Essays on Firms' Growth and their Survival in Ethiopia: The Role of Firm Experience

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A Dissertation Submitted

to

Addis Ababa University, Department of Economics,

Presented in partial fulfillment of the Requirements for the degree of

Doctor of Philosophy in Economics

Addis Ababa, Ethiopia

July 2020

DECLARATION

I, **Guta Legesse Tessema** would like to declare that this thesis entitled "Essays on Firms' Growth and their Survival in Ethiopia: The Role of Firm Experience" submitted in partial fulfillment of the requirements for the Degree of Doctor of Philosophy (Economics) is my own original work except where explicitly stated otherwise in the text. I confirm that all the chapters in this work have not been submitted for any other degree or processional qualification.

Essay 4 and 5 of this thesis were published as a book chapters by Springer in 2018 as Chapter 10 and 11 of the Book entitled "Economic Growth and Development in Ethiopia, Perspectives on Development in the Middle East and North Africa (MENA) Region" by Heshmati and Yoon.

I declare that I have undertaken the research work independently with the guidance and support of my supervisors and that all sources of materials used for this thesis have been duly acknowledged.

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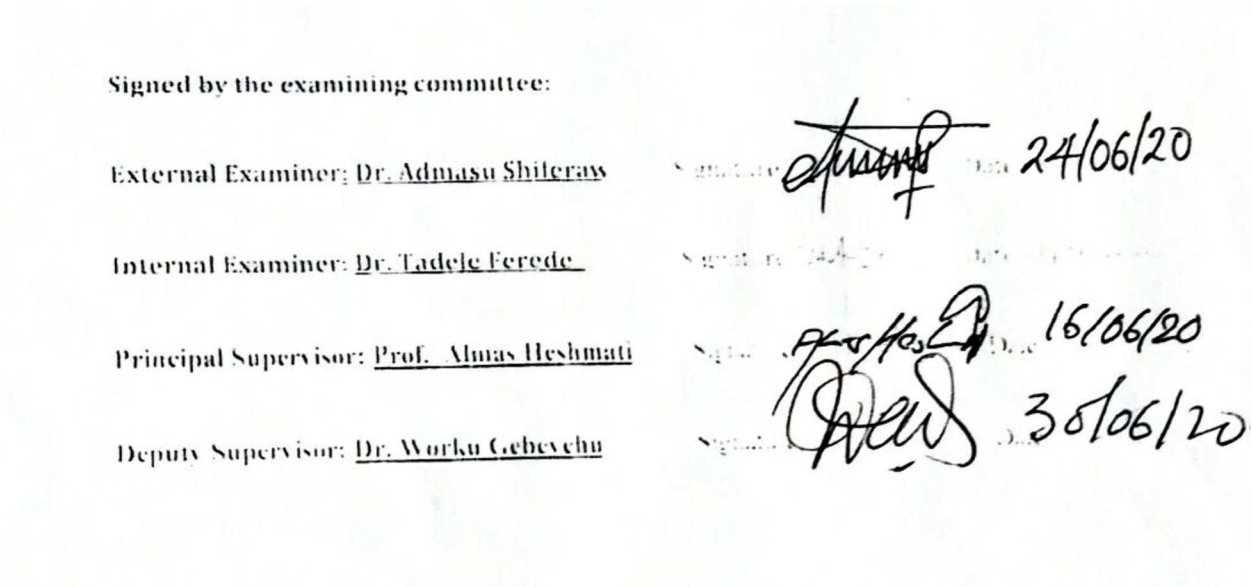

Abstract

Firms' growth, survival, and distribution has been a key research subject in many countries and more so in developing countries because of the limited number of firms and scant evidence on their performance and where they are located in these countries. The nexus between ageing, performance, and survival is important for sustaining the promising and fast-growing Ethiopian economy. This thesis addresses the link between firms' experience, growth, survival, and distribution using medium and large-scale manufacturing firms in the country.

The major data source is the Central Statistical Agency (CSA) of Ethiopia. Data for Chapter 4 comes from the World Bank's Enterprise Survey database (World Bank, 2015). The thesis applies multiple estimation techniques including system GMM, quantile regression, complementary log-log regression, the Kaplan-Meier survival analysis plots, probit estimation, Heckman selection model, and the fixed effects models. The results of the pooled OLS estimation are reported for a comparison.

The studies included in the thesis have some key findings. The findings of the first essay (Chapter 2) on firms' experience and performance show that experience is positively associated with labor productivity both in the short and in the long run. Firm experience was measured using a composite index developed for this purpose. The sensitivity analysis, however, shows that the positive effect of experience disappears when we estimate the relationship using true panel data. From the elements used in the development of the index, only cohort age and wage rate have a significant positive effect on a firm's performance.

Firms in Ethiopia rely heavily on imported inputs and how this relates to their performance is investigated in the second essay (Chapter 3). Using import intensity as a proxy for firm experience, we found a statistically significant negative effect of import intensity on the risk of exit using a probit estimation. Imported input-intensive firms show a better likelihood of survival using the complementary log-log estimation. Overall, the results from the Kaplan-Meier plots, the complementary log-log, and probit estimations show that importing inputs from abroad is associated with lower risks of a firm's exiting.

In the third essay (Chapter 4), the focus of the analysis shifts to the distribution and determinants of high-growth firms (HGFs). Firm growth distribution and HGFs' special features is another important aspect of this thesis. The over population of high growth firms in Addis Ababa and Oromia and their unique business challenges are discussed in the third essay.

The fourth essay (Chapter 5) examines how ageing is related to a firm's performance. It complements the first paper which uses pseudo panel data. In Essay 4, we use a true panel of firms and use age as an indicator as opposed to an index in the first essay. After controlling for sample selection using Heckman's selection model, we observe that there is a no relationship between growth and a firm's age but there is a convex relationship between size and a firm's growth rate. Small firms tend to grow faster but there is no significant difference in labor productivity values among firms based on age and size.

Keywords: Firm growth; survival; ageing; high growth firms; pseudo panel and system GMM

JEL Classification Codes: D22; L11; L25

ACKNOWLEDGEMENT

God is the first thing that comes to my mind when I think of ending my years long journey in the demanding PhD program in Economics. Without the blessing and mercy of God throughout my life, I am nobody and thanks God for making me somebody!

I would like to take this opportunity to thank my supervisors, Professor Almas Heshmati and Dr. Worku Gebeyehu. Without your help this thesis work is impossible, and I thank you for your critical comments, availability and guidance during the thesis work. It was a nice learning season working with you.

My sincere thank goes to My mother (Bekelech Hundie) and father (Legesse Tessema). I have been in education for more than 20 years and your unreserved support in the early cycles of education was very important for where I am today. With your limited education, you believed in the value of education and sent me to school and supported me throughout my carrier. I can't thank enough my mother for the sacrifice she made to help me grow and develop as a man. Thank you "*Adado*". May God bless your remaining life with love and joy.

At times, my family is my major source of inspiration. My wife (Wubit Fiseha), My lovely son (Nalema Guta) and angel daughter (Amnen Guta), I thank you so much for being my motivation and giving me unconditional love and trust. I would like to thank my wife's mother (Asnakech Tessema) and father (Fiseha Zewdie) for their love, prayer and all rounded support during my decade long married life and education. I am glad to have joined this lovely family and wish you long-life filled with love and joy.

I would like to say thank you to all my brothers, sisters, uncles and aunts who have helped me morally and financially during my education. I can't list all of them but special thank goes to: Sisay Legesse, Gexenesh Legesse, Berhanu Legesse, Sintayehu Legesse, Mestawot Legesse, Dereje Legesse, Jemanesh, Elfnesh, Tesfaye and Hiywot Legesse. This long list also includes Tesfaye Fiseha, Tekilachew Tekile, Zekarias Fiseha, Ayantu Tesfaye, Tadesse Dhaba, Afrasa Tefera, Professor Mulatu Lemma, Diriba Tessema, Fikru Tola, Dejene, Chaltu, Wegene and Tegenu. I thank you for your unreserved love and support. Much respect and wish you long live.

I thank SIDA and JIBS staff for their financial and technical support during my study. The international exposure at JIBS through the financial support by SIDA was quite useful and I want to say thank you. Special thank goes to Professor Scott, Mr. Lars, Mrs. Monica, Mrs. Vaida, and Dr. Anna and all participants of the Friday Seminars for your invaluable comments and suggestions. I also benefited a lot from the comments from the anonymous external reviewer and language editors and they deserve special thanks. Dashen Bank S.Co and My old friends there (Tibebu Solomon and Fikadu Alemu) deserve special thanks for being my major source of foreign currency and their beliefs in human capital development).

Administrators and professors in CoBE and Department of Economics have also played a significant role in making this project happen. COBE dean office (Dr. Alemu), Department heads (Dr. Tadele and Dr. Zerayehu) graduate program coordinators (Mr. Kebede and Dr. Mesele) and my professors Dr. Fantu, Dr. Alemayehu, Prof. Tassew, Dr. Assefa, Dr. Adane, Dr. Seid and many more. Friends and colleagues at AAU also deserve special thanks. Namely Mr. Abraham, Mrs.

Saba Y. Dereje Y., Dereje F., Jonse, Hailu A., Eyayu, Dr. Atnafu, Dr. Hailu, and Department ssecretaries (Mrs. Saba and Agerenesh)

I would like to take this opportunity to thank my former professors at various levels who gave me the motivation to go for more education. Professor Jema Hadji (MSc thesis supervisor) and the excellent people whom I benefited from during my MSc, BA and high school studies. I want to say thank you to all of you for playing your role in my 20+ years educational journey.

Finally, my neighbors at Menen University guest house were also very important part of my life specially during my absence and at that difficult time when my son was diagnosed with diabetics. Mr. Sintayehu and Habtamnesh, Mr. Paulos and Tsion, Dr. Abrar and Fikirte, Professor Nigussie and Hanna, Dr. Shumey and Nigisti, Dr. Tadesse, Dr. Damtie and family, Dr. Tebarek and family, Dr. Negash and family, Dr. Yirgashewa, Dr. Tesfaye and family, Dr. Kassa and Teki, Dr. Gemechu and family, Dr. Mesfin, Dr. Samuel and Lensa, Mr. Tsegaberhan and family, Dr. Amanuel and family, Mr. Girma and Asnaku, S/r Selam, Dr. Derib and Tsigie and all the community whose name is not mentioned here. I would like to say thank you for standing alongside me at those good and bad times and filled me with love and joy. Thank you for getting me through those difficult times.

Guta Legesse

July 2020

Dedication

To:

my wife Wubit Fiseha, my son Nalema Guta and my daughter Amnen Guta

and

the late artist Hachalu Hundessa and thousands of youths who have lost their lives due to the mass protest in Ethiopia over the past few years while I was doing my “luxury” PhD degree.

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Acronyms and Abbreviations

AfBD	African Development Bank Group
AR	Auto regressive
CFA	Confirmatory factor analysis
cloglog	Complementary log-log regression
CEO	Chief executive officer
CSA	Central Statistical Agency of Ethiopia
EIC	Ethiopian Investment Commission
FDRE	Federal Democratic Republic of Ethiopia
FeMSEDA	Federal Micro and Small Enterprise Development Agency of Ethiopia
FE	Fixed effects panel data method
GDP	Gross domestic product
GMM	Generalized Method of Moments
GTPI	Growth and transformation plan I
GTPII	Growth and transformation plan II
HGFs	High-growth firms
HHI	Herfindahl-Hirschman Index
IDS	Industrial development strategy
ICT	Information communication technology
ISIC	United Nations International Standard Industrial Classification of All Economic Activities

K-M	Kaplan–Meier
LPE	Law of proportionate effects
MVA	Manufacturing value added
MLSM	Medium and large-scale manufacturing firms
NBE	National Bank of Ethiopia
NPC	National Planning Commission of Ethiopia
NESTA	National Endowment for Science, Technology and the Arts
OECD	Organization for economic cooperation and development
OLS	Ordinary Least Squared regression
PASDEP	Plan for Accelerated and Sustained Development to End Poverty
PIT	Personal income tax
QR	Quantile regression
RBT	Resource-based theory of a firm
REER	Real effective exchange rate
SDPRP	Sustainable Development and Poverty Reduction Program
SNNP	Southern nations, nationalities and people of Ethiopia
SSA	sub-Saharan African countries
SYS_GMM	System based generalized method of moments
TFP	Total factor productivity
UNCTAD	United Nations Conference on Trade and Development
UNIDO	United Nations Industrial Development Organization
VAT	Value-added tax
WB	World Bank
WBES	World Bank enterprise survey

Chapter 1

Introduction to and Summary of the Thesis

1. Introduction

1.1. General Background

Economists have concentrated on discovering what determines firms' growth over the past several years. According to Sutton (1997), Robert Gibrat's work was the first formal model dealing with the dynamics of firm size and industry structure. According to him, the rate of a firm's growth is independent of its size and is framed as the law of proportionate effects (LPE) (Gibrat, 1931 cited in Sutton, 1997). Several empirical studies have tested this law using data from different countries and their findings in general are inconclusive.

Another group of researchers shows how a firm's age affects its performance (Coad, 2018; Loderer and Waelchli, 2010). The different liabilities discussed by researchers such as liability of newness; liability of adolescence; liability of senescence; and liability of obsolescence all seem to coexist and have offsetting effects on a firm's performance. A more recent and less studied issue is the effect of a firm's supply experience on its performance. Since innovations tend to be generated by accumulated non-transferable knowledge, a firm's experience is expected to have a positive effect on its growth.

These proposed liabilities present different ways of understanding the role of a firm's age in determining its performance. Some argue that performance increases with age (liability of newness) but for others it decreases with age (liability of obsolescence and liability of senescence). Proponents of liability of adolescence argue that there is a non-linear relationship between age and a firm's performance.

Accordingly, liability of newness occurs because new firms have to incur the cost of learning how to do a business, have employees who are less familiar with each other, and lack informal rules and norms that generate understanding among stakeholders (Stinchcombe,1965). For Barron et al. (1994), old firms suffer from the liabilities of obsolescence and senescence. These two liabilities reduce a firm's performance and the major differences in their performance are because of these two liabilities. Liability of senescence is caused by internal factors while liability of obsolescence is due to changes in the external environment. Liability of senescence exists when firms become accustomed to the existing rules, routines, and organizational structures which generate inflexibility and hence inferior performance (Barron et al., 1994; Coad et al., 2018; Hannan and Freeman, 1987; Le Mens et al., 2011). Liability of obsolescence, on the other hand, is due to a firm's inability to cope with changes in its external environment (Barron et al., 1994). Firms might face high risks of exit even during their initial phases due to loss of enthusiasm and support until they reach a certain maturity level after which the exit rate declines and this idea is presented under the liability of adolescence (Fichman and Levinthal, 1991).

Huber (1991) classified a firm's possibilities of learning into five sub-processes: inter-organizational learning; congenital learning; experiential learning; organizational grafting; and searching. In his classic work, Huber (1991) argues that congenital learning is due to employees' prior experience and knowledge acquired before the birth of a firm. Variables like the CEO's prior work experience and education and employees' prior experience capture this type of learning.

The gains from experience can be classified as learning from one's own experience in business (experiential learning) (Kolb, 1984); learning from the management team's pre-start-up knowledge (congenital learning) (Huber, 1991); and learning through interactions with stakeholders and competitors (inter-organizational learning or learning from others) (Huber,1991; Levitt and March, 1988). The first essay of this thesis (Chapter 2) generates a broader understanding of the link between a cohort's experience and performance in Ethiopia using pseudo panel data. It develops a composite index based on a confirmatory factor analysis to capture the cohort's experience.

The second essay (chapter 3) studies the impact of international trade engagement on a firm's survival using data for firms in advanced economies. Firms which engage in international trade through export decisions are found to face higher probability of survival (Baldwin and Yan, 2011; Bernard and Jensen, 2007; Dai et al., 2016; Dzhumashev et al., 2016; Esteve-Pe'reze and Mañez-Castillejo , 2008; Kimura and Kiyota, 2007). Lopez (2006) and Emami Namini et al. (2013) show that firms that engage in international trade are more likely to survive.

Further, a firm's entry into the market is generally considered to be easy in modern economies as opposed to their survival. In fact, Schumpeter (1943) argued that the process of 'creative destruction' is critical and inevitable for the continued dynamism of the modern economy. A firm's growth and survival are an important channel through which economic growth in developing countries can be sustained. Policymakers in these countries also need to closely follow a firm's dynamics and how these relate to policy interventions. A firm's survival could be as important as a new firm's entry for policymakers, owners, and the employees in general.

Imported inputs can affect a firm's survival in various ways mainly through their productivity enhancing effects. One possible route through which imported inputs affect a firm's performance is through the opportunity created for buying inputs at cheaper prices from international markets (Acharya and Keller, 2007; Gibson and Graciano, 2011; Wagner, 2013). For others, importing inputs opens the door for technology transfers and purchase of higher quality components (Gibson and Graciano, 2011). Vogel and Wagner (2010) discuss the positive role played by importing inputs in relation to their effect on specialization and this idea is also supported by Andersson et al. (2008). By importing inputs from abroad, firms are better focused on their competitive advantages and this deepens international specialization (Andersson et al., 2008). The positive effects of imports on export engagement have been studied by many scholars and importing inputs has been found to increase the probability of foreign market entry (Aristei et al., 2013; Kasahara and Lapham, 2013).

Despite such rich literature on the link between imported inputs and a firm's productivity, the contribution of imported inputs to a firm's survival is a less studied phenomenon globally. The two influential papers in this regard are those by Wagner (2013) and Keller (2002). Wagner (2013) finds a strong positive link between a firm's survival and importing and two-way trading using firm level data from Germany using a probit estimation. Keller (2002) also finds that 20 percent of the productivity growth in OECD countries' firms is due to foreign R&D and could be even more for firms in developing countries. In developing countries, the role of importing intermediate

inputs for a firm's survival has not been addressed so far in literature. Hence this study fills this gap in literature and the second essay discusses this relationship.

The prevalence of high growth firms (HGFs)[1] in different countries and industries has shown that HGFs form only a small percentage of all firms and are found in all countries across all industries where they play a significant role in job creation (Acs et al., 2008; Anyadike-Danes et.al, 2013; Autio et al., 2000; Coad et al., 2014, Daunfeldt et al., 2014; Davidsson and Henrekson, 2002; Delmar et al., 2003; Henrekson and Johansson, 2010; Moreno and Coad, 2015; NESTA, 2009, 2011; Schreyer, 2000; Storey, 1994).

Coad et al. (2014), for instance, present the disproportionate job creation role of HGFs as a stylized fact. NESTA (2009) documents that the 6 percent of the HGFs in UK generated 49.5 percent of all new jobs created by operational firms during 2002-08 while Storey (1994) found that 4 percent of firms created 50 percent of the jobs.

The third essay (Chapter 4) in this thesis investigates the growth determinants of HGFs in Ethiopia and maps their distribution.

The effect of a firm's age on its performance (ageing) is the subject of essay 4 (chapter 5) of the thesis. Here the focus it to show how performance changes with a change in the age of a firm. Some researchers discuss a positive role of age on a firm's performance (Arrow, 1962; Coad, 2018; and Thompson, 2010) while for others performance declines with age due to liabilities of senescence and obsolescence (Barron et al., 1994; Coad et al., 2018; Hannan and Freeman, 1987; Le Mens et al., 2011). In this chapter, we show how performance varies with age using data from Ethiopia.

This thesis examines the nexus between experience and a firm's performance in Ethiopia, one of the fastest growing economies in Africa and in the world over the last few years. It uses three alternative indicators for capturing a firm's experience including the composite index for cohort experience, a firm's age, and import intensity. The main purpose of the thesis is showing how a firm's experience relates to its performance as measured by firm growth in size, labor productivity, and survival.

1.2. The Industrial and Manufacturing Sector's Performance in Ethiopia

The fundamental economic challenge for sub-Saharan Africa is lack of pivotal structural changes and low levels of export diversification. Agriculture in general has not been modernized, and manufacturing stalled at around 15 percent of GDP through the 1960s to the 2000s (UNCTAD, 2009). This period includes both the phases of import substitution and trade liberalization policies and the recent wave of globalization.

Productivity growth is a key determinant of a country's development and improvement in living standards. Since the absolute level of productivity and its potential for growth vary across activities, a country's ability to catch up with the more advanced countries is largely dependent on what it produces and sells in the world market reflecting its production technological capabilities and market competitiveness. An economy that is dominated by technologically dynamic firms

[1] In this thesis, we used two approaches to capture high growth firms. We used a modified OECD definition and Birch-Index based measures.

tends to grow faster. On the other hand, for productivity growth, knowledge and its spillovers are important factors (UNCTAD, 2007).

Over the last two and a half decades, the Ethiopian economy has moved significantly from a command economy which was hostile to the private sector to an economy which is friendlier to the development of the private sector and its role as an engine of development. Several initiatives have been taken up for promoting private sector development. The impact of these policy changes on private sector development has been encouraging but the economy is not showing a structural transformation.

The Ethiopian economy has experienced strong and broad-based growth over the last decade with an average GDP growth rate of 10.1 percent per year between 2006-07 and 2016-17 (NBE, 2018). This, despite low initial development levels, is relatively high compared to the growth rate of the region. The manufacturing value added (MVA) as a share of GDP, however, has remained low at about 6 percent in 2018 which is by far below the 11 percent for sub-Saharan African countries. The promising thing about the manufacturing sector's performance in Ethiopia is that the manufacturing value added is growing at a very high rate of 5.5 percent relative to the sub-Saharan African average rate of 2.1 percent (World Development Indicators, 2019). This shows that there is some hope for potential catch-up by the Ethiopian economy if this growth rate can be sustained.

The agriculture sector was a major contributor to the Ethiopian economy's GDP till recently. According to latest reports by NBE, the service sector has become the major contributor to GDP accounting for 39 percent in 2017-18 (NBE, 2018). Agriculture accounted for 35 percent of the GDP in the 2017-18 budget year while the remaining 27 percent came from the industrial sector (NBE, 2018). In the industrial sector, the role of the manufacturing industries compared to construction activities was relatively small with only 25 percent coming from manufacturing industries as opposed to the 71 percent share of construction activities in 2017-18 (NBE, 2018). The service sector becoming a dominant source of GDP in Ethiopia in recent years is a common phenomenon in many African economies and the situation has been presented as a premature deindustrialization process (African Development Bank Group, 2019).

Looking at the industrial sector, we see that the role of the manufacturing industries was relatively small. In 2017-18, 71 percent of the industrial output was associated with construction activities while 25 percent came from manufacturing industries (NBE, 2018). Hence, improving firms' performance and industrial output is a pressing challenge.

Policy wise, there are ongoing efforts to bring about rapid and sustainable economic growth and development and structural changes in the economy. A series of policies, strategies, and programs have been designed and implemented in the country over the last few decades. The introduction of the Sustainable Development and Poverty Reduction Program (SDPRP) in 2002-03 and the Plan for Accelerated and Sustained Development to End Poverty (PASDEP) in 2005-06 to 2009-10 followed by GTP shows these efforts. Currently, the government is implementing the second phase of its five-year growth and transformation plan (GTP) which covers the period 2015-16 to 2019-20. Under these programs, there is more focus on firms in the manufacturing sector (NPC, 2016).

The government has also embarked on the development of industrial parks and integrated agro-processing parks to enhance the process of transformation. To sustain the promising performance of the Ethiopian economy, a study on the dynamics of firms' performance and the business environment under which they operate is essential.

1.3. Statement of the Problem

The Government of Ethiopia is currently implementing the second phase of its five-year growth and transformation plan (GTP II) to transform the economy and achieve lower-middle-income country status by 2025. Prior to GTP II, the government implemented PASDEP during 2006-10 and GTP I during 2011-15. Under GTP II, which started in 2015-16, the government aims to continue investing in developing physical infrastructure through public investment projects thus transforming the country into a manufacturing hub.

Private sector development initiatives have been given due attention in Ethiopia over the last few years, notably since the publication of the industrial development strategy document (IDS) in 2002 (FDRE, 2002). The industrial development strategy's aim is enhancing firms' productivity and helping the economy to industrialize. The industrial development strategy aims at the promotion of selected industries with special support and supervision by the government. Many manufacturing firms have been established following the strategy. Access to development infrastructure combined with regulations enforcing joint ventures with foreign firms will promote private sector development and its growth.

The other key policy initiatives and interventions include establishing separate intuitions to support the development of some sectors such as leather and leather product development and textile development industries; policy reforms and incentive packages; heavy investments in infrastructure; and massive privatization of publicly owned firms. Recently, the government has established a taskforce with the mandate of studying approaches and mechanisms for privatization of Ethiopian Airlines, Ethio-Telecom, and Ethiopian Shipping and Logistics Services Enterprise. However, despite such initiatives there is limited progress towards industrialization with only 27 percent of the GDP coming from the industrial sector and the manufacturing industries accounting only 5 percent of the GDP (NBE, 2018).

In Ethiopia, the maximum age of a firm was close to 100 years, but the median age was quite low (only 7 years) and the mean age was 10 years based on the 2016-17 Medium and Large-Scale Manufacturing (MLSM) firm survey data. This is due to high panel attrition in the survey as evidenced by high rates of entry and exit. With no upper limit for a firm's age, the question that arises is why do so many firms exit and how their performance changes over time. Globally, there are firms which have been around for over 1,000 years (Coad, 2018). This thesis shows how performance changes with experience and a firm's age in Ethiopia.

There are also conflicting findings on the role of age, experience, and size on a firm's performance. Some researchers argue that performance improves with experience (liability of newness) (Hannan and Freeman, 1984; Stinchcombe, 1965) while for others performance decreases with a firm's experience (liabilities of obsolescence and senescence) (Barron et al., 1994). A study of the dynamics of a firm's performance is essential for sustaining the promising performance of the Ethiopian economy.

Further, there is a high dependency of firms on imported inputs in Ethiopia and a study of how this behavior relates to their survival is important for policymakers. The 2016-17 MLSM survey on firms in Ethiopia, for instance, showed that about 35 percent of the firms had more than half of their inputs coming from abroad and nearly 70 percent of the surveyed firms used imported inputs. This shows that a significant number of MLSM firms in Ethiopia were depending on imported

goods. This thesis provides a systematic analysis of the link between import intensity (as a proxy for firm experience) and firm survival in Ethiopia.

In contrast, only 4 percent of the firms had export engagements during the study period. While importing often leads to export activities in other economies, the government need to take extra initiatives for promoting and supporting firms to sell their products in the international market in Ethiopia. Too much import engagement by manufacturing firms in Ethiopia coupled with limited export activity poses other research questions. There are limited studies on how age, imports, and experience relate to firms' performance in general.

Further, understanding of the persistence and incidence of HGFs has become an important task for policymakers as better insights of the existence, characteristics, and stimulating factors of high-growth firms could be a key breakthrough for sustaining economic growth. For shareholders, the concern is knowing what stimulates the growth of their firms while for policymakers it is an issue of sustaining firm growth and capitalizing on HGFs.

The Ethiopian government offers three different types of incentive packages to investors to attract and encourage investments both from domestic and foreign sources: income tax incentives, customs incentives, and financial incentives (EIC, 2020). The income tax incentives provide firms with different types of exemptions from business income tax based on the industry sector,[2] age of the firm, location across regions and industrial parks, export plans, achievements, and profit or loss situations.

Customs incentives, on the other hand, are designed to provide exemptions to firms pertinent to their import and export activities. They include exemption from customs duties and other taxes such as value-added tax (VAT), sur tax, withholding and excise tax on imported items such as capital goods, construction materials, spare parts, raw materials,[3] and vehicles, and export duty exemptions.

Finally, financial incentives are related to cost, subsidy, and credit facilities that the government and financial institutions can provide to selected firms. Although these packages have different approaches and requirements, their goal is supporting firms and paving the way for industrialization in the country (EIC, 2020).

One of the main objectives of the thesis is showing the role that experience plays in a firm's performance and survival. It uses alternative indicators of firm experience for measuring experience. We start the analysis by developing a composite index to capture firm experience. Later, we use import intensity and firm age as major indicators of a firm's experience. Further, an analysis of a firm's performance by growth quantiles is also an integral part of the study.

Accordingly, issues like how a firm's experience relates to its performance; the role of experience in a firm's survival and whether experience enhances survival rates; and the incidence of high-

[2] Business income tax for manufacturing, ICT, electricity generation and distribution up to 5 years; agriculture up to 10 years; industrial park developers (10-15 years); and pharmaceutical sector enterprises (7-14 years). There are 2 more years for exporters (at least 60 percent exports), an extra 2-4 years for firms in industrial parks with a minimum of 80 percent export achievements, and 2-4 years more of exemptions based on export achievements. It also offers carrying forward loss if firms incur losses during the income tax exemption period up to half of the period but limited to a maximum of 5 income tax periods. It also provides up to 5 years personal income tax (PIT) exemptions for expatriate staff in companies located in industrial parks.

[3] Import substituting local manufacturers get customs duty reductions on imported raw materials based on their value addition ranging from 5 percent (for manufacture of electronics) to 41 percent for manufacture of wines.

growth firms in the economy and their defining characteristics are some of the research subjects studied in this thesis. In addition, it also discusses the business challenges faced by firms in the country over time to see if older and younger firms face different challenges.

1.4. Objectives of the thesis

The general objective of this thesis is examining the link between firm experience[4] and performance using survey-based data on medium and large-scale manufacturing firms in Ethiopia.

The specific objectives of this thesis are:

- examining how a firm's experience relates to its performance.
- showing how a firm's import engagement affects the likelihood of its survival.
- exploring the distribution and characteristics of high-growth firms in the economy.
- investigating the determinants of high-growth firms in Ethiopia.
- assessing the business environment that affects a firm's performance by firm age and growth categories.
- identifying causal links between a firm's age and performance.

1.5. Summary of the Chapters

The essays in the thesis discuss how a firm's experience is related to its performance in Ethiopia. We measure firm experience using three different indicators. In the first essay (Chapter 2), we create a composite index while in the second essay (Chapter 3) we use import intensity to capture firm experience. Firm age is used as a proxy for experience in the fourth essay (Chapter 5). The third essay (Chapter 4) presents the nature and determinants of HGFs. Table 1.1 gives a brief summary of the essays in the thesis.

Table 1.1. Summary of the link among the essays in the thesis

Indicators	Chapter 1	Chapter 2	Chapter 3	Chapter 4
Main objective	How a firm's experience relates to its performance.	How a firm's experience is related to its performance.	Distribution and determinants of HGFs.	Study how a firm's experience relates to its performance.
Data source	MLSM firms' survey data collected by CSA[5]	MLSM firms' survey data collected by CSA. We follow all	The World Bank's Enterprise Survey data on	MLSM firms' survey data collected by CSA,

[4] Firm experience is measured by using alternative indicators in this thesis. In the first essay (Chapter 2), we develop a composite index based on confirmatory factor analysis (CFA) to measure experience. In the second essay (Chapter 3), we use import intensity as a proxy for firm experience. The last chapter (chapter 5) uses firm age and its squared term as proxies for firm experience.

[5] The Central Statistical Agency (CSA) does a mandatory census of Medium and Large-Scale Manufacturing (MLSM) firms in Ethiopia annually.

	in Ethiopia (2000-16).	MLSM firms that entered the survey on or after 2000 up to 2011.[6]	Ethiopia for 2015.	the latest available years post 2011.
Dependent variable	Labor productivity.	Survival rate of the firms.	Growth in employment.	Growth rate and labor productivity.
Key explanatory variable	Composite experience index developed using factor analysis.	Import intensity measured as a ratio of imported raw materials to total raw materials.	Size, age, and location.	Firm age.

Method of analysis	Pseudo-panel data estimated with system GMM and fixed effects.	Survival analysis using complementary log-log regression and K-M survival plots.	Quantile regression and OLS.	Heckman's two-step procedure and fixed effects.
Main findings	A firm's performance varies directly with experience. Role of foreign employees not significant. Existence of generic input supply bottlenecks.	Import intensity improves a firm's likelihood of survival. Liability of newness and liability of adolescence in the operations. Shortage of raw materials implies higher risks of exiting.	HGFs are concentrated in the capital, service sector, and are medium sized firms. Access to finance major problem for both the groups (HGFs and the non-HGFs). Different challenges reported by firms based on their growth and location.	No relationship between firm age and performance. Convex relationship between size and a firm's growth rate. Similar challenges reported by young and old firms.
Policy implications	• More attention should be paid to solving input supply bottlenecks. More work needed on removing infrastructure supply bottlenecks such as electricity and water supply. • Facilitating import of inputs in the short run and developing own sources of inputs in the long run. • Addressing the challenges by taking into consideration firms' locations and growth differences. • Encouraging and supporting small firms. • Improving access to markets and working capital.			

6 There is an identification number mismatch and break in 2011 and that is why we must end the data at 2011.

	• Some of the existing incentive packages (for example, customs incentives) give priority to size and the employment potential of investments by a firm but capital-intensive firms outperform others and hence it is advisable to incorporate these groups of firms in the incentive packages. • Business income tax exemptions offered to firms that operate in industrial parks and have expatriate staff should be reconsidered since these firms have not shown a statistically significant higher performance (labor productivity and survival).

Source: Author's computations using CSA and WBES data.

The rest of this chapter is organized as follows. Section 2 reviews literature while Section 3 gives the methods used in the thesis. Section 4 describes the data used and the last section gives the summary of the thesis and its main findings.

2. Literature on Firm Experience, Growth, and Survival

There are competing theories that explain how a firm's experience is related to its performance. Further, a firm's experience can be measured using several variables such as CEO's experience and a firm's age and its international trade engagements. Similarly, a firm's performance can be measured by growth, productivity (labor and TFP), and survival. In this section, we review the alternative theoretical arguments that show a link between a firm's experience and performance.

2.1. Learning and experience

Three broad classes of learning theories are frequently discussed -- the rationalist or cognitive approach, the behavioral theories of learning, and the experiential learning theory (Kolb, 1984). Organizational learning draws on experience either directly or indirectly. Kolb (1984) defines learning as a process of creating knowledge through the transformation of experience. Argote and Miron-Spektor (2011) argue that experience marks the beginning of learning. They also distinguish between knowledge creation and knowledge transfer. The former is where knowledge is created from a unit's own direct experiences while the latter refers to knowledge being developed from another unit's experiences. Knowledge retention presents the third sub-process of the organizational learning process.

Learning can also be classified as direct and vicarious (Levitt and March,1988). Under direct learning, trial and error provides the basis for learning while in vicarious learning a firm relies on the experience of other firms. Levinthal and March (1993) argue that firms suffer from some myopic behavior in valuing experience and are also unable to keep a balance between explorative and exploitative motives and hence may limit the gains from experience.

Huber (1991) classified a firm's possibilities of learning into five sub-processes: inter-organizational learning; congenital learning; experiential learning; organizational grafting; and searching. In his classic work, Huber (1991) argues that congenital learning is due to employees' prior experience and knowledge acquired before the birth of a firm. Variables like CEO's prior work experience and education and employees' prior experience capture this type of learning.

Firms acquire knowledge directly through their own experience after birth by making systematic efforts to improve their performance and could learn from unintentional and unsystematic

initiatives as well. Huber (1991) calls this type of learning experiential learning. Firms may engage in several activities such as an analysis of the feedback, organizational self-appraisals, and experimentation. These represent systematic initiatives taken by firms to acquire knowledge.

Other sub-processes of learning discussed by Huber (1991) include imitation or vicarious learning, grafting, and searching. These involve learning from others by imitation, searching, and grafting. Grafting involves acquiring new members with knowledge previously unavailable in the organization. We regroup these types of learning as inter-organizational learning and use market competition to capture it.

Accordingly, the gains from experience can be classified as learning from one's own experience in business (experiential learning) (Kolb, 1984); learning from the management team's pre-start-up knowledge (congenital learning) (Huber, 1991); and learning through interactions with stakeholders and competitors (inter-organizational learning or learning from others) (Huber, 1991; Levitt and March, 1988).

The congenital learning hypothesis argues that firms which have management teams with pre-start-up experience will bring better insights and capabilities to a firm (D'Souza et al., 2017; Dunne et al., 2005). This is also called learning by hiring and involves knowledge transfers through labor mobility.

Arrow (1962) discusses learning by doing (passive learning) and learning from experience. For him, learning from repetition is subject to diminishing returns and organizations need to introduce new machines which serve as a stimulus for new learning. Thompson (2010) further establishes the passive learning theory as equivalent to the learning by doing hypothesis and defines it as "an incidental and costless byproduct of a firm's production activities." For him, learning by doing (LBD) measures the unintended productivity growth associated with the accumulation of production experience by a firm. Firm age, a firm's prior output, and employees' previous work experience can be used for capturing firm experience (Thompson, 2010).

More recently, Coad et al. (2013) came up with three inter-related theories that explain how a firm's age affects its performance - selection effects, learning by doing effects, and inertia affects. Selection effects arise when the weakest firms are eliminated from the industry resulting in an increase in the average productivity levels of the surviving firms even if the productivity levels of individual firms do not change with age. Learning by doing proposes that older firms have better financial performance because they are more experienced and benefit from learning by doing. This is discussed by Arrow (1962) and Chang et al. (2002). Firms' tendency to learn and apply new production techniques increases with time. Third, ageing can have a negative impact on firms' performance through inertia effects where firms become inflexible and face difficulties in fitting into the rapidly changing business environment in which they operate.

