



**ST. MARY'S UNIVERSITY
SCHOOL OF GRADUATE STUDIES**

**FINANCIAL STRUCTURE AND INNOVATION: FIRM LEVEL
EVIDENCE FROM ETHIOPIA**

BY

YONAS GEBRE

ID No: SGS/0631/2012A

**JULY, 2021
ADDIS ABABA, ETHIOPIA**

**FINANCIAL STRUCTURE AND INNOVATION: FIRM LEVEL
EVIDENCE FROM ETHIOPIA**

BY

YONAS GEBRE

**A THESIS SUBMITTED TO ST.MARY'S UNIVERSITY SCHOOL OF
GRADUATE STUDIES IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF MBA IN ACCOUNTING AND
FINANCE**

ADVISOR: MISRAKU MOLLA (PhD)

**JULY, 2021
ADDIS ABABA, ETHIOPIA**

ST. MARY'S UNIVERSITY

**SCHOOL OF GRADUATE STUDIES
MBA IN ACCOUNTING AND FINANCE**

**FINANCIAL STRUCTURE AND INNOVATION: FIRM LEVEL
EVIDENCE FROM ETHIOPIA**

BY: YONAS GEBRE

APPROVED BY BOARD OF EXAMINERS

DEAN, GRADUATE STUDIES SIGNATURE

RESEARCH ADVISOR SIGNATURE

INTERNAL EXAMINER SIGNATURE

EXTERNAL EXAMINER SIGNATURE

DECLARATION

I, Yonas Gebre hereby declare that "financial structure and innovation: firm level evidence from Ethiopia" is my own work, that it has not been submitted for any degree or examination at any other institution of higher learning in Ethiopia, and that all references have, to the best of my knowledge, been correctly reported. This study is being submitted for the partial fulfillment of master degree in Accounting and Finance at St Mary's university school of graduate studies.

Full name: Yonas Gebre

Signature_____

Date_____

Approval from the Advisor's

The Undersigned certifies that, He has read and hereby recommends for acceptance by the St Mary's University a thesis entitled: "*Financial Structure and Innovation: Firm-level Evidence from Ethiopia*", in partial fulfillment of the requirements for the MBA in Accounting and Finance of the St Mary's University.

Misraku Molla (PhD)

Supervisor

July, 2021

ACKNOWLEDGMENTS

I would like to express my sincere gratitude to my advisor Misraku Molla (PhD), for his guidance and valuable suggestion at each stage of this thesis. I also appreciate those who encouraged me for their unconditional support.

TABLE OF CONTENTS

DECLARATION	i
ACKNOWLEDGMENTS	iii
LIST OF TABLES	vii
LIST OF FIGURE.....	vii
ABSTRACT.....	viii
CHAPTER ONE.....	1
INTRODUCTION	1
1.1 Back Ground of the Study.....	1
1.2 Statement of the Problem	2
1.3 Objective of the Study.....	4
1.3.1 General Objective of the Study.....	4
1.3.2 Specific Objectives of the Study.....	4
1.4 Significance of the Study	5
1.5 Scope of the Study.....	5
1.6 Limitations of the Study.....	5
1.7 Organization of the Study	6
CHAPTER TWO---REVIEW OF LITERATURES.....	7
2.1 THEORETICAL LITERATURES	7
2.1.1 Definition, Classifications And Measures Of Innovation.....	7
2.1.1.1 Definition Of Innovation.....	7
2.1.1.2 Classifications Of Innovation	7
2.1.1.3 Measures Of Innovation.....	8
2.1.2 Underlining Theories	9
2.2 EMPIRICAL REVIEW	13

2.3. Research Gap, Research Hypotheses And Conceptual Framework.....	21
2.3.1. Research Gap.....	21
2.3.2. Research Hypotheses.....	22
2.3.3. Conceptual Framework.....	25
CHAPTER THREE	26
RESEARCH METHODOLOGY.....	26
3.1 Research design.....	26
3.2 Research Approach	26
3.3 Data Source and Type	26
3.4 Population and sampling of the Study.....	27
3.4.1. Sample selection, composition and distribution	27
3.5 Method of Data Analysis.....	29
3.6 Research Models and Econometric Specifications	29
3.7 Variable Definition and Measurement	31
CHAPTER FOUR.....	35
DATA ANALYSIS AND PRESENTATION	35
4.1. Descriptive Statistics	35
4.2. Correlation analysis.....	36
4.3. Results	39
4.3.1. Sources of finance for innovation.....	39
4.3.2. Financing pattern of innovative and non-innovative firms: Mann-Whitney Test	41
4.3.3. Effects of firm’s financial structure on their innovative performance	42
4.3.4. Robustness Tests.....	45
4.4. Discussion	47
CHAPTER FIVE	50

CONCLUSIONS AND RECOMMENDATIONS	50
5.1. CONCLUSIONS	50
5.2. RECOMMENDATIONS	51
References	
APPENDICES	

LIST OF TABLES

TABLES	PAGE No.
Table 2.1: Summary of empirical reviewed.....	17
Table 3.1: sample distribution based on firms' location.....	28
Table 3.2: sample composition based on firms' size and age	28
Table 3.3: variables definition and measurement	33
Table 4.1: descriptive statistics	35
Table 4.2: correlation matrix.....	37
Table 4.3: two sample t-tests.....	41
Table 4.4: probit regression results	42
Table 4.5: probit regression results based on size group.....	45
Table 4.6: probit regression results based on age group.....	46
Table 4.7: comparison of test results and hypotheses	48

LIST OF FIGURE

Figure 2.1: Conceptual framework	25
--	----

ABSTRACT

This paper aimed at examining the relationship between financial structure and innovation based on evidence from firms in Ethiopia. The study employed quantitative research approach and cross sectional data of World Banks' Enterprise Survey (WBES) between the years of 2012 and 2014 was used. Seven hypotheses were investigated using probit regression and Mann Whitney test (U-test) techniques. Probit model considered the effect of financial structure (sources of finance) on firm's probability to innovate. The effect of financial structure on firm's probability to innovate across firms' size and age is also examined using this model. Mann Whitney test, on the other hand, was used to distinguish financing pattern of innovative and non-innovative firms which also used to know financial sources of innovative firms. Empirical results indicated that the main sources of finance for Ethiopian innovative firms are internal finance followed by debt finance (principally bank finance). Further, innovative firms exhibit different financing pattern from non-innovative firms in Ethiopia. Finally, the study found that financial sources have significant effect on innovation which is different across firms' size and age. The order of effect is nonbank finance, bank finance, debt finance, internal finance and equity finance. Based on these results the study recommended management to consider finance source with higher effect to improve their innovation performance. The size and age of their firms also need to be considered as financial sources have different effect among size and age group. Further, policy makers are suggested to take these facts into account while facilitating sources of finance for firms.

Keywords: Innovation, Financing sources, Innovation financing, Innovative firms, Ethiopia.

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

The general concept of innovation describes that when new concepts, solutions and resources are introduced, they emerge in order to alter the circumstances of a business organization and to improve its situation (Dabic et al. 2011). OECD (2005) defined technological product and process (TPP) innovations by dividing into two components namely introduced technologically new products and processes and significant technological improvements in products and processes. Thus, innovation embraces the business that first launches it and then extends it to others (Shelagh et al. 2008). Schumpeter (1961) was the first to define innovation as a “spontaneous and discontinuous change in the channels of flow, disturbance of equilibrium which, forever alters and displaces the equilibrium state previously existing”.

Innovation is considered to be an important factor in economic activity and its role in economic growth both at macro and micro level is indisputable. At the micro level, it impacts corporate performances (Crépon and Iung, 1999) and has a bearing on the survival of firms. It also increases the productivity of a corporate enterprise and generates value for its shareholders (Grudzewski et al, 2010). At the macro level, it has a strong influence on economic growth, and consequently also affects employment. Innovation is also considered integral phase of economic development process (Schumpeter, 1934) and thus stimulate faster growth in the economy on a permanent basis (King and Levine, 1993).

Considerable empirical study indicated that there is relationship between a firm’s financial structure and innovation. Some assumes that the direction of connection goes from finance to innovation as financial development promotes innovation (Aghion and Howitt, 2005). This is through lowering costs of loan screening and monitoring and thus by mitigating agency problems and increasing frequency of innovation (Aghion and Howitt, 2009). But, the effect of financial development on innovation depends on the types of financial source (Law, et al. 2018).

However, others argue that when innovative projects are able to open up opportunities, there could be a demand for specific financial instruments, affecting a firm’s financial decision and thus innovation affects financial structure (Ueda and Hirukawa, 2003;Geronikolaou and

Papachristou, 2008). This indicates that the relationship between financial structure and innovation and how financial structure affects innovation is not clearly stated which require further investigation for better clarification. Moreover, it is not clear whether or not innovative firms exhibit different financing structure in relation to their non-innovative counterparts. Therefore, the aim of this particular study was to investigate whether or not innovative firms exhibit different financial structure and further examine the effects of financial structure on firm's innovation performance in Ethiopia. The remaining section of this chapter presents; statement of the problem, research objectives and hypothesis, significance of the study, limitations and scope of the study.

1.2 STATEMENT OF THE PROBLEM

A survey by Levine (2005) establishes a clear correlation between large financial development initiatives and economic growth. The financing of research and development, a crucial contribution to innovation and growth in modern economies, is a potentially significant medium through which finance can be used for growth. Innovation and productivity play critical role in driving economic growth and development (Barasa et al. 2018) and without financial innovation, technical and economic growth would slow down the income of nations which in turn, would lower economic development (Joanna Blach. 2011).

As Frame and White (2004) have pointed out, as a result of the article analysis, the determinants of innovation have remained poorly understood even though innovation has been a vital part of the financial environment over the last few decades. There is also an emphasis on the need to encourage more theoretical and analytical work on the effect of financial institutions on innovation (Lerner, 2006). The issue is more necessary in developing countries, where there has been little research on the relationship between innovation and the financial structure (Ayalew et al, 2019a).

Considering the significant role of innovation on economic growth of a country, specifically Ethiopia, various issues caused this particular study to be carried out. Generally, there are key practical and theoretical problems that need to be solved. Firstly, African countries in general and Ethiopia in particular are characterized by low productivity, prolonged poverty, and slow economic development (Ayalew et al, 2019). According to the 2019 World Bank report, the average poverty rate in Ethiopia is about 24% while it is below 13% global average. This may be

due to the fact that they are technologically backward and the development of Science, Technology and Innovation (STI) in the region is sluggish (Ayalew et al, 2019b). Evidence shows that Ethiopia ranks 127th among the 130 GII economies, 13th among the 16 low-income group economies, and 24th among the 26 sub-Saharan African economies (Global Innovation Index, 2020). This indicates that the Ethiopia's innovation performance is smaller compared to other economies (Geneva, 2020).

Secondly, access to finance remains the key problem in developing country's innovation process and, it also remains the core concern of researchers, policymakers and business leaders. In this regard, African countries in general are severely disadvantaged from financial development, and financing constraint is the most binding constraint for firms' growth (Ayalew and Xianzhi 2019). Financing constraint in the region is twice higher than non-African countries, and only about 23 percent of firms use bank loans (Otchere, Senbet et al. 2017). In Ethiopia, the level of financial constraints is worse than even compared with other African countries. For instance, Ayalew and Xianzhi (2019) reported, in Ethiopia, about 44% of firms face financial constraints which higher 36% and 42% of East Africa and Africa average, respectively. In Ethiopia, the financial sector is opaque, underdeveloped, and bank-based which adversely affect the firm's access to external finance to fund their innovative projects. However, we know very little how and to what extent the firm's financial structure (which is also affected by the firm's degree of access to external finance) would affect innovation.

Thirdly, the available theory did not provide a clear interaction between financial structure and innovation. As a result, we know very little whether and how financial structure affects the rate and direction of innovation performance (Ayalew et al, 2019a). There is a theoretical problem which requires further investigation. Available empirical evidence fail to provide concrete evidence and are not providing consistent and critical evidence. There is a contradiction on the direction of effect and the preference of finance source for innovative firms. Thus, this particular study contributed to existing literatures, especially for developing economies.

Fourthly, the limited extant literature does not specifically examined the effect of the various sources of debt finance (bank finance, non-bank financial institutions finance, trade credit finance and other informal debt finance) on innovation. Instead, they examine the effect of

overall dependence on external finance on a firm's innovation (e.g. Bernstein, 2015; Acharya and Xu, 2017; Cui and Yang, 2018; and Wellalage and Fernandez, 2019).

Finally, the available limited research done so far are mainly concentrated on developed countries perspectives, and to the researcher's knowledge, there is no similar study conducted in Ethiopia in the subject so far. It is known that Ethiopia is among developing countries which highly need the role of technological innovation for improved economic growth. In 2021, the country's overall economic freedom score is below the regional and world averages (index of economic freedom, 2021). Hence, information about the performance of firm's innovation helps for economic growth. Thus, the study contributed to fill empirical gap in the country.

Therefore, the study examined; 1) whether the financing pattern of innovative firms is different from the non-innovative counterparts, and 2) the effect of firm's financial structure on innovation performance in Ethiopia using survey data that comes from the World Bank's Enterprise Survey (WBES).

1.3 OBJECTIVE OF THE STUDY

1.3.1 GENERAL OBJECTIVE OF THE STUDY

The general objective of this study was to examine the relationship between the firm's financial structure and innovation performance in Ethiopia.

1.3.2 SPECIFIC OBJECTIVES OF THE STUDY

This study specifically employed;

- i)** To know the sources of the required capital that innovative firms use to finance their innovation activities.
- ii)** To investigate whether the financing patterns of innovative firms is different from their non-innovative counterparts.
- iii)** To examine the effects of firm's financial structure on their innovation performance.
- iv)** To show the effect of firm's financial structure on their innovation performance across firm's heterogeneities in size and age.

1.4 SIGNIFICANCE OF THE STUDY

The study is significant in a number of ways and has various contributions to the firms and country as well. First, it will allow the management of the company to gain an understanding of how innovation can be funded and will also help them improve the innovation performance of companies. Besides, it will help them to understand the consequence of using different sources of financing strategy and hence suggest the better financing option. This in turn will provide information which enhances the firm's competitive advantage as a result of innovation performance.

For policy makers, the investigation will provide information on the innovation and financial structure in Ethiopia. Geneva (2020) predicted the cost of new technologies and access to credit is of concern to enterprises in the country. Therefore, the study will provide additional information which can be used by policy makers to support firm's access to different sources of finance. This in turn helps as input for economic growth of a country as firms improve their innovation performance.

