**THE EFFECT OF FINANCIAL**

**CONSTRAINTS ON INNOVATION AND FIRM GROWTH: EVIDENCES FROM ETHIOPIA**



**ST. MARY'S UNIVERSITY**

**SCHOOL OF POST GRADUATE STUDIES**

**BY**

**SEMIRA BEDRU HUSSEIN**

**Advisor: Misraku Molla (PhD)**

**A Thesis Proposal Submitted to Saint Mary’s University**

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Addis Ababa, Ethiopia

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**Approved by Board of Examiners**

**Advisor Signature Date**

**External Examiner Signature Date**

**Internal Examiner Signature Date**

**Chairman Signature Date**

# DECLARATION

I, Semira Bedru Hussein, ‘’The Effect of Financial Constraints on Innovation and Firm Growth: Evidences from Ethiopia” is my original and submitted for the award of MBA in accounting and finance, St. Mary’s University at Addis Ababa and it hasn’t been presented for the award of any other degree. Under this study, fellowship of other similar titles of any other university or institution of all sources of material used for the study has been appropriately acknowledged and notice.

Semira Bedru Hussein \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Candidate Signature Date

# CERTIFICATION

This is to certify that Mrs. Semira Bedru Hussein has properly completed her research work entitled “’The Effect of Financial Constraints on Innovation and Firm Growth: Evidences from Ethiopia” with my guidance through the time. In my suggestion, her task is appropriate to be submitted as a partial fulfillment requirement for the award of Degree in MBA in Accounting and Finance.

Research Advisor

Misraku Molla (PhD)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Signature and Date

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|  |  |
| --- | --- |
| ESANOVAOSL | Enterprise Survey Analysis of variance Ordinary Least Squares |
| R&D | Research and Development  |
| TPPVIF | Technological Product or Process Variance inflation factor |
| WBES | World Bank Enterprise Survey  |

# ABSTRACT

*The purpose of this paper is to investigate the effect of financial constraints on innovation and firm growth in Ethiopia. It also examines how the effect of financial constraints varies by the main firm characteristics such as size, age and sector. The study utilized firm-level data from World Bank Enterprise Survey of 2015 for the fiscal year 2012-2014. 770 firms have been included in the sample in Ethiopia. Quantitative research approach and explanatory research design was used. Probit regression model was used to investigate effect of financial constraint on firm’s product and process innovation. The Multiple linear regression models were used to examine the effect of financial constraints on firm’s growth in Ethiopia. Stata version 14 was used to analyze the data and estimate the model parameters.*

*The result from the probit regression analysis reveals that firms that face financial constraints are less likely to introduce any innovational activities and it also reduces the firm’s growth. Firms that have larger number of full-time employees are not affected by financial constraints and are more likely to introduce any new or improved products without being affected by the financial constraint. Similarly, firms that invest on R&D and human capital are more likely to introduce new or improved products and process (TPP). Across manufacturing and service sector firms that have financial constraints are less likely to introduce any improved product or improved process (TPP).Financial constraint adversely affect the manufacturing sector than the service sector at 5% level of significant with a p-value of 0.000. Also research and development and human capital significantly positively affect both sectors.*

*Having the analyses on the variables the study recommends different stakeholders to apply sensible strategy in order to reduce the financial constraints by improving budget utilization, enhancing project study capacity, increasing information systems, and well maintained, clear property records to facilitate collateralization.*

***Key Words: Financial constraints, Firm growth, Firm heterogeneity, Innovation***

## CHAPTER ONE

## INTRODUCTION

##  Background of the Study

Innovation is an introduction of new things that are novel and useful like goods, services, and methods of production, markets, acquiring of new sources of supply and carrying-out of a new organization in any industry Innovation is defined as the multi-stage process whereby organizations transform ideas into new/improved products, service or processes, in order to advance, compete and differentiate themselves successfully in their marketplace (Hall, 2010). Innovation in its behavior needs highly educated and skilled manpower that have valuable knowledge the firm needs in order to interpret the innovative idea and to make it marketable. And this educated manpower is highly paid. These human capitals can’t be used as collateral in order to get external fund from investors and other interested parties to maintain daily activities because it is uncertain whether this human capital will stay in the firm in the long run (Ayalew and Xianzhi, 2019). And these aspects make it hard for innovation companies to get funds externally.

In economic research there is a widely accepted policy practice view about innovation and firm growth in which innovation constitutes an important driving force of firm growth by improving firm-level of productivity, competitiveness, and sustainable economic growth (Hanna Hottenrott and Bettina Peters, 2012).

A financial constrain is something that restricts a course of economic action (Sean, 2019). Firm growth is directly affected by financial limitation and in order to hinder financial constraints firms make different financial decision in order to fund their financial needs. And these financial needs are meeting by using both internal and external sources. Firm’s growth and innovation needs financial funds in order to achieve a long term plans related with firm growth and innovation implementation. This innovation implementation and Firm growth improvement leads to the growth of the country’s economy as a hole.

Finance is the application of economic principles to decision-making that involves the allocation of money under conditions of uncertainty. Investors allocate their funds among financial assets in order to accomplish their objectives, and businesses and governments raise funds by issuing claims against themselves that are invested (Frank and Pamela, 2009).

On the other hand, financing decisions are always concerned with the acquisition of funds to be used for investing and financing day-to-day operations. A company’s operations and investment can be financed from outside the business by incurring debts, such as through bank loans and the sale of bonds, or by selling ownership interests (Fridson and Alvarez, 2002). For the reason that each method of financing obligates the business in different ways, financing decisions are very important.

However, Ayalew and Xianzhi (2019) claimed that investment in innovative activities has unique features that make it different from traditional investment. In the same way, the finance and economic theories also document that these unique features make it challenging to finance innovation from the perspective of investment theory. Thus, this study is envisioned to examine the effect financial constraints on innovation and firm growth: evidences from Ethiopia.

##  Statement of the Problem

Innovative projects are risky with negative consequences both for their equity financing as investors discount this uncertainty on financial and stock markets and for their debt financing when collateralisation becomes prohibitive or even impossible. The issue how innovation financed is the widespread worldwide issue and problem, particularly financing innovation remain a major problem in African countries and other developing economies (Ayalew and Xianzhi, 2019). Accordingly there were previous studies done in the area of financial constraint and innovation as well as firm growth in the developed and developing countries. For example, Mulkay et al. (2001) studied on Firm level investment and R&D in France and the United States and Pereira and João (2016) focused on Italian and Portuguese manufacturing firms. Mohnen et al. (2008) studied the financial constraint obstacles in Netherlands. Also regarding relationship between financial constraint and firm growth of developed countries was investigated in many studies before.

There are studies done on the issue of the impact of financial constraint on firm’s growth. One of the studies done was by Mysso & Schiavo (2007), titled “the impact of financial constraint on firms Survival & Growth”. And in this study firm growth was measured by taking size and in terms of productivity. Cherchye et al. (2020) suggest an additional study regarding firms hetroginity across firms on the effect of financial constraints.

There was a recent study done by Ayalew and Xianzhi (2019), about the effect of financial constraint on innovation in developing countries. The study was done in 11 sample countries of Africa, and Ethiopia was not included within the sample. And in there study they recommend further study to be done on the degree of the effect of financial constraint have on innovation in Africa. And there is also most recent study done by Bikila (2021), on the effect of financial constraint on innovation across firm heterogeneity. And in his study the researcher investigate innovation variable. In the study the relationship of financial constraint was studied by measuring product & process innovation, Technological product or process, firm’s characteristics (size, age, and sector), R&D and human capital. And this work studied the relationship of financial constraint with innovation.

The Effect of financial constraints on the growth of firms was studied evidencing developed country, Turkey done by [Ergün](https://link.springer.com/article/10.1186/s40854-020-00188-z#auth-Bahad_r-Erg_n) & [Doruk](https://link.springer.com/article/10.1186/s40854-020-00188-z#auth-_mer_Tu_sal-Doruk) (2020). In the study the firms were classified based on ownership, family and non-family firms as dependent variable. Firm age, size and asset tangibility were used as controlling variables. The finding of the studies proves that there is a positive relationship between cash flow and firm growth.

Studies had been done on the relationship between financial constraint and innovation but there are very limited studies done on relation with firm growth especially in Africa and more specifically in Ethiopia. Innovation has a big role in economic development of developing countries in addressing & improving the economy. And also firm’s growth plays a bigger role in developing countries. A firm growth implies employment and sales volume of a firm. According to Ciani et al. (2020), close to 10 present of the GDP of Ethiopia were accounted from large firms. And this number implies the importance of firm growth in the country in contributing to the economy. Reducing the obstacles that the firms have regarding financial constraint on innovation and firm growth helps the economy. Improving the firms’ growth helps Ethiopia by reducing unemployment by having large share of employment. Many including the above empirical studies have different study results and this is countered because of bias of the researchers, unavailability of data and others related reasons.

Generally the aim of this study is to investigate the effect of financial constraint on innovation and firm growth using firm age, size sector, human capital, R&D and innovational variable (product innovation, process innovation and technological product & process). Having the above limitation on the study done previously this study addresses the limitation and fills the gap of studies by addressing both innovation and firm growth in Ethiopia in relation with financial constraint.

##  The Objective of the Study

* + 1. General Objective

The general objective of this study is to examine the effect of financial constraints on the firm’s innovation activities and Firm growth in Ethiopia. It also investigated how the effects of financial constraints on innovation & firm growth vary across firm characteristics. Specifically, this study has the following specific objectives.

* + 1. Specific Objective

This study has the following specific objectives

* To examine the effect of financial constraints on the firm’s innovational activities in Ethiopia.
* To investigate the effect of financial constraints on the firm’s growth in Ethiopia.
* To further examine the financial constraints effect on innovation across firms heterogeneity in size (small, medium, and large), age (young. Mature, and old), sector (manufacturing vs service) firms in Ethiopia.
* To show how firm-level and extent of innovation and financial constraints in Ethiopia.

##  Research Questions

This study addressed the following research questions.

1. Do financial constraints affect innovation activities of firms in Ethiopia?
2. Do financial constraints affect firm’s growth in Ethiopia?
3. How does the effect of financial constraints on innovation vary across firm size, age and sector?
4. To what extent firms face challenge of a financial constraint?

##  Significance of the Study

This study contributes in adding growing theory on the finance of innovation by providing additional empirical evidence from developing countries’ perspective. In addition, this study filled the pool gaps related shortage of related study conducted in Ethiopia and in developing countries. Concerning methodological issues, this study has the following contributions: in investigating the effect of financial constraints on innovation and firm performance, this study intentionally separate firms based on firms characteristics such as size, age and sector. Consequently, a more comprehensive understanding of the effect of financial constraints has on innovational activities and firm growth can be found. More importantly, this study takes into an account the heterogeneity of the existence of financial constraints similar to most of the previous studies. For that reason, it provides a resolution to the existing paradox: the heterogeneity of financing constraints that are consequence of costly innovation investment.

The study is very useful to several stakeholders including investors, international organizations such as World Bank and IMF, other non-governmental organizations, donor agencies, corporations, government & policy makers to reform and implement new laws and to plan future reduction of the constraints, firms’ executives, banks and other entities.

This study helps to understand the role of financing in innovation and firm growth in imperfect and competitive market set up. The study also benefits other international and local organizations as thousands of projects are designed and implemented each year by different organizations on their financial decision that involves investing, financing, or both.