2.2. The role of experience in a firm's growth and productivity

Several studies have been done to address the question of what determines firm growth and productivity. Moreno and Coad (2015) presented two types of theoretical explanations of a firm's growth determinants where one relates to dynamic strategic choices within the firm while the other considers growth as purely random. Other recent studies classify determinants of firm growth into firm size, firm age, firm innovations and capabilities, entrepreneurial characteristics, and resources.

Growth varies by a firm's age and size. Young firms have higher growth rates, but also more erratic growth paths as compared to older firms (Jovanovic, 1982). This concept is called liability of newness (Hannan and Freeman, 1984; Stinchcombe, 1965). According to this argument, young firms might achieve minimum efficient scales as they struggle to overcome their liability of newness but once they have survived the first few years and have settled into their new organizational routines, growth will lose its momentum. Further, older firms may have more experience and foresight regarding their business environment and hence a smoother growth path with fewer bumps and surprises. According to the proponents of the liability of newness, new firms face cost of learning in doing business and have employees who are less familiar with each other and lack informal rules and norms that generate understanding among stakeholders (Stinchcombe,1965).

Barron et al. (1994) argue that old firms suffer from the liabilities of obsolescence and senescence. According to the liability of senescence, firms become accustomed to the existing rules, routines, and organizational structures which generate inflexibility and hence inferior performance (Barron et al., 1994; Coad et al., 2018; Hannan and Freeman, 1987; Le Mens et al., 2011). Liability of senescence was originally introduced by Hannan and Freeman (1987) as the structural inertia theory in the late 1980s. They argued that the timing of the response or the change was important in addition to pressures of adjustment inertial which increased with age.

Liability of obsolescence is due to a firm's inability to cope with changes in its external environment (Barron et al., 1994). The major difference between these two liabilities is that liability of senescence is caused by internal factors while liability of obsolescence is due to changes in the external environment.

Bruderl and Schussler (1990) incorporated these arguments and presented a non-linear relationship between a firm's performance and age. They introduced the idea of 'liability of adolescence' which conditions the effect of a firm's age on its survival on a golden age beyond which the hazard rate decreases. According to their analysis, firm performance, as captured by the risk pattern, has an inverted 'U' shaped relationship with its age.

2.3. Nexus between experience and survival

The resource-based theory of a firm is the basis of the survival analysis. The resource-based theory (RBT) argues that a firm could have superior competitive advantage over others due to its resources and capabilities which could determine both its growth and survival (Barney, 1991). RBT, which presents an alternative approach to achieving a competitive advantage, emerged in the 1980s and 1990s. Valuable and rare resources owned by a firm enable it to have a temporary competitive advantage over others. This competitive advantage can be sustained in the long run if other competitors are unable to copy or access this advantage or develop substitute inputs (Wade and Holland, 2004).

Wernerfelt (1984) defines a resource as anything which can be considered as a firm's strength or weakness including trade agreements in addition to traditional resources such as labor, capital, technology, and skills. Analyzing firms from the resource side vis-à-vis the product side, the growth strategy is found to depend not only on existing resources but also on the development of new ones. Barney (1991) argues that resources are sources of competitive advantage for firms if they are valuable, rare, difficult to imitate, and are in short supply. These resources could be

grouped into physical, human, and capital resources. Some resources are difficult to imitate because they are property-based and hence protected by property rights while others are knowledge-based and will not be copied due to knowledge barriers (Miller and Shamsie, 1996).

A firm's survival may vary systematically across firms based on their age and size and many scholars link the various liabilities to a firm's survival patterns. Accordingly, the liability of newness (Hannan and Freeman, 1984; Stinchcombe, 1965) maintains declining exit rates with age. The liability of adolescence (Bruderl and Schussler,1990; Fichman and Levinthal,1991), presents two narrations. For Fichman and Levinthal (1991), firms face a high risk of exit even during their initial phases due to loss of enthusiasm and support. Finally, the liability of senescence (Barron et al., 1994; Coad et al., 2018; Hannan and Freeman, 1987; Le Mens et al., 2011) and liability of obsolescence (Barron et al., 1994) show that older firms show inferior performance relative to the new and less experienced firms.

3. Methodological Approach and Data

3.1. Methods of Analysis

In this thesis, multiple estimation techniques are applied including system GMM, quantile regression, the complementary log-log estimation technique, Kaplan-Meier survival analysis plots, probit estimation, the Heckman selection model, and the fixed effects model. OLS estimates are also reported for comparison purposes in some chapters. The main explanatory variable is firm experience which is measured using three different indicators. In the first essay (Chapter 2), we use a composite index to measure a firm's experience developed from a confirmatory factor analysis, followed by import intensity and the firm's age in the second and fourth essays, respectively. The third essay (Chapter 4) is devoted to the study of distribution and determinants of HGFs. Details of the estimation methods in each chapter are now presented.

3.1.1. Modeling a firm's experience as a determinant of its performance (Essay 1, Chapter 2)

In the first essay the analysis is based on cohort level panel data (pseudo panel) formed by grouping individuals sharing some common characteristics. A cohort is a group of establishments with a fixed membership which is created based on some pre-defined criteria (Deaton, 1985). Researchers use time invariant characteristics such as location and birth date as criteria for forming cohorts and the averages within these cohorts are treated as observations in the analysis (Deaton, 1985; Verbeek, 2008). We formed cohorts based on three-time invariant characteristics: year of establishment, region of operations, and two-digit industry classifications based on the International Standard Industrial Classification of All Economic Activities (ISIC Rev 3.1).

We opted for pseudo panel data due to two reasons. First, there is a firm identification mismatch in the dataset for 2011 and 2012 and it was not possible to merge data before 2011 with that from the post 2011 period. Second, we observed a large number of missing firms in consecutive survey years from the mandatory census survey and we wanted to control for this behavior. Attrition rates are generally lower for pseudo panel datasets and hence the datasets are very often substantially larger since true panel datasets are subject to problems of a non-response attrition bias (Antman and Mckenzie, 2005; Deaton, 1985; Verbeek, 2008). An analysis of the data based on repeated cross-sections also serves as a link between micro and aggregate data (Moffitt, 1993). It also allows

the application of dynamic models in estimation techniques. Since the pseudo panel data method involves averaging data at the cohort level, this also eliminates individual-level measurement errors (Antman and Mckenzie, 2005).

The dependent variable was labor productivity measured as value added per employee in logarithmic form. The main explanatory variable was the composite experience index developed using a confirmatory factor analysis. The index was based on six key indicator variables as suggested by Huber (1991) which were selected based on data availability are: cohort age (AGE), import intensity of a cohort (IMPORT_INTENSITY), total wages of the employees (LWAGE), number of foreign employees in the cohort (FOREMP), degree of competition as measured by the market share of a cohort within the industry (MARKET_SHARE), and initial size of a cohort measured by the size of the initial paid-up capital (INITIAL_SIZE).

In our analysis, we used initial size and the number of foreign employees in a firm as a proxy for congenital learning and firm age, import engagement, and employee wages to capture experiential learning. Finally, we captured inter-organizational learning by the market share of a cohort in the industry. We assumed that a high degree of competition facilitated this type of learning.

In this analysis, we controlled for the effects of cohort specific and other macroeconomic variables. Capital intensity, raw material per employee, inflation, and economic growth rates are used as key control variables in addition to time, industry, and location dummies. A unique approach used in this essay is developing a composite experience indicator index to measure cohort experience and using it in a regression analysis.

The estimation technique involved use of the system GMM. After developing a composite indicator to measure firm experience drawing on Huber (1991), we used it as an explanatory variable in the regression. Pooled OLS and panel fixed effects methods' results are also reported for a comparison. Two additional estimations were done to check the sensitivity of the results to the estimation methods. First, we estimated the same model using true panel data and later replaced the index by its elements in the pseudo panel model.

3.1.2. Modeling import intensity as a determinant of a firm's survival (Essay 2, Chapter 3)

The second essay (Chapter 3) shows how import experience affects a firm's survival. It also shows how import decisions are linked to a firm's survival. A firm is said to have survived if it appears in a sequence of the annual surveys. Failure or exit could be due to the business shutting down or its inability to meet the minimum number of employees engaged to be considered in the survey (firms need to engage 10 or more employees to remain in the survey). Hence, we are unable to distinguish between those who stopped operations from those who fell below the minimum size due to the nature of the survey. In this research, firm survival is measured by the number of years a firm appears in the dataset.

The main explanatory variable in this essay is the amount of imported intermediate inputs relative to the total raw materials used by a firm. We measure firm experience by import intensity which is defined as the ratio of total value of imported raw materials to total value of raw materials used.

Firm survival is expected to be positively associated with importing intermediate inputs due to several reasons. Many scholars link importing inputs to higher firm productivity since importers can buy inputs globally from cheaper markets (Acharya and Keller, 2007; Gibson and Graciano, 2011; Wagner, 2013) and have access to new technologies through the purchase of higher quality

components (Gibson and Graciano, 2011). According to Vogel and Wagner (2010) importing inputs from abroad allows firms to focus on their competitive advantages. Importing inputs is found to have a positive effect on export engagement as it increases the probability of foreign market entry (Aristei et al., 2013; Kasahara and Lapham, 2013). Other studies have shown the positive link between import engagement and survival (Keller, 2002; Wagner, 2013)

The decision to import inputs could be endogenous and more productive firms may self-select to import. Moreover, firms in specific industries are expected to import more as there are no or limited domestic supplies of the inputs that they need. Firms also face initial uncertainty and sunk costs for entering international markets, especially export markets (Melitz, 2003). The import related sunken costs could be due to a search for reliable suppliers and establishing distribution channels while the fixed costs of importing inputs may include those for transportation and customer services (Elliott et al., 2019). To control for such effects, we used predicted import values as an alternative measure of actual imports; this helped make the endogenous import decisions exogenous.

The analysis in this essay was done using two different methods: First was the Kaplan-Meier survival model which helps understand how survival rates are associated with importing and other firm characteristics. The Kaplan-Meier survival analysis is used to show survival behavior by firm location, import intensity, firm size, and industry classifications.

The K-M survival analysis was supported by a complementary log-log regression with robust standard errors. We followed a discrete-time survival model since firm exit is reported at a discrete time (annually by CSA) even though firms exiting could be a continuous process. In the survey, entry dates are observed but exact exit dates are not observed. This type of data is called right censored incomplete spell data (Jenkins, 2005).

The estimation technique involved two steps. The first step involved estimating determinants of import intensity. There is strong evidence in the data and in theory that importers are more productive, and they self-select to import, and we need to control for this in the regression analysis. This is done by estimating a linear regression of import intensity on firm and industry characteristics such as firm age, capital stock, lagged labor productivity, location, industry size and competition, initial size, GDP, and inflation. We predict the import intensity and use it in step 2 as an explanatory variable in the complementary log-log equation to estimate hazard rates.

To check for the robustness of the results, we did two sensitivity analyses. First, we estimated the determinants of a firm's decision to exit by running a probit model. Second, we used the actual import intensity values by ignoring the endogeneity issue in the cloglog survival model.

We also used the Kaplan-Meier survival model to examine how survival rates are associated with importing and other firm characteristics. Both the distribution analysis and the Kaplan-Meier survival analysis were used to show survival behavior by a firm' location, import intensity, size, and industry classifications.

Concerning exports, very few firms (4 percent of the observations) had export engagements in contrast to the significant number of firms (58 percent of the observation) reporting positive import values. Accordingly, we did not study the role of export engagement as it is less frequent in the data.

3.1.3. Modeling determinants and distribution of HGFs (Essay 3, Chapter 4)

Essay 3 (Chapter 4) studies growth determinants and the distribution of high-growth firms in Ethiopia using data from WBES. It uses a descriptive analysis to explore the distribution of high-growth firms (HGFs) in Ethiopia using firm characteristics and other relevant factors.

The empirical model for this research closely follows Goedhuys and Sleuwaegen (2010) who modeled firm growth as a function of firm age and size after controlling for other relevant factors which they classified into three major categories: firm characteristics, technological characteristics, and firm resources.

Firm age and size, sex of the entrepreneur, and education levels of the top management are typical examples of firm characteristics. Firm resources refer to resources that enable a firm to deal with constraints arising from limited infrastructure, insecurities, and financial constraints. Further, a firm's record concerning export status, licensing technology from foreign-owned companies, ownership of a website, and delivery of training were used as a proxy for a firm's technological characteristics. In the estimation process, we further adjusted the determinants based on data availability for some of these variables.

In literature, there are multiple ways of identifying HGFs with their corresponding advantages and disadvantages. We used the modified versions of the Eurostat-OECD definition and the Birch Index. According to the OECD definition, a firm is a HGF if it meets an annualized growth rate of at least 20 percent over a 3-year period and has at least 10 employees (Eurostat- OECD, 2007). To reflect on the nature of the Ethiopian economy and following Goedhuys and Sleuwaegen's (2010), recommendation we redefined the threshold level of a firm's initial size and the minimum growth rate to 5 employees and 10 percent, respectively. Annualized firm growth was calculated as the difference between the logarithm of size between 2 years and was divided by 4 as:

$$GROWTH4 = \{\ln(S_{,2014}) - \ln(S_{,2010})\}/4 \quad (1.1)$$

Accordingly, HGFs are firms with annualized growth rate in excess of 10 percent, over the period 2010-14 and with at least 5 employees in 2010.

Birch-Index based HGFs are used as an alternative measure of HGFs in the essay. The original proposition suggested by Birch was considering firms as HGFs if the establishments had achieved a minimum of 20 percent sales growth each year, starting from a base-year revenue of at least $100,000 (Birch, 1987 cited in Henrekson and Johansson, 2010). We used a modified version of the Birch Index. The Birch-Index based criteria uses both the relative and absolute employment growth rates between two periods and is based on a multiplicative combination of the absolute growth rate and the relative growth rate (Coad et al., 2014; Hölzl, 2011). The value of this index for this study is calculated as:

$$BI = [\text{Employ't } 2014 - \text{Employ't } 2010][\frac{(\text{Employ't } 2014)}{\text{Employ't } 2010}] \quad (1.2)$$

Owing to the low incidence of HGFs in Ethiopia and to generate a comparable number of HGFs to the Eurostat- OECD based HGFs, the top 20 percent firms were used for the Birch Index based measure of HGFs.

Using these two measures, two cohorts of HGFs were identified. The Eurostat-OECD classified 137 firms as HGFs while using the BI based criteria, there were 109 HGFs. We first estimated the

Eurostat- OECD based HGFs and took the top 20 percent firms from BI to generate a comparable number of HGFs.

In the empirical section, we use a quantile regression to examine the determinants of HGFs. Since the HGFs are in the extreme tail of the conditional growth distributions, factors that affect the upper deciles can be considered as factors that generate a significant number of high-growth firms. Using a quantile regression avoids regression to the mean and shows the marginal effects at various deciles of the growth distribution. Results from the OLS estimation were used for a comparison.

3.1.4. Modeling the nexus between ageing and a firm's performance (Essay 4, Chapter 5)

The fourth essay (Chapter 5) deals with the link between ageing and a firm's performance. We measure a firm's performance by two inter-related variables to check the robustness of the results for the choice of variables. We use firm growth rate in size (that is, Growth_SIZE of employees) and labor productivity in levels as a proxy for a firm's performance. We measure labor productivity (LnLabour_Produ) as the ratio of value added per employee in logarithmic form. The total number of employees includes both permanent and temporary workers with the number of temporary workers being converted to their equivalent permanent employees by CSA.

Firm age is the key explanatory variable in this essay and is measured as the difference between the survey period and the establishment year. To capture non-linearity aspects, we also included the squared term of firm age. We used one period lagged values of age and its squared terms without transforming them to log form (AGE_t_1 and AGESQ_t_1).

The estimation techniques used in this essay involve the FE and Heckman selection models, but we started by testing Gibrat's law. This law states a firm's growth is proportional to its size (the law of proportionate effects). Mansfield (1962) summarizes the law as "probability of a given proportionate change in size during a specified period is the same for all firms in a given industry regardless of their size at the beginning of the period." pp (1030-1031). Firm growth follows a random walk (Almus and Nerlinger, 2000) or a firm's size in each period is proportional to the current size of the firm (Sutton,1997). Alternative ways of measuring firm size are available, and the common ones include amount of annual sales, current employment, and total assets (Sutton,1997).

The empirical model used in this essay to show the nexus between a firm's performance and ageing is the Heckman two-step selection model. The dependent variable is a firm's growth rate. We believe that the population of firms included in the survey is biased in favor of more productive firms. The less productive firms will leave the survey and hence the likelihood of ageing depends on a firm's performance. The selection equation shows the likelihood of firm ageing (joining the class of firms above the median age). The exclusion restriction was imposed to use lagged values of labor productivity.

A sensitivity analysis was done using labor productivity as the dependent variable in place of growth rate and estimation using the fixed effects model.

3.2 Data Source

The data used in this thesis comes from two sources. The data source for three of the four chapters is the Central Statistical Agency (CSA) of Ethiopia. Data source for the third essay is the World Bank's Enterprise Survey database (World Bank, 2015).

The Central Statistical Agency (CSA) of Ethiopia's data is yearly and mandatory on medium and large-scale manufacturing industries (MLSM) in the country. To be included in the survey, manufacturing firms must engage a minimum of 10 people and use power driven machinery. The survey covered both public and private industries in all regions of the country.

Essay 1 (Chapter 2) is based on a pseudo panel data created from the survey. The pseudo panel database covered the period 2000-16. We opted for pseudo panel data due to the large number of missing firms in consecutive surveys and identification mismatch in the post 2011 period. There was a high attrition rate of firms in the data. We categorized firms into cohorts based on three-time invariant characteristics: year of birth, region of operations, and two-digit industry classifications based on the International Standard Industrial Classification of All Economic Activities (ISIC Rev 3.1).

Firms were classified into birth cohorts based on the year they started operations. Cohorts were assigned a number from 1 to 8 based on their birth year. Eight birth cohorts were formed from the year when they started operations and by classifying years into decades starting with 1950. Those who started operations on or before 1950 were given the number 1. The remaining seven birth cohorts were formed by dividing the birth year into decades (1950s – 2010s). Similarly, we recoded firms' region of operations and condensed the classification from 11 in the survey to seven by regrouping firms according to size. Finally, the industry cohorts were formed by using the ISIC Rev 3.1 classification.

Accordingly, the analysis in Essay 1 (Chapter 2) is based on a pseudo sample of 361 cohorts observed over the period 2000-16 with 3,550 observations. The data period covers the years 2000-16.

Essay 2 (Chapter 3) is based on a panel dataset consisting of 3,170 firms and 5,518 firm-year observations covering 2000-11. We used firms which entered the survey on or after 2000 and followed them until 2011. We stopped observing these firms post 2011 because of the identification mismatch observed in the dataset. The data cleaning process includes excluding firms with no data on employment records in the last quarter of the year (that is, June) and total number of permanent employees, and firms with no wage data. Close to 8 percent of the firm re-entered the census after exiting and these observations were dropped for the analysis.

The World Bank's Enterprise Survey (WBES) database was the sole source of data for the third essay (Chapter 4). The survey was based on stratified random sampling with industry, establishment size, and region representing the three levels of stratification. The survey covered 848 firms including micro, small, medium, and large firms.

We did some data cleaning including dropping the 26 micro firms and firms with missing employment history in 2010 (to calculate the growth rate over four years). We also defined outliers in the employment data as observations that were more than three standard deviations away from the mean in 2014 to purge out the effect of a few outliers, leading to 547 firms.

In the fourth essay (Chapter 5), we use CSA's MLSM firms survey data. Under the current scenario, we preferred using the latest available survey data post 2011 and hence the data covers

all firms over the 2012-16 period. We used the post 2011 survey data due to a firm identification mismatch observed in the dataset. Panel data was constructed using the latest 5-year data from the survey leading to 7,217 firms and 12,427 firm-years.

4. Summary and Contributions

The first essay (Chapter 2) discusses the effect that a firm's experience has on its performance based on pseudo panel data for medium and large-scale manufacturing (MLSM) firms operating in Ethiopia. Cohorts of firms were formed using a firm's establishment date, region of operations, and a two-digit industry classification. The research used a system GMM method of estimation. The findings of the study show that experience was positively associated with labor productivity both in the short and long run. This positive effect of experience disappeared when we estimated the relationship using true panel data as a check for robustness. The essay also estimates the pseudo panel data model by replacing the index with its components and only cohort age and wage rate have a statistically significant effect on performance.

The main aim of the second essay (Chapter 3) is examining the effect of a firm's experience on its survival. A firm's experience is measured by the magnitude of its import input intensity. The results of the Kaplan-Meier plots, the complementary log-log, and probit estimations show that imported inputs enhanced a firm's likelihood of survival. Further, firms which reported shortage of raw materials as their key business challenge also faced higher risks of exiting. A plot of duration dependence of survival estimates showed that firms passed through the liability of adolescence (corresponding to rising exit rates initially) and liability of newness which implies declining hazards with time. The probit estimation showed that a unit increase in import intensity lowered firms' likelihood of exit by 8 percentage points. The empirical support of the positive role of imports on a firm's survival combined with the negative effect of raw material shortages on its survival shows that encouragement of more imports of inputs can be taken as a short-term policy option. The long-term solution is solving the input supply problem through the development of domestic sources of inputs.

The third essay (Chapter 4) identifies the incidence of HGFs in Ethiopia along with their business obstacles and growth determinants. The research found that HGFs were concentrated in the capital city and in the service sector while medium sized firms dominated the population of HGFs. Like the non-HGFs, access to finance was the biggest perceived obstacle to HGFs. For HGFs, tax rates were the biggest obstacle next to finance compared to informal sector activities for non- HGFs. Region-wise, access to finance was the key problem only for firms operational in Addis Ababa and Tigray while practices of informal sector dominated in Oromia region. In Amhara region, corruption was found to be the top ranked obstacle.

Firms' growth determinants were found to vary depending on their growth levels in the growth quantile distribution. The econometric estimation results show that, for HGFs, firm growth was negatively related to a firm's size (convex relationship). Export engagement, product and process innovations, and resources and overdraft facilities were all found to show a positive association with growth for the HGFs. However, the research failed to show any significant difference among firms' growth based on age, gender of ownership, competition, capacity utilization, and nationality of ownership among the HGFs. The heterogeneity in business obstacles across regions and firms' growth performance can be taken as an important lesson for policy interventions.

For non-HGFs, the key growth determinants were size and age (negative and convex), innovations and website ownership, use of alternative sources of power, access to overdraft facilities, and export engagement which had growth enhancing effects.

The fourth essay (Chapter 5) examines how a firm's age relates to its performance as measured by labor productivity and growth rate in employment using survey-based panel data of medium and large-scale manufacturing (MLSM) firms in Ethiopia. After controlling for sample selection using Heckman's selection model, we observed no relationship between growth rate and a firm's age. Concerning firm size, small firms tended to grow faster with this effect declining over time. Wage rate tended to be associated with lower growth rates in employment. When it comes to the role of other control variables, initial size, capital intensity, and firm internationalization had a positive and significant effect on a firm's growth performance.

This thesis makes several contributions to literature. It shows the links among a firm's growth, experience, and survival. We used three different indicators of experience (composite index, import intensity, and firm age) and showed how they are linked to a firm's performance. The thesis provides a comprehensive study of the link between a firm's experience and performance using data from MLSM firms in Ethiopia.

The first essay contributes to literature by introducing a composite index for firm experience. The use of a composite indicator for experience to capture a cohort's experience solves the conflicting findings of the effect of age, trade, employee experience, and other experience variables on a firm's performance. The index presents an overall picture of the association between experience and performance. Second, the use of pseudo panel data gives a longer time series data for the cohorts and controls for the attrition problem in cross-sectional firm census data.

The contribution of imported inputs to firm survival is a less studied phenomenon globally. In developing countries, the role of imported intermediate inputs in a firm's survival is not well addressed in literature; this is a gap that the second essay fills. A test of the different liabilities proposed in literature in a developing economy context is another key contribution of the thesis.

The third essay explores the less studied phenomenon of high-growth firms. Studying the distribution and growth determinants of these special types of firms is a contribution of this essay.

In the fourth essay, we extend Bigsten and Gebreeyesus's (2007) work by using the latest available CSA dataset. We use the Heckman selection model as opposed to the system GMM estimation techniques to check for the robustness of the results to variations in the estimation methods. We also capture the different liabilities faced by firms (liability of adolescence and liability of newness).

The exploration of the business environment under which different groups of firms operate is an important contribution of this thesis (Essays 3 and 4). Old and young firms reported similar types of challenges while HGFs and non-HGFs reported different challenges. An analysis of business obstacles using the region of operations as a reference point showed that there were systematic differences among the regions. The key business challenges that firms faced differed across locations and this is another important contribution of this thesis.

Finally, the Ethiopian manufacturing sector is one of the least performing sectors in the world despite a strong macroeconomic performance over the last two decades. This thesis characterized the determinants of a firm's performance by focusing on the experience variable which is a less studied phenomenon in Africa and the rest of the developing countries.

Concerning topics for future research, alternative measures of firm growth could improve the research outcomes. Another concern is the persistence of high growth firms. Daunfeldt and Halvarsson (2014) show that high-growth firms are one hit wonders and the probability of repeating the high-growth rates is very low. This issue is more complicated in Ethiopia, due to high entry and exit rates of firms in the manufacturing industry.

Another aspect left for future research endeavors is a follow-up for identifying the behavior of firms which leave the survey each year. Failure or exit from the survey could be due to the business shutting down or its inability to meet the minimum number of employees required to be considered in the survey (10 employees). The results of this thesis could improve if distinctions can be made between these two groups of firms.

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Chapter 2, Essay 1

Firm Experience and Performance: Pseudo Panel Evidence from Ethiopia

Abstract

This essay discusses the effect that a firm's experience has on its performance based on pseudo panel data for medium and large-scale manufacturing (MLSM) firms operating in Ethiopia. Cohorts of firms are formed based on three-time invariant features -- birth date, region of operations, and a two-digit industry classification. A pseudo sample of 361 cohorts observed over the period 2000-16 with 3,550 observations is used in the analysis. The study uses the system GMM (SYS_GMM) estimation technique to examine how a composite index of experiences constructed based on a confirmatory factor analysis relates to a firm's performance. The findings of the study show that experience is positively associated with labor productivity both in the short and long run. This positive effect of experience disappears when we estimate the relationship using true panel data as a check for robustness. The essay also estimates the pseudo panel data model by replacing the index with its components when only the cohort's age and market competition have a statistically significant effect on performance.

JEL classification: D22; L11; L25

Keywords: Firm performance, pseudo panel, cohort experience, and system GMM

2.1 Introduction

Ethiopia has been one of the fastest growing economies in Africa and in the world over the last few years. The economy registered an average GDP growth rate of 9.3 percent per year over the 2013-14 and 2017-18 fiscal years. The per capita nominal GDP also showed a dramatic increase over the last two decades from a very low value of USD 135 in 1999-2000 to USD 883 in 2017-18 (NBE, 2018).

Looking at the industrial sector, we see that the role of the manufacturing industries was relatively small. In 2017-18, 71 percent of the industrial output came from construction activities while 25 percent came from manufacturing industries (NBE, 2018). Hence, improving firms' performance and industrial output is a pressing challenge.

The issue of a firm's ageing and how its behavior and performance relate to this has captured the interest of several researchers (Coad, 2018; Loderer and Waelchli, 2010). The different liabilities discussed by researchers such as liability of newness; liability of adolescence; liability of senescence; and liability of obsolescence all seem to coexist and have offsetting effects on a firm's performance. A more recent and less studied issue is the effect of a firm's supply experience on

its performance. Since innovations tend to be generated by accumulated non-transferable knowledge, a firm's experience is expected to have a positive effect on its growth.

This essay investigates how a firm's performance changes with experience using pseudo panel data of firms in Ethiopia instead of using true panel data. Following a pseudo panel data approach, the analysis is based on cohort level panel data formed by grouping individuals sharing some common characteristics. A cohort is a group of establishments with a fixed membership which is created based on some pre-defined criteria (Deaton, 1985). Researchers use time invariant characteristics such as location and birth date as criteria for forming cohorts and the averages within these cohorts are treated as observations in the analysis (Deaton, 1985; Verbeek, 2008).

Pseudo panel data methods have some advantages over methods based on cross-sectional datasets. Attrition rates are generally lower for pseudo panel datasets and hence the datasets are very often substantially larger. True panel datasets are subject to problems of a non-response attrition bias (Antman and Mckenzie, 2005; Deaton, 1985; Verbeek, 2008). An analysis of data based on repeated cross-sections also serves as a link between micro and aggregate data (Moffitt, 1993). It also allows the application of dynamic models in estimation techniques. Since the pseudo panel data method involves averaging data at the cohort level, this also eliminates individual-level measurement errors (Antman and Mckenzie, 2005).

A pseudo panel dataset provides more information than data from a single cross-section but is generally regarded as inferior to a true panel data (Moffitt, 1993). A major limitation of relying on pseudo panel data is loss of individual histories useful for data transformation such as differencing and deviations from individual means (Verbeek, 2008).

This essay uses pseudo panel instead of true panel data because of problem observed regarding identification number of establishments. There is ID number mismatch in the post-2010 data with pre 2010 data on MLSM firms. An extremely large number of establishments disappear from the mandatory census survey in Ethiopia when we merge the 2010 dataset with datasets from 2011 and 2012 and the remaining latest years. Firms may have exited the survey due to two possible reasons. First, they might have closed their businesses and hence exited the industry. Second, there could have been downsizing of firms. Establishments need to engage at least 10 people to be classified as medium and large-scale manufacturing firms. Due to these reasons, true panel data suffers from a higher exit rate.

This essay makes a three-fold contribution to literature. First, the use of a composite indicator for experience to capture a cohort's experience solves the conflicting findings on the effect of age, trade, employee experience, and other experience variables on a firm's performance. The index presents an overall picture of the association between experience and performance. We expect a cohort's performance to vary directly with experience. Second, the use of pseudo panel data gives a longer time series data for the cohorts and controls for the attrition problem in the cross-sectional firm census data. Third, the Ethiopian manufacturing sector is one of the least performing sectors in the world and there is a need to study the underlying challenges that the sector is confronting.

The rest of this essay is organized as follows. Section 2 reviews related literature and Section 3 describes the methodology used. Section 4 discusses the main findings and Section 5 gives the conclusion.

2.2 Literature Review

2.2.1 Organizational learning and experience theories

Studying how firms acquire knowledge in managing and developing their businesses has been a subject of research. Some researchers have studied the sources of learning while others have studied the communities of learning. Three broad classes of learning theories are frequently discussed -- the rationalist or cognitive approach, the behavioral theories of learning, and the experiential learning theory (Kolb, 1984).

Organizational learning draws on experience either directly or indirectly. Kolb (1984) defines learning as the process of creating knowledge through the transformation of experience. Argote and Miron-Spektor (2011) argue that experience marks the beginning of learning. They also distinguish between knowledge creation and knowledge transfer. The former is where knowledge is created from a unit's own direct experiences while the latter refers to knowledge developed from another unit's experience. Knowledge retention presents the third sub-process of the organizational learning process.

Learning can also be classified as direct and vicarious (Levitt and March, 1988). Under direct learning, trial and error provides the basis for learning while in vicarious learning a firm relies on the experiences of other firms. Levinthal and March (1993) argue that firms suffer from some myopic behavior in valuing experience and are also unable to keep a balance between explorative and exploitative motives and hence may limit the gains from experience.

Huber (1991) classified a firm's possibilities of learning into five sub-processes: inter-organizational learning; congenital learning; experiential learning; organizational grafting; and searching. In his classic work, Huber (1991) argues that congenital learning is due to employees' prior experience and knowledge acquired before the birth of a firm. Variables like CEO's prior work experience and education and employees' prior experience capture this type of learning.

Firms acquire knowledge directly through their own experience after birth by making systematic efforts to improve their performance and could learn from unintentional and unsystematic initiatives as well. Huber (1991) calls this type of learning experiential learning. Firms may engage in several activities such as an analysis of the feedback, organizational self-appraisals, and experimentation. These represent systematic initiatives taken by firms to acquire knowledge.

Other sub-processes of learning discussed by Huber (1991) include imitation or vicarious learning, grafting, and searching. These involve learning from others by imitation, searching, and grafting. Grafting involves acquiring new members with knowledge previously unavailable in the organization. We regroup these types of learning as inter-organizational learning and use market competition to capture it.

Accordingly, the gains from experience can be classified as learning from one's own experience in business (experiential learning) (Kolb, 1984); learning from the management team's pre-start-up knowledge (congenital learning) (Huber, 1991); and learning through interactions with stakeholders and competitors (inter-organizational learning or learning from others) (Huber, 1991; Levitt and March, 1988).

The congenital learning hypothesis argues that firms which have management teams with pre-start-up experience will bring better insights and capabilities to the firm (D'Souza et al., 2017; Dunne et al., 2005). This is also called learning by hiring and involves knowledge transfers through labor mobility.

2.2.2 Empirical Review

Several dimensions of experience have been studied in literature with most of the studies focusing on the CEO's experience and the team leader and employees' prior experience (Easton and Rosenzweig, 2012; Hamori and Koyuncu, 2014; Propheter, 2016; Sala and Yalcin, 2012). In line with the organizational learning theory, others focus on international trade (Girma, 2014; Haile et al., 2016; Kasahara and Rodrigue, 2008; Loecker, 2013; Zaheer, 1995). Accordingly, firms are expected to learn through their own experience in business (experiential learning) (Kolb, 1984) and may benefit from the pre-start-up knowledge of the management team (congenital learning) (Huber, 1991), and through their interactions with stakeholders and competitors (inter-organizational learning or learning from others) (Huber, 1991; Levitt and March, 1988).

The opportunities associated with exposure to international trade are commonly called learning by import (LBI) and learning by export (LBE). Both exporters and importers are found to enjoy productivity premia over others (Bigsten and Gebreeyesus, 2009; Edwards et al., 2016; Girma, 2014; Halpern et al., 2015; Haile et al., 2016; Kasahara and Rodrigue, 2008; Loecker, 2013; Wagner, 2012; Zhang, 2017). Loecker (2013) found evidence of substantial productivity gains of entering export markets. Bigsten and Gebreeyesus (2009) did a study using data from the Ethiopian Central Statistical Agency (CSA) and found a positive and significant effect of export engagements on a firm's performance. They also documented the self-selection of high growth firms in the export market.

Researchers have also studied importing as a strategy for improving a firm's performance and have found supporting evidence for the positive role of imports of intermediates on productivity. Kasahara and Rodrigue (2008) show that a switch to imported intermediates increased productivity by up to 18 percent in Chile. Wagner (2012) did a literature review of the impact of imports on a firm's performance and concluded that imports had a significant effect on a firm's performance. Using data for Hungarian firms, Halpern et al. (2015) found that half of the productivity growth over the period 1999-2003 was due to imported inputs. Zhang (2017) documented static and dynamic gains due to input imports by firms using data on Columbian firms and he referred to productivity improvements as a dynamic gain. Edwards et al.'s (2016) study on the effect of imports on a firm's performance also supports these findings. Using data for firms in South Africa, the authors showed that firms using imported intermediate inputs had significant productivity premia.

Evans (1987) shows how a firm's age, size, and growth are related. He used manufacturing firms in the US. According to his findings, age plays an important role in decreasing the likelihood of failure. Further, he found a firm's growth rate to decline with firm size at a diminishing rate.

A producer's experience at the time of entry has also been found to play an important role in determining firms' performance (Dunne et al., 2005). Using the World Bank Enterprise Survey (WBES) database on firms from 27 Eastern European and Central Asian countries, D'Souza et al. (2017), found that de novo firms outperformed privatized firms because privatized firms faced the difficult task of adjusting to their new mandate of profit maximization.

Another dimension of organizational learning and experience is through managerial and educational experience in foreign countries. Based on data collected on Chinese listed companies, Yuan and Wen (2018) found that management experience (both the experience of studying abroad

and work experience) in foreign economies was positively associated with corporate innovations. Heshmati and Rashidghalam (2016) analyzed determinants of labor productivity using data on manufacturing and service sectors in Kenya. Their data source was the World Bank's Enterprise Survey database for 2013. According to their findings, CEOs' managerial experience had a positive association with higher labor productivity. Other important determinants of performance that emerged from their study include capital intensity, workers training and education, and wages which were all found to have a positive effect on labor productivity while higher female share in the labor force tended to reduce labor productivity.

A few initiatives have been taken in Ethiopia to investigate the role of a firm's experience in its performance. A recent study by Haile et al. (2016) based on a panel of 1,940 firms in Ethiopia over the period 1996-2004 showed that employment evolution was positively associated with engagement in international trade and foreign ownership of firms (FDI). Their research also showed that FDI encouraged more skilled labor as opposed to the effect of international trade. A similar study which examines the causal relationship between importing and firm productivity is by Girma (2014) who uses the same data source over the period 1996-2011 and shows that firms with import experience performed better thus supporting the hypothesis of learning by importing (LBE) and their productivity gains were small. Using Levinsohn-Petrin (LP) estimates, a 1 percent increase in the share of imported inputs increased a firm's productivity by 0.02 percent immediately and by 0.01 percent in the next period. This result was obtained despite more productive firms' self-selection in importing. Another relevant study is by Bigsten and Gebreeyesus (2009) who examined the role of export engagement in a firm's performance. They used CSA survey data for 1996-2004 and confirmed the positive effect of exports on a firm's productivity hence showing learning by exporting.

2.3 Methods

2.3.1 Conceptual framework

The analysis in this study is based on the organizational learning theory. According to this theory, organizations learn through a continuous organization-wide process that involves responding to and learning from both internal and external changes. It refers to an adaptive process that exploits and explores organizational knowledge to respond to changing circumstances (March, 1991). A key facet of organizational learning is acquiring knowledge and gaining understanding from experience.