Finally, since most of the studies have focused on developed economies, the study will contribute to the provision of additional empiric evidence on developing countries. Specifically, as there is a void in the literature in Ethiopia, the study will draw the attention of other scholars, provide information and suggest more studies.

1.5 SCOPE OF THE STUDY

The study focused on the effect of firm's financial structure on innovation performance in Ethiopia using the 2015 WBES for Ethiopia. The data used was delimited to secondary survey data extracted from the WBESs Indicator Database which was surveyed in 2015, covering from 2012 to 2014. Methodologically, the study was delimited to quantitative approach and an explanatory research design.

1.6 LIMITATIONS OF THE STUDY

This study has some limitations that open opportunities for future research. First, although different types of innovation measurement are available, the study was delimited to address the objectives from core innovation indicators, namely product innovation and process innovation. This innovation often called Technological product and process Innovation (TPP). This study did

not address the objective from the perspectives of other types of innovation such as organizational innovation and marketing innovations. This is due to the fact that, the data source did not have such information. Second, the data used for this study is relatively old. This is because the latest available data for Ethiopia is the 2015 survey. Hence, the data may not reflect the current and future economic situation, yet it has a good base to reflect the existing fact. The third limitation goes to the cross-sectional nature of the data. Finally, only secondary data was used which may affect reliability of the data.

1.7 ORGANIZATION OF THE STUDY

The study report is organized in five chapters. Chapter one explains the introduction part which comprises; back ground of the study, statement of problem, research objectives, significance of the study and scope of the study. Chapter two presents reviews of related literature; conceptual and theoretical framework and detailed discussions of empirical studies on innovation. Besides, hypotheses development is included in this chapter.

Chapter three describes the research methodology used to carry out the study. Definition and measurement of variables are also encompassed in this section. Chapter four explains about the data analysis and discussion on the findings. Finally, Chapter five brings to an end the research with conclusion, recommendations and further research suggestions.

CHAPTER TWO---REVIEW OF LITERATURES

2.1 THEORETICAL LITERATURES

2.1.1 Definition, Classifications and Measures of Innovation

As innovation is a pervasive, heterogeneous and multi-faceted phenomenon, clear and concise definitions for innovation and related concepts are required for accurate measurement and interpretation of business innovation activities and to establish a common standard that serves the needs of the producers and users of innovation statistics (OECD, 2018).

2.1.1.1 Definition of Innovation

Schumpeter defined innovation by categorizing into five types which includes; introduction of new products or a qualitative change in an existing product, process innovations new to an industry, the opening of a new market, development of new sources of supply for raw materials or other inputs and changes in industrial organization (Schumpeter, 1997).

The Oslo Manual defined innovation as the implementation of a new or significantly changed product or process. A product is a good or a service while process includes production or delivery, organization, or marketing processes. The manual further defined these categories as follows; Product innovation is the implementation of a product with improved performance characteristics such as to deliver objectively new or improved services to the consumer while technological process innovation is the adoption of new or significantly improved production or delivery methods (OECD, 2015).

2.1.1.2 Classifications of Innovation

The Oslo Manual for measuring innovation classified innovation by object as product innovations, innovations that change the firm's products, and business process innovations, innovations that change the firm's business processes. Marketing innovation and organizational innovation are also included in addition to these core innovations (OECD, 2005).

- I. **Product innovation:** A good or service that is new or significantly improved. This includes significant improvements in technical specifications, components and materials, software in the product, user friendliness or other functional characteristics.

- II. Process innovation:** A new or significantly improved production or delivery method. This includes significant changes in inputs, infrastructure within the institutional unit, and techniques.
- III. Marketing innovation:** A marketing innovation is the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing.
- IV. Organizational innovation:** An organizational innovation is the implementation of a new or significantly changed organizational method in the business practice, workplace organization or external relations of the institutional unit.

2.1.1.3 Measures of Innovation

Firms that innovate engage in a complex set of activities with multiple outcomes, some of which can change the boundaries and nature of the firm itself. The problem is to decide which of these activities and outcomes should and can be measured. Broadly, there are two indicators of innovation: input and output indicators (OECD, 2005).

1. Inputs to innovation

One of the oldest and most common methods of measuring innovative activities is through capturing research and development data. The popularity and prevalence of these data stem from their ability to quantitatively capture efforts related to innovation directly. However these data neither provide a complete picture of innovation nor are the most reliable or easiest indicators to interpret. Input indicators comprise, for example, the R&D expenditures or the percentage of the R&D employees to all other employees.

2. Output to innovation

Another method to measure innovation is through output indicators which comprise mostly the number of patents as well as the number of product and process innovations. Part of challenging of this method relates to the difficulty of agreement on definition. Existing definitions focus on those creative outputs related to new final and intermediary products produced by the firms, new production process employed to produce products, new ways for organizing firm resources and new means for commercializing products.

The measurement of these two innovation indicators usually takes two approaches, i.e., the objective and subjective approaches. The objective approach measures innovation using directly measurable indicators, such as the number of patents a company registers. The subjective approach, on the other hand, measures innovation based on the self-assessment of the company as to its innovation activities (OECD, 2005).

2.1.2 Underlining Theories

Capital Structure Theories

Capital structure refers to a strategy in which a company finances its assets by a combination of equity, debt, or hybrid securities. The capital structure of the company is then the composition or structure of its debt and equity (Modigliani-Miller, 1958). Aghion et al, (2004) stated that the theories of capital structure suggest explanations why more innovative firms may prefer particular sources of finance. It tends not to concentrate specifically on technological characteristics.

I) Modigliani–Miller (MM) Theory

MM Theory, which is known as the basic theory of capital structure, states that the valuation of a business and its investment decisions are not determined by its capital structure. In particular, the value of a company is measured by its own assets, not by the proportion of the debt or equity given. Thus, any combination of debt and equity does not affect the value of a company. However, this theory is based on restrictive assumptions about perfect capital markets, perfect information, no transaction costs and no taxes that are not confirmed in the real world.

Few years later, Modigliani and Miller (1963) corrected their position by relaxing the presumption of a tax-free country. As the tax deductibility of interest payments enters the model, the company's value rises with leverage. Thus, they argued that in the presence of corporate taxes, a value-maximizing company can obtain an optimal capital structure. In other words, if the market is not perfect, as result of, say, the existence of taxes, or of underdeveloped financial markets, or of inefficient case, firms must consider the costs entailed by these imperfections. A proper decision on capital structure can be helpful to minimize these costs.

II) Trade-off theory

The static trade-off theory argues that companies can balance the costs and benefits of debt to maximize their value (Kraus and Litzenberger, 1973; Myers, 1984). As per Miller and Modigliani (1963), the debt advantage comes mainly from the tax shield of declining profits by paying interest. In other words, the tax benefit comes from the fact that the payment of interest on debt would reduce the company's taxable income. The cost of the debt is extracted from direct and indirect costs of bankruptcy by raising the financial risk (Kim, 1978; Kraus and Litzenberger, 1973). Briefly, this theory postulates that the worth of a debt firm is equal to that of a debt-free firm plus a tax shield after the cost of financial distress has been deducted. Dynamic trade-off theory sets up a multi-period model in which the optimal capital structure of the company changes over time and expectations and modifications plays an important role (Fischer E.O, Heinkel R & Zechner J, 1989).

The trade-off theory predicts that safe firms, firms with more tangible assets and more taxable income to shield should have high debt ratios. While risky firms, firms with more intangible assets that the value will disappear in case of liquidation, ought to rely more on equity financing. In line with this theory Aghion et al, (2004) suggested that bankruptcy costs are likely to be relatively low for firms with a high proportion of tangible capital among their assets related to generally applicable technologies. They are likely to be higher for creative companies with a higher proportion of intangible assets, such as knowledge and reputation, and more advanced equipment. The probability of bankruptcy may also be higher for a given level of debt. Based on these factors Aghion et al, (2004) concluded that more innovative companies are likely to be less dependent on debt financing, thereby minimizing the expected costs of bankruptcy.

III) Pecking order theory

The pecking order theory was developed by Myers and Majluf (1984) and focuses on asymmetric information costs. Asymmetric information reveals the information inequalities between internal and external users of the organization that external investors do not have access to the necessary information on the valuation of the assets and growth opportunities of the business. The information asymmetry may also explain why current investors do not endorse new capital financing. The explanation is that new investors may need higher returns to repay the risk of their investment, and this request dilutes the returns of existing investors.

This theory argues that financing follows a particular hierarchy: internal financing, such as retained earnings, is used first, debt is issued, and equity is issued when no further debt can be achieved (Myers and Majluf, 1984; Ross, 1977). This implies that businesses will initially finance new ventures with internal funds and will only pursue external funds when the available internal funds are depleted. If they are unable to access internal capital, companies would choose debt over equity. It is obvious that the risks, as well as the costs of funding, are rising along with the hierarchy.

Firms will definitely first attempt to finance investment from their retained earnings in order to ease the participation constraint of outside investors; but then, when more investment funds are required, firms will use debt funding and it is only when the size (or scope) of the project becomes sufficiently large and/or when assets become sufficiently intangible that firms will grant fuller control rights to them by issuing new equity. Given the more attractive investment prospects and the fewer tangible assets of innovative companies, this strategy assumes that they will appear to be more dependent on new equity finance. This theory also predicts that more innovative companies are likely to be more dependent on external funding, but are likely to prefer debt over new equity among external sources in order to avoid these relatively high dilution costs (Aghion et al, 2004).

IV) Agency theory

The Agency Theory, founded by Jensen and Meckling (1976), Jensen (1986) and Hart and Moore (1994), argues that the optimal capital structure for optimizing firm value minimizes conflicts of interest between owners, managers and debt holders. Conflict between managers and shareholders means that managers strive to accomplish their personal objectives instead of maximizing the value of the firm and the return of the shareholders.

According to Jensen and Meckling (1976), capital structures are determined by agency costs, which includes the costs for both debt and equity issue. The costs related to equity issue may include: The monitoring expenses of the principal (the equity holders), the bonding expenses of the agent (the manager) and reduced welfare for principal due to the divergence of agent's decisions from those which maximize the welfare of the principal.

Besides, debt issue increases the owner-manager's incentive to invest in high-risk projects that yield high returns to the owner-manager but increase the likelihood of failure that the debt holders have to share if it is realized. If debt holders anticipate this, higher premium will be required which in turns increase the costs of debt. Then, the agency costs of debt include the opportunity costs caused by the impact of debt on the investment decisions of the firm; the monitoring and bond expenditures by both the bondholders and the owner-manager; and the costs associated with bankruptcy and reorganization. Since both equity and debt incur agency costs, the optimal debt-equity ratio involves a trade-off between the two types of cost.

V) Signaling theory

The signaling theory introduced by Ross (1977) implies that the option of the firm's debt/equity ratio would send a signal to the market. Indeed, managers will service debts first in the event of a company undervaluation and, conversely, equity will be provided if the firm is overvalued. The explanation for this action is that a corporation only issues additional equity if the stock price is higher than its true value and this issuance often gives investors a negative signal that may lower the price of the share (AbuTawahina, 2015). On the other hand, debt formation sends a positive signal that a business has trust in its future cash flow and will be able to repay its interest and principal value. In addition to issuing debts and equity, investors may also consider other financial signals such as paying dividends, repurchase of shares, announcement of mergers or acquisitions, announcement of tenders and announcement of spin-offs (Markopoulou and Papadopoulos, 2009).

Stressing the costs of the agency and the informational asymmetries between investors and managers of companies or entrepreneurs, Aghion et al (2004) suggested that it is possible that there will be a higher level of asymmetrical information between insiders and outsiders for more innovative firms, and thus these dilution costs will appear to be higher. They also suggested that innovative firms are also likely to be more dependent on external debt or new equity funding than less innovative firms, which are more likely to have ample internal funds to cover all their desired investment expenditure.

2.2 EMPIRICAL REVIEW

A variety of studies have analyzed the relationship between the financial structure and innovation from the above theoretical standpoints. The analysis of these studies shall be summarized as follows.

The study by Bartoloni (2010) focused on capital structure and financing innovation of firms included in third Community Innovation Survey (CIS3) from different sectors and geographical distributions. Data obtained from financial statements referring to the period 1996-2003 was analyzed using standard bi-directional Granger-causality tests. The study concluded that the need for external finance increases with the innovative effort while Small innovative firms are more likely to rely on internal funds rather than debt. Overall results may indicated that pecking order mechanism dominates access to financial resources as debt financing increases with the intensity of innovative efforts, thus indicating that when internal resources are not sufficient to cover large innovative projects, debt financing is required.

Ayyagari et al (2011) examined firm innovation in emerging markets by focusing on the role of finance, governance, and competition. Unlike existing finance literatures on innovation which are limited to large public firms in developed markets, the study addressed 19,000 firms across 47 developing economies. Besides, both public and private firms, and small and medium-sized enterprises included. Findings of the research showed that access to external financing is associated with greater firm innovation. Further, having highly educated managers, ownership by families, individuals, or managers, and exposure to foreign competition is associated with greater firm innovation.

Bonte and Nielen (2011) empirically examined the relationship between trade credit and product innovation using a sample of small and medium-sized enterprises from 15 European countries. Data set based on the World Bank Private Enterprise was analyzed using probit regression. The results confirmed a positive relationship between innovation and trade credit. Particularly SMEs with product innovations have a higher probability of using trade credit than other SMEs. Hence, the results point to the relevance of trade credit as a source of short-term external finance for innovative SMEs that are credit constrained.

Coleman and Robb (2012) explored the extent to which various theories of capital structure fit in the case of new technology-based firms. The study used data from the Kauffman Firm Survey, a longitudinal data set of over 4,000 firms in the USA from which descriptive statistics and multivariate results are provided. Findings of the study reveal that new technology-based firms demonstrate different financing patterns than firms that are not technology-based. When compared to non-technology-based firms, technology-based firms raised a substantially higher ratio of external equity financing and used a lower ratio of owner provided financing and external debt. These results are contrary to the pecking order theory.

Chang and Song (2014) examined capital structure and investment in research and development using Compustat North America fundamentals annual data for the period during 1975 to 2011 to construct financial statement variables. Multinomial logistic regression was employed to analyze firms' choice among internal funds, equity and debt. The study found that firms with favorable patent characteristics tend to issue less debt and more equity in the short run and have lower leverage in the long run. Hence, innovative firms choose to issue more equity after their credit constraints are to some extent relieved and this is not mainly because they are credit constrained and cannot issue debt, but they prefer equity to debt for external financing.

Zuluaga et al (2015) examined the relation between innovation activities and specific sources of funding within the scope of economic theory in Colombia. The data obtained from World Bank Enterprise Survey 2010 was tested statistically. The findings suggest that innovative companies use internal resources, bank financing and credit from suppliers to finance working capital which are lacking in non-innovative enterprises. This indicates that innovative firms exhibit different financing pattern.