The study has significant in the suggestion of areas requiring further research to build on the topic of factors affecting innovation and firm’s growth to future researchers and academicians. There are studies done on these topics on the continent by taking some sample countries, Ethiopia was not from the sample population taken and examined. So these studies contribute on the knowledge pool for future study done on the field in Ethiopia. Future studies may have a clue on firms’ specific features in terms of risk with external investors in Ethiopia. This study solves the shortage of studies in the area.

##  Scope of the Study

The notion of financial constraint that is employed in this paper is that of credit rationing which arises due to informational asymmetry between the borrower/firm and the lender about the quality of project that a firm wishes to undertake and also due to the risk of bankruptcy in the event of the failure of the project. Moreover, this study utilized data that come from World Bank Enterprise Survey (WBES). The WBES covers a broad range of business environment topics, including firms’ general information, access to finance, corruption, infrastructure, crime, competition, performance measures and some incomplete information on innovation and technology. Specifically, this study uses WBES data for the variables such as firm characteristics. This study was conducted on financial constraints effect on innovation and firm’s growth in Ethiopia. Accordingly, the study is restricted mainly on firms’ Size, age and sector. It is primarily concerned with investment decisions and financing decisions within business organizations. This study was more mainly used explanatory and quantitative type research design. It uses the survey conducted by the World Bank called World Bank Enterprise Survey (ES) of 2015 publication.

## Limitation of the Study

This study is delimitated in main categories such firms characteristics (age, size & sector) for innovation and it only takes employment growth to investigate the variable firm growth. The study used a survey conducted by World Bank for the year 2012-2014 and published in the year 2015 for 848 firms in the country in the six selected regions. It has been seven years and there is no recent statistics done by the World Bank enterprise Survey.

##  Organization of the Study

The study is well organized by five crucial chapters. The first chapter presents introductory part of the study, which includes background of the study, problem statement, research objective, research questions, and methodologies, significances of the study and the scope and limitations of the study. The second chapter presents the related literatures review of the effect of financial constraints on innovation and firm’s performance. With this background, the study includes study methods in chapter three and analysis and interpretation of the data with appropriate discussion in chapter four. Lastly, chapter five presents the summary and conclusion of the study including recommendations.

## CHAPTER TWO

## REVIEW OF RELATED LITERATURES

##  Theoretical Literature Review

Finance is the application of economic principles to decision-making that involves the allocation of money under conditions of uncertainty. Investors allocate their funds among financial assets in order to accomplish their objectives, and businesses and governments raise funds by issuing claims against themselves that are invested. This study has been reviewed various theories of innovation and financial including concepts and definitions of the.

* + 1. Concepts and Definitions of Financial Constraints and Innovation

Innovation is considered as an important driving element of firm-level productivity, competitiveness and growth. Equally largely accepted is the view that innovative activities are difficult to finance due to imperfect capital markets. Firm innovative activities are likely to be more severely affected by financial constraints than fixed capital investment due to the higher complexity, specificity and degree of uncertainty characterising innovation projects, cost and availability of external funding and overall country financial development for R&D investment (Hall 2002 ). Regarding government intervention, it has become common practice to support private innovative activities in most industrialised countries and additional effects or else they merely replace private funding of given RD investments (Hall and Lerner, 2010).

In principle there are two sources for financing innovation projects: external sources, which include bank loans or other debt contracts, and internal sources, which basically originate from retained profits or (new) equity. Hanna and Bettina (2012) cited Modigliani and Miller (1958) show that in markets characterized by no taxes, no bankruptcy costs, and no asymmetric information, investment decisions are indifferent to capital structure. Hence, in a neoclassical world with frictionless markets, sources of financing would not matter.

Information asymmetries arise due to the specific characteristics of innovation cause lenders or investors to demand a premium on their required rate of return. Besides information asymmetries, the intangible nature of the asset that is being created by RD usually makes external fundraising more costly than for other types of investment. A large fraction of innovation investments, particularly RD, is sunk and cannot be redeployed. Debt holders such as banks prefer physical and redeploy able assets as security for their loans since these can be liquidated in case of project failure or bankruptcy (Hall and Lerner, 2010).

Moreover, serving debt requires a stable cash flow, which makes financing of innovation projects by external sources more difficult since most of these projects do not immediately lead to returns. In addition, serving debt reduces cash flow for future investments. Internal funds, however, are naturally limited, and raising new equity may be costly and often unwanted. Consequently, the extent to which financial constraints are binding depends on firms’ ability to raise funds under the conditions of imperfect capital markets (Hanna and Bettina, 2012).

* + 1. Constraint-Induced Financial Innovation Theory

Peter and Justus (2018) stated that the constrained-induced financial innovation theory was developed by Silber (1983). The theory identified that the main motive for embracing financial innovation in a firm is to improve its financial position. Though, in the process of improving financial performance a firm faces some constraints like external handicaps such as policy and internal handicaps such as organizational management. The constraints not only give an assurance on the stability of the management they reduce the competence of any financial institution. Therefore, financial institutions struggle towards removing or lessening or casting the constraints off through financial innovation. This theory is helpful in this study as companies that operate in a market with more constraints have the greatest inducement of embracing financial innovation that assist in boosting their financial performance because of reduction in operational costs and they do not hold financial innovation are deemed to fail.

* + 1. Transaction Cost Innovation Theory

The transaction cost innovation theory is considered mainly transaction cost reduction and earning benefits. Financial innovation is expressed by technology advancement which cause transaction cost to reduce and better financial performance. Commercial banks just like other firms face the challenges of increasing transaction costs that threaten sustainability. As a result, they embark on invention of methods that can reduce transaction costs (Muia, 2013). This theory is for that reason significant to this study as it relates financial innovations and performance as a result of transaction cost reduction measures and earning profits.

* + 1. Information Asymmetry Theory

According to Guariglia (2008), Myers and Majluf (1984) develop a theoretical framework to study the impact of financing constraints on corporate investment behaviours by introducing the information asymmetry theory in capital market research. They develop a two-period general equilibrium model to analyse the association of internal and external financing constraints with a firm’s investments, and they theoretically posit that, when a firm facing an insufficient internal capital market (internal funding sources), it has to rely on its ability to obtain external capital to satisfy its investment demands, so corporate investment and financing constraints are negatively correlated. For that reason, this theory is helpful to release that firms prefer to utilize internal financing resources first, followed by debt financing and equity financing. This is due to the fact that firms facing greater financing constraint have a higher degree of investment cash flows sensitivity or firms’ investment decisions are determined by their financial structure and financing capability concurrently.

* + 1. Theory of the Firm

This theory focused on a production process that utilizes two inputs, capital (K) and labour (L), to produce output (Q). The technology available for converting capital and labour into output is summarized in the production function. The production function is an engineering relation that defines the maximum amount of output that can be produced with a given set of inputs (Hall, 2010). For that reason, this theory is helpful to release two views of the firm. One, the neoclassical (traditional) theory that stated as Firm is a calculating entity that makes decisions, buys inputs, making output, and selling for profit for loss. Second, Firm is a collection of contracts between owners of resources, who wish to combine some portion of their resources, for some period, for some purpose. As results, they may be addressed two kinds of problems including how organizations react to particular events such as changes in input prices and changes in output prices. Another, Partnerships, proprietorships, corporations, joint ventures, non-profits, and government agencies solved different types of organizations doing different things.

* + 1. Agency Costs

Who gets what — or thinks they deserve something — is a part of what we call Agency Costs or Agency Problems. Agency costs exist as a problem whenever a principal hires an agent to act on his behalf. Solving these problems is a key managerial problem in managing personnel and in controlling costs. These are a problem because we are human. If we “cheat” ourselves, then no one else bears the cost. So we never cheat ourselves (except after the fact we may think so). It is natural for us to want to exploit others — get others to pay more than they agreed to pay, or we produce less than we agreed to produce. That is, a divergence in interest between principal and agent (Brown, et al., 2009). Thus, this theory solve the financial constraints as the agency problem (and cost it imposes) arises from the problem of the separation of ownership and control. Owners of firms are interested in profit maximization. Managers and other employees are interested in maximizing own self-interests.

* + 1. Modern Investment Theory

Haugen (2001) explained investing overseas by firms, as a response to the availability of opportunities not shared by their competitors, that is, to take advantage of imperfections in markets and only enter foreign spheres of production when their comparative advantages outweigh the costs of going overseas. These advantages may be production, brand awareness, product identification, economies of scale, or access to favourable capital markets. These firms may make horizontal investments, producing the same goods abroad as they do at home, or they make vertical investments, in order to take advantage of sources of supplies or inputs. Going a step further, some believe that firms within an oligopoly enter foreign markets merely as a competitive response to the actions of an industry leader and to equalize relative advantages. Oligopolies are those market situations in which there are few sellers of a product that is usually mass merchandised. As a consequence, these theories explained and helpful for this study as firms must be keenly aware of the actions, market reach, and activities of their competitors. Unless their response to the actions of competitors is following the leader, they yield precious competitive edges to their competitors. And so, it follows that when a market leader establishes a foreign production facility abroad, its competitors rush to follow suit. In consequence, the impetus for a firm to go abroad may come from a wish to expand for internal reasons to use existing competitive advantages in additional spheres of operations, to take advantage of technology, or to use raw materials available in other locations.

* + 1. The Relationship Between Financial Constraints and Innovation

The significance of binding financial constraints for firm innovative activities assured the sensitivity of firms’ investment to cash flow fluctuations reveals the presence of financing constraints for firms. The investment cash flow sensitivities need not increase monotonically with financial constraints and that investment opportunities may not be sufficiently controlled for. The long debate is also considered as alternative proxies for firm wealth and different ways of identifying how financing constraints may impact firm activities such as growth, fixed capital investment, inventory accumulation and RD expenditure.

Mulkay et al. (2001) showed the role of internal finance for firm RD investment, use panel data and employ an instrumental variable approach to control for the endogeneity of cash flow. Brown et al. (2012) advocate the use of cash holdings, instead of cash flow, as it more accurately incorporates firm RD smoothing behaviour in response to high adjustment costs. On other hand a payment incident variable as an indicator of firm credit constraints is proposed as firms’ R&D investment is negatively correlated with supplier overdue payments and the effect is stronger in sectors more dependent on external finance (Aghion et al., 2012). Kim and Weisbach (2008) suggest equity plays an important role in raising capital for RD spending. Brown et al. (2012) estimate dynamic panel models and confirm the linkage between stock issues and RD investment of US and European firms, respectively. Hall (2002) reports that RD-intensive firms normally exhibit lower debt ratios than firms engaging less in RD.

Firms’ innovative projects were delayed, abandoned or non-started due to unavailability of new financing, searching and waiting for new financing or too high cost of finance. Firms’ decisions to invest in innovative activities are sensitive to financial frictions (Gorodnichenko and Schnitzer, 2013).

##  Empirical Reviews

Frédérique (2007) examined the impact of financial constraints on innovation for established firms. The study used a direct measure of the existence of financial constraints obtained. This is a distinctive feature of this paper as most of previous studies had to rely on proxies (like the cash-flow sensitivity) which may be subject to interpretation problems. The probability to have innovative activities and the probability to face financial constraints are simultaneously estimated by a recursive bivariate probit model. Accounting for the heterogeneity of the financial constraint variable, the study found that financial constraints significantly reduce the likelihood that firms have innovative activities.