In empirical research, experiential learning is measured by using proxy variables such as a firm's engagement in international trade (both importing and exporting), investments in research and development (R&D), lessons from extreme performance (Kim et al., 2009; March et al., 1991), and a firm's age. Congenital learning, on the other hand, has been predominantly measured by using prior experience of the CEO and higher-wage employees. A firm's inter-organizational learning experience is usually expected to operate through interactions with stakeholders and competitors.

We developed a composite indicator to measure firm experience drawing on Huber's (1991) work. Due to problems associated with the data, we limited the analysis to the variables for which data was available. In our analysis, we used initial size and the number of foreign employees in a firm as a proxy for congenital learning and firm age, import engagements, and employee wages to

capture experiential learning. Finally, we captured inter-organizational learning by the market share of a cohort in the industry. We assumed that a high degree of competition facilitated this type of learning.

A unique approach used in this essay is developing a composite experience indicator index for measuring the cohort's experience and using it in a regression analysis. We used a factor analysis to develop the composite index. Hence, Equations 2.1 and 2.2 show that a firm's performance relates to its experience unidirectionally as:

$$(2.1)\quad Perofrmance_{ci,t} = f\{Experience_{ci,t}, X_{ci,t}, \varepsilon_{i,t}\}$$

$$(2.2)\quad Experience_{ci,t} = f\{AGE_{ci,t}, \text{IMPORT\_INTENSITY}_{ci,t}, \text{LWAGE}_{ci,t}, \text{FOREMP}_{ci,t}, \text{MARKET\_SHARE}_{ci,t}, \text{INITIAL\_SIZE}_{ci,t}\}$$

where $X_{ci,t}$ shows a set of conditional explanatory variables and $Experience_{ci,t}$ is the experience index constructed from the factor analysis and replaced by $INDEX_{c,t}$.

2.3.2 Measuring a firm's performance and other explanatory variables

The dependent variable is labor productivity and we measured it as the natural logarithm of value added per employee. Value added was estimated as the difference between total value of production and total value of raw materials per employee. CSA's survey covers both permanent and temporary workers adjusting seasonal and temporary workers to equivalent full-time workers (CSA, 2016.)

A composite experience index was developed by assigning weights derived from the factor analysis.[7] A factor analysis was preferred to a principal component analysis because the indicators used in the index were based on a pre-specified theory. According to OECD (2008), it is better to use a factor analysis when there is a model or an assumption about the factors that are the basis of the composite index in the data.

The index was based on six key variables that captured the cohort's experience. These indicators were selected based on Huber's (1991) proposition and also the data available. The indicators used in the factor analysis are cohort age (AGE), import intensity of a cohort (IMPORT_INTENSITY), total wages of the employees (LWAGE), number of foreign employees in the cohort (FOREMP), degree of competition as measured by the market share of a cohort within the industry (MARKET_SHARE), and initial size of a cohort measured by the size of the initial paid-up capital (INITIAL_SIZE).

Deaton (1985) recommends weighting of each observation before aggregation by the square root of the cohort's size given that cohorts are very different in size. Accordingly, we applied weighting to the data by the square root of the cohort size. INDEX_CLASS dummy was also created to further study how cohort experience related to performance. Cohorts were classified into three based on their index scores. Cohorts whose experience score was below the first quartile were classified as cohorts with low experience and those with experience scores above the third quartile were classified as highly experienced ones. The middle 50 percent of the distribution whose

[7] The results of the factor analysis are not reported here due to space constraints.

experience score fell between the first and the third quartile were considered as moderately experienced cohorts.

We estimated capital stock $K_{(t)}$ using the perpetual inventory method for a cohort as:

(2.3) $$K_{ct} = K_{c(t-1)} + I_{ct} - (\delta + S)_{ct}$$

where δ_{ct} shows the amount of depreciation while S_{ct} stands for the portion of capital sold, and $K_{c(t-1)}$ is previous year's capital stock. I_{ct} shows annual investments by the cohorts.

We measured import intensity by taking the ratio of the value of imported intermediate inputs to total raw materials. Firms were classified as 'import-dependent' if the import intensity ratio was at least 50 percent or more and the remaining were considered as 'domestic resource-based firms.'

Raw material intensity measures the amount of raw materials used per employee. We used non-food or core inflation as a proxy for inflation since it is more appropriate for producers relative to the consumer price index. The real GDP growth rate was used for controlling the effects of the macroeconomic performance on the cohorts. Cohort age was measured as the difference between the survey year and a firm's birth year.

2.3.3 Empirical Model

Based on the extended version of the neoclassical Cobb-Douglas production function, we estimated the factor demand model for a cohort in Equations 2.4-2.7:

(2.4) $$Y_{c,t} = f(K, L, M, Experience).$$

where capital stock is estimated using the perpetual inventory method as $K_{c,t} = K_{c,(t-1)} + I_{c,t} - (\delta + S)_{c,t}$ for a cohort. δ shows the amount of depreciation while S stands for the portion of capital sold, and $K_{c,(t-1)}$ is the previous year's capital stock. L captures the number of employees, M stands for intermediate inputs, while $INDEX_{c,t}$ is our index for cohort experience. I_{ct} shows annual investments by the cohorts.

(2.5) $$Y_{c,t} = f({K_c}^{\gamma}, {L_c}^{\alpha}, {M_c}^{\lambda}, {INDEX_c}^{\beta})$$

Taking the natural log on both the sides, we have:

(2.6) $$ln\, Y_{c,t} = \theta_0 + \gamma\, ln(K_{c,t}) + \alpha\, ln(L_{c,t}) + \lambda\, ln(M_{c,t}) + \beta\, ln(INDEX_{c,t})$$

(2.7) $$\ln \bar{y}_{c,t} = \theta_0 + \gamma \ln(\bar{K}_{c,t}) + \alpha \ln(\bar{L}_{c,t}) + \lambda \ln(\bar{M}_{c,t}) + \beta \ln(INDEX_{c,t})$$

Since we are estimating a pseudo panel, we used the cohort's means for all the observations as presented in Equation (2.7). Cohort fixed effects might vary over time since firms join and leave the census. There could also be endogeneity and heteroscedasticity problems in the data. Lagged values of the dependent variable might affect current performance. To account for such problems, we estimated a two-step system-generalized method of moments (SYS_GMM). Pooled OLS and panel FE are also reported for a comparison. The FE model controls for individual specific effects

and hence leads to a better outcome although it fails to account for autocorrelation and endogeneity problems. The system GMM technique corrects all such problems. Accordingly, we estimate Equation (2.8) using a two-step SYS_GMM as:

$$(2.8) \quad \text{Lproductivity}_{(c,t)} = \phi \text{Lproductivitylag}_{c,t} + \beta INDEX_{c,t} + \gamma Z_{c,t} + \mu_c + \alpha_t + e_{ct}$$

where $\text{Lproductivity}_{(c,t)}$ is the natural log of labor productivity measured as value added per employee and $\text{Lproductivitylag}_{(c,t)}$ is the lagged value of labor productivity. $INDEX_{c,t}$ is the composite index that measures a cohort's experience and it is the main explanatory variable. $Z_{c,t}$ is a host of control variables such as the cohort's current size, capital, employee experience, location, industry classification, economic growth, and inflation. α_t is the time dummy and μ_i is the unobserved cohort-specific fixed effects. ϕ, β, *and* γ are parameters to be estimated; c is the number of cross-sections (=1,…,N); t is the number of time series (=1,…,T); and e is the error term.

We estimated averages within the cohorts and treated these averages as individual observations in the pseudo panel analysis. Eight birth categories, seven region categories, and 10 industry categories were used to form the cohorts.

Rather than differencing the previous values from the current values of the variables, we used orthogonal deviations as instruments for the endogenous variables as proposed by Arellano and Bover (1995). This involves subtracting the mean of the remaining future observations from the contemporaneous values of a variable. A system GMM estimation was preferred because it uses more moment conditions and is efficient and robust to heteroscedasticity and autocorrelation problems. It is also appropriate when we have a small T and a large number of observations and when the independent variables are not strictly exogenous. It also corrects for fixed individual effects (Roodman, 2009).

The long run effect was estimated for variables which had a statistically significant effect in the short run. The long run effects of the k^{th} parameter were estimated by estimating Equation (2.9) as:

$$(2.9) \quad LR\_effect = \beta_k / (1 - \Phi)$$

where ϕ is the coefficient of the lagged dependent variable and β_k is the short run coefficient of a statistically significant variable.

Two sensitivity analyses were done to check the robustness of the results against measurement issues. First, we replaced the experience index by its components (that is, cohort age, import engagement, employee wages, number of foreign employees, market share of a cohort in the industry, and initial size). This allowed us to see which elements of the index were driving its effect.

Second, we repeated the estimations using true panel data. Although there seems to be some discontinuity and deviations in the identification number of firms in some years (particularly post 2010), we can use the true panel data for comparison purposes.

2.3.4 Data and Descriptive Statistics

The pseudo panel database is formed based on medium and large-scale manufacturing firms operational in Ethiopia over the period 2000-16. The survey was administered annually by the Central Statistical Agency (CSA) to firms which had a minimum of 10 employees and used power driven machines. There was a high attrition rate of firms in the data and to overcome this problem, we constructed pseudo panel data by categorizing firms in cohorts based on three time invariant characteristics -- year of birth, region of operations, and two-digit industry classifications based on the International Standard Industrial Classification of All Economic Activities (ISIC Rev 3.1).

Firms were classified into birth cohorts based on the year in which they started operations. Cohorts were assigned a number from 1 to 8 based on their birth year. Eight birth cohorts were formed from the year when they started operations and by classifying years into decades starting with 1950. Those who started operations on or before 1950 were given the number 1. The remaining seven birth cohorts were formed by dividing the birth year into decades (1950s-2010s). Similarly, we recoded firms' regions of operations and condensed the classification from 11 in the survey to seven by regrouping firms according to size. Finally, the industry cohorts were formed by using the ISIC Rev 3.1 classification.

Hence, we had 361 cohorts and 3,550 observations. This is an unbalanced panel dataset in which a cohort was observed on average for close to 10 years. The panel was based on 27,504 firms.

Labor productivity was measured by value added per employee and the average value was Birr 46,172 while the average cohort size was around 279 employees. Imports of intermediate inputs were also common among the cohorts. Import intensity as measured by the ratio of imported raw materials to total raw materials shows high intensity. On average, a little over half (50.6 percent) of the inputs came from abroad for all the observations.

As per UNIDO's (2018) definition most MLSM firms in Ethiopia fall in the category of low technology firms. From the data set, cohorts in the manufacture of chemicals and chemical products industries fall in the category of medium-high and high technology industries and they account for only 7 percent of the population. The remaining cohorts belong to either medium or the low technology industries. Close to 50 percent of the cohorts fell in the category of low technology industries; 30 percent of the observations were cohorts representing medium technology industries. Product category of some 10% cohorts was not captured in the data and was reorganized as "other" categories for ease of analysis.

The composite index developed for capturing firm experience showed that the cohorts were less experienced in general with a maximum score of 41 out of a possible 100 points. The mean score was around 13 points showing low experience. Cohorts were categorized into three groups based on their scores on the experience index as cohorts with low, moderate, and high experience. Cohorts whose experience index score was below the lowest quartile (25^{th} percentile and below) were considered as having low experience and cohorts whose experience index score was in the upper quartile (75^{th} percentile and above) of the distribution were classified as cohorts with relatively higher experience. The rest of the cohorts whose experience index fell between the first and the third quartiles were categorized as medium experienced cohorts (see Table 2.1 for a summary of the key variables).

Table 2.1. Summary Statistics of the Variables

Variable Name	Definition and Measurement	Obs	Mean	Std.Dev.	Min	Max
LnProductivity	Ln of labor productivity measured as value added per employee	2907	10.75	1.57	-2.35	16.48
LnSIZE	Natural log of total number of employees in a cohort	3546	4.69	1.43	0.00	9.3
LCAPITAL_NEW_INT	Per capita capital stock measured using the perpetual inventory method (ln)	3491	10.59	1.8	-6.32	15.45
IMPORT_INTENSITY	Import intensity measured as a ratio of imported raw materials to total raw materials	3183	0.49	0.35	0.00	1.00
INDEX	Composite experience index based on age, import intensity, wage, industry competition, initial size, and number of foreign employees	3042	13.12	4.19	5.6	40.91
LnWAGE	Ln of total wages paid	3,553	13.8	1.97	0.00	20.56
FOREMP	Number of foreign employees	3550	2.66	13.48	0.00	306.19
AGE	Cohort age measured as the difference between the survey year and operation year	3440	22.87	19.21	0.00	105.0
HHI_SALES	Industry competition captured by HHI using sales	3550	1579.4	783.83	687.3	4879.0
Econ_ growth	The real GDP growth rate	3550	8.91	3.69	-2.10	12.60
INFLATION	Inflation measured by non-food (core) inflation	3550	10.75	7.6	0.2	23.8
LMATERIALS_INT	Natural logarithm of intermediate inputs intensity	3183	10.95	1.58	3.44	16.77
tdm	Year dummy	17 years (2000-16)				
Cohorts	Number of cohorts	361 cohorts				
Observations	Total number of observations	3,550 observations				

Source: Author's computations using CSA data.

Concerning the macroeconomic variables, the economy registered a very high growth rate as evidenced by 8.9 percent average growth rate of real GDP and a relatively high inflationary pressure indicated by the core inflation rate of 10.75 over the study period.

Table 2.2 gives additional descriptive statistics on the cohorts based on their experience category. A closer look at the mean values in Table 2.2 shows that cohorts with low experience were also smaller in size (about 83 employees) relative to the other two groups. Cohorts in the high experience category had around 199 employees on average showing a firm's growth over time.

More experienced firms were found to be superior to less experienced firms in many dimensions. On average, they were more productive and had higher gross sales. Average labor productivity was around Birr 30,946 for the low experienced cohorts while this figure jumped to Birr 75,357.6 for the most experienced groups. The medium experienced cohorts had a mean labor productivity value of Birr 49,513.5. There was also a big difference in the average sales value for these groups. The mean sales value of the highly experienced cohorts was more than twice the corresponding value of the moderately experienced cohorts and nearly seven times that of the low experienced cohorts.

Experienced cohorts had two disadvantages relative to the less experienced cohorts as can be seen in the data in Table 2.2. More experienced firms had higher total costs and hence lower profit margins.

Table 2.2. Mean values of key variables by experience category

Experience Index	Experience index score	SIZE	Labor produ. (ln)	Profit Margin	SALES (000')
Low experience	8.65	82.76	9.92	(0.84)	7838.55
Medium experience	12.48	182.40	10.93	(2.54)	77300.00
High experience	18.88	198.98	11.25	(1.02)	197000.00
Full sample	13.12	161.58	10.75	(1.74)	90000.00

Source: Author's computations using CSA data.

2.4 Empirical Results

2.4.1 Results and Discussion

Firms face multiple factors with divergent effects on their performance that operate simultaneously. For example, firms develop capacity with age, but they may also become rigid to change. Likewise, importing allows firms to access cheap and alternative inputs but it could also increase risks of exit due to input availability and prices. This is why we need a composite index to show how performance varies with experience.

Table 2.3 gives the results of the empirical models. Concerning the effects of the main explanatory variable (cohort experience) on performance, we see that experience was positively associated with a cohort's performance under all the methods of estimation. The results of the two-step system GMM also show that more experienced cohorts outperformed the less experienced ones and this result was statistically significant at the 5 percent significance level. A one-unit increase in the experience score led to a 0.108 percentage point increase in the log of labor productivity other things remaining the same. This shows that firm experience is an important determinant of performance. This is equivalent to a 11.5 percent increase in labor productivity following a unit

increase in the experience index score.[8] The OLS and FE estimates, which were reported for comparison purpose, showed a positive and statistically significant effect on performance.

Looking at the effect of lagged labor productivity on a cohort's performance, we observed that there was a positive and inelastic relationship between labor productivity and its lagged values. Estimates showed a positive and statistically significant effect of lagged labor productivity on current firm performance under all estimation methods (pooled OLS, FE, and system GMM). This captures the dynamic effect of labor productivity on a firm's performance. Considering the GMM model, a 10 percent increase in current labor productivity led to a 1.07 percent increase in labor productivity in the following year other things remaining the same.

Similarly, intermediate inputs intensity and a cohort's capital intensity had positive and statistically significant effects on its performance irrespective of the method of estimation. Given that these variables were measured in log form, the coefficients show their respective elasticities. For example, an increase of 10 percent in intermediate input intensity tended to be associated with a 4 percent increase in labor productivity and only a 1.2 percent growth was observed for a comparable change in capital stock. Hence, the relationship between a firm's performance and intermediate and capital input use is inelastic. Intermediate inputs tend to be associated with stronger variations in labor productivity relative to a change in capital stock.

Cohort size had a statistically significant non-linear effect on labor productivity. Productivity increases at an increasing rate for small firms and later the rate increases at a decreasing rate since the squared term showed a negative and significant effect on performance. Besides supporting young firms, attention should also be paid to ageing cohorts to address this negative relationship.

The two macroeconomic variables included in the regression (growth and inflation) had an insignificant effect on a firm's performance under all specifications. A cohort's location, time, and industry effects were controlled for in all these estimations. Robust standard errors are reported for the SYS_GMM estimation.

The overall test of significance and robustness tests were also done. The Hansen test for instruments over-identifying restrictions confirmed the adequacy of the instruments. Similarly, we also conducted the Arellano and Bond (AR) test for autocorrelation and the results supported the consistency of the GMM estimators with second order instruments.

Table 2.3. System GMM Estimates (Dependent Variable: labor productivity (log))

VARIABLES	Pooled OLS	FE (Panel)	SYS_GMM
L.Lproductivity	0.237***	0.084***	0.107*
	(0.019)	(0.020)	(0.057)
LnMATERIALS_INT	0.443***	0.491***	0.406***
	(0.022)	(0.029)	(0.054)
LnSIZE	-0.065	0.289**	1.847*
	(0.109)	(0.143)	(0.977)
LnSIZESQ	0.009	-0.025*	-0.196**

[8] When the dependent variable is in log and the explanatory variable is in levels, we can estimate a percent change in the dependent variable as $\%\Delta L.productivty = 100(e^{\beta} - 1)percent$.

	(0.011)	(0.014)	(0.099)
LnCAPITAL_NEW_INT	0.159***	0.149***	0.118**
	(0.018)	(0.022)	(0.057)
INDEX	0.0484***	0.066***	0.108***
	(0.007)	(0.016)	(0.036)
Econ_growth	0.004	0.003	0.002
	(0.0413)	(0.0394)	(0.007)
INFLATION	0.086**	0.048	0.004
	(0.039)	(0.039)	(0.008)
Industry cohort	Yes	No	Yes
Year dummy	Yes	Yes	Yes
Location dummy	Yes	Yes	Yes
Number of instruments			78
GMM instrument lag			1/16
AR (1)			0.000
AR (2)			0.696
Hansen test			0.119
Constant	0.542	1.056	-1.596
	(0.537)	(0.650)	(1.849)
No. of observations	2,066	2,066	2,066
R-squared / F -statistic	0.624	0.457	38.97
Number of groups		288	288

Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, and * p<0.1.
Source: Author's computations using CSA data.

Table 2.4 gives a summary of the long run effects of the variables. The experience index continued to be significant even in the long run and a one-unit increase led to 0.12 percentage point increase in the expected natural log of labor productivity. The experience index had a similar short run and long run effect on performance. The short run effect of intermediate inputs and capital persisted and remained statistically significant in the long run with the same sign as in the short run and with comparable magnitudes. Cohort size effect remains significant in the long run too.

Table 2.4. Long run effects of the explanatory variables (Dependent Variable: labor productivity (log))

Variable Name	Coefficient	Std. Err.	p-value
LnMATERIALS_INT	0.455	1.075	0.054
LnSIZE	2.068	0.058	0.000
LnSIZESQ	-0.219	0.108	0.043
LnCAPITAL_NEW_INT	0.132	0.063	0.035
INDEX	0.121	0.039	0.002

Source: Author's computations using CSA data.

2.4.2 Robustness Checks

To check for the robustness of the estimated results, we used three different approaches. The first attempt was to estimate similar relationship using true panel data[9] (Table 2.5). The second robustness check was to replace the index by its elements and re-ran the pseudo panel model (Table 2.6). Finally, we reconstructed the index again by replacing total wage and initial paid-up capital stock by per capita wage and capital intensity. This last step was done to correct for biases, if any, that may arise due to use of total values wage and capital in the first index. Results are reported in Table 2.7 below.

Table 2.5 gives the estimation results based on true panel data estimations. We developed a new experience index based on the true panel data and adopted the models to check for consistency and robustness. The main explanatory variable (the firm experience index) became insignificant under the current scenario in the GMM estimation but showed a positive association with a cohort's performance under the FE and OLS estimation techniques.

Table 2.5. Robustness checks using true panel data

VARIABLES	Pooled OLS	FE(Panel)	SYS_GMM
LnProductivity	0.265***	-0.126***	0.107**
	(0.001)	(0.014)	(0.043)
AGESQ	-0.000***	-0.000***	-0.000
	(0.000)	(0.000)	(0.000)
LnSIZESQ	-0.038***	-0.183***	0.002
	(0.009)	(0.020)	(0.126)
LnMATERIALS_INT	0.333***	0.397***	0.106
	(0.012)	(0.021)	(0.129)
LnCAPITAL_NEW_INT	0.114***	0.095***	0.221***
	(0.009)	(0.014)	(0.059)
INDEX	0.133***	0.145***	0.067
	(0.013)	(0.027)	(0.100)
Econ_growth	-0.051	-0.004	0.003
	(0.034)	(0.053)	(0.011)
INFLATION	0.013	0.043	0.035*
	(0.028)	(0.035)	(0.02)
Industry cohort	Yes	No	Yes

[9] We ignored the panel attrition and firm identification mismatch and created a new panel dataset for this analysis. There is a problem of firm identification number in the survey (especially in 2011).

Year dummy	Yes	Yes	Yes
Location dummy	Yes	Yes	Yes
Number of instruments			76
GMM instrument lag			1/16
AR (1)			0.000
AR (2)			0.696
Hansen test			0.456
Constant	2.397***	6.510***	4.911***
	(0.334)	(0.700)	(1.296)
No. of observations	7,385	7,385	7,385
R-squared / F -statistic	0.492	0.240	50.28
Number of groups		3,181	3,181

Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, and * p<0.1.
Source: Author's computations using CSA data.

This could be due to too many firms leaving the survey every year. Overall, too many firms were excluded due to the lag structure and identification problems. Concerning the other explanatory variables, lagged labor productivity, capital intensity, and inflation tended to have positive effects.

We also did a second test for robustness by dropping the index and using its components independently in the regressions. We used age and size including their squared terms, employee wages, industry competition, import intensity, initial size, and the number of foreign employees separately in the estimations. We treated labor productivity, import intensity, and amount of intermediate inputs as endogenous variables.

Table 2.6 gives a summary of the results. Lagged labor productivity had a positive effect on current productivity levels lending support to the persistent effect of the dependent variable. The coefficient of lagged labor productivity in the SYS_GMM was rightly between the OLS and FE values and its value was less than unity showing the stability of the variable.

From the six components of the index, a cohort's age and wage rates were found to have positive and statistically significant effects on a cohort's performance based on the results of the GMM estimation. These two components tended to drive the effect of the composite index in the study with age showing a non-linear effect. Cohort age had a non-linear relationship with performance with the squared term showing a negative and significant effect as opposed to the positive effect of age at levels. The remaining four elements of the composite index (cohort size, import intensity, industry competition, and number of foreign employees) did not have a statistically significant effect on the cohort's performance. This contrasts with Girma's (2014) findings of a small positive effect of import intensity on a firm's performance using firm level data from Ethiopia.

Capital intensity and amount of raw materials used had a positive effect on performance. From the two macroeconomic performance variables included in the analysis the core (non-food) inflation rate had a positive association with a cohort's performance.

Looking at the results of the FE estimation technique, we see that lagged labor productivity, capital stock, use of intermediate inputs, cohort's wage expenditure, initial size, and industry competition had a positive and significant effect on its performance. Under this estimation method, cohort size

had a negative and significant effect on the performance as opposed to age, which now became insignificant. Like the GMM method, import intensity had a statistically insignificant effect on a firm's performance under the FE model.

Number of foreign employees did not show a significant effect. Cohorts that hired foreigners did not have any significant benefits of labor productivity under all the three model specifications.

Time, industry, and location effects were controlled for in all the estimations. The Arellano-Bond test of autocorrelation and the Hansen test of instrument over-identification were all done.

Table 2.6. Robustness checks using pseudo panel data without the index

VARIABLES	OLS	FE	SYS_GMM
LnProductivity	0.205***	0.079***	0.154***
	(0.018)	(0.019)	(0.043)
LnMATERIALS_INT	0.315***	0.317***	0.348**
	(0.023)	(0.029)	(0.143)
LnCAPITAL_NEW_INT	0.105***	0.092***	0.123**
	(0.020)	(0.023)	(0.061)
AGE	0.006*	-0.003	0.024**
	(0.003)	(0.018)	(0.012)
AGESQ	0.000	0.000	-0.000*
	(0.000)	(0.000)	(0.000)
SIZE	-0.614***	-0.294**	-0.251
	(0.118)	(0.145)	(1.538)
LnSIZESQ	0.004	-0.033**	-0.030
	(0.010)	(0.013)	(0.150)
IMPORT_INTENSITY	-0.078	-0.054	-0.494
	(0.072)	(0.086)	(0.344)
LnWAGE	0.403***	0.406***	0.409***
	(0.037)	(0.042)	(0.124)
FOREMP	0.001	0.001	0.002
	(0.002)	(0.002)	(0.002)
MARKET_SHARE	0.030***	0.049***	0.026
	(0.004)	(0.005)	(0.044)
INITIAL_SIZE	0.0112	0.035**	-0.012
	(0.015)	(0.017)	(0.090)
Econ_growth	0.005	0.001	0.003
	(0.039)	(0.037)	(0.006)
INFLATION	0.112***	0.08**	-0.002
	0.205***	0.079***	0.154***
Industry cohort	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes
Location dummy	Yes	Yes	Yes
Number of instruments			98
GMM instrument lag			1/16
AR (1)			0.000
AR (2)			0.596

Hansen test			0.246
F-test	98.08	65.74	57.35
P-value	0.000	0.000	0.000
Constant	-0.449	0.469	-0.168
	(0.572)	(0.707)	(3.390)
Observations	2,113	2,066	2,113
R-squared	0.648	0.506	
Number of COID	2,113	290	290

Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, and * p<0.1.

Source: Author's computations using CSA data.

Modification of the composite index using wage rate and initial capital per employee as opposed to total wage and capital stock results in similar outcome to main estimation results reported in Table 2.3. The major difference that we observe here is that firm size is no more significant since several explanatory variables are measured on per unit basis. The experience index is still significant with slightly lower magnitude.

Table 2.7. System GMM Estimates with new index (Dependent Variable: labor productivity (log))

VARIABLES	Pooled OLS	FE (Panel)	SYS_GMM
L.Lproductivity	0.233***	0.091***	0.128**
	(0.019)	(0.020)	(0.056)
LnMATERIALS_INT	0.427***	0.431***	0.396***
	(0.022)	(0.028)	(0.054)
LnSIZE	-0.043	0.332**	1.743
	(0.106)	(0.134)	(1.257)
LnSIZESQ	0.008	-0.040**	-0.157
	(0.011)	(0.013)	(0.129)
LnCAPITAL_NEW_INT	0.176***	0.144***	0.104*
	(0.018)	(0.022)	(0.063)
INDEX_NEW	0.048***	0.162***	0.072***
	(0.005)	(0.019)	(0.027)
Econ_growth	0.005	0.014	-0.000
	(0.041)	(0.038)	(0.007)
INFLATION	0.077**	0.035	0.005
	(0.038)	(0.036)	(0.008)
Industry cohort	Yes	No	Yes
Year dummy	Yes	Yes	Yes
Location dummy	Yes	Yes	Yes
Number of instruments			78
GMM instrument lag			1/16

AR (1)			0.000
AR (2)			0.799
Hansen test			0.015
Constant	0.542	1.056	-1.596
	(0.537)	(0.650)	(1.849)
No. of observations	2,113	2,113	2,113
R-squared / F -statistic	0.620	0.467	37.06
Number of groups		290	290

2.5 Conclusion and Policy Implications

The main aim of this study was examining the link between a firm's experience and performance using a pseudo panel dataset constructed from the annual MLSM firms' census in Ethiopia; the census was done by CSA. The census included all firms in the manufacturing sector which had a minimum of 10 employees and used power-driven machines. Pseudo panel data was preferred to control for firm attrition and using a large dataset. The data covered 17 years (2000 -16).

The dependent variable was labor productivity and it was measured as value added per employee in a logarithmic form. The estimation method was a two-step system-GMM technique. The key explanatory variable was cohort experience and a composite index was developed based on the organizational learning theory proposed by Huber (1991). The index was developed using a confirmatory factor analysis.

The main finding of this study is a positive and statistically significant effect of a cohort's experience on its performance. A one-unit increase in a cohort's experience is associated with about a 11 percent increase in labor productivity in the short run. The effect of experience on a firm's performance was positive and statistically significant even under the OLS and FE models with a relatively lower magnitude. Cohorts in the lower quartile of experience distribution had statistically significant lower performance relative to more experienced cohorts. This supports the hypothesis of learning by doing and needs to be developed further. A cohort's age and wage rate tended to drive this positive effect of experience on the cohort's performance as evidenced in the sensitivity analysis. The effect of age on firm-level true panel data, however, showed that age did not affect a firm's performance. This could be due to a high rate of firm attrition from the survey and the cohort level analysis allowed us to capture experience over longer periods of time.

The effects of the other control variables were also studied. There was a positive relationship between a cohort's performance and the lagged value of labor productivity, use of intermediate inputs, and capital stock. The two macroeconomic variables included in the regression (growth and inflation) had a statistically insignificant effect on a firm's performance based on the output from the SYS_GMM regression.

This study has some important policy implications. At the cohort level, we see that there is accumulation of learning and a positive role of age and experience in a cohort's experience although the composite experience index was insignificant in the true panel data estimations. At the cohort level, experience mattered and needs to be taken into consideration. This view is quite important when we notice that the MLSM firms in Ethiopia are predominantly low-technology firms. From the cohorts in the dataset, only 7 percent of the cohorts qualified as medium-high and

high-technology industries according to the OECD classification. We have many traditional low-technology firms and their experience shows added value in the performance measurement, especially in the cohort level analysis.

Encouraging and supporting small firms could be useful for the economy given that size has a negative and statistically significant effect on performance.

Use of intermediate inputs, wage rates, and capital stock had a positive effect on a firm's performance as expected. More attention should be given to solving input supply bottlenecks to sustain a firm's performance in the future.

The fact that import intensity did not have a statistically significant effect on a cohort's performance presents a big concern about the provision of duty-free imports to firms. One of the biggest business obstacles in the manufacturing sector is lack of intermediate inputs. A little more than 45 percent of the cohorts reported that lack of inputs was their major current problem. Firms relied on imported inputs to solve their input supply problems and these firms did not have statistically significant productivity premia relative to those who did not import or imported a lesser proportion of their inputs from abroad.

The persistent nature of a cohort's performance due to the significant effect of the lagged values of labor productivity also shows that past performance matters and needs to be considered when analyzing a firm's performance.

Cohorts with a higher number of foreign employees did not show a statistically significant difference in their performance relative to those with low or no foreign employees. This could be due to a low proportion of firms with foreign employees in the dataset or firms' low absorptive capacities and weak knowledge transfers. Or it could be due to the quality and relevance of foreign employees in a firm. It will be useful to examine the quality and quantity of foreign experts and their role in enterprises in the future.

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Chapter 3, Essay 2

Imported Inputs and a Firm's Survival: Evidence from Ethiopia

Abstract

The main aim of this essay is examining the effects of a firm's experience on its survival as measured by one period lagged values of its imported inputs. The analysis is based on a sample of 3,170 medium and large-scale manufacturing (MLSM) firms and 5,518 firm-year observations in Ethiopia. It does complementary log-log and probit estimations to show how import intensity affects a firm's survival. It also uses the Kaplan-Meier survival analysis plots. The results of the Kaplan-Meier plots, the complementary log-log, and probit estimations show that imported inputs enhance a firm's likelihood of survival. Further, firms which reported a shortage of raw materials as their key business challenge also faced higher risks of exiting. A plot of duration dependence of survival estimates shows that firms pass through the liability of adolescence (corresponding to rising exit rates initially) and liability of newness which implies declining hazards with time. The probit estimation shows that a unit increase in import intensity lowers firms' likelihood of exit by 8 percentage points. The empirical support of the positive role of imports on a firm's survival combined with the negative effects of raw material shortages on a firm's survival show that encouraging more imports of inputs can be taken as a short-term policy option. The long-term solution is solving the input supply problem through the development of domestic sources of inputs.

JEL classification: L11; L25

Keywords: Kaplan-Meier; firm survival, imports; complementary log-log; Ethiopia

3.1 Introduction

Ethiopia is among the fastest growing economies in the world with a dramatic rise in its per capita nominal GDP in recent years. Its per capital nominal GDP was USD 135 in 1999-00 which went up to USD 883 in 2017-18 (NBE, 2018). The Ethiopian economy is an agrarian economy with agriculture and allied activities accounting for close to 75 percent of its export receipts and providing employment to 74 percent of the labor force in the 2014-15 fiscal year (NPC, 2016). The plan is to reduce its employment share to 68 percent and its export revenue share to 55 percent by the end of the 2019-20 budget year as stipulated in the second growth and transformation plan (GTP II) (NPC, 2016).

When it comes to the composition of GDP, the agriculture sector accounted for 35 percent of the GDP in the 2017-18 budget year while the service sector accounted for 39 percent and the remaining 27 percent came from the industrial sector (NBE, 2018). In the industrial sector, the role of manufacturing industries compared to construction activities was relatively small with only 25 percent coming from the manufacturing industries as opposed to the 71 percent from construction activities in 2017-18 (NBE, 2018).

Policy-wise, there are ongoing efforts to bring about rapid and sustainable economic growth and development and structural changes in the economy. A series of policies, strategies, and programs have been designed and implemented in the country over the past few decades. The introduction

of the Sustainable Development and Poverty Reduction Program (SDPRP) in 2002-03 and the Plan for Accelerated and Sustained Development to End Poverty (PASDEP) covering the period 2005-06 to 2009-10 followed by GTP shows these efforts. Currently, the Ethiopian economy is in the final year of the second growth and transformation plan (GTP) which covers the period 2015-16 to 2019-20. Under these policies, more focus was given to firms in the manufacturing sector (NPC, 2016).

Firms' entry to the markets is generally considered easy in modern economies as opposed to their survival. In fact, Schumpeter (1943) argued that the process of 'creative destruction' was critical and inevitable for the continued dynamism of a modern economy. Firm growth and survival are an important channel through which economic growth in developing countries can be sustained. Policymakers in these countries also need to closely follow firm dynamics and how these relate to their policy interventions. Firms' survival could be as important as a new firm's entry, if not more to policy makers, owners and the employees in general.

Determinants of a firm's survival can be generally classified into three broad areas: Firm specific characteristics, industry specific characteristics, and macroeconomic and environmental variables. Firm specific characteristics include variables such as gender of the owner; (intermediate) input intensity; diversification (both product and market); firm size category (small, medium, and large); productivity; innovations; total assets owned; and experience. Initial conditions such as source of initial capital, indebtedness, and size have also been studied. The second major category is industry specific characteristics such as degree of concentration and competition; industry location and industry wages; and availability of markets while the third category is macroeconomic or environmental variables which include political stability, GDP per capita, inflation, unemployment, government regulations, public support, and institutions.

Empirically, the effects of most of these variables has been well documented in literature. Large firms have been found to face lower probabilities of exiting relative to small firms (Audretsch and Mahmood, 1994; Davies and Kerr, 2018; Esteve-Pérez and Mañez-Castillejo, 2008; Greenaway et al., 2009; Mata and Portugal, 1994). The findings of the role of age in a firm's survival are not conclusive with some researchers showing a positive effect (Mata and Portugal, 1994) and other showing an inverted U-shaped effect (He and Yang, 2015).

The impact of international trade engagement on a firm's survival has been studied using data on firms from advanced economies. Firms which engage in international trade through export decisions have been found to face a higher probability of survival (Baldwin and Yan, 2011; Bernard and Jensen, 2007; Dai et al., 2016; Dzhumashev et al., 2016; Esteve-Pe'reze et al., 2008; Kimura and Kiyota, 2007). Lopez (2006) and Emami Namini et al. (2013) show that firms that engage in international trade are more likely to survive.

Importing inputs contribute to the survival of a firm in various ways. The link between the two could be through productivity enhancing effects. Some scholars talk about the opportunity to buy inputs globally from cheaper markets due to import decisions (Acharya and Keller, 2007; Gibson and Graciano, 2011; Wagner, 2013). For others, importing inputs opens the door for technology transfers and purchase of higher quality components (Gibson and Graciano, 2011). Vogel and Wagner (2010) discuss the positive role played by importing inputs in relation to their effect on specialization. By importing inputs from abroad, firms are better focused on their competitive advantages and this deepens international specialization (Andersson et al., 2008). This is true especially for import of capital goods. The positive effects of imports on export engagement have

also been studied by many scholars. Importing inputs has been found to increase the probability of foreign market entry (Aristei et al., 2013; Kasahara and Lapham, 2013).