Olexandr M. et al (2015) studied the place and role of non-banking financial organizations in financing innovation based on the analysis of investment activity. The investigation also compared banks and non-banking financial institutions as participants of innovation projects. Based on the statistical data the article showed the advantages of participation of non-banking financial institutions compared to banks, which appears valuable from the point of view of development of this issue in the financial science environment. The study argued that banks and non-banking financial institutions are competitors in the market of crediting innovation projects.

Mina and Lahr (2015) investigated how innovation affects the hierarchy of financing behaviors. The dataset was derived from a unique survey of UK and US businesses jointly carried out in 2004-2005. The sample covered all manufacturing and business service sectors. In contrast with the majority of studies on firm capital structure the study focused on unlisted companies and explores the effects of information asymmetries. The results show that innovation is negatively associated with a standard pecking order characterized by increasing agency costs, and that the more uncertain the innovation signal, the stronger its effect on the pecking order.

Alinejad et al (2015) examined the probability of firms of different age, size and innovation intensity to seek debt or equity finance in Australia by focusing on young innovation-active SMEs and the state of venture capital. The study used data from the Business Characteristics Survey (BCS), an annual survey administered by the ABS. The result showed that firms do not tend to seek debt or equity finance and most young SMEs obtain the debt finance they seek. Young innovative firms are significantly more likely to seek debt and equity finance than non-innovators. Moreover, the study suggested Australia's low venture capital early-stage investments may present significant challenges for the diversification and growth of innovative, disruptive firms in Australia.

Algieri et al. (2018) examined the impact of capital structure on firm's innovative performance of seven European countries. The analysis is carried out on data taken from the EU-Efige Survey, retrieved from the Amadeus Database (Bureau Van Dijk). The data consist of a representative sample for manufacturing industry of almost 15,000 firms in selected countries. Probit model was employed to analyze data. Innovative activities have been distinguished in R&D expenditures, process and/or product innovations and patenting. The study suggested that the outputs of innovation (patenting) depend mainly on long term debt, the size of the company and the presence of skilled workers, whereas investments in R&D are pushed by the contribution of several forms of financing, including equities. In addition, product and process innovations are mainly fostered by short and long term debts and the firm's cash flow.

Singh and Maiti (2019) investigated sources of finance, innovation and exportability in Asia based on cross-country evidences. The study used firm-level data from the World Bank Enterprise Survey data (WBES) of around 71,000 firms from 100 countries mainly the countries of low- and middle-income category which was estimated using bi-probit model. The result of

the study confirmed that firms depend more on formal banking source for investment in innovation, and this is found to be significant in explaining innovation and exportability.

Ayalew et al (2019) investigated how firms in developing countries finance innovation. The study utilizes firm-level data from the World Bank Enterprise Survey. From 28 African countries, 11,173 firms have been included in the sample. A statistical t-test is used for two independent samples and logistic regression models. The results show that innovative firms, specifically innovative small- and medium-size firms exhibit financing patterns different from non-innovative peers. In Africa, innovation is mostly financed using internal sources and bank finance. Equity finance and bank finance have shown a higher effect followed by internal finance, finance from non-bank financial institutions and trade credit finance on firms' probability to innovate.

The recent work by Geelen et al (2020) investigated the relationship between debt financing, innovation and growth. The paper tried to answer how does debt financing influence innovation at the firm level and how do innovation in turn feed back into firms' financing policies. The implications of debt financing in innovative firms for aggregate levels of innovation and growth are also evaluated. The study developed a Schumpeterian growth model and standardized the model to match the observed characteristics of innovation and capital structure policies to answer these questions. US public firms' financial data from Compustat and the data on firms' innovation activity from selected literature were used. The results show that while debt hampers innovation by incumbents due to debt overhang, it also stimulates entry, thereby fostering innovation and growth at the aggregate level. Moreover, the study found that debt financing has large effects on firm entry, firm turnover, and industry structure and growth and significant difference exist in leverage and innovation within industry.

The study by Blach et al (2020) addressed the types of innovation activity of small and medium-sized enterprises in the European Union and its association with financing decisions. The main purpose was to capture the cross-country differences in the types of innovation in SMEs and then investigate the relationship between the types of innovations and relevance of a given type of funding. The data that reflect the types of SMEs innovation and the relevance of various types of financing was obtained from Survey of Access to Finance of Enterprises (SAFE) reports. The non-parametric methods, particularly non-parametric ANOVA was used. The study found that

there are differences in the types of innovation activity of SMEs in the cross-country dimension and various types of innovations co-exist. Although the study found no unified pattern of correlations between the relevance of source of financing and a given type of innovation, it concluded debt financing seems to be a primary source of financing innovation in all clusters of countries and external equity remains relevant only in the case of new EU countries. The study further indicated that the main sources of finance for innovative SMEs come from the banking sector and private equity capital providers.

Liu (2020) examined the relationship between financial structure and technical innovation and the impact of financial structure on heterogeneous technical innovation in China. Provincial panel data from 2004 to 2016 was used. The study showed that the market-oriented financial structure had an incentive effect that led to improvement in the level of technical innovation. Besides, financial structure had different impacts on heterogeneous technical innovation. Specifically, the market-oriented financial structure significantly enhances the improvement in the output level of regional original technical innovation; but, it has no significant impact on imitative technical innovation.

Table 2.1: Summary of empirical reviewed

No.	Author	Year	Title	Finding
1	Bartoloni	2010	Capital Structure and Innovation: Causality and Determinants.	<ul style="list-style-type: none"> ➤ The need for external finance increases with the innovative effort. ➤ Small innovative firms are more likely to rely on internal funds rather than debt. ➤ Pecking order mechanism dominates access to financial resources as debt financing increases with the intensity of innovative efforts.
2	Ayyagari et al	2011	Firm Innovation in Emerging Markets: The Role of Finance, Governance, and Competition	<ul style="list-style-type: none"> ➤ Access to external financing is associated with greater firm innovation. ➤ Having highly educated managers, ownership by families, individuals, or managers, and exposure to foreign competition is associated with greater firm innovation.

3	Bonte and Nielen	2011	Product Innovation, Credit Constraints, and Trade Credit: Evidence from a Cross-country Study.	<ul style="list-style-type: none"> ➤ There is a positive relationship between innovation and trade credit. ➤ SMEs with product innovations have a higher probability of using trade credit than other SMEs. ➤ Trade credit is relevant source of short-term external finance for innovative SMEs that are credit constrained.
4	Coleman and Robb	2012	Capital structure theory and new technology firms: is there a match?	<ul style="list-style-type: none"> ➤ New technology-based firms demonstrate different financing patterns than firms that are not technology-based. ➤ Contrary to the pecking order theory, technology-based firms raise a substantially higher ratio of external equity financing and used a lower ratio of owner provided financing and external debt.
5	Chang and Song	2014	Research and Development Investment and Capital Structure.	<ul style="list-style-type: none"> ➤ Firms with favorable patent characteristics tend to issue less debt and more equity in the short run and have lower leverage in the long run. ➤ Innovative firms prefer equity to debt for external financing.
6	Zuluaga et al	2015	Analysis of the relation between entrepreneurial innovation and finance in Colombia.	<ul style="list-style-type: none"> ➤ Innovative companies use internal resources, bank financing and credit from suppliers to finance working capital which are lacking in non-innovative enterprises. ➤ Innovative firms exhibit different financing pattern.
7	Olexandr M. et al	2015	Participation of non-banking financial organizations in	<ul style="list-style-type: none"> ➤ Banks and non-banking financial institutions are competitors in the market of crediting innovation projects.

			crediting innovation projects	
8	Mina and Lahr	2015	The pecking order of innovation finance	<ul style="list-style-type: none"> ➤ Innovation is negatively associated with a standard pecking order characterized by increasing agency costs, and that the more uncertain the innovation signal, the stronger its effect on the pecking order.
9	Alinejad et al	2015	Financing innovative entrepreneurship	<ul style="list-style-type: none"> ➤ Firms do not tend to seek debt or equity finance and most young SMEs obtain the debt finance they seek. ➤ Young innovative firms are significantly more likely to seek debt and equity finance than non-innovators.
10	Algieri et al.	2018	The Impact Of Capital Structure On Firms' Innovative Performance	<ul style="list-style-type: none"> ➤ Outputs of innovation (patenting) depend mainly on long term debt, the size of the company and the presence of skilled workers. ➤ Investments in R&D are pushed by the contribution of several forms of financing, including equities. ➤ Product and process innovations are mainly fostered by short and long term debts and the firm's cash flow.
11	Singh and Maiti	2019	Sources of Finance, Innovation and Exportability in Asia: Cross-country Evidences	<ul style="list-style-type: none"> ➤ Firms depend more on formal banking source for investment in innovation, and this is found to be significant in explaining innovation and exportability.
12	Ayalew et al	2019	The finance of innovation in Africa.	<ul style="list-style-type: none"> ➤ Innovative firms, specifically innovative small- and medium-size firms exhibit financing patterns different from non-innovative peers. ➤ In Africa, innovation is mostly financed using internal sources and bank finance.

				<ul style="list-style-type: none"> ➤ Equity finance and bank finance have shown a higher effect followed by internal finance, finance from non-bank financial institutions and trade credit finance on firms' probability to innovate.
13	Geelen et al	2020	Debt, Innovation, and Growth	<ul style="list-style-type: none"> ➤ Debt hampers innovation by incumbents due to debt overhang. It also stimulates entry, thereby fostering innovation and growth at the aggregate level. ➤ Debt financing has large effects on firm entry, firm turnover, and industry structure and growth and significant difference exist in leverage and innovation within industry.
14	Blach et al	2020	Innovation in SMEs and Financing Mix.	<ul style="list-style-type: none"> ➤ There are differences in the types of innovation activity of SMEs in the cross-country dimension and various types of innovations co-exist. ➤ Debt financing seems to be a primary source of financing innovation in all clusters of countries and external equity remains relevant only in the case of new EU countries. ➤ The main sources of finance for innovative SMEs come from the banking sector and private equity capital providers.
15	Liu	2020	The Impact of Financial Structure on Technical Innovation.	<ul style="list-style-type: none"> ➤ Market-oriented financial structure has an incentive effect that led to improvement in the level of technical innovation. ➤ Financial structure has different impacts on heterogeneous technical innovation. ➤ Market-oriented financial structure significantly enhances the improvement in the output level

of regional original technical innovation; but, it has no significant impact on imitative technical innovation.

Source: researcher's critique

2.3. Research Gap, Research Hypotheses and Conceptual Framework

2.3.1. Research Gap

The economic and corporate finance theories underline due to the unique feature of innovation, which includes intangibility, uncertainty, high asymmetric information problem, and moral hazard problems, innovative firms face difficulties to obtain external finance. Generally, innovative firms tend to rely more on internal than external sources (Ayalew et al, 2019; Kerr & Nanda, 2015). Innovative firms are more dependent on internal finance and less dependent on external finances such as debt finance and external equity finance. Similarly, a large volume of empirical literature has examined the theoretical predictions and tests the validity of capital structure theories in the perspective of innovative firms (see, e.g., (Bartoloni, 2013; Coleman & Robb, 2012; Hummel et al., 2013; Ayalew et al, 2019). Generally, three main gaps were identified from the existing literature on the implication of a firm's financial dependence on innovation.

Firstly, research that examines the interaction between the financial dependence of firms and innovation is a new topic and the limited extant literature does not provide concrete evidence on the question "to what extent a firm's financial dependence or financing preference affects its innovation performance?" Prior studies mainly focus on examining the effect of external financial dependence on innovation (e.g., Bernstein (2015); Acharya and Xu (2017); Cui and Yang (2018); and Wellalage and Fernandez (2019)). In addition, they have not examined the effect of the various sources of debt finance (bank finance, non-bank financial institutions finance, trade credit finance, and other informal debt finance) on innovation. Instead, they examine the effect of overall dependence on external finance on a firm's innovation.

Secondly, in investigating the financial dependence of innovative firms and its effect on innovation, most of the prior studies do not consider firm heterogeneities, such as size, age, and industrial type. However, a firm's financial dependence is adjusted in response to the impending

financial needs of the firm over its life cycle, which hinges on the size, age, and the information environment (Berger & Udell, 1995, 1998). Obtaining external finance is often difficult for SMEs and young firms than their large and old counterparts (Beck & Demirguc-Kunt (2006); Brown et al (2009); He & Tian (2018); Hummel et al (2013) and Lee et al (2015)). Similarly, the financial dependence of firms is also largely dependent on the industry sector a firm belongs to. For instance, manufacturing firms often are more fixed asset-intensive than service sectors; as a result, the difficulty in securing external finance may be less as fixed assets are usually used as collateral to obtain external funding (Brown et al., 2009; Hall, 1992, 2002; Hall & Lerner, 2010).

Finally, prior studies in the area are concentrated in the developed and emerging markets. Studies that address developing countries, including Ethiopia countries, are scant. However, research that addresses innovation in general and financing investment in innovation, in particular, from the perspective of African countries and Ethiopia, is desirable due to the two main reasons. First, Ethiopia exhibits a large population, inefficiency in production, and are generally far away from the innovation frontier (Ayalew, Xianzhi, Dinberu, et al., 2019). Second, in Ethiopia, the financial sector is opaque, underdeveloped, and bank-based (Ayalew et al, 2019). As a consequence, financial constraint in the region is much higher than in non-African countries (Otchere et al., 2017) and it is more binding for firms' growth than other obstacles such as corruption or unsound infrastructure (Ayyagari et al., 2011). Thus, this thesis was designed to fill the above mentioned gaps in the literature.

2.3.2. Research Hypotheses

2.3.2.1. Hypothesis on the Financing Pattern of innovative and non-innovative firms

Innovative firms faced with unique characteristics such as intangibility, uncertain return, moral hazard and asymmetric information to invest in innovative activities (Kerr and Nanda, 2015). Studies indicated that due to these unique features of investment in innovative activities, innovative firms exhibit different financing pattern from non-innovative firms (Ayalew et al, 2019), (Zuluaga et al, 2015) and (Coleman and Robb, 2012). Accordingly, the following hypothesis can be postulated as,

H1. Innovative firms exhibit different financing patterns from non-innovative firms in Ethiopia.

2.3.2.2. Hypotheses on Financial Structure and Innovation

Internal Finance and Innovation

According to pecking order theory financing hierarchy internal financing is used first and businesses will initially finance new ventures with internal funds (Myers and Majluf, 1984; Ross, 1977). This source of finance is less risky and minimizes costs of funding when compared to external source of funding. Besides, in order to ease the participation constraint of outside investors firms prefer internal financing. Previous studies also reveal that innovative firms mostly rely on internal financing (Ayalew et al, 2019) and Zuluaga et al, 2015). Hence, it is reasonable to assume as follows.

