UNIVERSITY OF CAPE COAST

EFFECTS OF FIRM SIZE ON FIRM PERFORMANCE OF MANUFACTURING FIRMS IN GHANA

DENNIS OBODAI BATCHA

2016

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BY

DENNIS OBODAI BATCHA

Thesis submitted to the Department of Economics of the Faculty of Social Sciences, College of Humanities and Legal Studies, University of Cape Coast, in partial fulfilment of the requirements for the award of Master of Philosophy Degree in Economics

DECEMBER 2016

DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature: ....Date: ....

Name: Dennis ObodaiBatcha

Supervisors' Declaration

We hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Principal Supervisor's Signature:.................................... Date:.........................

Name: Prof. I. K. Acheampong

Co-Supervisor's Signature: .... Date:.........................

Name: Dr. Peter Aglobitse

ABSTRACT

The main objective of the study was to determine the effects of firm size on performance of manufacturing firms in Ghana. The study employed a quantitative research design under the positivist philosophy to address the research objectives.A panel on about 1,203 firms were involved based on the Enterprise Survey for Ghana data set for the periods 2007 and 2013. Multiple measures were adopted for firm size but just one measure was adopted for firm performance. Firm size was proxied by number of employees and real value of total assets while firm performance was proxied by total factor productivity. The Fixed Effectsand Random Effects estimatorswereapplied to the static model.The results indicated that firm size, proxied by the value of assets, has negative effects on firm performance. It was also found that firm size, proxied by total number of employees, has positive effects on firm performance except for the case of small manufacturing firms.

KEY WORDS

Firm Size

Firm Performance

Total Assets

Total Number of Employees

Total Factor Productivity (TFP)

Static Panel Estimation

ACKNOWLEDGMENTS

I am grateful to my Principal Supervisor,Prof. I. K. Acheampong and Co-Supervisor,Dr.PeterAglobitse for their directions and support thatwhich helped to shape this work. I would also like to express my sincere appreciation to the management and staff of African Economic Research Consortium (AERC) and the Economics Department of the University of Cape Coast for a well packaged programme which made it possible for me to face the numerous challenges of writing a thesis.

Anotherthanks go to Mr Abass Adams and Mr Fredrick Nyenzu for theircontributions, encouragement and advice in pursuing this programme and throughout this study. Final thanks go to my friends especially my colleagues who pursued this programme together with me, thank you for the support.

DEDICATION

I dedicate this work to my family especially to my mum, Margaret Amuzu.

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LIST OF ACRONYMS

2SLS	Two Stage Least Squares
ABL	Accra Brewery Limited
AERC	African Economic Research Consortium
ANCOVA	Analysis of Covariance
EAs	Enumeration Areas
FE	Fixed Effects
GBL	Ghana Brewery Limited
GDP	Gross Domestic Product
GLS	Generalized Least Squares
GMM	Generalised Method of Moments
HS	Hypothetical Syllogism
LM	Lagrange Multiplier
LSDV	Least Squares with Dummy Variable
MFP	Multi-Factor Productivity
OLS	Ordinary Least Squares
R & D	Research and Development
RE	Random Effects

RESET Test	Regression Equation Specification Error Test
RMSE	Root Mean Square Error
ROA	Return on Assets
ROE	Return on Equity
SSUs	Secondary Sampling Units
TFP	Total Factor Productivity
UK	United Kingdom
UNECA	United Nations Economic Commission for Africa
US	United States
VIF	Variance Inflation Factor
WG	Within-group

CHAPTER ONE

INTRODUCTION

Background to the Study

African governments have continuallystressed the need for industrializationfor the purposes of achieving economic transformation, modernization and self-reliance. As the United Nations Economic Commission for Africa (UNECA,1990) has commented that industrial development has, since the 1960s, been seen as “the key in diversifying economies away from the past pattern of heavy dependence on imported manufactures and export of primary commodities, as well as in achieving rapid growth and modernization.”(Baah-Nuakoh & Teal, 1993, p. 4)

According toBaah-Nuakoh and Teal(1993), the Ghanaian economy has experienced one of the most comprehensive programmes of structural adjustment in Africa since 1983.The impact of such programmes on the manufacturing sector has high policy importance. Ghana’s most important manufacturing industries include Aluminium smelting, Agro-food processing, Oil refining and Cement production. Other manufacturing activities include the production of Beverages, Textiles, Apparel, Glass, Paints, Plastics, Chemicals and Pharmaceuticals, and the processing of Metals and Wood products.

The size of a firm has a lot to do with the amount and variety of production capacity and ability a firm possesses or the amount and variety of services a firm can provide concurrently to its customers. The size of a firm is a primary factor in determining the performance of a firm due to the concept known as economies of scale which can be found in the traditional neo-classical view of the firm. Simple firm performance such as profit optimizationand efficiency under the Neo-Classical Theory of the firm suggests that there is an output level that maximizes profit or firm efficiency beyond which expansion may be sub-optimal. The immediate implication of optimization process is that firm performance should be related to firm size in both the short and long run. In the short run, output increases in response to labour increase (return to variable factor) and hence, variations in firm size shall be captured as the changes in number of employees while variations in size shall reflect changes in both number of employees and capital (return to scale) in the long run. (Hall & Weiss, 1967) Contrary to this, alternative theories of the firm argue that larger firms come under the control of managers pursuing self-interest goals and therefore, managerial utility maximization function may substitute firm efficiency and profit maximization of the firms' objective function as seen in the works of Jensen and Murphy (1990) and Pi andTimme(1993).One of the early thrusts in the empirical study of the relationship between firm size and firm performance, as already mentioned, is economies of scale. This theme is reflected in the works of Stekler(1975),Hall and Weiss (1967) and Scherer (1973). A second theme in the literature is that of market imperfections. This view has been propounded by Baumol(1967) and Steindl (1964) and is reflected in the empirical study of Hall and Weiss (1967). A more recent theme in the literature has introduced the concept of strategic groups and drawn implications from that concept for the firm-size profitability relationship. The strategic groups concept, as reflected in the works of Caves and Porter (1977), Beehrand Newman(1978) and Porter (1979), suggests that the relationship between firm size and profitability is industry specific, depending upon the industry's network of mobility barriers, group specific sources of market power and other variables common to firms in the same strategic group. The final theme in the literature talks about the relative importance of concentration and market share in the structure-profit relationship. Gale and Branch (1982) and Ravenscraft(1983), following the earlier work byShepherd(1972), have approached the firm size issue indirectly by considering the relative effects of market share and concentration on profits.

Previous studies have empirically examined the question from various perspectives; however, differences, for example, in the theoretical stance and methodologies applied, make direct comparisons of the results of these studies difficult. These studies are mainly based on small samples of large manufacturing firms. Findings of previous studies are mixed regarding this possibility. Yazdanfar(2013), Fukao, Ito, Kwon, and Takizawa (2008),Nunes, Serrasqueiro, andSequeira(2009), Zaid, Ibrahim, andZulqernain(2014), Pratheepan(2014), and Stierwald(2010) find that firm size significantly and positively influences profitability. Jensen and Murphy(1990), Pi andTimme(1993), Dhawan(2001), and Goddard, Tavakoli, and Wilson(2005)however predict an inverse relationship between firm size and profitability. A recent study by Garicano, Lelarge, and Van Reenen(2013) postulates that policies must target firms of given size based on performance not the mere fact that such firms are small and would want to expand. RestucciaandRogerson(2008) argue further that more efficient firms may have "too little" output or employment allocated to them due to various distortions in their economies. This creates a vacuum to explore as far as the size performance relationship is concerned and this may largely owe to differences in results due tovariable measurement problems as varied measures of firm performance have been used. Since the work of Solow (1956) the development and growth literature has noted that under standard neo-classical assumptions, the observed differences in human and physical capital per worker cannot account for differences in output per worker across firms. This implies that a theory that measures the portion of output not explained by the amount of inputs used or observable units in production is essential in understanding why firms of various sizes are characterised by very different levels of performance.

Problem Statement

There have been a number of studies on the impact of firm specific characteristics on firm performance (Hall & Weiss, 1967; Goddard et al. 2005; Yazdanfar, 2012) but the measure of firm performance has not been reflective enough of firm productivity. In other words, earlier studies have not paid special attention to the effects of firm size on firm performance measured as firm productivity but have focused on profitability measures, especially in the manufacturing sub-sector of Ghana (Awunyo-Vitor& Badu, 2012; Abor, 2008) . This means that the inadequate nature of firm performance measured as firm productivity is not only on a global scale but is evident in the Ghanaian context as well.

In the firm performance literature, performance is usually captured in terms of efficiency, productivity or both. Financial performance measures like return on assets, profitability and the likes are considered a measure of firm performance and are believed to reflect both efficiency and productivity. According to Santucci, Cardone, and Mostafa(2013) cited in Adjotor(2013), profitability should reflect the best way of measuring firm performance but this is not entirely true mainly because profits are mostly influenced by external factors including shift in demand or inflation and so forth. This means that profit can increase and decrease but management would be unable to contain these fluctuations since causes are exogenous. This makes profitability an insufficient measure of the performance of firms. Productivity, on the other hand, reflects the effort of firm management in enhancing profits and in ensuring competition through the improvement in firm efficiency. Productivity is, hence, a preferable measure of performance in organizations or firms as well as nations.

It is important to go for aproductivity concept that is invariant to theintensity of use of observable factor inputs.Thus, using Total Factor Productivity (TFP) satisfies this need. Comin(2006) explains TFP to be the portion of output not explained by the amount of inputs used in production.Saliola and Seker(2011) assert that TFP is a crucial measure of efficiency and thus an important indicator for policymakers. Total Factor Productivity (TFP) reflects a more suitable economic measure for firm performance and this is scarce in most size-performance papers.

The above implies that despite the volume of work done on the firm size-performance relationship in the advanced and other developing countries, there is still the need for attention to be given to the issue in a developing country like Ghana. It is therefore a necessary option to analyse the effects of firm size on the performance of manufacturing firms in Ghana.

Objectives of the Study

The main objective of this study is to analyse the effects of firm size on the performance of manufacturing firms in Ghana. The specific objectives are to:

1. Determine the differences inTFP acrossfirm size categories.
2. Evaluate the effects of number of employees on TFP.
3. Assess the effects of total assets on TFP.

Hypothesis

For the study, the following hypotheses are formulated.

1. H0: There are no differences in TFPin the firm size categories.

   H1: There aredifferences in TFP in the firm size categories.
2. H0: There is no effect ofnumber of employees on TFP.

   H1: There is an effect of number of employees on TFP.
3. H0: There is no effect of total assets on TFP.

   H1: There is an effect of total assets on TFP.

Significance of the Study

The study explored the status of performance of manufacturing firms in Ghana. The results shall inform managers on the best assessment criteria for performance in relation to other studies that have used accounting profit. The outcome shall also inform policy decision on whether to seek "many small firms" or "few large ones". Also, the results would aid investors in determining where to invest.

Also, the outcome of the study shall inform stakeholders on the adoption of appropriate incentive scheme for management. According to Hogan and Lewis(2005), adopting a compensation package based on economic profit usually leads to value creation. If firms are earning negative economic profit, the best will be to adopt an economic compensation scheme which shall enhance value creation.

Finally, the outcome of the study would advise policy makers in revising their notes on whether to target size or stage of development in their support programs.

Scope of the Study

The study seeks to determine the effect of firm size on firm performance of the manufacturing firms in Ghana. The decision to use TFPas the measure of firm performance is due to a prolonged debate on which performance measure is most appropriate.

The Enterprise Surveyfor Ghana data was employed for the study. The data set is a two-year panel of about 1,203observationsforthe years 2007 and2013.The data set serves the interest of the study well because it considers firms of all size categories. The measures of firm size employed which are total assets and total number of employees are all found in the data. Other firm specific characteristics such as labour productivity and skill intensity were also found in the data, hence making usage of the data most appropriate to satisfy the research objectives.

Organization of the Study

The study is organised into five main chapters with each chapter further divided into sections and sub-sections. The first chapter is the introductory chapter whereas thesecond chapter reviews both the theoretical and empirical literature on firm size, life cycle, managerial theories of the firm and total factor productivity.

Chapter Three focuses on the specification of the empirical model and estimation technique employed in conducting the study as well asthe descriptions of data employed for the study. Chapter Four presents the empirical results and discussion of the study. The final chapter presents the summary of findings, conclusions, recommendations of the study, limitations and directions for future studies.

CHAPTER TWO

LITERATURE REVIEW

Introduction

This chapter reviews the theoretical and empirical literature that exist and relate to the study. The chapter begins with a brief overview of the manufacturing industry of Ghana followed by the rationale for the use of Total Factor Productivity as a measure for firm performance and review of models for performance. The remaining section includesthe theoretical literature which is meant to explain the meaning of firm size and the position of the theoretical framework of the study. The empirical review deals with the relationship between firm size and performance with much detail. A special review on the situation in developing countries is cut out to draw the difference between the expected relationship in Ghana and other advanced countries like USA and UK where a very large literature exists on the size-performance relationship.

Overview of the Manufacturing Sector in Ghana

According to Baah-Nuakohand Teal(1993), the manufacturing sector in Ghanaplays asignificant role in the productive capacity of the country. Its main industries were established in the immediate post-colonial period in an attempt to diversify the economy from the traditional primary sectors. Though not strong as it should be, the manufacturing sector continues to play a respectable role in the economy by contributing to employment and GDP at large (Steel & Webster, 1991). As already stated in the first chapter, Ghana's manufacturing industries include Aluminium smelting, Agro-food processing, Oil refining and Cement production. Other industries include the production of Beverages, Textiles, Apparel, Glass, Paints, Plastics, Chemicals and Pharmaceuticals, and the processing of Metals and Wood products.

More than 80% of the industries are small size enterprises with less than 50 employees and it is estimated that 55% of all enterprises are located within the Greater Accra/Tema Region (Steel & Webster, 1991). The manufacturing sector recorded a 6.9% distribution of GDP during 2009 as compared to a 5.8% distribution of GDP in 2013. Table 1 gives the size distribution and employment of the manufacturing sector in 1987 as compared to that of 2003.

Table 1: ***Ghanaian Firm Size***

Share	Number of firms		Employment	
	1987	2003	1987	2003
Small (<11)	75%	85%	18%	35%
Medium (11-99)	22%	14%	28%	31%
Large (>99)	3%	1%	54%	34%
Total	100%	100%	100%	100%
	(8,349)	(26,088)	(157,084)	(243,516)

Source: Nsowah-Nuamah, Teal, andAwoonor-Williams(2010)

From Table 1, it could be inferred that Small and Medium enterprises accounted for most of gross and net job creation between 1987 and 2003, but these firms have not grown into medium or large-scale enterprises over time. That is, in Ghana, small enterprises have been found to die early and small but rather large firms in Ghana are born big(Sandefur, 2010). These developments are not good for the progress of the manufacturing sector because according to Lucas(1982), “most changes in product demand are met by changes in firm size, not by entry or exit of firms.”

According to Baah-Nuakohand Teal(1993), the manufacturing sector has an important role to play in the development process of Ghana, not only due to the dynamic nature of the sector itself, but also, to the perceived positive externalities that it generates for the rest of the economy. These externalities take several forms and include:

a. Technology effects – where firms in the manufacturing sector develop and/or use technology which can then be adapted for use in other sectors;
b. Human capital effects-the development of the technical, organisational and managerial skills in the manufacturing;
c. Learning effects-where investment by one firm in the implementing a new production process reduces leaning cost for all other entrant (leaning by doing);
d. An expanding manufacturing sector is historically associated with increasing income per capita-due to relative high returns to capital and labour, with positive consumption and investment effects.

The special role of the manufacturing sector in overall economic development makes research into the sector a welcome option.

Review of Theoretical Literature

This section reviews the theoretical basis for the empirical studies. The main focus is the definitions and operationalization of concepts as well as the review of related theories with some empirical support where necessary.

The Concept of Firm Productivity and Total Factor Productivity

Productivity is of great importance for any organization or enterprise. At its fundamental level, productivity is based on the economics of the firm. Traditionally, productivity is often expressed as the ratio of output to the most limited or critical input used in the production process, with all the other inputs held constant (i.e. output per unit of input, which represents the relationships between inputs and outputs in the production process). Productivity shows the effectiveness and efficiency of an organization in converting resources into marketable products. Dating as far back as the 18th century, the word "productivity" has been coined and used by several groups of scholars.

Syverson(2011) simply explained productivity as efficiency inproduction; how much output is obtainedfrom a given set of inputs. Therefore, productivity is typically expressed as an output–inputratio. Despite the countless definitions of productivity, one thing stands out "a comparison of input versus output" (Kuykendall, 2007, p. 18).

As such, it can be expressed as: Productivity $=\frac{\text{Output}}{\text{Input}}$. It can therefore be inferred from the ratio above that, there are two major ways to increase productivity: increase the numerator (output) or decrease the denominator (input). Similarly, productivity can be improved if both input and output increase, but the increase in output must be faster than the increase in input. Hence, high productivity means producing as much output as possible using as little input as possible. It also implies that increasing productivity means greater efficiency in producing output of goods and services from labour, capital, materials and any other necessary inputs. Consequently, productivity is useful as a relative measure of actual output of production compared to the actual input of resources, measured across time or against common entities. As output increases for a level of input, or as the amount of input decreases for a constant level of output, an increase in productivity occurs. Therefore, a "productivity measure" describes how well the resources of an organization are being used to produce output.