The contribution of imported inputs to a firm's survival is a less studied phenomenon globally. A study by Wagner (2013) is one among the few. Using a probit estimation, he found a strong positive link between a firm's survival and importing and two-way trading using firm level data from Germany. Keller (2002) found that 20 percent of the productivity growth in OECD countries' firms was due to foreign R&D and this could be even more for developing countries' firms. In developing countries, the role of importing intermediate inputs for firm survival is not well addressed so far in literature and this essay fills this gap.

This essay shows how a firm's input imports in the current period affect its survival in the next fiscal year. We take the MLSM firms in Ethiopia, one of the fastest growing economies in Africa and use the lagged measure of import intensity to better reflect the delay associated with input imports. Firms also plan and import inputs for future use.

There is high dependency on imported inputs by firms in Ethiopia and a study of how this behavior relates to their survival is of paramount importance for policymakers. The 2016-17 survey on Medium and Large-Scale Manufacturing (MLSM) firms in Ethiopia, for instance, shows that about 35 percent of the firms had more than half of their inputs coming from abroad and nearly 70 percent of the surveyed firms used imported inputs. This shows that a significant number of MLSM firms in Ethiopia are import dependent and this essay provides a systematic analysis of the link between import intensity (as a proxy for firm experience) and firm survival in Ethiopia.

The rest of this chapter is organized as follows. Section 2 reviews theoretical and empirical literature. Section 3 gives the method used for measuring firm survival, data source, and method of estimation. Section 4 gives the results and the last section gives the conclusion.

3.2 Literature Review

3.2.1 Theoretical Review

The resource-based theory of a firm forms the basis for a survival analysis. The resource-based theory (RBT) argues that a firm could have superior competitive advantage over others due to its resources and capabilities which could determine both its growth and survival (Barney, 1991). RBT, which emerged in the 1980s and 1990s, presents an alternative approach to achieving a competitive advantage. Valuable and rare resources owned by a firm enable it to have a temporary competitive advantage over others. This competitive advantage can be sustained in the long run if other competitors are unable to copy or access this competitive advantage or develop substitute inputs (Wade and Holland, 2004).

Wernerfelt (1984) defines a resource as anything which can be considered as a firm's strength or weakness including trade agreements in addition to traditional resources such as labor, capital, technology, and skills. Analyzing firms from the resource side against the product side, growth strategy is found to depend not only on existing resources but also on the development of new ones. Barney (1991) argues that resources are sources of competitive advantage for a firm if they are valuable, rare, difficult to imitate, and are in short supply. These resources could be grouped into physical, human, and capital resources. Some resources are difficult to imitate because they are property-based and hence protected by property rights while others are knowledge-based and will not be copied due to knowledge barriers (Miller and Shamsie, 1996).

Firms' decision to import inputs can be considered as an integral part of the resource-based theory. Firms which face resource problems at present may decide to import inputs or invest in the development of local domestic inputs. The current stock of a firm's resources might also create asymmetries in the competition for new resources in the future (Wernerfelt, 2011).

Firm survival may vary systematically across firms based on their age and size and many scholars discuss the various liabilities that link a firm's survival to its age and size. There are four major liabilities discussed in literature: liability of newness (Hannan and Freeman, 1984; Stinchcombe, 1965); liability of adolescence (Bruderl and Schussler,1990); liability of senescence (Barron et al., 1994; Coad et al., 2018; Hannan and Freeman, 1984; Le Mens et al., 2011); and liability of obsolescence (Barron et al., 1994).

According to the liability of newness, older firms may have relatively smooth performance with limited instances of extreme outcomes. This is due to their accumulated experience and insights regarding their business environment. The growth rates experienced by the younger firms might be higher but also more erratic (Jovanovic, 1982). Stinchcombe (1965) also provides evidence in support of the liability of newness. According to him, there are several factors that disproportionately drive young firms to exit from industry including the cost of learning in doing business and constraints in innovations. In addition, several employees of young firms are new to each other and have less understanding among themselves and with the relevant stakeholders.

Hannan and Freeman (1984) introduced the liability of senescence in the 1980s which was later developed by other researchers. This type of liability is caused by internal factors ranging from a firm's experience which creates rigidity and inflexibility. It is argued that a firm's past experience through rules and regulations and organizational structure leads to inflexibilities which are a major reason for experienced firms' inferior performance (Barron et al., 1994; Coad et al., 2018; Hannan and Freeman, 1984; Le Mens et al., 2011). Liability of senescence is generated by internal factors.

According to Barron et al. (1994) liability of obsolescence is the result of a mismatch between firms' abilities and the speed of changes in the external environment. Firms become outdated and obsolete with time. Liabilities of obsolescence and senescence lead to lower firm performance and higher risks of exiting from industry. A comparison of the two types of liabilities shows that one is caused by internal factors while the other emanates from external sources.

Bruderl and Schussler (1990) discuss another form of liability – the liability of adolescence. According to this liability, the hazard rate for firms varies directly with their age until a certain age level is reached (adolescence period) beyond which the risk of exit declines with age. Exit is not a monotonically declining function of age as proposed by the liability of newness (Bruderl and Schussler, 1990) but follows an inverted 'U' shape with the rising part due to the liability of adolescence and the falling part due to the liability of newness.

Bruderl and Schussler (1990) argue that the rising part should be interpreted as zero risk to a firm but rising risk to a population of firms since they assume that firms need some time to settle and establish themselves to talk about exit rates. Initial resource endowments and size are important determinants of the duration of adolescence (Bruderl and Schussler, 1990).

The analysis in this essay closely follows the Fichman and Levinthal (1991) version of the liability of adolescence which argues that firms face high risks of exiting even during the initial phases due to loss of enthusiasm and support.

So far, literature has not thrown up any theories that directly show the link between imports of inputs and a firm's survival. In Ethiopia, firms heavily rely on imported inputs and this decision is expected to increase the likelihood of a firm's survival.

3.2.2 Empirical Review

The role of a firm's experience in determining its survival has been studied by researchers using data from advanced countries. Most of these researchers use firm age and size, CEO's experience, and export engagement as proxy variables for firm experience.

Firms which engage in international trade have been found to enjoy what is now commonly called productivity premia which has been documented by Vogel and Wagner (2010); Kasahara and Lapham (2013); and Abreha (2017). The contribution of these variables in a firm's survival has also been investigated although very few studies have investigated the role of imports in a firm's survival.

From these studies, exporting firms are found to face significantly lower probability of failure than non-exporting firms (Baldwin and Yan, 2011; Bernard and Jensen, 2007; Dai et al., 2016; Dzhumashev et al., 2016; Esteve-Pe´rez et al., 2008; Greenway et al., 2009; Kimura and Kiyota,2007; Schröder and Sørensen, 2012).

Baldwin and Yan (2011), studied the determinants of plant deaths in Canada. From their probit estimation, they observed that exporters had much lower failure rates as compared to non-exporters. Bernard and Jensen (2007) did a similar study based on data from US firms during 1992-97. They estimated the probit model for plant deaths and showed that exporting was associated with a large reduction in the probability of shutting down. Another relevant study is Esteve-Pérez et al.'s (2008) work done using data from Spain covering the 1990-2002 period. They investigated the role of exporting in a firm's survival using the discrete time proportional hazard model and found that exporting SMEs faced a significantly lower probability of failure as compared to non-exporters. Greenway et al. (2009) studied how firms exited the market and what determined this exit decision in Sweden over the 1980-96 period. They used the multinomial logit model to capture the relationship between export decisions and a firm's survival and found that firms which exported were less likely to close. Using data from Japanese firms, Kimura and Kiyota (2007) investigated the role of exports in a firm's survival over the period 1994-2000. The estimated Cox proportional hazard model showed that exporting had a positive impact on a firm's survival and hence exporters faced lower hazard rates relative to non–exporters.

Dai et al. (2016), Dzhumashev et al. (2016), and Giovannetti et al. (2011) are among the few influential papers that base their analyses on export data of firms in developing countries. Dai et al. (2016) show a positive role of export engagement in a firm's survival using data from Chinese firms. Dzhumashev et al.'s (2016) study on the role of firm internationalization in its survival using data from the IT sector in India shows that export engagements had a positive effect on a firm's survival. They argue that despite their positive effect on a firm's productivity, export engagements were also sources of uncertainty that may lead a firm to exit. Their study shows that exporting firms face a lower hazard of exiting than non-exporting firms. On the contrary, Giovannetti et al. (2011) showed that engagement in exports reduced a firm's survival probability among Italian firms. They argue that competition in international markets increases a firms' risk of failure.

The contribution of import engagements and two-way trading on a firm's survival is a less studied phenomenon relative to export engagements. Lopez (2006), Emami Namini et al. (2013), and Wagner (2013) are among the frequently cited papers that show the link between importing and two-way trading and a firm's survival. Lopez (2006) and Emami Namini et al. (2013) investigated how both importing and exporting affected a firm's survival in Chile over the 1990–99 period. Using probit and IV probit models, they showed that firms that engaged in international trade were more likely to survive. Emami Namini et al. (2011) further showed that the probability of survival due to export engagement decreased with an increase in the volume of exports in a sector. According to Lopez (2006), exporters were more likely to survive given that they imported intermediate inputs. Using data from firms in Germany, Wagner's (2013) results of a probit estimation on determinants of firm survival showed that there was a strong positive link between firm survival and importing and two-way trading. His study also showed that exporting alone did not affect firms' survival rates.

Using data from the World Bank's Enterprise Surveys (ES) on firms, Aga and Francis (2017) examined the link between firm productivity and exiting. They found that labor productivity, as measured by sales per worker, reduced a firm's likelihood of exiting. They also observed a positive and significant relationship in the link between a firm's age and survival. Another relevant paper on the determinants of a firm's survival in Ethiopia is by Shiferaw (2009). He used data on MLSM firms in Ethiopia and showed a positive role that age, and productivity played in a firm's survival.

In general, using different methods of estimation and data source variability, export engagement has been found to be predominantly positively associated with a firm's survival. Most of the existing studies are based on data of firms from advanced economies and hence little is known about the link between firm export engagements and survival probabilities in developing countries. Moreover, most of the studies focus on the role of exports and the link between importing and a firm's survival is less studied across the world and is non-existent in developing economies.

3.3 Methods

3.3.1 Measuring firm survival and experience

In this essay, a firm is said to have survived if it appears in a sequence of the mandatory annual surveys. Failure or exit could be due to the shutting down of the business or its inability to meet the minimum number of employees required to be considered in the survey (10 employees). Hence, we are unable to distinguish between those who stopped operations from those who fell below the minimum size because of the nature of the survey. This essay measures firm survival by the number of years that a firm appears in the dataset.

Concerning firm experience, we use firms' import intensity as a proxy for experience. We measure experience by firms' import intensity which is defined as the ratio of total value of imported raw materials to the value of total raw materials. The decision to import inputs could be endogenous and more productive firms may self-select to import. Firms face initial uncertainties and sunken costs of entering international markets, especially export markets (Melitz, 2003). To control for such effects, we use predicted import values as an alternative measure of imports. The import related sunken costs could be due to a search for reliable suppliers and establishing distribution channels while the fixed costs of importing inputs include costs such as transportation and

customer services (Elliott et al., 2019). Elliot et al., also found significant sunk-entry costs for importing and exporting in Chinese firms.

Concerning exports, very few firms (4 percent of the observations) had export engagements in contrast to the significant number of firms (58 percent of the observations) that reported positive import values. Accordingly, we do not study the role of export engagement as it is less frequent in the data.

3.3.2 Measuring other control variables

Several control variables were used in this essay which can be classified into three broad categories as firm related characteristics, industry related characteristics, and macroeconomic variables. Firm productivity was measured by labor productivity. A firm's initial size, business challenges, legal number and form of ownership, lagged size, age, and region of operations were studied under firm characteristics. We use lagged values of labor productivity measured by value added per employee. Industry characteristics' variables include the market concentration indicator (HHI), industry size, and industry product classification based on the 2-digit International Standard Industrial Classification (ISIC) Rev. 3.1. Lagged values of real GDP growth rates and core inflation were used for showing how macroeconomic variables related to a firm's survival. The baseline hazard duration dependence was also analyzed by including it in the estimation. Table 3.1 gives the details.

Market concentration was measured using the Herfindahl-Hirschman index (HHI). HHI is based on the share in sales and it is calculated as the sum of squared sales' share of all firms in the total sales of a sector. For ease of interpretation, the market share is multiplied by 100 before squaring it:

(3.1) $$HHI = \sum_i {S_i}^2.$$

When HHI <1,500, there is no concentration, HHI ranging between 1,500 and 2,500 shows moderate concentration while HHI>2,500 shows high concentration (US Department of Justice and Federal Trade Commission, 2010)

Table 3.1. Summary of variables used in the study

Name of variable	Description
IMPORT_INT	Value of import intensity measured as a ratio of value of total imported raw materials to the value of total raw materials.
AGE	Age of a firm calculated as the difference between survey year and the first year of operations.
LnSIZE	Firm's current size as measured by the natural log of total employment.
Ln_Labour_prodlag	Natural logarithm of lagged labor productivity measured as the ratio of value added per employee.
LnCAPITAL_INTENSITY	Natural log of capital intensity. Capital measured as total beginning value plus total fixed investments, total maintenance investments, sold capital, and depreciation.
LnWAGE_PERCAPITA	Wage rate measured as total wage expenditure per employee.

D_RAWMAT_CURRENT	Dummy variable indicator (=1 for firms which reported shortage of raw materials as their current major problem, that is, first or second top problem).
INDUSTRY_SIZE	Shows size of the industry using median employment value in the industry.
INDUSTRY_CLASS	Refers to the product classification based on the 2-digit International Standard Industrial Classification (ISIC) Rev. 3.1. and a market for their inputs. We classify industries into three major groups based on markets from which they buy their inputs as domestic resource dependent (industry import intensity is less than 40 percent), industries with dual markets (industries which have import intensity between 40 percent and 65 percent), and foreign inputs based industries (industries with more than 65 percent import intensity).
HHI	HHI is calculated as the sum of squared sales' shares of all firms in the total sales of a sector.
OWNERSHIP_FORM	Dummy for the legal ownership form. Sole proprietorship is represented by "1", "2" shows partnership or joint venture, "3" is for share company, "4" is for private limited company (PLC), "5" is for cooperatives while other forms of ownership are represented by "6".
INITIAL_SIZE_CLASS[10]	Dummy for size category of firms using initial paid-up capital with "1" representing microenterprises, "2" for small firms, "3" for medium sized firms, and "4" for large firms based on the Federal Micro and Small Enterprise Development Agency (FeMSEDA, 2011) and Federal Negarit Gazette Regulation No. 373/2016.
REG_COHORT	Dummy for region of operation of firms. "1" for Tigray, "3" for Amhara, "4" for Oromia, "7" for SNNP, "14" for Addis Ababa, and "16" for firms in other regions.
Economic_growth_lag	A period lagged values of the real GDP growth rate.
INFLATION_lag	Annual core inflation as reported by CSA in the previous period.
t	Duration dependence indicator.

Note: To account for the heteroscedasticity problems, we report robust standard errors.

Source: Author's computations using CSA data.

3.3.3 The Model

Import intensity was used as a proxy to capture firm experience. The analysis begins with a simple descriptive and distribution analysis. Descriptive statistics (averages, ratios, percentages, etc.)

[10] According to these two sources, firms whose capital is ≤ 100,000 Birr or which have less than 5 employees are micro firms and firms with capital between 100,000 – 1.5 million Birr (or 6-30 employees) are classified as small firms. Capital between 1.5 million - 20 million Birr (or 30 – 100 workers) are medium sized firms and capital greater than 20 million Birr or employment of more than 100 workers are large firms.

were used to show an overall picture of how a firm's exit relates to its characteristics and the business environment.

Further, we also used the Kaplan-Meier survival model to examine how survival rates are associated with importing and other firm characteristics. Both the distribution analysis and the Kaplan-Meier survival analysis were used to show survival behavior by a firm's location, import intensity, size, and industry classifications.

An empirical estimation was done using a discrete-time survival model since firms' exiting is reported at a discrete time (annually by CSA) even though firms exiting could be continuous. From this survey, entry dates are observed, and exact exit dates are not observed, and this type of data is called right censored incomplete spell data (Jenkins, 2005).

In a survival analysis, the hazard rate measures the probability that an event occurs during any given interval (t and t + dt) given that no event has occurred before time t. The hazard rate expresses the probability of occurrence of an event within a very small interval of time and the discrete-time hazard function (h) can be written as (Bruderl and Schussler,1990; Jenkins, 2005):

(3.2) $h(t) = \frac{lim}{dt \to 0} Pr(t < T \leq t + dt | T \geq t)$ and hence the survivor function becomes:

(3.3) $S(t) = Pr(T \geq t)$, where t shows a specific value of time (T).

The cumulative density function F(t) of survival time (T) is given as (Jenkins, 2005):

(3.4) $F(t) = 1 - S(t) = Pr(T < t)$.

We conducted a likelihood-ratio test for the significance of the panel level effect and failed to reject the null hypothesis of no panel-level effect. Under such circumstances, estimating a pooled complementary log-log (cloglog) function is the same as a panel level estimation (Jenkins, 2005).

The empirical estimation was based on a complementary log-log function of the discrete time survival model with robust standard errors as given in Equation 3.6. To control for the sample selection effect which may arise due to high productivity firms self-selecting to import, we employed two estimations.

The first step involves estimating determinants of import decisions. There is strong evidence[11] in data and in theory that importers are more productive firms which self-select to import, and we need to control for this in the regression analysis. This is done by estimating a linear regression of import intensity on firm and industry characteristics such as firm age, capital stock, lagged labor productivity, location, industry size and competition, initial size, GDP, and inflation. In the second stage, we used the predicted import intensity in the complementary log-log regression as a proxy for the true import intensity. This helps in making the potentially endogenous import intensity exogenous. We predict the import intensity and use it in step 2 as an explanatory variable in Equation 3.7.

$$(3.5)\ reg(IMPORT_{INT}) = AGE + LnCAPITAL_{INT} + LnLabour_{lag} + + INITIAL_{SIZE} + HHI + Economic\_Growth_{lag} + i.LnSIZE + INFLATION_{lag} + i.D_{RAWMAT_{CURRENT}} + t + i.REG_{COHORT} + + i.INDUS\_CLASS + \epsilon_i$$

[11] For example, imported input-intensive firms are more productive, more capital intensive, bigger in size, and older in age.

(3.6) cloglog $[h(\text{j, x})] = \beta_1' IMPORT\_INT + \alpha'\text{X} + \gamma_t$

(3.7) cloglog $[h(\text{j, x})] = \beta_1' Predicted\_IMPORT\_INT + \alpha'\text{X} + \gamma_t$

The sensitivity analysis was done ignoring the endogeneity problem of import decisions in the cloglog estimation and estimating a probit model of the determinants of firms exiting.

where: h is the hazard ratio.

: IMPORTINT captures import intensity.

:X is a vector of control variables.

: γ_t is a set of spell length dummies used for capturing duration dependence.

: The dependent variable is a dummy which equals to 1 for exit.

We estimated Equation 3.7 as indicated in these two steps.

We did three robustness check estimations. One is to use probit model and estimate probability of a firm exiting (Model 4 in Table 3.4) and the other the use of actual import intensity values in place of the predicted import intensity (Model 5 in Table 3.4) in the complementary log-log regression. Alternatively, we did a 3rd sensitivity analysis model by using an instrumental variable (IV) regression in which we use real effective exchange rate as an IV for import intensity (Table 3.5). We know that manufacturing firms' decision to import depends on cost of import as captured by REER the mechanism predominantly operates through import since firms heavily rely on imported inputs. The REER data source is the National Bank of Ethiopia (NBE) over the same period.

Several control variables were included in the analysis including firm specific characteristics (firm age, initial and current size, productivity, ownership form, and location), industry specific characteristics (industry size and product category based on the 2-digit ISIC classification), and macroeconomic variables such as inflation and the real GDP growth rate. Time was also included to account for the duration dependence of the baseline hazard rate.

In the discrete analysis, γ_t needs to be specified after conducting a plot inspection of the hazard [12] function. We used time (t) to capture time dependence of a firm's exit.

3.3.4 Survey description and descriptive evidence

The data source for this research is the annual census survey of medium and large manufacturing (MLSM) enterprises in Ethiopia which engage a minimum of 10 people and use power driven machinery (CSA, 2017).

The scope of the analysis is limited to 12 years of data from 2000 to 2011. We follow firms which started operations between 2000 and 2011 and were part of the survey. The problem with the data is that we do not immediately observe a firm when it starts operations if it does not meet the minimum size requirements. A firm might be in operations for a couple of years before it joins the survey. We study the risk of exit once a firm joins the survey. This controls for left truncation

[12] Hazard ratios smaller than one indicate a reduction in the hazard and hence a longer duration while hazard ratios greater than one indicate the opposite. Hazard rate which equals one indicates the absence of any effect on the hazard by the considered independent variable (Esteve-Pérez et al., 2018)

(censoring) as we follow firms from their first entry into the survey. There is an establishment identification mismatch from 2011 onwards and the post-2011 MLSM firms' data is not considered in this study.

The panel dataset consists of 3,170 firms and 5,518 firm-year observations. We excluded firms with missing number of permanent employees and no wage data. Close to 8 percent of the firm re-entered the census after exiting and these observations were dropped for the analysis.

The survey questionnaire has multiple parts in which several questions are asked. It has eight major components with relevant sub-sections for each. It also covers all the nine geographical regions and the two city administrations.

For ease of analysis, firms were re-grouped into a smaller number of regions comprising of the major hosts of firms. Accordingly, six regional cohorts (Amhara, Oromia, SNNP, Tigray, Addis Ababa, and other regions) were formed and used in the analysis.

Regional distribution of the firms shows that Addis Ababa and Oromia regions accounted for more than half (53 percent) of the total observations. The remaining three regions (Tigray, Amhara, and SNNP) accounted for nearly 41 percent of the observations (see Table 3.2 for details). The number of observations coming from Tigray region exceeded that from Amhara region due to the lower exit rate observed in Tigray region over the study period. Entry rate in the Tigray region was slightly lower than the rate observed in Amhara region but the difference in exit rates between these two regions outweighed the difference in their respective entry rates.

Table 3.2. Summary Statistics of key variables by firm location (mean values)

	Region of Operation						Total
	Tigray	Amhara	Oromia	SNNP	Addis Ababa	Others	
Number of firms	757	698	1,205	823	1,745	290	5518
Exit rate (%)	37.64	42.98	29.71	43.62	34.50	34.48	36.32
Entry rate (%)	56.41	67.91	56.10	62.82	52.10	57.59	57.45
Firm size (number of employees)	26.3	23.75	54.76	18.99	45.97	25.88	37.30
Initial size (number of employees)	24.08	22.68	51.40	17.34	39.84	24.95	33.89
Import intensity	38.02	29.78	45.61	23.29	56.49	37.41	42.76
Industry growth rate	16.01	14.89	17.76	14.57	19.14	14.86	16.97
HHI (Sales)	2788	2119	1743	2083	1786	2033	2013
Labor productivity (in 1000 Birr per employee)	19.43	14.99	28.82	17.10	24.09	26.80	21.87

Source: Author's computations using CSA data.

The role of import experience in a firm's survival is given in Table 3.2 and Figure 3.1. They both convey a similar message of the positive role of import intensity in a firm's survival. Firms in Addis Ababa and Oromia regions had the highest import intensity rates and the lowest exit rates. Firms operating in SNNP and Amhara regions had the lowest import intensity ratios and the highest exit rates. All differences were found to be statistically significant. Figure 3.1 also shows that firms with higher import intensity had a higher probability of survival.

A cross tabulation of the firms' legal form of ownership with region of operations shows that 45 percent of the firms were sole proprietorships followed by PLCs (private limited companies) which accounted for 23 percent of the observations. Cooperatives accounted for 18 percent of the observations. These three forms of ownership dominated the legal forms of ownership in MLSM firms in Ethiopia and accounted for 86 percent of the firms over the survey period. Except in the Tigray region where cooperative form of ownership was the dominant form (38 percent), sole proprietorship was the dominant form of ownership in all the remaining regions and accounted for a minimum of 42 percent. The reason why firms in Tigray preferred a cooperative form of ownership is not clear and this form of ownership was less preferred by firms in Addis Ababa and Oromia which are major hosts of the observations (55 percent) (see Appendix A3.1 for details).

Looking at the descriptive statistics, we see that firms' labor productivity tended to be associated with lower rates of exit. The highest average labor productivity value was observed in Oromia region where the exit rate was the lowest.

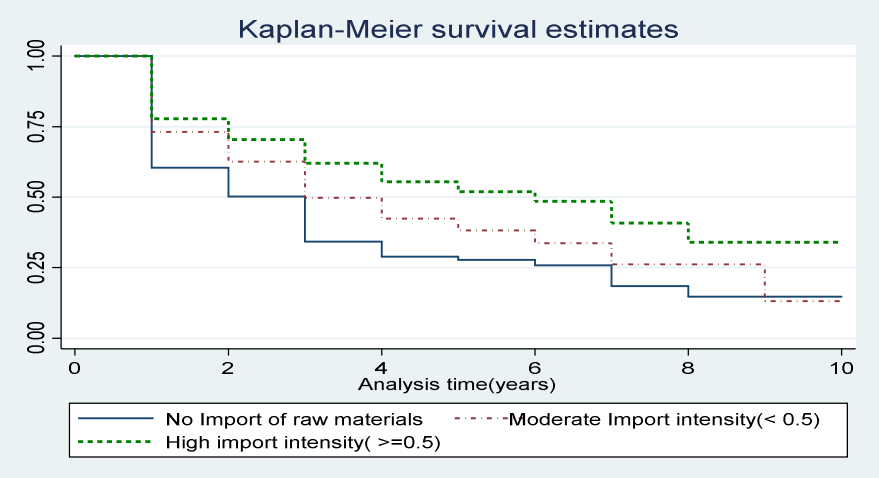


Figure 3.1. Kaplan-Meier survival estimates by input import intensity

Source: Author's computations using CSA data.

Among the firms which started operations and were included in the survey between 2000 and 2011, the dominant type of industries in Ethiopian MLSM firms were manufacture of other non-metallic mineral products using ISIC 2-digit revision 3.1 classifications. Non-metallic minerals accounted for about 30 percent followed by food products and beverage industries with a total share of around 25 percent. Manufacture of furniture was the third highly preferred industry with a total share of around 14 percent of the observations. Overall, these three industries represented 69 percent of the observations showing high concentration of these industries among MLSM firms.

The distribution of industries across regions shows that food products and beverage industries dominated in Addis Ababa, Oromia, and other regions while manufacture of other non-metallic mineral products was the dominant sector in Tigray and SNNP regions (for details see Appendix A3.2). Looking at industry classifications in the recent survey's (2016 fiscal year) results, we see that three industries (food and beverages, non-metallic minerals, and furniture) were dominant accounting for about 57 percent of the firms.

Table 3.3 shows summary statistics of key variables used in the analysis by industry type. The top three industries that accounted for 68 percent of the observations are non-metallic minerals, food

and beverages, and furniture industries. Considering all the industries, manufacture of fabricated metals had the highest exit rates with close to 45 percent exit rates followed by manufacture of furniture (in third place with 43 percent). Publishing and printing showed the lowest exit rates.

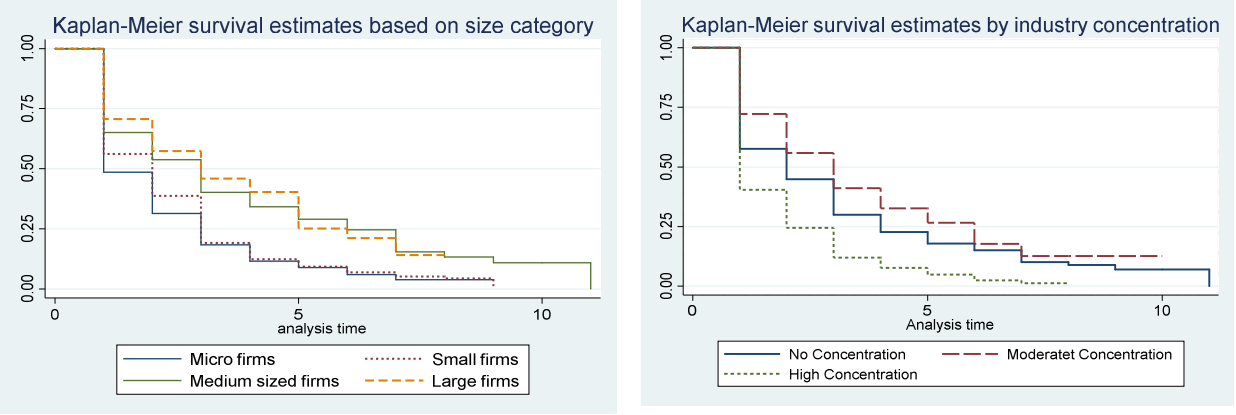
Table 3.3. Summary statistics of key variables by industry cohorts (mean values)

Industry type	Exit rate (%)	Entry rate (%)	Import Intensity (%)	Initial Size	Firm size	Productivity (ln labor)	Industry growth rate (%)	HHI (Sales)
Food and Beverage	25.13	0.49	0.22	31.25	35.42	10.32	12.00	860.76
Textile	35.23	0.65	0.48	148.53	177.40	10.47	11.00	2573.00
Publishing and Printing	23.40	0.41	0.79	23.72	29.50	10.32	19.00	1379.39
Chemical Products	36.75	0.55	0.76	63.62	66.13	10.68	57.00	1506.10
Rubber and Plastic	25.53	0.44	0.89	84.31	98.49	10.65	22.00	1142.07
Non-metallic Minerals	44.91	0.62	0.19	15.89	18.11	9.68	17.00	3769.25
Basic Metals	31.51	0.62	0.86	73.60	72.17	11.81	24.00	2566.55
Fabricated Metals	45.05	0.71	0.63	40.85	41.03	10.17	10.00	2708.27
Furniture	42.78	0.64	0.41	17.46	18.10	9.23	11.00	1218.47
Other industries	34.27	0.59	0.56	54.79	55.43	10.24	25.00	852.09
All industries	36.32	0.57	0.43	33.90	37.30	9.99	16.97	2013.76

Source: Author's computations using CSA data.

The highest exit rates were observed in the fabricated metals industry which had one of the lowest labor productivity values.

Figure 3.2 gives the K-M survival plot of firms based on their size classifications. As can be seen in the figure survival rates improved with size. Medium and large firms enjoyed higher rates of survival relative to small and the micro enterprises. Large firms enjoyed a positive role of size relative to medium sized firms for a couple of years (around 5 years).



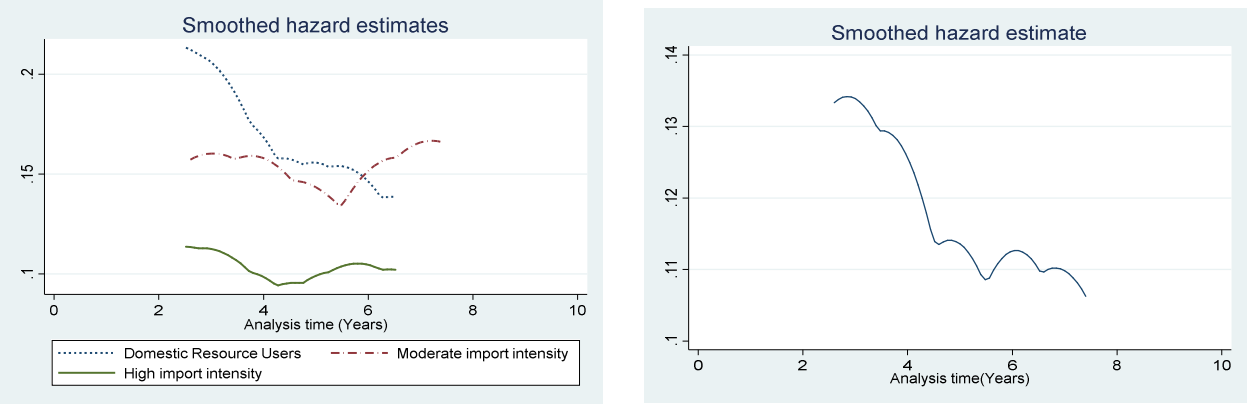
a) by firm size category

b) by industry concentration (HHI) category

Figure 3.2. Kaplan-Meier survival estimates

Source: Author's computations using CSA data.

The role of market concentration in firms' exit is given in Figure 3.3 which uses the Kaplan-Meier survival graph. The graph shows that firms which operated in markets with moderate concentration had a higher probability of survival than those operating both in the high and no concentration markets. Shiferaw (2009) also found a similar relationship between concentration and exit rates. This relationship is also supported by the results of the cloglog estimation.



a) by import intensity of inputs b) For the whole population of firms

Figure 3.3. Duration dependency of firms' exiting

Source: Author's computations using CSA data.

Figure 3.3 gives the different liabilities that apply to a firm's performance. For the whole population, firms are subject to small periods of the liability of adolescence (the rising part of the smoothened hazard curve in Panel b which it is close to 3 years) before they enter the liability of newness range.

Looking at how the levels of imported inputs used by firms relate to hazard rates, we see that there is a systematic difference across the three groups (domestic resource users, moderately importing firms, and high import dependent firms). We classify industries into [13] three major groups based on the markets from which they buy their inputs as domestic resource dependent (industry import intensity is less than 40 percent), industries with dual markets (industries which have import intensity between 40 percent and 65 percent), and foreign inputs based industries (industries with more than 65 percent import intensity). Only industries in which the import intensity is reasonably close to 50 percent had the opportunity to buy inputs from either domestic or foreign sources. We call these industries dual input market industries. The other groups do not have the luxury to choose from where to buy their resources. They either buy from domestic or foreign markets. Hence, the decision to import inputs may not be related to productivity and efficiency differentials and might be dictated by product type.

Highly import intensive firms face not only lower risks of exit but also need fewer years to gain maturity (close to four years) as opposed to close to six years for moderate import dependent firms. Non-importers do not show the liability of obsolescence and are predominantly governed by the liability of newness and hence younger firms face higher hazard rates for non-importers. For the

[13] Food and non-metallic mineral industries are domestic resource dependent industries. Industries that fall in the category of dual input markets include textiles, fabricated metals, furniture, and other industry groups. Publishing, chemicals, plastic and rubber, and basic metals are industries with high import intensity.

importers, there is a maturity stage beyond which the exit rate tends to increase with duration, and this is indicated by the turning points in the graph in Figure 3.3.

3.4 Empirical Analysis

3.4.1 Econometric analysis

Table 3.4 presents the details of the econometric estimation of the complementary log-log equation and probit estimations with robust standard errors. The dependent variable is survival. A firm is said to have survived if it appears in a sequence of the mandatory annual surveys. Import intensity being the key explanatory variable in the regression analysis it was used with duration dependence before including a host of control variables starting with size and productivity.

Import intensity had a statistically significant positive effect on a firm's survival under all the specifications. This finding is supported by statistically significant differences in exit rates between importers and non-importers using a two-sample t-test. Firms with high import intensity were more productive and had lower mean exit rates as compared to less import intensive firms. They were larger in size, had higher wage rates, and were more capital intensive. The K-M survival estimate plot further supplements this positive role of import engagement on survival. Firms with higher import intensity faced a lower hazard of exiting from the survey. This effect of import intensity on a firm's survival persisted under all estimation techniques after controlling for firm productivity and other firm and industry characteristics.[14] This lower hazard rate of firms exiting due to import of inputs is in line with other findings (Emami Namini et al., 2011; Gibson and Graciano, 2011; Lopez, 2006; Wagner, 2013).

Several control variables were included in the estimation including firm age and size, firm productivity (labor productivity), industry type and concentration, location and economic growth rate, and inflation. After controlling for other relevant factors, firm age does not have a significant effect on higher hazard rates under all scenarios and this could be due to the nature of the data used. We followed firms which started operations on or after 2000 and hence their maximum age is 11 years with mean age of just four years. The duration dependence of the baseline hazard shows that the hazard varied with time (and hence age) but the regression results show that age had an insignificant effect. The hazard rate decreased with time after an initial increase (Figure 3.4).

The effects of raw material shortages on a firm's survival were captured by including a dummy variable for firms which reported shortages of raw material as a major problem at present in the regression analysis. The result of the regression shows that firms which reported a shortage of raw materials as their top current challenge (first or second problem) faced higher risks of exiting from the market. Firms which were unable to solve their input problems were less likely to import inputs and more likely to leave the industry as observed from the probit estimation.[15]

Concerning the role of firm productivity, lagged values of labor productivity were associated with superior probabilities of a firm's survival. Productive firms faced lower hazards of exiting. Less productive firms were more likely to exit the market.

[14] The conventional significance levels of 1%, 5%, and 10% were used for all the regressors.

[15] Firms which face raw material supply shortages can either leave the market or import inputs from abroad. In this essay, firms tend to leave the market than opting for imports. The results of the probit estimation of exit and the import dummy (not reported here) as a function of raw material imports support the first argument.

Current firm size, on the other hand, had no significant effect on the risk of exiting using the cloglog estimation. Initial size of a firm played a key role in its survival with medium sized firms outperforming the rest as measured by the size of the initial paid-up capital. Medium sized firms faced lower risks of exiting when we studied the effect of initial size on a firm's survival.

