg and Siegel, 1987; Bertrand and Zitouna, 2008; Dimara *et al*., 2008; Plehn-Dujowich, 2009; Buddelmeyer *et al*., 2010).

To understand the mechanism of farm exit and takeover in detail, we analyzed a subsample of farms for which we have detailed information. Specifically, we examined the characteristics of the farms operating as of 2007, when we conducted the first round of our survey, by looking at the operation status of each farm as of 2009, when we obtained the latest data from the second round of our survey. This subsample of farms consisted of (1) 55 farms that continued operation under the same ownership between 2007 and 2009, (2) seven farms that were taken over between 2007 and 2009, and (3) nine farms that exited from the industry between 2007 and 2009. Column 1 of Table 2 shows that the average farm that continued operation under the same owner until 2009 was established in 2005, owned by a foreign investor, located 2 km above sea level and 1.6 hours away from the international airport, and was a little concerned with the local water supply for irrigation use.[8] Moreover, the average general manager was highly educated with 15.7 years of schooling, and 8.0 years of working experience in a related sector. The average farm employed 354 workers to earn a gross profit per worker of 5.8 thousand USD in 2007.[9]

According to Column 2 of Table 2, the farms that were taken over by 2009 tended to be more favorably endowed with the local water supply for irrigation use than the farms that were not taken over, and the unconditional mean difference was statistically significant at the 10% level. This result implies that farms blessed with abundant local

[8]"Scarcity of water supply" measures the degree of the general manager's concern about the sustainability of water supply in the production site: 1 = not at all, 2 = little, 3 = moderate, and 4 = very high concern.
[9]Gross profit is equal to sales revenue minus material cost and labor cost.

water supply tended to be taken over and this is consistent with the first half of our Hypothesis 3. Furthermore, the exiting farms were slightly older than the continuing farms, and this result is in line with our Hypothesis 1 (Column 3 of Table 2). In addition, the exiting farms had a smaller number of workers and significantly lower gross profit per worker than the continuing farms, which is consistent with Hypothesis 2. During the 2010 survey, we interviewed several former owners of the exiting farms, and they told us that their productivity and profitability turned out to be unexpectedly lower than what the feasibility studies had indicated before starting the business.

To see the effect of takeover on the business performance of the farms, we compared the seven farms taken over between 2007 and 2009 (Columns 1 and 3 in Table 3) with the 55 farms operated by the same owner during the same period (Columns 2 and 4 in Table 3). We began our analysis of the effect of takeover on the farm's business performance by using the differences-in-differences (DID) approach. For instance, the calculated DID of the number of workers was 609.0 (=[1108.0–385.1]–[468.4–354.5]), significantly greater than zero. This result suggests that takeover of farms is positively associated with expansion of business. This result is consistent with the second part of our Hypothesis 3. But the DIDs in all the other measures were not statistically significant.

These results were, however, obtained from unconditional statistical associations. More importantly, observations on farms operated by the same owners between 2007 and 2009 are right-censored in the sense that these farms might have exited or might have been taken over after we conducted the second survey. We thus used the hazard models to more carefully examine the empirical evidence with proper controls. Furthermore, to measure the effect of takeover on business performance, we used the matching methods to alleviate the bias associated with the systematic selection in the takeover process. The next section draws up our empirical strategy.

5. Empirical strategy

We attempted to identify the determinants of exit and takeover of farms by using hazard approaches to cope with the right-censoring problem inevitably caused by the timing of the survey. Specifically, we tested Hypotheses 1, 2, and the first half of Hypothesis 3 postulated above. Furthermore, we measured how much the takeover of a farm affects its business size, productivity, and profitability by using the DID matching methods to take account of systematic selection in the takeover process. We tested the second half of Hypothesis 3.

5.1. Determinants of exit and takeover

Let $T \geq 0$ denote the age at which a farm exits from the industry or is taken over by another investor. The cumulative distribution function of T conditional on the vector of observable farm characteristics x is defined as $F(t|\, x;\theta) = P(T \leq t|\, x)$, where $t \geq 0$ and θ is the parameter vector, with the corresponding conditional probability density function $f(t|\, x;\theta)$. The conditional hazard function for T is defined as $\lambda(t;x,\theta) = f(t|\, x;\theta)/\{1 - F(t|\, x;\theta)\}$, while, letting d be a censoring indicator (d = 1 if uncensored, and d = 0 if censored), the conditional likelihood can be written as $f(t|\, x;\theta)^d\,[1 - F(t|\, x;\theta)]^{1-d}$. For each t, $\lambda(t;x,\theta)$ is the instantaneous rate of exiting or being taken over per unit of time conditional on the vector of explanatory variables x. If $\partial\lambda(t;x,\theta)/\partial t > 0$ for all $t > 0$, then the process exhibits positive duration dependence, i.e., the probability of exit and takeover increases with operation years. We tested Hypothesis 1 by examining whether the sample process exhibits this positive duration dependence.