Hanna and Bettina (2012) presented a novel empirical approach to identify financing constraints for innovation based on the concept of an ideal test based on Hall (2008). Firms were offered a hypothetical payment and asked to choose between alternatives of use. If they selected additional innovation projects, they must have had some unexploited investment opportunities that were not profitable using more costly external finance. They attributed constraints for innovation not only to lacking financing, but also to firms’ innovative capability. Using econometric model, the study found that financial constraints do not depend on the availability of internal funds per se but that they are driven by innovative capability. On other hand, Jun, Shengqiang and Fangcheng (2017) investigated the association between financing constraints/agency problem (agency costs) and corporate R&D investment in China by using the two-tier stochastic frontier model in light of the Euler equation analysis framework. The results display that there is a significantly negative association between financing constraints and firms’ R&D investments and a significantly positive relationship between agency costs and R&D investments. Thus, financing constraints lead to R&D underinvestment, while agency costs cause R&D overinvestment by the sample firms. Nevertheless, government subsidies have a positive moderating effect on the relationships. The impact of financing constraints and agency costs on R&D investment varies slightly by firms in different geographical regions, industries, business ownerships, and years.

The relationship between financing constraints, investments in research and development (R&D) and innovative performances has just attracted changed attention in the aftermath of a financial crisis that has led to problems of access to the credit on which innovation activities crucially rely.

Accordingly, Bronwyn et al. (2015) investigated the financing constraints, R&D investments and innovative performances based on new empirical evidence at the firm level for Europe. They also examined the contribution of the papers it contains, which provide new conceptualizations and empirical evidence at the firm level for Europe. They confirmed the most previous research results, which were mainly based on extending models of financing constraints and physical investments to R&D investments. While new insights about this relationship are uncovered, in terms of the structural characteristics of the constrained firms, of the industries in which they operate, of their innovative activities and of the innovation outcomes they achieve.

Moreover, Brown, et al. (2012) assessed financing constraints matter for R&D. The study focused on information problems and lack of collateral value should make R&D more susceptible to financing frictions than other investments, yet existing evidence on whether financing constraints limit R&D is decidedly mixed, particularly in the studies of non-U.S. firms. They examined a large sample of European firms and also find little evidence of binding finance constraints when we estimate standard investment-cash flow regressions. Though, they found that strong evidence that the availability of finance matters for R&D once we directly control for efforts to smooth R&D with cash reserves and the use of external equity finance. Their findings also indicated a major role for external equity in financing R&D, highlighting a causal channel through which stock market development and liberalization can promote economic growth by increasing firm-level innovative activity. Gorodnichenko & Schnitzer (2013) assessed financial constraints and innovation in poor countries. They examined micro-level channels of how financial development can affect macroeconomic outcomes like the level of income. Specifically, we investigate theoretically and empirically how financial constraints affect a firm's innovation activities. Theoretical predictions are tested using unique firm survey data which provides direct measures for innovations and firm-specific financial constraints, as well as information on shocks to firms' internal funds that can serve as firm-level instruments for financial constraints. They found that unambiguous evidence that financial constraints restrain the ability of domestically owned firms to innovate and hence to catch up to the technological frontiers.

##  Summary and Research Gap

There are a plenty of previous studies which focused on to investigate the effect of financial constraints on innovation in developing countries. They also examined how the effect of financial constraints varies by sector and with main firm characteristics such as size and age. For example, Frédérique (2007) inspected the impact of financial constraints on innovation for established firms. Hanna and Bettina (2012) identified financing constraints for innovation based on the concept of an ideal test. Jun, et al., (2017) examined the association between financing constraints/agency problem (agency costs) and corporate R&D investment. Bronwyn, et al., (2015) considered the financing constraints, R&D investments and innovative performances.

All these studies focused on empirical evidence at the firm level for developed countries French, and other Europe countries. Moreover, Brown, *et al*, (2012) assessed financing constraints matter for R&D. Others focused on R & D rather than innovation and firm’s innovative performance. These studies ignored firm’s ex-ante financing structure, collateral, accounting and auditing practices, risk associated with the investment and information asymmetry on innovation and firm performance. Rather they included distinct features in their studies such as information problems; lack of collateral value should make R&D, financing frictions and investments including financing constraints limit particularly in specific developing countries like Europe and U.S. firms.

##  Conceptual Framework

Figure 2.1. present the conceptual framework that link the relationship between financial constraints and firm’s product, process, and TPP innovations. It also indicate the link between financial constrains and frim growth. The framework also shows the inclusion of control variables (firm size, firm age, and R&D) in each estimation.

##

Product Innovation

Control Variables (Size, Age, Sector, R&D, Human capital)

Financial Constraint

Process Innovation

Technological Product & Process (TPP)

Number of Employee

Firm Growth

# Figure 2.1. Conceptual framework (self-develop)

##  Research Hypothesis

Frédérique (2007) mentioned Schumpeter (1942) argues that a firm is incited to innovate if it enjoys a monopoly position and Arrow (1962) who shows that under perfect ex-post appropriation, the pro.t margins are larger in a competitive industry than under a monopoly situation. The empirical studies are not in contradiction to the Schumpeterian theory in this respect and confirmed that a positive relationship between firms’ market share and innovation. It is related to technological opportunities contribute to the decision to undertake innovative projects regarding the role of the environment. The technological opportunities may result from the past history of knowledge accumulation and from the technological progress in the firms’ environment. Thus, this study proposed that Firms’ financing structure has a positive and significant effect on innovation and firm growth. Hanna and Bettina (2012) stated that skills are an important success factor of R&D investors do not sufficiently value such skills although they might be aware of the fact that. However, firms investing in intangible assets such as human capital instead of physical capital may even experience an additional disadvantage in raising funds due to lower relative collateral value.

Ayalew and Xianzhi (2019) identified that R&D spending is a high-risk investment as its initial input is typically a permanent sunk cost with high uncertainty or no returns can be expected. Because a firm’s executives’ compensations are more or less related to its financial performance, short-term managerial behaviour to maximize managerial compensations at the expense of the firm’s long-term growing potential is a typical agency problem derived from the conflicts between owners (shareholders) and managers. Because government subsidies increase the available funding for firms to invest, it can alleviate firms’ exposure to financing constraints and reduce the risk or potential losses associated with the uncertain R&D spending.

The problems of opportunistic behaviour, adverse selection and moral hazard affecting the financing of capital investments in general are exacerbated in the case of R&D financing, with respect to which contract incompleteness, opaqueness and information asymmetry between firms and investors are also more pervasive (Hall and Lerner 2010). Ayalew and Xianzhi (2019) mentioned Myers and Majluf (1984) who develop a theoretical framework to study the impact of financing constraints on corporate investment behaviours by introducing the information asymmetry theory in capital market research. They develop a two-period general equilibrium model to analyse the association of internal and external financing constraints with a firm’s investments, and they theoretically posit that, when a firm facing an insufficient internal capital market (internal funding sources), it has to rely on its ability to obtain external capital to satisfy its investment demands, so corporate investment and financing constraints are negatively correlated. For that reason, firms prefer to utilize internal financing resources first, followed by debt financing and equity financing and the firms facing greater financing constraint have a higher degree of investment–cash flows sensitivity or firms’ investment decisions are determined by their financial structure and financing capability simultaneously.

**Hypothesis 1*:*** *Financial constraints adversely affect firm innovation performance*

**Hypothesis 1a*:*** *Financial constraints adversely affect a firm’s product innovation*

**Hypothesis 1b***: Financial constraints adversely affect a firm’s process innovation*

**Hypothesis 1c**: *Financial constraints adversely affect a firm’s technological product & process (TPP).*

Frédérique (2007) mentioned that a specific information about the financial problems encountered by firms for innovative projects whereas accounting variables or credit rating index reflect the global financial situation of the firm. Especially in the case of large firms, free cash flow levels may be determined by accounting as well as dividend policies aimed at mitigating moral hazard problems. In addition, a positive relationship between investment and cash flow may simply reflect that both of them correlate with promising market demand. Firms tend to smooth R&D spending over time, leading to difficulties in measuring the impact of changes in cash in one period on subsequent investments (Hanna and Bettina, 2012). Ayalew and Xianzhi (2019) stated that the accounting and auditing practices of firms may affect access to external sources of finance. This is due to the fact that lenders are usually interested in the financial reports of borrowers that are certified by independent external auditors. They found that on average firms, if their financial statements are audited, are 5% less likely to be credit constraint than those their financial statement not audited and certified from the perspective of African countries. Internal capital markets render access to internal resources easier for firms that are a member of a group which can more easily to acquire the financial resources required to pursue innovative activities.

Financial constraint has adverse effect on innovation activities and also on the process and product innovation decision to participating on innovation activities. And decision making participating on innovation is affected by 40% based on Ayalew and Xianzhi (2019).

***Hypothesis 2:*** *The adverse effect of financial constraints on innovation is higher for smaller firms than larger ones.*

According to WBES smaller firms were characterized by the number of employees’ ranges from 5 to 19. But number of employees is not the only the characteristics and measurement of firms size there are also financial characteristics that differ one size to the other. According to Hamel (2019), firms’ size can be characterized by source of finance. Large firms received financing by selling shares of stock or corporate bonds which bring finance to the firm but small firms can’t sell their shares to have more funds rather they are more dependent on own capital/savings, family, friends, personal loan, small business loan and bank.

Accessing finance has great barriers for smaller firms than large firms in terms of long term financing (Segarra & Teruel, 2009). Accordingly when the sensitivity of company growth to cash flow rises as company size falls. And this shows that small firms have financial constraints than large companies and this prevent them in using the firm’s full potential in order to achieve growth.

Credit financing is one of sources of receiving finance for smaller, medium and also for large firms. And this form of financing need collateral and this obstacle is highly observable in innovative small firms since the fixed capital of the firm has lesser value compared to large companies. Arza & López, (2018) had studied the obstacle of innovation on firms’ size, age and related firm characteristics and in their study they have concluded that smaller firms had suffered more intensively in cost related barriers.

**Hypothesis 3*:*** *The effect of financial constraints on innovation is higher for younger firms than older ones.*

One of the characteristics of classifying firms is based on their age. In the WBES firm characteristics was defined in years of establishment range from the 0 -10 year establishment up to 60 and above. According to Annalisa (2013), the age of firms have positive relation with access to finance. Small business financing faces greater difficulty than older firms in securing commercial bank debt than large firms which are more established. The reason behind this according to Robb (2002) is that the risk associated with young firms. Young firms have many financial constraints since they have higher establishment and expansion costs. And innovation being intangible by its nature makes it difficult for lenders as well as borrowers when it comes to collateral and young innovative firms are highly affected by the financial constraint.

**Hypothesis 4*:*** *The effect of financial constraints on innovation is higher for service sector than manufacturing sector.*

The major difference between manufacturing and service sector is tangibility of output. Service sector produces outputs that are intangible in nature. And in this hypothesis both innovation activities and service are intangible. And this characteristic of the sector makes it more difficult in funding finance. The reason is that, risk that both innovational firms and the service sector have is higher than the innovational firms in the manufacturing sector. Fixed asset like machinery can be used as collateral for firms that need external financial sources like banks for firms that are in manufacturing sector.

* **Hypothesis 5:** *financial constraints adversely affect firm’s growth.*

Finical constraint also affects firm growth that is measured by employment growth in this study. According to  [Ergün](https://jfin-swufe.springeropen.com/articles/10.1186/s40854-020-00188-z#auth-Bahad_r-Erg_n) & [Doruk](https://jfin-swufe.springeropen.com/articles/10.1186/s40854-020-00188-z#auth-_mer_Tu_sal-Doruk) (2020) they have confirmed in there research, financial constraint is an obstacle in firm growth.

In this hypothesis this research investigate the effect of financial constraint have on firm growth by measuring the employment growth of firms from the fiscal year 2012-2014.