The role of industry concentration on firm exit showed that a high degree of concentration led to higher risks of exiting. Concentration implies intensive competition among firms and hence, is associated with higher risks of exiting. This is in line with findings in literature that maintain that firms which operate in highly concentrated industries face intensive competition which leads to higher exit rates (Gorg and Strobl, 2000). Audretsch (1991) shows that the effect of market concentration on firm survival depends on the period of analysis and concentration tends to promote firms in the short-run with the effect disappearing in their long-run survival. Figure 3.2 gives the graphical version of this conclusion.

From the two macroeconomic variables included in the analysis, the economic growth rate did not have a significant impact on the hazard rate while inflation tended to increase the risk of exiting. The effects of a firm's ownership type, location, and product category were controlled for in the analysis. The F-statistic showed that the model was statistically significant (Table 3.4).

Concerning the post estimation tests, we did the Wald and likelihood ratio tests. The results if these two tests support the significance of the variables.[16]

Table 3.4. Complementary log-log and probit estimations with alternative specifications (coefficients are hazard ratios and marginal effects)

VARIABLES	Model1	Model2	Model3	Model4	Model5[17]
IMPORT_INT	0.573***	0.769**	0.563*	-0.082**	0.707**
	(0.039)	(0.098)	(0.192)	(0.038)	(0.120)
LnSIZE		0.772	1.212	-0.017*	1.211
		(0. 164)	(0.326)	(0. 016)	(0.327)
LnSIZESQ		1.011	0.957		0.956
		(0.033)	(0.038)		(0.038)
Ln_Labour_prod_lag		0.810***	0.816***	-0.051***	0.813***
		(0.024)	(0.032)	(0.009)	(0.032)
AGE			1.034	0.009	1.036
			(0.333)	(0.008)	(0.033)
EXPORT_DUMMY			0.840	-0.057	0.812
			(0.344)	(0.075)	(0.333)
LnCAPITAL_INTENSITY			1.000	0.002	1.003
			(0.038)	(0.009)	(0.038)
LnWAGE_PERCAPITA			1.006	0.001	1.004
			(0.066)	(0.015)	(0.065)
FOREMP			1.047	0.012	1.047
			(0.042)	(0.010)	(0.041)
D_RAWMAT_CURRENT			1.239**	0.050**	1.234
			(0.134)	(0.025)	(0.134)

[16] The results of the Wald and likelihood ratio tests are not reported here for brevity.

[17] Model 1 (import & duration), Model 2 (import, size, & productivity), Model 3 (main model estimated with predicted import intensity), Model 4 (probit estimation), and Model 5 (estimated with actual import intensity).

Table 3.4. Complementary log-log estimation …continued

VARIABLES	Model1	Model2	Model3	Model4	Model5
Economic_growth_lag			1.012	0.004	1.012
			(0.021)	(0.004)	(0.021)
INFLATION_lag			1.024**	0.005**	1.024**
			(0.012)	(0.002)	(0.012)
Initial Size of firms (Micro firms are reference groups)					
Small Size_Initial			0.925	-0.031	0.910
			(0.133)	(0.037)	(0.131)
Medium Size__Initial			0.693*	-0.091**	0.681**
			(0.135)	(0.046)	(0.132)
Large Size__Initial			1.272	0.053	1.227
			(0.3)	(0.077)	(0.374)
DUMMY_CONCENTRATION (Referenced groups are markets with no concentration)					
Moderately concentrated			1.001	0.012	1.000
			(0.164)	(0.035)	(0.164)
Highly concentrated industries			1.783***	0.158***	1.831
			(0.266)	(0.040)	(0.273)
[18]Region control			Yes	Yes	Yes
Industry cohort control			Yes	Yes	Yes
[19]Legal ownership type			Yes	Yes	Yes
T	0.786***	0.990	0.971	-0.005	0.967
	(0.021)	(0 .035)	(0.041)	(0.010)	(0.041)
Constant	0.994	6.369***	1.298	0.393	1.201
	(0.055)	(2.695)	(0.993)	(0.569)	(0.908)
Wald chi2(37)			153.42	147.15	156.01
Prob > chi2			0.000	0.000	0.000
Observations	3,865	1,522	1,327	1,327	1,327

Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, and * p<0.1.

Source: Author's computations using CSA data.

[18] There is no statistically significant difference based on location.
[19] Partners or JVs and cooperatives face higher risks of exiting.

3.4.2 Sensitivity Analysis

The last two columns of Table 3.4 (Models 4 and 5) give the results of the alternative forms of estimations. Under the current scenario, we estimated the probability of a firm exiting using the probit estimation (Model 4) and used actual import intensity values in place of the predicted import intensity (Model 5) in the complementary log-log regression.

The dependent variable in the probit estimation is a dummy variable for firm exit and the results from the new estimation technique support the findings of the complementary logistic regression. Import intensity has a significant negative effect on a firm's likelihood of exiting. Medium sized firms faced lower risks of exiting relative to the other groups.

Other factors such as capital intensity, export orientation, wage rates, and number of foreign employees did not affect the hazard rates.

Further, as indicated in Table 3.5, import intensity as proxied by real effective exchange rate lowers firm exit rates. An increase in REER shows a rise in cost of import and hence lower import engagement and ultimately higher exit rates.

The findings of the new estimations are the same as previous findings. Import intensity, whether we use true or predicted values, tends to reduce firm exit although it shows a more significant effect under the new estimation.

From the other explanatory variables, firm labor productivity and medium size tend to be associated with lower hazard rates. Raw material shortages and industry concentration did not affect hazard rates while the inflation rate was associated with higher risks of firms exiting using the results of the cloglog estimation.

Table 3.5. Complementary log-log with alternative specifications (one period lagged REER as an IV for lagged import intensity)

VARIABLES	Hazard ratios
REER (one period lagged)	1.023***
	(0.003)
Ln_Labour_prod_lag	0.844***
	(0.03)
AGE	1.002
	(0.029)
LnCAPITAL_INTENSITY	0.974
	(0.033)
EXPORT_DUMMY	0.654
	(0.268)
LnWAGE_PERCAPITA	1.001
	(0.061)
LnSIZE	0.931
	(0.057)
HHI	1.000***
	(0.000)
D_RAWMAT_CURRENT	1.254

	(0.121) **
Economic_growth_lag	0.983
	(0.018)
INFLATION_lag	0.983
	(0.11)
Industry cohort control	Yes
Region control	Yes
Industry class dummy (degree of import intensity)	Yes
Ownership form	Yes
Initial size category	Yes
Observations	1796
Log pseudolikelihood	-951.62
Wald chi2(28)	0.000

3.5 Conclusion and Recommendations

The main purpose of this research was exploring the relationship between a firm's experience measured by import intensity and a firm's survival based on firm level data from Ethiopia. The analysis covered MLSM firms which started operations between 2000 and 2011 and were also part of the census. Although the post-2011 survey data was available, there is a firm identification mismatch and hence it was decided not to include this in the analysis. The analysis was based on 3,170 firms and 5,518 observations.

Considering firm exit from the annual CSA surveys as an indicator of firm exit, we estimated the discrete time firm survival model. More specifically, the complementary log-log model was estimated to show how a firm's import engagements related to its survival. We controlled for other firm specific control variables such as firm age, size, location, and nature of products. Moreover, market concentration was also included in addition to the macroeconomic variables of inflation and the economic growth rate. Duration dependence of the baseline hazard rate was also studied in the model.

International markets are important sources of inputs for MLSM firms in Ethiopia. For the study period, 43 percent of the production inputs for all firms came from abroad and the median import intensity rate was 30 percent. We studied how this decision of importing input related to a firm's survival.

From the descriptive statistics, importing firms were found to be more productive, bigger in size, more capital intensive, and paying higher wages. They had a statistically significant lower exit rate. The Kaplan-Meier survival estimate of the effect of imports on a firm's survival showed that firms with high import intensity faced lower hazard rates of exiting as opposed to those with lower import intensity. The complementary log-log estimation of the determinants of firm survival showed that import intensity was associated with lower hazards of exiting even after controlling for the selection effect.

Similarly, firms that reported raw material supply problems as their key business challenge faced higher risks of exiting as presented by the econometric model. The results of the probit estimation also showed similar findings on the role of imports in manufacturing production and in a firm's

survival. Overall, the study showed a positive association between import engagement and survival.

Over the 2000-11 period, the average exit rate was 36 percent and the entry rate over the same period was around 57 percent. Firm exit rate was found to be the highest in the regions with low import intensity ratios and this can be taken as indirect proof of the positive association between import engagement and firm survival.

A few policy implications can be drawn from the results. A major lesson learned is the positive role of import engagement in a firm's survival. This is in line with the argument of 'learning by importing' proposed by Vogel and Wagner (2010). Firms that reported input problems as their key business challenge had higher risks of exiting from the industry and the market. Accordingly, more import of inputs could be taken as a short-term policy recommendation while solving input supply problems by working on developing domestic sources can be considered as a long run solution. From the three broad classes of industries based on where they bought inputs, the risk of exit was the highest among industries which predominantly relied on domestic sources for inputs. These are manufacture of food and beverages and non-metallic minerals. The mineral industry might have been affected by the ongoing political unrest in the country since 2015. Hence, the government needs to revisit existing policies and work closely with stakeholders for supporting domestic resource dependent industries since importing cannot be seen as a permanent solution.

Firms failure to involve adequately in export markets is another issue that needs to be addressed. We observed a weak transition from imports to exports by firms and only 4 percent of the firms had export engagements during the study period. While importing has often led to export activities in other economies, the government needs to take extra initiatives in Ethiopia for promoting and supporting firms to sell their products in international markets. The Ethiopian economy experienced higher inflationary pressure over the study period with a very high non-food inflation rate of round 24 percent in 2009 which needs to be controlled as inflation was found to be associated with a higher risk of exiting.

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Appendix A3

Table A3.1 Correlation Coefficients

	IMPORT_INT	Ln_Labour_~g	AGE	MKT_SHARE	FOREMP	EXPORT_DUMMY	LnCAPITAL_~Y	LnWAGE_PER~A	LnSIZE	INITIAL_SI~S	D_RAWMAT_C~T	OWNERSHIP_~M	INDUSTRY_C~S	REG_COHORT
IMPORT_INT	1.00													
Ln_Labour_~g	0.17	1.00												
AGE	0.08	0.19	1.00											
MKT_SHARE	0.20	0.17	-0.07	1.00										
FOREMP	0.07	0.08	0.04	0.10	1.00									
EXPORT_DUMMY	-0.02	0.08	0.05	0.08	0.01	1.00								
LnCAPITAL_~Y	0.20	0.35	0.09	0.22	0.09	0.09	1.00							
LnWAGE_PER~A	0.18	0.28	0.19	0.11	0.06	0.09	0.30	1.00						
LnSIZE	0.38	0.22	0.11	0.40	0.16	0.14	0.33	0.18	1.00					
INITIAL_SI~S	0.29	0.40	0.08	0.27	0.12	0.10	0.61	0.23	0.56	1.00				
D_RAWMAT_C~T	0.00	-0.13	-0.03	-0.01	-0.03	0.01	-0.01	0.02	0.01	-0.02	1.00			
OWNERSHIP_~M	0.02	0.02	-0.17	0.06	0.06	0.05	-0.06	0.05	0.02	-0.03	-0.01	1.00		
INDUSTRY_C~S	0.22	0.12	0.02	0.08	0.08	-0.10	0.25	0.05	0.20	0.28	0.05	-0.08	1.00	
REG_COHORT	0.18	-0.01	0.11	0.08	0.01	-0.03	0.04	0.05	0.11	0.05	0.01	-0.10	0.13	1.00

Source: Author's computations using CSA data.

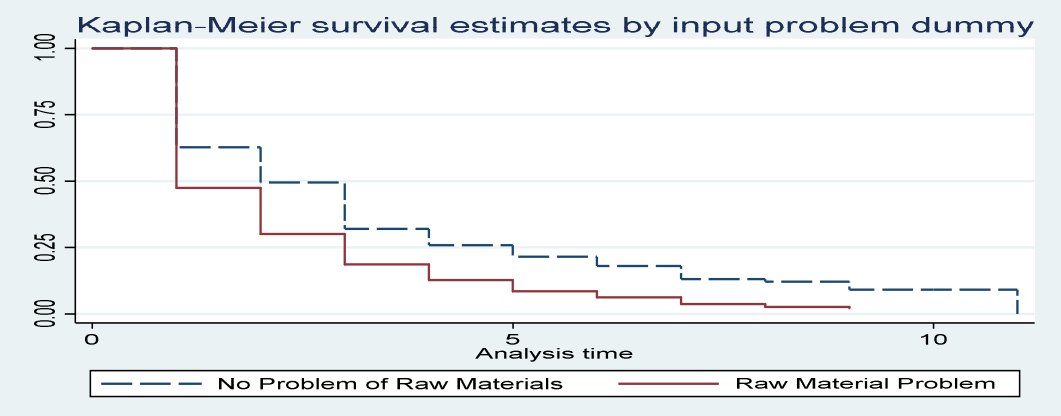


Figure A3.1 The smoothened hazard estimates

Source: Author's computations using CSA data.

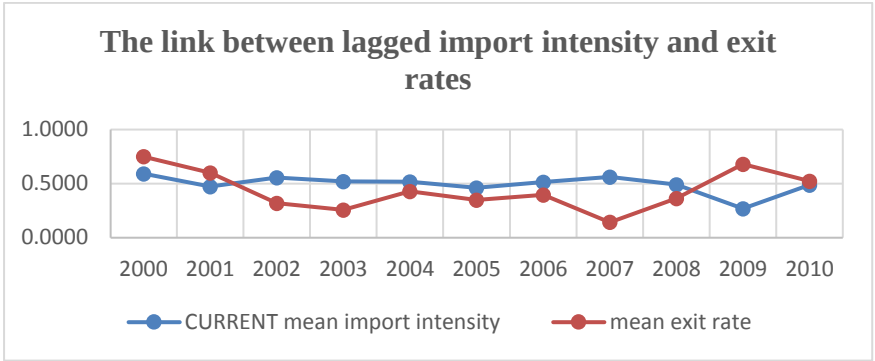
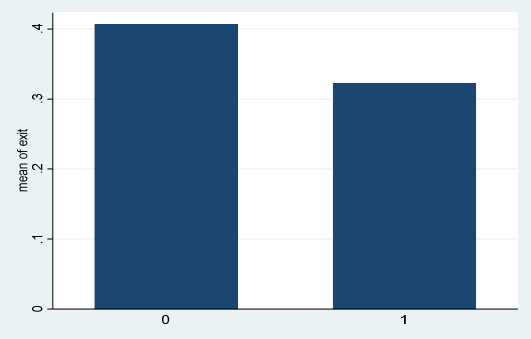
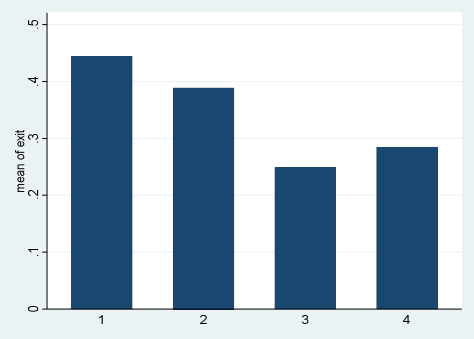


Figure A3.2 The link between lagged import intensity and exit rates

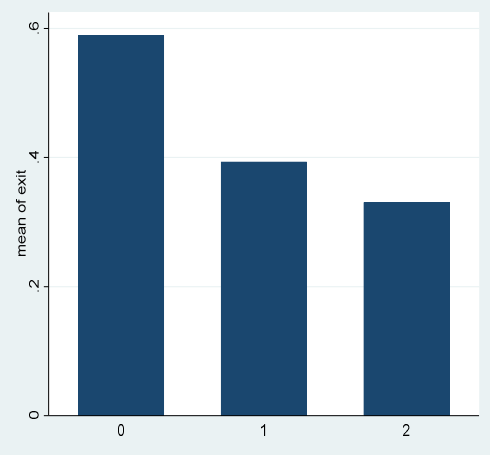
Source: Author's computations using CSA data.



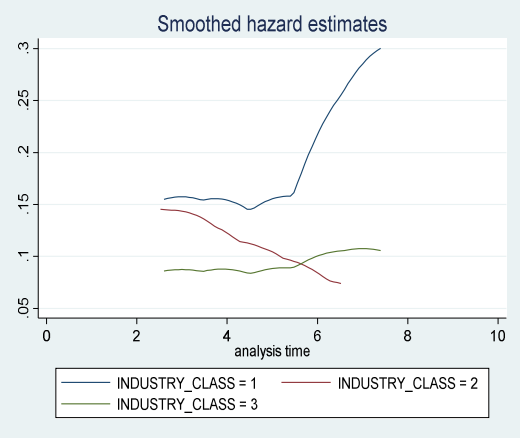
a). Firm exit by age category (0== young and 1 ==old, that is, above the median age)



b). Firm exit by initial size category (1= micro, 2 = small, 3 medium, and 4= large)



c). Firm exit by import intensity category (0 no import, 1 low intensity of imports, and 2 high intensity of imports, that ism >0.5)



d). Smoothened hazard by industry nature (1= domestic market for inputs, 2= dual market for inputs, and 3 for inputs with mainly foreign markets).

Figure A3.4. The link between lagged import intensity and exit rates

Source: Author's computations using CSA data.

Chapter 4, Essay 3

An Analysis of Firm Growth in Ethiopia: An Exploration of High-growth Firms[20]

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Abstract

The determinants of firm growth and the role of firms in an economy have been extensively studied in literature. The concept of high-growth firms (HGFs) and their role and determinants, however, is a recent subject of study. This essay identifies the incidence of HGFs in Ethiopia along with their corresponding business obstacles and growth determinants. The research is based on data from the World Bank's Enterprise Survey dataset of 2015. The survey covered 848 firms distributed over the six major regions in the country -- Addis Ababa, Oromia, Amhara, SNNP, Tigray, and Dire Dawa. The analysis is done using OLS and QR methods. The study finds that HGFs are concentrated in the capital city and in the service sector and that medium sized firms dominate HGFs. Like the non-HGFs, access to finance is the biggest perceived obstacle that HGFs face. For HGFs, tax rates are the biggest obstacle next to finance compared to informal sector activities for non-HGFs. Region-wise, access to finance is a major problem only for firms operating in Addis Ababa and Tigray while practices of informal sector dominate in Oromia region. In Amhara region, corruption is the top ranked obstacle. The econometric estimation results show that firm growth is negatively related to firm size and export engagement while it is positively associated with firms' product and process innovations, resources, and owning a website. The research fails to show any significant differences among firms' growth based on the gender of ownership, competition, capacity utilization, and nationality of ownership. The heterogeneity in business obstacles across regions and the firms' growth performance can be taken as important lessons for policy interventions.

Keywords: High-growth firms, business obstacles, and quantile regression

JEL Classification Codes: D22; L11; L25

[20] Published as a book chapter by Springer in 2018. Chapter 10 of the Book entitled "Economic Growth and Development in Ethiopia, Perspectives on Development in the Middle East and North Africa (MENA) Region." Chapter title is "An Analysis of Firm Growth in Ethiopia: An Exploration of High-Growth Firms."

[21] The author would like to thank the World Bank Enterprise Survey team for granting him access to the data and Seid Ali (PhD) for his comments and supervision.

4.1 Introduction

The process of firms' growth has long attracted the attention of economists. According to Sutton (1997) Robert Gibrat came up with the first formal model dealing with the dynamics of firm size and industry structure. According to Gibrat, the rate of firm growth was independent of its size and was framed as the law of proportionate effects (LPE) (Gibrat, 1931, cited in Sutton, 1997). Gibrat's law stipulates that the capacity to grow is the same for all firms, regardless of their initial size. Several empirical works have been done on this aspect with inconclusive findings.

Following the well-documented role of entrepreneurial firms in employment creation and wealth generation, more recent studies have turned their attention to the prevalence and determinants of HGFs in addition to measurement and definition issues. Several alternative measures have been suggested to classify firms as HGFs with employment being the most studied output variable although productivity, sales, wages, and revenue have also been used as indicators (Daunfeldt et al., 2014).

Attempts to identify the prevalence of HGFs in different countries and industries have shown that HGFs form only a small percentage of all firms and are found in all countries across all industries. A meta- analysis by Henrekson and Johansson (2009), for instance, failed to show any evidence in support of the view that HGFs are over-represented in high-technology industries. In their survey, they noted that service industries were the major hosts of HGFs relative to manufacturing industries. Daunfeldt et al. (2014) updated Henrekson and Johansson's study by incorporating nine additional studies published after 2009 on HGFs. One of their key findings is significant differences in HGFs' characteristics depending on the growth indicator that one uses and how it is measured. They found that absolute and relative measures of HGFs led to "most pronounced difference between HGFs" with HGFs defined in relative terms being younger and smaller than HGFs defined in absolute terms for most of the indicators.

Further, understanding the persistence and incidence of HGFs has become an important task for policymakers as better insights into the existence, characteristics, and stimulating factors of high-growth firms could be a key breakthrough for policies for sustainable economic growth. The shareholders' concern is knowing what stimulates the growth of their firms while for policymakers it is the issue of sustaining firm growth and capitalizing on incidences of HGFs.

A new initiative in research has been undertaken to find out if HGFs can be sustained. Its aim is finding out if a firm's growth can be sustained for a long period of time and whether firm growth is a random process. Researchers want to know if the probability of repeating high-growth rates was high. We know that governments spend a considerable amount of money for supporting specific types of firms based on either firm size and/or industry type to encourage them to grow. It would be difficult to target policies towards certain groups of firms if growth is unsustainable. A dominant empirical work in this regard is the study by Daunfeldt and Halvarsson (2014) who argue that high-growth firms are one hit wonders and the probability of repeating the high-growth rates is very low. However, the role played by HGFs is well documented.

Studies have shown that HGFs play an important role in job creation and fostering innovative behavior. Bravo-Biosca (2010), for instance, shows that a small number of HGFs accounted for a disproportionate 35-50 percent of all jobs created by all firms with 10 or more employees for a large number of countries that he studied.

The role of business environment in deterring firm performance is not well-studied in literature. Firms have heterogeneous abilities and entrepreneurs could perceive environmental challenges differently. For firms operating in different regions and sectors, the effect of this obstacle could vary, and this is another dimension of this essay.

The purpose of this essay is providing insights into the incidence of HGFs in Ethiopia by firm characteristics (such as size, age, location and ownership type, and industry type). The research also explores the perceived obstacles in firms' performance and the growth determinants of these firms.

In general, HGFs have attracted considerable attention of researchers, policymakers, and also of practitioners. This essay adds to literature by investigating the incidence of HGFs and the business obstacles that they face by region, industry type, and the relationship between firms' size and growth using the enterprise survey database for Ethiopia. To the best of our knowledge this research is the first of its kind in Ethiopia.

The rest of this chapter is organized as follows. Section 2 reviews related literature while Section 3 gives the data description. The method used is discussed in Section 4 and the results are discussed in Section 5. Section 6 gives the summary and conclusion.

4.2 Literature Review

Firms have long been recognized as one of the determinants of economic growth and the factors affecting their performance have attracted a number of researchers among which Robert Gibrat is recognized as the first to come up with a formal model dealing with the dynamics of firm size and industry structure (Sutton, 1997). His work is called Gibrat's law which states that the rate of a firm's growth is independent of its size although empirical studies conducted later have predominantly rejected this.

Firm growth is seen as a result of continuous discovery and use of productive knowledge which requires an institutional framework that determines the incentives to acquire and utilize knowledge (Henrekson and Johansson, 2010).

4.2.1 Job creation as HGFs' major role

There is an increased interest among academicians and policymakers in the prevalence of HGFs in the economy. Some of the questions that address include size, age, industry type, and region of HGFs.

The role of HGFs in the job creation process has been examined in a large number of empirical studies with most of them showing that job creation is accounted for by only a few firms. Several recent works have verified the role played by HGFs in terms of job creation (Acs et al., 2008; Anyadike-Danes et al., 2013; Autio et al., 2000; Coad et al. 2014; Davidsson and Henrekson, 2002; Delmar et al., 2003; Henrekson and Johansson, 2010; Moreno and Coad, 2015; Nesta, 2009, 2011; Schreyer, 2000; Storey, 1994).

Coad et al. (2014) present HGFs' disproportionate job creating role as a stylized fact. Nesta (2009) documented that the 6 percent of the HGFs in UK generated 49.5 percent of all new jobs created by operational firms in the country during 2002-08 while Storey (1994) found that 4 percent of the

firms created 50 percent of the jobs. Although the role of HGFs may depend on how they are measured, Daunfeldt et al. (2014) found that they play a key role in the economy as a source of economic growth, employment growth, and sales and productivity growth.

4.2.2 Determinants of firm growth

Several researches have been done to address the question of what determines firm growth. Moreno and Coad (2015) present two types of theoretical explanations for a firm's growth determinants where one relates to dynamic strategic choices within a firm while the other considers growth as purely random. Other recent studies classify the determinants of a firm's growth into firm size, firm age, firm innovations and capabilities, entrepreneurship characteristics, and resources.

Proponents of the strategic choice theory argue that a firm's output will depend on the owner's behavior, which is determined by his/her knowledge, skills, and abilities to access and capitalize on key resources. This theory relates to the contribution of human capital in the form of formal education and experience (industry, managerial and/or prior business experience). It proposes that human capital and firm resources together with entrepreneur specific capabilities allow some entrepreneurs to enter profitable niches and enjoy sustained superior performance compared to others (Moreno and Coad, 2015). According to this explanation, HGFs can be seen as skilled firms with the ability to identify entrepreneurial opportunities for creating a competitive advantage for themselves.

The second argument about the determinants of firm growth argues that growth is a product of random events. According to this argument the patterns that are identified in stochastic methods are confused and used for fitting a specific theory of convenience and hence it is difficult to fully understand the systematic drivers of sustained superior performance unless the effect of randomness is known in a large population of firms (Henderson et al., 2012).

4.2.3 Business environment and a firm's performance

The role of business environment in a firm's growth and improved performance has been of interest for policymakers and entrepreneurs. The World Bank's publication of 'Doing Business' has been widely used to give a general picture about the business environment in an economy. Policymakers have been advocating various reforms for improving their countries' ranking and efficiency.

Amin and Soh (2019) did a comparative study of the business environment of firms operating in Malaysia with those operating in upper-middle-income and high-income countries using the WBES database for 2014-15. They observed that the top three challenges that firms faced in Malaysia were practices of the informal sector, tax rates, and licensing procedures. For upper-middle-income countries, the major challenge was access to finance, and it was tax rates for firms that operated in high income countries. Licensing and permits were not among the top three challenges in these groups of countries.

Nguimkeu (2013) investigated the main barriers of doing business in Cameroon using ES data on retailing firms for 2009. His findings show that taxation, illicit trade, lack of infrastructure, lack of access to credit, administrative delays, and incompetence of the labor were the major obstacles for

retailing firms. Using a structural econometric analysis, he was able to show that business climate factors reduced the annual gross margins of domestic traders significantly.

In their study on the prevalence and determinants of high-growth enterprises in 11 SSA countries, Goedhuys and Sleuwaegen (2010) show that electricity and access to finance were major constraints in all surveyed countries among the listed elements of the business environment.

4.2.4 Current status of African firms' growth and industrialization

The performance of many countries in Africa has been described as weak and vulnerable to shocks. One of the key reasons for the observed low performance of African economies could be the missing manufacturing sector in these economies. The rapid growth that occurred in some countries on the continent was not pro-poor (African Development Bank Group, 2019).

According to reports by the African Development Bank Group (2019, 2020), there is a huge mismatch between labor supply and demand in addition to a skill mismatch. The Bank projects the continent's labor force to grow by 30 percent by 2030. With the existing job creation rates, only half of the labor force is expected to get jobs and most of the jobs are predicted to be in the informal sector. In terms of number of people without a job, this is equivalent to about 100 million young people by 2030 (African Development Bank Group, 2019).

Two more key challenges on the road to industrialization in African economies are premature deindustrialization on the continent (that is, the service sector becoming dominant) and high rate of firm exit and job losses. The African Development Bank Group (2019) estimates that every year 1.3–3 million jobs are lost due to challenges that emanate from inappropriate business environments and this would have supplied jobs to 20 percent of the new entrants to the labor force every year. These challenges are related to weak institutions (administration, taxation, and corruption) and inadequate infrastructure.

The limited cases when small and medium firms graduate to medium and large firms present another hurdle in the industrialization process in African economies. Small firms show little dynamism in Africa showing small chances of transitioning into medium and large firms (African Development Bank Group, 2019).

Iacovone et al. (2013) did a comparative study of the growth performance of firms in African countries and firms in the rest of the world using the WBES database. In their analysis, they used 41,000 firms from 119 countries to examine the drivers of firm growth. A key finding of their research was that African firms were smaller than firms in other regions of the world by 20–24 percent at any age considered.

The manufacturing sector value added as share of GDP for sub-Saharan African countries excluding high-income countries was 11 percent (compared to 20 percent for middle income countries) with an annual growth rate of 2 percent (compared to 6.2 percent for low income economies) in 2018 (The World Bank, 2019).

These numbers show that the manufacturing sector in Africa is lagging behind and its critical role in economic development in Africa is limited by two inter-related factors of lack of comparative advantage in the manufacturing sector and low investments in capital intensive manufacturing activities (Bigsten and Söderbom, 2010).

One potential advantage of firms in Africa over the rest of the world is low wage rates. Clarke (2012) showed that there were low labor costs in the region, and this might give Africa a competitive advantage.

4.3 Methods

4.3.1 Defining and measuring HGFs

An analysis of the prevalence and determinants of HGFs could not be done without setting a working definition of HGFs. Several approaches are used in this regard although the following four and their derivatives are widely used in literature.

i. Top 1 percent or 5 percent firms in terms of revenue, employment, profits, and labor productivity as measured in growth rates, absolute change, log changes, and index.

ii. Firms with 20 or more employees for the period under investigation as defined by the Global Entrepreneurship Monitor (GEM) (Autio, 2007).

iii. Firms with annualized growth rate of at least 20 percent over a 3-year period and at least 10 employees (Eurostat- OECD, 2007).

iv. Establishments which have achieved a minimum of 20 percent sales growth each year over the interval, starting from a base-year revenue of at least $100,000 (Birch, 1987, cited in Henrekson and Johansson, 2010).

Earlier estimates of high-growth firms defined HGFs as the share of firms with the highest growth during a particular period. Studies used the top 1 percent or top 5 percent firms in terms of growth rates. The problem with this approach is that it is difficult to create consistent time series data on HGFs because the threshold that defines the top firms is subject to change depending on their macroeconomic performance as indicated by business cycles (could be a high cut-off point during expansion and a low cut-off point during recession). This makes comparing HGFs across time and across countries inconvenient.

Later, Birch's (1987) original proposition was dropped and a new index called the 'Birch Index' was introduced as an alternative measure of firm growth (Coad et al., 2014; Hölzl, 2011; Schreyer, 2000). The Birch Index (BI) corrects the inherent bias of using absolute and relative measures of growth since several studies have documented that small firms exhibit larger relative growth rates of employment while bigger firms show larger absolute growth rates. The Birch Index based on HGFs considers both the relative and the absolute employment growth rates and is based on a multiplicative combination of the absolute growth rate and the relative growth rate. The value of this index for this study is calculated as (Coad et al., 2014; Hölzl, 2011):

$$(4.1) \quad BI = [\,Employ't\ 2014 - Employ't\ 2010\,][\frac{(Employ't\ \ 2014)}{Employ't\ 2010}]$$

Under this index, firms can be classified as HGFs by deciding the cut-off point to be used such as firms with BI values of top 1 percent, 5 percent, and 10 percent. Some studies define the top 10 percent of firms with the highest Birch Index as high-growth firms (Lopez-Garcia and Puente, 2012; Schreyer, 2000).

For the investigation at hand, although one or a combination of these approaches can be used, customizing the criteria is required due to availability of data and the economic situation in

Ethiopia. Application of the GEM approach does not really show the potential of firms' growth since it ignores the number of years required to reach the threshold employment level. On the other hand, the threshold level of growth rates and initial employment recommended by OECD needs to be adjusted by considering that there are a limited number of entrepreneurial firms in Ethiopia. Based on ES data on Ethiopia, the standard Eurostat-OECD definition of HGFs will exclude more than 95 percent of the firms in the sample.

Based on Goedhuys and Sleuwaegen (2010), the threshold level of initial size is firms with at least five employees and the growth rate is calculated for four years owing to data availability problems in 2010-14 while the threshold is set to be a minimum of 10 percent average growth rate per annum. Accordingly, HGFs are firms with an annualized growth rate in excess of 10 percent over the period 2010-14 and with at least five employees in 2010.

For the Birch Index measure of HGFs in this study, owing to the low incidence of HGFs in Ethiopia and to generate a comparable number of HGFs using the Eurostat-OECD definition, the top 20 percent firms are used.

The ES of World Bank's reports sales data for all firms for two years only (2012 and 2014) leads to a very narrow measurement of firm growth in terms of sales. Therefore, growth of an establishment measured by its sales growth is ignored in this essay as the survey does not report sales data for 2010.

Using the relative measure of growth, 137 firms were classified as HGFs while only 109 firms emerged as HGFs using BI. The number of HGFs further decreased to 86 and 56 if one adopted the top 15 percent and 10 percent cut-off points respectively in BI. Like the Eurostat-OECD approach, a 10 percent cut-off point on the BI will exclude 90 percent of the sample firms.

In this analysis, we capture fast-growing firms based on the modified Eurostat-OECD definition as HGF and the modified Birch Index based high growth firms as BHGF.

4.3.2 Measuring Business Obstacles

Two groups of questions are presented on business obstacles in the questionnaire of the enterprise survey by the World Bank. The first group of questions asks about the severity of an obstacle using a Likert scale question format by listing each obstacle separately. Establishments are then asked to express their perceptions about the magnitude of the obstacle caused by elements of the business environment with a zero score implying it is not an obstacle while a score of five implies that it is a very severe obstacle. The second type of questions, however, ask firms to select the single most important obstacle among a list of possible ones. In the second approach, firms are expected to compare obstacles and select the one they believe is the biggest obstacle relative to all listed obstacles while in the first approach they are exposed to one challenge at a time and asked to state if it is an obstacle or not.

Since the sampling design for the World Bank Enterprise Survey is stratified random sampling, individual observations should be properly weighted when drawing inferences about the population. Under stratified random sampling, unweighted estimates are biased unless sample sizes are proportional to the size of each stratum. This is important because individual observations may not represent equal shares of the population.

To identify key business obstacles, the analysis in this essay is based on the percentage of firms which reported the listed elements as major or severe obstacle (scores of 3 or 4) from the first group of questions. In an effort to identify the number one perceived obstacle among the given list of obstacles, the frequency with which an obstacle is selected by firms as the biggest obstacle is computed.

4.3.3 Modeling the determinants of a firm's growth

The data analysis involves the use of both descriptive and econometric techniques. The descriptive analysis is used for exploring the distribution of HGFs in Ethiopia using firm characteristics and other relevant factors.

Although several researchers have modeled the determinants of firm growth differently, the empirical model for in this essay is based on Goedhuys and Sleuwaegen (2010) who modeled firm growth as a function of firm age and size after controlling for other relevant factors which they classified into three major categories -- firm characteristics, technological characteristics, and firm resources. Firm characteristics refer to variables such as firm age and size, sex of the entrepreneur, and education levels of the top management while resources refer to firm level resources to deal with constraints arising from poor infrastructure, insecurity, and financial constraints. Further, the nature of a firm concerning export status, licensing technology from foreign-owned companies, ownership of a website, and delivery of training were used as a proxy for a firm's technological characteristics.

Owing to data non-availability and a high rate of non-response to some of these variables, some of these characteristics were dropped and other new variables were included. The model estimated is given in Equation 4.4.

$$\text{Firm growth} = f(\text{firm age, firm size \& firm resources, technological \& market characteristics \& other dummies}) \tag{4.2}$$

$$\begin{aligned} GROWTH4 = {} & a_0 + a_1\,(\text{Employment 2010}) + a_2\,(\text{Employment 2010})^2 \\ & + a_3\,(\text{Firm age}) + a_4\,(\text{Firm Age})^2 + a_5\,(\text{Employment 2010}) * (\text{Firm age}) \\ & + \sum b\,(\text{Entrepreneur characteristics}) + \sum c\,(\text{Technological \& Market characteristics}) \\ & + \sum d\,(\text{Resources}) + \sum f\,(\text{Industry dummies}) + \varepsilon_i \end{aligned} \tag{4.3}$$

Given several approaches of measuring HGFs, this essay uses the two most frequently used ones: the modified Eurostat-OECD definition and the modified Birch Index.

To measure firm growth using the modified Eurostat-OECD definition, we take the logarithmic difference in the number of employees over a 4-year period as:

$$GROWTH4 = \ln(S_{i,2014}) - \ln(S_{i,2010}) \tag{4.4}$$

where GROWTH4 is the growth rates for firm i, and $S_{i,\,2014}$ and $S_{i,\,2010}$ show firm sizes in 2014 and 2010 respectively.

A quantile regression (QR) is preferred to the OLS method for estimating the results in this study because OLS estimates how the mean of the (conditional) distribution of firm growth rates change systematically with its covariates assuming a well-shaped normal distribution of growth around

the mean. In other words, it provides the marginal effect of the explanatory variables at the mean of the growth distribution (Goedhuys and Sleuwaegen, 2010).

A quantile regression, on the other hand, estimates the effects of the different explanatory variables at different quantiles of the growth distribution. Since the HGFs are located in the extreme tail of the conditional growth distributions, factors that affect the upper deciles can be considered as factors that generate a significant number of HGFs. Using a quantile regression avoids regression of the mean and shows the marginal effects at various deciles of the growth distribution.