Productivity is an objective concept. As an objective concept, it can be measured, ideally, against a universal standard. As such, organizations can monitor productivity for strategic reasons such as corporate planning, organization improvement, or comparison to competitors. Productivity is a required tool in evaluating and monitoring the performance of an organization, especially a business organization. Managers are concerned with productivity as it relates to making improvements in their firm. Managers are also concerned with how productivity measures relate to competitiveness.

Reiterating what was said in the problem statement, according to Adjotor(2013), profitability should have been the best way of measuring the performance of any kind of business but this is not the case mainly due to the fact that profits aremainlyinfluenced by external factors including shift in demand or inflation and so forth. Thus, profit can rise and fall but management is incapable of containing these fluctuations since causes are exogenous. This makes profitability an insufficient measure of the performance of firms. Productivity unlike profitability reflects the effort of management in improving profits and in remaining competitive through the improvement in efficiency. Productivity is, hence, a preferable measure of performance in organizations or firms as well as nations. A productivity ratio may be computed for a single operation, a department, a facility, an organization or even an entire country.

Productivity is usually expressed in one of two forms: partial factor productivity or single-factor productivity and multifactor productivity or total productivity. Productivity measures that use one or more inputs or factors, but not all factors, are called partial productivity. It is concerned with efficiency of one particular characteristic. A common example in economics is labour productivity, usually expressed as output per hour. Multi-factor productivity (MFP), an index of output obtained from more than one of the resources, is usually defined as the residual output growth of an industry or economy after calculating the contribution from all inputs (or factors of production). Put another way, it is the output growth which cannot be explained by increasing volume of inputs and is assumed to reflect increases in the efficiency of use of these inputs. Typically, it is estimated indirectly as the residual after estimating the effect of the change in the volume of inputs. It is also sometimes called Total Factor Productivity. Total

Factor Productivity is rather the broadest measure of productivity and is concerned with the performance of an entire plant or organization.

Galarneauand Dumas(1993) andAdjotor(2013) note that the simplest and most frequently-encountered measure is that of labour productivity. However, it is considered a partial one; in that, theoretically, it reflects only the contribution of the labour factor. In industries that require skilled labour, which is often in relative shortage, output per worker is considered as the most appropriate measure of productivity. According to Kuykendall(2007), high level of labour productivity in the form of increase in knowledge and skills will increase output or the quality of output. However, such single-factor-based measures of productivity suffer from obvious limitations as argued by Syverson(2011). First, in most industries or sectors, there may be several factors of production that are of almost equal importance, in which case it might be difficult to choose among them. Second, the relative importance of inputs may change over time.

For this reason, researchers often use aproductivity concept that is invariant to theintensity of use of observable factor inputs.This measure is called total factor productivity (it is also sometimes called multifactor productivity). Comin(2006) defines total factor productivity as the portion of output not explained by the amount of inputs used in production. As such, its level is determined by how efficiently and intensely the inputs are utilized in production. Total Factor Productivity (TFP) is the combined productivity of all inputs, and hence, avoids the problems faced by measures based on just one factor. One does not have to choose any factor on which to base productivity growth, since all factors are included. Furthermore, the impact of each input on total factor productivity is allowed to vary, hence, taking into account the possibility that the relative importance of factors may change over time. As a result of these advantages, TFP is the most commonly known and widely used method of productivity measurement.SaliolaandSeker(2011) assert that TFP is a crucial measure of efficiency and thus an important indicator for policymakers.

It is indicated in the literature that productivity at all levels including the firm is determined by several factors among which are: human capital, capital utilization, innovation, firm characteristics and management, competition, and industry environment. Adjotor(2013) states that human capital is the most prominent determinant of productivity at all levels, since it comprises the education, skill, knowledge and health of the individual required to have control over the other factors of production.

According to VandenbergheandLebedinski(2013), productivity is, in essence, a firm-level phenomenon and should be primarily assessed at that level. In modern economies where most people work inside firms, skills/education-related productivity gains cannot possibly exist at the individual-level (as highlighted in Mincer-type analyses) if they do not show up at the firm level. However, individual workers' productivity is hardly ever observed due to lack of firm level data or inadequacy of it. Comprehensive firm level data that captures firm and worker characteristics or variables is limited and thus, makes investigation into the impact of skills/educational attainment on firm productivity challenging. Nonetheless, workers'characteristics (e.g. skill and their educational attainment) can be aggregated at the firm level and introducedinto firm-level equations in order to explore how they influence productivity. Firm-specific characteristics, including the characteristics of the workforce, are important for explaining or determining firm productivity (Wixe, 2013).

Vandenberghe et al.(2013) also note that productivity is intrinsically determined by the (heterogeneous) ability of firms to successfully aggregate individual productivity, in conjunction with other factors of production. A similar reasoning applies to countries.Thus, the benefits of human capital should show clearly in the performance of firms, if they are to emerge at a more aggregate level.

Determinants of Firm Productivity

The vast majority of firm-level based works on productivity recognizes the existence of high heterogeneity among firms with common characteristics (heterogeneity in terms of size, age, technologies, productivity levels, entry-exit patterns, and so on). Such heterogeneity cannot be appreciated under the macroeconomic approach as it aggregates different firms that share some characteristics and they are all supposed to be affected by the economic forces in a similar way. Thus, such models may not explain the observed differences in productivity levels among small, medium and large firms adequately, while the microeconomic approach permits a deeper analysis of the characteristics that may explain such differences in productivity. Some models in industrial organization try to model this heterogeneity, for example, Lucas Jr(1978) proposed a theory of the size distribution of business firms (Castany, López-Bazo, & Moreno, 2005).

Definition and Measurement of the Size of the Firm

The definition of a firm size varies as seen by a lot of researchers. The first, based on Coase(1937) and Penrose(1995)holds that the boundary of the firm is where the internal planning mechanism is superseded by the price mechanism. That is, the firm's border is at the point where transactions are regulated by the market rather than by administration. In most cases, this means that the operating firm is equivalent to the legal corporation. The second definition is that ownership sets a firm's boundaries (Hart, 1995). With this definition, a firm is the combination of activities for which the bearers of residual risk are one and the same. A third definition sees the firm as a network (Richardson, 1972). The fourth definition is based on the firm's sphere of influence. This includes distributors, alliance partners, first- and second-tier suppliers, and so on (Williamson, 1985).

For the purpose of this study, the firm was defined as having commonly owned assets (the ownership definition) but employees were also treated as part of the firm. The study follows a composite of the Neo-Classical, Transaction Cost Economics and the Principal-Agent Theories of the firm. Therefore, it is natural that the definition of a firm should follow the Coase(1937), Williamson(1985) and Hart(1995) definitions. Thus, a firm is an incorporated company (the legal entity) which includes its total employees. Based on the definition of a firm, the size of the firm can be defined as the number of employees, value of assets or both. Both definitions were adopted in this study.

There are various ways to measure firm size. According to Canback(2002), a better measure of size is value added, which is more or less equivalent to revenue less externally purchased products and services. Number of employees is the most widely used measure of size. A review by Kimberly (1976) reveals that more than 80% of academic studies use number of employees as proxy for firm size. Finally, assets can define size (Grossman & Hart, 1986). There are other measures like capital, sales and revenue. As with revenue, assets measure may not reflect underlying activity but for manufacturing firms, asset–to–value-added ratios are fairly homogeneous.

In a nutshell, the best measures of size are value added and number of employees, although assets can be used in certain types of studies. This study adopts both assets and number of employees as measures of size.

Williamson's Theoretical Framework on the Limit of the Firm Size

The Williamson's Theoretical Framework attempts to show how the various opposing forces counter each other as the firm expands in size. The review follows the work of Canback(2002) and Canback, Samouel, and Price(2006). Transaction cost economics focuses on the boundary of the firm(Holmström & Roberts, 1998; Williamson, 1981). The boundary of the firm as used here refers to the distinction between what is made internally in the firm and what is bought and sold in the marketplace (Canback, 2002). The boundary can shift over time and for a number of reasons, and the current research looks at dynamics of the limit of the firm along its life cycle in terms of economic performance.

As firms internalise transactions and expand, bureaucratic diseconomies of scale appear. Thus, a firm will reach a size at which the benefit from the last internalised transaction is offset by bureaucratic failure. But this may mark the end of one phase and the beginning of another along the life cycle of the firm. How soon one phase will end for another to begin depends on the implementation and efficacy of the moderating factors aimed at reducing the transaction cost, agency cost and rigidity associated with expansion.

Two factors moderate these diseconomies of scale. First, firms can lessen the negative impact of diseconomies of scale by organizing activities appropriately and by adopting good governance practices. Second, the optimal degree of integration depends on the level of asset specificity, uncertainty and transaction frequency (Canback, 2002). Coase'ssubmissions in his article ,"The Nature of the Firm" (Coase, 1937), establishes the basic framework. "Limits of Vertical Integration and Firm Size" in Williamson's(1975) book *Markets and Hierarchies* suggests the nature of size limits. "The Limits of Firms: Incentive and Bureaucratic Features" in Williamson's book,*The Economic Institutions of Capitalism*(Williamson, 1985) expands on this theme and explains why the limits exist. Riordan and Williamson(1985) augment the theoretical framework presented here by combining transaction costs with neoclassical production costs. The remainder of the section discusses the details of the argument of

Williamson's Theoretical Framework which seeks to explain what determines the limit and long run performance of firms.

Diseconomies of Scale

Williamson(1975) found that the limits of firm size are bureaucratic in origin and can be explained by transaction cost economics. He identified four main categories of diseconomies of scale: atmospheric consequences due to specialisation, bureaucratic insularity, incentive limits of the employment relation and communication distortion due to bounded rationality. Williamson's categories are similar to those Coase described in 1937.

Coase(1937) talked about the determination (or planning) cost, the resource misallocation cost and the cost of lack of motivation. Williamson's first and second categories correspond broadly to the determination cost; the third category to the demotivation cost, and the fourth category to the resource misallocation cost. Williamson's categories are, however, more specific and allow for easier operationalization. The four categories are detailed below:

Atmospheric Consequences

According to Williamson(1975), as firms expand, there will be increased specialisation.Nonetheless, there will also be less commitment on the part of employees. In such firms, the employees often have a hard time understanding the purpose of corporate activities, as well as the small contribution each of them makes to the whole. Thus, alienation is more likely to occur in large firms.

Bureaucratic Insularity

Williamson(1975) argued that as firms increase in size, senior managers are less accountable to the lower ranks of the organisation and to shareholders. They, thus, become insulated from reality and will, given opportunism, strive to maximise their personal benefits rather than overall corporate performance. According to Williamson(1975), this problem is most acute in organizations with well established procedures and rules and in which management is well entrenched.

Incentive Limits of the Employment Relation

Williamson(1975) argued that the structure of incentives that large firms offer its employees is limited by a number of factors. First, large bonus payments may threaten senior managers. Second, performance-related bonuses may encourage less-than-optimal employee behaviour in large firms. Therefore, large firms tend to base incentives on tenure and position rather than on merit. Such limitations may especially affect executive positions and product development functions, putting large firms at a disadvantage when compared with smaller enterprises in which employees are often given a direct stake in the success of the firm through bonuses, share participation and stock options.

Communication Distortion due to Bounded Rationality

It is impossible to expand a firm without adding hierarchical layers. This is due to the fact that a single manager has cognitive limits and cannot understand every aspect of a complex organization. Information passed between layers inevitably becomes distorted. This reduces the ability of high-level executives to make decisions based on facts and negatively impacts their ability to strategize and respond directly to the market. In an earlier article, Williamson(1967) found that even under static conditions (no uncertainty), there is a loss of control due to communication distortions.

Economies of Scale

Transaction cost economics does not usually deal with economies of scale, which are more often associated with neo-classical production costs. However, Riordan and Williamson(1985) made an explicit attempt to reconcile neo - classical theory and transaction cost economics and showed, among other things, that economies of scale are evident in both production costs and transaction costs. Also, both can be kept internal to a firm if the asset specificity is positive. That is, the economies of scale can be reaped by the individual firm and are not necessarily available to all participants in a market.

Moderating Influences on Firm Size Limits

While the four categories relating to diseconomies of scale theoretically impose size limits on firms, two moderating factors tend to offset diseconomies of scale: organisation form and degree of integration. Both are central to transaction cost economics.

Organizational Form

Williamson(1975) recognised that diseconomies of scale can be reduced by organising activities in the firm appropriately. Based on Chandler's pioneering work on the evolution of the American corporation(Chandler, 1982), Williamson argued that the M-form organisation lowers internal transaction costs compared to the U-form organisation. It does so for a key reason that the M-form allows most senior executives to focus on high-level issues rather than day-to-day operational details, making the whole greater than the sum of its parts. Thus, large firms organised according to the M-form should perform better than similar U-form firms (Williamson, 1975).

Degree of Integration

Williamson showed that three factors play a fundamental role in determining the degree of integration: uncertainty, frequency of transactions and asset specificity, under conditions of bounded rationality (Barnard & Simon, 1947) and opportunism (Williamson, 1993). While uncertainty and frequency play some role in creating transaction costs, Williamson considered asset specificity as the most important driver of integration (Riordan & Williamson, 1985).

The diseconomies are arguably great where asset specificity is slight, since the outside supplier here can produce to meet the needs of a wide variety of buyers using the same (large scale) production technology. As asset specificity increases, however, the outside supplier specialises his investment relative to the buyer. As these assets become highly unique, moreover, the firm can essentially replicate the investments of an outside supplier without penalty. The firm and market production technology, thus, become indistinguishable at this stage (See Canback, 2002; Canback et al., 2006 for more on these issues).

Life Cycle Theory of the Firm

In the case of Ghana, Sandefur(2010)recognised the existence of clear life cycle in his study on firm size distribution in the manufacturing sector and concluded that firm size over the life cycle is driven almost entirely by selection. Sandefur(2010), however, discovered that most entering cohorts are relatively large in the case of the manufacturing sector of Ghana and that the small entrant firms do not usually survive the test of time.

Ratheand Witt(2001) defined life cycle as the age and stage of development of a firm. The idea that firms can be compared to human beings who are born, live and die is not necessarily a recent development but an age long concept. Mueller(1972) wrote extensively on the Life Cycle Theory of the firm where he extended his argument to cover profit maximisation. More recently, van Wissen(2002) created what he termed a useful metaphor between the demographic nature of human and that of a firm. According to Famaand French(1998), the demographic metaphor does not arise because of applying biological laws to firms, but because of the methodological similarities in population dynamics and micro-macro linkages.

van Wissen(2002) reached a number of conclusions about the distinctions between the demography of humans and that of the firm. The major distinction between human and firm demography that is of interest to this study is that firm size is the key characteristic of the firm and a major determinant of all demographic events (van Wissen, 2002). van Wissen(2002) further added that research in any of the other dimensions of firm demography without taking into account firm size differentials, is likely to be biased.

Most empirical studies have focused on two possible effects of aging upon firm performance: the effect on the survival probability, and the effect on firm growth and size (van Wissen, 2002). There is a general agreement that younger firms have a higher mortality rate, which is called the liability of newness, and that the mortality rate declines with age (Carroll & Hannan, 2000; Freeman, Carroll, & Hannan, 1983). An important hypothesis behind this observed relationship is that firms learn from their behaviour over time. Mature firms are, therefore, better equipped than young firms, which still have to learn the tricks and avoid the pitfalls of market operation. This is called the Theory of the Learning Organisation (van Wissen, 2002).

The main gist of the life cycle hypothesis is that the age of a firm and the stages of a firm's development are complementary factors in the relationship between firm size and performance which includes financial performance. That is, the explanation given by van Wissen(2002) on the demographic nature of a firm's life span clearly suggests that most of the effects of age can be captured in the size effects of a firm.

Thus, the decision to study the joint effects of size, age and stages of development of a firm simply seeks to assess the nature of the firm size-performance relationship over the entire life span of a firm. Thus, an integration of the Williamson's framework on limit of firm size and dynamic or life cycle hypothesis is implied in this study.

Managerial Theories of the Firm

The established economic theory of the firm lays the foundation for the study of the structure and behaviour of the firm. Managerial theories of the firm are recent theories which takes it root from established economic theories of the firm and models of profitability to rationalised the appropriate variables that determines firms performance. The managerial theories of the firm can be classified as technological, organisational and institutional depending on whether they emphasise the production technology used by the firm, the firm's organisational architecture and relations among stakeholders or the legal and political environment where the firm operates (Kumar et al., 2001).

The theories often contain implicit assumptions about the relation between size and profitability, especially those theories that suggest the existence of an "optimal size" firm or limits to firm size due to diseconomies of scale or market size. The brief review is done with respect to what they predict, if anything, about the relation between size, age and profitability. The review follows the structure used by Kumar et al.(2001) and Becker-Blease, Kaen, Etebari, and Baumann(2010).

Technological theories: Technological theories emphasize physical capital and economies of scale and scope as factors that determine optimal firm size and, by implication, profitability. These theories focus on the production process and the investment in physical capital necessary to produce output.

Increasing economies of scale, that permit lumpy fixed costs to be spread over large output volumes, thereby, decreasing the average cost of production and increasing the return on capital invested, are associated with increases in firm size. If no limit exists to economies of scale, the unregulated outcome would be one firm and a natural monopoly. However, if economies of scale cease to exist, at that point bigger is no longer better, at least in terms of lowering production costs and improving efficiency.