#

# CHAPTER THREE

# METHODOLOGY

## 3.1 Introduction

This chapter presents research approach and design of the study to which the practical “how” the research is systematically designed to ensure a valid and reliable outcome as per the objective. This chapter includes five main contents which include the research approach, design, data source & type & population and sampling. It also includes sampling procedure and techniques, validity and reliability test, data presentation and model of the study and ethical research standards of the study.

##  3.2 Research Approach

According to Chatty, 2016, “research approach is a plan and procedure that consists of the steps of broad assumptions to detailed methods of data collection, analysis & interpretation. There are three types of research approach, quantitate, qualitative & mixed method approaches according to Cresweel (2018).

Quantitate Research Approach: emphasize on collecting and analyzing numerical data; it concentrates on measuring the scale, range, frequency etc. of phenomena. It is a means of testing objective theories by examining the relationship among variables. These variables in turn can be measured, typically on instruments, so that the numbered date can be analyzed using statistical data. In quantitative research analysis is made based on deductive reasoning, beginning with certain theory or hypotheses and drawing logical conclusions (Creswell, 2009).

Qualitative Research Approach: involves collecting & analyzing non-numerical data including values, attitude, opinions, experience and perceptions. It is more subjective in nature than quantitative research. Qualitative research method used observation, interview focus groups and other means of data collection. These kinds of research collect data through open-ended and conversational communication.

Mixed Research Approaches: it is an approach that uses both qualitative and quantitative data. This research is assumed to give additional understanding beyond the information delivered by either qualitative or quantitative approach.

The study is based on statistical tests; it attempted to investigate the effect of financial constraints on innovation and firm growth by considering the firm structure (size, age & sector). Further, it tried to examine the degree of influence of financial constraints has on innovation taking into consideration the structure of Firm’s size, age and sector in Ethiopia. Having the above descriptions, the study uses quantitate approach to collect and analyze data to answer the hypothesis. As a result, the results were directly tested for validity and reliability using objective statistical methods, which strengthen the generalizations of results. Besides, this study collected and analyzed numerical data; concentrates on measuring the scale of phenomena. The study was highly detailed and structured and results can be easily collected and presented statistically. Generally, the study applied quantitative research approach.

## 3.3 Research Design

Research design is a systematic approach use to conduct a scientific study. Alternatively, the most widely-used classification is the one based on the objective of the study. Accordingly, there are three types of research design based on the study’s purpose: exploratory, descriptive and causal (Creswell, 2009).

Exploratory Research Design: is used to investigate a problem which is not clearly defined before. As the name implies it intends to explore the research question. The design objective is not to offer a solution to the problem addressed rather it is to explore the question. This type of research design helps in laying the foundation of a research, which will lead to further research in the future.

Descriptive Research Design: is a type of research design that describes a population or a phenomenon characteristic that is being examined. As the name implies it uses to describe the subject of the research, not why a certain phenomenon happens or occurs.

Explanatory Research Design: also called causal, explains the first type of correlational design and conducted when researchers want to explore the extents to which two or more variables co-vary. And also it answers a question of what and why. And it uses experiments as a method of data collection.

The study attempts to examine the effect of financial constraints on innovation and firms’ growth by taking financial characteristics (age, size & sector) into consideration. Because the research was conducted to test the cause and effect relationship of variables influencing innovation and firm growth the study uses explanatory research design. Thus, this study applied explanatory research design to explore the effect of financial constraint on innovation and firm’s growth in Ethiopia.

##  3.4 Data Source and Type

The source of data for this study is the 2015 World Bank Enterprise Survey (ES) for Ethiopia which contain information for three years; 2012, 2013, and 2014. World Bank is a global partnership which includes five institutions working in one group and strives to meet the objective of sustainable poverty reduction solution and to promote shared prosperity by increasing the incomes of the in developing countries and have 189 member countries. The institution engaged in providing credits for middle and low income countries for the objective of pursuing capital projects. The institution main strategic objective is reduction of poverty by improving the area of investment, job creation and to bring sustainable growth for developing countries. The institution has many ongoing projects and one of the projects is World Bank Enterprise Survey.

World Bank Enterprise Survey (ES) it is ongoing project conducted since 1998, engaged in collecting objective data based on firm’s growth and enterprise perception in which the firm is performing. The survey had conducted for more than 148 countries worldwide and conducted manly on manufacturing and service sector covers large, medium and small size of firms which is determined by the number of employees ranging from 100 and more (large), 20 to 99 (medium), and 5-19 (small). The ES topic study includes access to finance, innovation and technology, capacity utilization and performance measure.

In general, this study used a firm-level data that come from the World Bank's Enterprise Surveys (WBES). The World Bank Enterprise group conducted survey for Ethiopia in 2011 and 2015. However, the 2011 WBES for Ethiopia did not include innovation-related questions. Consequently, this study used the latest ES for Ethiopia published in 2015. The 2015 ES for Ethiopia contain information related to firm’s innovation performance, particularly, product innovation, process innovation and technological product & process (TPP). The WBES used face-to-face interviews to collect information.

The ES data collection follows two stage procedures. The first stage is conducted to determine the eligibility of the firm’s and to have an appointment through screener questioner done using phone. The second stage is conducted using face to face interview with manger & owner of each establishment.

## 3.5 Sample Distribution and Composition

According to WBES, 2015 the sampling methodology used on selecting the sample sizes is to achieve two main objectives: the first objective is to mark the investment climate of individual economies across the globe and, the other objective is to conduct Firm Growthanalyses focusing mainly on how investment climate constraints affect productivity and job creation in manufacturing and service sectors. Having these objectives the sampling methodology selects the whole private economy other than agriculture which includes the manufacturing, service and other relevant sectors of the economy using stratified random sampling. Geographical region, establishment size and industry were used as a level of stratification.

Geographical region stratification of ES consists of six regions: Addis Ababa, Dire Dawa City Administration, Amhara, Oromia, Southern Nation Nationality Peoples Republic (SNNPR) and Tigray Regional State. Establishment size stratification was further classified in to small, medium and large firms. This consists 5 to 19, 20 to 99 & more than 99 employees respectively.

Industry stratification was classified in to two main classifications, manufacturing & service sectors. Within manufacturing there are four sectors, food & beverage, textile and garments, non-metallic mineral products and other manufacturing. And in the service sector there are also three strata. Transportation, retail and other service are stratification from the service sector.

The 2015 ES for Ethiopia includes 848 firms of which 377 manufacturing firms, 287 non-retail services firms and 184 retail businesses. The survey includes 26micro, 392 small, 251 medium-sized and 179 large firms. In the 2015 World Bank Enterprise Surveys for Ethiopia about of 849 firms were included. However, due to some screening criterion about 770 firms are actually included in our final sample. The screening criterion was 1) Micro firms (firms with less than 5 employees) are excluded, 2) Variables with Omitted data or spontaneous response of “I don’t know” are excluded, and 3) observation with possible out layer effect are also dropped in order to have final sample of 770 firms.

# Table 3.1. Sample Size Determination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| .Sub group | Size | Target  | Proportion  | Sample Size  |
|  | Small (5 to 19 permanent employees  | 177 | 0.92 | 163 |
| Firm Size | Medium (20 to 99 permanent employees) | 260 | 0.92 | 240 |
| Large (Above 99)  | 397 | 0.92 | 367 |
|  |  | 835 |  | 770 |

Source: Enterprise Surveys and Indicator Surveys and Study result, 2021

The overall sample size depends on the decision of the sample size for each level of stratification and the objectives of stratification are to allow an acceptable level of precision for estimates, at, first, different size (small, medium, and large*)*.The quantitative method is preferable because of it is objective, formally structured and a systematic process in which information is obtained using numeric data about a particular research topic. It is the collection of numeric data and explanation of the correlation between theory and research with an objective conception of social reality. The main characteristic of this method is the use of statistics to analyze data, result oriented approach to analyzing data which ignores the perspectives of the researcher thereby reducing the influence of subjectivity and it is very popular with a testing hypothesis which is more scientific on measurement. The data obtained from the ES is analyzed using Stata version 14. Stata is statistical software for data science that provided data analysis, data management and other related uses.

* 1. Econometric Model Specification

In situations where the dependent variable to be modelled is limited in its range using OLS estimation would result in biased and inconsistent parameter estimates. Dependent variables the value of which is censored at zero pose self-selection problems in econometric estimation and econometric models such as limited dependent models, Tobit and Heckman two stage estimation procedures have been suggested to overcome self-selection problem that might arise. The main objective of this study was to examine the effect of financial constraints on innovation and firm growth in Ethiopia. Based on previous studies, this study used a probit model to investigate the effect of financial constraints on innovation. This is due to the fact that its dependent variable ‘innovation’ is measured based on a binary response that takes value 0 and 1. As a result, the study employs a non-linear model. The empirical model to investigate the effect of firm’s financial constraints is developed based on a latent regression. For that reason, the probit model derived from latent regression is specified as follows. Therefore, the probit model derived from latent regression is specified as follows.

𝓎i∗= ɸ (β0+β1 FinConij+ β2𝐶𝑜𝑛𝑉𝑎𝑟i+εi)

**Where,**

𝓎ij∗: the propensity for firm i: innovate. It represents the two dependent variables; product innovation and process innovation. And these variables are measured as a dummy variable that take value of 0 or 1. ɸ : the standard normal cumulative distribution function (cdf), whereas, 𝐶𝑜𝑛𝑉𝑎𝑟i: control variables (firm size, age, sector & human capital), more precisely, including the main independent variable (Fin Con) and each control variables in to equation, the final model can be rewrite as follow.

𝓎i∗=ɸ(β0+β1FinConi+β2𝐿𝑜𝑔(𝑠𝑖𝑧𝑒i)+ β3𝑙𝑜𝑔 (𝑎𝑔𝑒i)+β4𝑅𝐷i+ β5𝐻𝐾i+ εi)

 Where: β0: Constanta

 β1: Coefficient of financial constraint

 β2: Coefficient of firm size

 β3: Coefficient of firm age

 β4: Coefficient of research & development

 β5: Coefficient of human capital

 ε: The mean zeroeError

* 1. Variable Definition and Measurement

**3.7.1. Measuring Financial Constraints**

Financial constraint is one of the main variables in this study. In order to measure this variable we refer section K of the WBES. We used a recent multi-step measure of financial constraints proposed by Ayalew and Xianzhi (2019). This approach is the most effective to capture the exitance of financial constraints using survey data. The measurement has 5 steps which are presented as follows.

***Step-I:*** In order to know whether a firm has access to external finance or not, we first refer K.8 “*Does this establishment have a line of credit or a loan from a financial institution?*” Following Kuntchev et al. (2013), firms that report ‘yes’ are less likely to face credit constraints and considered as ‘financially unconstrained.’ In contrast, firms that report ‘no’ are considered as ‘financially constrained.’

***Step-II****:* In order to investigate whether the establishment needs external finance, we refer K16 *“**Did the establishment apply for any line of credit or loan?”* Firms that response ‘yes’ for K.16 are more likely to face internal financing constraints; hence, considered as ‘financially constrained.’ Whereas, firms that response ‘no’ are less likely to face internal financing constraints; hence considered as ‘financially unconstrained.’