To determine the most suitable distribution for modeling the data at hand, we plotted non-parametric unconditional hazard estimates of farm exit, which is calculated as a weighted kernel-density estimate using the estimated hazard contributions (Figure

2). The plotted hazard estimates monotonically increased with the farm's years of operation, indicating positive duration dependence consistent with Hypothesis 1. We selected the Weibull and the Gompertz distributions, which are considered most suitable for modeling data with monotone hazard rates (Cameron and Trivedi, 2005, ch. 17). The Weibull hazard can be expressed as $\lambda_W(t;x,\theta_W) \equiv \exp(x\beta)pt^{p-1}$ where $\theta_W = (\beta, p)$, which is monotonically increasing with farm age *t* if $p > 1$. Analogously, the Gompertz distribution is similar to the Weibull distribution as it has the hazard $\lambda_G(t;x,\theta_G) \equiv \exp(x\beta)\exp(\gamma t)$ where $\theta_G = (\beta, \gamma)$, which is monotonically increasing with farm age *t* if and only if $\gamma > 0$. The Gompertz distribution is frequently used to analyze mortality data in biostatistics.

To test Hypothesis 2, more properly controlling for other relevant factors, the vector of explanatory variables *x*, evaluated in the base year 2007, contains not only (1) the profitability measured by the gross profit per worker (Deily, 1988; Baden-Fuller, 1989; Schary, 1991; Salvanes and Tveteras, 2004) but also (2) the firm size measured by the number of employees (Ghemawat and Nalebuff, 1985; Klepper and Simons, 2000; Agarwal and Audretsch, 2001; Klepper, 2002; Disney *et al.*, 2003); (3) the nationality of the owners measured by the dummy variable indicating whether the farm is domestically owned (Gorg and Strobl, 2002; Bertrand and Zitouna, 2008); (4)

geographic conditions, measured by the scarcity of local water supply for irrigation use, the altitude, and the driving hours to the international airport (Chen, 2002); and (5) human and managerial capital of the general manager (GM), measured by years of schooling and years of working experience in a related sector (Thompson, 2005; Mano *et al*., 2012).

We analogously analyzed the takeover process. To determine the most suitable distribution for modeling the data at hand, we again ploted non-parametric unconditional hazard estimates of takeover of farms (Figure 3). Since the plotted hazard estimates indicated positive duration dependence, which is consistent with Hypothesis 1, we selected the Weibull and Gompertz distributions.

In the analysis of farm exit, we treated farms taken over and farms operating as of 2009 as the right-censored observations. Similarly, we treated exit farms and farms operating as of 2009 as the right-censored observations in the analysis of takeover of farms. Strictly speaking, however, an event of takeover has a different implication from the standard right-censoring due to termination of follow-up. When subjects are lost to follow-up (i.e., right censoring), they are still considered at risk of exit, whereas takeover of a farm is a permanent condition to prevent exit of the original farm. With this implication in mind, we treated exit and takeover explicitly as competing risks to be estimated with the CRM (Fine and Gray, 1999). We supplemented the separate analyses on exit and takeover in the individual-risk framework.

5.2. Effect of takeover on business performance

We next measured the effects of takeover on the farm's business size, productivity, and profitability. Using the primary data collected in early 2008 and late 2010, we can compare business size, productivity, and profitability of the farms that experienced takeover between 2007 and 2009 with those of the farms that continued operation under the same ownership until 2009. As discussed throughout this paper, we have enough evidence to suspect that takeover does not randomly occur to a farm. Takeover is, rather, systematically associated with some characteristics of a farm, as is examined below. In consequence, the effect of takeover on the farm's business performance, which is estimated with a simple DID regression model, may well be biased.

To mitigate potential selection bias, we compared farms that were taken over with "similar" farms that were not, by using the DID bias-corrected matching (BCM) method (Abadie *et al*., 2004; Abadie and Imbens, 2006). We controlled for the starting year of the farm and the observable farm characteristics in the baseline year 2007, and we assumed that the selection on time-variant unobservable characteristics is negligible.

To improve the quality of matching further, the common support assumption was imposed, and observations off the common support were excluded from the analysis. The DID-BCM is particularly suitable for a small-sized sample because standard errors of its estimates can be analytically obtained (Imbens and Wooldridge, 2009; Abadie and Imbens, 2011).[10, 11]

6. Estimation results

Table 4 presents the estimation results from the hazard models.[12] As for the takeover process of the farms, the sign and the magnitude of the estimated coefficients were overall similar across the three different distributional models (Columns 1 to 3), and the Akaike information criteria (AIC) reported at the bottom of the table suggest that CRM is marginally superior to the other two models. The abundance in local water supply for irrigation use significantly explained the takeover of farms. This result supports the first half of Hypothesis 3. The ancillary parameter p of the Weibull

[10]Matching methods have been widely applied to non-experimental data from developing economies (Iddrisu, Mano, and Sonobe, 2012; Diaz and Handa, 2006; Park and Wang, 2010). For example, Behrman *et al*. (2009) use DID-BCM to evaluate schooling impacts of conditional cash transfers on young children in Mexico.

[11]We used STATA command *nnmatch* developed by Abadie *et al*. (2004) to implement the DID-BCM.