Whether efficiency and profitability eventually fall (average costs increase) as firms expand under a purely technological story is unclear. One can assert that they do due to diseconomies of scale; but, the question then arises as to what causes these diseconomies. Organisational theories are relevant here.

Organisational Theories: Organisational theories have size affecting profitability through organisational transaction costs (Williamson, 1985), agency costs (Jensen & Meckling, 1976), span of control costs, critical resource (Grossman & Hart, 1986; Raghuram & Luigi, 2001) and competency (Foss, 1993; Niman, 2003) theories of the firm. Transaction costs are the costs of planning, adapting and monitoring task completion and performance in an organisation. These costs include drafting and negotiating agreements as well as the costs of dealing with disputes and handling unintended outcomes. Agency costs arise out of conflicts of interest among the stakeholders of the firm due to information asymmetries and self-seeking behaviour.

A common proxy for the number of administrative layers is the number of employees. So, organisational theories of the firm based on transactions and agency costs and span of control costs predict that at some point, average per unit transaction and agency costs would increase and offset economies of scale and scope, thus, establishing an optimal size for the firm in terms of profitability.

Critical resource theories of the firm emphasize the control that an entrepreneur or owner has over those resources (assets, technology, and intellectual property) as determinants of firm size. Kumar et al.(2001) find that as legal institutions and laws improve the protection afforded the owner of the company over these critical resources, the size of the firm increases.Raghuram et al.(2001) went on to construct a model that ties firm size to the ability of the entrepreneur to maintain control over the intangible factors that make the firm profitable. The greater the importance of these intangible factors (relative to, say, fixed assets such as machinery), the less likely the firm is to grow (become larger). So, critical resource theories also tie firm size and profitability together in such a way that at some point, increased size leads to lower profits.

However, under a critical resource theory of the firm "small" firms need not necessarily be less profitable than "large" firms within a given institutional environment. Competency theories of the firm posit that the firm is a collection of competencies that allow it to earn more than its opportunity cost of capital (surplus, economic rents, and positive net present value projects). These competencies can include superior production technologies, superior marketing skills and superior research and development skills.

The important point is that one or more of these competencies permit the firm to remain competitive and earn more than an adequate return. In order for the firm to protect its position, it must make sure other companies do not acquire its superior competencies – also called secrets. At this point, competency theories join critical resource theories. Think of competencies as the critical resources. One way to control the dissemination of secrets is to share them with as few people as possible and this implies restricting the size of the firm where size is defined in terms of employees.

Consequently, the need to protect the secrets of the firm places a limit on its size. Competency theories, however, do not assume that small firms are more or less profitable than large firms (or less than the size where secrets are disclosed). One of the appealing attributes of Competency Theory is that a "small" firm can be just as profitable as a "large" firm in a given industry because the firms have different competencies that let them both earn surplus returns. As described by Niman(2003, p. 283), "survival depends not on being better, but rather on being sufficiently different (due to different competencies) so that the advantages of others do not prove fatal". In fact, a "small" firm may be more profitable than a "large" firm within its product niche due to its unique competencies. The reason the "small" firm does not grow is attributed to a "small" market for its product or services and/or to the loss of its secrets.

Institutional Theories: Institutional theories tie firm size to such factors as legal systems, anti-trust regulation, patent protection, market size and the development of financial markets.

Kumar et al.(2001) report, for example, that capital- intensive firms are larger in countries with efficient judicial systems and that research and development intensive industries have larger firms in countries with stronger patent protection. This study is restricted to firms in the manufacturing sector of Ghana. So, to some extent, institutional factors can be assumed to be uniform with less tendency of biasing the outcome.

Theory Implications for Firm Size and Life Cycle

This study combines the technological, organisational and evolutional theories since the study's setting is in the same country which therefore implies that firms face relatively the same institutional factors. The basic implication of combining technological and organisational theories with emphasison transaction and agency costs of firm size is that within a specific industry (common production technology) and within a common institutional environment, firm size and firm performance may be linked through a trade-off of economies of scale, transactions costs and agency costs. Kumar et al.(2001) and Becker-Blease et al.(2010) wrote extensively on the implications of these theories of the firm on the size and performance (measured as profitability) relationship.

The only addition here is the introduction of age based on the life cycle hypothesis but which does not in any way confound the firm size – firm performance relationship but rather refines the magnitude of the effects of the respective explanatory variables. The transmission mechanisms were explained in the Williamson's Theoretical Framework and Life Cycle hypothesis in the earlier sections of this Chapter.

In summary, the following expectations about firm size and firm performance may exist; either firm performance initially increases and then levels off or it declines with respect to firmsize or no relation exists between firm size and firm performance.

Review of Empirical Literature on Firm Size and Firm Performance

Quite a number of factors are found to be major determinants of firm performance but firm size has received special empirical attention in recent times (Mahmoud Abu-Tapanjeh, 2006; Majumdar, 1997; Vlachvei & Notta, 2008). Majumdar(1997) used an extensive sample of 1,020 Indian firms to investigate the impacts that size and age of firms have on firm-level productivity and profitability. The results turned out that older firms are more productive and less profitable, whereas the larger firms were, conversely, found to be more profitable and less productive. Majumdar(1997) used pooled ordinary least squares (OLS) estimation and employed accounting profit as a measure of performance while this study concentrates on a more economic performance measure (TFP) and employs a static Panel estimation technique.

A good number of researchers have investigated the relationship between firm size and firm performance(Berk, 1997; Dhawan, 2001; Hall & Weiss, 1967; Lafrance, 2012; Prescott & Visscher, 1980; Salman & Yazdanfar, 2012; Whittington, 1980). The results came out with varying opinions. Some studies postulate positive relationship between size and profitability (Berk, 1997; Hall & Weiss, 1967; Prescott & Visscher, 1980) while some studies have evidence supporting a negative relationship (Dhawan, 2001; Goddard et al., 2005; Salman & Yazdanfar, 2012; Whittington, 1980).

Hall and Weiss(1967) conducted an empirical analysis of Fortune 500 Industrial Corporations for the years 1956–1962 which aimed at testing the relationship between profit rates and other appropriate variables such as firm size, concentration, leverage and growth. The results of the study showed that firm size (proxied by the log of firm assets) exhibited a positive relationship with profitability [represented by Return on Equity (ROE) and Return on Assets (ROA)]. They concluded that large firms have all the options of small firms, and, in addition, the capability of harnessing economies of scales and access to capital markets from which small firms are excluded, thus leading to higher profit rates. Hall and Weiss (1967) study, however, considered only firms of optimal size.

Prescott andVisscher(1980) showed that the positive association between firm size and profitability stems from implementing greater differentiation and specialisation strategies, and should therefore lead to higher efficiency. Other studies also suggest that larger firms are able to leverage on economies of scale (Sidhu & Bhatia, 1993). Berk(1997) suggested that investor returns are positively correlated with size when size is measured with non-market measures such as employees, assets and sales.

Goddard et al.(2005) studied manufacturing and service firms in four European countries for the period 1993–2001. They concluded that firms that increased in size tend to experience reduction in profitability, but an increase in market share was associated with increased profitability on the average. Dhawan(2001) also found a negative relation between firm size and profitability for U.S. firms during "1970 to 1989" but at a highly aggregated level of services and manufacturing. Salman andYazdanfar(2012) used data for more than 2,500 Swedish micro firms for the year 2007 to study the profitability of micro firms and discovered that lagged profitability, productivity growth sales and asset turnover had significant positive effects on micro firms‟‟profitability but the firms‟‟ size and age had negative effects on profitability.

Salman andYazdanfar(2012) employed the Quantile Regression Approach to their analysis and had alternating sign for the firm size at different quartiles. Whittington(1980) also discovered a negative association between firm size and profitability for U.K. based listed manufacturing companies covering the time period from 1960 to 1974.

Downs and Corporation(1967) suggested that larger firms could lead to increased coordination requirements, which in turn, makes the managerial task more difficult leading to organisational inefficiencies and lower profit rates. Further, it has been suggested that increased size tends to be associated with higher bureaucratisation (Ahuja & Majumdar, 1998; Williamson, 1975). Larger firms may have overly bureaucratic management structures, thereby inhibiting swift and efficient decision-making process. It is also possible that with the additional management layers needed to organise an increasingly large and diverse workforce, management may be affected by the agency problems (Ramasamy, Ong, & Yeung, 2005).

Ramasamy et al.(2005) studied the effects of firm size and firm ownership on the level of profitability in the Malaysian palm oil sector and suggested that size (proxied by the value of asset) was negatively related to performance while privately owned plantation companies were more profitably managed. Ramasamy et al.(2005) attributed their findings to inherent organisational problems which result in X-inefficiencies raising the cost of production above the optimum levels and lowering possible profitability to the firm. X-efficiency theory proposes that environmental forces change the nature of incentives facing firms and permit slack-causing behaviour.

However, most of the studies that considered the size-profitability relationship tend to show non-significant results. In fact, in a meta-analysis conducted by Capon, Farley, andHoenig(1990), firm size was not considered significant and further confirmed in an Analysis of Covariance (ANCOVA).

Poensgenand Marx(1985), for example, tested the relationship between firm size and profitability for a sample of 1,478 German manufacturing firms in 31 industries. Their results revealed a weak size-profitability correlation that was unstable over the study period. These results could suggest that firm size is not the major determinant of profitability and that profitability would depend, largely, on how well firms cope with size and explore the opportunities associated with it. Leledakis, Davidson, and Smith(2004) also found that there is little correlation between firm size and profitability, while Hecht(2001) conveyed that there is no correlation between non-market measures of size and investor returns. Jordan, Lowe, and Taylor(1998) also found that there is no relationship between financial structure and enterprise size.

Critical resource theories stress a firm industry control over the resources such as assets, technology and intellectual property as determinants of firm size. Legal institutions and laws improve the protection afforded the owner of the company over these critical resources, when the size of the firm increases Kumar et al., 2001). Further, Raghuram et al.(2001) postulated a model that proper control over the intangible factors makes the firm profitable. Thus, they concluded that the greater the importance of intangible factors like fixed assets, the lesser the firm grows. So, firm size and profitability sometimes lead to lower profits with the increase of size.

However, small firms also need not necessarily be less profitable than “large” firms within a given institutional environment. Competency theories appeal that a small firm can be just as profitable as a large firm in a different competency that leads to surplus returns. Also, there are quite a number of indirect effects of size on profitability with empirical supports. According to DesmetandParente(2010), large firms are more innovative than small firms because large firms can spread the fixed costs of Research and Development (R & D) over more units. Here, an indirect effect of size is stems from the fact that innovation has positive effect on profitability in the long run which implies a direct relationship between size and profitability in the long run from R & D point of view.

Abzari, Fathi, Moatamedi, andZarei(2012) discovered that company age and company size had positive relationships with deviation of earning prediction. But accuracy in earning forecasting simply reduced risk and improved profitability; hence an implied positive relationship was established between firm size and firm performance (in this case measured as profitability). Other negative relationships such as increasing transaction cost with firm size (Cordes, Richerson, McElreath, & Strimling, 2011) and opportunistic behaviour (Hodgson & Knudsen, 2007) can be implied between size and profitability. Quite a number of empirical studies have also suggested that small and large firms adapt differently to the path to profitability and hence, both can be profitable within the same business environment.

Famaand French(1998) captured much of the cross-section of average stock returns. If stocks were priced rationally, systematic differences in average returns were due to differences in risk. Thus, with rational pricing, size and book equity to market equity must proxy for sensitivity to common risk factors in returns. Famaand French(1998) also attributed this predictive power of size to its ability to capture risk. Again, from the company's perspective, small firms apparently faced higher capital costs than larger firms. Here, we can mention Baumol's proposition that large firms have all of the options of small firms, and in addition, these large firms can invest in lines requiring such scale that small firms are excluded. (Baumol, 1959)

In adaptation to the inherent financial constraint, Michaelas, Chittenden, andPoutziouris(1999) indicated that larger firms use higher gearing ratios than smaller firms, and they suggested this is a result of the fact that smaller firms face higher financial barriers. This view is also supported by Chittenden, Hall, and Hutchinson(1996) and Cassarand Holmes(2003), who provided empirical evidence suggesting that size is positively related to long term debt and negatively related to short-term debt. Lopez-GraciaandAybar-Arias(2000) also suggested that size significantly influenced the self-financing of smaller companies.

The most appealing development in the size-profitability relationship perhaps is the implication of inverted "U" shape size-profitability curve. The implication of inverted "U" shaped curve is that profitability initially increases with size up to an optimal size after which further increase in size reduces profitability. Also, within the neighbourhood of the optimal size, no or very weak relationship may be observed between size and profitability. There have been some empirical supports for this kind of relationship.

Amato and Wilder(1985) conveyed that the relationship between firm size and profitability may be positive for some firm size ranges and negative for others. According to Amato and Wilder(1985), if the firm size reaches a certain threshold, additional expansion of firm size may further separate ownership from control. This suggests that the relationship between firm size and profitability can become negative beyond some threshold of firm size. Lafrance(2012) confirmed the results of Amato and Wilder(1985).

Becker-Blease et al.(2010) examined the relation between firm size and profitability within 109 SIC four-digit manufacturing industries in the U.S.A. Depending on the measure of profitability, they discovered that profitability increased at a decreasing rate and eventually declined in up to 47 of the industries. No relation between profitability and size was found in up to 52 of the industries. Profitability continued to increase as firms became larger in up to 11 industries. They concluded that regardless of the shape of the size – profitability function, profitability was negatively correlated with the number of employees for firms of a given size measured in terms of total assets and sales.

Thus, from the existing theories and past research, it can be concluded that the empirical study on the effect of firm size and profitability has come out with mixed results. Some studies conclude that there is negative relation; others observe positive relation; while some claim no relation exist between firm size and profitability.Some studies predict inverted U-shape relationship as firm size increases. The bottom line from the empirical review is that if a non-linear relationship can exist between size and profitability, then most of the earlier studies might have suffered from misspecification. Another issue is the proxy adopted for size and profitability which this study attempted to address by adopting polynomial specification and multiple measures of size and profitability. If the relationship is indeed linear then the coefficients of terms with power greater than one in the polynomial specification shall tend out as insignificant.

Empirical Literatureon Ghana and Other Emerging Economies

It should not be too hard to assert, even without any empirical evidence, that well-developed institutions are pre-requisite for the development of large corporations. At least, two recent studies form the basis to accepting the fact that activities of organisations in emerging economies are strikingly different from those of organisations in more advanced economies. Thus, there is the need to pay special attention to the findings from studies done in developing countries so as to ascertain the kind of relationships being established and to compare the outcome with studies done in advanced countries.

First, Beck, Demirguc-Kunt, Laeven, and Levine(2004) used a panel data of 44 countries drawn from both advanced and developing countries from 1988 to 2002 and reached a conclusion that firm size was positively related to financial intermediary development, the efficiency of the legal system and property rights protection. The gist of the outcome was that optimal firm size depends on country specific characteristics in that the assessment of the effect of size on another variable must control from such random effects (RE) otherwise the results shall be biased. In this study, however, all the sample firms were from the same comparative business environment and in the same country so the results are not likely to be biased by country specific characteristics.

Using modern econometric techniques which allow for the presence of structural breaks, Congregado et al.(2012) found for the majority of countries (14 out of 23) evidence of a scenario where embodied technological progress positively influences average firm size but at the same time disembodied technological progress negatively influences average firm size.

Based on the fact that the limit of the firm depends on some country specific characteristics, the literature was reviewed with special reference to Ghana and other developing or emerging economies. It must be stressed that there has been quite a number of studies on firm specific characteristics and performance for which size and firm performance were involved. However, for most of these studies, size was hardly the main variable of interest; rather,it was used as a control for the model specifications. In other words, earlier studies have not paid special attention to the effects of size, especially in the manufacturing sub-sector of Ghana, on performance. In most studies, the results of size were presented in the discussion but not mentioned in the conclusion or no recommendations were offered on them. Some of the empirical studies are reviewed below.

Awunyo-Vitorand Badu(2012) used size as a control variable in their study and discovered that firm size (represented by total assets), age, board size, and market capitalisation all exhibited a negative relationship with return on equity (ROE) which was used as a profitability measure. Mahmoud(2010) also emphasized that size, age and sales turnover of firms had some level of influences on business performance. Age and size variables were, however, dropped from the remaining of their analysis since they were only used to avoid specification bias.

A rather interesting deduction can be made from the work of Abor(2008); an African Economic Research Consortium (AERC) funded paper. First, Abor(2008) found an inverse relationship between both long-term and short-term debt and profitability among firms in Ghana. In the same study, he discovered a positive relationship between short-term debt ratio and firm size, but a negative relationship between firm size and long-term debt ratio (Abor, 2008). Then by syllogistic logical implication, firm size must be positively related to profitability in the short run (super-imposing a positive relationship on another positive relation in a binary manner gives a positive relationship between the “major and minor terms”. Here the short-term debt ratio is the “middle term” in a Hypothetical Syllogism (HS) logical structure). Following the same argument, an inverse relationship between firm size and profitability is obtained in the long run. This could be seen as the most vivid empirical demonstration of the “inverted U-shaped” relationship between firm size and profitability in Ghana though by logical implication.

On the issue of the differences between size classes, Amoako-GyampahandBoye(2001) contented that the effects of business factors on the operations strategy choices made by small firms are different from the effects that the same factors have on the operations strategy choices made by large firms. Similarly, their results proved that the nature of ownership might be important when a firm is deciding on its operations strategy. According to Frazer(2005), larger firms are more likely to survive than smaller ones while older firms are also more likely to survive than younger firms, although the effect decreases with age. Thus,Frazer(2005) suggested a quadratic specification of the age variable.