***Step-III:*** Firms that did not express their demand for external finance (not applied for any line of credit or loan) does not necessarily mean financially unconstrained. Therefore, we need to know the reason why they did not apply for credit/loan; hence, we referred to K17- *what was* *the main reason for not applying for a new loan/line of credit?* The alternative answers for this question were; 1) no need for loan-establishment had sufficient capital, 2) application procedure were complex, 3) collateral requirement were too high, 4) size of loan and maturity were insufficient, 5) did not think it would be approved, and 6) other. Firms that response ‘no need for loan-establishment had sufficient capital’ can be considered firms that have no internal financing problem, thus, Ayalew and Xianzhi (2019) considered them as unconstrained firms. However, Firms that state any reasons other than need not new loan or line of credit are considered as internally financially constrained firms. Ayalew and Xianzhi (2019) and Leon (2015) categorized these firms as ‘*discouraged firms’* to express their demand for external finance.

***Step-IV:*** In practice, all loan applications may be accepted or granted by lenders. Therefore, we must identify firms their loan application accepted by the lender from those denied. To do this, we refer to question K20 - *what was the outcome of the application for credit/loan?* The response to this question varied between the application was; 1) approved in full, 2) approved in part, 3) rejected, 4) withdrawn, and 5) still in process. Firms their application approved in full has internal financing problem but their financing problem is solved through external sources of finance, hence, categorized within unconstrained firms. However, firms that responses other than ‘the application was approved in full and approved in part’ are in a serious problem of meeting their financial needs either using internal or external sources of finance.

***Step-V:*** Regarding the firms that report ‘the application was approved in part,’ we need to have other means to identify them as financially constrained or unconstrained. Therefore, as possible means to further investigate, they refer K7- *does the establishment* *have an overdraft facility?* If the establishment response ‘yes’ for K7, we assume the partial amount of loan not granted may temporarily solve using overdraft access. Therefore, firms that grant their loan application in part but have access to overdraft facilities are categorized in the unconstrained firm, otherwise as financially constrained.

Based on the above 5 steps, the existence of financial constraint is measured by a dummy variable ‘financial constraints (*FIN\_CON*)’ which take value 1 if the firm; 1) have no external sources of finance, 2) applied for loan/credit but their application was rejected, withdrawn, or still in process, 3) need external fund but did not apply for loan/credit because they are discouraged, and 4) Applied for loan/credit but their application approved in part and has no overdraft facility, zero otherwise.

**3.7.2. Measuring Innovation**

According to Ayalew, Xianzhi (2019) innovation indictors were classified into output and inputs indicators. Output indicators were paten counts, the number of product/process innovation and the share of the product/process sales. And input indicators were staff training, R&D, machinery, software, purchase of new equipment’s used to process new innovational activities.

In this study innovative activities were construct a dummy variable that takes a value of 0 or 1 in order to indicate whether there is any innovative activities takes place in the firm product or process. WBES prepared questions regarding firm’s innovative activities in section H of the manual. And in this section there were nine questions raised. However, this study use response obtained from the following questions.

* H.1: During the last three years, has this establishment introduced new or improved product or services?
* H.2: Were any of the new or improved products or services also new for the establishment’s main market?
* H.5: During the fiscal year, has this establishment introduced any new or improved process? These include: methods of manufacturing products or offering services; logistics, delivery, or distribution methods for inputs, products, or services; or supporting activities for processes?
* H.8: During fiscal year 2012-2014, did this establishment spend on research and development activities, either in-house or contracted with other companies, excluding market research surveys?

On the above questions the word “new” refers to new product or service to the firm not to the market. In the question dependent variables of innovation, process innovation and product innovation, were raised in the sections H.1, H.2 and H.5 also. The question answer can be “yes” if there is an innovation activities takes place or “no” if not. And based on the response a dummy variable indicator is given. If the answer for the question is “yes” then it takes a value of 1 and if it is otherwise it takes a value of 0. In this section there was also question raised about Variables in the innovation equation which is R&D. and the methodology indicating the value is also dummy.

* + - 1. **Measuring Process and Product Innovation**

Likewise, this study took section H.5 of the ES that committed to request a firm’s about their process innovation performance. It included ‘From fiscal year 2012-2014, did this establishment introduce any new or significantly improved process?’; then a dummy variable was constructed as ‘Process innovation’ which takes the value of 1 if the firm introduces any innovative methods of manufacturing products/offering services, logistics, delivery/distribution, methods/product or service, or supportive activity during the last three years, 0 otherwise. Product innovation took H.1 of ES. This section requests about if the establishment introduced new or improved products during the fiscal year of 2012-2014. And a dummy variable equal to 1 is constructed if a firm introduces new or improved products/service; if not then the value is 0.

* + - 1. **Technological Product or Process**

Lastly, a variable was applied in this study that was pooled product or process innovation Technological product or process (TPP) which takes equal to 1 if a firm introduces the new or significantly improved process such as innovative methods of manufacturing products/offering services, logistics, delivery/distribution, methods/product or service, or supportive activity/process in the last three years, 0 otherwise. And this data was conducted in section H.1 and H.5.

### 3.7.3 Measuring Firm Growth

Firm growth is one of the variables to be measured. In WBES this variable questions were on section L. This section tries to collect information about human capital/labor Growth and this aspect of helps to analyze firm’s growth in study. Section L was about labor /human capital. In the section collection of data on number of full time & permanent employees, skilled job workers were main aim. And in order to achieve this there were questions regarding these points. Some of the questions raised were number of permanent and full time employees in the fiscal year of 2012-2014. And also related with this, number of skilled workers that is professional whose tasks requires extensive theoretical and technical knowledge, semi-skilled workers hired in a position were mechanical and technical knowledge is required and unskilled employees that works that didn’t involve specialized knowledge.

### 3.7.3 Measuring Control Variables.

Firm’s size, age, human capital and R&D are the controlling variables of the dependent variables. The variable, firm size (Log (size)) is defined as a natural logged value of the number of permanent fulltime employees and data was collected in section L of 2. Firm age (log(age)) is the year of the firms operate from day of their establishment and was in section B.5. Human capital data were collected under L9b. Number of full time permanent employees completed secondary school in the fiscal year data was used to measure human capital. And the value was taken in percentage. Research and Development (R&D) variable is a dummy variable and took 1 or 0 values, found in section H.8. The section investigates whether the firm spends on research and development activities, either in-house or contracted with other companies, excluding market research survey. If the company spends on R&D then the firms answer is yes and it have a value of 1 and if not then the value is 0.

# CHAPTER FOUR

## RESULTS AND DISCUSSIONS

This section presents results and findings from the study and also present findings of the analysis based on the objectives of the study. The first section is descriptive statistical analysis; correlation and VIF result as well as normality test using skewness statistics. the second section is the regression results of the effect of financial constraints on firm’s innovation in probit regression model and the third section is the regression results of the effect of financial constraints on firm’s innovation in in OLS regression model, and the last section is about summary of the result and recommendations.

## 4.1. Descriptive Statistics

Table 4.1 presents the financial constraints face by the firms, 31.8 percent of firms face no constraints, 21.4 percent of them have faced minor constraint, and 17.3 percent of them have faced moderate financial limitations compared to the other values 15.6 percent of them have faced major obstacles and 13.9 percent of them have faced very severe obstacles.

# Table.4.1. *Summary of financial obstacles*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Financial obstacles  | Frequency | Percent | Valid Percent | Cumulative percent |
| No obstacle  | 245 | 31.8 | 31.8 | 31.8 |
| Minor obstacle  | 165 | 21.4 | 21.4 | 53.2 |
| Moderate obstacle | 133 | 17.3 | 17.3 | 70.5 |
| Major obstacle | 120 | 15.6 | 15.6 | 86.1 |
| Very severe obstacle  | 107 | 13.9 | 13.9 | 100.0 |
| Total | 770 | 100.0 | 100.0 |   |

Description of the variables used in the study and the results of their descriptive statistics are presented in Table 4.2. On average, 37.5 percent of sampled firms have introduced new technological products during the three years prior to the survey and 21.4 percent of the firms have introduced improved process. The existence of “financing constraints” show that on average 70.1 percent of in Ethiopia encountered financial constraints during the study period which is very high compared to universal average of about 20 percent (see Ayalew and Xianzhi, 2019a).

The summary statistics for the controls variables (firm size, firm age, sector, human capital and R&D) show that firms included in the sample have on average 97.86 permanent employees with a maximum of 7600 and minimum of 5 employees. Approximately, firms included in the sample have an age of 14.5 years indicating majority of firms includes in the sample are matured or old firms which constitute 81.8 percent with a minimum of 1 year and maximum of 90 years old. On average, only 8.6 percent of firms conduct internal or external R&D during the sample period.

# Table.4.2. *Summary of descriptive statistics*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variable  | Observations  | Mean | Std. Dev. | Min | Max | Skewness |
| Product innovation  | 770 | 0.3753 | 0.4845 | 0 | 1 | 0.5159 |
| Process innovation  | 770 | 0.2142 | 0.4105 | 0 | 1 | 1.3953 |
| TPP | 770 | 0.435 | 0.496 | 0 | 1 | 0.2624 |
| fin\_con | 770 | 0.7012 | 0.4579 | 0 | 1 | -0.8813 |
| Firm Size  | 770 | 97.86 | 388.22 | 5 | 7600 | 0.8337 |
| Firm age | 770 | 14.5 | 13.04 | 1 | 90 | -0.0230 |
| RD | 770 | 0.0857 | 0.2801 | 0 | 1 | 2.9655 |
| Human capital | 770 | 0.632 | 0.3047 | 0 | 1 | -0.5476 |
| sector\_dummy | 770 | 0.4558 | 0.4987 | 0 | 1 | 0.1776 |

## 4.2. Correlation Matrix and VIF Analysis

Table 4.2 shows the Pearson correlation among the predictor variables is very small with a maximum value of 0.3374 which is between the variables firm size and process innovation. This indicates there is no multicollinearity problem among the explanatory variables.

# Table.4.3. *Correlation matrix*

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Code |   | 1 |  2 |  3 |  4 | 5 | 6 | 7 | 8 | 9 |
| 1 | Product innovation  | 1 |   |   |   |   |   |   |   |   |
| 2 | Process innovation  | 0.3731 | 1 |  |  |  |  |  |  |  |
| 3 | TPP | 0.8833 | 0.5951 | 1 |   |   |   |   |   |   |
| 4 | Financial constrai. | -0.0333 | 0.0089 | -0.0225 | 1 |   |   |   |   |   |
| 5 | Firm Size  | 0.2637 | 0.3374 | 0.3008 | -0.0929 | 1 |   |   |   |   |
| 6 | Firm age | 0.1629 | 0.1178 | 0.1748 | -0.0517 | 0.3916 | 1 |   |   |   |
| 7 | RD | 0.213 | 0.3602 | 0.2647 | 0.0275 | 0.2636 | 0.0992 | 1 |   |   |
| 8 | Human capital | 0.1256 | 0.156 | 0.1568 | 0.0008 | 0.0764 | -0.0137 | 0.1284 | 1 |   |
| 9 | Sector dummy | 0.0714 | 0.113 | 0.1015 | 0.0333 | 0.2977 | 0.0742 | 0.0923 | -0.0577 | 1 |

Table 4.3 presents the variance inflation factor (VIF) and the tolerance which is the reciprocal of VIF result. The VIF value is much less than the minimum standard of 10 when collinearity exists. The tolerance is also found by subtracting the coefficient of determination from one. A maximum standard value for tolerance is 0.10 when collinearity exists among the variables. All predictors have tolerance level much greater than 0.1. Therefore, there is no multicollinearity problem in our model.