H2. Internal finance has significant impact on firm's innovation performance in Ethiopia.

➤ Debt Finance and Innovation

Regarding debt finance and innovative firms, pecking order theory argues that firms pursue external funds when the available internal funds are not enough to finance innovation. Due to lower risks and costs of debt funding than external equity, companies would choose debt financing. Debt finance is also preferred to avoid relatively high dilution costs (Aghion et al, 2004).

Studies argued that debt finance encourage product and process innovations (Algieriet al.2018). It also stimulates entry thereby fostering innovation and growth at the aggregate level (Geelen et al, 2020). As per Blach et al (2020) debt financing appears to be a primary source of financing innovation. Based on theory and studies, the relationship between debt finance and innovation is hypothesized as follows.

H3. Debt finance has significant impact on firm's innovation performance in Ethiopia.

Debt finance can be obtained from various sources and for this particular study they are classified as bank, non-bank and trade credit. Various studies claimed that firms depend more on formal banking source for financing innovation which is found to be significant in explaining

innovation (Singh and Maiti, 2019),(Zuluagaet al, 2015) and is main sources of finance for innovative SMEs (Blach et al, 2020). In Africa, bank finance is mostly used source of finance and has higher effect on firms' probability to innovate (Ayalew et al, 2019). From this empirical argument the following hypothesis is developed.

H3A. Bank finance has significant impact on firm's innovation performance in Ethiopia.

On the other hand, Olexandr M. et al (2015) showed that both banks and non-banking financial institutions are competitors in the market of crediting innovation projects. Although its influence comes next to banking finance, finance from non-bank financial institutions have effect on firms' probability to innovate (Ayalew et al, 2019). Hence, the following assumption can be developed.

H3B. Non-Bank finance has significant impact on firm's innovation performance in Ethiopia.

Trade credit is another relevant source of short-term external finance for innovative firms and has positive relationship with innovation (Bonte and Nielen, 2011), (Zuluagaet al, 2015) and (Ayalew et al, 2019). Therefore, the following hypothesis can be developed.

H3C. Trade credit finance has significant impact on firm's innovation performance in Ethiopia.

➤ **External Equity Finance and Innovation**

The trade-off theory predicts that creative companies, firms with more intangible assets, ought to rely more on equity financing. According to Aghion et al, (2004) more innovative companies are likely to be less dependent on debt financing, thereby minimizing the expected costs of bankruptcy and dilution. On the other side, due to the more attractive investment prospects and the fewer tangible assets of innovative companies, it is assumed that they will appear to be more dependent on new equity finance.

Consistent with the above theories, most studies found significant effect of external equity finance on innovation and concluded that innovative firms prefer equity to debt for external financing (Coleman and Robb, 2012) and (Chang and Song, 2014). Evidence from Africa showed higher effect of equity finance on firms' probability to innovate (Ayalew et al, 2019). Based on these evidences the following hypothesis is developed.

H4. External equity finance has significant impact on firm's innovation performance in Ethiopia.

2.3.3. CONCEPTUAL FRAMEWORK

According to Mugenda and Mugenda (2003) a conceptual framework stands for a hypothetical model identifying the model under study and the relationship between the independent and the dependent variables. Kothari (2004) defined a variable as concept which can be expressed in quantitative terms. Dependent variable a result of another variable, and a variable that causes the dependent variable is known as independent variable (Kothari, 2004).

The conceptual framework of the study is based on the fundamental concepts of the study and the literature review, for this particular study based on financial structure and innovation in Ethiopia. The constructed conceptual framework was used in the analysis of the results of the study and helped the researcher of this study to have a framework of thinking which in turn assisted to achieve research objective. The conceptual framework of the study is depicted as follows.

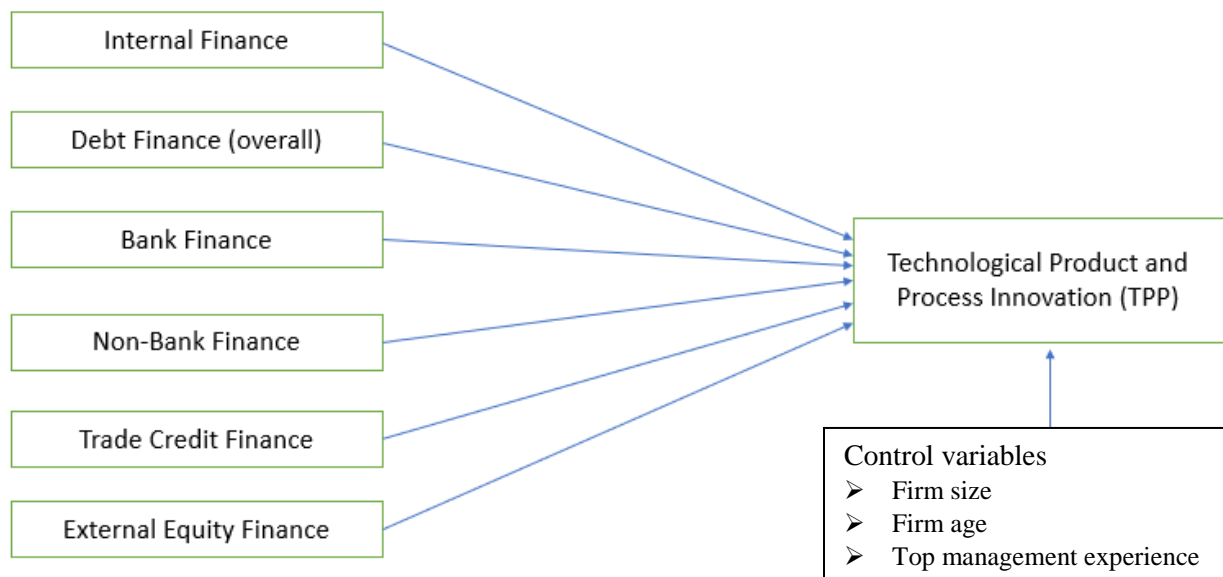


Fig 2.1. Study Conceptual Framework (Self-developed)

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Research design

Research design refers to a blueprint of the research project enabling to collect measure and analyze data (Kothari, 2003). This study employed explanatory research design which is used to identify the extent and nature of cause-effect relationships between the independent and the dependent variables. It is appropriate for the study as it focused on relationship between financial structure and innovation performance of firms under consideration.

3.2 Research Approach

A business research may use one of the three types of research approaches namely; quantitative, qualitative and mixed methods approach. Quantitative research is a means for testing objective theories by examining the relationship among variables (Creswell, 2009). Qualitative research approach is one in which the investigator often makes knowledge claims based primarily on the multiple meanings of individual experiences, socially and historically constructed meanings, participation in issues, collaboration or change oriented with an intent of developing a theory or pattern (Creswell 2003). Mixed research is an approach to inquiry that combines or associates both qualitative and quantitative forms (Creswell, 2009).

Considering the research problem and objective, quantitative research approach is appropriate for this particular study. This is because the study was conducted with the use of numbers as explanatory variables are measured quantitatively.

3.3 Data Source and Type

The data source of the study is World Bank's Enterprise survey which is conducted in 2015 from (2012-2014) years inclusively for selected firms. The survey collected data from key manufacturing and service sectors in every region of the world using properly designed survey instruments and uniform sampling methodology.

The objectives of World Bank's Enterprise Survey includes providing statistically significant investment climate indicators that are comparable across countries; assessing the constraints to private sector growth and job creation and building a panel of establishment-level data that will

make it possible to track changes in the business environment over time, thus allowing impact assessments of reforms; and stimulate dialogue on reform opportunities.

Therefore, secondary data were used in the study as obtained from second hand.

3.4 Population and sampling of the Study

This study is used a survey data which is collected by the World Bank Enterprise Survey Group called World Bank Enterprise Survey (WBES) for Ethiopia. The World Bank Enterprise Survey Group used global methodology which follow international standard. As the study obtained data from World Bank's Enterprise Surveys (ES), which is appropriate to achieve its objectives, the population of industries included in the surveys is all manufacturing sectors, construction, services, transport, storage, and communications and subsector (ISIC, revision 3.1).

Strata sampling was used for Enterprise Surveys and Indicator Surveys based on three criteria; sector of activity, firm size, and geographical location. Stratification by firm size divides the population of firms into 3 strata: small firms (5-19 employees), medium firms (20-99 employees), and large firms (100 or more employees). Geographical distribution is defined to reflect the distribution of the non-agricultural economic activity of the country; for most countries this implies including the main urban centers or regions of the country (ES sampling methodology, 2009).

The sample size generated by sampling methodology of the World Bank's Enterprise Survey was large enough for selected industries to substantiate assertions about the economy with levels of precision at a minimum 7.5% precision for 90% confidence intervals (ES sampling methodology, 2009).

3.4.1. Sample selection, composition and distribution

The target population of the study was all enterprises in Ethiopia included in World Bank Enterprise Surveys. Certain criteria were applied to select firms with complete and adequate data. The first criteria was a firm with more than five (5) employees as micro firms (firms having less than 5 employees) have no adequate data. Thus, micro firms were excluded. Secondly, firms with omitted data or spontaneous response of "I don't know" were removed from sample. Accordingly, out of 849 firms surveyed by WBES, 779 firms were selected and included in the analysis. The sample composition and distribution of these firms is presented in the tables below.

3.4.1.1. Distribution of sample firms according to location

Table 3.1 shows sample composition according to firms' location. Out of 779 firms, 415 (53.27%) are located in Addis Ababa which constitute more than half of total firms. 127 firms are from Oromia which covers 16.3%, 101 firms are from Tigray which is 12.97%, 63 firms are from Amhara which is 8.09%, 49 firms are from SNNPR which is 6.29% and 24 firms are from Dire Dawa which covers 3.08% of firms under investigation.

Table.3.1. Sample Composition according to Firm location

No.	Location	Frequency	Percent
1	Addis Ababa	415	53.27
2	Amhara	63	8.09
3	Dire Dawa	24	3.08
4	Oromia	127	16.3
5	Tigray	101	12.97
6	SNNPR	49	6.29
	Total	779	100

3.4.1.2. Distribution of Sample According to Firm Size, Firm Age & Sector

Table 3.2. Present sample distribution across firm size, firm age and sector. From total sample of 779 firms, 389 small firms which comprise 49.94% of total sample, 232 medium firms covering 29.78% and 158 large firms are included in the study. The figures show that the number of firms included in sample decrease as firm size increase.

The age of firms was categorized in accordance with Ayalew and Zhang (2019a) as presented in the table. Accordingly, 135 (17.33%) young firms, 379 (48.65%) matured firms and 265 (34.02%) old firms are included in the sample. Thus, matured firms dominated the sample of the study followed by old and young firms.

Regarding sector of firms, 354 firms are manufacturing which is 45.44%, while remaining 425 (54.56%) firms are service rendering. This indicates that the number of manufacturing firms included in the sample is less than service rendering firms.

Table.3.2. *Sample Composition according to firm size, firm age & sector.*

Sub-group	Category	Frequency	Percent
Firm size	large (≥ 100 permanent employees)	158	20.28
	medium (20 to 99 permanent employees)	232	29.78
	Small (5 to 19 permanent employees)	389	49.94
Firm age	Old (≥ 15 years)	265	34.02
	Matured (6 to 15 years)	379	48.65
	Young (1 to 5 years)	135	17.33
Sector	Manufacturing firms	354	45.44
	Service Rendering firms	425	54.56

3.5 Method of Data Analysis

The quantitative data that obtained from World Bank’s Enterprise Survey was analyzed by using computer software known as (STATA) version 14. It is a package of programs for manipulating, analyzing, calculating and presenting data. The package is widely used in the social and behavioral sciences. This software is better for this research because it is able to handle large quantities of data and thus efficient for the data processing and analysis. Probit regression analysis was conducted so as to understand whether innovation performance of firms in Ethiopia is affected by financial structure.

3.6 Research Models and Econometric Specifications

In order to investigate whether innovative firms exhibit financing patterns different from non-innovative firms, a non-parametric u-test (Mann-Whitney test) for two independent samples was used. Non parametric tests rely on the assumption that data is not normal distributed and hence appropriate as data used for this study was not normal distributed. The study also used a parametric t-test for two independent samples and the statistical results of both tests (t-test and u-test) were similar. The mean of independent variables of t-test provided information to know the finance sources for innovative firms.

The dependent variable ‘innovation’ is measured based on a binary response that takes value 0 and 1. Thus, the choice is whether to use logit or probit model. For the majority of the applications, the logit and probit models give very similar characterizations of the data because

the densities are very similar. Both approaches are much preferred to the linear probability model (Brooks, 2008). Therefore, this study was used a cross sectional probit model which drive from the latent regression of the form;

$$y^* = x\beta + \varepsilon, \quad y = 1[y^* > 0]$$

Where y^* is unobserved variable ranging from $-\infty$ to ∞ , ε is a continuously distributed variable independent of x , and the distribution of ε is symmetric about zero. x is a vector of explanatory variables, and its primary goal is to explain the effect of x_i on the response probability $p(y = 1 | x)$ the and β is a vector of parameters, respectively. The probit model uses the cumulative normal distribution function (Φ) to transform the model (Brooks, 2008).

Regression model (probit) to examine the effect of financial structure on innovation performance is formulated as follows which included control variables.

$$TPP = \beta_0 + \beta_1 IntFin + \beta_2 Debfin + \beta_3 BankFin + \beta_4 NonBankFin + \beta_5 TradCredFin + \beta_6 EquiFin + \beta_7 logsize + \beta_8 logage + \beta_9 logManExp + \varepsilon \text{ --- (3.1)}$$

Where; TPP - Technological Product and Process

β_0 -Constant

β_1 -Coefficient of internal finance

β_2 - Coefficient of debt finance

β_3 - Coefficient of bank finance

β_4 - Coefficient of non-bank finance

β_5 - Coefficient of trade credit finance

β_6 - Coefficient of external equity finance

β_7 - Coefficient of firm size

β_8 - Coefficient of firm age

β_9 - Coefficient of management experience

ε -Error

In order to test whether the financing patters of innovative firms is different from non-innovative firms, following Ayalew et al., (2019), Manny Whitney (U-test) for two independent samples (innovative vs. non-innovative) was used. This test initially implies the calculation of a U statistic for each group. These statistics have a known distribution under the null hypothesis identified by Mann and Whitney (1947).

$$H_0: \theta_x = \theta_y \text{ vs. } H_1: \theta_x \neq \theta_y$$

Where; θ_x indicates to the median of the first group and θ_y indicates to the median of the second group.