The correlation among the explanatory variables was checked by using the correlation matrix (not reported here for brevity) and no problem of multicollinearity was found.

4.3.4 Data

4.3.5 Data Source

This essay is based on the World Bank's Enterprise Survey (ES) data on Ethiopia for 2015 which was a sample survey conducted using stratified random sampling with industry, establishment size, and region representing the three levels of stratification used. The survey covered 848 firms including micro, small, medium, and large firms. In this study, the 26 micro firms were excluded owing to their insufficient representation, so we had a total of 822 firms. Further cleaning of the data by considering firms with positive employment history in 2010 (to calculate growth rate over four years), dropping firms with no/error responses to employment size, and defining outliers in employment data as observations that are more than three standard deviations away from the mean in 2014 to purge out the effect of a few outliers, led to 547 firms. After removing the outliers, nearly 97 percent of the enterprises had 5-290 employees.

The WBES questionnaire is very comprehensive with a number of relevant questions covering both the manufacturing and the service sectors. The questionnaire has 14 major components with relevant sub-sections for each. It starts by asking respondents' control information (biography) on firm size, size of locality, industry classification, and region of operations. The general information section asks about issues related to ownership type and sex of the top manager while the next section raises questions related to infrastructure and services. Questions related to sales and supplies, degree of competition, innovations, capacity utilization, land and permits, incidence and cost of crime, sources of finance, business-government relations, labor, business environment, and firm performance are an integral part of both the manufacturing and service sector questionnaires. The questionnaires distributed to manufacturing firms and the service sector have comparable contents with some minor differences.

The survey covered firms operating in six major geographical regions in the country -- Addis Ababa, Oromia, Amhara, SNNP, Tigray, and Dire Dawa while the size stratification was defined into small if employment was between 5 to 19 employees, medium if employment was between 20 to 99 employees, and large if a firm had more than 99 employees. Half of the sample firms were operational in Addis Ababa with Oromia and Tigray hosting 15 percent of the sample firms each. Dire Dawa had the smallest number of firms while Amhara and SNNP accounted for about 8 percent of the sample firms each.

The survey was conducted for all categories of businesses. Two questionnaires were used in the survey (one for manufacturing and the other for the service sector) with common questions (core module) and additional questions to capture sector specific issues. The distribution of the sample

by industry classifications shows that the highest number of enterprises were from the wholesale industry (16 percent) followed by the food industry (11 percent). The retail trade sector accounted for the third highest number of firms in the sample (11 percent). In terms of gross classification into service and manufacturing sectors, 56 percent of the firms belonged to the service sector while the remaining 44 percent belonged to the manufacturing sector. Considering their size, the small firms accounted for just over half (51 percent) of the firms while the remaining half was accounted for by medium (33 percent) and large (16 percent) firms (Tables 4.1 and 4.2 give the details).

Table 4.1: Distribution of the sample establishments by region and size

	Screener Size			
Sampling region	Small	Medium	Large	Total
Addis Ababa	101	117	58	276
Amhara	24	17	4	45
Dire Dawa	8	6	2	16
Oromia	54	14	16	84
SNNP	26	13	4	43
Tigray	64	16	3	83
Total	277	183	87	547

Source: Enterprise Survey 2015 (The World Bank).

Table 4.2: Distribution of the sample by industry and firm size

Industry Screener	**Screener Size**			
	Small	Medium	Large	Total
Food	19	26	19	64
Textiles	1	1	4	6
Garments	11	7	1	19
Leather	4	4	5	13
Wood	1	3	2	6
Paper	0	1	1	2
Publishing, printing,	4	13	2	19
Chemicals	1	1	3	5
Plastics & rubber	1	10	8	19
Non-metallic mineral	24	12	2	38
Basic metals	3	4	1	8
Fabricated metal products	6	5	1	12
Machinery and equipment	3	0	1	4
Electronics (31 & 32)	0	1	0	1
Precision instruments	1	1	0	2
Transport machines (3)	1	2	1	4
Furniture	12	5	3	20
Construction section	12	13	5	30
Services of motor vehicles	17	11	3	31
Wholesale	48	29	10	87
Retail	49	8	5	62
Hotels and restaurants	28	16	6	50

Transport Section I:	29	9	4	42
Information Technology (IT)	2	1	0	3
Total	277	183	87	547

Source: Enterprise Survey 2015 (The World Bank).

4.4 Empirical Results

4.4.1 The prevalence of HGFs

Using the two measures, two cohorts of HGFs were identified. The Eurostat- OECD classified 137 firms as HGFs. Using a top 20 percent cut-off from BI, there were 109 HGFs. Compared to BI, the Eurostat- OECD measure identified close to 30 percent of the surveyed firms as HGFs while BI showed that 20 percent of the firms could be considered as HGFs in Ethiopia (Table 4.3). The relaxation of the assumptions in the Eurostat- OECD measure could lead to different levels and types of HGFs. Using the standard Eurostat-OECD definition of 20 percent annualized growth rate and a minimum of 10 employees at the start of the study period, only 6 percent of the sample firms emerged as HGFs. These results are consistent with Petersen and Ahmad (2007) and Goedhuys and Sleuwaegen's (2010) results.

Irrespective of the type of measurement used, 369 firms (over two-third of the establishments) were non-high-growth firms. On the other hand, more than 50 percent of the HGFs identified through the relative criteria remained HGFs when evaluated using the Birch Index while 86 percent of the HGFs identified using the Birch Index remained in the same category when the Eurostat-OECD measure was used. This result is consistent with previous research findings that claim that different measures of HGFs lead to different firms being selected as high-growth firms.

Table 4.3: A comparison of high-growth firms by measurement type (percent)[22]

	BI-based HGF		
HGF	0	1	Total
0	67.45	2.72	70.17
1	13.04	16.79	29.83
Total	80.49	19.51	100

Source: Enterprise Survey 2015 (The World Bank).

The two cohorts of HGFs identified in Ethiopia and used in this essay had similar features. In terms of age, for example, the mean age of HGFs was around 12 years compared to the mean age of the non-high-growth firms which was close to 15 years and 14 years for all the firms respectively. Under both the measures, HGFs were younger by three years on average than the non-HGFs. Concerning ownership structure, the Eurostat-OECD measure identified around 53 percent of the HGFs that had sole ownership while 25 percent of them were operational under the limited partnership form of ownership. The Birch Index, on the other hand, showed that 70 percent of the BI-based HGFs had sole ownership and limited partnerships with each contributing half of the proportion. The differences were found to be statistically significant using the two-sample t-test and chi2 test of independence. The search for gazelles, firms which are HGFs and younger than five years, was unsuccessful as there were no firms of this kind in the economy.

[22] HGFs are defined as the dummy variable and 1 shows HGFs for BI-based HGFs while 0 stands for non-HGFs.

On the other hand, persistence of HGFs was not studied due to data problems. In Ethiopia, since most of the firms are small there is a high tendency for firms to fall below the threshold level of employment. Ayenew's (2015) study based on CSA data on large and medium sized manufacturing firms in Ethiopia showed that on average 22 percent of the firms were new entrants while 19 percent of them left the category in the same year with the exit level reaching as high as 46 percent. This makes it difficult to analyze the persistence of high growth firms.

Looking at the industry type, the two measures refer to nearly the same types of firms where the service sector is over-represented in the HGF classification with a share of over 90 percent and 85 percent under the Eurostat- OECD and Birch Index measures respectively. The Eurostat- OECD measure shows that service of motor vehicles (section G) had the highest incidence of HGs (around 27 percent) followed by the construction sector (around 27 percent) with both belonging to the service sector while under BI, wholesale business represented the highest incidence of HGFs (29 percent) followed by service of motor vehicles (section G) which accounted for 22 percent of the BHGFs. Under the two measures, service of motor vehicles, wholesale businesses, and the construction section represented the top three dominant sources of HGFs. From the manufacturing sector, only food, non-metallic mineral products, and plastics and rubber accounted for a noticeable proportion of HGFs. The three accounted for 4 percent of the HGFs using the Eurostat-OECD measure while this figure doubled to 8 percent using BI. The domination of HGFs in the service sector in Ethiopia is consistent with the findings of Henrekson and Johansson (2009) who did a meta-analysis of the role of HGFs. The incidence of high-growth firms in the manufacturing sector is very low in Ethiopia with only 4 - 8 percent of the HGFs in this sector.

Table 4.4: Distribution of HGFs by sector and by growth measure

Distribution of HGFs by sector and by growth measure			
Sector	Industry Screener Sector	Proportion of HGFs (%)	Proportion of BHGFs (%)
Service Sector	Service of motor vehicles (G)	26.92	22.13
	Construction section (F)	20.57	21.60
	Wholesale (G)	19.08	29.10
	Retail (G)	15.07	3.42
	Transport Section I: (60-64)	6.48	5.49
	Hotels and restaurants (H)	5.30	5.00
	Sub-total	93.41	86.75
Manufacturing Sector	Non -metallic mineral products (D)	1.71	2.25
	Food products and beverages (D)	1.32	4.01
	Plastics and rubber (D)	1.04	1.97
	Sub-total	4.07	8.23
The rest of the sectors		2.50	5.02

Source: Enterprise Survey 2015 (The World Bank).

Coming to the size of the firms, both measures showed somewhat similar cohorts of HGFs since medium sized firms (between 20 and 99 employees) dominated the proportion of HGFs as shown in Figure 4.1 and Table 4.5. Under the Eurostat- OECD measure, they constituted 60 percent of the HGFs while in the BI-based measure they accounted for 75.5 percent of the HGFs. The essential difference between the two measures, however, is that the Eurostat- OECD measure shows that the incidence of HGFs tended to be the least for large firms (only 2.4 percent) while it was the least for small firms under BI (less than 1 percent). This finding could be due to the

inherent bias of relative growth measures such as the Eurostat- OECD measure's bias towards small firms while the BI controls for such a bias (Coad et al., 2014; Hölzl, 2011).

Table 4.5: Proportion of HGFs in each size classification

Size screener	Proportion of HGFs using the Eurostat- OECD measure (%)	Proportion of BI-based HGFs (%)
Small	9.46	0.78
Medium	17.93	14.74
Large	2.44	3.99
Total	29.83	19.51

Source: Enterprise Survey 2015 (The World Bank).

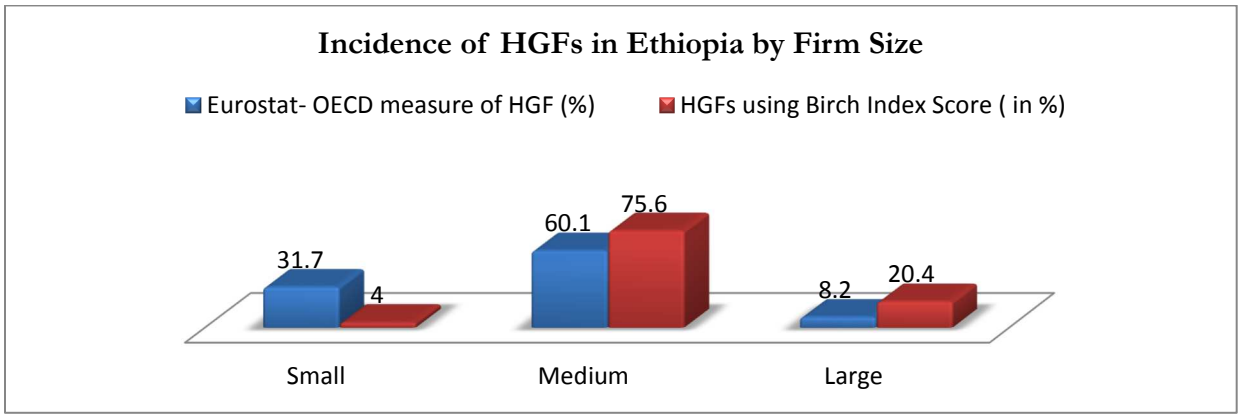

Figure 4.1: Incidence of HGFs by firm size classification

Source: Enterprise Survey 2015 (The World Bank).

Another indicator of the prevalence of HGFs used in this essay is their regional distribution. Nearly all the HGFs are concentrated in Addis Ababa regardless of the type of measurement used (over 90 percent of them) while Oromia region is the second largest host for HGFs (around 4.5 percent) under BI and 2.4 percent under the Eurostat- OECD measure. Regions showed higher share of HGFs when BI was used relative to the Eurostat- OECD measure. This result is not surprising as Addis Ababa accounted for over 80 percent of the sampled establishments and a significant percentage of them were medium sized firms (35 percent of them) with high incidence of HGFs in the survey and the differences were found to be statistically significant.

Table 4.6: Distribution of HGFs by region and by growth measure

Incidence of HGFs in Ethiopia by Firm Region and Measurement Type		
Sampling region	Percent of HGFs	Percent of BHGFs
Addis Ababa	93.9%	89.9%
Amhara	0.6%	1.5%

Dire Dawa	0.2%	0.2%
Oromia	2.4%	4.5%
SNNP	1.3%	2.7%
Tigray	1.6%	1.5%
Total	100.0%	100%

Source: Enterprise Survey 2015 (The World Bank).

Table 4.7: Descriptive Statistics (average values) in 2014 for HGFs and non-HGFs

Static	HGFs in terms of Eurostat-OECD	Non- HGFs in terms of Eurostat- OECD	HGFs measured as top 20% on BI score (i.e. BHGF)	Non- HGFs measured using BI score
Employee growth in 2010–14	22.3 %	7.2%	26.5%	8.1%
Sales growth in 2012–14	12.4%	13.5%	18.5%	12%
Firm size	11 employees	9 employees	17 employees	9 employees
R&D engagement	4.8%	2.6%	6.5%	2.5%
Export engagement	4.5%	2.6%	6.5%	2.5%
Innovation activities	45%	55%	32.5%	67.5%
Domestic ownership	27.6%	72.4%	15.9%	84.1%
Foreign ownership	60.5%	39.5%	70.5%	29.5%
Female ownership	38%	62%	20.8%	79.2%

Source: Enterprise Survey 2015 (The World Bank).

Table 4.7 gives the average statistics of firm performance for the two cohorts of firms. The table shows that HGFs had a growth rate which was three times that of non-high-growth firms on average under the two measures. HGFs also showed a higher number of employees on average with nearly twice the number of employees as compared to non-HGFs using BI. They also had a high proportion of export engagements and a significantly large proportion of firms were owned by foreigners.

4.4.2 Business obstacles as perceived by establishments

This analysis of business obstacles is based on the two inter-related groups of questions asked in the questionnaire. Measuring the proportion of firms which reported an element of a business environment as a major obstacle or a very severe obstacle, 33 percent of all firms reported supply of electricity as a major or severe obstacle making it the top ranked obstacle to doing business followed by corruption and tax rates. Corruption was perceived to be the top obstacle by around 29 percent of the establishments and 28 percent of them ranked tax rates either as a major or very severe obstacle. Problems related to tax administration and informal sector competition were the fourth and fifth major or severe obstacles in doing business in Ethiopia. From this data, it can be seen that both tax rates and its administration are a severe obstacle to doing business. Figure 4.2 presents the details of the obstacles perceived by firms.

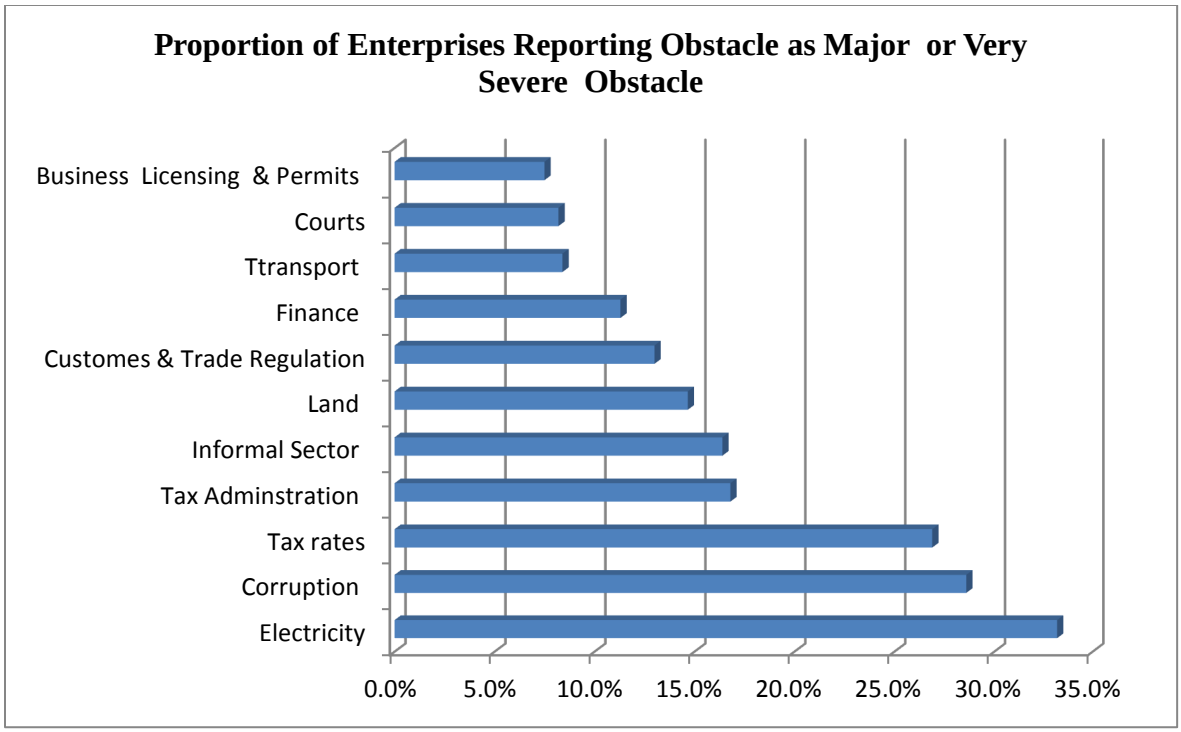

Figure 4.2: Percentage of firms reporting Business Obstacles as a major or very severe obstacle

Source: Enterprise Survey 2015 (The World Bank).

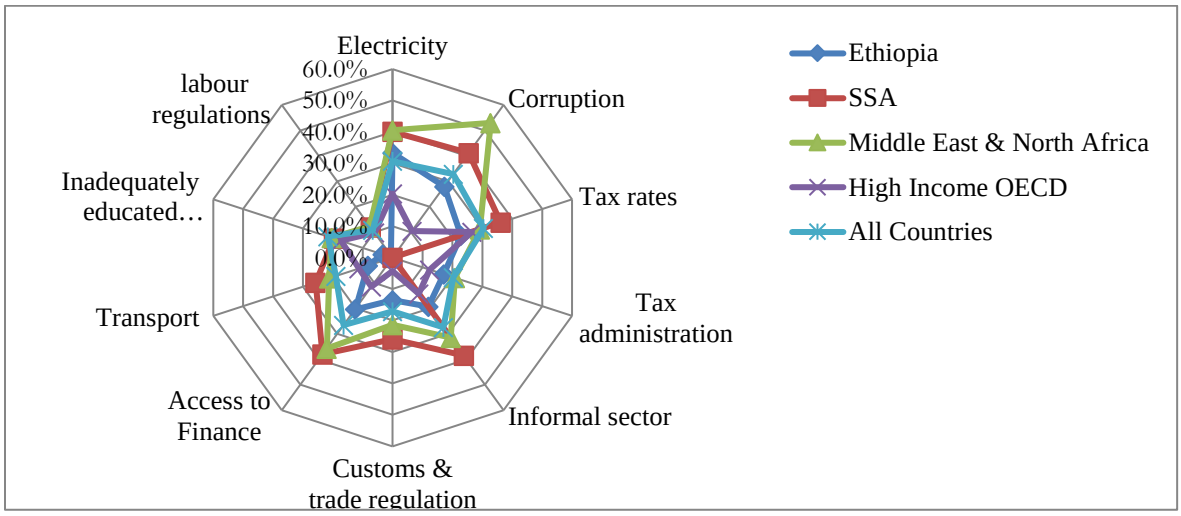

Figure 4.3: Global picture of perceptions about business obstacles by firms

Source: Enterprise Survey 2015 (The World Bank).

The World Bank Enterprise Survey which covers 139 countries and over 125,000 firms (The World Bank, 2015) presents an excellent opportunity for doing a global comparison of the business environment in which firms operate. Figure 4.3 sheds light on the global picture of business obstacles that firms believe hinder their growth. The radar locates Ethiopia close to the center next to the high-income OECD countries using most of the indicators which shows that firms in

Ethiopia work under a better environment relative to most of the countries surveyed. Compared to SSA, for example, Ethiopia is superior in nearly all the indicators.

Further, ES also asks establishments to identify the biggest obstacle among a given list of 15 obstacles some of which have been identified earlier. Looking at the responses to the question that asks the single most important obstacle, over 40 percent of the establishments selected access to finance as the number one problem while customs and trade regulations and electricity supply were rated as the biggest obstacles by 12 percent and 10 percent of the establishments respectively. Tax administration and the informal sector's practices were reported as the biggest obstacles by approximately 8 percent and 6 percent of the establishments respectively. Figure 4.4 gives the details.

Taken together, the two types of questions reveal that access to finance and shortage of electricity were the two most important obstacles followed by customs and trade regulations and corruption with tax rates emerging as another important challenge.

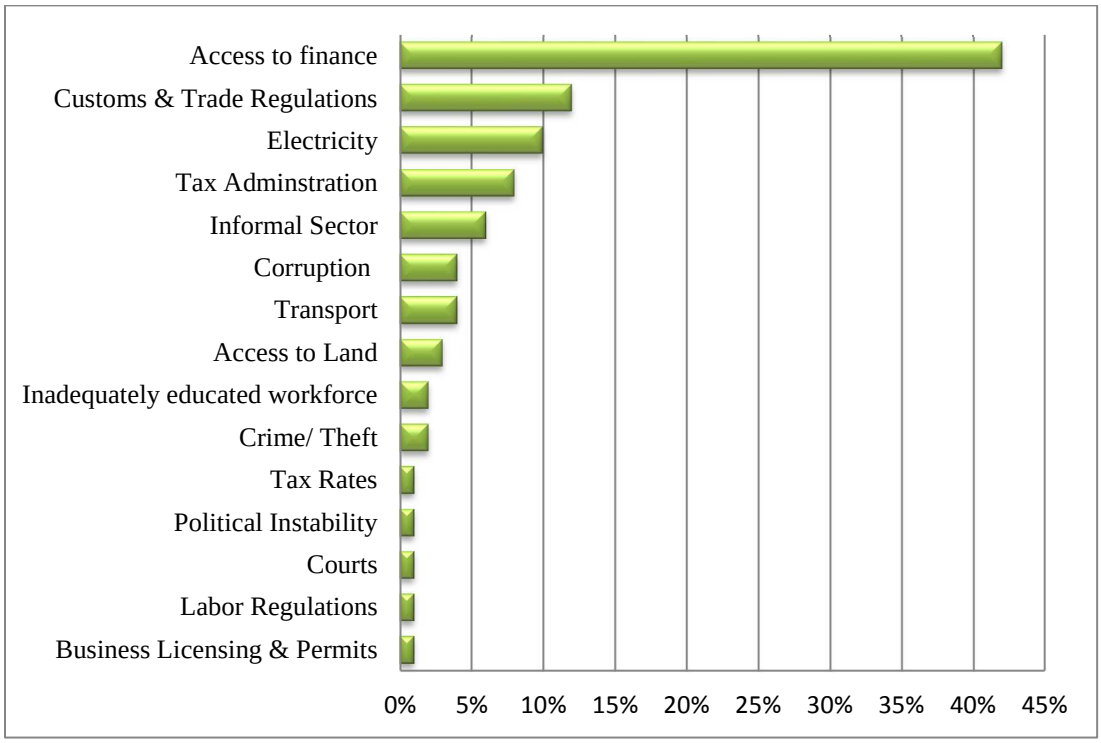

Figure 4.4: Single most important obstacle to doing business in Ethiopia (%)

Source: Enterprise Survey 2015 (The World Bank).

A decomposition of the analysis of the biggest obstacles using a firm's growth achievements shows that the perceived business obstacles were not the same for the two cohorts of firms. Access to finance was perceived as the biggest obstacle by both cohorts of firms with the problem being more severe for non-HGFs. For HGFs, tax rates and customs and trade regulations represented the second and third biggest obstacles for firms while electricity and corruption completed the list of the top five obstacles. For non-HGFs, the informal sector, electricity, tax administration and customs, and trade regulations were among the top five biggest obstacles in order of importance (see Figure 4.5 for details). These findings show that access to finance is a dominant challenge affecting a significant number of firms irrespective of the growth of the firms. The difference in

perceived obstacles by the two groups of firms was tested using the chi2 test of independence and the result confirms the presence of a statistically significant difference at the 5 percent significance level.

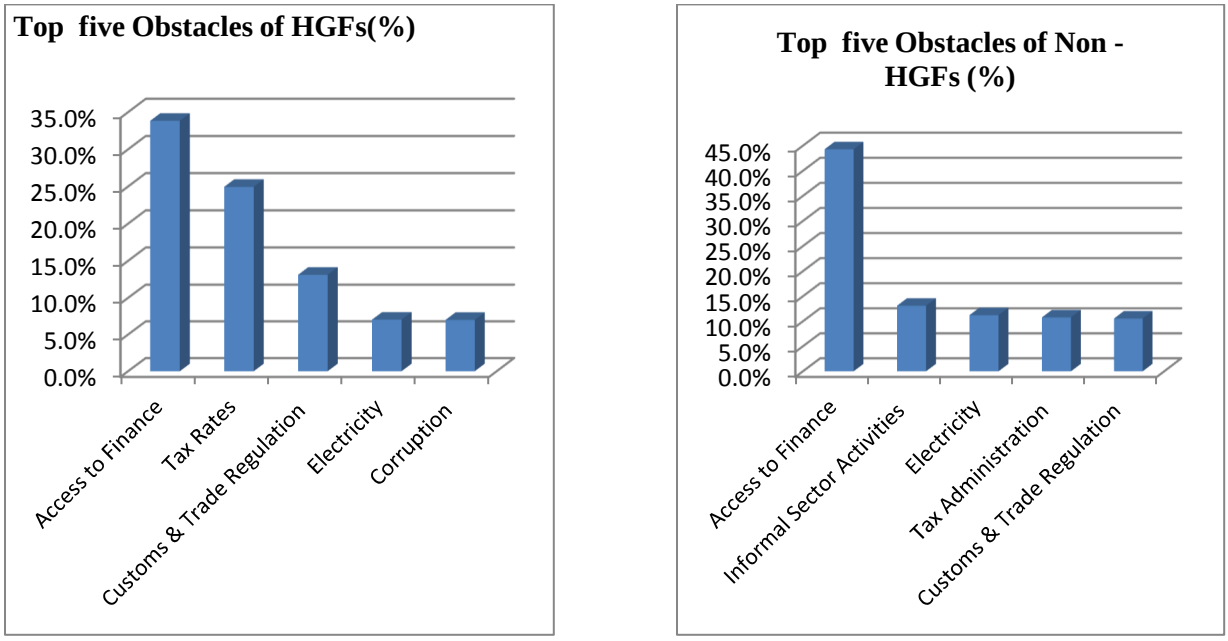

Figure 4.5: Top-five most important obstacles in Ethiopia by firm growth category

Source: Enterprise Survey 2015 (The World Bank).

An analysis of the business obstacles using the region of operations as a reference point shows that there is a systematic difference among the regions (Figure 4.6). Looking at these problems from a regional perspective, firms operating in different regions perceive different obstacles and the differences have been found to be statistically significant. For establishments in Addis Ababa, for example, 45 percent of the firms believed that the biggest obstacle was access to finance while only 21 percent of the firms operating in Oromia considered finance as the biggest obstacle and it was not reported in the list of top three problems for firms operating in Amhara region and SNNP. For firms in these regions, corruption topped the list in Amhara while electricity was the biggest obstacle in SNNP. Establishments in Oromia reported informal sector activities as their biggest obstacle (29 percent) while those operating in Tigray reported finance as a key problem (42 percent). The implication of this finding is that regions should take into account these differences in their attempts at improving the business environment.

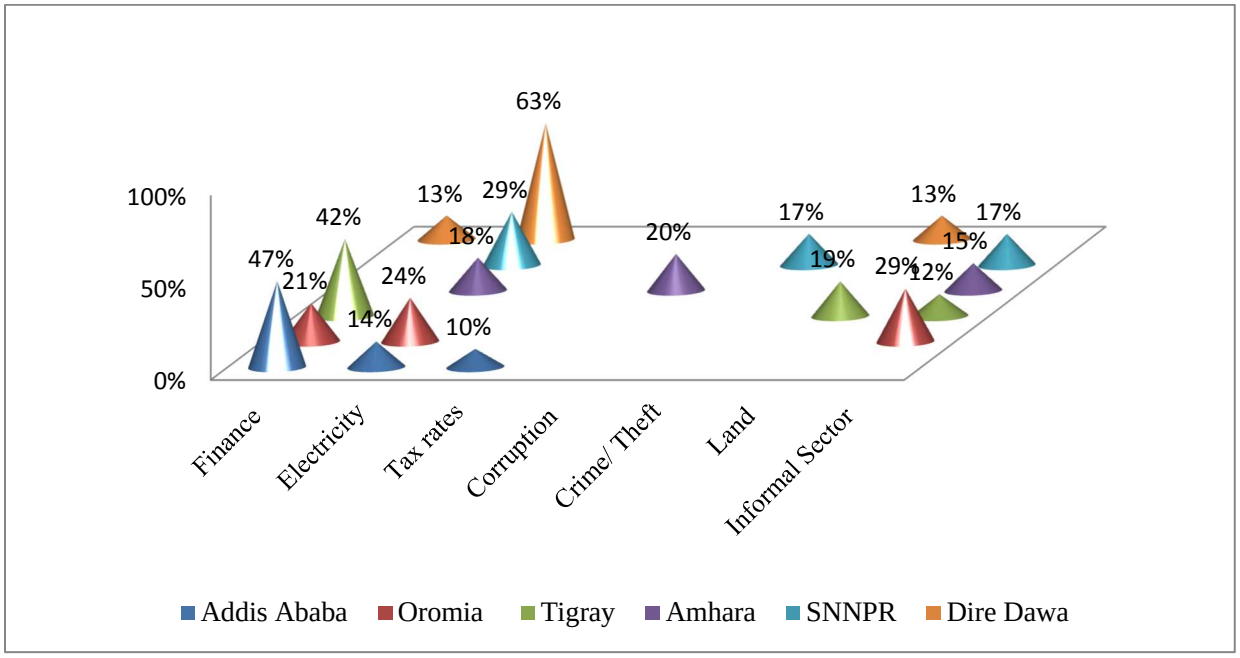

Figure 4.6: Top Business Obstacles by region of establishment

Source: Enterprise Survey 2015 (The World Bank).

Regrouping the obstacles into five major categories, as indicated in Figure 4.7, as infrastructure (electricity and transport), access to finance, institutions (business licensing and permits, labor regulations, crimes/thefts, courts, customs and trade regulations, corruption, tax administration, tax rates, and the informal sector), access to land and other obstacles which include political instability and an inadequately educated workforce, generates three dominant obstacles. According to this classification, institutions emerge as the second biggest obstacle with 34 percent of the establishments reporting it as the biggest obstacle next to finance with 42 percent of the firms reporting finance as the biggest obstacle. Further, 14 percent of the firms reported infrastructure as the biggest obstacle with these three obstacles being reported by nearly 90 percent of the establishments.

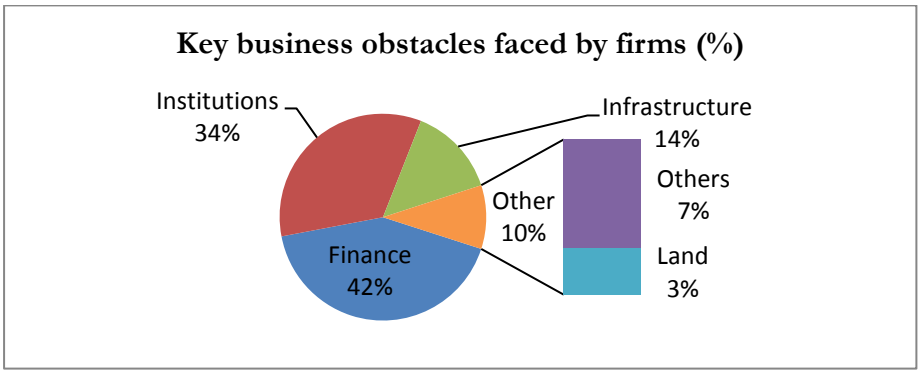

Figure 4.7: Top Business Obstacles classified into five major elements

Source: Enterprise Survey 2015 (The World Bank).

4.4.3 A Test of Gibrat's law

Gibrat's law of proportionate effects proposes that a firm's growth is independent of its size. This law can be easily tested by plotting the log size of the firm size at a given point of time. The plot was done by using the number of employees in 2014. In Figure 4.8, the normal line is presented by the dashed line while the unbroken line represents the kernel density curve. Looking at Figure 4.8, the natural logarithm of size does not follow a normal distribution. The distribution has a peak around eight employees and is skewed to the right. This is indirect proof against the law because small firms (as presented by the high density around eight employees) grow faster than their medium and large counterparts.

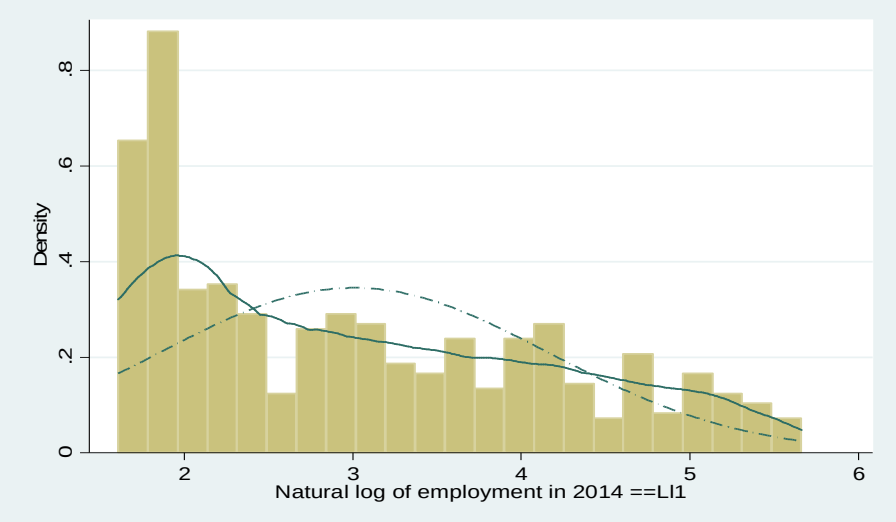

Figure 4.8: Log normality plot of firm size using number of employees in 2014

Source: Enterprise Survey 2015 (The World Bank).

4.4.4 Econometrics Analysis

An econometric estimation was done using OLS and quantile regression and the results are presented in Table 4.6. The first column gives the results of the OLS estimation while columns 2–10 give the QR results which show the marginal effects at various deciles of the distribution. The reference group consists of firms in Addis Ababa, active in hotels and restaurants, and solely owned by male domestic entrepreneurs.

An analysis of the results of the OLS estimation shows that firm growth was negatively related to firm size and positively related to the squared term. The average marginal effect was negative and significant implying a convex relationship between size and firm growth. The QR results also support the OLS estimation. From the quantile regression, the size effect is highly significant and negatively related to firm growth at each decile. The negative relationship shown in the table suggests that small firms grow faster than larger firms and this result is consistent with many global studies on the nexus between firm size and growth. The log normality plot of firm size introduced in this essay is also in line with this finding. Further, Bigsten and Gebreeyesus (2007) found similar results using CSA data on Ethiopian manufacturing firms.

Similarly, concerning the association between firm age and growth, the analysis shows that there is a negative and convex relationship between age and growth under the OLS estimation. QR also shows a similar relationship between the two but the relationship is significant only at the 60th, 70th, and 80th growth deciles. For HGFs which would be normally located in the 90th decile, age is no more significant.

Other important variables of interest in the analysis are the role played by gender and nationality of the owners of the establishments on firms' growth. From the OLS regression, there is no statistically significant difference in firms' growth based on gender and nationality of the owner. The result is generally the same when evaluated using QR except for the 30th and 40th growth deciles for which female ownership has a statistically significant negative effect on growth at the conventional significance level.

Concerning technological and market factors that are hypothesized to determine growth, the OLS regression shows that firm level product and process innovations and ownership of a website had a positive and significant effect on firm growth. Other explanatory variables in this category such as degree of competition, experience of the top management, training, degree of capacity utilization, and export engagement had an insignificant effect on firm growth.

An analysis of QR conveys more or less similar results on the effect of technological and market factors. From the QR findings, innovations (both product and process) are found to positively and significantly affect growth at all deciles of the distribution. Both process and product innovations could contribute for a maximum of a 5-percentage point increase in firm growth. Previous export engagements have a positive and significant effect on firms in the 90th decile. For most of the growth distribution, exporting firms had lower growth rates using QR and the results were significant for most of the growth deciles. Exporting firms' growth might be better measured by other measures of growth such as sales or revenue growth. Goedhuys and Sleuwaegen (2010) also found similar relationships in their study. All the other technology and market factors were insignificant in affecting HGFs.