[12]We initially estimated the Weibull and the Gompertz models, including unobservable heterogeneity to avoid underestimation of positive duration dependence for both the takeover and the exit models (Heckman and Singer, 1985; Keifer, 1988). But the estimation results did not reject the absence of unobservable heterogeneity, suggesting that we estimate the models without unobservable heterogeneity.

model (Column 1) was estimated to be significantly greater than unity, indicating that older farms are more likely to be taken over. This result supports Hypothesis 1. For instance, after 2 years of operation, the farms were 3.6 times (or $(2/1)^{2.887-1}$ times) more likely to be taken over than after 1 year of operation.

In the exit process of the farms (Columns 4 to 6), the coefficients of gross profit per worker were highly negatively significant. The associated hazard ratio, ranging from $\exp(-0.139)=0.870$ to $\exp(-0.129)=0.879$, suggests that farms with smaller gross profit per worker by 1 thousand USD per person are more likely to exit by about 13%. This result supports our Hypothesis 2 and is also consistent with Salvanes and Tveteras' (2004) finding in the analysis of the Norwegian manufacturing sector. The exit of less profitable farms and the survival of more profitable farms suggest improved economic efficiency at the industry level. Furthermore, Table 4 reports that the ancillary parameter *p* in the Weibull model was significantly greater than unity (Column 4) and that the parameter γ in the Gompertz model significantly exceeded zero. For instance, after 2 years of operation, the farms were 2.6 times, according to the Weibull model, and 1.8 times, according to the Gompertz model, more likely to exit the industry than after 1 year (or $(2/1)^{2.381-1}$ times and $\exp[0.620\times(2-1)]$ times, respectively). These results suggest that relatively older farms are more likely to exit than younger farms, providing supporting evidence for our Hypothesis 1. Furthermore, the takeover process was more highly time-dependent than the exit process, which suggests that the local production environment is relatively easier to learn than the farm's own business ability. We also found that the hazard of farm exit increases by more than 10% with every additional year of the general manager's related experience. This result might suggest that related experience helps to evaluate the prospects of a business project and to make an exit decision relatively quickly.

Table 5 presents the effect of takeover on business size, productivity, and profitability of farms estimated with the DID-BCM. The takeover was significantly and positively associated with the number of workers, sales revenue, gross profit, and sales revenue per worker. These results provide evidence supporting the second half of Hypothesis 3 on the positive impact of takeover on the industry's efficiency.[13] The estimated effect on gross profit per worker was also positive but not statistically significant. Combined with the above findings on the takeover process, this positive takeover effect on business performance suggests that original owners of farms endowed with abundant water do not necessarily take full advantage of the favorable production environment. New investors take over those relatively inefficient farms

[13]This result is consistent with the results of Lichtenberg and Siegel (1987) and Bertand and Zitouna (2008) in the manufacturing sectors in the U.S. and in France, respectively.

and improve business performance by replacing the management team and changing the business strategies. Discontinuation of ownership might particularly ease the removal of vested right and interests and promote the restructuring of farms.

7. Conclusion

The literature on industry evolution suggests that less profitable firms are more likely to exit and that takeover of firms improves the quality of management through replacement of management teams and business strategies. In consequence, resources are reallocated toward more efficient use, and economic efficiency can improve in an industry and economy as a whole. However, the existing empirical evidence is only from mature industries in developed economies. By contrast, we examined ongoing changes in economic efficiency through firm exit and takeover in an emerging industry in a developing economy. As a result, this study provides supportive evidence for the mechanism of industry evolution with productivity learning.

More specifically, this paper studied the development process of Ethiopia's emerging cut flower industry, using our primary census data. According to the hazard analysis, less profitable and older farms are more likely to exit from the industry. This result suggests that learning of one's own productivity and making exit decisions take some time. Farms gradually learn of their own productivity through operation and determine whether they should quit the business. As for takeover, farms endowed with favorable local production conditions (i.e., abundant water supply) are more likely to be taken over. Furthermore, using the matching methods to take this systematic selection in the takeover process into account, we found that the takeover of farms increases the business size, productivity, and profitability.

For the economic efficiency of an industry to improve through market selection, a well-functioning market is essential. Singh (1975) provides the evidence for the U.K. and the U.S., suggesting that ownership change can *negatively* affect the economic efficiency of industries if capital and product markets are imperfect. Therefore, governments should design and implement industry policies to make sure that the (re-)allocation of resources through the market mechanism improves economic efficiency. For this purpose, governments can promote (re-)allocation of resources toward more efficient use through the reduction of associated transaction cost by speeding up and simplifying the relevant administrative procedures and supporting provision and transmission of related business information. These issues clearly deserve further investigation in our future research agenda.

Reference

Abadie, A.; Drukker, D.; Herr, J. L. and Imbens, G., 2004, ‘Implementing Matching Estimators for Average Treatment Effects in STATA,’ *STATA Journal*, 4(3), pp. 290-311.

Abadie, A. and Imbens, G., 2006, ‘Large Sample Properties of Matching Estimators for Average Treatment Effects,’ *Econometrica*, 74(1), pp. 235-267.

Abadie, A. and Imbens, G., 2011, ‘Bias-Corrected Matching Estimators for Average Treatment Effects,’ *Journal of Business & Economic Statistics*, 29(1), pp. 1-11.