Mathematically, the Mann- Whitney U statistics are expressed as follows:

$$U_x = n_x n_y + \left(\frac{n_x(n_x + 1)}{2} \right) - R_x \dots \dots \dots (1)$$

$$U_y = n_x n_y + \left(\frac{n_y(n_y + 1)}{2} \right) - R_y \dots \dots \dots (2)$$

Where; n_x = the number of observations or participants in the first group,

n_y = the number of observations or participants in the second group,

R_x = the sum of the ranks assigned to the first group and

R_y = the sum of the ranks assigned to the second group.

3.7 Variable Definition and Measurement

3.7.1 Innovation

Innovation can be measured by input indicator (R&D expenditures or the percentage of the R&D employees) and output indicators (technological product and process). In this study innovation is dependent variable and Technological Product and Process (TPP), the core definition of innovation, was used as indicator. Technological product and process (TPP) innovations comprise implemented technologically new products and processes and significant technological improvements in products and processes. It has been implemented if it has been introduced on the market (product innovation) or used within a production process (process innovation) and

involves a series of scientific, technological, organizational, financial and commercial activities. The TPP innovating firm is one that has implemented technologically new or significantly technologically improved products or processes during the period under review (OECD, 2005).

3.7.2 Financial Structure (sources)

The independent variables used in this study capture sources of financing for working capital and investment. The measurement and classification of financing instruments are based on their presentation to the WBES. The WBES Section K addresses the sources of finance for enterprises. We construct the data for financing sources based on the responses to the following survey questions:

- *Over the last completed fiscal year, please estimate the proportion of this establishment's working capital that is the funds available for day-to-day operations that was financed from each of the following sources? Working capital finance*
- *Over the last completed fiscal year, please estimate the proportion or amount of this establishment's total purchases of fixed assets that were financed from the following sources? Investment finance*

The alternative sources of finance for the above questions are: 1) internal/retained earnings, 2) owners' contribution or new equity finance, 3) bank finance (private and public banks), 4) financed from non-bank financial institutions which include microfinance institutions, credit cooperatives, credit unions or finance companies, 5) trade credit which represent credit due to purchases on credit from suppliers and advances from customers, and 6) other sources which include moneylenders, friends, relatives and bonds. Thus, the variables are measured in terms of ratio. The detail about measurement of variables is given in Table 3.3.

Control Variables

Control variables refer to those variables which affect innovation performance but are not the main interest of this study. However, the model should control these variables to arrive at a concrete empirical finding. The model controls the effect of firm size, firm age and experience of top management on firms TPP performance.

i) Firm Size

Several studies show that, the size of the firms found to be significant to influence the firm's behavior to innovate. Schumpeterian theory stated that large scale firms or monopolist tend to be more innovative than small scale or competitive firms. This is as a result of capital market imperfections which leave small firms with insufficient internal resources to fund innovative activities or due to the higher level of output which renders larger firms able to produce more output (Schumpeter, 1942), (Cohen and Klepper, 1996).

ii) Firm Age

Regarding the age of firms and innovation suggestion from different literatures oppose each other. Schumpeter (1934) stated that new entrant firms are vital sources of novel and technologically superior products and processes, rendering younger firms more likely to innovate.

On the other side, others argued that older firms are more innovative due to non-negligible learning-by-doing effects which materialize over time Cohen and Klepper (1996). There is consistent evidence that young age is a strong disadvantage for firms seeking bank credits. Beck et al. (2006) demonstrated that older firms face lower financing constraints but also stress that age was more important in high-income countries. Similarly, Winker (1999) demonstrates that older firms face a lower risk of being rationed on the credit market while Ferrando and Mulier (2013) find that younger firms consider access to finance as the most pressing problem and are more likely to face actual credit constraints.

iii) Experience of Top Management

According to Protogerou et al. (2017) management experience increases the efficiency of human capital, decreases uncertainty about the value of opportunities and provides access to diverse types of information required for opportunity identification, and also help to acquire resources including financial resources. This implies that the firm with more experienced managers minimizes the problem associated with finance access and thus could innovate more.

Table 3.3. Variable definition and measurement

Variable	Measurement and definition
Main dependent and independent variables	
Technological Product or Process (TPP)	Dummy variable equal to 1 if a firm introduced the improved product or improved process in the last 3 years, 0 otherwise.
Internal/retained earnings	The proportion of working capital and investment financed using internal/retained earning
Equity finance	The proportion of working capital and investment financed from owners' contribution or issued new equity shares
Debt finance	The proportion of working capital and investment financed borrowed from external sources.
Bank finance	The proportion of working capital and investment financed borrowed from the bank
Finance from non-bank financial institutions	The proportion of working capital and investment financed borrowed from non-bank financial institutions, which include microfinance institutions, credit cooperatives, credit unions, or finance companies
Trade credit finance	The proportion of working capital and investment financed using credit from suppliers and advances from customers
Control variables	
Firm size (<i>Log(size)</i>)	Natural logged value of the number of permanent full-time employees.
Firm Age (<i>Log(age)</i>)	Natural logged value of age in years of a firm since its establishment.
Log (experience)	Log of experience in this sector that the top manager has

CHAPTER FOUR

DATA ANALYSIS AND PRESENTATION

4.1. Descriptive Statistics

Table 4.1 below shows summary statistics of the variables with total observations of 799 (Stata output exist in Appendix A). The mean, standard deviation and minimum and maximum values for the variables are also presented.

Table 4.1 Summary statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Innovation (TPP)	779	.4428	0.4970	0	1
Internal finance	779	.5723	0.2759	0	1
Bank finance	779	.0971	0.1886	0	1
Nonbank finance	779	.0022	0.027	0	0.5
Trade credit finance	779	.0141	0.0611	0	0.5
Debt finance	779	.1135	0.1964	0	1
Equity finance	779	.0061	0.0494	0	0.5
Firm size	779	99.2926	386.7321	5	7,600
Firm age	779	14.7304	13.0918	1	90
Management experience	779	15.9460	10.6494	2	60

The study conducted descriptive statistic using stata-14 software in order to provide more understanding about the study variables under investigation. As presented in previous chapter, innovation was identified using technological product and process (TPP) approach and it is dummy variable as it has binary outcomes. Table 4.1 shows the minimum and maximum value of innovation is 0 and 1 respectively indicating it is dummy variable.

All independent variables of the study are financial sources of firms and measured as ratio of each source to total finance. Hence, minimum value of 0 indicates no fund was raised from the source while maximum value of 1 reveals that 100 percent of fund was obtained from that source of finance. As shown in the Table, all sources of finance have a minimum value of 0 but they

have different maximum value. The maximum value of internal finance, Bank finance and Debt finance is 1 which shows 100% of fund was obtained from these sources of finance in some firms under investigation. Nonbank finance, Trade credit finance and Equity finance, on the other hand, have a maximum value of 0.5 which expresses that the maximum proportion of fund raised from these sources is 50%. The mean of all main variables (dependent and independent variables) is between 0 and 1 for the same reason explained above (dummy variable and ratio value). Further, their standard deviation is low which indicates the data point tend to be very close to the mean (Brooks, 2008).

Regarding the size of the firms, natural logarithm of number of permanent full-time employees was used as measurement. According to the summary statistics table, the mean of firms' size over the study period is 99.2926. This implies, on average, companies have 99 permanent full-time employees over the study period with standard deviation of 386.7321. High standard deviation shows that the data points are spread out over a large range of values (Brooks, 2008) which is also indicated using minimum and maximum value. Minimum number of permanent employees is 5 and maximum number is 7600.

Age of firms is measured using natural logarithm of years since their establishment. Figures in the descriptive statistics table shows mean age of firms is 14.7304 which implies on average firms included in the sample have an age of 14 years. It has standard deviation of 13.0918 ranging from minimum value of 1 year (young firm) to maximum value of 90 years (old firm).

The experience of top managers was measured as log of their experience in the sector. The output of descriptive statistics from the table shows the mean value of management experience is 15.9460. This implies on average, experience of top managers of firms included in the sample is around 16 years. A minimum year of top managers' experience is 2 while a maximum year of top managers' experience is 60 which are spread out by 10.6494.

4.2. Correlation analysis

Correlation analysis shows the degree of association between the variables. Before the regression analysis it is important to check the correlation test between dependent variable and independent variables (Wajahat, 2010). The values of the correlation coefficient are always between -1 and +1. A correlation coefficient of +1 indicates that the two variables are perfectly related

positively; while a correlation coefficient of -1 indicates that two variables are perfectly negatively related. A correlation coefficient of 0, on the other hand indicates that there is no linear relationship between two variables (Gujarati, 2004). The correlation between variables of the study is given in table 4.2 (see Appendix B for stata output).

Table 4.2 Correlation Matrix

No.	Variables	1	2	3	4	5	6	7	8	9
1	Internal finance	1								
2	Bank finance	-0.4306	1							
3	Nonbank finance	-0.0569	0.0006	1						
4	Trade credit finance	-0.1916	-0.0617	-0.0175	1					
5	Debt finance	-0.4810	0.9413	0.1332	0.2495	1				
6	Equityfinance	-0.0487	0.0102	-0.0079	-0.0060	0.0068	1			
7	Firm size	0.0780	0.1555	-0.0383	-0.0629	0.1245	0.0758	1		
8	Firm age	-0.0088	0.1269	-0.0603	-0.0039	0.1123	-0.0220	0.3814	1	
9	Management experience	-0.0546	0.0897	-0.0653	0.0330	0.0874	-0.0697	0.1404	0.4609	1

As shown in the table, all external sources of finance (bank, non-bank, trade credit and total debt) are negatively correlated with internal finance. This indicates that an increase in the use of internal source of finance is followed by the decrease to the all external sources of finance. Besides, some independent variables are negatively correlated with each other while certain independent variables are positively correlated. Trade credit finance is negatively correlated with bank and non-bank finance. This indicates that using higher fund raised through trade credit results in use of lower fund from financial institutions (bank and non-bank). Likewise, equity finance is negatively correlated with bank finance and trade credit finance which shows an increase use of equity finance is followed by decreased use of finance from bank and trade credit.

Control variables have statistically insignificant correlation with independent variables with different directions. For instance, Firm size is positively correlated with internal finance, bank finance, debt finance and equity finance and negatively correlated with non-bank finance and

trade credit finance. Besides, Firm age is positively correlated with bank finance and debt finance and negatively correlated with internal finance, non-bank finance, trade credit finance and equity finance. Lastly, top managements' experience is positively correlated with bank finance and debt finance and negatively correlated with internal finance, non-bank finance, trade credit finance and equity finance.

Multicollinearity

Multicollinearity indicates correlations among explanatory variables. When independent variables are multicollinear, there is overlap or sharing of predictive power which may lead to the paradoxical effect, where by the regression model fits the data well, but none of the explanatory variables (individually) has a significant impact in predicting the dependent variable (Gujarati,2004). Different literatures argued different correlation coefficient level to cause serious multicollinearity problem. For example, Cooper and Schendlar (2003) suggested 0.8.

No		1	2	3	4	5	6
1	Internal finance	1.0000					
2	Bank finance	-0.4306	1.0000				
3	Nonbank finance	-0.0569	0.0006	1.0000			
4	Trade credit finance	-0.1916	-0.0617	-0.0175	1.0000		
5	Debt finance	-0.4810	0.9413	0.1332	0.2495	1.0000	
6	Equity finance	-0.0487	0.0102	-0.0079	-0.0060	0.0068	1.0000

The results in the above correlation matrix show that the correlation between the independent variables is low except the highest correlation of 0.94 which is between debt finance and bank finance. This is due to the fact that most of debt finance in Ethiopia is obtained from banks (see Two-sample t-test result). Therefore, these two variables were regressed step by step (stepwise regression). So, it is possible to conclude that there is no problem of multicollinearity.

Additionally, the variance inflation factors (VIF) for the independent variables were computed and showed the same result. As presented in the table below (see Appendix F) the result of VIF of the variables are less than 10 except Debt finance and bank finance which are correlated for the reason presented above.

The mean VIF was 3.62, which is much lower than the threshold of 10. The VIF for other variables was also very low which indicates these explanatory variables were not substantially correlated with each other.

Variable	VIF	1/VIF (tolerance)
Debt finance	11.05	0.090524
Bank finance	10.35	0.09665
Log age	1.46	0.682865
Internal finance	1.35	0.741217
Log experience	1.29	0.777867
Log size	1.23	0.813258
Nonbank finance	1.19	0.839049
Equity finance	1.02	0.982556
Mean VIF	3.62	

4.3. Results

4.3.1. Sources of finance for innovation

Table 4.3 presents the financing patterns of innovative and non-innovative firms. Firms are identified as innovative or not using technological product and process (TPP). Under this approach innovating firm is one that has implemented technologically new or significantly technologically improved products or processes during the period under review (OECD, 2005). According to this approach 345 firms are innovative while the remaining 434 firms are non-innovative. This means out of 779 firms which are included in the study only 43.17 percent are innovative.

As shown in the table 4.3 innovative firms mostly finance their innovation activities with internal finance from which 62.41 percent is funded. This indicates firms that have implemented technologically new or significantly technologically improved products or processes mostly rely on retained earnings to finance innovation. Next to internal finance, innovative firms rely on borrowing from external sources (debt finance).13.33 percent of fund is obtained from bank, non-bank and credit from suppliers and advances from customers. Thus, innovative firms rely

more on internal finance than debt finance which contradicts Bartoloni (2010), Ayyagari et al (2011) and Algieri et al (2018).

Bank is the most preferred source to borrow for innovative firms when compared to non-bank financial institutions and trade credit. This source of finance contributes 12.18 percent which is from both private owned and state owned banks. From these results, 74.59 percent of finance for innovative firms were raised from above two sources (internal finance and bank finance) and indicates that they are main sources of finance for innovative firms. This result is similar with Zuluaga et al, (2015) and Ayalew et al, (2019). Singh and Maiti(2019) and Blachetal (2020) also agreed innovative firms depend on formal banking source which is supported by this result to some extent.

On average 0.9 percent of fund used by innovative firms are raised from trade credit source of finance. This means innovative firms cover 0.9 percent of fund to finance innovation by purchasing on credit from suppliers and collecting advances from customers. This result is consistent with finding of Zuluaga et al, (2015) which reported trade credit as source of innovation finance next to internal and bank sources. On the other hand, the finding contradicts Bonte and Nielen (2011).

Equity finance also contributes only 0.65 percent of the total funds of innovative firms which is contributed by owners or generated from issued new equity shares. This source of finance contributes less which implies that innovative firms less likely seek external equity finance which is due to absence of capital market in the economy. The finding contradicts the conclusion of Coleman and Robb (2012), Chang and Song (2014) and Alinejad et al (2015) as they found external equity finance is substantially used by innovative firms.