BokpinandOnumah(2009) highlighted the importance of firm level factors such as profitability, firm size, and free cash flow and growth opportunities available to firms as significant predictors of corporate investment decisions in Ghana.

The rationale behind most merger and acquisition is that the resulting large firm shall improve performance mainly in the area of financial performance. Merger and acquisition seems to have received more attention in the domestic scene than the size-performance relationship itself. Seidu(2008),using Guinness Ghana Breweries Limited as case study ,examines the impact of mergers and acquisitions on the acquiring company's corporate financial performance within the Ghanaian economy The results of the study showed that the accounting performance declined after the merger. That is, there was a downward fall in profitability performance and sales growth declined sharply during the post-merger periods; although in absolute terms, there were increases.

Owusu(2008) examined the financial performance of Ghana Breweries limited after merger and enlistment on the Ghana Stock Exchange. The study aimed at assessing the profitability level of Ghana Brewery Limited (GBL), its solvency and liquidity position; the effectiveness and efficiency of the use of owners and creditors fund and the appropriateness of mix of debt and owners' equity in financing its operations. The finding showed that despite the severe attack from cheaper brands on its products and the unfavourable economic environment that followed the merger, the company's performance over the period under study was satisfactory.

Adjei(2009)also carried out a research on the evaluation of the financial position of Accra Brewery limited (ABL). The study was designed to evaluate the financial position and the profitability position over a seven-year period (2000 to 2006) of ABL, a public company, whose stock is listed and traded on the Ghana Stock Exchange. The study assessed ABL's risk of bankruptcy using bankruptcy prediction model, the Altman's Z-score. It revealed that ABL's risk situation was more threatening in 2000 and 2006. The study again used traditional ratio analysis in appraising the financial performance of ABL focusing on the assessment of liquidity, solvency and financial profitability. Based on the ratio analysis, the study revealed trends of ABL's financial ratio and the results showed both an impressive and unimpressive performance.

Another area of interest is the empirical works done on the efficiency levels of small and large firms of which there is very limited literature. Bigsten et al., Mohammed andAlorvor and Söderbomand Teal (2000; 2004; 2001)are among the studies that could be found in the literature on the efficiency of the Ghanaian manufacturing firms.

Bigsten et al.(2000) used stochastic production frontier models and firm-level panel data covering the period 1992 to 1995, for the manufacturing sector in four African countries (Cameroon, Ghana, Kenya and Zimbabwe) to investigate the association between exports and firm-level efficiency. Contrary to previous studies, they found that export hada large and significant effect on efficiency. They also found evidence of a learning-by-exporting effect as well as self-selection of the most efficient firms into exporting and concluded that the effect of exporting on efficiency appeared to be larger in those four African countries sampled than in comparable studies of other regions which were consistent with the smaller size of domestic markets.

Söderbom et al.(2001) investigated the role of size and human capital in determining both earnings and productivity using a panel data set from Ghana's manufacturing sector. They employed Generalised Method of Moments (GMM) estimator to control for issues of endogeneity, measurement errors and fixed firm effects. Using the empirical results, they argued that size was the most important of the factors used in determining earnings across firms of differing size. They also used a production function to show the existence of constant returns to scale exhibited by the data. Allowing for measurement error, they showed the existence of the Cobb-Douglas form with constant returns to scale, thus, accepting the hypothesis that technology is homothetic. Their results also showed a weak effect of human capital in explaining either distribution of earnings or productivity across firms of differing size.

Mohammed andAlorvor(2004) employed a meta-frontier model to investigate the performance of firms in Ghana's manufacturing sector. They observed that firms with foreign presence/ownership performed significantly less than the local firms in Ghana within the period under study. Furthermore, firm size was important in the productive efficiency of the Ghanaian manufacturing.

They argued further that there were no variations in the efficiency scores for the different categories of firms. Thus, they suggested that manufacturing firms in Ghana do not need foreign human capital but rather physical capital. The results indicate that all the firms of all categories in the manufacturing industry in Ghana are generally less efficient. However, they found that local firms had higher efficiency scores than firms with foreign presence.

Conclusion

The general conclusion from the empirical literature was that there is no agreement regarding the relationship between firm size and firm performance in both developed and developing countries. Another striking observation from the survey was that most studies that postulate a negative relationship between firm size and firm performance have used total assets as the measure of size. In general, accounting profitability measure has been used to proxy financial performance with very limited use of economic performance measures.

The Enterprise Survey data for Ghana has been proved empirically to exhibit constant elasticity which provides some justifications for the level of aggregation in the data set for this study. That is, since differences in levels of technology are expected to reflect in the performance of the firms given the same market conditions, the results of the study shall not be biased by issues of technology or productivity.

CHAPTER THREE

RESEARCH METHODOLOGY

Introduction

This chapter deals with the methodology of the study and makes specific reference to the research design, model specification, justification, measurement of variables and a-priori expected signs, source of data and description, sample design, estimation techniques and post estimation diagnostics.

Research Design

A quantitative research design was used to tackle the research hypotheses of the study. Research design refers to specific data analysis techniques or methods that the researcher intends to use. One of the basic types of research design is the Quantitative Design which allows the relationship between variables to be established explicitly, once one of the variables is set as a dependent variable. Quantitative design is most appropriate for this study due to the fact that the dependent variable and the main explanatory variables were all continuous in nature. However, one of the major innovations in econometrics is the ability to quantify qualitative variables for a quantitative analysis and that simplifies the task of incorporating categorical variables in the analysis of any economic study (Wooldridge, 2010).

The entire study is embedded in the context and assumption of the Positivist tradition. The Positivist tradition assumes that the objective knowledge systematically pursued by researchers is based on general causal laws (Acquaah, Zoogah, Kwesiga, & Damoah, 2013). Furthermore, the philosophy assumes that as knowledge is externally objective, researchers take strictly neutral and detached positions towards the phenomenon being investigated (i.e. no or minimized subjective judgments). Such a position ensures that the values and biases of the researcher do not influence the study and thereby, harm its validity. In accordance with this criterion, closed ended questions were used to capture the Enterprise Survey data for Ghana which was employed in this study. In addition, various statistical tests were applied to minimize the possible threat to validity if not totally eliminate it.

Firm performance and firm size are among the main constructs that the study attempted to measure and quantify. Among the primary issues in measurement of a construct are internal and external validity. Internal validity concerns whether or not the research evidence justifies the claim (Fisher, 2007; Ghauri & Grønhaug, 2005). Various statistical tests such as the F-test, the OV-test and the Hausman test were all applied in order to ensure that the result of each variable was internally valid.

Related to internal validity is construct validity. While internal validity ensures that claims of relationships among variables supply statistical justifications, construct validity ensures that variable operationalization and/or definition actually measures the concepts they seek to measure in order to bring about a meaningful interpretation of the research findings. According to

GhauriandGrønhaug(2005), construct validity can be ascertained in a number of ways, namely:

1. Face validity – which ensures whether or not the operationalization of the variables makes sense both theoretically and institutively;

2. Convergent validity – which also establishes whether or not multiple measures of the same variable produce comparable results; and

3. Discriminant and/or divergent validity – which ascertains whether or not variables have a meaning of their own which does not overlap with other variables.

To ensure internal validity, the study ensured that the variables were measured in accordance with the best standards in the literature in a way that is relevant to the context of the study. Also, multiple measures were employed where applicable to ensure consistency. Firm Performance was measured as Total Factor Productivity while size was captured as either number of employees or value of total assets but in separate instances.

One of the main issues in positivist research is the generalizability of the research findings. Consequently, external validity concerns whether or not the study findings can be generalized to comparable units of analyses in comparable settings. As a result of this criterion, the positivist tradition uses probability sampling techniques and a large sample size to prevent threats to external validity (Fisher, 2007). The data used for this study was drawn from a random distribution following randomly sampled firms from the 2007 and 2013 enterprise survey.The study involved about 669 manufacturing firms, studied for the above years (2007 and 2013), which gives a maximum data point of about 1,214 observations. Hence, external validity is strongly improved in order for the study's outcome to be generalized across time and space. Though the issue of missing values greatly reduced the final observations involved in the regression analysis, the sample size was big enough for generalization. Finally, improved econometric techniques were applied to the estimation of the models while more than one estimation method was applied to a single model to ensure that the coefficients actually represent the effects of the explanatory variables.

Reliability in positivist research refers to the extent to which study results can be repeated and replicated in comparable settings. The concept of reliability relates to the external validity of the measuring instrument of a study. Once all the assumptions of the positive research are met, positivist research can exhibit a high likelihood of reliability, enabling confident replication and/or repetition in similar settings. In this work, various robust checks were further performed on the regression results. Consequently, other researchers can replicate this study in similar contexts and obtain similar results. Though both internal and external validity are assured which shall ensure reliability, since firm behavior is difficult and cannot be predicted with certainty, the results of the research at times may not be entirely applicable to the entire population which encompasses all manufacturing firms in Ghana.

Theoretical Model Specification

Production has to do with the process where inputs are turned into outputs. Factors of production such as labour and capital are the inputs or resources needed for production. Considering a firm that uses "x" inputs to produce a single output "y".

$Y = f(X)$ ……………………………………………………………………… (1)

An efficient transformation of inputs into output is depicted by the production function f(x) which shows the maximum possible output obtainable with a given level of technology from a set of inputs.

The Cobb-Douglas production function is usually used in Economics to show the link between input factors (labour and capital) and the level of production.Baptist and Teal (2008) note that extensive investigation of issues of functional form employing Ghana and African firm-level data more generally, have shown the Cobb-Douglas form to be remarkably robust. Hence, the baseline specification of this study is the Cobb–Douglas production function which relates output with inputs and firm productivity as follows:

$Y_{it} = A_{it}K_{it}^{\beta k}L_{it}^{\beta l}e_{it}$ ………………………………………………………….. (2)

Y_{it}isthe real output measured in this study as the value of total annual sales (the closest measure of output in the Enterprise Surveyof Ghana data that was employed for this study). A_{it}represents total factor productivity (TFP) of firm i in period t,K_{it} denotes capitalof firm i in period $t$and L_{it} denotes labour of firm i in period t. $e_{it}$is a random disturbance term. $\beta k$and $\beta l$are capital and labour output elasticities respectively which are determined by available technology.

$A_{it}(TFP)$ deals with effects not caused by changes in labour and capital and hence are unobserved by the researcher.On the other hand, Y_{it},K_{it} and L_{it} are all observed by the researcher (although usually in value terms rather than in quantities).

It is important to note that issues of functional form are crucial in estimating such production functions. A couple of those issues, which have featured prominently in the literature, have been the use of gross-output or value-added specifications and the use of the Cobb-Douglas as a special case of more general functional forms. Research by Basuand Fernald(1995), as indicated in Baptist and Teal(2008), shows that adopting a value-added production function may report misleading results if there is imperfect competition or increasing returns to scale. According toKurz(2006), large differences in intermediate inputs may translate into large differences in TFP. In other words, using output and intermediate inputs to estimate a production function may not be as robust as differences in technology across producers (Kurz, 2006). An alternative problem may also arise if there is a systematic bias in the value-added measurement. This study therefore adopts a gross output (measured as gross sales) specification over value-added by exclusion of the value of raw materials or intermediate inputs. Factor inputs were estimated in value terms instead of actual quantities.

Taking natural logarithms of equation (2) yields equation (3) below:

$\text{In}Y_{it} = \beta_0+\beta_k\ln K_{it}+\beta_l\ln L_{it} + \varepsilon_{it}$ …………………….……………………………… (3)

And re-arranging equation (3)slightly yields equation (4):

$y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + \quad_{it}$ …...…………….…………...……………………….. (4)

Equation (4), written in logarithmic form gives a production function expressed in value terms, where lower case letters denote log values,

$$\ln(A_{it}) = \beta_0 \text{ and } \varepsilon_{it} = \ln(e_{it})$$

Firm productivity is an unobservable firm characteristic which can be recovered from estimating the production function (4). y_{it}, real gross output (measured as total sales),is the value-added for firm *i* at time *t*, k_{it} is capital for firm *i* at time *t*, l_{it} is labour and ε_{it} represents the residual term. Also, from (4) β_0 measures the mean efficiency level across firms over time and is common across production units in the sample (typically available technology is estimated at the industry or sector level). ε_{it} is the time-specific and producer-specific deviation from that mean, which can then be further decomposed into an observable (or predictable) and unobservable component.That is, production function estimates are made with the assumption that firms have identical technology (cost shares) at the industry level.

In the classic Solow models, TFP is, at its core, a residual (Solow, 1957). It is the variation in output that cannot be explained based on observable inputs (Syverson, 2011). Total Factor Productivity measures output net of the contribution of some combined set of inputs (usually capital and labour or employment). Single factor productivity levels are affected by the intensity of use of the excluded inputs, and that TFP measure of productivity is often preferred since it is invariant to the intensity of use of observable factor inputs (Syverson, 2011). TFP is alternatively called multifactor productivity.

In estimating Cobb-Douglas' production functions, many researchers use the translog form which is a second-order approximation approach of estimating the elasticities. The (logged) TFP is simply the estimated sum of the constant and the residual (ln (A_{it}) =$\beta_0 + \varepsilon_{it} = TFP$). In estimating a production function like (4), Ackah et al (2010) denote log valuesln (A_{it}) and $\varepsilon_{it} =$ ln (e_{it})whilst Beveren (2008) also defines ln (A_{it}) = $\beta_0 + \varepsilon_{it}$.

When (4) is rearranged after taking natural logs, we have

$y_{it} \quad \beta_k k_{it} \quad \beta_l l_{it} = \beta_0 + \quad \varepsilon_{it}$ ……………..………………………………… (5)

ε_{it}constitutes the error. It is noted thatε_{it} is an independently and identically distributed shock or disturbance not known to the firm-level decision maker.

Essentially, if (4) is estimated and the erroris predicted ($\widehat{\varepsilon_{\iota t}}$), it results in TFP as this study's measure of firm performance.

$ln\widehat{TFP}_{\iota t}= y_{it} \quad \widehat{\beta_{\iota t}}k_{it} \quad \widehat{\beta_{\iota t}}l_{it} = \widehat{\beta_0} + \widehat{\ }_{\iota t}$ ……………………………………..…… (6)

It presupposes therefore that

$ln\widehat{TFP}_{\iota t}=\widehat{\beta_0} + \widehat{\ }_{\iota t}$ ………………………………………………………………….… (6a)

(6a) shows that TFP is simply the estimated sum of the constant and the residual, as indicated above, which is tantamount to transmitted plant-specific efficiency or productivity as an unobservable characteristic idiosyncratic to a particular producer or firm.

By extension, if (4) is estimated, (log) TFP which is the firm productivity term of interest is realized by predicting the errors. $ln\widehat{TFP}_{\iota t}$is then regressed on other variables that determine total factor productivity (TFP). It means that, principally, all other determinants of TFP or productivity will enter the model through the residual term. Based on (6a), an empirical TFP model can be estimated which includes the variable of interest (*Size*) and a set of firm level variables (*X*) as controls as seen in equation (7) below.

$$TFP_{it} = \beta_0 + \alpha_s Size_{it} + \phi X_{it} + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

From equation (7), β, α and $\emptyset$ are parameters to be estimated. The subscripts i and t represent firm and time period, respectively. Several approaches have been used to estimate (7) in the empirical literature.

Note that, the right-hand side variables could be strictly exogenous, predetermined or endogenous. A first step in obtaining consistent estimates is to eliminate the firm-specific heterogeneity.

Essentially, if (7) is estimated, the log-linear equation below is arrived at:

$$\widehat{lnTFP_{\iota t}} = \widehat{\beta_0} + \widehat{\alpha_{\iota t}} Size_{it} + \widehat{\emptyset_{\iota t}} X_{it} + \widehat{\ }_{\iota t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

Estimating equation (8) by OLS may be problematic since input variables are in general correlated with the unobserved productivity shock but might not be observed by the econometrician, leading to the well-known simultaneity problem in production function estimation (Ackah, Aryeetey, Ayee, & Clottey, 2010; Levinsohn & Petrin, 2003).

Several solutions have been proposed in the production function literature to address this econometric problem. In the most recent best-practices, firm-level TFP is calculated following the innovations espoused by OlleyandPakes(1992) (hereafter, called the Olley-Pakes estimator) that corrects the simultaneity bias arising from the fact that firms choose their levels of input once they know their levels of productivity. The method also corrects the selection bias induced by the fact that firms choose to stay or exit the market depending on their levels of productivity, which in turn depends on the level of their fixed factor input, namely, capital stock.

Other best-practice methods such as the within-group and GMM-type estimators (e.g., Arellano & Bond, 1991) have also been extensively employed to correct for simultaneity biases but it is believed that (if properly done) the Olley-Pakes estimator has several advantages as it does not assume that the firm-specific productivity component reduces to a 'fixed' (over time) firm effect and hence is a less costly solution to the omitted variable and/or simultaneity problem" (Frazer, 2005). The problem with the Olley-Pakes estimator is that the procedure requires strictly positive investment, meaning that all observations with zero investment have to be dropped from the data. This condition may imply a considerable drop in the number of observations because often firms do not have positive investment in every year.