From the resource dummies used in the regression, the OLS regression shows a positive relationship between ownership of generator(power) and access to overdraft facilities with growth. The mean growth is predicted to grow by 2 and 3 percentage points for firms with generators and access to overdraft facilities respectively. QR shows that the role of these resources is not the same for all firms. Ownership of a generator enhances growth for firms that fall in the 60th and 70th growth percentile while access to overdraft facilities could increase firm growth by 6 percentage points for the top growing firms.

An analysis of ownership type and region of operations dummies provides an interesting insight. Sole ownership seems to have the upper hand in growth performance for some of the growth deciles against all other forms of ownership although the OLS estimation found it to be insignificant. Hence, the role of ownership in a firm's growth is not well established. Similarly, establishments whose business operations were located in the capital city, as expected, outperformed others. The differences were significant for firms in Oromia, SNNP, and Tigray regions under the OLS estimation. The QR estimates confirm these findings although the top growing firms (that is, firms in the 90th percentile) did not show statistically significant differences across regions. For firms in the Amhara and Dire Dawa regions, both estimation techniques failed to show any statistically significant difference from firms in Addis Ababa.

Concerning the relationship between the sector of establishment and growth, the OLS estimation shows that there were no significant differences among firms except the construction sector in which firms had a statistically significant superior growth performance relative to those in the hotel and tourism sector. From QR, there is no significant difference in growth rate of firms based on industry type. The only exception is firms in the construction sector which have higher growth rates relative to the reference groups for most of the growth quantiles. Firms from the garment and textile industry outperformed the reference group at the 90th decile.

Table 4.8: OLS and QR Estimation Results

VARIABLES	OLS	QR10	QR20	QR30	QR40	QR50	QR60	QR70	QR80	QR90
SIZE	-0.152***	-0.130***	-0.146***	-0.146***	-0.156***	-0.156***	-0.161***	-0.159***	-0.157***	-0.133***
	(0.016)	(0.027)	(0.022)	(0.014)	(0.017)	(0.018)	(0.017)	(0.018)	(0.025)	(0.033)
SIZE2	0.017***	0.015***	0.016***	0.018***	0.019***	0.020***	0.021***	0.019***	0.017***	0.011*
	(0.003)	(0.005)	(0.004)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.005)	(0.006)
AGE	-0.005***	-0.002	-0.001	-0.001	-0.000	-0.001	-0.004**	-0.004**	-0.006**	-0.006
	(0.002)	(0.003)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
AGE2	0.001***	0.001*	0.001	0.001	0.001	0.001	0.001**	0.001**	0.001*	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
AGESIZE	-0.001	-0.001*	-0.001	-0.001	-0.001	-0.001	-0.001*	-0.001	-0.001	-0.001
	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
FIRM OWNERSHIP DUMMIES WITH MALE AS A REFERENCE GROUP										
FEMALE	-0.012	-0.001	-0.016	-0.022*	-0.025*	-0.022	-0.017	-0.017	-0.018	0.003
	(0.013)	(0.022)	(0.017)	(0.011)	(0.014)	(0.015)	(0.014)	(0.015)	(0.021)	(0.027)
FOREIGN	-0.017	0.037	0.029	0.007	-0.001	0.004	-0.013	-0.021	-0.027	-0.007
	(0.018)	(0.030)	(0.023)	(0.015)	(0.019)	(0.020)	(0.019)	(0.020)	(0.028)	(0.036)
TECHNOLOGICAL AND MARKET DUMMIES										
COMPETITION	-0.025	-0.049	-0.036	-0.016	-0.018	-0.029	-0.027	-0.030	-0.001	-0.022
	(0.021)	(0.035)	(0.028)	(0.018)	(0.022)	(0.024)	(0.023)	(0.024)	(0.033)	(0.043)
CAPACITY	0.013	-0.008	-0.010	0.004	0.003	0.012	0.011	0.002	0.016	0.028
	(0.016)	(0.027)	(0.021)	(0.014)	(0.017)	(0.018)	(0.017)	(0.018)	(0.025)	(0.032)

Table 4.8: …..cont'd

LEXP	-0.003	0.004	-0.014	-0.018**	-0.019**	-0.015*	-0.010	-0.008	-0.002	-0.009
	(0.008)	(0.013	(0.011)	(0.007)	(0.008)	(0.009)	(0.008)	(0.009)	(0.012)	(0.016)
DEXPO	-0.027	-0.013	-0.038	-0.038**	-0.033*	-0.036*	-0.048**	-0.048**	-0.020	0.100***
	(0.019)	(0.031)	(0.025)	(0.016)	(0.020)	(0.021)	(0.020)	(0.021)	(0.029)	(0.038)
TRAIN	0.012	0.044*	0.021	0.016	0.009	0.000	0.012	0.012	0.005	0.007
	(0.015)	(0.025)	(0.020)	(0.013)	(0.016)	(0.017)	(0.016)	(0.017)	(0.023)	(0.030)
WEB	0.044***	0.037*	0.039**	0.030***	0.033***	0.023*	0.024*	0.044***	0.047**	0.037
	(0.012)	(0.020)	(0.016)	(0.011)	(0.013)	(0.014)	(0.013)	(0.014)	(0.019)	(0.025)
PINNO	0.040***	0.039**	0.026*	0.019*	0.021*	0.030**	0.041***	0.037***	0.039**	0.050**
	(0.011)	(0.019)	(0.015)	(0.010)	(0.012)	(0.013)	(0.012)	(0.013)	(0.018)	(0.023)
PROCINNO	0.029**	0.009	0.040***	0.042***	0.046***	0.032**	0.06**	0.026**	0.025	0.050**
	(0.012)	(0.019)	(0.015)	(0.010)	(0.012)	(0.013)	(0.012)	(0.013)	(0.018)	(0.023)
RESOURCE DUMMIES										
POWER	0.022**	-0.012	0.004	0.008	0.006	0.020	0.029**	0.026**	0.027	0.023
	(0.011)	(0.018)	(0.014)	(0.009)	(0.011)	(0.012)	(0.011)	(0.012)	(0.017)	(0.022)
ODRAFT	0.032***	0.018	0.014	0.021**	0.013	0.015	0.011	0.015	0.027	0.061**
	(0.012)	(0.020)	(0.016)	(0.010)	(0.013)	(0.014)	(0.013)	(0.014)	(0.019)	(0.024)
REGIONAL DUMMIES										
AmhD	-0.003	0.016	-0.006	-0.017	-0.004	-0.008	-0.005	0.005	0.019	-0.011
	(0.019)	(0.032)	(0.026)	(0.017)	(0.020)	(0.022)	(0.021)	(0.022)	(0.030)	(0.039)
OroD	-0.038**	-0.037	-0.047**	-0.044***	-0.039**	-0.036**	-0.032**	-0.032*	-0.024	-0.050
	(0.015)	(0.026)	(0.020)	(0.013)	(0.016)	(0.017)	(0.016)	(0.017)	(0.024)	(0.031)

Table 4.8 : …..cont'd

SNNP	-0.045**	-0.001	-0.061**	-0.068***	-0.063***	-0.054**	-0.052**	-0.028	-0.028	-0.034
	(0.020)	(0.034)	(0.027)	(0.018)	(0.021)	(0.023)	(0.022)	(0.023)	(0.031)	(0.041)
TigD	-0.051***	-0.022	-0.041*	-0.047***	-0.043***	-0.055***	-0.050***	-0.051***	-0.048*	-0.048
	(0.016)	(0.026)	(0.021)	(0.014)	(0.016)	(0.018)	(0.017)	(0.018)	(0.024)	(0.032)
DDD	-0.005	-0.002	0.007	0.002	-0.012	-0.010	-0.020	0.016	-0.005	-0.048
	(0.031)	(0.052)	(0.041)	(0.027)	(0.032)	(0.035)	(0.033)	(0.035)	(0.048)	(0.063)
OWNERSHIP DUMMIES (SOLE OWNERSHIP IS THE REFERENCE GROUP)										
SHARE	0.019	0.001	-0.064	-0.069***	-0.040	0.009	0.027	0.022	0.077*	0.046
	(0.03)	(0.050)	(0.040)	(0.026)	(0.031)	(0.034)	(0.032)	(0.034)	(0.047)	(0.060)
PARTNER	-0.008	-0.017	-0.026	-0.023**	-0.011	-0.003	0.005	0.001	-0.004	-0.010
	(0.013)	(0.021)	(0.017)	(0.011)	(0.013)	(0.014)	(0.014)	(0.014)	(0.020)	(0.026)
OTHEROWNER	-0.021	-0.025	-0.046**	-0.031**	-0.028	-0.028	-0.022	-0.021	-0.023	-0.050
	(0.017)	(0.028)	(0.022)	(0.015)	(0.017)	(0.019)	(0.018)	(0.019)	(0.026)	(0.034)
INDUSTRY DUMMMIES (HOTEL AND RESTAURANT IS THE REFERENCE GROUP)										
Wholesale	-0.002	-0.039	-0.020	0.003	-0.013	-0.012	0.009	0.019	0.023	0.011
	(0.022)	(0.037)	(0.029)	(0.019)	(0.023)	(0.025)	(0.024)	(0.025)	(0.034)	(0.045)
Food	0.029	0.031	0.024	0.020	0.010	0.012	0.027	0.042	0.031	0.044
	(0.030)	(0.050)	(0.039)	(0.026)	(0.031)	(0.034)	(0.032)	(0.034)	(0.046)	(0.060)

Table 4.8: …..cont'd

Retail	-0.030	-0.039	-0.019	-0.014	-0.037	-0.039	-0.022	-0.024	-0.034	-0.011
	(0.023)	(0.039)	(0.030)	(0.020)	(0.024)	(0.026)	(0.024)	(0.026)	(0.036)	(0.047)
Transport	0.009	-0.055	-0.027	-0.026	-0.021	-0.014	-0.001	0.034	0.028	0.061
	(0.025)	(0.042)	(0.033)	(0.022)	(0.026)	(0.029)	(0.027)	(0.029)	(0.039)	(0.051)
Mineral	0.025	0.038	0.028	-0.001	-0.015	0.045	0.039	0.054	0.019	0.026
	(0.035)	(0.058)	(0.046)	(0.030)	(0.036)	(0.039)	(0.037)	(0.039)	(0.054)	(0.070)
Vehicles	0.004	0.006	0.017	0.006	-0.001	-0.009	-0.002	-0.001	0.014	-0.003
	(0.027)	(0.044)	(0.035)	(0.023)	(0.028)	(0.030)	(0.028)	(0.030)	(0.041)	(0.054)
Construction	0.059**	0.032	0.037	0.048**	0.058**	0.055*	0.077***	0.068**	0.068	0.115**
	(0.03)	(0.04)	(0.04)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.05)
GARTEX	0.035	-0.041	0.005	-0.010	-0.023	-0.017	-0.006	0.014	0.061	0.157**
	(0.04)	(0.06)	(0.05)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)	(0.06)	(0.07)
WOODFUR	0.026	0.020	0.040	0.015	0.013	0.034	0.034	0.043	0.022	0.036
	(0.04)	(0.06)	(0.05)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)	(0.06)	(0.07)
OtherSEC	0.030	0.016	0.052	0.030	0.016	0.027	0.038	0.046	0.026	0.041
	(0.030)	(0.050)	(0.040)	(0.026)	(0.031)	(0.034)	(0.032)	(0.034)	(0.047)	(0.061)
Constant	0.385***	0.234***	0.315***	0.327***	0.366***	0.386***	0.404***	0.420***	0.448***	0.480***
	(-0.035)	(-0.057)	(-0.045)	(-0.030)	(-0.036)	(-0.039)	(-0.037)	(-0.039)	(-0.053)	(-0.070)
Observations	536	536	536	536	536	536	536	536	536	536
(Pseudo) R2	0.428									

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, and * p<0.1.

Source: Enterprise Survey 2015 (The World Bank).

4.5 Summary, Conclusion, and Recommendations

The aim of this research was identifying the incidence of HGFs with their corresponding growth determinants in Ethiopia using the World Bank's enterprise survey database for Ethiopia in 2015. The survey covered 848 firms distributed over the six major regions in the country -- Addis Ababa, Oromia, Amhara, SNNP, Tigray, and Dire Dawa. Firm growth was measured by employment size over four years (2010-14). The essay also identified if the challenges perceived by HGFs were different from those perceived by non-high growth firms. The incidence of HGFs and their perceived business obstacles were discussed under the descriptive analysis while the econometric estimations using OLS and QR techniques identified the drivers of firm growth across different growth distributions.

Concerning the incidence of HGFs, the Eurostat- OECD classified 137(30 percent) of the firms as HGFs while BI classified 109(20 percent) of the firms as HGFs. Compared to BI, the Eurostat-OECD measure identified a higher number of firms as HGFs. Regardless of the type of measure used, 369 firms (over two-third of the establishments) were non-high-growth firms. These percentages could have been significantly higher if the standard Eurostat-OECD definition was used.

Coming to the location of the HGFs, the essay showed that they were concentrated in the capital city and the service sector while the medium sized firms dominated in Ethiopia. Nearly all the HGFs were concentrated in Addis Ababa regardless of the type of measurement used (over 90 percent of them) while Oromia region was the second largest host of HGFs (around 4.5 percent) under BHGF and 2.4 percent using the Eurostat- OECD measure.

Characterizing the HGFs using their age and ownership style, under both measures HGFs were found to be younger by three years on average than non- HGFs. In terms of ownership structure, most of these firms were sole ownerships followed by limited partnerships. Looking at the industry type, the two measures referred to nearly the same types of firms where the service sector was over-represented in the HGF classification with a share of over 90 percent and 85 percent under the Eurostat- OECD and Birch Index measures respectively. The domination of HGFs in the service sector in Ethiopia is consistent with the findings of Henrekson and Johansson (2009) who did a meta-analysis of the role of HGFs.

HGFs had a growth rate which was over three times that of non-high-growth firms under the two measures on average. HGFs also hired nearly twice the number of employees compared to non-HGFs. They also had a high proportion of export engagement and a significantly large proportion of foreign ownership.

With regard to the severity of perceived business obstacles, 33 percent of all the firms reported supply of electricity as a major or severe obstacle followed by corruption and tax rates. Corruption was perceived to be a top obstacle by around 29 percent of the establishments and 28 percent of them ranked tax rates either as a major or very severe obstacle. Compared to other countries in the region such as SSA, the Middle East, and North Africa and all countries surveyed by the World Bank, firms in Ethiopia operate under a better environment relative to most of these countries. Coming to the issue of identifying the single most important obstacle, over 40 percent of the establishments reported access to finance as the number one problem while customs and trade regulations and electricity supply were rated as the biggest obstacles by 12 percent and 10 percent of the establishments respectively. Regrouping the obstacles into five major categories, institutions emerged as the second top obstacle next to access to finance.

An analysis of business obstacles using the region of operations as a reference point showed that there were systematic differences among the regions. For establishments in Addis Ababa and Tigray, the biggest obstacle was access to finance while it was the practice of the informal sector for firms operating in Oromia. Corruption topped the list for firms in Amhara while electricity was reported as the biggest obstacle by firms in SNNP and Dire Dawa. The implication of this is that regions should take into account these differences in their endeavors to improve the business environment.

Coming to sectoral aspects, finance and electricity were reported as key problems by a significant number of firms in all the industries which shows that there is a need to address these generic problems before resolving industry specific problems such as land (for leather, wood & furniture, metal products & other manufacturing industries), the informal sector (for food, textiles & garments, leather, and hotel industries), tax rates (for retail businesses), and corruption for (the construction and transport sectors).

Considering the perceptions about elements of a business environment and firm growth, for non-HGFs access to finance was the biggest perceived obstacle to growth. However, the key difference here is that, for HGFs, tax rates were found to be the next biggest obstacle compared to informal sector activities for non- HGFs. A policy implication of this is giving priority to problems related to access to finance and tax rates for promoting HGFs.

This essay also explored the determinants of firm growth. Firms' product and process innovations and ownership of websites were found to positively influence their growth. The research failed to show any significant difference among firms' growth based on gender of owner, degree of competition, capacity utilization, and nationality of the ownership. Export engagement, on the other hand, had a negative relationship with growth. Facilitating innovation activities and technology acquisition such as website ownership and access to financial alternatives might be used as policy tools for to support firm growth.

When it comes to future research, alternative measures of firm growth could improve research outcomes. Another concern is the persistence of HGFs. Daunfeldt and Halvarsson (2014) show that high-growth firms are one hit wonders and the probability of repeating their high-growth rates is very low. This issue is more complicated in Ethiopia, due to firms' high entry and exit rates in the manufacturing industry.

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Chapter 5, Essay 4

An Analysis of the effects of ageing and experience on a firm's performance: The case of Ethiopia[23]

Guta Legesse[24]

Abstract

This study identifies the effects of a firm's age on its performance as measured by labor productivity and the growth rate of employment using survey-based panel data of medium and large-scale manufacturing (MLSM) firms in Ethiopia. The analysis is based on 7,217 firms and 12,427 firm-year observations. The study period covers the latest 5-year of the MLSM survey period (2012-16). After controlling for sample selection using Heckman's selection model, we observe that there is no relationship between a firm's growth rate and its size and age. There is convex relationship between size and firm growth rate. Initial size positively affects firm growth rates. There is no significant difference in labor productivity values among firms based on age. Among the key control variables, capital intensity has a significant positive effect on a firm's growth performance, but wage rates have a negative effect on a firm's growth. The effect of imported raw materials is positively associated with a firm's performance. Old and young firms report similar factors as obstacles.

JEL classification: L11, L25

Keywords: Firm age, firm performance, fixed effects, Heckman selection model

5.1 Introduction

The Ethiopian economy has experienced strong and broad-based growth over the last decade with an average GDP growth rate of 10.1 percent per annum between 2006-07 and 2016-17 (NBE, 2016). This is relatively high compared to the growth rates in the region. Ethiopian manufacturing sector's export performance, however, was below firms' average performance in sub-Saharan African countries.

The service sector emerged as the top contributor to this growth with a share of slightly over 45 percent over the last six years while the role of agriculture declined from 45 percent in 2010-11 to

[23]Published as a book chapter by Springer in 2018. Chapter 11 of the Book entitled "Economic Growth and Development in Ethiopia, Perspectives on Development in the Middle East and North Africa (MENA) Region." Chapter title is "An Analysis of the Effects of Aging and Experience on Firms' Performance."

[24]The author would like to thank Professor Almas Heshmati (JIBS, Jönköping University) and Dr Worku Gebeyehu, Addis Ababa University, Department of Economics.

37 percent in 2016. Similarly, the industrial sector showed modest progress over the past decade with a maximum share of 16.7 percent in 2016-17 (NBE, 2016).

The manufacturing sector plays a key role in the development of the Ethiopian economy. In 2016-17, the manufacturing sector accounted for over 32 percent of the total production of the industrial sector; the construction sector accounted for more than 50 percent. In 2015, the number of persons employed in the manufacturing sector was more than 329,000 and the total wages and salaries were over Birr 9 million. Further, the total gross value of production in 2014-15 was about Birr 142 billion (CSA, 2016).

The Government of Ethiopia is implementing the second phase of its five-year growth and transformation plan (GTP II) to transform the economy and achieve lower-middle-income status by 2025. Under GTP II, which started in 2015-16, the government aims to continue investing in physical infrastructure through public investment projects and work towards transforming the country into a manufacturing hub. The government has also embarked on the development of industrial parks to enhance this transformation process.

A study of the dynamics of a firm's performance is essential for sustaining the promising performance of the Ethiopian economy. This essay studies how a firm's performance changes over time. It is important to study this because there are two contradictory findings about the effects of a firm's age on its performance in literature. Some researchers argue that age increases a firm's performance while for others age lowers a firm's performance.

Most of the literature on firm growth talks about the determinants of firm growth. Early work on firm dynamics focused almost exclusively on how firm size was related to firm growth, and a firm's age received little attention. These researchers drew an analogy between ageing of living organisms and a firm's performance. It is known that ageing leads to deterioration in the performance of organisms and researchers wanted to know if firms also faced a decline in their capacity to compete as they got older (Loderer and Waelchli, 2010).

There is a large body of literature which suggests a negative relationship between a firm's age and growth rates. In his seminal work Jovanovic (1982) shows that firms learn about their efficiencies over time as they operate, and their growth and survival depend on their efficiencies. Small and younger firms face more variability in their growth rates and grow faster than older firms.

One dominant line of thinking is that since firms are organizations that can be restructured if the need arises there is no reason why they should age (Coad et al., 2018). This hypothesis suggests that firms should be able to learn by doing[25] or by investing in research and development; they can hire human capital and train their employees; and they can learn from other firms. Hence, older firms should enjoy higher profits and value. Others argue that due to organizational rigidities and environmental changes, old firms face a higher probability of failure.

Some researchers argue that both young and old firms face corresponding liabilities. New entrants face what is now commonly called the 'liability of newness' (Hannan and Freeman, 1984; Le Mens et al., 2011; Stinchcombe, 1965). This hypothesis claims that new firms have higher failure rates and there is a monotonic decline in firm deaths with time.

[25] Thompson (2010) defines passive learning or learning by doing as "an incidental and costless byproduct of a firm's production activities."

However, Bruderl and Schussler (1990) introduced another relationship between age and a firm's performance termed the 'liability of adolescence.' According to this theory, there is an inverted 'U' shaped relationship between a firm's age and its risk of exiting (Bruderl and Schussler, 1990; Le Mens et al., 2011). This happens because during the adolescence period, firms depend on their initial stock of resources and decision makers tend to commit themselves to the organization (Bruderl and Schussler,1990).

Barron et al. (1994) introduced the liability of obsolescence and liability of senescence. These two liabilities have negative effects on a firm's performance. The liability of obsolescence emerges due to changes in the external environment in which a firm operates while the liability of senescence is due to internal changes and accumulated rigidities within a firm (Barron et al., 1994; Coad et al., 2018; Le Mens et al., 2011). Proponents of the liability of obsolescence argue that ageing firms have a lower performance as they do not adapt to changing business environments. It is difficult to know which of these arguments dominates firms at work without doing a survey. Since these liabilities suggest conflicting roles of a firm's age on its performance and with all the liabilities being at work simultaneously, the net effect of age could vary from firm to firm and from place to place and that is why we need this essay.

This essay studies how the performance of medium and large-scale manufacturing (MLSM) firms evolves with age using census-based panel data from Ethiopia. Ethiopia provides a unique environment for studying the nexus between a firm's age and performance for at least two reasons. Its economy is among the fastest growing economies in the region and the world. The data used in this study comes from a large census of firms which engage a minimum of 10 employees and use power driven machines and hence the data does not suffer from the inclusion of too many small firms.

The rest of this chapter is organized as follows. Section 2 gives a literature review and Section 3 presents the method of analysis. The findings of the study are discussed in Section 4 while Section 5 gives the conclusion.

5.2 Literature Review

5.2.1 Theoretical Review

There are competing theories that explain how a firm's age is related to its performance. Firm performance is expected to improve with age due to several reasons including dependence on routines, links and relationships with customers, the reputation built over time, and the learning curve effect (Coad, 2018). Others argue that the opposite is true.

Arrow (1962) discusses learning by doing (passive learning) and learning from experience. For Arrow, learning from repetition is subject to diminishing returns and organizations need to introduce new machines which serve as a stimulus for new learning. Thompson (2010) further establishes the passive learning theory as equivalent to the learning by doing hypothesis and defines it as "an incidental and costless byproduct of a firm's production activities." For him, learning by doing (LBD) measures the unintended productivity growth associated with the accumulation of production experience by a firm. A firm's age, its prior output, and employees' previous work experience can be used for capturing firm experience (Thompson, 2010).

On the other hand, young firms have higher growth rates, but also more erratic growth paths as compared to older firms (Jovanovic, 1982). This concept is termed liability of newness (Hannan

and Freeman, 1984; Stinchcombe, 1965). According to this argument young firms might achieve minimum efficient scales as they struggle to overcome their liability of newness but once they have survived the first few years and have settled into their new organizational routines, growth will lose its momentum. It also argues that older firms may have more experience and foresight regarding their business environment and hence a smoother growth path with fewer bumps and surprises. Stinchcombe (1965) argues that the liability of newness is relevant because new firms face the cost of learning in doing business, face constraints in innovating (both capital and ideas), have employees who are less familiar with each other, and lack informal rules and norms that generate understanding among stakeholders.

Barron et al. (1994) argue that old firms suffer from the liabilities of obsolescence and senescence. According to the liability of senescence, firms become accustomed to the existing rules, routines, and organizational structures which generate inflexibility and hence inferior performance (Barron et al., 1994; Coad et al., 2018; Hannan and Freeman, 1984; Le Mens et al., 2011). Liability of senescence was originally introduced by Hannan and Freeman (1987) as the structural inertia theory in the late 1980s. They argued that the timing of a response or a change were quite important in addition to adjusting to inertial pressures which increase with age.

Liability of obsolescence is due to a firm's inability to cope with the changes in its external environment (Barron et al., 1994). The major difference between these two liabilities is that the liability of senescence is caused by internal factors while the liability of obsolescence is due to changes in the external environment.

Bruderl and Schussler (1990) incorporate these two arguments and present a non-linear relationship between a firm's performance and age. They introduced the idea of 'liability of adolescence' which conditions the effect of a firm's age on its survival in a golden age beyond which the hazard rate decreases. According to their analysis, firm performance, as captured by risk patterns, has an inverted 'U' shaped relationship with age (Bruderl and Schussler,1990).

Coad et al. (2013) gave three inter-related theories that explain how a firm's age affects its performance - selection effects, learning by doing effects, and inertia affects. Selection effects arise when the weakest firms are eliminated from the industry resulting in an increase in the average productivity levels of the surviving firms even if the productivity levels of individual firms do not change with age. Learning by doing proposes that older firms have better financial performance because they are more experienced and benefit from learning by doing. This idea is discussed by Arrow (1962) and Chang et al. (2002). Firms' tendency to learn and apply new production techniques increases with time. Third, ageing can have a negative impact on firms' performance through inertia effects where firms become inflexible and face difficulties in fitting into the rapidly changing business environment in which they operate.

One can also think of the dynamics of firm performance as a development process coupled with an ecological or evolutionary process (Coad et al., 2018). The evolution idea implies factors that change due to a firm's evolution over time while the ecological concept is a study of how firms react to the ever-changing business environment (Coad et al., 2018). These authors also argue that the evolution process emanates from within while the ecological aspects show a reaction to external sources. The effect of age on a firm's performance can be classified as direct and indirect effects and we need to consider both these effects of age.

5.2.2 Empirical Review

In early studies on the nexus between a firm's age and performance, researchers treated a firm's age and size as measures of the same phenomenon since younger firms tended to be smaller and vice versa. Later studies introduced firm age as an independent variable in the model (Coad et al., 2013).

Evans (1987) studied the relationship between a firm's age, size, and growth using a sample of all the firms operating in 100 manufacturing industries in the US. His results show that firm growth and the probability of a firm failing decreased with its age. He also found that a firm's growth decreased at a diminishing rate with firm size even after controlling for the exit of slow-growing firms from the sample.

Huergo and Jaumandreu (2003) did a study of the impact of firms' age and (process) innovations on productivity their growth using semi-parametric methods. They show the impact of productivity growth on process innovations introduced by firms along with their different ages using (unbalanced) panel data for the ages for more than 2,300 Spanish manufacturing firms and their process innovations during 1990-98. Their results show that new firms' productivity increased more rapidly while the productivity growth of the surviving firms converged to common (activity-specific) growth rates.

The relationship between a firm's age and its level and growth rate of productivity has also been studied by Brouwer et al. (2005) in the Dutch manufacturing industry. Their study covers all enterprises with at least 20 employees and with at least 10 years of existence during 1994-99. Their study showed that young firms either caught up with the more mature firms or they exited resulting in an above average growth rate of productivity in the early stages. In general, they found very few indications of a relationship between age and productivity in the Dutch manufacturing industry. They also found no or little indication that sector-specific levels of productivity and productivity growth rates were related to a firm's age.

Palangkaraya et al.'s (2006) study of the relationship between productivity, size, and age of large Australian firms employing more than 100 people found that there was an inverse relationship between firm productivity and age. They found that larger and older firms were on average less productive. They used the World Bank's database on large manufacturing firms in Australia.

Another important study on the role of ageing in a firm's performance is by Loderer and Waelchli (2010). Their study investigates the relationship between a firm's age and performance using a dataset consisting of 10,930 listed US firms and covering the years 1978-2004. Their empirical results show that as firms got older, all measures of their profitability declined. They also found that returns on assets, profit margins, and Tobin's Q ratios all deteriorated with age suggesting ageing of firms.

Coad et al., (2013) verified the performance of firms over time using a panel of Spanish manufacturing firms' active between 1998 and 2006. They found mixed results depending on how performance was measured. Using the ratio of profits to sales as a proxy for performance, they found that older firms enjoyed higher productivity and profits. They thus provide evidence of firms improving with age. Further, they also show that older firms were better able to convert their sales growth into subsequent growth in profits and productivity. Using other measures of a firm's performance such as expected growth rates in sales, profits, and productivity, they showed that a

firm's performance deteriorated with age and it appeared to be less capable of converting employment growth into growth in sales, profits, and productivity.

Coad et al. (2013) presented new evidence on the relationship between a firm's age and performance by using firms from Sweden during 1997-2010. Using autocorrelation methods, they found that new firms' sales growth was characterized by positive autocorrelation while it showed a negative autocorrelation for older firms. The implication is that older firms were distracted by the environmental turbulence around them while new firms needed to grow to achieve a minimum efficient scale.

Akben-Seluck (2016) did a study on the effects of a firm's age on its productivity using Turkish firms covering the period 2005-14. They used a fixed-effects model with robust standard errors. Using multiple measures of profitability such as returns on assets, returns on equity, and gross profit margins, they showed that there was a negative and convex relationship between a firm's age and profitability suggesting that younger firms started declining in profitability over time.

Heshmati (2001) did a study on the links between firms' size, age, and growth rates using data on micro and small firms in Sweden and found a positive relationship between size and growth in the employment model after controlling for selection. The findings on the relationship between age and growth were negative for employment growth but positive for sales.

Heshmati and Rashidghalam (2016) did an analysis of labor productivity and its determinants in the manufacturing and service sectors in Kenya using the World Bank's Enterprise Survey database for 2013. Using OLS with robust standard errors they showed that capital intensity and wages significantly and positively affected labor productivity while a higher female share in the labor force reduced labor productivity. Training and education of workers had positive effects on labor productivity. In their study, the managerial experience of the CEO was also associated with higher labor productivity. Regarding the role of the business environment elements, lack of access to utilities and infrastructure tended to hinder labor productivity.

So far two studies have been done using data on firms in Ethiopia which try to link a firm's performance with its age and other firm characteristics. Bigsten and Gebreeyesus (2007) used CSA data on firms from 1996 to 2003 and estimated determinants of firms' performance using the system GMM. They found that there was a non-linear relationship between a firm's age and performance, but this relationship existed only for young firms. They also rejected Gibrat's law by plotting employment size of firms in two periods. Rijkers et al. (2010) did a study on the role of location and the characteristics of the investment climate on a firm's performance. They used data on urban firms from the Ethiopia Enterprise Survey (EES) carried out by the Ethiopian Development Research Institute (EDRI) in 2006. They found that urban firms were larger, more capital intensive, and had higher labor productivity than rural firms, although there was no strong evidence of increasing returns to scale. They also did not find enough evidence to reject the hypothesis of firms' same average total factor productivity irrespective of their location of operations. However, according to their results rural firms grew less quickly than urban firms.

This essay extends the less studied phenomenon of a firm's age and performance nexus in Ethiopia. It extends the works of Bigsten and Gebreeyesus (2007) by using CSA's latest available dataset. It uses the Heckman selection model as opposed to the system GMM estimation techniques to check for the robustness of the results for the choice of estimation methods.

5.3 Methods

5.3.1 Measuring a firm's performance

We measure firm performance using two inter-related variables to check the robustness of the choice of the variables. We use firm growth in size (that is, Growth_SIZE of employees) and labor productivity in levels as a proxy for a firm's performance. These variables are converted to logarithmic form.

We measure labor productivity (LnLabour_Produ) as the ratio of value added per employee in logarithmic form. The total number of employees includes both permanent and temporary workers.

5.3.2 Measuring a firm's age and other control variables

Firm age is measured as the difference between the survey period and the year the firm started its business operations. To capture aspects of non-linearity, the squared term of firm age is also included. We also include the age-size interaction term in the regression. We use one period lagged values of age and its squared terms without transforming them to log form (AGE_t_1 and AGESQ_t_1). We use a dummy for the firm age category which equals one for firms whose age is above the median age of seven years.

Firms in the survey had a median age of seven years and a mean age close to 10 years. This shows that most of the firms were quite young. The oldest firm had a century of experience[26] (104 years) while the youngest firm had an age of 0 years. The mean age was above the median age. This shows that most firms had ages below the mean age and were younger which could be due to high rates of firms' entry and exit.

Other control variables used in the analysis include capital intensity, import intensity, export orientation, firm size, wage expenditure, industry category, location dummies, and year dummies.

Firm lagged size (LnSIZE_t_1) is measured as a natural logarithm of total employees in a firm; the squared term is also used (LnSIZESQ_t_1). It includes both temporary and permanent workers.

Previous period capital intensity (LnCAPITAL_INTENSITY_t_1)[27] is the amount of capital per employee where capital is measured using the perpetual inventory method. Wage expenditure (LnTOTAL_WAGES) is measured as the natural logarithm of total wages and per capita wage is measured as LnWAGE_PER CAPITA . A dummy variable was included to control for the effect of export orientation (EXPORT_DUMMY) and import engagements (IMPORT_INT_Dummy). A categorical variable for legal form of ownership (OWNER_FORM) of a firm was introduced. A dummy variable for publicly owned firms (Public_NEW) captures the role of state ownership's performance. We capture amount of raw materials used as LnRAW_MAT.

Finally, region, industry, and time dummy variables were introduced to control for region industry, and year specific effects. These are region cohorts (REGCOHORT),[28] industry category

[26] We used the winsorizing technique to control for outliers in the variables used in the analysis including AGE and growth. Hence, the values are bounded by 1 percent and 99 percent. This technique reduces the maximum age to 60 years. The maximum growth in size is limited to 245 percent.

[27] Capital stock equals beginning capital plus total investments in fixed assets and repair and maintenance investments minus depreciation expenses and sold or disposed capital.

[28] Seven region cohorts were used in the analysis.

(INDUSTRY_COHORT),[29] and birth year cohorts (B_COHORT).[30] The role of macroeconomic performance was captured by the lagged value of GDP growth rate (econ_growth_t_1) and core inflation by $\text{Inflation}_{\_t\_1}$.

Firm initial size class (INITIAL_SIZE_CLASS) was formed based on initial paid up capital based on the definition provided by the Federal Micro and Small Enterprise Development Agency (FeMSEDA, 2011) and the Federal Negarit Gazette Regulation No. 373/2016. According to these two sources, micro firms are those whose total capital is ≤ 100,000 Birr (employing five or less workers in terms of employment criterion), while small firms have capital between 100,000 – 1.5 million Birr (6-30 employees). Medium sized firms have capital between 1.5 million - 20 million Birr (30 – 100 workers) while large firms are those whose total capital is in excess of 20 million Birr (more than 100 workers). According to capital requirement's definition, over 63 percent of the firms fell in the category of either micro (29 percent) or small (34 percent) firms. Only 34 percent of the surveyed firms met the criteria of medium (27 percent) and large firms (10 percent) from the current data. This shows the overall picture of manufacturing firms' size in Ethiopia.

Hence, 33 percent of the MLSM firms fell in the category of micro firms while 27 percent were small firms. The population of large firms was only 11 percent while the remaining 29 percent were medium sized firms.

5.3.3 Modeling the nexus between a firm's age and performance

We start the study of how a firm's performance relates to its age and size by testing Gibrat's law. This law states that firm growth is proportionate to its size (the law of proportionate effect). Mansfield (1962) summarizes this law as "probability of a given proportionate change in size during a specified period is the same for all firms in a given industry regardless of their size at the beginning of the period." pp (1030-1031). Firm growth follows a random walk (Almus and Nerlinger, 2000) or a firm's size in each period is proportional to the current size of the firm (Sutton,1997). There are alternative ways of measuring a firm's size and the common ones include amount of annual sales, current employment, and total assets (Sutton,1997).

We test this hypothesis by plotting the firm size distribution and check if it is normally distributed proving the law of proportionate effects (Almus and Nerlinger 2000; Bigsten and Gebreeyesus, 2007).

Our empirical model to show the nexus between a firm's performance and ageing is the Heckman selection model. We estimated a two-step model. We believe that the population of firms included in the survey is biased in favor of more productive firms. The less productive firms will leave the survey and hence the likelihood of ageing depends on a firm's performance. The selection equation shows the likelihood of a firm ageing (joining the class of firms above the median age).

We estimated the fixed-effects panel data model for comparison purposes. We ran two separate regressions depending on the proxy used for measuring a firm's performance. Equations 5.1-5.4 presents the main estimated equations used in the analysis while Equation 5.5 is done as a sensitivity test using pooled OLS and panel FE.

[29] Firms were regrouped into 11 industries at the 2-digit industry classification based on ISIC, Rev.3.1.
[30] Starting with firms established before the 1950s, we have eight birth cohorts representing a decade each.