Agarwal, R. and Audretsch, D., 2001, ‘Does Entry Size Matter? The Impact of the Life Cycle and Technology on Firm Survival,’ *Journal of Industrial Economics*, 49, pp. 21-43.

Agarwal, R. and Gort, M., 1996, ‘The Evolution of Markets and Entry, Exit, and Survival of Firms,’ *Review of Economics and Statistics*, 78, pp. 489-498.

Baden-Fuller, C., 1989, ‘Exit from Declining Industries and the Case of Steel Castings, *The Economic Journal*, 99, pp. 949-961.

Behrman, J. R.; Parker, S. W. and Todd, P. E., 2009, ‘Schooling Impacts of Conditional Cash Transfers on Young Children: Evidence from Mexico,’ *Economic Development and Cultural Change*, 57(3), pp. 439-478.

Bertrand, O. and Zitouna, H., 2008, ‘Domestic versus Cross-Border Acquisitions: which Impact on the Target Firms’ Performance?’ *Applied Economics*, 40(11), pp. 2221-2238.

Buddelmeyer, H.; Jensen, P. H. and Webster E., 2010, ‘Innovation and the Determinants of Company Survival,’ *Oxford Economic Papers*, 62, pp. 261-285.

Cameron, A. C. and Trivedi, P. K., 2005, *Microeconometrics: Methods and Applications*, Cambridge University Press: New York.

Chen, M.-Y., 2002, ‘Survival Duration of Plants: Evidence from the US Petroleum Refining Industry,’ *International Journal of Industrial Organization*, 20, pp. 517-555.

Deily, M. E., 1988, ‘Investment Activity and Exit Decision,’ *Review of Economics and Statistics*, 70, pp. 595-602.

Diaz, J. J. and Handa, S., 2006, ‘An Assessment of Propensity Score Matching as a Nonexperimental Impact Estimator: Evidence from Mexico’s PROGRESA Program,’ *Journal of Human Resources*, 41(2), pp. 319-345.

Dimara, E.; Skuras, D.; Tsekouras, K. and Tzelepis, D., 2008, ‘Productive Efficiency and Firm Exit in the Food Sector,' *Food Policy*, 33, pp. 185-196.

Disney, R., Haskel, J. and Heden, Y., 2003, 'Entry, Exit and Establishment Survival in UK manufacturing,' *Journal of Industrial Economics*, 51, pp. 91-112.

Du Rietz, G., 1975, 'New Firm Entry in Swedish Manufacturing Industries during the Post-War Period,' Doctoral dissertation, Stockholm.

Dunne, T.; Roberts, M. J. and Samuelson, L., 1989, 'Plant Age and Technology Use in U.S. Manufacturing Industry,' *International Journal of Industrial Organization*, 23, pp. 399-431.

Embassy of Japan in Ethiopia, 2008, *A Series of Studies on Industries in Ethiopia*, 32. [Online: <http://www.et.emb-japan.go.jp/>.]

Ericson, R. and Pakes, A., 1995, 'Markov-Perfect Industry Dynamics: A Framework for Empirical Work,' *Review of Economic Studies*, 62(1): 53-82.

Fine, J. P. and Gray, R. J., 1999, A Proportional Hazards Model for the Sub-distribution of a Competing Risk, *Journal of the American Statistical Association*, 94, pp. 496-509.

Ghemawat, P. and Nalebuff, B., 1985, 'Exit,' *The RAND Journal of Economics*, 16, pp. 184-194.

Getu, M., 2009, 'Ethiopian Floriculture and its Impact on the Environment: Regulation, Supervision, and Compliance,' *Mizan Law Review*, 3 (2), pp. 240-70.

Gorg, H. and Strobl, E., 2002, '"Footloose" Multinationals?' *Manchester School*, 71(1), pp. 1-19.

Gort, M. and Klepper, S., 1982, 'Time Path in the Diffusion of Product Innovations,' *Economic Journal*, 92(367), pp. 630-653.

Harris, R.; Siegel, D. S. and Wright M., 2005, 'Assessing the Impact of Management Buyouts on Economic Efficiency: Plant-Level Evidence from the United Kingdom,' *Review of Economics and Statistics*, 87(1), pp. 148-153.

Heckman, J. J. and Singer B., 1985, *Longitudinal Studies of Labor Market Data*, Cambridge University Press: New York.

Hirschman, A., 1970, *Exit, Voice, and Loyalty: Responses to Declines in Firms, Organizations, and States*, Harvard University Press: Cambridge, Massachusetts.

Hopenhayn, H., 1992, 'Entry, Exit, and Firm Dynamics in Long-Run Equilibrium,' *Econometrica*, 60(5), pp. 1127-1150.

Hughes, A., 2000, 'Retailers, Knowledge and Changing Commodity Networks: the Case of the Cut Flower Trade,' *Geoforum*, 31, pp.175-190.

Iddrisu, A., Mano, Y, and Sonobe, T., 2012, 'Entrepreneurial Skills and Industrial Development: the Case of a Car Repair and Metalworking Cluster in Ghana,' *Journal of the Knowledge Economy*, 3(3), pp.302-326.