# Table.4.4. *VIF and Tolerance to assess multicollinearity*

|  |  |  |
| --- | --- | --- |
|   | Tolerance (1/VIF) | VIF |
| Product\_innov | 0.825 | 1.212 |
| Process\_innov | 0.733 | 1.364 |
| Financial Constraints | 0.893 | 1.119 |
| Financial Obstacles | 0.869 | 1.150 |
| Log(size) | 0.667 | 1.500 |
| log(age) | 0.830 | 1.205 |
| R&D | 0.831 | 1.204 |
| human capital | 0.954 | 1.048 |
| sector\_dummy | 0.897 | 1.115 |

## 4.3. Heteroscedasticity Tests

To test heteroscedasticity assumption, whether the variance of the errors in the regression model is constant or not, we use the Breusch-Pagan / Cook-Weisberg test for heteroskedasticity. The Breusch-Pagan / Cook-Weisberg test is reported below in table 4.4 According to this test, if the p value is greater than 0.05, the null hypothesis of the variance of the residuals is homogenous must not be rejected. The p-value of chi2 is significance indicating the existence of heteroscedastic problem in the OLS model that we used to examine the effect of financial constraints on firm’s growth. As a remedy, we must use robust option in estimating the OLS model (Brooks, 2008).

# Table.4.5. *Test of heteroscedasticity*

|  |
| --- |
| Breusch-Pagan / Cook-Weisberg |
| Ho: Constant Variance  |
| Variable: Fitted values of employement growth |
| Chi2 (7) = 6456.85 |
| Prob > chi2  = 0.000 |

## 4.4. Regression Results

In this section we discuss the results of the probit and ordinary least square (OLS) regression model results. In the first part we discuss the effect of financial constraint on innovation performance; product innovation, process innovation & TPP. In the second part we discuss the effect financial constraints and other covariates on the employment growth of the firm. And a measure of firm’s heterogeneity in size, age and sector also used to measure the effect that financial constraint have on innovation. Thirdly this study examines the effect that financial constraint has on firm’s growth.

### 4.4.1. The Effect of Financial Constraints on Product Innovation

The model used to estimate the effect of financial constraints on the product innovation is the probit model which was specified in chapter three.

Table 4.6 presents the probit regression model estimation of the effect of financial constraints has on the product innovation of firms. Financial constraint is a significant variable with p-vale 0.04 at 5% level of significance. The results show that financial constraint has a negative effect on product innovation. Firm that has a financial constraint is 1.91 percent (See the marginal effect in table 4.6) less likely to have new product innovation.

Regarding control variables, log (size), R&D and human capital are also significant variables. Firms that have larger number of full-time employees are more likely to introduce new or improved products. The result from the analysis also supports that firms that invest on R&D are more likely to introduce new or improved products than those who do not introduce (p-value 0.005) at 5% level of significance. The result also shows that firms that invest on human capital are more likely to innovate products than those who do not invest (p-value 0.000) at 5% level of significance.

# Table.4.6. *The effect of financial constraints on product innovation*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variables | Coef. | marginal | Robust |  z |  P>z  |  [95% confi. Inter.]  |
|   | effect | Std. Err. |   |   |
| Fin\_con | -0.0505 | -0.0191 | 0.1039 | -2.07 | 0.04\*\* | -0.2541 | 0.1531 |
| Log(size) | 0.3941 | 0.1484 | 0.0908 | 4.34 | 0.000\*\*\* | 0.2162 | 0.5719 |
| Log(age) | 0.3133 | 0.118 | 0.1518 | 2.06 | 0.039 | 0.0159 | 0.6107 |
| R&D | 0.667 | 0.2608 | 0.1793 | 3.72 | 0.000\*\*\* | 0.3157 | 1.0184 |
| Human capital | 0.4507 | 0.1697 | 0.1603 | 2.81 | 0.005\*\*\* | 0.1365 | 0.7649 |
| Sector\_dummy | 0.008 | 0.003 | 0.1009 | 0.08 | 0.937 | -0.1898 | 0.2058 |
| \_cons | -1.5225 |   | 0.213 | -7.15 | 0.000\*\*\* | -1.94 | -1.1049 |
| No. Obs. = 770Wald Chi2 (6) = 75.17Prob > Chi2= 0.0000Log pseudo likelihood = -468.34Pseudo R squared= 0.0808*Note: 1) the dependent variable “Product\_Innov” is a dummy variable equal to 1 if a firm introduced new or improved product in the last 3 years, 0 otherwise. 2) \*\*\* denotes significant at 1% level 3.*4.4.2 The Effect of Financial Constraints on Process InnovationTable 4.7 presents the probit regression model estimation of the effect of financial constraints on the process innovation of firms. Financial constraint is a significant variable with p-vale 0.02 at 5% level of significance. The results show that firms that have financial constraints are less likely to introduce any new or improved processes. Firm that has financial constraint is 1.97 percent (See the marginal effect in table 4.7) less likely to introduce new processes.  |

# Table.4.7. *The effect of financial constraints on process innovation*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variables | Coef. | marginal | Robust |  z |  P>z  |  [95% confi. Inter.]  |
|   | effect | Std. Err. |   |   |
| Fin\_con | -0.0764 | -0.0197 | 0.1227 | -2.62 | 0.002\*\*\* | -0.1640 | 0.3168 |
| Log(size) | 0.6399 | 0.1674 | 0.1000 | 6.40 | 0.000\*\*\* | 0.4439 | 0.8359 |
| Log(age) | -0.0693 | -0.0181 | 0.1770 | -0.39 | 0.695 | -0.4163 | 0.2776 |
| RD | 1.1141 | 0.3846 | 0.1798 | 6.20 | 0.000\*\*\* | 0.7618 | 1.4664 |
| Human capital | 0.6832 | 0.1787 | 0.1914 | 3.57 | 0.000\*\*\* | 0.3080 | 1.0584 |
| Sector\_dummy | 0.0797 | 0.0209 | 0.1163 | 0.69 | 0.493 | -0.1483 | 0.3078 |
| \_cons | -2.3596 |   | 0.2742 | -8.60 | 0.000 | -2.8971 | -1.8221 |
| No. Obs. = 770Wald Chi2 (6) = 128.76Prob > Chi2= 0.0000Log pseudo likelihood = -327.25Pseudo R squared= 0.182*Note: 1) the dependent variable “Process\_Innov” is a dummy variable equal to 1 if a firm introduced new or improved process in the last 3 years, 0 otherwise. 2) \*\*\* denotes significant at 1% level*  |

The control variables, log size, R&D and human capital are also significant variables. Firms that have larger number of full-time employees are more likely to introduce new or improved process. The result from the analysis also supports that firms that invest on R&D are more likely to introduce new or improved process than those who do not introduce (p-value 0.000) at 5% level of significance. The result also shows that firms that invest on human capital are more likely to introduce any new or improved products or process than those who do not invest (p-value 0.000) at 5% level of significance.

### 4.4.3 The Effect of Financial Constraints on TPP

Table 4.8 presents the probit regression model estimation of the effect of financial constraints on TPP. Financial constraint is a significant variable with p-vale 0.000 at 5% level of significance. The results show that firms that have financial constraints are less likely to introduce any improved product or improved process (TPP) in the last 3 years prior to the survey. Firm that has financial constraint is 1.07 percent (See the marginal effect in table 4.7) less likely to introduce any improved product or improved process (TPP) in the last 3 years prior to the survey.

The control variables, log size, log age, R&D and human capital are also significant variables. Firms that have larger number of full-time employees are more likely to introduce improved product or improved process. As the age increase the firm is more likely to introduce improved product or improved process. The result from the analysis also supports that firms that invest on R&D are more likely to introduce improved product or improved process than those who do not introduce (p-value 0.000) at 5% level of significance. The result also shows that firms that invest on human capital are more likely to introduce improved product or improved process than those who do not invest (p-value 0.000) at 5% level of significance.

# Table.4.8. *The effect of financial constraints on technological product and process innovation (TPP)*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variables | Coef. | marginal | Robust |  z |  P>z  |  [95% confi. Inter.]  |
|   | effect | Std. Err. |   |   |
| Fin\_con | -0.0273 | -0.0107 | 0.1041 | -2.48 | 0.000\*\*\* | -0.2313 | 0.1768 |
| Log(size) | 0.4379 | 0.1723 | 0.0928 | 4.72 | 0.000\*\*\* | 0.2560 | 0.6197 |
| Log(age) | 0.3100 | 0.1220 | 0.1518 | 2.04 | 0.041\*\* | 0.0125 | 0.6075 |
| RD | 1.0402 | 0.3843 | 0.2065 | 5.04 | 0.000\*\*\* | 0.6354 | 1.4450 |
| Human capital | 0.5670 | 0.2232 | 0.1607 | 3.53 | 0.000\*\*\* | 0.2520 | 0.8820 |
| Sector\_dummy | 0.0682 | 0.0269 | 0.1004 | 0.68 | 0.497 | -0.1285 | 0.2649 |
| \_cons | -1.5539 |   | 0.2172 | -7.15 | 0.000\*\*\* | -1.9797 | -1.1281 |
| No. Obs. = 770Wald Chi2 (6) = 95.46Prob > Chi2= 0.0000Log pseudolikelihood = -467.26Pseudo R squared= 0.1137Note: 1) the dependent variable “TPP” is a dummy variable equal to 1 if a firm introduced new or improved products or process in the last 3 years, 0 otherwise. 2) \*\*\* denotes significant at 1% level  |

### 4.4.4 The Effect of Financial Constraints on Innovation: - Across Size-Based Sub-Groups

The effect of financial constraints on innovation across size-based subgroups is reported in table 4.9. The firms are classified according to size as small, medium and large. The effect of financial constraints on innovation is assessed in each of the subgroups. Across small sized firms, the variables financial constraint, log(size), log(age), R&D and human capital are significant variables. Financial constraint is a significant variable with p-vale 0.054 at 10% level of significance. The results show that small firms that have financial constraints are less likely to introduce improved product or improved process (TPP) in the last 3 years prior to the survey. Log(age) significantly positively affect TPP for small firms with p-value 0.033 at 5% level of significance. Investing on R&D for small firms affect TPP positively with p-value 0.011 at 5% level of significance. Investing on human capital also positively affect TPP for small firms (p-value = 0.007) at 5% level of significance.

Across medium sized firms, the variables financial constraint, R&D and human capital are significant variables. Financial constraint is a significant variable with p-vale 0.054 at 10% level of significance. The results show that medium size firms that have financial constraints are less likely to introduce any improved product or improved process (TPP) in the last 3 years prior to the survey. Investing on R&D for medium size firms affect TPP positively with p-value 0.0000 at 5% level of significance. Investing on human capital also positively affect TPP for medium size firms (p-value = 0.040) at 5% level of significance.

Across large sized firms, financial constraint is a significant variable with p-vale 0.0000 at 5% level of significance. The results show that medium size firms that have financial constraints are less likely to introduce any improved product or improved process (TPP) in the last 3 years prior to the survey. Investing on R&D for large size firms affect TPP positively with p-value 0.003 at 5% level of significance.