To overcome this limitation, LevinsohnandPetrin(2003) recently proposed an estimation methodology that corrects the simultaneity bias using intermediate input expenditures, such as material inputs, as a proxy for the transmitted plant-specific efficiency.The specific intermediate input chosen as a proxy for the unobservable shock is electricity (Kurz, 2006). This is especially useful as there are many firm-level datasets containing significantly less zero-observations in intermediate inputs than in firm-level investment. The Levinsohn-Petrin technique imposes less stringent data requirements than the Olley-Pakes approach (Ackah et al., 2010). Unfortunately, both procedures have come under a methodological critique regarding the (lack of) identification of the labour coefficient in these estimation procedures(Ackerberg, Caves, & Frazer, 2006).

The approach in the production function literature builds on the work of OlleyandPakes(1992) and LevinsohnandPetrin(2003) methodologies. In short, they separate the error term into firm productivity, ω_{it} , which is seen by the firm manager, and u_{it}, which is a pure noise residual, including for example, measurement error in output. Equation (8) depicts this form of production function. Recall:

$$ln\widehat{TFP_{\iota t}} = \widehat{\beta_0} + \widehat{\alpha_{\iota t}} Size_{it} + \widehat{\emptyset_{\iota t}} X_{it} + \widehat{\ }_{\iota t} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

Equation (8) is rewritten to arrive at equation (9)

$$ln\widehat{TFP_{\iota t}} = \widehat{\beta_0} + \widehat{\alpha_{\iota t}} Size_{it} + \widehat{\emptyset_{\iota t}} X_{it} + \widehat{\omega_{\iota t} + u_{\iota t}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (9)$$

Where $\widehat{\omega_{\iota t} + u_{\iota t}} = \widehat{\ }_{\iota t}$

Alternatively, using a Cobb-Douglas log-linear production function approach (including fixed-effects,β_0) as exemplified by (9) a new TFP model can be developed.

The Empirical Econometric Model Specification

Once the essential variables of the study are correctly specified, the next duty is to present the explicit econometric model and interpret it. The econometric specification may follow a normal cross section multiple regression model if the panel is considered as a simple pool of individual cross section whiles disregarding the effect of time. Nonetheless, the effect of time is an essential part of this study because of the age variable and life cycle effects. Thus, the available options are Static and Dynamic Panel Model specifications which take into account both individual and time effects of the variables.

Both theoretical and empirical evidence suggest that past productivity has positive impacts on current productivity which presupposes that lag values of the dependent variable (TFP) must be included in the explanatory variables to avoid misspecification. But in this study, the time period has only two points as the data was collected only in 2007 and 2013. This means that the data is a short panel and hence, the effect of past productivity on current productivity will not be significant enough to estimate a Dynamic Panel Model. This is because there are missing observations for the years 2008 to 2012. Hence, the decision to use a Static Panel specification ispresented in Equations (10).

$$y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + \alpha_s Size_{it} + \omega_{it} + u_{it} \quad \text{………………………………} (10)$$

Where $Size_{it}$(main explanatory variable) is the size of the firm in firm *i* at time *t*. Equation (10) is further improved by incorporating among other things firm level variables as controls:

$$y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + \alpha_s Size_{it} + \phi' X_{it} + \omega_{it} + u_{it} \quad \text{..} (11)$$

Equation (11), therefore, represents a broader augmented production function where (X_{it}) is a vector of controls or observed variables determining TFP.$\omega_{it}$is the firm specific error term which is constant through time and captures unobserved firm heterogeneity effects (the productivity variable of interest earlier indicated). And u_{it} is a pure noise residual.X_{it}varies across specifications in order to avoid omitted variable bias.

According to Greene(2006), a multiple linear regression should be used to study the relationship between a dependent variable and more independent variables. Therefore, combining all these variables firm age, labour productivity, skill intensity, capacity utilization, tangibility of assets, sales growth as controls coupled with the variables of interest firm size, an empirical model can be formulated for this study.

The empirical model which is a broader augmented production to be estimated therefore is

$$TFP_{it} = \beta_0 + \alpha_s Size_{it} + \phi^{'}(Age, Lab\_Prod, Skl\_Int, Cap\_Utl, TangAssets, Sales\_Growth) + \omega_{it} + u_{it} \quad \text{.......(12)}$$

Where $Size_{it}$ represents value of total assets of firm *i* in time *t* in one scenario and the number of employees of firm *i* in time *t*in another scenario as it measures the main variable of interest (size). The controls largely represent some firm characteristics. β, α and ϕ are parameters to be estimated. TFP_{it} is an increase in output of the firm caused by other factors other than traditional inputs measured as Solow residue or residual term of production function(Mugendi, Gachanja, &Nganga, 2015; Saliola&Seker, 2011). $\omega_{it}$is the firm specific error term which is constant through time and captures unobserved firm heterogeneity effects (the productivity variable of interest earlier indicated).$u_{it}$is a pure noise residual andX_{it} varies across specifications in order to avoid omitted variable bias.

Justification, Measurement of Variables and Expected Signs

The selection of variables follows the Structural Conduct Performance approach which supposes that firm specific characteristic directly determines the performance of a firm.

As was noted in the review of the related literature, one accepted measure of performance is firm efficiency which can be proxied by total factor productivity (TFP). It was also noted that firm efficiency is superior to accounting profitability and as a result TFP was employed for this study. Firm Size is the main explanatory variable of the study while other firm specific characteristics were introduced as controlled variables since they were found to be important variables in explaining profitability in the empirical literature. The control variables include firm age**,**labour productivity, skill intensity, capacity utilization, tangibility of assets and sales growth. Below are the definition and measurement of the dependent variables and the main explanatory variables of the study.

Estimating Total Factor Productivity (TFP)

The economic definition of productivity is relative to a given level of input as compared to resulting output level which is affected by several workplace environmental factors. In this study, TFP is the measure of firm performance. A Cobb-Douglas production function with two factors of production – capital and labour – is used to estimate TFP. Total Factor Productivity (TFP) is estimated as the residual term of the production function.SaliolaandSeker(2011) assert that TFP is a crucial measure of efficiency and thus an important indicator for policymakers.Syverson(2011) also notes that TFP as a measure of productivity is often preferred to single factor productivity measures since it is invariant to the intensity of use of observable factor inputs. Total Factor Productivity (TFP) is referred to as an increase in output of the firm caused by other factors other than traditional inputs.

A popular two-stage approach for estimating TFP was adopted by this study, as shown in the literature by Van Beveren(2012) as demonstrated by OlleyandPakes(1992) and LevinsohnandPetrin(2003) and others including Harris andTrainor(2005) and Harris andMoffat(2011).It is used to estimate equation (11) without including $Size_{it}$ and X_{it} on the right-hand-side of the equation, and then use it to obtain TFP. Typically, $ln\widehat{TFP_{it}}$ is then regressed on X_{it} to measure the determinants of TFP as part of a two-stage approach. The two-stage approach can be summarized as below:

i. Estimate a typical functional production function with respect to common inputs (capital and labour) and predict the errors. The predicted errors yield TFP.

ii. Subsequently,regressing the TFP realized in the first step on the variables of interest (in this case firm size) and a set of controls on the right-hand side, to explain productivity at the firm level.

This procedure results in a much-reduced production function in TFP. According toHarris andMoffat(2011), clear estimates of the elasticity of output (and thus$\widehat{TFP_{it}}$) from this two-stage approach would be expected to be biased because of an omitted variable(s) problem. The

LevinsohnandPetrin(2003)approach (LP approach), however, posits that following this standard methodology of estimating production function (TFP), simultaneity between unobservable productivity and the observable input choices can largely be controlled for.They further claim, for instance, that the simultaneity problem could be solved by using a proxy for the transmitted plant-specific efficiency such as electricity.

Besides the increasingly popular OlleyandPakes(1992) and LevinsohnandPetrin(2003) approaches, and associated extensions such as Ackerberg et al.(2006) which account for both endogeneity of inputs and outputs in the production function and selection bias through using a two-stage procedure where unobserved TFP is proxied by another state variable(s) such as investment or intermediate inputs, class of other models could be (and indeed have been) used to estimate (12), using micro-level panel data as proposed by Harris andMoffat(2011). These include among others:

i. Simple OLS models that ignore fixed effects (FE), endogeneity of inputs and outputs in the production function, and selection bias due to firm entry and exit (which is likely to be correlated with productivity);

ii. Least squares with dummy variable (LSDV) models that allow for fixed-effects;

iii. Within-group fixed effects (WG) least squares models that transforms the production function to remove the fixed effects but only controls for endogeneity and selection bias if the unobserved productivity shock is constant throughout time (and is therefore part of the removed fixed effect);

iv. Two stage least squares (2SLS) within-group fixed effects which allows for endogeneity and selection bias associated with instrumented right-hand side variables;

v. Frontier models where the (one-sided) inefficiency term includes fixed effects but do not control for endogeneity and selection bias; and

vi. Finally, system-GMM, which includes fixed effects and tackles endogeneity of the right-hand-side variables and selection bias by using their lagged values (in first differences and levels) as instruments.

The current study attempts to estimate equation (12) using a mixed panel regression model which include estimates of OLS, RE and fixed effects and based on the outcomes of Breusch and Pagan Lagrangian multiplier and Hausman tests, interpret the most robust or superior model or estimator.

An integral part of TFP estimation is the definition and measurement of output (Y) and key input variables such as capital (k) and labour (l). The coefficients of K and L are expected to be positive (i.e. $\beta_k, \beta_l > 0$).Syverson (2011) assumes that deflated revenues accurately reflect the producer's output. Equations in y_{it} capture value-added or real gross output measured as gross or total sales to deal with problems arising from differences in intermediate input usage. Output is measured as a continuous variable. *Capital (K)* is the value of fixed assets of each firm, which can be used as a proxy for the stock of capital or the firm's book value of its capital stock in this study. In this study, capital is proxiedby the replacement value or cost of machinery, vehicles and equipment. *Labour (L)* refers to the mental and physical efforts used in production. Alternatively, labour is referred to as the physical work done for wages and is measured by the total cost for labour. It can also be measured in physical units such as number of employees, employee-hours or hours worked or some quality-adjusted measure (since wages are assumed to capture marginal products of heterogeneous labour units, the wage bill is often used as quality-adjusted labour measure). Labour is, therefore, assessed by the total compensation of workers including wages, salaries and bonuses in the current study.

Firm Size and Firm Size Categorization

Number of employees and value of total assets were among the best measures of firm size as was revealed in the review of the related literature in Chapter Two. This study, therefore, employed number of employees and total assets as the measure of firm size because economies and diseconomies of scale should be associated with human frailties and the robustness of the measure of size is needed to satisfy the main objectives of the study. Moreover, the study deals with Bureaucratic failures, which in the end are the result of coordination costs which is best measured in relation to number of employees (Kumar et al., 2001). Also, transactional cost deals mainly with assets specificity (Canback, 2002).

Also, almost all size categorization in Ghana are done in terms of number of employees (Teal, 2002). The National Board for Small Scale Industries, however, used both number of employees and assets to define size. Despite the widely uses of number of employees to define size, most studies in Ghana have used total assets to measure size (Abor, 2008; Amidu & Hinson, 2006). The Enterprise Survey for Ghana data set allows size to be measured in terms of number of employees and value of assets which makes the comparison easy. However, size categorization already exists in the data set in terms of number of employees as below:

1. Small enterprises - firms with 5-19 employees,

2. Medium enterprises - firms with 20-99 employees and

3. Large enterprises - firms with 100 employees or more

Size measured as number of employees is expected to be positively related to productivity. Size, measured as value of total assets, is expected to tell a story directly opposite to that of number of employees. That is, increase in asset has the tendency to increase the cost or opportunity cost of capital employed which reduces TFP but the effect is expected to decrease in size.

Firm Age

There seem to be an agreement as to how to measure age in the literature. Almost all the reviewed studies that involve age have measured it as the number of years a firm has operated in the market. The study employed the same measure with the assumption that selected firms have been in continuous operation since the inception of the factory.

The empirical review pointed to the fact that on the average younger firms were more productive than older firms; hence, age is expected to have positive effect on firm performance (TFP) but the effect must be decreasing in age.

Labour Productivity

Labour productivity is measured as the total output per worker. The economic definition of productivity is relative to a given level of input as compared to resulting output level which is affected by several workplace environmental factors. The expectation is that labour productivity shall be positively related to TFP.

Skill Intensity

Skill intensity is measured as the ratio of number of skilledlabour to the total number of employees. Skill intensity is introduced to account for the effects of the quality of human capital on TFP. Studies carried out by SiddharthanandDasgupta(1983) and Kumar(1985) have suggested a positive relationship between the skill of employees and financial performance.

Capacity Utilization

Capacity utilization is the extent to which an enterprise uses its installed productive capacity. An alternative approach, sometimes called the "economicutilization rate", is, therefore, to measure the ratio of actual output to the level of output beyond which the average cost of production begins to rise. In this case, surveyed firms are asked by how much it would be practical for them to raise production from existing plant and equipment, without raising unit costs(Berndt & Morrison, 1981).

In economic statistics, capacity utilization is normally surveyed for goods-producing industries at plant level. The results are presented as an average percentage rate by industry and economy-wide, where 100% denotes full capacity. This rate is also sometimes called the "operating rate". If the operating rate is high, this is called "under capacity", while if the operating rate is low, a situation of "excess capacity" or "surplus capacity" exists. If a firm operates at full production capacity, it is expected that productivity will be positively affected but lower capacities may affect productivity negatively.

Tangibility of Assets

The assets of a firm could be tangible or intangible. Tangibility of assets is measured as the ratio of xed tangible assets to the total assets of the rm. Tangibles are easily monitored and provide good collateral and, thus, they tend to mitigate agency con icts (Himmelberg, Hubbard, & Palia, 1999). This implies that higher levels of asset tangibility could guarantee excess borrowing. Tangibility of assets is introduced to account for the effects of the quality of tangible and intangible assets on TFP. Studies carried out are inconclusive as to a positive or a negative relationship between the tangibility of assets and financial performance.

Sales Growth

Sales growth is measured as the ratio between current sales minus previous sales and previous sales. In the Enterprise Surveyfor Ghana data, a previous sale was accounted as three-year-old sales and not the immediate past year. Sales growth is expected to have a positive relationship with TFP but cannot be certain since there could be negative growth rate as is found in the data set.

Table 2 shows the definition, measurement and relationship expectations between the firm specific characteristics and total factor productivity.

Table 2: ***Definition, Measurement and A-Priori Expectation of Variables***

Variable	Definition	A priori sign
Assets	Summation of net book value of machinery, vehicles, & equipment and net book value of land and buildings in the last fiscal year.	-
Number of Employees	Summation of permanent full-time employees & full-time temporary employees at the end of the last fiscal year	+
Age	Difference between current year andthe year which the establishment began operations	+
Labour Productivity	Ratio of total annual sales (proxy for value of output in the data) in the last fiscal year to total number of employees	+
Skill Intensity	Ratio of number of full-time skilled employees to total number of employees	+
Capacity Utilization	Full utilization of production capacity	+/-
Tangibility of Assets	Ratio of fixed assets to total assets	+/-
Sales Growth	Ratio between current sales minus previous sales to previous sales	+/-

Source: Author’s construct

Source, Description and Justification of Data

This study resorts to the use of a secondary data which was a firm level data gathered for Ghana under The World Bank's Enterprise Survey for two waves or periods. Secondary data can be viewed in different lights as either a data set gathered for a purpose other than that of a given study or a data set gathered by another or a more abled body for purpose of future research. The secondary data used in this study falls into the later definition since the data was gathered by The World Bank primarily to aid research into the manufacturing, services and other sectors of Ghana. Sorensen, Sabroe, and Olsen(1996)advocate for the use of secondary data from credible sources to ensure speed in the research process.

To estimate the output model, empirical data at the firm level was drawn from the first and second rounds of the Enterprise Survey for Ghana (2007 & 2013) to study the effects of firm size on firm productivity in Ghana. The data is a national survey that was conducted in the years 2007 and 2013 on firms in the manufacturing, services and other sectors. This means the data is a nationally representative data collected across firms in different sectors of the country by The World Bank. The Enterprise Survey for Ghana is a firm-level survey representative of the economy's private sector. The Enterprise Surveys target formal firms with five or more employees that are not 100 percent state/government owned.The firms used for the study include small, medium and large firms among other characteristics.

More specifically, the data focuses on firms as the unit of analysis; however, data is collected on employees or workforce within the firm and industry. Though the dataset is predominantly a firm-level one, it contains a great deal of information on the workforce or employees (characteristics and composition) which helps to determine size from assets and total number of employees and their impact on productivity. The characteristics of the data make analysis at the firm level involving the workforce highly feasible. Whilst individual workers have attributes peculiar to them, the sum total as the workforce and their qualities are possessed by the firms as labour input used in the production process. In this dataset, employees have been categorized into various occupational groups: production and non-production workers; skilled and unskilled production workers, permanent/full-time and temporary/part-time workers among others.

The data set was selected above other available data sets because it was purely African and country specific. Next, the firms in the sample were not truncated by size and covered many sectors at the same time (manufacturing, services and others). Also, the accurate characterization of the firm's labour force in the data set allowed for a more accurate measurement of firm productivity, one that accounts for a firm's use of human capital. On that score, the Enterprise Survey data can be described as useful since it serves as a source of information for the purpose of this study.