Nonbank financial institutions including; microfinance institutions, credit cooperatives, credit unions or finance companies together contributes the lowest of other finance sources under consideration which is only 0.24 percent of total of innovative firms' finance. As compared to bank source of finance, non-bank institutions source of finance is low and hence, the result opposes the finding of Olexandr M. et al (2015) which concluded nonbank financial institutions are competitor with banks in financing innovation.

Generally, the financing preferences of innovative firms in Ethiopia can be ordered as internal source of finance, debt finance (finance source from banks, trade credit finance and non-bank financial institutions) and equity finance. This order of financing preference is consistent with pecking order. Therefore as per empirical findings of this study, internal finance is regarded as most important source of innovation financing for Ethiopian innovative firms followed by bank finance.

4.3.2. Financing pattern of innovative and non-innovative firms: Mann-Whitney Test

In order to exhibit difference in financing pattern of innovative and non-innovative firms, the study employed two independent samples u-test (Mann-Whitney test). The appropriateness of u-test is based on the assumption that data distribution is not normal, which was tested using the histogram and the result confirmed that data are not normally distributed. The result of U-test is presented in Appendix C. But for reporting purpose two-sample t-test result is presented after comparing and confirming similarity of the result of both tests.

Table 4.3: Two-sample t-test

Source of finance	Innovative firms			Non-Innovative firms			t-value	diff. mean
	Mean	SE	SD	Mean	SE	SD		
Internal finance	0.6241	0.0156	0.2911	0.5311	0.0123	0.2562	-4.7382	0.093 (*)
Bank finance	0.1218	0.0110	0.2059	0.0774	0.0082	0.1713	-3.2825	0.044(*)
Nonbank finance	0.0024	0.0014	0.0275	0.0021	0.0012	0.0267	-0.1931	0.0003(*)
Trade credit finance	0.0090	0.0025	0.0473	0.0181	0.0033	0.0699	2.0804	-0.009(*)
Debt finance	0.1333	0.0112	0.2087	0.0977	0.0088	0.1847	-2.5222	0.0356(*)
Equity finance	0.0065	0.0028	0.0520	0.0058	0.0022	0.0472	-0.2177	0.0007(**)
No. of obs.	345			434				
* Significant a 1% level of significance; ** insignificant.								

Table 4.3 shows whether there is a difference in the financing patterns of innovative and non-innovative firms. To quantify the differences in financing sources, t-test was used for the independence of two samples namely; innovative and non-innovative. The p-value of the t-test indicates the null hypothesis that the two samples have an equal mean is rejected at 5 percent

significance level for trade credit finance and 1 percent significance level for all financing sources except equity finance. Hence, the result confirms hypothesis that the financial patterns of innovative firms is basically different from non-innovative firms.

Therefore, the study failed to reject the null hypothesis that innovative firms exhibit different financing pattern from non-innovative firms. This result is similar to previous studies that concluded innovative firms exhibit different financing pattern (See coleman and Robb (2012), Zuluaga et al, (2015) and Ayalew et al, (2019).

4.3.3. Effects of firm's financial structure on their innovative performance

To examine the effects of financial structure on innovative performance of firms, probit regression was employed. It is important to note that, unlike linear regression, we cannot interpret the parameter estimates rather we need to calculate the marginal effects. Table 4.4 presents the result of the probit models estimation results in which both coefficients and marginal effects are reported (Appendix D presents stata output of probit regression and marginal effects).

Table 4.4: Probit regression results

Innovation (TPP)	Coefficients	marginal effects (dy/dx)	Std. Err.	z	P>z	[95% Conf. Interval]
Internal finance	1.0930	0.4307	0.1965	5.56	0.000***	.7078537 1.478223
Bank finance	1.2127	0.4779	0.2852	4.25	0.000***	.6536317 1.77193
Nonbank finance	1.5928	0.6277	1.6917	0.94	0.346	-1.722894 4.908674
Trade credit finance	-1.7191	-0.6786	0.8108	-2.12	0.034 **	-3.308489 -.1298479
Debt finance (overall)	1.1228	0.4425	0.2761	4.07	0.000***	.5814995 1.66418
Equity finance	0.4955	0.1954	0.9125	0.54	0.587	-1.292943 2.28413
Firm size	0.5225	0.2059	0.0831	6.28	0.000***	.3595553 .6855885
Firm age	0.6883	0.2715	0.1550	4.44	0.000***	.3845109 .9921118
Management experience	0.1716	0.0677	0.1379	1.24	0.214	-.0988557 .4420872
_cons	-1.7949		0.2297	-7.81	0.000***	-2.245336 -1.344542
Number of obs. = 779 Log likelihood = -477.28804			LR chi2(8) = 115.16 Prob> chi2 = 0.0000 Pseudo R2 = 0.1077			

Note: 1) The dependent variable TPP, is measured as a dummy variable which takes the value equal to 1, if the firm introduce new or significantly improved product or process during the last three years before the survey. 2) The marginal effect is computed after probit estimate, 3) *** and ** present significant at 1% and 5% respectively.

The results in table above reveal that non-bank finance and equity finance are insignificant as their p-value is higher and statistically not significant. Other sources of finance are positively and significantly affect the probability to innovate. The marginal effect results further indicates that the order of effect from large to small follows the following order: trade credit finance, finance from non-bank financial institutions, bank finance, internal finance, debt finance and new equity finance.

The marginal effect value of internal finance (0.43) implies that a unit increase in the internal finance of the firms would increase the probability to innovative by 43%, holding all other independent variables constant whereas the value of the coefficient shows a one-unit increase in internal financing increase the probability to be an innovative firm by 1.09, holding all other independent variables constant. The positive sign of coefficient expresses the positive relationship between internal finance and innovation. Therefore, the study fail to reject hypothesis that internal source of finance has significant impact on firm's innovation performance in Ethiopia.

The bank finance has a marginal effect value of 0.477 which indicates a unit increase in the bank finance of the firms would increase the probability to innovative by 47.7%, holding all other independent variables constant. The coefficient value of the variable shows a one-unit increase in bank financing increase the probability to innovate of firms by 1.21, holding all other independent variables constant. As indicated by the sign of coefficient bank finance and innovation have positive relationship. As the result is in line with theories and literatures, the study failed to reject hypothesis.

The non-bank source of finance has a marginal effect value of 0.6277 indicating a unit increase in the bank finance of the firms would increase the probability to innovative by 62.77%, all other independent variables remaining constant. The coefficient value shows holding all other independent variables constant, a one-unit increase in non-bank financing increase the probability to innovate of firms by 1.59. The sign of coefficient shows positive relationship

between dependent variable and independent variable and statistically insignificant at 5% of significance level. Hence, the study reject hypothesis that non-bank source of finance has significant impact on firm's innovation performance in Ethiopia.

Unlike other independent variables, trade credit finance has negative relationship with innovation as its coefficient has negative sign. The marginal effect value of trade credit finance is -0.678 which indicates a unit increase in the trade credit finance of the firms would decrease the probability to innovative by 67.8%, holding all other independent variables fixed. The coefficient value shows that a one-unit increase in trade credit finance decrease the probability to innovate of firms by -1.71 holding all other independent variables constant. Hence, this result is consistent with theories and previous studies and the study failed to reject hypothesis.

The debt finance has a marginal effect value of 0.44 indicating a unit increase in the overall debt finance of the firms would increase the probability to innovative by 44%, all other independent variables remaining constant. The coefficient value shows holding all other independent variables constant, a one-unit increase in overall debt finance increase the probability to innovate of firms by 1.12. The sign of coefficient shows positive relationship between dependent variable and independent variable. Based on this finding, the study failed to reject hypothesis that debt finance has significant impact on firm's innovation performance in Ethiopia.

The marginal effect value of equity finance is 0.195 which shows that a unit increase in the equity finance of the firms would increase the probability to innovative by 19.5%, holding all other independent variables constant. The value of the coefficient shows a one-unit increase in equity financing increase the probability to be an innovative firm by 0.495, holding all other independent variables constant. The variable has the positive relationship with innovation as revealed by sign of coefficient and statistically insignificant at 5% of significance level. Thus, the study reject hypothesis that equity finance has significant impact on firm's innovation performance in Ethiopia.

From results presented, in general there is no sufficient evidence to support no effect of financial sources on innovation performance of Ethiopian innovative firms. Hence, we can conclude that financial structure has a significant effect on the probability of the firms to innovate which is consistent the findings of Ayalew et al (2019), Geelen et al (2020) and Liu (2020).

The control variables also have an effect on firm's probability to innovate; especially firm size and firm age have more effect as compared to management experience. All control variables have positive relationship with innovation. A one unit increase in log-size increases the probability of being an innovative firm by 0.205 (20.5%). A one unit increase in log-age of the firm also increases the probability of firm being an innovative by 0.271 (27.1%). Furthermore, an increase of natural log of management's experience by one unit results in probability of firm being an innovative by 0.067 (6.7%) which is statistically insignificant at 5% of significance level.

4.3.4. Robustness Tests

Evidence show that firms exhibit different finance pattern and through their life cycle which is reflected by size and age. Thus, it is important to examine whether the effects of financial structure on innovation vary across firm's heterogeneity in size (small, medium and large) and age (young, mature and old).

The figures in table 4.5 indicate the effects of financial sources on innovation performance based on size groups. The effects of internal finance significantly increase as size of the firms increase. This implies retained earnings are more important for innovative large firms than medium and small firms. The effect of equity finance shows higher in small size firms and decrease as firms grow and finally become negatively related with large size firms.

The effect of nonbank finance is higher in medium and large firms and lower in small firms. Trade credit finance and debt finance shows interesting results which have positive effect on one group and negative effect on the other. Besides, their relationship is inverse with the same size group. Bank finance, on the other hand, has more effect on medium than small firms which has lowest influence in large firms. Trade credit finance has positive relationship with innovation of medium size firms and negative relationship with small and large firms. In reverse, debt finance has negative relationship with innovation of medium size firms and negative relationship with small and large size firms.

These results indicate that the effect of financial sources on firms' innovation varies across firms' size in Ethiopia. Therefore, firms in each size category should rely on finance source that more help them to improve their innovation performance.

Table 4.5: Effects of financial sources on innovation performance based on size group

Variables	Small firms (5 to 19 permanent employees) Marginal effects	Medium firms (20 to 99 permanent employees) Marginal effects	Large firms (more than 99 permanent employees) Marginal effects
Internal finance	0.3059(0.002)	0.4022 (0.003)	0.5036 (0.374)
Bank finance	0.3745 (0.012)	0.4899(0.009)	0.2900 (0.982)
Nonbank finance	0.5356(0.334)	61.37 (0.585)	30.43(0.990)
Trade credit finance	-0.3713 (-0.82)	0.3376 (0.570)	-0.8542 (0.517)
Debt finance	0.0914 (0.463)	-0.0596 (-0.11)	0.0174 (0.927)
Equity finance	0.4634 (0.87)	0.2243 (0.146)	-0.8485 (0.429)

The effect of financial sources on innovation performance based on age group is presented Table 4.6. The results reveal that the effect of internal finance on innovation considerably increases with an increase in the age of the firms. In all age group of the firms internal finance is positively related with innovation. The effect of Bank finance also increase as firm's age increase from young to mature and then decline for old firms. Non-bank finance shows negative relationship with innovation of young firms while positively related to innovation of matured and old aged firms.

Trade credit finance, on the other hand, is negatively related with innovation in young and mature aged firms while it is positively related in old aged firms. Unlike in matured firms, debt finance is positively related to innovation in young and old aged firms. The effect of equity finance decreases with increase in the age of firms and finally negatively related with old aged firms.

Generally, the finding indicates there is a difference in the effect of financial sources on innovation performance of firms in Ethiopia across age. Therefore, firms in each age category should rely on finance source that more help them to improve their innovation performance.

Table 4.6: Effects of financial sources on innovation performance based on age group

Variables	Young firms (1 to 5 years) Marginal effects	Matured firms (6 to 15 years) Marginal effects	Old firms (more than 15 years) Marginal effects
Internal finance	0.2864 (0.687)	0.4916 (0.000)	0.5473 (0.000)
Bank finance	0.4393 (0.149)	0.5367(0.786)	0.3848 (0.953)
Nonbank finance	-5.4364(0.981)	19.935 (0.961)	34.219 (0.979)
Trade credit finance	-1.0919(0.704)	-0.8113 (0.189)	0.5874 (0.246)
Debt finance	0.0488 (0.838)	-0.0596 (-0.11)	0.1733 (0.231)
Equity finance	0.2503 (0.782)	0.2302 (0.081)	-0.2696 (0.677)

4.4. DISCUSSION

In the section below the discussion on results obtained is presented based on the specific objectives of the study. The findings of this study are compared with previous works.

The first objective of the study was to know the sources of finance used by innovative firms in Ethiopia. The results of two samples t-test shows that internal source (retained earnings) is principal source of finance for innovative firms, followed by debt finance (mainly bank finance and then trade credit finance). This finding supports the finding of Zuluaga et al, (2015) and Ayalew et al, (2019). Singh and Maiti(2019) and Blach et al (2020) also agreed innovative firms depend on formal banking source which is supported by this result to some extent. When we compare internal finance with debt finance firms rely more on internal finance than on debt finance which opposes Bartoloni (2010), Ayyagari et al (2011) and Algieri et al (2018). Non-bank finance and Equity finance contributes low amount to finance of innovation and this contradicts Coleman and Robb (2012), Chang and Song (2014), Alinejad et al (2015) and Olexandr M. et al (2015).

The second objective was to exhibit whether there is difference in financing pattern of innovative and non-innovative firms. Two independent samples t-test result supports hypothesis that the financial pattern of innovative firms is basically different from non-innovative firms. This reveals that innovative firms exhibit different financing pattern from non-innovative firms in Ethiopia. This result supports Coleman and Robb (2012), Zuluaga et al, (2015) and Ayalew et al, (2019).

The third objective was to examine the effects of financial structure on innovative performance of firms. According, the probit regression result shows, except nonbank finance and equity finance which are statistically insignificant, other financial sources have significant impact on innovation performance of firms. Hence, overall financial sources have effect on innovation performance of Ethiopian innovative firms and this finding is similar with the findings of Ayalew et al (2019), Geelen et al (2020) and Liu (2020).