# Table.4.9. *The effect of financial constraints on innovation: - Across size-based sub-groups*

|  |
| --- |
| **Small (number of observations = 367)** |
| Variables | Coef. |  Robust |  Z |  P>z  |  [95% confi. Inter.]  |
|   |  Std. Err. |   |   |
| Fin\_con | -0.0498 | 0.1640 | -2.61 | 0.054\* | -0.2717 | 0.3713 |
| Log(size) | 0.6044 | 0.4046 | 1.49 | 0.135 | -0.1886 | 1.3973 |
| Log(age) | 0.5200 | 0.2443 | 2.13 | 0.033\*\* | 0.0411 | 0.9989 |
| R&D | 1.1719 | 0.4588 | 2.55 | 0.011\*\* | 0.2727 | 2.0710 |
| Human capital | 0.6035 | 0.2255 | 2.68 | 0.007\*\*\* | 0.1616 | 1.0454 |
| Sector\_dummy | 0.2075 | 0.1526 | 1.36 | 0.174 | -0.0915 | 0.5065 |
| \_cons | -2.1224 | 0.4543 | -4.67 | 0.000\*\*\* | -3.0127 | -1.2320 |
|  | **Medium (number of observations =240)** |  |  |
| Variables | Coef. | Robust Std.Err. |  Z |  P>z  | [95% confi. Inter.] |
| Fin\_con | -0.0141 | 0.1790 | -2.06 | 0.073\* | -0.3366 | 0.3649 |
| Log(size) | 0.0670 | 0.3632 | 0.18 | 0.854 | -0.6448 | 0.7788 |
| Log(age) | 0.2338 | 0.2545 | 0.92 | 0.358 | -0.2650 | 0.7327 |
| RD | 1.3184 | 0.3749 | 3.52 | 0.000\*\*\* | 0.5835 | 2.0532 |
| Human capital | 0.6339 | 0.3081 | 2.06 | 0.040\*\* | 0.0300 | 1.2378 |
| Sector\_dummy | -0.0220 | 0.1685 | -0.13 | 0.896 | -0.3523 | 0.3083 |
| \_cons | -0.7906 | 0.6720 | -1.18 | 0.239 | -2.1077 | 0.5265 |
| **Large (number of observations = 163)** |
| Variables | Coef. |  Robust Std. Err. |  z |  P>z  | [95% confi. Inter.] |
| Fin\_con | -0.2378 | 0.2198 | -3.06 | 0.000\*\*\* | -0.6686 | 0.1930 |
| Log(size) | -0.0216 | 0.2543 | -0.08 | 0.932 | -0.5200 | 0.4769 |
| Log(age) | -0.0690 | 0.3222 | -0.21 | 0.830 | -0.7006 | 0.5626 |
| RD | 0.8428 | 0.2854 | 2.95 | 0.003\*\*\* | 0.2834 | 1.4021 |
| Human capital | 0.0037 | 0.4123 | 0.01 | 0.993 | -0.8044 | 0.8119 |
| Sector\_dummy | -0.0203 | 0.2280 | -0.09 | 0.929 | -0.4671 | 0.4266 |
| \_cons | 0.5615 | 0.7922 | 0.71 | 0.478 | -0.9911 | 2.1142 |

Note:1) the dependent variable “TPP” is a dummy variable equal to 1 if a firm introduced the improved product or improved process in the last 3 years, 0 otherwise. 2) \*\*\*, \*\*, and \* denotes significant at 1%, 5%, and 10% significant level, respectively. 3

### 4.4.5 The Effect of Financial Constraints on Innovation: - Across Age-Based Sub-Groups

The effect of financial constraints on innovation across age-based subgroups is reported in table 4.10. The firms are classified according to age as young, matured and old. The effect of financial constraints on innovation is assessed in each of the subgroups. Across young firms, financial constraint is a significant variable with p-vale 0.0000 at 5% level of significance. The results show that young firms that have financial constraints are less likely to introduce any improved product or improved process (TPP) in the last 3 years prior to the survey. Investing on R&D for young firms affect TPP positively with p-value 0.024 at 5% level of significance.

Across matured firms, the variables financial constraint, log size, R&D and human capital are significant variables. Financial constraint is a significant variable with p-vale 0.060 at 10% level of significance. The results show that matured firms that have financial constraints are less likely to introduce any improved product or improved process (TPP) in the last 3 years prior to the survey at 10% level of significance. Investing on R&D for matured firms affect TPP positively with p-value 0.004 at 5% level of significance. Investing on human capital also positively affect TPP for matured firms (p-value = 0.003) at 5% level of significance.

Across old firms, the variables financial constraint, log size and R&D are significant variables. Financial constraint is a significant variable with p-vale 0.001 at 5% level of significance. The results show that old firms that have financial constraints are less likely to introduce any improved product or improved process (TPP) in the last 3 years prior to the survey at 5% level of significance. Investing on R&D for old firms affect TPP positively with p-value 0.000 at 5% level of significance.

# Table.4.10. *The effect of financial constraints on innovation: - Across age-based sub-groups*

|  |
| --- |
| **Young (n=140**) |
| Variables | Coef. | Robust |  Z |  P>z  |  [95% confi. Inter.]  |
|   | Std. Err. |   |   |
| Fin\_con | -0.1762 | 0.2609 | -3.4 | 0.000\*\*\* | -0.6875 | 0.3351 |
| Log(size) | 0.4811 | 0.2451 | 1.96 | 0.050\* | 0.0008 | 0.9614 |
| Log(age) | 0.6437 | 0.7288 | 0.88 | 0.377 | -0.7847 | 2.0722 |
| RD | 1.2484 | 0.5528 | 2.26 | 0.024\*\* | 0.1650 | 2.3318 |
| Human capital | 0.6069 | 0.3741 | 1.62 | 0.105 | -0.1262 | 1.3400 |
| Sector\_dummy | -0.1753 | 0.2422 | -0.72 | 0.469 | -0.6500 | 0.2995 |
| \_cons | -1.5587 | 0.5768 | -2.7 | 0.007\*\*\* | -2.6892 | -0.4283 |
| **Matured (n=374)** |
| Variables | Coef. | Robust Std. Err. |  Z |  P>z  | [95% confi. Inter.] |
| Fin\_con | -0.0736 | 0.1513 | -2.01 | 0.060\* | -0.2230 | 0.3702 |
| Log(size) | 0.6086 | 0.1562 | 3.9 | 0.000\*\*\* | 0.3024 | 0.9148 |
| Log(age) | 0.9617 | 0.5711 | 1.68 | 0.092\* | -0.1576 | 2.0811 |
| RD | 0.8647 | 0.3028 | 2.86 | 0.004\*\*\* | 0.2712 | 1.4582 |
| Human capital | 0.7319 | 0.2434 | 3.01 | 0.003\*\*\* | 0.2549 | 1.2089 |
| Sector\_dummy | 0.1956 | 0.1441 | 1.36 | 0.175 | -0.0869 | 0.4780 |
| \_cons | -2.6286 | 0.6162 | -4.27 | 0.000\*\*\* | -3.8364 | -1.4209 |
| **Old (n-256)** |
| Variables | Coef. | Robust Std. Err. |  Z |  P>z  | [95% confi. Inter.] |
| Fin\_con | -0.1054 | 0.1748 | -2.52 | 0.001\*\*\* | -0.4481 | 0.2372 |
| Log(size) | 0.2749 | 0.1358 | 2.02 | 0.043\*\* | 0.0088 | 0.5410 |
| Log(age) | 0.6131 | 0.4506 | 1.36 | 0.174 | -0.2701 | 1.4963 |
| RD | 1.2101 | 0.3270 | 3.7 | 0.000\*\*\* | 0.5692 | 1.8511 |
| Human capital | 0.3947 | 0.2753 | 1.43 | 0.152 | -0.1449 | 0.9344 |
| Sector\_dummy | -0.0271 | 0.1797 | -0.15 | 0.880 | -0.3792 | 0.3251 |
| \_cons | -1.5459 | 0.6773 | -2.28 | 0.022\*\* | -2.8735 | -0.2183 |

Note:1) the dependent variable “TPP” is a dummy variable equal to 1 if a firm introduced the improved product or improved process in the last 3 years, 0 otherwise. 2) \*\*\*, \*\*, and \* denotes significant at 1%, 5%, and 10% significant level, respectively.

### 4.4.6 The Effect of Financial Constraints on Innovation: - Across Sector-Based Sub-Groups

The effect of financial constraints on innovation across sector-based subgroups is reported in table 4.11. Firms are classified as manufacturing and service according to sector. The effect of effect of financial constraints on innovation is assessed in each of the sectors. Across manufacturing sector, the variables financial constraint, log size, R&D and human capital are significant variables. Financial constraint is a significant variable with p-vale 0.000 at 5% level of significance. The results show that manufacturing firms that have financial constraints are less likely to introduce any improved product or improved process (TPP) in the last 3 years prior to the survey at 5% level of significance. Log(sizes) significantly positively affect TPP for manufacturing firms with p-value 0.002 at 5% level of significance. Investing on R&D in manufacturing sector affect TPP positively with p-value 0.001 at 5% level of significance. Investing on human capital also positively affect TPP in the manufacturing sector (p-value = 0.003) at 5% level of significance.

Across service sector, the variables financial constraint, log size, R&D and human capital are also significant variables. Financial constraint is a significant variable with p-vale 0.078 at 10% level of significance. The results show that manufacturing firms that have financial constraints are less likely to introduce any improved product or improved process (TPP) in the last 3 years prior to the survey at 10% level of significance. Log(size) significantly positively affect TPP for service sector firms with p-value 0.000 at 5% level of significance. Investing on R&D in service sector forms affect TPP positively with p-value 0.000 at 5% level of significance. Investing on human capital also positively affect TPP in the manufacturing sector (p-value = 0.013) at 5% level of significance.

# Table.4.11. *The effect of financial constraints on innovation: - Across sector-based sub-groups*

|  |
| --- |
| **Manufacturing (n=351)** |
| Variables | Coef. | Robust |  Z |  P>z  |  [95% confi. Inter.]  |
|   | Std. Err. |   |   |
| Fin\_con | -0.1109 | 0.1549 | -2.48 | 0.000\*\*\* | -0.4145 | 0.1927 |
| Log(size) | 0.3782 | 0.1237 | 3.06 | 0.002\*\*\* | 0.1358 | 0.6205 |
| Log(age) | 0.2592 | 0.2209 | 1.17 | 0.241 | -0.1737 | 0.6921 |
| RD | 0.8595 | 0.2479 | 3.47 | 0.001\*\*\* | 0.3735 | 1.3454 |
| Human capital | 0.5317 | 0.2382 | 2.23 | 0.026\*\*\* | 0.0649 | 0.9986 |
| \_cons | -1.2393 | 0.3110 | -3.99 | 0.000\*\*\* | -1.8488 | -0.6298 |
| **Service (n= 419)** |
| Variables |  Coef. | Robust Std. Err. |  z | P>z  | [95% confi. Inter.] |
| Fin\_con | -0.05525 | 0.14272 |  -1.81 | 0.078\* | -0.2245 | 0.3350 |
| Log(size) | 0.53979 | 0.14319 |  3.77 | 0.000\*\*\* | 0.2591 | 0.8204 |
| Log(age) | 0.37162 | 0.20927 |  1.78 | 0.076\* | -0.0385 | 0.7818 |
| RD | 1.37598 | 0.39342 |  3.5 | 0.000\*\*\* | 0.6049 | 2.1471 |
| Human capital | 0.54309 | 0.21810 |  2.49 | 0.013\*\* | 0.1156 | 0.9706 |
| \_cons | -1.79492 | 0.31284 |  -5.74 | 0.000\*\*\* | -2.4081 | -1.1818 |

Note:1) the dependent variable “TPP” is a dummy variable equal to 1 if a firm introduced the improved product or improved process in the last 3 years, 0 otherwise. 2) \*\*\*, \*\*, and \* denotes significant at 1%, 5%, and 10% significant level, respectively.