Another useful feature of the dataset is that, the survey covers a broad range of business environment topics or information including firm characteristics, gender participation, access to finance, annual sales, costs of inputs such as labour, workforce composition, bribery/corruption, licensing, infrastructure, trade, crime, competition, capacity utilization, land and permits, taxation, informality, business-government relations, innovation and technology, obstacles to growth, and performance measures.

The data set comes with an explanatory note on the sampling procedures, content of questionnaire, and a detailed description of all the variables which allowed the researcher, after carefully studying the explanatory note, to understand and efficiently use the data.

The discussion above indicates that the firm level panel dataset (sourced from the Enterprise Surveyfor Ghana in 2007 and 2013) was the main data for the econometric analysis, presupposing that the researcher was, to a large extent, also able to deal with the problems of unobserved firm-specific heterogeneity and simultaneity biases.

The study employed both descriptive and quantitative regression analysis. Charts such as tables and graphs were employed to aid in the descriptive analysis. Panel multiple regression analysis was the prominent analytical tool employed in the study. All estimations were carried out using STATA version 13.1 statistical packages.

Sample Design

The Enterprise Surveyfor Ghana was conducted using a stratified probability/random sampling technique.The population or universe of the study is all the private owned firms in the manufacturing, services and other industries in

Ghana. The levels of stratification used were firm sector, firm size, and geographic region. Industry or sector stratification was designed in the way that follows: the universe was stratified into four manufacturing industries (food, textiles and garments, chemicals and plastics, other manufacturing) and two service sectors (retail and other services). Regional stratification for the Ghana Enterprise Survey was defined in four Regions: Accra, North (Kumasi and Tamale), Takoradi, and Tema. In all, a total of 1,336 observations comprising 616 and 720 from the first and second waves in 2007 and 2013 respectively were originally selected nationwide. In the end, a sample of 1,203panel of firms was selected due to some level of attrition seen in Figure 1.

Author's Sample

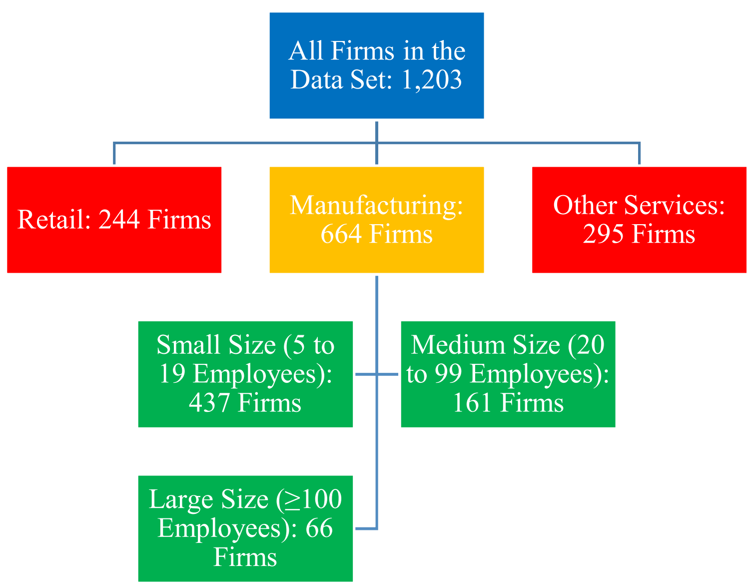

***Figure 1*: Sampling Tree**

Source: Author's Construct from Enterprise Survey for Ghana (2007 & 2013)

The observations used in this work were sampled based on the type of firm and size stratification in the sense that the study makes an assumption of homogeneity by size of firms. The focus of the work was on manufacturing firms and hence, retail and other service firms were excluded from this study. The analysis in this study was therefore done on all firm sizes in the manufacturing category. Based on size categorization, the analysis originally set out with 437 small firms, 161 medium firms and 66 large firms. The samples for small, medium and large firms further dropped to 194, 72 and 40 respectively as explanatory variables were plugged in the model when firm size was measured by total assets. On the other hand, the samples for small, medium and large firms dropped to 194, 64 and 30 respectively as explanatory variables were plugged in the model when firm size was measured by number of employees.

Estimation Techniques

A panel model contains two subscripts (i and t) which differentiate it from either cross-sectional (*i*) or time series (*t*). Thus, panel data can be seen as a time series of individual cross-sections and hence, has the attributes of both time series and cross-sectional data. Panel data, therefore, has some superiority over pure cross sectional or time series data especially its ability to handle individual heterogeneity (Greene, 2003).

The TFP model to be estimated in this study relates firm characteristics to firm's outcome, controlling for firm variables. To ensure the robustness of the estimation results irrespective of the econometric technique, three different panel data techniques were employed for the exercise. The first modelis done using standard pooled OLS estimators. Fixed and Random effect panel estimation techniques was also employed in the study to control for unobserved effects which are ignored by the pooled OLS estimation procedure after which results were compared to the above-stated panel estimation procedures for consistencies and meaningful conclusions. The following section discusses in detail the three panel techniques used for the study.

Pooled OLS

Consider a linear panel data model,

$y_{it} = x_{it}^{/}\beta + \varepsilon_{it}$ i= 1...., N t= 1..., T.. (13)

This model may appear overly restrictive because β is the same in each time period. Parameters changing over time can, however, be allowed for by appropriately choosing x_{it}. The fact that x_{it} is written for some elements does not mean those elements may not be time varying. The two assumptions required for pooled OLS to consistently estimate β are as follows:

Assumption 1: $E(x_t\varepsilon_t) = 0$, *t= 1,2.... T.*

Assumption 2: $rank\left[\sum_{t=1}^{T} E(x_t^{/}x_t)\right] = K.$

While Assumption 1 does not talk about the relationship between x_s and ε_t for $s \neq t$, the idea of perfect linear dependencies among the explanatory variables is in effect ruled out by Assumption 2. In order to apply the usual OLS statistics from the pooled OLS regression across *i* and *t*, homoskedasticity and no serial correlation assumptions must be assumed. The weakest forms of these assumptions are the following:

Assumption 3

(a) $E(\varepsilon_t^2 \mid x_t^/ x_t) = \sigma^2 E(x_t^/ x_t),\ t = 1, 2, ...,T,\ where\ \sigma^2 = E(\varepsilon_t^2)\ for\ all\ t;$

b) $E(\varepsilon_i \varepsilon_s x_t^/ x_s) = 0, t \neq s, t, s = 1, ...T.$

The first part of Assumption 3 is a fairly strong homoskedasticity assumption; sufficient is $E(\varepsilon_t^2 \mid x_t) = \sigma^2$ for all t. This implies that the conditional variance does not depend on x_t , and also the unconditional variance is the same in every time period. The conditional covariance of the errors across different time periods is restricted to be zero by Assumption 3b. In fact, since x_t almost always contains a constant, assumption 3b requires at a minimum that $E(\varepsilon_i \varepsilon_s) = 0,\ t \neq s.$ Sufficient for 3b is $E(\varepsilon_i\ \varepsilon_s \mid x_t^/ x_s) = 0, t \neq s, t, s = 1, ...T.$

Assumption 3 implies more than just a certain form of the unconditional variance matrix of $u = (u_1, ..., u_T)^{/.}$ Assumption 3 also implies $E(u_i u_i^/) = \sigma^2 I_T$ denoting constant unconditional variances and zero unconditional covariance. However, it also effectively restricts the conditional variances and covariance. Heteroskedasticity and serial correlation can be accounted for to guarantee correct inference and estimates.

Mixed Regression Model - Panel Estimation

This study employed an unbalanced panel data and therefore panel estimation technique for the econometric analysis. A panel model contains two subscripts (*i* and *t*) which differentiate it from either cross-sectional (*i*) or time series (*t*). Thus, a panel data can be seen as a time series of individual cross-sections and hence, has the attributes of both time series and cross- sectional data. Panel data, also called longitudinal data or cross-sectional time series data, are data where multiple cases (individuals, firms, countries etc.) are observed at two or more time periods.

Panel data therefore has some superiority over pure cross sectional or time series data especially its ability to handle individual heterogeneity (Greene, 2003) by controlling for unobserved variables (Torres-Reyna, 2007). Panel data allow for inclusion of variables at different levels of analysis and thus, suitable for multilevel or hierarchical modeling. According to Hsiao(1986), panel data are useful in the sense that they offer a much larger data set with more variability and less collinearity among the variables than is typical of cross-section or time-series data; they are also better able to identify and estimate effects that are simply not detectable in pure cross-sections or pure time-series data; and finally with additional, more informative data, panel data guarantee reliable estimates and test more sophisticated behavioral models with less restrictive assumptions.

A typical panel data regression model looks like (7). Recall

$$TFP_{it} = \beta_0 + \alpha_s Size_{it} + \phi X_{it} + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

Assumptions about the error term determine whether we speak of fixed effects or random effects. In a fixed effect model, ε_{it} is random and assumed to vary nonstochastically over $i$or t making the fixed effects model analogous to a dummy variable model in one dimension. In a random effects model, ε_{it} is assumed to vary stochastically over $i$or t requiring special treatment of the error variance matrix. Panel data are most useful when the researcher suspects that the outcome variable depends on explanatory variables which are not observable but correlated with the observed explanatory variables. If such omitted variables are constant over time, panel data estimators allow consistentestimatingof the effect of the observed explanatory variables.

Panel data analysis has three more-or-less independent approaches: independently pooled panels, random effects models,fixed effects models or first differenced models. The selection between these methods depends upon the objective of the analysis, and the problems concerning the exogeneity of the explanatory variables. The fixed effect sweeps away the time-constant or time-invariant variables by time demeaning their effect, by way of dealing with the unobserved heterogeneity. The random effect, on the other hand, allows for the estimation of the time-invariant variables and thus, desirable under certain circumstances, especially if the unobserved variables are uncorrelated with all the observed variables.

For the purpose of this study, a mixed panel regression model involving OLS, random effects (RE) and fixed effects (FE) was estimated and one with superior results based on OLS and panel diagnostic tests interpreted as earlier indicated in this chapter.

Assumptions under Fixed Effects and Random Effect Models

There are two common assumptions made about the individual specific effect: the random effects assumption and the fixed effects assumption. The random effects assumption is that the individual or firm specific effects are uncorrelated with the independent variables. The fixed effects assumption is that the individual or firm specific effect is correlated with the independent variables. If the random effects assumption holds, the random effects model is more efficient than the fixed effects model. However, if this assumption does not hold, the random effects model is not consistent.

Fixed Effect Models

For fixed effect models, there are unique attributes of individuals or firms that are not the results of random variation and that do not vary across time. They are said to be adequate if we desire to draw inferences only about the examined individuals or firms. Fixed effects regression is the model to use in order to control for omitted variables that differ between cases but are constant over time. Principally, fixed effect models examine (group or individual) differences in intercepts; assumes the same slopes and constant variance across entities or subjects; claims a group (individual specific) effect is time invariant and considered a part of the intercept; and the error is allowed to be correlated to other regressors.

The fixed-effect models control for all time-invariant differences between the individuals or firms, so the estimated coefficients of the fixed-effect models cannot be biased because of omitted time-invariant characteristics of the entities. One side effect of the features of fixed-effects models is that they cannot be used to investigate time-invariant causes of the dependent variables. Technically, time-invariant characteristics of the entity are perfectly collinear with the entity (person or firm) dummies.

Estimation methods usually employed under fixed effects modelling is the least squares dummy variable (LSDV) and within effect estimation methods e.g. ordinary least squares (OLS) regressions with dummies.

Random Effect Models

Random effect models are used in the analysis of hierarchical or panel data when one assumes nofixed effects(it allows for individual effects). The random effect model is a special case of the fixed effects model. The random effect model basically omits the fixed effects and overcomes the omission by modelling the error structure. According to Wooldridge(2010), random effects model is unobserved effects panel data model where the unobserved effect is assumed to be uncorrelated with the explanatory variables in each time period. Random effects estimator, therefore,is a feasible Generalized Least Squares (GLS) estimator in the unobserved effects model.

With random effects, there are unique, time constant attributes of individuals or firms that are the results of random variation and do not correlate with the individual regressors. This model is adequate if we want to draw inferences about the whole population, not only the examined sample. If there is any reason to believe that some omitted variables may be constant over time but vary between cases, and others may be fixed between cases but vary over time, then both types can be included by using random effects. In other words, if there is reason to believe that differences across entities have some influence on your dependent variable; random effects models may be useful.

The rationale behind random effects model is that, unlike the fixed effects model, the variation across entities is assumed to be random and uncorrelated with the predictor or independent variables included in the model: "…the crucial distinction between fixed and random effects is whether the unobserved individual effect embodies elements that are correlated with the regressors in the model, not whether these effects are stochastic or not" (Green, 2008, p. 183).

An advantage of random effects is that the researcher can estimate coefficients for explanatory variables that are constant over time (i.e. include time invariant variables). In the fixed effects model, these variables are absorbed by the intercept. If "N" is large, and "t" is small, and the cross-sectional units are a random sample from a population, then random effects model becomes attractive. Furthermore, random effects provide enough degrees of freedom than fixed effects, because rather than estimating an intercept for virtually every cross-sectional unit, one estimates the parameters that describe the distribution of the intercepts.

Linear Random effects models are estimated via GLS. If there are no omitted variables (or if the omitted variables are uncorrelated with the variables that are in the model), then a random effects model is preferable to fixed effects because:

a. The effects of time-invariant variables like race or gender can be estimated, rather than just controlled for, and
b. Standard errors of estimates tend to be smaller. However, if relevant time-invariant variables have been omitted from the model, coefficients may be biased.

Generally, random effects have been described as efficient, and preferred (to fixed effects) provided the assumptions underlying them are believed to be satisfied. For random effects to be useful in this study, it is required that the firm-specific effects be uncorrelated to the other covariates of the model. This can be tested by running fixed effects, then random effects, and doing a Hausman specification test. If the test rejects the null hypothesis, then random effects is biased and fixed effects is the correct estimation procedure.

Post-Estimation Tests

The following post estimation tests were carried out: test for normality, multicollinearity, heteroskedasticity, omitted variable bias and model fit tests with other useful ones. This is to ensure that estimates from the regression are robust and consistent.

Normality Test

One of the basic classical regression assumptions is that variables should be normality distributed in the model. Although most researchers assume the existence of normality without empirical testing, it does not undermine the importance of this test in research (Park, 2008). The violation of this assumption makes the interpretation and inferences from the study unreliable and invalid.

Multicollinearity Test

Multicollinearity refers to the situation where some of the explanatory variables are not independent but are correlated with each other. Multicollinearity is a problem in regression analysis, since it becomes impossible to assign a change in a dependent variable precisely to a particular explanatory variable. Moreover, in the presence of multicollinearity, the precision power of the independent variable is reduced (Salvatore & Reagle, 2002). The addition of variables, the utilization of prior information, transformation of the data set or the dropping of one of the highly correlated explanatory variables are the means of avoiding multicollinearity in regression analysis. Multicollinearity can be checked using either the VIF (Variance Inflation Factor), the DW (Durbin Watson) statistics or by the Correlation Matrix test. A correlation coefficient of 0.8 gives an indication of multicollinearity, but a value of 0.95 and beyond implies that there is serious multicollinearity in the data set. This approach for checking multicollinearity conveys little information on the presence of multicollinearity because it may conceal problems like curve linearity, outliers or clustering of data points. Hence, the problem of multicollinearity is better diagnosed by the VIF. A VIF value of 10 indicates the presence of multicollinearity in the data set (Salvatore & Reagle, 2002).

Heteroskedasticity Test

Heteroskedasticity occurs if the OLS assumption of equal variance of the error term is violated. This is a major setback in most cross-sectional data sets since they appear not to have equal variance. In the presence of heteroskedasticity, the OLS estimators, although unbiased, become inefficient hence, they have weak statistical precision power. The standard errors of the coefficient are both biased and inconsistent. This increases the probability of accepting a false null hypothesis. To diagnose the presence or absence of heteroskedasticity, one can either perform the Breusch Pagan/ Cook – Weisberg test or the plot of the residual against the fitted values of the dependent variable. In the Breusch Pagan/ Cook – Weisberg test, a null hypothesis of equal variance is set. The test statistics is the chi-square test. This follows a chi-square distribution with degree of freedom at a chosen alpha value. The k refers to the total number of regressors in the model. The null hypothesis is rejected if the calculated chi-square does not fall in the critical region. In the case of the plot of the residual against the fitted values of the dependent variable, the lack of pattern and a uniform distribution of the observations suggest the absence of heteroskedasticity.

Following Stock and Watson(2008), as a rule-of-thumb estimation of every model always requires an assumption of heteroskedasticity. By default, STATA assumes homoscedastic standard errors, so the model was adjusted to account for heteroskedasticity by using heteroskedasticity-robust standard errors to deal with the problem of heteroskedasticity(Ronchetti, Field, & Blanchard, 1997). By adding "robust" to the equation in STATA, therefore, the researcher addresses the problem of heteroscedasticity in STATA statistical package.

Omitted Variable Test

Omitted variables problem occurs when we would like to control for one or more additional independent variables usually, because of data unavailability, we cannot include them in a regression model conducted (Wooldridge, 2003). This means that the model is poorly specified. This may lead to bias of the OLS estimates of the coefficients. To check for the specification of the model, the study conducted the regression specification error test proposed by (Ramsey, 1969). The test is based on the assumption that the error term has a zero-conditional mean. The error term, *u,* has an expected value of zero, given any values of the independent variables. The idea of the Ramsey Regression Equation Specification Error Test (RESET test) is that if a model satisfies the conditional zero mean assumption, then nonlinear function of the regressors should not be significant when added to the model.