Concerning control variables the regression result expresses, except management experience which is statistically insignificant, they have positive and significant relationship with innovation. Specifically, firm size and firm age have higher effect on innovation performance as compared to management experience. The finding of the study regarding size of the firms is consistent with Schumpeter (1942) and Cohen and Klepper (1996). On the other side, the result about effect of firm age supports the finding of Beck et al. (2006), Winker (1999) and Ferrando and Mulier (2013). The management experience of firms has insignificant impact on innovation performance and this finding opposes the finding of Protogerou et al. (2017) which found firms with more experienced managers innovate more.

The fourth and last objective of the study was to examine the effect of financial sources on innovation across heterogeneities. Probit regression results specify that the effect of financial sources on firms' innovation varies across firms' size and firm age in Ethiopia. This finding is comparable with the findings of Ayalew et al (2019).

Based on the above outcomes we can compare findings of the study with hypotheses proposed and it is summarized as follows.

Table 4.7: Comparison of test Result with Expectation

No.	Hypothesis	Statistical Significance	Decision
H1	<i>Innovative firms exhibit different financing patterns from non-innovative firms in Ethiopia.</i>	<i>at 1%</i>	<i>Accepted</i>
H2	<i>Internal finance has significant impact on firm's innovation performance in Ethiopia</i>	<i>at 1%</i>	<i>Accepted</i>
H3	<i>Debt finance has significant impact on firm's innovation performance in Ethiopia</i>	<i>at 1%</i>	<i>Accepted</i>
H3A	<i>Bank finance has significant impact on firm's</i>		<i>Accepted</i>

	<i>innovation performance in Ethiopia</i>	<i>at 1%</i>	
H3B	<i>Non-bank finance has significant impact on firm's innovation performance in Ethiopia</i>	<i>Insignificant</i>	<i>Rejected</i>
H3C	<i>Trade credit finance has significant impact on firm's innovation performance in Ethiopia</i>	<i>at 5%</i>	<i>Accepted</i>
H4	<i>Equity finance has significant impact on firm's innovation performance in Ethiopia</i>	<i>Insignificant</i>	<i>Rejected</i>

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1. CONCLUSIONS

The main purpose of the study was to; 1) investigate whether innovative firms exhibit different financing choice and pattern than their non-innovative counterparts; and 2) examine the effect of firm's financial structure on innovation performance in Ethiopia. Quantitative research approach was used to carry out the study. Secondary data was obtained from World Bank's Enterprises Survey (WBES) which was conducted in 2015 covering a period from 2012 to 2014. From total of 849 companies included in the survey, 799 firms have been selected for this study by exclusion criteria of data in completeness and micro firms (firms with less than five permanent employees).

Empirical literature identified financial sources as an important factor of innovation. Hence, the study examined the effect of these sources of finance and their comparative importance in innovation performance of Ethiopian companies. To achieve these objectives, seven hypotheses were formulated and tested using probit regression which is appropriate model for binary outcome dependent variable. Mann-Whitney test (u-test) and t-test were also used to demonstrate financing pattern and know finance sources of innovative firms. Innovation was dependent variable in the study which takes 1 if firm under consideration is innovative or 0 otherwise. Sources of finance for innovative activities were regarded as independent variables and include internal finance, bank finance, nonbank finance, trade credit finance, debt finance and equity finance.

The results of t-test showed that internal finance is the most substantial source of innovation financing for Ethiopian innovative firms followed by debt finance (principally bank finance). Equity finance is last choice of financing source for innovative firms. This order of financing preference is similar with pecking order of financing hierarchy. The finding further reveals that innovative firms exhibit different financing pattern from non-innovative firms in Ethiopia.

The results from probit regression analysis indicated positively significant relationship between innovation and financial sources except trade finance which have negative relationship. Further, results showed that most sources of finance such as trade finance, bank finance, internal finance

(retained earnings) and deb finance have significant impact on innovative performance of firms in Ethiopia. While nonbank finance and equity finance was found to be insignificant positively in relationship with innovation. The order of effect from higher to lower follows; nonbank finance, bank finance, debt finance, internal finance and lastly equity finance. This indicates the order of significance in driving innovation.

Furthermore, from probit regression analysis across firms' size we can conclude that the effect of financial structure on firm's innovation performance in Ethiopia varies both in direction and magnitude. This provides information regarding financial sources separately for each category of firm's size. The same result was found considering the age category of firms under consideration. Hence, it can be concluded that financial sources have difference in effect on innovation performance of firms in Ethiopia both in direction and magnitude.

5.2. RECOMMENDATIONS

Due to the fact that managers usually desire their firms to become innovative, which in turn is required as a country, it is essential to know substantial factors that affect firms' performance to innovate specifically financial sources. The results of this study have provided insight into the financial sources that have an important influence on innovation performance of Ethiopian companies. It further showed the finance source preference of innovative firms which is not similar with order of effect on the probability to innovate. For example, bank finance has higher effect on the probability to innovate than internal finance although it is least preferred financial instrument. Hence, management can improve the innovation performance of their company by reducing their dependency on financial sources which have lower effect on innovation.

The conclusion shows that an external source of finance, predominantly nonbank finance, is a significant driver of innovation. Therefore, it is essential to consider the type of financial structure that supports the innovation performance. Bank finance follows nonbank finance to significantly drive innovation performance and hence, the regulation of financial systems, particularly banking sectors must go hand in hand with policies that are aimed at innovation and industrial development. As financial system and banking industries are underdeveloped in developing countries particularly in Ethiopia it requires reform to reduce the adverse effects of financial system on innovation performance of firms which in turn affect productivity and economic growth.

The study further reveals that debt source of finance, mainly nonbank finance followed by bank finance, is a substantial driver of innovation in different groups of firms' size and age. Hence, management need to consider the type of financial structure that is better for its firm's innovation performance. Additionally, the difficulty in financing innovation using the above sources is particularly severe for small or young firms in the region. Therefore, policy makers should consider these firms in helping to facilitate access to external financing for a broad range of firms.

Further studies suggestion

To enhance the findings of this study and come up with strong conclusion, future studies are suggested by considering the following points.

The study focused on cross sectional data of 2015 which is not recent data. Hence, it is better if future studies use panel data, especially including most recent data if available. Besides, variables than are controlled in his study were limited. Therefore, it would be interesting to conduct future by controlling additional firm related factors. For instance ownership status, research and development, export or import nature and gender of top managers. Finally, it is suggested to test heterogeneities effect across industry.

References

- Aghion, P., & Howitt, P. (2005). Growth with quality improving innovations: an integrated framework. *Handbook of economic growth*. Amsterdam, Elsevier.
- Aghion, P., & Howitt, P. (2009). The economics of growth. Cambridge, Massachusetts. MIT press.
- Aghion, P., Stephen, B., Alexander, K., & Ioana, M. (2004). Technology and financial structure: are innovative firms different? *Journal of the European Economic Association*, 2(3), 277-288.
- Algieri, B., Aquino, A., & Succurro, M. (2018). The Impact of Capital Structure on Firms' Innovative Performance. Department of Economics, Statistics and Finance, University of Calabria.
- Alinejad, M., Balaguer, A., & Hendrickson, L. (2015). Financing innovative entrepreneurship. Australian government Department of Industry, Innovation and Science.
- Ayyagari, M., Kunt, A. D., & Maksimovic, V. (2011). Firm Innovation in Emerging Markets: The Role of Finance, Governance, and Competition. *The Journal of Financial and Quantitative Analysis*, 46(6), 1545-1580.
- Ayalew, M.M. & Xianzhi, Z. (2018). Bank competition and access to Finance: evidence from African countries. *Journal of industry, competition and trade*, 1-30.
- Ayalew, M.M., Xianzhi, Z., & Hailu, D. H. (2019). The finance of innovation in Africa. *European Journal of Innovation Management*, <https://doi.org/10.1108/EJIM-11-2018-0242>.
- Barasa, L., Vermeulen, P., Knobens, J., Kinyanjui, B., & Kimuyu, P. (2018). Innovation inputs and efficiency: manufacturing firms in Sub-Saharan Africa. *European Journal of Innovation Management*, 22(1), 59-83.
- Bartoloni, E. (2013). Capital structure and innovation: causality and determinants. 40(1), 111-151.
- Bartoloni, E. (2010). Capital structure and innovation: causality and determinants. Opening up Innovation: Strategy, Organization and Technology, Imperial College London Business School.
- Blach, J., Kosmala, M. W., & Siok, J. T. (2020). Innovation in SMEs and Financing Mix. *Journal of Risk and Financial Management*, 13, 206.
- Blach, J. (2011). Financial innovations and their role in the modern financial system: identification and systematization of the problem. *University of Information Technology and Management*, 7(3), 15-26.
- Bonte, W., & Nielen, S. (2011). Product Innovation, Credit Constraints, and Trade Credit: Evidence from across country Study. *Managerial and Decision Economics*, Wiley, 32(6), 413-424. <https://www.jstor.org/stable/23012471>
- Brooks, C. (2008). *Introductory Econometrics for Finance* (2nd ed.). New York, Cambridge University Press.

- Brooks, C. (2014). *Introductory Econometrics for Finance* (3rd ed.). New York, Cambridge University Press.
- Coleman, S., & Robb, A. (2012). Capital structure theory and new technology firms: is there a match? *Management Research Review*, 35(2), 106 – 120.
- Cooper & Schendler, C.D. (2003). *Business Research Methods* (8th ed.). New York: McGrawHill/Irwin.
- Crepon, B., & N, Iung. (1999). Innovation, employ et performances. INSEE, document de travail G 9904.
- C. R. Kothari. (2003). *Research Methodology: Methods and Techniques* (2nd ed.). New Delhi: New Age International Publishers.
- Creswell, J. W. (2003). *Research design: qualitative, quantitative and mixed methods approach* (2nd ed.). Sage Publications, California.
- Creswell, J.W. (2009). *Research design: qualitative, quantitative and mixed methods approach* (3rd ed.). Sage publications, United States of America.
- Dabic, M., Cvijanovic, V., & Gonzalez, L. M. (2011). Keynesian, Post-Keynesian versus Schumpeterian, Neo-Schumpeterian. An integrated approach to the innovation theory. *Management Decision*, 49(2), 195-207.
- Geelen, T., Hajda, J., & Morellec, E. (2020). Debt, Innovation, and Growth. HEC Lausanne and Swiss Finance Institute, Switzerland.
- Geronikolaou, G., and Papachristou, G. (2008). Venture Capital and Innovation in Europe. Working Paper, University of Thessaloniki, <http://ssrn.com/abstract=1309186>.
- Grudzewski, W. M., Hejduk, I. K., Sankowska, A., Wańtuchowicz, M. (2010). Sustainability w biznesie czyli przedsiębiorstw przyszłości. Zmiany paradygmatów i koncepcji zarządzania. Warszawa: Poltext.
- Gujarati, D. N. (2004). *Basic Econometrics* (4th ed.). McGraw-Hill Companies.
- Hook, L. S., Lee, W. C., & Singh, N. (2018). Revisiting the finance-innovation nexus: Evidence from a non-linear approach. *Journal of Innovation & Knowledge*, 3(3), 143-153.
- Hall, B.H. (2002). The financing of research and development. *Oxford Review of Economic Policy* 18, 35-51.
- InfoDev. (2013). Financing the Next Wave of African Innovation. Addressing Critical Funding Gaps for East African Technology Entrepreneurs.
- Jensen, M., & Meckling, W. (1976). Theory of the firm: managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, 3(4), 305-360.
- King, R., & R. Levine (1993). Finance, entrepreneurship, and growth: Theory and evidence. *Journal of Monetary Economics*, 32, 514-542.

- Leitner, S. M., & Stehrer, R. (2015). What Determines SMEs' Funding Obstacles to Bank Loans and Trade Credits? The Vienna Institute for International Economic Studies, Vienna, No. 114.
- Levine, Ross, (2005). Finance and growth: Theory and evidence, in P. Aghion & S. Durlauf (Eds.), *Handbook of Economic Growth*, Amsterdam, North-Holland Elsevier Publishers.
- Liu, X. (2020). The Impact of Financial Structure on Technical Innovation Research. *Journal of Finance and Accounting*, School of Economics, Henan University, China, 11 (20).
- Mann, H. B., & Whitney, D. R. (1947). On a test of whether one of 2 random variables is stochastically larger than the other. *Annals of Mathematical Statistics*, 18, 50- 60.
- Mugenda, O., & Mugenda, A. (2003). *Research Methods: Quantitative and Qualitative Approaches*. Nairobi: Acts Press.
- Mina & Lahr. (2015). the pecking order of innovation finance. Paper to be presented at DRUID15, Rome.
- Modigliani, F., & Miller, M.H. (1958). The cost of capital, corporation finance and the theory of investment. *The American Economic Review*, 48, 261-297.
- Myers, S.C. (1984). The capital structure puzzle. *The journal of finance*, 39(3), 574-592.
- OECD (2015). *Frascati Manual: Guidelines for Collecting and Reporting Data on Research and Experimental Development, The Measurement of Scientific, Technological and Innovation Activities*, Paris, OECD publishing.
- Olexandr, M. D., Ye, P. A., & Gernego I. O. (2015). Participation of non-banking financial organizations in crediting innovation projects, 1, 272-277.
- Schumpeter, J.A. (1934). *The Theory of Economic Development*. Cambridge, Harvard University Press.
- Schumpeter, J.A. (1942), *Socialism, Capitalism and Democracy*, Harper and Brothers, New York, NY.
- Schumpeter, J.A. (1961). *The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle*. New York, OUP.
- Shelagh, H., Xiaoqing, M. F., & Xiaolan, F. (2008). *Financial Innovation in the UK*. Faculty of Finance Working Paper No 4.
- Singh, P. & Maiti, D. (2019). Sources of Finance, Innovation and Exportability in Asia: Cross-country Evidences. *Journal of Asian Economic Integration*, ASEAN-India Centre, India, 1(1), 73-96.
- Ueda, M., & Hirukawa, M. (2003). *Venture Capital and productivity*. University of Wisconsin, USA.
- United Nations (2020). *Science, Technology and Innovation: Policy Review of Ethiopia*.
- Zuluaga, B. B., Godoy, J. A. R., & Cifuentes, C. I. A. (2015). Analysis of the relation between entrepreneurial innovation and finance in Colombia. *Cuadernos de Administración*, 28 (50).