Imbens, G. W. and Wooldridge J. M., 2009, 'Recent Developments in the Econometrics of Program Evaluation,' *Journal of Economic Literature*, 47(1), pp. 5-86.

Jensen, M. C., 1988, 'The Takeover Controversy: Analysis and Evidence,' in J. C. Coffee, Jr.; L. Lowenstein, and S. Rose-Ackerman, eds., *Knights, Raiders, and Targets: The Impact of the Hostile Takeover*, Oxford University Press: New York.

Jovanovic, B., 1982, 'Selection and Evolution of Industry,' *Econometrica*, 50(3), pp. 649-670.

Jovanovic, B. and McDonald G., 1994, 'The Life Cycle of a Competitive Industry,' *Journal of Political Economy*, 102(2), pp. 322-347.

Jovanovic, B. and Rousseau P. L., 2008, 'Mergers as Reallocation,' *Review of Economics and Statistics*, 90(4), pp. 765-776.

Keifer, N., 1988, 'Economic Duration Data and Hazard Functions,' *Journal of Economic Literature*, 26, pp. 646-679.

Klepper, S., 1996, 'Entry, Exit, Growth, and Innovation over the Product Life Cycle,' *American Economic Review*, 86 (3), pp. 562-583.

Klepper, S., 2002, 'Firm Survival and the Evolution of Oligopoly,' *The RAND Journal of Economics*, 33 (1), pp. 37-61.

Klepper, S. and Graddy, E., 1990, Evolution of New Industries and Determinants of Market Structure, *The RAND Journal of Economics*, 21 (1), pp. 27-44.

Klepper, S. and Simons, K. L., 2000, 'The Making of Oligopoly: Firm Survival and Technological Change in the Evolution of the U.S. Tire Industry,' *Journal of Political Economy*, 108, pp. 728-760.

Klepper, S. and Simons, K. L., 2005, 'Industry Shakeouts and Technological Change,' *International Journal of Industrial Organization*, 23 (1), pp. 23-43.

Lichtenberg, F. R. and Siegel, D., 1987, 'Productivity and Changes in Ownership of Manufacturing Plants, *Brookings Papers on Economic Activity*, 3, pp. 643-683.

Manne, H. G., 1965, 'Mergers and the Market for Corporate Control,' *Journal of Political Economy*, 73, pp. 110-120.

Mano, Y.; Iddrisu, A., Yoshino, Y. and Sonobe, T., 2012, 'How Can Micro and Small Enterprises in Sub-Saharan Africa Become More Productive? The Impacts of Experimental Basic Managerial Training,' *World Development*, 40(3), pp. 458-468.

Mano, Y. and Suzuki, A., 2013, '*Measuring Agglomeration Economies: the Case of the Ethiopian Cut Flower Industry*,' Discussion Papers, 2013-04, Graduate School of Economics, Hitotsubashi University.

Mano, Y.; Yamano, T.; Suzuki, A.; and Matsumoto, T., 2011, ‘Local and Personal Networks in Employment and the Development of Labor Markets: Evidence from the Cut Flower Industry in Ethiopia,’ *World Development*, 39 (10), pp. 1691-1890.

Mansfield, E., 1962, ‘Entry, Gibrat’s Law, Innovation, and the Growth of Firms,’ *American Economic Review*, 52, pp. 1023-1051.

Meade, J. E., 1968, ‘Is the New Industrial State Inevitable?’ *Economic Journal*, 78, pp. 372-392.

Pakes, A. and Ericson, R., 1998, ‘Empirical Implication of Alternative Models of Firm Dynamics,’ *Journal of Economic Theory*, 79(1), pp. 1-45.

Park, A. and Wang, P. 2010, ‘Community-Based Development and Poverty Alleviation: An Evaluation of China’s Poor Village Investment Program,’ *Journal of Public Economics*, 94 (9-10), pp. 790-799.

Pender, J. and Fafchamps, M., 2005, ‘Land Lease Markets and Agricultural Efficiency in Ethiopia,’ *Journal of African Economies*, 15 (2), pp. 251-284.

Plehn-Dujowich, J. M., 2009, ‘Entry and Exit versus Existing Firms,’ *International Journal of Industrial Organization*, 27, pp. 214-222.

Salvanes, K. G. and Tveteras, R., 2004, ‘Plant Exit, Vintage Capital and the Business Cycle,’ *Journal of Industrial Economics*, 52 (2), pp. 255-276.

Schary, M. A., 1991, ‘The Probability of Exit,’ *The RAND Journal of Economics*, 22 (3), pp. 339-353.

Singh, A., 1975, ‘Take-overs, Economic Natural Selection, and the Theory of the Firm: Evidence from the Post-War United Kingdom Experience,’ *Economic Journal*, 85 (339), pp. 497-515.

Solow, R. M., 1956, ‘Technical Change and the Aggregate Production Function,’ *Quarterly Journal of Econometrics*, 70 (1), pp. 65-94.

Sonobe, T. and Otsuka, K., 2006, *Cluster-Based Industrial Development: An East Asian Model*, Palgrave Macmillan: New York.