### 4.4.7 The Effect of Financial Constraints on Firm’s Growth

The second main objective of this thesis is to assess the effect of financial constraints on firm’s growth. To assess this effect the OLS regression model specified in chapter three is used. STATA software is used to fit the model. The normality and homoscedasticity assumptions are tested. As it can be seen from the summary table, the skewness statistics for most of the explanatory variables is near to zero which shows the normality assumption is fulfilled for these variables. But the variables process innovation, and R&D deviate from normality to some extent but this does not significantly affect the analysis since most of the explanatory variables fulfills the normality assumption.

The fit of the model is also assessed by using ANOVA and the coefficient of determination (R squared) value. The F-value from the ANOVA table is 43.15 with p-value 0.0000 at 5% level of significance. This shows the model fits well to the data. The coefficient of determination (R squared) is 0.2839. This shows 28.39 percent of the variation on the employment growth (number of employees) is caused by the variation of the explanatory variables the rest 71.61 percent of the variation is explained by unknown factors.

Table 4.12 presents the effect of financial constraints on firm’s growth. Process Innovation, log (size) and log (age) are significant variables. The variable Process Innovation which denotes the firm’s establishment introduced any new or improved process significantly positively affect the employment growth of the company with p-value 0.048 at 5% level of significance. Log(size) also significantly positively affect the employment growth with p-value 0.000 at 5% level of significance. Log(age) significantly negatively affect the employment growth. A unit increase in the log(age decreases employment by 85.83. Product innovation and financial constraints does not seem to have an effect on the employment growth of a firm at 5% level of significance.

# ­Table.4.12. *The effect of financial constraints on employment growth*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Variables | Coef. | Std. Err. t | P>t |  | [95% confi. Inter.] |
|   |
| Product\_innov | -26.2959 | 27.02343 | -0.97 | 0.331 |  | -79.34512 | 26.7533 |
| Process\_innov | 66.8437 | 33.80794 | -1.98 | 0.048\* |  | 133.2115 | 0.47594 |
| Fin\_cons | 31.93431 | 26.15997 | 1.22 | 0.223 |  | -19.41986 | 83.28848 |
| Log(size) | 371.6907 | 22.35477 | 16.63 | 0.0000\*\*\* |  | 327.8065 | 415.575 |
| Log(age) | -85.829 | 37.76548 | -2.27 | 0.023\*\* |  | -159.9658 | -11.6923 |
| R&D | -89.2563 | 46.4183 | -1.92 | 0.055\* |  | -180.3792 | 1.866616 |
| Human\_Capital | -24.5883 | 39.79736 | -0.62 | 0.537 |  | -102.7138 | 53.53719 |
| \_cons | -308.898 | 51.89922 | -5.95 | 0.0000\*\*\* |  | -410.7807 | -207.016 |
| No. Obs. = 770F (7, 762) = 43.15Prob > F = 0.0000 R squared = 0.2839 Adj. R squared= 0.2773 Note: 1) the dependent variable “No\_mployees” which is the number of employees of the firm is a continuous variable, 2) \*\*\*, \*\*, and \* denotes significant at 1%, 5%, and 10% significant level, respectively.  |

## 4.5. Summary of Results and Discussions

In the analysis section, the study investigates the effect of financial constraints on innovation across firm’s characteristics and the effect has on firm’s growth through number of employment. The summery of the financial obstacles shows that 68.2% of the firms face financial obstacle across different ranges of minor, moderate and major obstacles. The descriptive statistics shows that, on average, 37.5% of firms introduces technological products, 21.4% of the firms introduce improved process. The “financial constraints” in the descriptive analysis show that on average 70.1 percent of in Ethiopia encountered financial constraints during the study period which is very high compared to universal average of about 20 percent (see Ayalew and Xianzhi, 2019a). Having this results the study conclude that the existence of a financial constraint adversely affect innovation performance in Ethiopia and accepts the hypothesis H1.

Regarding the adverse effect of financial constraint have on product innovation the result shows that financial constraint is a significant variable with p-vale 0.04 at 5% level of significance and has a negative effect on product innovation. Firm that has a financial constraint is 1.91 percent less likely to have new product innovation and this result support hypothesis H1a. Hypothesis H1b and H1c are also accepted having the result of 1.97 percent firms less likely to introduce new process innovation with 0.02 value of financial constraint and 1.07 percent less likely to introduce any TPP in the last 3 year prior to the survey.

Concerning the analyst done on firm’s strata hypothesis H2, H3 and H4 are examined. And in the analysis size based sub groups were measured and results shows that financial constraint is a significant variable with p-vale 0.054 at 10% level of significance for small firms. Across medium sized firms, financial constraint is a significant variable with p-vale 0.054 at 10% level of significance and across large sized firms; financial constraint is a significant variable with p-vale 0.0000 at 5% level of significance. Comparing there p values the result shows that large firms are adversely affected by financial constraint than smaller and medium firms. Thus hypothesis H2 (the adverse effect of financial constraints on innovation is higher for smaller firms than larger ones) is not accepted. Considering the firm’s characteristics firms are classified according to age as young, matured and old. The effect of financial constraints on innovation is assessed in each of the sub-groups. Financial constraint is a significant variable with p-vale 0.0000, 0.060 and 0.001 for young, matured and old firms respectively at 5% level of significance for young and old firms and 10% level of significance for medium aged firms. Having this result the study accepts hypothesis 3 (the effect of financial constraints on innovation is higher for younger firms than older ones).

Hypothesis 4 states that the effect of financial constraints on innovation is higher for service sector than manufacturing sector. Having this hypothesis analysis was done across sector groups of manufacturing and service sector. Across manufacturing sector, financial constraint is a significant variable with p-vale 0.000 at 5% level of significance. The result shows that manufacturing firms that have financial constraints are less likely to introduce any improved product or improved process (TPP) in the last 3 years prior to the survey at 5% level of significance. Across service sector, financial constraint is a significant variable with p-vale 0.078 at 10% level of significance. Comparing there p-values manufacturing sectors are adversely affected by financial constraint than service sector and the hypothesis was not accepted.

The effect of financial constraint have on firm growth was tested and analyzed in hypothesis 5 and the result shows that firm growth is not significantly affected by financial constraint taking number of full time employment as dependent variable to test firm growth.

# *Table 4.13*. *Summary of hypothesis confirmation*

|  |  |  |
| --- | --- | --- |
| № | Derived Hypothesis  | Result |
| H1 | Financial constraints adversely affect firm innovation performance | Accepted |
| H1a | Financial constraints adversely affect a firm’s product innovation | Accepted |
| H1b | Financial constraints adversely affect a firm’s process innovation | Accepted |
| H1c | Financial constraints adversely affect a firm’s technological product & process (TPP). | Accepted |
| H2 | The adverse effect of financial constraints on innovation is higher for smaller firms than larger ones. | Not Accepted |
| H3 | The effect of financial constraints on innovation is higher for younger firms than older ones. | Accepted |
| H4 | The effect of financial constraints on innovation is higher for service sector than manufacturing sector. | Not Accepted |
| H5 | Financial constraints adversely affect firm’s growth. | Not Accepted |

# CHAPTER FIVE

## CONCLUSION AND RECOMMENDATION

## 5.1 Conclusion

In this study we used a sample of 770 samples of firms in Ethiopia. The thesis primarily aims is to address the following four objectives; one is to assess the effect of financial constraints on innovation and activities of innovation, firm’s products and process innovation. The second objective is to examine the effect financial constraints on TPP and the third objective is to assess the effect of financial constraints on innovation across firm size, age & sector. The fourth aim is to examine and access the effect of financial constraint on firms’ growth. The data was obtained from the WBES which is conducted in 2015 covering the fiscal period 2012 to 2014. In the study we used a standard probit model and OLS regression to examine the impact of financial constraints on the products, process innovations and the effect of financial constraints on firm’s employment growth in Ethiopia, respectively. Thus, a quantitative research approach along with explanatory research design was used.

The findings of the study reveal that firms that have financial constraints are 1.91 percent less likely to innovate new product or services. Firms that have larger number of full-time employees are more likely to introduce any new or improved products. The result from the analysis also supports that firms that invest on R&D are more likely to introduce any new or improved products than those who do not introduce the products. The result also shows that firms that invest on human capital are more likely to introduce any new or improved products than those who do not invest on it.

Firms that have financial constraints are less likely to introduce any new or improved processes. Firms with large number of full-time employees innovate new or improved process. The result from the analysis also supports that firms that invest on R&D are more likely to introduce new or improved process than those who do not introduce. The result also shows that firms that invest on human capital are more likely to introduce any new or improved process than who do not invest on it.

The results show that firms that have financial constraints are less likely to introduce any improved product or improved process (TPP) in the last 3 years prior to the survey. Firms that have larger number of full-time employees are more likely to introduce improved product or improved process. As the age increase the firm is more likely to introduce improved product or improved process (TPP).

Firms that have financial constraints are less likely to introduce any improved product or improved process (TPP) in fiscal years. Log(age) significantly positively affect TPP for small size firms. Investing on R&D and human capital for small size firms affect TPP positively. Across medium sized firms, financial constraints are less likely to introduce improved product or improved process (TPP) in the fiscal year. Investing on R&D and human capital for medium size firms affect TPP positively. Across large sized firms, financial constraints are less likely to introduce any improved product or improved process (TPP) Investing on R&D for large size firms affect TPP positively.

Across young, matured and old firms ‘financial constraints are less likely to introduce any improved product or improved process (TPP). Investing on R&D for young firms affect TPP positively.

The results show that manufacturing firms that have financial constraints are less likely to introduce any improved product or improved process (TPP). And also investing on R&D and in human capital in manufacturing sector affect TPP positively.

Across service sector firms that have financial constraints are less likely to introduce any improved product or improved process (TPP). Log size significantly positively affects TPP for service sector investing on R&D and human capital in service sector affect TPP.

## 5.2 Recommendation

This study shows that there is an adverse effect of financial constraints on innovation. Having the results, different stakeholders including investors, international organization, financial institutions, and others have to give attention in reducing the financial constraints by applying sensible strategy that helps making finance available demandingly, which may include an enhanced screening process, improved budget utilization, enhanced project study capacity, increased information systems, and well maintained, clear property records to facilitate collateralization.

Firms also should enhance their financial flexibility in order to improve innovative activities of their product, process or/and technology. Spending resources on skilled human capital also help to develop new products or/and process. A firm should also support the enhancement of existing products or processes. On the other hand, the growth of companies is unattainable unless they improve their products and process. The introduction of goods or services that is new or significantly improved has to be realized and also a new or significantly improved production or delivery methods has to be implemented in order to achieve the growth of the firm.

## 5.3. Limitations and Future Research Directions

This study has a number of limitations that open avenue for future researchers. First, this study mainly used product innovation, process innovation and TPP as a measure of the firm’s innovation performance. It did not consider other innovation performance measures such as marketing innovation and organizational innovation. Second, this study used cross-sectional survey data that comes from the WBES. The use of panel data might provide robust finding. Finally, recent studies conducted such as by Ayalew and Xianzhi (2019) stress financial constraints may be endogenous to the innovation models. Unfortunately, this study did not address the possible endogeneity problem in the model. Thus, future researchers can fill and strengthen the findings of this study by filling the above gaps. Thus we recommend future researchers to conduct research to fill the above limitations.

This study have data of availability firm level data WBES.it has several limitations involve around the cross sectional nature of data. The recent available data on innovation Ethiopia are 2015 WBES. Considering the valuable information I am placed to indicate the necessity of innovation survey in Ethiopia. Other researchers can investigate effect of financial constrain on innovation firms of Ethiopia which is not addressed by this study and done before.

Managerial implication, the management of company should strength their internal and external financing capacity to decrease financing constrains and their effects on innovation.

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