APPENDICES

Appendix A:summary statistics

```
. summarize tpp intfin banfin nonbanfin tradcref debfin equifin size age exp_mgmtb7
```

Variable	Obs	Mean	Std. Dev.	Min	Max
tpp	779	.4428755	.4970452	0	1
intfin	779	.5723363	.2759744	0	1
banfin	779	.0971438	.1886233	0	1
nonbanfin	779	.0022829	.0271106	0	.5
tradcref	779	.0141271	.0611123	0	.5
debfin	779	.1135538	.1964058	0	1.005
equifin	779	.0061617	.0494075	0	.5
size	779	99.29268	386.7321	5	7600
age	779	14.73042	13.09189	1	90
exp_mgmtb7	779	15.94608	10.64946	2	60

Appendix B: correlation result

```
. correlate intfin banfin nonbanfin tradcref debfin equifin logize logage logexp
(obs=779)
```

	intfin	banfin	nonban~n	tradcref	debfin	equifin	logize	logage	logexp
intfin	1.0000								
banfin	-0.4306	1.0000							
nonbanfin	-0.0569	0.0006	1.0000						
tradcref	-0.1916	-0.0617	-0.0175	1.0000					
debfin	-0.4810	0.9413	0.1332	0.2495	1.0000				
equifin	-0.0487	0.0102	-0.0079	-0.0060	0.0068	1.0000			
logize	0.0780	0.1555	-0.0383	-0.0629	0.1245	0.0758	1.0000		
logage	-0.0088	0.1269	-0.0603	-0.0039	0.1123	-0.0220	0.3814	1.0000	
logexp	-0.0546	0.0897	-0.0653	0.0330	0.0874	-0.0697	0.1404	0.4609	1.0000

Appendix C: Two independent samples u-test (Mann-Whitney test).

```
. ranksum intfin, by(tpp)
```

Two-sample Wilcoxon rank-sum (Mann-Whitney) test

tpp	obs	rank sum	expected
0	434	155558.5	169260
1	345	148251.5	134550
combined	779	303810	303810

unadjusted variance 9732450.00

adjustment for ties -766971.27

adjusted variance 8965478.73

Ho: intfin(tpp==0) = intfin(tpp==1)

z = -4.576

Prob > |z| = 0.0000

Two-sample Wilcoxon rank-sum (Mann-Whitney) test

tpp	obs	rank sum	expected
0	434	158466	169260
1	345	145344	134550
combined	779	303810	303810

unadjusted variance 9732450.00

adjustment for ties -3.21e+06

adjusted variance 6523311.33

Ho: banfin(tpp==0) = banfin(tpp==1)

z = -4.226

Prob > |z| = 0.0000

Two-sample Wilcoxon rank-sum (Mann-Whitney) test

tpp	obs	rank sum	expected
0	434	158137.5	169260
1	345	145672.5	134550
combined	779	303810	303810

unadjusted variance 9732450.00

adjustment for ties -3.12e+06

adjusted variance 6611868.31

Ho: nonban~n(tpp==0) = nonban~n(tpp==1)

z = -4.326

Prob > |z| = 0.0000

Two-sample Wilcoxon rank-sum (Mann-Whitney) test

tpp	obs	rank sum	expected
0	434	172164	169260
1	345	131646	134550
combined	779	303810	303810

unadjusted variance 9732450.00
adjustment for ties -7.81e+06

adjusted variance 1919250.20

Ho: tradcref(tpp==0) = tradcref(tpp==1)
z = 2.096
Prob > |z| = 0.0361

Two-sample Wilcoxon rank-sum (Mann-Whitney) test

tpp	obs	rank sum	expected
0	434	160435.5	169260
1	345	143374.5	134550
combined	779	303810	303810

unadjusted variance 9732450.00
adjustment for ties -2.42e+06

adjusted variance 7307567.48

Ho: debfin(tpp==0) = debfin(tpp==1)
z = -3.264
Prob > |z| = 0.0011

Two-sample Wilcoxon rank-sum (Mann-Whitney) test

tpp	obs	rank sum	expected
0	434	169334	169260
1	345	134476	134550
combined	779	303810	303810

unadjusted variance 9732450.00
adjustment for ties -9.22e+06

adjusted variance 515350.67

Ho: equifin(tpp==0) = equifin(tpp==1)
z = 0.103
Prob > |z| = 0.9179

Appendix D: probitregression result and marginal effects.

```
. probit tpp intfin banfin nonbanfin tradcref equifin logize logage logexp

Iteration 0:    log likelihood = -534.86645
Iteration 1:    log likelihood = -477.35941
Iteration 2:    log likelihood = -477.28804
Iteration 3:    log likelihood = -477.28804

Probit regression                               Number of obs       =           779
                                                LR chi2(8)          =           115.16
                                                Prob > chi2         =           0.0000
Log likelihood = -477.28804                    Pseudo R2          =           0.1077
```

tpp	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
intfin	1.093038	.1965263	5.56	0.000	.7078537	1.478223
banfin	1.212781	.2852854	4.25	0.000	.6536317	1.77193
nonbanfin	1.591605	1.691979	0.94	0.347	-1.724612	4.907823
tradcref	-.3021175	.8515219	-0.35	0.723	-1.97107	1.366835
equifin	-.0442883	.9254169	-0.05	0.962	-1.858072	1.769495
logize	.5225719	.0831733	6.28	0.000	.3595553	.6855885
logage	.2700146	.1695253	1.59	0.111	-.0622489	.602278
logexp	-.0918747	.1653141	-0.56	0.578	-.4158843	.232135
_cons	-1.812464	.2338366	-7.75	0.000	-2.270775	-1.354152

Marginal effects

```
. mfx

Marginal effects after probit
y = Pr(tpp) (predict)
= .43781662
```

variable	dy/dx	Std. Err.	z	P> z	[95% C.I.]		X
intfin	.4307512	.07745	5.56	0.000	.278943	.58256	.572336
banfin	.4779401	.11244	4.25	0.000	.257553	.698327	.097144
nonban~n	.6272296	.66677	0.94	0.347	-.679616	1.93407	.002283
tradcref	-.1190603	.33555	-0.35	0.723	-.776732	.538612	.014127
equifin	-.0174534	.3647	-0.05	0.962	-.732244	.697337	.006162
logize	.2059384	.0328	6.28	0.000	.141653	.270224	1.40497
logage	.106409	.0668	1.59	0.111	-.024524	.237342	1.03632
logexp	-.0362065	.06515	-0.56	0.578	-.163898	.091485	1.0945

Appendix E: probit regression result and marginal effects across firm size and age.

. by agecateg, sort : probit tpp intfin banfin nonbanfin tradcref equifin logize

-> agecateg = Matured

```
Iteration 0: log likelihood = -260.25821
Iteration 1: log likelihood = -227.82722
Iteration 2: log likelihood = -227.41033
Iteration 3: log likelihood = -226.98319
Iteration 4: log likelihood = -226.94595
Iteration 5: log likelihood = -226.94049
Iteration 6: log likelihood = -226.93951
Iteration 7: log likelihood = -226.93932
Iteration 8: log likelihood = -226.93929
Iteration 9: log likelihood = -226.93929
```

```
Probit regression                               Number of obs   =           379
                                                LR chi2(8)      =           66.64
                                                Prob > chi2     =           0.0000
Log likelihood = -226.93929                    Pseudo R2      =           0.1280
```

tpp	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
intfin	1.046438	.2837817	3.69	0.000	.4902365 1.60264
banfin	.9358809	10.63226	0.09	0.930	-19.90296 21.77472
nonbanfin	53.4936	2124.843	0.03	0.980	-4111.121 4218.108
tradcref	-1.252573	1.507834	-0.83	0.406	-4.207873 1.702727
equifin	.2730673	1.410105	0.19	0.846	-2.490687 3.036821
logize	.6508064	.1291717	5.04	0.000	.3976346 .9039783
logage	.7874674	.5808936	1.36	0.175	-.3510632 1.925998
logexp	.0588186	.2623455	0.22	0.823	-.4553692 .5730064
_cons	-2.556429	.6094956	-4.19	0.000	-3.751018 -1.361839

Note: 0 failures and 1 success completely determined.

-> agecateg = Old

```
Iteration 0: log likelihood = -183.63683
Iteration 1: log likelihood = -166.92752
Iteration 2: log likelihood = -166.8086
Iteration 3: log likelihood = -166.79312
Iteration 4: log likelihood = -166.79141
Iteration 5: log likelihood = -166.79111
Iteration 6: log likelihood = -166.79105
Iteration 7: log likelihood = -166.79104
```

```
Probit regression                               Number of obs   =           265
                                                LR chi2(8)      =           33.69
                                                Prob > chi2     =           0.0000
Log likelihood = -166.79104                    Pseudo R2      =           0.0917
```

tpp	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
intfin	1.20638	.3363825	3.59	0.000	.5470823 1.865677
banfin	.7943153	16.49352	0.05	0.962	-31.53239 33.12102
nonbanfin	78.51519	3297.428	0.02	0.981	-6384.324 6541.354
tradcref	1.141461	1.257945	0.91	0.364	-1.324066 3.606989
equifin	-1.313175	1.594064	-0.82	0.410	-4.437484 1.811133
logize	.39939	.1264378	3.16	0.002	.1515765 .6472035
logage	.1999569	.4574371	0.44	0.662	-.6966034 1.096517
logexp	-.1551471	.2739769	-0.57	0.571	-.6921319 .3818378
_cons	-1.57117	.71368	-2.20	0.028	-2.969957 -.1723832

-> agecateg = young

```
Iteration 0: log likelihood = -83.698218
Iteration 1: log likelihood = -74.305312
Iteration 2: log likelihood = -74.074851
Iteration 3: log likelihood = -74.027133
Iteration 4: log likelihood = -74.019036
Iteration 5: log likelihood = -74.017954
Iteration 6: log likelihood = -74.017809
Iteration 7: log likelihood = -74.017782
Iteration 8: log likelihood = -74.017776
```

```
Probit regression                               Number of obs   =           135
                                                LR chi2(8)      =           19.36
                                                Prob > chi2     =           0.0130
Log likelihood = -74.017776                    Pseudo R2      =           0.1157
```

tpp	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
intfin	.9655735	.5301197	1.82	0.069	-.073442 2.004589
banfin	1.461446	3.637535	0.40	0.688	-5.667991 8.590883
nonbanfin	-16.60096	707.7942	-0.02	0.981	-1403.852 1370.65
tradcref	-2.358649	3.353003	-0.70	0.482	-8.930414 4.213116
equifin	2.243988	2.087146	1.08	0.282	-1.846744 6.334719
logize	.5419773	.2540064	2.13	0.033	.0441339 1.039821
logage	1.505036	.928026	1.62	0.105	-.3138619 3.323933
logexp	-.7255113	.4059865	-1.79	0.074	-1.52123 .0702077
_cons	-1.941804	.7500533	-2.59	0.010	-3.411881 -.4717265

. by sizecateg, sort : probit tpp intfin banfin nonbanfin tradcref equifin logi:

```

-> sizecateg = large

Iteration 0: log likelihood = -100.79871
Iteration 1: log likelihood = -92.286871
Iteration 2: log likelihood = -92.193131
Iteration 3: log likelihood = -92.181465
Iteration 4: log likelihood = -92.180097
Iteration 5: log likelihood = -92.179853
Iteration 6: log likelihood = -92.179806
Iteration 7: log likelihood = -92.179797
Iteration 8: log likelihood = -92.179794

Probit regression                                     Number of obs = 158
LR chi2(8) = 17.24
Prob > chi2 = 0.0277
Pseudo R2 = 0.0855

Log likelihood = -92.179794

```

tpp	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
intfin	1.41492	.4366865	3.24	0.001	.5590301	2.27081
banfin	.8149478	.3579682	0.02	0.982	-69.34554	70.97543
nonbanfin	85.51707	7158.226	0.01	0.990	-13944.35	14115.38
tradcref	-2.400046	2.63273	-0.91	0.362	-7.560101	2.760009
equifin	-2.38394	1.555841	-1.53	0.125	-5.433332	.6654517
logize	.1769872	.3263971	0.54	0.588	-.4627394	.8167138
logage	-.0953569	.3474196	-0.27	0.784	-.7762869	.585573
logexp	-.2293605	.3576503	-0.64	0.521	-.9303422	.4716212
_cons	-.572898	.9676167	-0.59	0.554	-2.469392	1.323596

```

-> sizecateg = medium

note: equifin != 0 predicts success perfectly
      equifin dropped and 2 obs not used

note: nonbanfin omitted because of collinearity
Iteration 0: log likelihood = -158.1694
Iteration 1: log likelihood = -150.44429
Iteration 2: log likelihood = -150.41764
Iteration 3: log likelihood = -150.41764

Probit regression                                     Number of obs = 230
LR chi2(6) = 15.50
Prob > chi2 = 0.0167
Pseudo R2 = 0.0490

Log likelihood = -150.41764

```

tpp	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
intfin	1.018342	.3463184	2.94	0.003	.3395706	1.697114
banfin	1.240242	.4779132	2.60	0.009	.3035491	2.176934
nonbanfin	0	(omitted)				
tradcref	.8546681	1.506189	0.57	0.570	-2.097408	3.806744
equifin	0	(omitted)				
logize	-.2726844	.4331399	-0.63	0.529	-1.121623	.5762543
logage	.5801512	.3188891	1.82	0.069	-.0448599	1.205162
logexp	-.5235093	.3046228	-1.72	0.086	-1.120559	.0735405
_cons	-.2200562	.7733767	-0.28	0.776	-1.735847	1.295734

```

-> sizecateg = small

Iteration 0: log likelihood = -232.59584
Iteration 1: log likelihood = -222.18798
Iteration 2: log likelihood = -222.10551
Iteration 3: log likelihood = -222.10529
Iteration 4: log likelihood = -222.10529

Probit regression                                     Number of obs = 389
LR chi2(8) = 20.98
Prob > chi2 = 0.0072
Pseudo R2 = 0.0451

Log likelihood = -222.10529

```

tpp	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
intfin	.9613573	.2973793	3.23	0.001	.3785046	1.54421
banfin	1.063309	.4471436	2.38	0.017	.186924	1.939695
nonbanfin	1.765152	1.736968	1.02	0.310	-1.639243	5.169548
tradcref	-1.011908	1.372599	-0.74	0.461	-3.702153	1.678337
equifin	1.648264	1.611233	1.02	0.306	-1.509695	4.806223
logize	.6410173	.4020467	1.59	0.111	-.1469798	1.429014
logage	.2968854	.2688365	1.10	0.269	-.2300245	.8237953
logexp	.0359128	.2607983	0.14	0.890	-.4752425	.5470681
_cons	-2.079235	.4676239	-4.45	0.000	-2.995761	-1.162709

Appendix F: Variance Inflation Factors.

```
. estat vif
```

Variable	VIF	1/VIF
debfin	11.05	0.090524
banfin	10.35	0.096650
logage	1.46	0.682865
intfin	1.35	0.741217
logexp	1.29	0.777867
logize	1.23	0.813258
nonbanfin	1.19	0.839049
equifin	1.02	0.982556
Mean VIF	3.62	