Sonobe, T. and Otsuka, K., 2011, *Cluster-Based Industrial Development: A Comparative Study of Asia and Africa*, Palgrave Macmillan: New York.

Thompson, P., 2005, ‘Selection and Firm Survival: Evidence from the Shipbuilding Industry, 1825-1914,’ *Review of Economics and Statistics*, 87 (1), pp. 26-36.

Tveteras, R. and Eide, G. E., 2000, ‘Survival of New Plants in Different Industry Environments in Norwegian Manufacturing: A Semi-Proportional Cox Model Approach,’ *Small Business Economics*, 14(1), pp. 65-82.

Utterback, J. M. and Suarez, F. F., 1993, ‘Innovation, Competition, and Industry

Structure,' *Research Policy*, 22 (1), pp. 1-22.

Wijnands, J. H. M., 2005, *Sustainable International Networks in the Flower Industry: Bridging Empirical Findings and Theoretical Approaches*, Leuven: International Society for Horticultural Science.

Table 1. Export of Ethiopia and Cut Flower Export of Kenya (million USD).

	Ethiopia			Kenya
	Total	Coffee	Cut flower	Cut flower
	(1)	(2)	(3)	(4)
Year				
2005	926	335	0	242
2006	1,043	426	25	275
2007	1,277	418	68	313
2008	1,601	562	104	446
2009	1,618	369	131	421

Source: UN COMTRADE
(http://comtrade.un.org/db/default.aspx, accessed on October 3, 2011)

Table 2. Mean Characteristics of the Cut Flower Farms in 2007, by Farm Status as of 2009.

	Farm status as of 2009			p value for the mean test		
	Same owner	Taken over	Exit			
	(1)	(2)	(3)	(1) vs (2)	(1) vs (3)	(2) vs (3)
Farm characteristics						
Starting year	2005	2005	2004	0.962	0.219	0.345
Domestic ownership (%)	34.0	20.0	62.5	0.533	0.127	0.158
Locational characteristics						
Altitude (km)	2.10	2.16	2.23	0.644	0.319	0.757
Hours to airport	1.64	1.90	1.68	0.443	0.896	0.610
Scarcity of water supply	1.98	1.00	1.87	0.056*	0.811	0.183
Human capital of the GM						
Years of schooling	15.7	15.7	15.8	0.980	0.935	0.943
Years of related experience	8.0	8.5	16.1	0.913	0.031**	0.352
Employment and gross profit						
No. of workers	354.5	385.1	242.2	0.982	0.239	0.283
Gross profit per worker (1000 USD/person)	5.8	4.0	0.6	0.561	0.0005***	0.178
No. of observations	53	7	8			

Notes: The descriptive statistics here are for the sub-sample of farms presented in Figure 1 that were operating as of 2007 and we have detailed information on. "Scarcity of water supply" is measured by the GM's concern on the sustainability of water supply at the production site: 1 = not at all; 2 = little; 3 = moderate; and 4 = very high concern.

*, **, *** = statistical significance at 10%, 5%, and 1%.

Table 3. Comparison of Farm Size, Productivity, and Profitability in 2007 and 2009, by Ownership Status.

	Taken over		Same owner		Differences-in-differences	
	2007	2009	2007	2009	DID:	*p*-value for the mean test:
	(1)	(2)	(3)	(4)	[(2)-(1)]-[(4)-(3)]	[(2)-(1)]-[(4)-(3)] = 0
No. of workers	385.1	1108.0	354.5	468.4	609.0	0.009***
Sales revenue[a]	2.1	2.3	3.1	3.3	0.03	0.997
Gross profit[a]	1.2	0.9	1.9	1.2	0.4	0.670
Sales revenue per worker[b]	7.8	7.2	9.2	8.3	0.3	0.927
Gross profit per worker[b]	4.0	1.5	5.8	3.6	-0.3	0.905

Notes: The number of farms taken over from the end of 2007 to the beginning of 2009 is 7 (Columns 1 and 3). The number of farms operated by the same owner is 53 (Columns 2 and 4).
[a].The unit of sales revenue and gross profit is million USD.
[b].The unit of sales revenue per worker and gross profit per worker is thousand USD per person.
*** = statistical significance at 1%.

Table 4. Hazard Analysis on Farm Exit and Takeover.