(5.1) $\text{Growth\_SIZE}_{i,t} = f\{AGE_{i,\_t\_1}, \text{AGESQ}_{i,\_t\_1}, X_{i,t}, \varepsilon_{i,t}\}$

(5.2) $\text{LnLabour\_Produ}_{i,t} = f\{AGE_{i,\_t\_1}, \text{AGESQ}_{i,\_t\_1}, X_{i,t}, \varepsilon_{i,t}\}$

The main or substative growth equation is given as

(5.3) $$\begin{aligned}\text{Growth\_SIZE}_{i,t} &= \beta_1 AGE_{i,\_t\_1} + \beta_2 \text{AGESQ}_{i,\_t\_1} + \beta_3 LnSIZE_{i,\_t\_1} + \beta_4 \text{LnSIZESQ}_{i,\_t\_1} \\ &+ \beta_5 \text{LnCAPITAL\_INTENSITY}_{i,t\_1} + \beta_6 \text{LnWAGE\_PER CAPITA} + \beta_7 \text{IMPORT\_INT\_Dummy} \\ &+ \beta_8 \text{EXPORT\_Dummy} + \beta_9 \text{INDUCOHORT} + \beta_{10} \text{REGCOHORT} \\ &+ \beta_{11} \text{INITIAL\_SIZE\_CLASS} + \beta_{12} \text{OWNER\_FORM} + \beta_{13} \text{Inflation}_{\_t\_1} + \varepsilon_{i,t}\end{aligned}$$

The Selection Equation is

(5.4) $$\begin{aligned}&\text{AGE\_CLASS} = \alpha_1 \text{LnLabour\_Produ\_t\_1} + \alpha_2 \text{LnSIZE\_t\_1} + \alpha_3 \text{LnCAPITALINTENSITYt\_1} \\ &+ \alpha_4 \text{LnWAGE\_PERCAPITA} + \alpha_5 \text{INDUSTRY\_COHORT} + \alpha_6 \text{REGCOHORT} + \alpha_7 \text{i.Year}\end{aligned}$$

(5.5) $$\begin{aligned}\text{LnLabour\_Produ}_{i,t} &= \omega_i + \beta_1 AGE_{i,t\_1} + \beta_2 \text{AGESQ}_{i,t\_1} + \beta_3 LnSIZE_{i,t\_1} + \beta_4 LnSIZESQ_{i,t\_1} \\ &+ \beta_5 \text{LnCAPITAL\_INTENSITY}_{i,t} + \beta_6 LnWAGE_{i,t} + + \beta_7 \text{IMPORT\_INT\_Dummy} \\ &+ \beta_8 \text{EXPORT\_Dummy} + \beta_9 \text{OWNER\_FORM} + \beta_{10} \text{LnRAW\_MAT} + \beta_{11} Inflation + \varepsilon_{i,t}\end{aligned}$$

where

$\text{LnLabour\_Produ}_{i,t}$ is labor productivity as an indicator of a firm's performance for firm *i* in year *t*, $\text{Growth\_SIZE}_{i,t}$ is the growth rate of employment.

$X_{i,t}$ is a set of control variables.

$\beta_1, \beta_2, \beta_3 ..... \beta_{11}$, are vectors of the parameters to be estimated, $\varepsilon_{i,t}$ is the error term. To control for potential heteroscedasticity, robust standard errors are reported. We also do an IV regression to account for the self-selection effect which may occur due to early exit of less performing firms as a sensitivity analysis. There are no factors which cause firm age to increase or decrease but selection affects the distribution of the population (Coad et al., 2018). In the selection equation, the dependent variable is a firm's age category dummy coded as young or old. Labor productivity in the previous period is used as the exclusion restriction variable.

5.3.4 Data: Survey Description

The data used in this essay is survey-based panel data collected by the Central Statistical Agency (CSA) of Ethiopia on a yearly basis for medium and large-scale manufacturing (MLSM) firms in the country. To be included in the survey, manufacturing firms must engage a minimum of 10 people and use power driven machinery. The survey covered both public and private industries in all regions of the country.

We used the post-2011 survey data due to a firm identification mismatch observed in the dataset. Panel data was constructed using the data from the latest five years of the survey leading to 7,217 firms and 12,427 firm-year observations.

Several questions were asked in the questionnaire to capture important dimensions of a firm's performance, availability of infrastructure, and the business obstacles that a firm faced. The questionnaire had eight major components with relevant sub-sections for each. It started by asking a firm's background information on its location and region of operations, industry classifications,

issues related to ownership type, and sex of the top manager while the next section raised questions related to paid-up capital, business obstacles, and the number of employees with their corresponding wages and salaries. Cost of raw materials, infrastructure costs, sales and supplies, and capacity utilization were all a part of the questionnaire.

The survey covered firms operating in all the nine geographical regions of the country (Oromia, Amhara, SNNP, Tigray, Harari, Afar, Benishangul, Gambela, and Somale) and the two city administrations of Addis Ababa and Dire Dawa.

Looking at firm entry-exit dynamics we see that there was high firm turnover and panel attrition in Ethiopia. The total number of firms in the initial year (2012) was 2,129 and in the ending period the number of firms was 2,788. In the study period (2012-16), 7,211 firms entered while 4,423 firms left the survey. The data shows very high firm turnover over such a short period of time. The high number of exits can be due to a lower median for the number of employees (18). Firms in which the number of employees fell below 10 were excluded from the survey (see Table 5.1 for details).

Table 5.1: Statistics on entry and exit dynamics of firms in the survey period

Year	Number of new firms entering the survey	Share of new firms (%)	Total number of firms in the survey	Number of firms leaving the survey	Share of exiting firms (%)	Ending balance
2012[31]	2129	100	2129	486	22.83	1643
2013	902	38	2387	901	37.75	1486
2014	840	35	2405	1375	57.17	1030
2015	1732	64	2718	1661	61.11	1057
2016[32]	1608	58	2788	0	0.00	2788
Mean exit rate		55	Mean entry rate		41.65	

Source: Author's computations using CSA survey data.

5.4 Empirical Results

5.4.1 Descriptive Statistics

This part of the analysis presents the results of both the descriptive statistics and empirical estimations.

Table 5.2 gives the descriptive statistics of the variables included in the analysis. Labor productivity, on average, was Birr 69,936 while the median value was Birr 73,139. Similarly, mean sales value per employee was around Birr 153,260 and the median sales value per employee was Birr 147,663. Concerning firm size, the mean size was around 26 employees while the median was 21 employees. The discrepancy between mean and median sizes shows that there were too

[31] Includes all firms (new and old). Only 129 firms were reported as existing in 2012 from the 2011 survey showing id problem.

[32] Exit in 2016 will be observed in the next round of the survey (censoring). The net balance is the same as the total number of firms in 2016.

many small and medium sized firms. This could be one of the reasons why many firms exited the survey each year since the minimum number is 10 employees to be eligible for the survey. Looking at the recent survey results, we can say that there was a reasonable distribution of MLSM firms across industries but not across regions. Over 85 percent of the firms were in five regions out of a total of nine regions.[33]

Table 5.2: Descriptive statistics of manufacturing firms in Ethiopia (2012-16)

Variable	Median	Mean	Max	Min	St. Dev	N
Dependent Variables: performance measures						
Lagged Labor Productivity (ln)	11.20	11.15	14.52	7.59	1.41	4,420
Growth rate (SIZE) in	0.00	0.056	2.45	-2.21	0.642	4,776
Independent Variables: control variables						
AGE (in years)	7	10.39	60	0	11.5	12,061
Per capita sales (ln)	11.90	11.94	17.03	3.72	1.61	11,828
Lagged SIZE	3.04	3.25	6.91	0	1.4	4,822
Lagged Capital Intensity	10.89	10.60	14.42	3.86	1.93	4,708
LnTOTAL_IMPORT	14.20	13.34	19.91	0	3.85	6,990
LnTOTAL_EXPORT	16.14	15.80	20.22	8.32	2.46	618
Total Wage expenses (ln)	12.41	12.60	17.42	8.19	1.96	11,645

Source: Author's computations using CSA survey data.

Figures 5.1 summarizes the mean values of labor productivity and firm size in levels and their growth rates for older[34] and younger firms. Comparing growth rates in labor productivity and size, the t-test shows no statistically significant difference between these groups of firms. in terms of labor productivity and size values in levels, there is a statistically significant difference between the two. Older firms had higher labor productivity and size in levels. This shows that firms' growth rate slowed down after some time and younger firms' grew faster.

Figure 5.2 gives firms' growth and size distribution by birth cohort. It supports the findings given in Figure 5.1. Older firms (firms indicated by higher birth cohorts) had a bigger size but lower growth rates.

[33] Ethiopia will have 10 regions following the referendum on Sidama region which takes it out of SNNP.
[34] Age dummy equals 1 (old firm) if a firm's age is greater than or equal to the median age of 7 years.

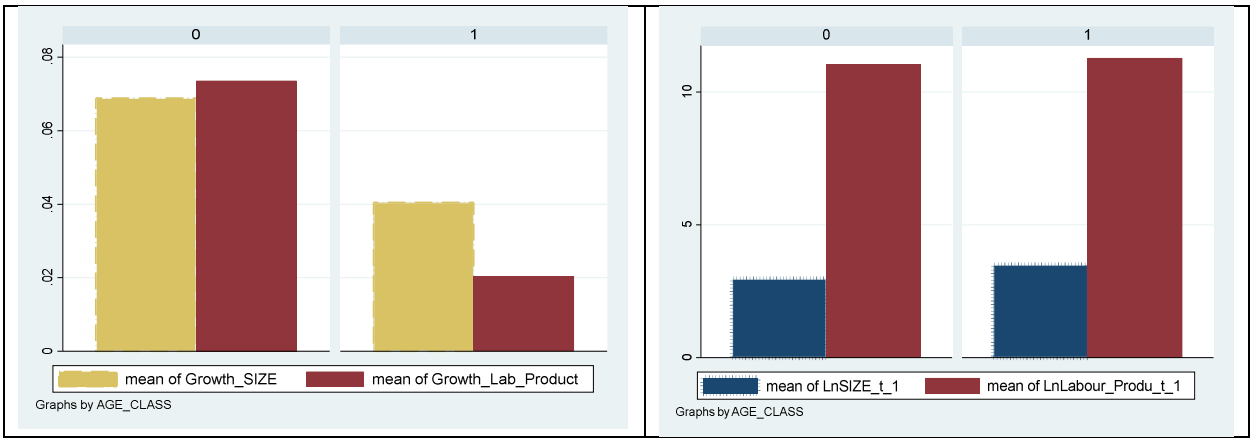


Figure 5.1: Firms' performance by age category (1 stands for old firms)

Source: Author's computations using CSA survey data.

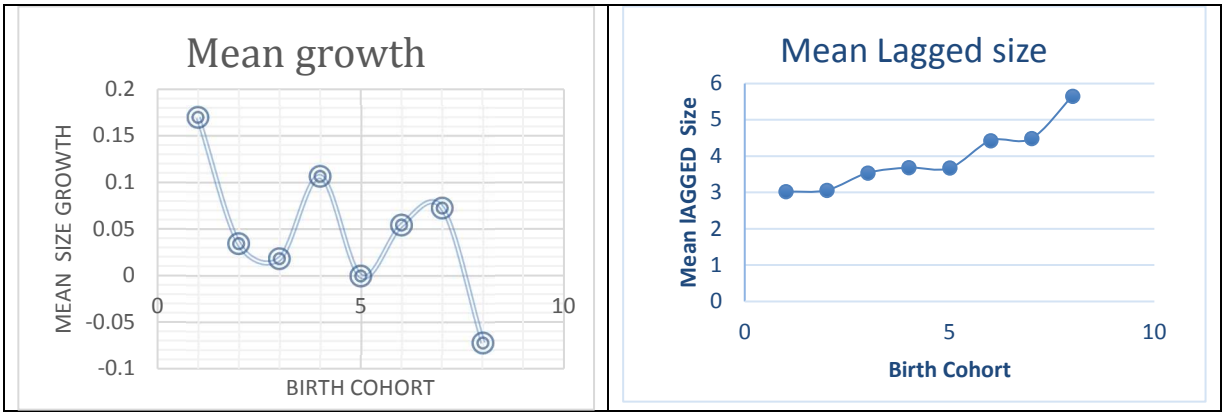


Figure 5.2: Firms' age and mean growth rates (by birth cohort)
Source: Author's computations using CSA survey data.

A matrix of correlation coefficients among the explanatory variables was generated to check for collinearity among the explanatory variables (see Appendix Table A5.1) and we see no problem of multicollinearity.

Finally, the log size distribution of firms as presented in Appendix Figure A5.1 shows that firm growth was not random, and this finding does not support Gibrat's law of proportionate effects. We see that younger firms grew faster, and the size distribution was skewed to the right with high peaks to the left of the center. When firm employment (size) was replaced with either labor productivity or sales value, firm distribution followed a normal distribution (Appendix Figure A5.2).

5.4.2 Business challenges faced by firms[35]

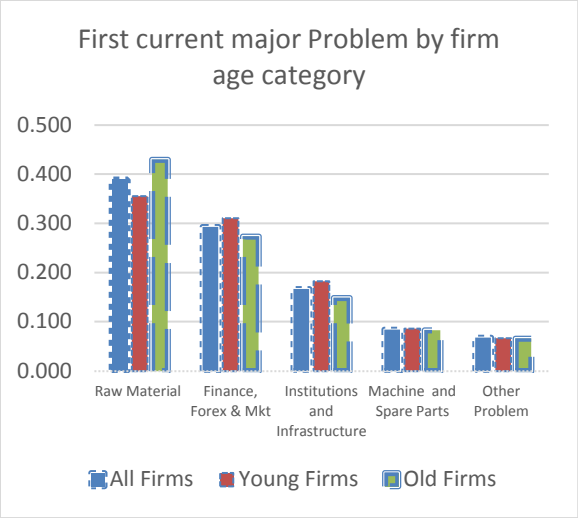
The questionnaire presented three sets of questions to the firms. One related to factors hindering their full capacity operations while the other discussed why firms were unable to operate for a full year. The third category asked firms to list the current major challenges that they faced. For the analysis, we focus on current major challenges faced by firms and factors hindering full capacity operations. We decomposed the business obstacles by a firm's age to see if there were systematic differences in the business environment based on a firm's age.

Access to raw materials emerged as the top current problem in doing business with 39 percent of the observations reporting it as their number one problem. Close to 29 percent of the firms perceived access to market and financial resources including foreign exchange as their major problem at present. Institutions and infrastructure supply (electric power) was ranked as a major problem by around 17 percent of the firms.

Decomposing these problems by a firm's age showed no significant difference in the business environment that the firms operated in. Problem of raw material supply emerges as the main problem hindering full capacity utilization and current operation despite their age differences. Further, access to finance, the market, institutions and infrastructure supply tended to affect all types of firms. When firms were asked to reflect on the top business obstacles that they currently faced, a similar list of problems emerged among older and younger firms. For older firms, shortage of raw materials (43 percent), access to markets and finance (27 percent), and institutions and infrastructure (15 percent) were the top major problems. On the other hand, 36 percent of the younger firms said that a shortage of raw materials was their number one problem, while 31 percent of them rated access to markets and finance as their top problem followed by institutions and infrastructure (18 percent). Raw material shortages and access to market and finance dominated both groups of firms (see Figure 5.3). Although a slightly higher number of firms from the older group cited raw material supply as a major problem and a larger proportion of younger firms reported access to finance and markets as a key business challenge the list of the top three challenges was the same for both groups of firms.

Regarding factors hindering full capacity operations, similar trends emerged. Over 35 percent of the MLSM firms perceived shortages of raw materials as a major obstacle followed by access to market and finance including foreign exchange (25.5 percent). Nearly 24 percent of the firms perceived that problems related to institutions and infrastructure (electric power supply) as major hindrances for not fully operating their plants. Hence, these three classes of problems are key factors that hindered capacity utilization and overall performance irrespective of firms' age category. Old firms also reported machine breakage and lack of spare parts as a major problem.

[35] The percentages are calculated from the total number of firms which reported some problem and not the total population.



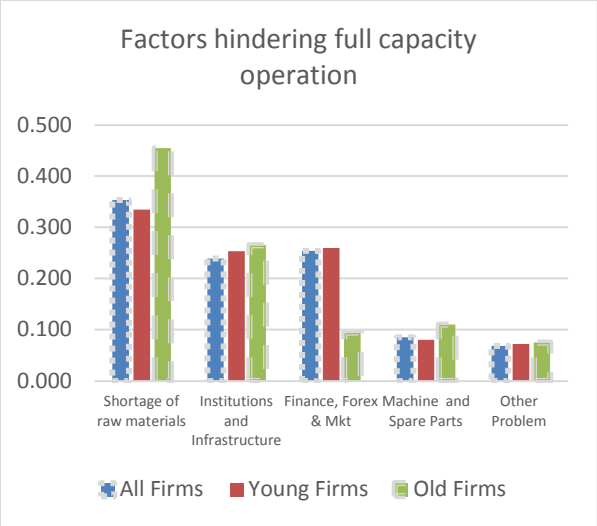


Figure 5.3: Business obstacles hindering firms' performance

Source: Author's computations using CSA survey data.

5.4.3 Results of the Econometric Estimation

The main estimation technique used for the analysis was the Heckman selection model which accounts for sample selection effects. We also report panel data FE and pooled OLS estimations with robust standard errors for a comparison while examining the link between a firm's age and performance.

Concerning the main research question of the link between a firm's age and growth, this essay shows lack of a statistically significant relationship between age and a firm's growth. Under all specifications, the size effect seems to dominate the age effect since we observe a highly significant non-linear relationship between one period lagged value of size and firm performance after controlling for the selection effect as presented in Table 5.4 using the Heckman two-step procedure. This result remains the same under OLS and FE estimations.

The effect of size, however, is negative at levels and the squared term is positive and significant. This finding partially supports the earlier findings of Bigsten and Gebreeyesus (2007) and Jovanovic (1982) who argues that the young and the small tend to grow faster.

We start the discussion of the findings with the results of the pooled OLS and panel data fixed-effects models presented in Table 5.3. We estimated the fixed-effects panel data model recommended by the Hausman test. The FE model controls for individual effects although it fails to account for selection and endogeneity. The important variable of interest is knowing how a firm's age relates to its performance.

A firm's size growth was used as a proxy for a firm's performance. After controlling for other firm specific and other factors, the OLS and FE estimations provide no evidence of the role of age in a firm's performance. Ageing does not have a statistically significant effect on firm growth and hence firm growth distribution is independent of the age of a firm. These findings on the role of age fail to support the 'learning by doing hypothesis' and this result could be due to a bias in OLS and FE methods when there is a sample selection effect. More productive firms survived and hence

we observe them more frequently in the survey and the FE estimation technique does not control for such a bias.

On the other hand, firm size showed a non-linear effect on growth. Smaller firms tended to grow faster than bigger firms. The marginal effect of firm size on growth was found to be negative and significant. This finding supports the existence of a convex relationship between a firm's size and growth.

We controlled for the initial size of the firms and found a non-linear relationship between a firm's size and growth. Concerning the effect of their initial size, firms which started as medium and large firms tended to grow faster than the micro-enterprises as given by the results of the pooled OLS method.

Capital intensive firms showed superior growth performance. Capital intensive firms will introduce new stimuli for learning and growth (Arrow,1962). Higher capital intensity leads to higher productivity and eventually more employment growth. Wage rate was used for capturing skill levels in a firm, and this varied inversely with firm growth. Firms with a high proportion of skilled workers (as measured by per capita wage rates) might face difficulties in increasing employment relative to others with more unskilled or less skilled workers. Hiring and firing of workers could be expensive for firms with a high proportion of skilled workers and this result was the same under OLS and FE.

Among the alternative forms of ownership, PLCs showed better growth performance relative to sole proprietorships using estimates from the pooled OLS estimation and there was no statistically significant difference in growth rates for other forms of ownership.

Table 5.3. Regression results using firm growth in size as the dependent variable

VARIABLES	Pooled OLS	Panel FE
AGE_t_1	0.001	0.002
	(0.003)	(0.007)
AGESQ_t_1	-0.000	-0.000
	(0.000)	(0.000)
LnSIZE_t_1	-0.857***	-1.181***
	(0.044)	(0.089)
LnSIZESQ_t_1	0.077***	0.009
	(0.004)	(0.013)
Firm INITIAL_SIZE_CLASS (Reference Group are Micro firms)		
Small firms	0.019	0.092
	(0.036)	(0.064)
Medium Firms	0.199***	0.061
	(0.044)	(0.077)
Large Firms	0.371***	0.019
	(0.061)	(0.094)
LnCAPITAL_INTENSITY _t__1	0.044***	0.014
	(0.008)	(0.014)
LnWAGE_PERCAPITA	-0.057***	-0.185***

	(0.018)	(0.026)
IMPORT_INT_Dummy	0.116***	0.016
	(0.028)	(0.044)
EXPORT_DUMMY	0.174***	0.134
	(0.051)	(0.096)
INFLATION_t_1	0.047***	0.016
	(0.011)	(0.013)
Sole proprietorship is the reference group		
Partnership or joint venture	0.034	-0.057
	(0.046)	(0.074)
Share company	0.068	0.022
	(0.060)	(0.091)
PLC	0.148***	-0.061
	(0.031)	(0.061)
Cooperatives	-0.022	-0.064
	(0.045)	(0.097)
Other forms	-0.180	-0.239
	(0.114)	(0.177)
Industry dummy	Yes	Yes
Location dummy	Yes	Yes
Constant	1.796***	5.314***
	(0.388)	(0.504)
Observations	2,499	2,501
R-squared	0.33	0.63
F-statistics	27.88	52.51
p-value	0.000	0.000
Number of groups	2,499	1,726

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, and * p<0.1.

Source: Author's computations using CSA survey data.

Firm internationalization through either imports or exports did not have a statistically significant effect on its growth in the FE model but this tended to be associated positively with growth under the OLS estimation. One period lagged inflation rate tended to promote firm growth. Industry, region, legal form of ownership, and time specific affects were captured using dummies for these categories.

Table 5.4 gives the details of the results of the main estimation technique of the Heckman selection model. We observe firms in the survey only when they manage to survive, and we assume that firm survival is not random. More productive firms survive as indicated by Jovanovic (1982). Hence, we used lagged values of labor productivity as a key determinant of firm ageing in the selection (probit) equation. The dependent variable is the firm age dummy which equals 1 if a firm has age above the median age. Further, lagged values of firm size, capital intensity, and wage rate were used as determinants in the selection equation to control for the selection effect with location and industry effects controlled for by including time effects.

Accordingly, using the Heckman selection model there is evidence in support of the existence of the selection effect since lambda is statistically significant and the exclusion restriction (lagged labor productivity) variable is also significant in the first stage equation.

Concerning the age effect, we failed to show a statistically significant relationship between a firm's age and growth rates. This relationship could be due to the nature of the data that we observed. Overall, our research findings fail to support the 'learning by doing' hypothesis. This could be one of the reasons why a large number of firms exited, and we observed lower levels of industrialization in Ethiopia as firms were unable to excel in performance with experience. Labor productivity distribution and sales per employee values followed a log normal distribution (see Appendix graph A5.2).

A two-sample t-test was done to see if there was a statistically significant difference between young and old firms[36] regarding growth in size. The results show that there is no statistically significant difference between these two groups of firms when it comes to growth rates. Coad et al. (2018) argue that age has direct and indirect effects on a firm's performance and controlling for the indirect effects by introducing a host of control variables might underestimate the effect of age.

Capital intensity tended to promote firm growth as productive firms opened up new opportunities for employment but firms with higher stock of skilled workers (measured by wage rates) showed lower rates of growth in employment. These results are also similar to the OLS results. This is so because it is easy to hire and fire low skilled workers relative to skilled and more expensive workers.

A firm's international trade activities (both imports and exports) were positively associated with their growth rates. Importing allowed firms to buy quality inputs at fair prices in international markets and access latest technologies which have more productive and higher growth rate implications. Exporter firms also had superior growth performance since they were generally more efficient and could be bigger in size.

Table 5.4. Regression results using the Heckman selection model, two-step, pooled (Dependent variable is firm size growth)

VARIABLES	Heckman Main equation	Selection Equation
AGE_t_1	-0.002	
	(0.005)	
AGESQ_t_1	0.000	
	(0.000)	
LnSIZE_t_1	-0.938***	0.189***
	(0.058)	(0.024)
LnSIZESQ_t_1	0.086***	
	(0.007)	
INTITIAL_ SIZE_CLASS (Reference Group are Micro firms)		
Small_initial	0.025	
	(0.044)	
Medium_initial	0.195***	
	(0.053)	

[36] Old firms are those whose age is above the median age of 7 years.

Large_initial	0.235***	
	(0.071)	
LnCAPITAL_INTENSITY_t_1	0.077***	-0.109***
	(0.015)	(0.017)
LnWAGE_PERCAPITA	-0.087***	0.070**
	(0.026)	(0.034)
IMPORT_INT_Dummy	0.079*	
	(0.041)	
EXPORT_DUMMY	0.174***	
	(0.064)	
INFLATION_t_1	0.018**	
	(0.008)	
LnLabour_Produ_t_1		0.103***
		(0.024)
Sole proprietorship is the reference group		
Partnership or Joint venture	0.011	
	(0.060)	
Share Company	0.009	
	(0.069)	
PLC	0.057	
	(0.043)	
Cooperatives	-0.003	
	(0.062)	
Other Forms of Ownership	-0.129	
	(0.188)	
Constant	2.285***	-3.014***
	(0.313)	(0.351)
lambda	-0.577***	
	(0.200)	
rho	-0.834	
Sigma	0.692	
Industry Dummy	Yes	Yes
Location Dummy	Yes	Yes
Time Dummy	Yes	Yes
Observations	3,158	3,158
Wald chi2 (35)	446.85	
p-value	0.000	
Number Selected	1,236	
Number non-selected	1,922	

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, and * p<0.1.

Source: Author's computations using CSA survey data.

5.4.4 Sensitivity analysis

Using employment growth as a dependent variable for measuring firm performance could be biased towards small firms since it is easy for firms to grow from 2 to 4 employees, for instance, and report 100 percent growth rates as opposed to a 50 percent growth rate with 200 to 300 employees. For the robustness check we used labor productivity measured as the natural logarithm of value added per employee as a dependent variable to estimate pooled OLS and panel FE.

Under the current specifications (as presented in Table 5.5), the effect of age disappeared under both estimation techniques. The labor productivity performance did not seem to be correlated with a firm's age and this could be because of many reasons. One reason could be due to the limited number of years covered in the data (2012-16). The second reason could be a firm's inability to learn with time as we do not observe productivity premia for older firms. The effect of age disappeared once we introduced appropriate covariates in the models.

The labor productivity values of older firms were slightly above those for younger firms. The median labor productivity (in ln), for instance, equaled 10.95 for younger firms and 11.24 for older firms and these differences were found to be statistically significant using t- tests although the regression failed to capture this.

Looking at the effect of firm size on productivity, firm size showed a statistically significant negative effect on performance only under the pooled estimation. The FE estimation failed to show a statistically significant relationship between current firm size and productivity. Rather than current size differences, initial size seemed to determine labor productivity in this data. Relative to the reference groups, firms with initial size classification in the large firms' category (based on initial paid-up capital) showed superior performance.

Firms' initial size showed a direct association with their productivity. Firms whose initial size fell in the category of micro-firms showed the lowest performance as measured by labor productivity relative to the other three groups. Firms which began operations in small, medium, or large size categories based on initial paid-up capital tended to outperform the micro beginners.

Capital intensity, per capita wages, and amount of raw materials used tended to increase labor productivity as expected. More capital-intensive firms will be more productive relative to labor intensive firms. A higher wage rate is a proxy for the number of skilled workers in a firm and hence is expected to be associated with superior productivity. Higher raw material usage can be taken as an indicator of the scale of operations and associated benefits from economies of scale.

Firm internationalization through import intensity is associated with better performance relative to exports. This is in line with theory which says that importing allows firms to get access to quality inputs and technologies that enhance their performance and encourage export engagements in the future. The export dummy was not significant under both the OLS and FE models. This could be because of the under-representation of exporting firms in the dataset (firms with positive exports were only 5 percent of the total observations compared to 56 percent importers). Secondly, we used a dummy for export engagement and did not consider the extent of exports. The import dummy, on the other hand, captured firms whose import intensity at least equaled 0.5 and not the decision to import.

A one period lagged value of inflation did not show a significant impact on firm productivity. Industry, region, legal form of ownership, and time specific affects were captured using dummies

for these categories. There was no statistically significant difference among firms based on their legal form of ownership (at least under the FE estimation) (Table 5.5 gives the details).

Table 5.5. Regression results using labor productivity(ln) as the dependent variable

VARIABLES	Pooled OLS	Panel FE
AGE_t_1	0.008	0.026
	(0.006)	(0.018)
AGESQ_t_1	-0.000	-0.000
	(0.000)	(0.000)
LnSIZE_t_1	-0.191***	0.098
	(0.064)	(0.201)
LnSIZESQ_t_1	-0.004	-0.017
	(0.009)	(0.030)
Initial Size of firms (Micro are reference		
Small Firms	0.122**	0.165
	(0.058)	(0.063)
Medium Size firms	0.033	0.281
	(0.077)	(0.203)
Large Firms	0.227**	0.595**
	(0.106)	(0.245)
LnCAPITAL_INTENSITY	0.172***	0.127***
	(0.016)	(0.034)
LnWAGE_PERCAPITA	0.470***	0.445***
	(0.031)	(0.064)
LnRAW_MAT	0.232***	0.201***
	(0.017)	(0.064)
IMPORT_INT_Dummy	0.113**	0.188*
	(0.049)	(0.112)
EXPORT_DUMMY	-0.134	-0.051
	(0.094)	(0.218)
Sole proprietorship is the reference group		
Partnership or Joint venture	-0.054	-0.152
	(0.087)	(0.175)
Share Company	-0.033	-0.274
	(0.102)	(0.208)
PLC	-0.109**	0.192
	(0.052)	(0.128)
Cooperatives	-0.257***	-0.277
	(0.074)	(0.237)
Other Forms of Ownership	-0.200	0.131
	(0.208)	(0.445)
INFLATION_t_1	0.002	0.008

	(0.005)	(0.007)
Constant	2.062***	1.959*
	(0.297)	(1.139)
Industry effects	Yes	Yes
Time effects	Yes	Yes
F-stat	138.21	6.42
P-value	0.000	0.000
Observations	2,314	2,314
R-squared	0.514	
Number of ESTID	2,314	1,677

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, and * p<0.1.

Source: Author's computations using CSA survey data.

5.5 Conclusion and Recommendations

This research showed how a firm's age relates to its performance using survey-based panel data on medium and large-scale manufacturing firms in Ethiopia which engaged a minimum of 10 employees and used power driven machines. The analysis was based on the recent 5- year data collected over the period 2012-16.

We measured a firm's age by the number of years since its establishment and used two measures of firm performance as the dependent variables. We used labor productivity and growth in employment to capture a firm's performance. Heckman's sample selection (two-step procedure) was used to control for potential selection effects of more productive firms in the sample.

Overall, the results of our study showed that there was no statistically significant relationship between performance and a firm's age. Using a firm's growth in employment as the dependent variable, our results showed no significant relationship between a firm's age and its performance after controlling for the selection effect using Heckman's selection method. The age-growth relationship was not significant under the pooled OLS and panel fixed estimations too. Alternatively, after replacing the dependent variable with labor productivity, both the pooled OLS and the FE estimations failed to show a significant relationship between a firm's age and its labor productivity.

The effect of firm size on growth is consistent with literature supporting the convex relationship between size and growth rates. This implies that small firms grew at a higher rate with diminishing effects over time. In the growth-size nexus, initial size played a key role since starting big was found to imply higher growth rates relative to small starters.

Concerning the role of other control variables, our results showed that capital intensity was positivity associated with a firm's performance. These effects were invariant to the method of estimation. The effect of wage expenditure was negative in the employment growth equation but positive in the labor productivity estimation. Having a higher proportion of skilled workers (as proxied by per capita wage expenditure) led to higher productivity but also made employment growth costly for firms.

Further, firm internationalization through imports was found to affect growth and productivity performance while the role of exporting was not conclusive. There was no statistically significant

difference among firms based on form of ownership and region of operations except in two cases in the labor productivity estimation.

An investigation of the elements of the business environment that hindered a firm's performance showed that the business obstacles reported by older firms were the same as those reported by younger firms. Decomposing these problems by firm age showed no significant difference in the firms' business environment. Problems of raw material supply, access to market and finance, institutions and infrastructure tended to affect all types of firms despite their age differences. The same variables emerged as top challenges for not fully operating their plants and these factors were the same for the two groups of firms. This shows that both cohorts of firms generally operated under a similar environment.

Some useful policy implications emerge from the findings of this study. Solving the generic problems of shortages of raw materials, access to markets, shortage of working capital, and insufficient infrastructure (electricity and water) are expected to improve a firm's performance. Improving access to finance will also be useful in sustaining a firm's performance.

There is very high rate of firm turnover (attrition). However, we were unable to identify why this is so from the census survey data and from current data. Hence, future data collection should also target firms which leave the survey as this could be due to closure or failure to meet the minimum size requirement of 10 employees. With the current available data, we were unable to identify these reasons.

Business outcomes can be improved if policymakers work on enhancing firms' learning and absorptive capacities. Small firms tend to outperform the other groups. Hence, the government needs to create a better platform for firms to learn and develop.

Importing inputs was found to positively affect a firm's performance so the government needs to work on facilitating imports in the short run and developing alternative (domestic) sources in the long run. Exporting firms also need to be supported further since they show superior growth performance.

Lack of a significant relationship between a firm's age and performance shows that the young firms were unable to outperform the older firms, or the older firms were unable to use their experience to have a superior performance. In some economies, young firms are dynamic and are more innovative and their performance slows down with time. The economy can benefit more if policy support is directed towards enabling capacity building of firms in the early stages so that they can survive and benefit from superior productivity in the later stages. This approach is relevant since most MLSM firms in Ethiopia are medium or low technology industries according to UNIDO's (2018) definition of industries based on the level of technology that they use.

A firm's initial size was found to positively influence its performance in this study. Hence, giving preferential support to firms that start in the higher firm size categories could be more useful for the economy.

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Appendix A5

Table A5.1: Matrix of correlation of coefficients

	AGE	AGESQ	LnSIZE~1	SIZESQ2	SIZE_C~S	LnCAPI~Y	LPERCA~E	LnRAW_~T	OWNER_~M	IMPORT~y	F_OWNE~y	PUBLIC	EXPORT~y	REGCOH~T	lag_Gr~h
AGE	1														
AGESQ	0.95	1.00													
LnSIZE_t_1	0.30	0.29	1.00												
SIZESQ2	0.20	0.20	0.42	1.00											
SIZE_CLASS	0.10	0.12	0.63	0.25	1.00										
LnCAPITAL_~Y	-0.02	0.02	0.38	0.09	0.56	1.00									
LPERCAP_WAGE	0.20	0.19	0.41	0.11	0.39	0.40	1.00								
LnRAW_MAT	0.19	0.19	0.68	0.30	0.65	0.53	0.47	1.00							
OWNER_FORM	0.08	0.09	0.18	0.14	0.13	0.00	0.14	0.07	1.00						
IMPORT_INT~y	0.04	0.04	0.27	0.07	0.29	0.24	0.21	0.32	0.03	1.00					
F_OWNER_Du~y	0.02	0.00	0.02	-0.05	0.04	0.01	0.03	0.02	0.07	0.01	1.00				
PUBLIC	0.27	0.28	0.21	0.30	0.15	0.06	0.11	0.13	0.28	-0.01	-0.07	1.00			
EXPORT_Dummy	0.14	0.14	0.31	0.27	0.21	0.12	0.12	0.22	0.07	0.02	-0.02	0.07	1.00		
REGCOHORT	0.27	0.22	0.08	-0.02	-0.03	-0.06	0.09	0.04	0.00	0.05	0.07	0.00	-0.01	1.00	
lag_Growth	0.02	0.02	-0.03	0.02	-0.01	0.00	0.12	0.04	-0.03	-0.01	0.00	-0.01	-0.01	0.01	1.00

Source: Author's computations using CSA survey data.

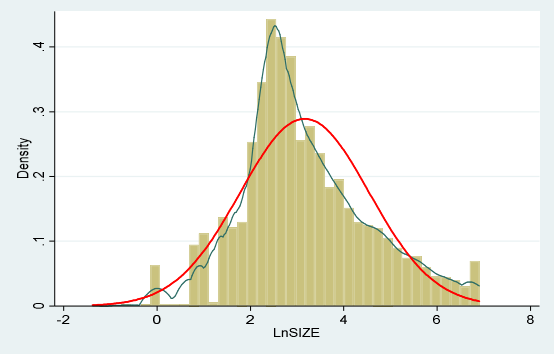

Figure A5.1. Gibrat's Law of Proportionate Effect

Source: Author's computations using CSA survey data.

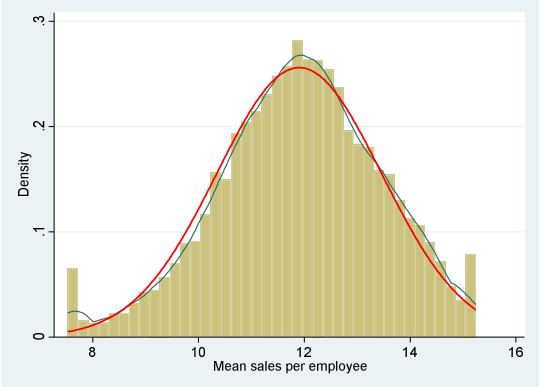

Figure A5.2. Normality plot of labor productivity

Source: Author's computations using CSA survey data.