Hausman Test

Hausman(1978) proposed a specification test which is based on the difference between the fixed and random effects estimators. To decide between fixed or random effects, it is appropriate to run a Hausman test where thenull hypothesis is that the preferred model is random effects against the alternative fixed effects model (Green, 2008). It basically tests whether the unique errors (u_i) are correlated with the regressors.

Goodness of Fit Test

Wooldridge(2003) posits that the goodness of fit is not usually as important as the statistical and economic significance of the explanatory variables. A model fit refers to the variation of the dependent variable explained in the model by the inclusion of the independent variables. Thus, in a well-fitting model, the predicted values will be closed to the observed values. There are 3 statistics used to evaluate model fitness in regression analysis. These are the R-squared, the overall F-test and the Root Mean Square Error (RMSE). Another commonly used test of model fit is the Pearson or Hosmer and Lemeshow's goodness-of-fit test. The idea behind the Hosmer and Lemeshow's goodness-of-fit test is that the predicted frequency and observed frequency should match closely, and that the closer they match, the better the fit. The Hosmer-Lemeshow goodness-of-fit statistic is computed as the Pearson chi-square from the contingency table of observed frequencies and expected frequencies. Similar to a test of association of a two-way table, a good fit, as measured by Hosmer and

Lemeshow's test, will yield a large p-value to indicate that the model fits the data. Apart from the Hosmer-Lemeshow test, the McFadden R2 is also a test for the goodness-of-fit of a model (McFadden, 1984).

Conclusion

The chapter essentially focused on how the study was conducted by providing full explanation on the methodology that was adopted. It, thus, showed that the study employed the quantitative technique and specifically adopted the descriptive research design to carry out the research. It shed light on the type of data used and sample design and selection procedure.

Also in this chapter, the theoretical model was specified. The model was derived from the Cobb-Douglas production function. Size was used as the main variable of interest coupled with firm level variables such as age, labour productivity and other controls to explain firm productivity.

Moreover, estimation techniques used in this study were discussed in this chapter. This study employed unbalanced panel data and thus, a mixed panel regression model involving least squares (OLS), random effects (FE) and fixed effects (FE) is estimated and one with superior results used or interpreted, based on panel diagnostic tests. Diagnostics such as Breusch-Pagan Lagrange multiplier (LM) test and Hausman specification test favoured the fixed effects estimation as more efficient.

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

This chapter presents the analysis and discussion of results of the study. The first section of this chapter examines the descriptive statistics of the variables to explore their distribution. The second section deals with the static panel regression analyses followed by the discussion and conclusion of the chapter.

Descriptive Statistics

This section presents some measures of central tendencies and measures of dispersion of the main variables of the study which helps to understand the distribution of the variables. The distributions of the variables are necessary for the partial analysis of the regression analyses in order to determine the performance of the various size categories. The mean and mode are presented for the continuous variables while only the mode is presented for the categorical variable since the mean losses its meaning in the case of categorical variables. The standard deviation is reported as a measure of dispersion for the respective variables though not much can be said about it in most cases due to the level of aggregation. The minimum and maximum values give a gist about the range of the variables. The standard deviation, however, has three different values for *within, between* and *overall* for a panel data.

The discussion is done at three levels; at the aggregated level, for the respective size categories for all the main variables of interest. The disaggregation allows the true picture of the respective firm size groups to be captured and it helps build the argument on what to expect in the regression analysis. The descriptive statistics of the respective variables are presented and discussed below.

Total Factor Productivity

The baseline specification of this study is the Cobb–Douglas production function which relates output with inputs and firm productivity. Table 3 shows how TFP was arrived at from the data set.

Table 3: ***Regression Results for Capital and Labour on Output***

Dependent Variable = Output (log); Explanatory Variables	Coefficient	Standard Error	t-Value	P> |t|
Capital (log)	0.1452884	0.0242679	5.99	0.000
Labour (log)	0.8090402	0.022901	35.33	0.000
_cons	2.63109	0.2132441	12.34	0.000
R-Squared		0.9367		
Observations		392		
Model Sum of Squares		5648.41331		
Residual Sum of Squares		381.580087		

Source: STATA/IC 13.1 output from Enterprise Survey for Ghana (2007& 2013)

The exponent of the predicted residual is generated to obtain TFP as this study's measure of firm performance.

Table 4 presents the aggregated descriptive statistics of the respective variables.

Table 4: ***Descriptive Statistics for the Aggregated Variables***

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
TFP	389	2.051536	4.424961	.1317884	49.33514
Assets	380	6.95e+09	7.10e+10	5.703783	1.26e+12
Age	664	18.78313	12.91478	1	101
Labr_Prod	571	3.91e+07	1.18e+08	136.3636	8.87e+08
Skl_Int	637	.5169725	.2767216	0	1.107692
Cap_Util	599	68.5384	19.00359	9	100
TangAssets	380	.5036123	.3164318	0	1.000693
Sales_Growth	520	12.00419	145.8678	-.9887373	2660.714

Source: STATA/IC 13.1 output from Enterprise Survey for Ghana (2007 & 2013)

The differences in observations can be accounted for by the data management process since the variables were formed by a combination of two or more variables and hence missing values for some variables were dropped indicating a reduction in frequency for the formed variable. A striking observation from Table 4 is that the standard deviations of TFP, Assets, Labour

Productivityand Sales Growth exceed the mean value which can be explained by the position of the mean value relative to the minimum and maximum values.

The arithmetic mean is usually less than the standard deviation in data sets with both positive and negative values due to the *telescopic cancellation*(that is a sum in which subsequent terms cancel each other, leaving only initial and final terms)in the data set. The positive Total Factor Productivity (TFP) indicates that firms are enhancing performance rather than declining for the firm owners or shareholders. The value of average real output per labour is GH¢39,100,000 per annum. Assets could be as low as GH¢5.703783 and as high as GH¢1,260,000,000,000 with an average value of GH¢6,950,000,000 per annum.

The general conclusion from the discussion above is that the manufacturing sector of Ghana is not in a very good shape in terms of TFP but improving at a decreasing rate. The breakdown of the analysis into the various size categories throws some light on the general performance.

One striking observation form the data is that about 66 per cent of the manufacturing firms in Ghana are in the small size category as is seen in Table 5.

Table 5: ***Descriptive Statistics for the Firm Size (No. of Workers) Categories***

Size	Observations	Mean	Standard Deviation	Minimum	Maximum
Small	423	11.32624	8.568511	5	19
Medium	155	43.14839	29.58057	20	99
Large	61	349.8197	417.8943	100	3000

Source: STATA/IC 13.1 output from Enterprise Survey for Ghana (2007 & 2013)

The statistics indicate that very few manufacturing firms are actually very large than the largest firm in the medium enterprise groups. The conclusion is that most features may cut across the medium and large firm size categories.

The size categories over-lap in terms of asset endowments as is seen in Table 6.

Table 6: ***Descriptive Statistics for Assets across Firm Size (No. of Workers) Categories***

Size	Observations	Mean Assets	Standard Deviation	Minimum	Maximum
Small	237	7.80e+07	2.11e+08	5.703783	1.91e+09
Medium	94	1.37e+09	7.05e+09	10.20359	6.50e+10
Large	49	5.09e+10	1.93e+11	13.43244	1.26e+12

Source: STATA/IC 13.1 output from Enterprise Survey for Ghana(2007 & 2013)

The implication is that when asset is used as a proxy for size, it will allow firms in different categories in terms of number of employees to end up in the same size group. This forms one of the bases for measuring size in this study as both number of employees and total assets in an attempt to make a case for the need to be concerned about the choice of proxy for size.

Trend in TFP

Figure 2 shows the distribution of Total Factor Productivity across the various firm size categories for the two years in which the survey was conducted.

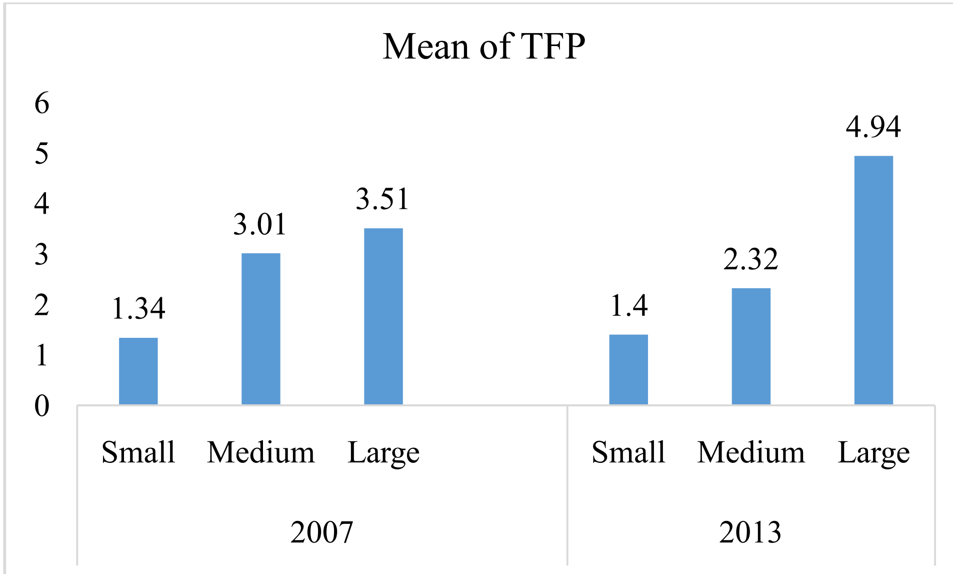

***Figure 2*: TFP across Firm Size (2007, 2013)**

Source: STATA/IC 13.1 output from Enterprise Survey for Ghana(2007 & 2013)

It can be observed that small and large firms had an increase in firm performance (measured by TFP) in the later year but the increase in TFP for small firms was not so much significant as compared to that of large firms. Total factor productivity in the medium sized firm category, unlike both the small and the large firms, dropped by 0.68507 between the years 2007 and 2013.

Trend in Assets

Figure 3 shows the distribution of assets (logged) across the various firm size categories for the two years in which the survey was conducted.

sizecategories for the two years in which the survey was conducted.

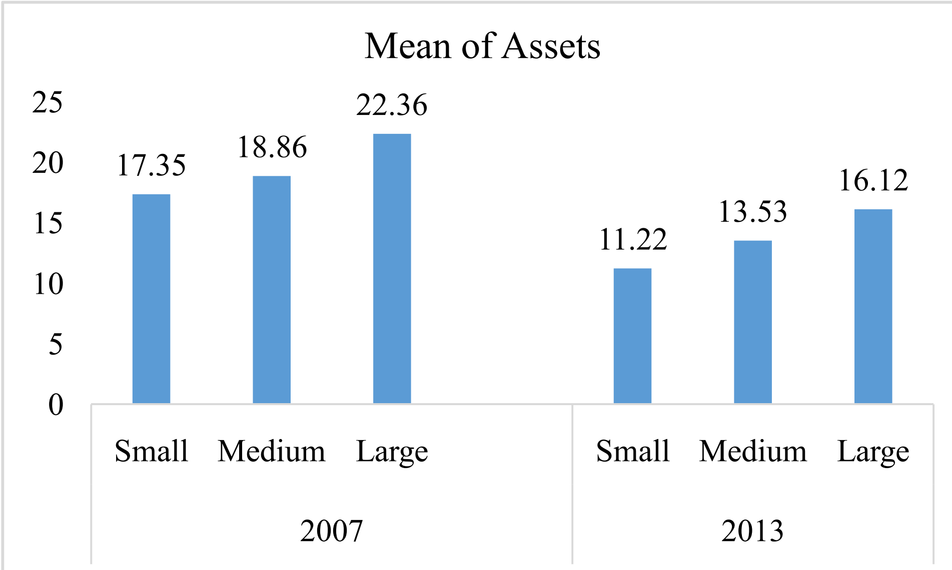

Figure 3**: Assets across Firm Size (2007, 2013)**

Source: STATA/IC 13.1 output from Enterprise Survey for Ghana (2007 & 2013)

It can be observed that asset acquisition for all the firm size categories dropped significantly. Most significant is the large firm category which saw a deference of GH¢6.2434 as assets dropped between the years, 2007 and 2013. Note that, the variable “assets” is logged in this analysis.

Trend in Labour Productivity

Labour productivity is measured as the ratio of sales to total number of employees. This is presented in Figure 4 and it shows a consistent decline for manufacturing firms in Ghana. The labour productivity (logged) values for 2007 for all small, medium and large firms were GH¢17.2239, GH¢17.541 and GH¢18.1652 respectively. However, in 2013, labour productivity (logged)reduced to GH¢9.1067, GH¢10.1933 and GH¢10.9725 for small, medium and large firms respectively.

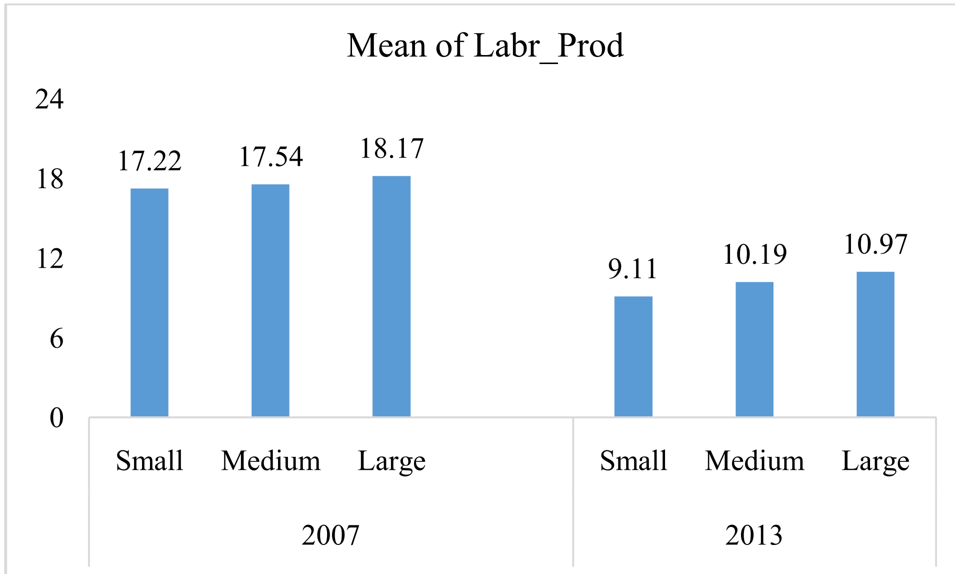

Figure 4: Labour Productivity across Firm Size in Survey Years

Source: STATA/IC 13.1 output from Enterprise Survey for Ghana (2007 & 2013)

It still remains that labour productivity keeps on reducing from large through to small manufacturing firms. The large firms have a higher labour productivity than the medium firms as well as the medium firms having a higher labour productivity than the small manufacturing firms. This pattern is evident in both years. This might be due to the fact that sales are much higher in the large and medium firm categories than the small firms.

Relationship between the Firm Size Categories and TFP

In order to establish if there is any significant difference and to ascertain the magnitude of the differencein TFP across the various firm size categories, an analysis of variance was conducted.

Table 7: ***Analysis of Variance (ANOVA); Test for Differences in TFP***

Source	SS	df	MS	F	Prob>F
Between Groups	357.16716	2	178.58358	9.52	0.0001
Within Groups	7239.98211	386	18.7564303		
Total	7597.14927	388	19.5802816		

Bartlett's test for equal variances: chi2(2) = 207.7738 Prob>chi2 = 0.000

Source: STATA/IC 13.1 output from Enterprise Survey for Ghana (2007 & 2013)

From Table 7, the 0.001 Prob>F tells that there is significant difference in TFP across the firm size categories. This was followed by a Bonferroni test to see the categories which have significant difference in TFP and those which do not have. The Bonferroni Testis presented in Table 8.

Table 8: ***Comparison of TFP by Size Categories; Bonferroni Test***

Row Mean – Column Mean	Small	Medium
Medium	1.40797	
	0.019**	
Large	2.70239	1.29442
	0.000***	00.272

Source: STATA/IC 13.1 output from Enterprise Survey for Ghana (2007 & 2013)

From Table 8, it can be seen that between small and medium firms, the p-value is significant at 5% and this tells us that there is a significant difference in TFP between those two firm size categories. A similar story can be told in the comparison of small and large firms. The situation for medium and large firms, however, is not as seen in the comparison between small-medium and small-large as earlier noticed. It can be seen that the p-value for firm efficiency between medium and large firm categories is insignificant and hence, this exhibits little or no significant difference in firm TFP for these two firm size categories. A summary statistics will then tell the TFP scores across all three firm size categories to determine the magnitude of difference. This is shown in Table 9.

Table 9: ***Summary Statistics of TFP for Firm Size Categories***

Size	Observations	Mean TFP	Standard Deviation	Minimum TFP	Maximum TFP
Small	240	1.35584	2.236685	.1317884	22.12527
Medium	102	2.763813	5.476077	.2806266	25.38827
Large	47	4.058229	8.082291	.2944173	49.33514

Source: STATA/IC 13.1 output from Enterprise Survey for Ghana(2007 & 2013)

The mean firm performance (TFP) value for small firms almost doubles in the medium firm category and almost triples in the large firm category. Thus, a difference of 1.407973 per cent confirms that there is significant difference in TFP between small and medium firms in Ghana as read from the Bonferronitest in Table 8. For the medium and large firm size categories, the difference is 1.294416 per cent which means there is also some significant difference in TFP between these two size categories.