	Takeover			Exit		
	Weibull	Gompertz	Competing-risks model [CR: Exit]	Weibull	Gompertz	Competing-risks model [CR: Takeover]
	(1)	(2)	(3)	(4)	(5)	(6)
Gross profit per worker	0.155	0.150	0.161	-0.139***	-0.129***	-0.130***
	(0.295)	(0.240)	(0.191)	(0.051)	(0.049)	(0.043)
No. of workers	-0.026	-0.025	-0.024	-0.001	-0.002	-0.001
	(0.023)	(0.019)	(0.018)	(0.003)	(0.003)	(0.002)
Domestic owner	-2.766	-2.651	-1.856	1.086	1.139	0.990
	(2.690)	(2.514)	(2.118)	(0.789)	(0.838)	(0.724)
Altitude (km)	0.0007	0.0002	-0.0004	0.002	0.002	0.002
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
Hours to airport	0.419	0.277	-0.246	0.997	1.117	1.013
	(1.477)	(1.259)	(0.919)	(0.751)	(0.854)	(0.789)
Scarcity of water supply	-17.447***	-17.458***	-25.439***	-0.255	-0.215	-0.199
	(1.753)	(1.513)	(1.153)	(0.435)	(0.424)	(0.370)
GM's years of schooling	-0.217	-0.316	-0.414	0.116	0.116	0.197
	(0.240)	(0.266)	(0.309)	(0.199)	(0.190)	(0.167)
GM's years of experience	0.002	-0.021	-0.075	0.137***	0.141***	0.111**
	(0.179)	(0.162)	(0.147)	(0.046)	(0.048)	(0.037)
Constant	18.357***	22.184***	---	-15.338*	-14.979	---
	(7.098)	(6.996)	(---)	(8.563)	(8.350)	(---)
Weibull p	2.887***	---	---	2.381***	---	---
	(1.093)	(---)	(---)	(0.642)	(---)	(---)
Gompertz γ	---	0.595	---	---	0.620**	---
	(---)	(0.411)	(---)	(---)	(0.274)	(---)
Log-likelihood	-5.900	-6.666	-7.009	-16.787	-16.639	-20.789
AIC	31.800	33.332	30.019	53.575	53.278	57.579

Notes. Robust standard errors are in parentheses. Explanatory variables are measured in 2007. *, **, *** = statistical significance at 10%, 5%, and 1%.

Table 5. ATT of Takeover between 2007 and 2009 (DID-BCM)

No. of workers	Sales revenue[a]	Gross profit[a]	Sales revenue per worker[b]	Gross profit per worker[b]
(1)	(2)	(3)	(4)	(5)
94.8*	1.70**	2.86**	13.68*	9.66
(51.2)	(0.73)	(1.39)	(8.23)	(6.67)

Notes. The outcome variables are measured in the change between 2007 and 2009. Robust standard errors are presented in parentheses. The number of matches per treatment group observation is 4.

[a].The unit of sales revenue, value added, and gross profit is million USD.

[b].The unit of sales revenue per worker and gross profit per worker is thousand USD per person.

*, ** = statistical significance at 10% and 5%.

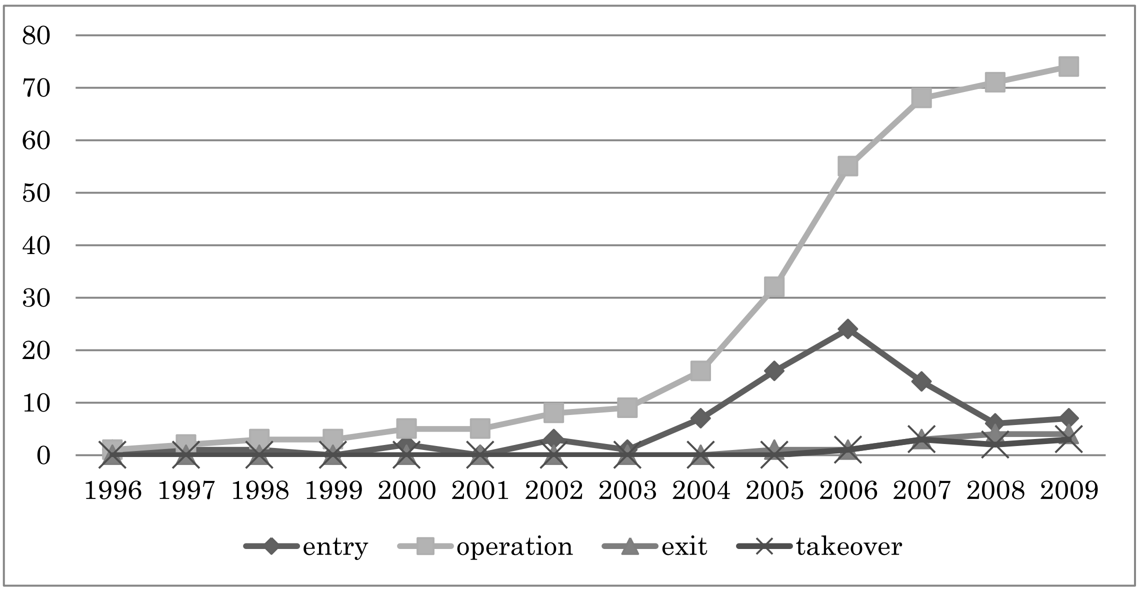

Figure 1. Changing number of new entrants, operating farms, exiting farms, and farms taken over.

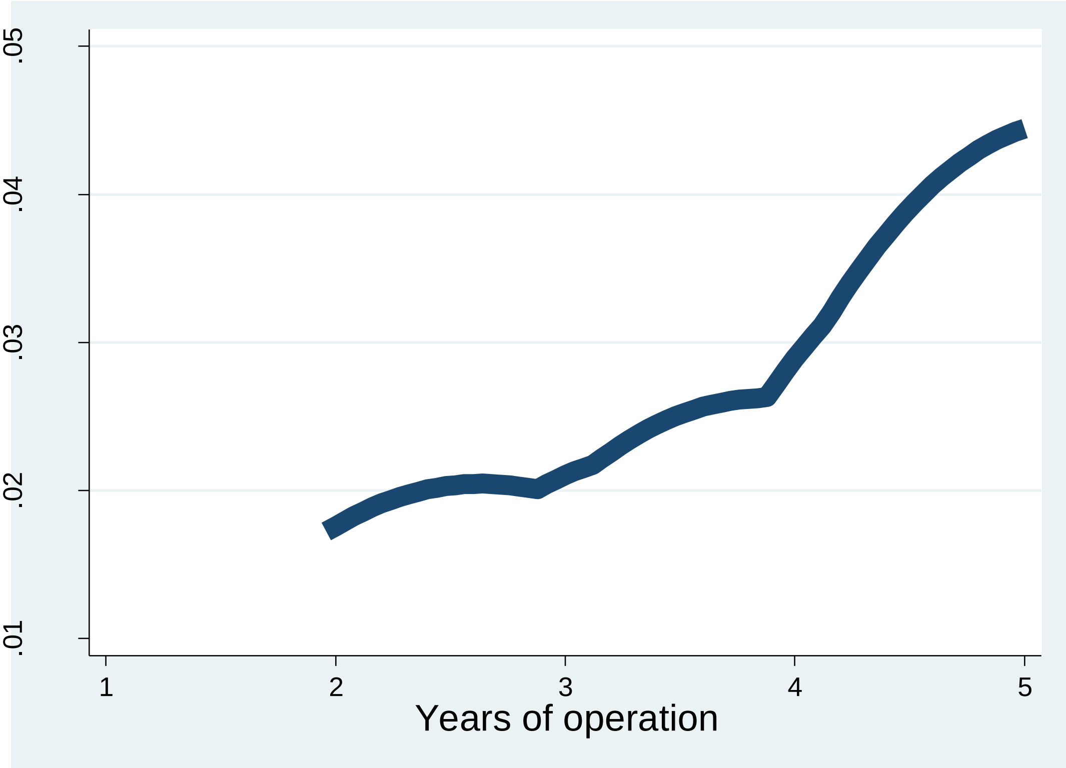

Figure 2. Hazard estimates of farm exit.

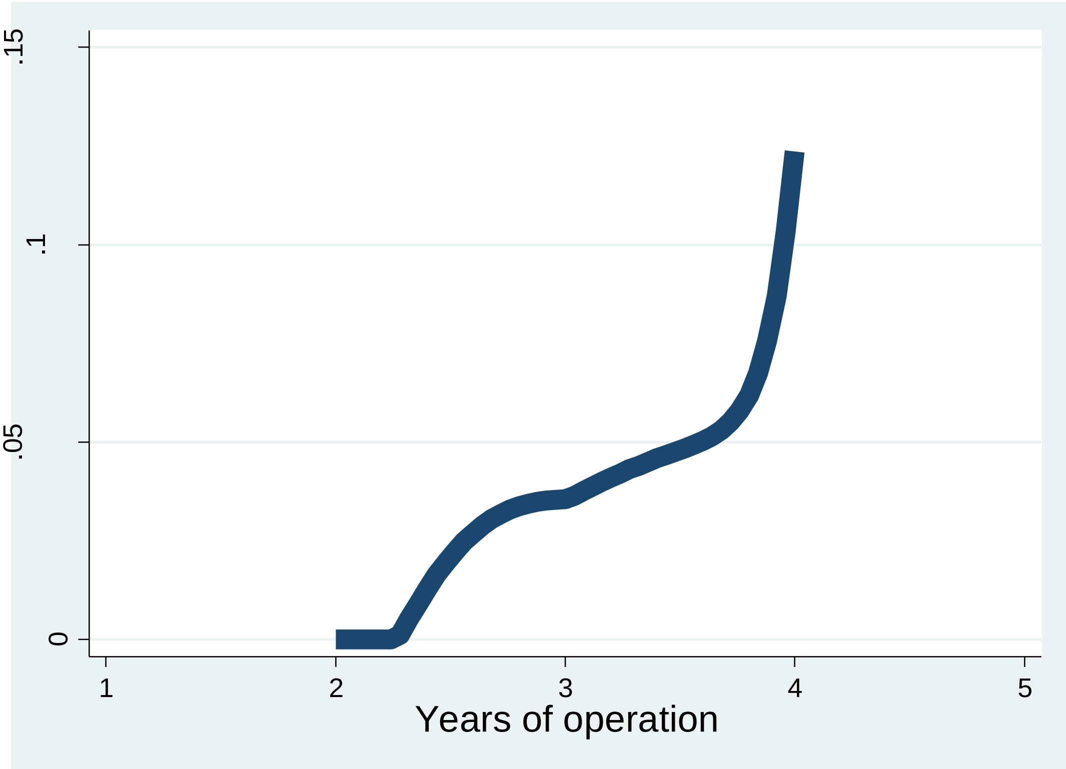

Figure 3. Hazard estimates of farm takeover.