Relationship between Total Assets (Firm Size) and TFP (Firm Performance)

Before the variables of interest were subjected to any estimation, a correlation matrix was done to deal with the situation of multicollinearity. The correlation matrix confirmed that there was no muticolliniarity in the selected variables since none of the correlation coefficients amounted to 0.8 [except a direct correlation (for instance; TFP to TFP) which will certainly produce a correlation coefficient of one].

The analysis was done based on the individual firm size categories as it would be wrong to lump them all together. This is because putting all the size categories together will mean there is similar or constant technology across all firm size categories. It is rather expedient to assume homogeneity across similar firm categories than across all firm size categories. The bonferroni test in Table 8 also saw a significant difference in TFP for the firm size categories and hence, assuming the same TFP for them would be wrong (thus, implying similar or constant technology across all manufacturing firms)

Table 10: ***Correlation Matrix; Test for Multicolliniarity***

	TFP	Assets	Age	Labr_Prod	Skl_Int	Cap_Util	TangAssets	Sales_Growth
TFP	1.0000							
Assets	0.0056	1.0000						
Age	0.1379***	0.2322***	1.0000					
Labr_Prod	0.1593***	0.7464***	0.2210***	1.0000				
Skl_Int	0.0654	-.0382	-.0059	0.1014**	1.0000			
Cap_Util	-.0066	0.0059	0.1144***	0.1966***	0.0410	1.0000		
TangAssets	-.0559	0.1728***	-.0272	-0.2931***	-.2153***	-0.0829	1.0000	
Sales_Growth	0.1128**	0.0512	0.0638*	0.0073	-.0888**	0.0366	0.0697	1.0000

P-values 1% - ***, 5% - **, 10% - *

Source: STATA/IC 13.1 output from Enterprise Survey for Ghana(2007 & 2013)

Table 11analyzes the effect of total assets on TFP of small manufacturing firms in Ghana.

Table 11: ***Regression Results for Total Assets on TFP of Small Firms***

Dependent Var = Firm Performance (TFP) Explanatory Variables	(1) OLS	(2) FE	(3) RE
Assets (log)	-1.092912***	-0.8580628***	-1.092912***
	(0.3857474)	(0.1380155)	(0.1316178)
Age	0.0282118	0.0320037**	0.0282118*
	(0.0203785)	(0.0139491)	(0.0145261)
Labr_Prod (log)	1.157154***	1.422005***	1.157154***
	(0.4015931)	(0.1424372)	(0.1332062)
Skl_Int	-0.950558	-0.9232392*	-0.950558*
	(0.7230487)	(0.4964898)	(0.5180738)
Cap_Util	-0.007849	-0.0068091	-0.007849
	(0.0084617)	(0.007676)	(0.0080062)
TangAssets	6.119209***	4.753067***	6.119209***
	(1.90882)	(0.9018543)	(0.8774924)
Sales_Growth	0.0244023	-0.008806	0.0244023
	(0.0285423)	(0.0592533)	(0.061279)
_cons	-1.437953	-8.760076***	-1.437953
	(1.555391)	(2.031657)	(1.081594)
Observations	194	194	194
R-Squared	0.2933	0.1350	0.2933
Number of id		97	97
Time Period		2	2

Standard errors are in parenthesis; P-values 1% - ***, 5%-**, 10%-*

Post-Estimation Tests

Omitted Variable Test: F(3, 183) = 116.94 Prob> |F| = 0.0000

Hausman Test: chi2(7) = 17.75 Prob> chi2 = 0.0131

Source: STATA/IC 13.1 output from Enterprise Survey for Ghana(2007 & 2013)

An OLS was estimated because the data is a short panel (large “N” with small “t”) and it has the tendency of exhibiting pooled effect. Nonetheless, the results of the post-estimation tests, specifically the omitted variable test, saw the OLS inappropriate for interpretation since it hadomitted variables; hence, the need to estimate the static panel and specify which model under the static panel estimation to interpret by the help of the hausman test. The hausman test has a significant p-value at one per cent and this means it has selected the fixed effects model and hence, coefficients for the fixed effects model were interpreted. The full fixed effects table is presented in Table 12.

Table 12: ***Fixed EffectsRegression Results for Total Assets on TFP of Small Firms***

TFP	Coefficient	Standard Error	t-value	P>|t|
Assets (log)	-0.8580628	0.1380155	-6.22	0.000
Age	0.0320037	0.0139491	2.29	0.023
Labr_Prod (log)	1.422005	0.1424372	9.98	0.000
Skl_Int	-0.9232392	0.4964898	-1.86	0.065
Cap_Util	-0.0068091	0.007676	-0.89	0.376
TangAssets	4.753067	0.9018543	5.27	0.000
Sales_Growth	-0.008806	0.0592533	-0.15	0.882
_cons	-8.760076	2.031657	-4.31	0.000

Source: STATA/IC 13.1 output from Enterprise Survey for Ghana(2007 & 2013)

Aside number of employees, value of asset was the commonest and most available proxy for size in the literature. Thus, in order not to consider the outcomes of using the number of employees as contradictory to earlier studies that used the value of total assets to proxy size, the effects of real value of total asset on TFP was extensively analyzed.

Assets and labour productivity is logged as a form of data transformation. Transformation of data is one way to soften the impact of outliers since the most commonly used expression, square root and logarithms, change the larger values to a much greater extent than they do to the smaller values. However, transformation may affect the interpretation. This is because taking the log of a variable does more than make a distribution less skewed; it changes the relationship between the original variable and the other variables in the model. In addition, most commonly used transformations require non-negative data or data that is greater than zero, so they do not always provide the answer (Chawsheen & Latif, 2006).

The variables that had significant effect on TFPof small manufacturing firms are assets, age, labour productivity, skill intensity and tangibility of assets. The main issue of interest from Table 12 is the coefficient of assets. The coefficient of assets is negative and statistically significant at one per cent. The implication is that increases in the value of assets of small manufacturing firms in Ghana have negative consequences on their TFP. That is, irrespective of the initial level of assets, a cedi increase in the value of assets may reduce TFP by about 0.009 per cent in a year. This result is more so in a situation where the increase in assets stems from an increase in the capital base used in the evaluation of TFP since the returns on assets are usually not released immediately. The negative effect of increase in the value of assets on firm performance was discovered by Awunyo-Vitorand Badu(2012) in their study on the manufacturing sector of Ghana.

Labour productivity and asset tangibilityof the firm were significant at one per cent and have direct effects on firm performance of small manufacturing firms in Ghana. Labourproductivity has direct effect on TFP as well as profitability which is an expectation in both theory and practice since productivity put revenue ahead of cost given a sustainable price level.

Age and skill intensity of the firm were significant at five per cent and ten per cent respectively. As expected, in both theory and practice, aging manufacturing firms enhance their level of firm performance which is contrary to the findings of Majumdar(1997). Skill intensity on the other hand has an indirect effect on TFP of small manufacturing firms in Ghana which is contrary to the findings of SiddharthanandDasgupta(1983).

Table 13analyzes the effect of total assets on TFP of medium manufacturing firms in Ghana.

Table 13: ***Regression Results for Total Assets on TFP of Medium Firms***

Dependent Var = Firm Performance (TFP) Explanatory Variables	(1) OLS	(2) FE	(3) RE
Assets (log)	-2.828445***	-2.438361***	-2.828445***
	(0.4728889)	(0.5065913)	(0.3100341)
Age	0.0717846	0.0671989*	0.0717846*
	(0.0505147)	(0.0376751)	(0.0373646)
Labr_Prod (log)	2.801246***	2.853852***	2.801246***
	(0.4388641)	(0.3155117)	(0.3107283)
Skl_Int	3.629955*	- 3.899238**	3.629955**
	(1.822242)	(1.763661)	(1.74115)
Cap_Util	-0.0698474***	-0.0618845**	-0.0698474***
	(0.0209812)	(0.023871)	(0.022418)
TangAssets	14.80836***	12.18145***	14.80836***
	(2.639105)	(3.753131)	(2.608603)
Sales_Growth	0.0003105	0.0002736	0.0003105
	(0.0005911)	(0.0014037)	(0.0014026)
_cons	2.290631	-4.647465	2.290631
	(3.236332)	(8.002277)	(3.64309)
Observations	72	72	72
R-Squared	0.6757	0.6183	0.6757
Number of id		36	36
Time Period		2	2

Standard errors are in parenthesis; P-values 1%-***, 5%-**, 10%-*

Post-Estimation Tests

Omitted Variable Test: F(3, 61) = 102.22 Prob> |F| = 0.0000

Hausman Test: chi2(6) = 0.95 Prob> chi2 = 0.9875

Source: STATA/IC 13.1 output from Enterprise Survey for Ghana(2007 & 2013)

Again, an OLS was estimatedand the results subjected to some post estimation tests.The results of the post-estimation tests saw the OLS inappropriate for interpretation since it suffered omitted variables.The static panel was then specified and subjected to the hausman test to know which model under the static panel estimation to interpret. The hausman test has aninsignificant p-value and this means it has selected the random effects model and hence coefficients for the random effect model will be interpreted. The full random effects table is presented on Table 14.

Table 14: ***Random EffectsRegression Results for Total Assets on TFP of Medium Firms***

TFP	Coefficient	Standard Error	z	P> |z|
Assets (log)	-2.828445	.3100341	-9.12	0.000
Age	.0717846	.0373646	1.92	0.055
Labr_Prod (log)	2.801246	.3107283	9.02	0.000
Skl_Int	3.629955	1.74115	2.08	0.037
Cap_Util	-.0698474	.022418	-3.12	0.002
TangAssets	14.80836	2.608603	5.68	0.000
Sales_Growth	.0003105	.0014026	0.22	0.825
_cons	2.290631	3.64309	0.63	0.530

Source: STATA/IC 13.1 output from Enterprise Survey for Ghana(2007 & 2013)

The variables that had significant effect on TFP of medium manufacturing firms are assets, age, labour productivity, skill intensity,capacity utilization and tangibility of assets. The main issue of interest from Table 14 is the coefficient of assets. The coefficient of assets is negative and statistically significant at one per cent as was seen in the case of small manufacturing firms. The implication is that assets of medium manufacturing firms havean indirect relationship with TFP. That is, a cedi increase in the value of assets may reduce TFP by about 0.02828445per cent in a year. This result is more so in a situation where the increase in assets stems from an increase in the capital base used in the evaluation of TFP since the returns on assets are usually not released immediately. The negative effect of increase in assets (measuring size) on firm performance was discovered by Jensen and Murphy(2010).

Labour productivity, capacity utilization and asset tangibility of medium firms were significant at one per cent and all, except capacity utilization,have direct effects on TFP of medium manufacturing firms in Ghana.

Age andskill intensityof the firm were significant at ten per cent and five per cent respectively. As expected, in both theory and practice, aging manufacturing firms as well as skills enhancing manufacturing firms enjoyhigher levels of TFP.

Table 15analyzes the effects of total assets on TFP of large manufacturing firms in Ghana.

Table 15: ***Regression Results for Total Assets on TFP of Large Firms***

Dependent Var = Firm Performance (TFP) Explanatory Variables	(1) OLS	(2) FE	(3) RE
Assets (log)	-2.363059**	-2.272634*	-2.363059**
	(0.869978)	(1.234451)	(0.9641235)
Age	0.0407853	0.0373641	0.0407853
	(0.0507616)	(0.0836632)	(0.0774621)
Labr_Prod (log)	2.18305**	2.259409*	2.18305**
	(0.9850637)	(1.212091)	(1.016643)
Skl_Int	3.976833	4.17566	3.976833
	(4.684063)	(5.788991)	(5.462024)
Cap_Util	-0.0442582	-0.0453898	-0.0442582
	(0.0581269)	(0.0933079)	(0.091392)
TangAssets	16.86586**	16.1381	16.86586**
	(7.423357)	(9.717999)	(7.488193)
Sales_Growth	0.000439	0.000473	0.000439
	(0.0040778)	(0.0075811)	(0.0074582)
_cons	6.352045	3.901099	6.352045
	(7.201131)	(22.94232)	(10.39104)
Observations	40	40	40
R-Squared	0.1864	0.1814	0.1864
Number of id		20	20
Time Period		2	2

Standard errors are in parenthesis; P-values 1% - ***, 5% - **, 10% - *

Post-Estimation Tests

Omitted Variable Test: F(3, 29) = 1.06 Prob> |F| = 0.3805

Hausman Test: chi2(7) = 0.01 Prob> chi2 = 1.0000

Source: STATA/IC 13.1 output from Enterprise Survey(2007 & 2013)

The results of the post-estimationtests, specifically the omitted variable test, saw the OLS suffering no omitted variables.The static panel was also specified. The hausman test has an insignificant p-value and this means it has selected the random effect model and hence, coefficients for the random effect model will be interpreted. This goes to confirm the appropriateness of the OLS which is not so different from the random effects model (Standard errors differ but coefficients and significance levels are the same). The full random effects table is presented below.

Table 16: ***Random Effects Regression results for Total Assets on TFP of Large Firms***

TFP	Coefficient	Standard Error	z	P> |z|
Assets (log)	-2.363059	0.9641235	-2.45	0.014
Age	0.0407853	0.0774621	0.53	0.599
Labr_Prod (log)	2.18305	1.016643	2.15	0.032
Skl_Int	3.976833	5.462024	0.73	0.467
Cap_Util	-0.0442582	0.091392	-0.48	0.628
TangAssets	16.86586	7.488193	2.25	0.024
Sales_Growth	0.000439	.0074582	0.06	0.953
_cons	6.352045	10.39104	0.61	0.541

Source: STATA/IC 13.1 output from Enterprise Survey(2007 & 2013)

The variables that had significant effect on TFPof large manufacturing firms are assets, labour productivity, and tangibility of assets. The same story can be told of the relationship between assets and TFP as was seen in both the small firm and medium firm categories. The implication is that assets of large manufacturing firms have an indirect relationship with TFP. This result is more so in a situation where the increase in assets stems from an increase in the capital base used in the evaluation of TFP since the returns on assets are usually not released immediately. The negative effect of increase in assets (measuring size) on firm performance was discovered by Mahmoud Abu-Tapanjeh(2006).

Labour productivity and asset tangibility of the firm were both significant at five per cent level of significance and have direct effects on firm performance of large manufacturing firms in Ghana.

Now that the relationship between assets and TFP for all the firm size categories has been established, (indirect relationship between assets and TFP for all firm size categories)the total number of employees and TFP is estimated in the next section of this chapter.

Relationship between Total Number of Employees (Firm size) and TFP (Firm Performance)

Before the variables of interest were subjected to any estimation, a Variance Inflation Factor (VIF) was done to test for multicollinearity.

Table 17: ***Variance Inflation Factor; Test for Multicolliniarity***

Variable	VIF	1/VIF
Labr_Prod (log)	14.66	0.068234
NumEmp_Cnt	13.44	0.074431
NumEmp_Age	12.85	0.077837
Cap_Util	12.44	0.080402
Age	5.12	0.195429
Skl_Int	4.52	0.221309
TangAssets	3.61	0.276944
Sales_Growth	1.03	0.974833
Mean VIF	8.46	

Source: STATA/IC 13.1 output from Enterprise Survey (2007 & 2013)

The multicolliniarity test applied here was the VIF. The mean VIF was 8.46, which is not up to 10, hence, the conclusion that there is no multicolliniarity amongst the variables.

The analysis was done based on the individual firm size categories as it would be wrong to lump them all together as already explained in the previous section.

Table 18 analyzes the effect of total number of employees on TFP of small manufacturing firms in Ghana.

Table 18: ***Regression Results for Total Number of Employees on TFP of Small Firms***

Dependent Var = Firm Performance (TFP) Explanatory Variables	(1) OLS	(2) FE	(3) RE
NumEmp_Cnt	0.1204106	0.9584564*	0.1204106*
	(0.0772043)	(0.3963143)	(0.0681274)
Age	0.0724984	0.9057371***	0.0724984*
	(0.0641588)	(0.2217489)	(0.0408352)
NumEmp_Age	-0.0053925	-0.0518316**	-0.0053925*
	(0.0041691)	(0.0175445)	(0.0032198)
Labr_Prod (log)	0.1479896**	1.838305**	0.1479896**
	(0.0699537)	(0.6779774)	(0.0584137)
Skl_Int	-0.1485999	-8.161176	-0.1485999
	(0.6600781)	(4.92142)	(0.6229985)
Cap_Util	0.0021466	-0.0865128	0.0021466
	(0.008382)	(0.0678852)	(0.0092541)
TangAssets	0.5670121	-7.515076	0.5670121
	(0.9791519)	(3.892173)	(0.6697448)
Sales_Growth	0.0258615	-0.5953715	0.0258615
	(0.0369577)	(1.758989)	(0.0717981)
_cons	-2.961683	-23.70189	-2.961683*
	(2.571555)	(12.92532)	(1.627225)
Observations	194	194	194
R-Squared	0.0477	0.5480	0.0477

Table 18, continued

Number of id	97	97
Time Period	2	2

Standard errors are in parenthesis; P-values 1%-***, 5%-**, 10%-*

Post-Estimation Tests

Omitted Variable Test: F(3, 182) = 16.91 Prob> |F| = 0.0000

Hausman Test: chi2(7) = 30.78 Prob> chi2 = 0.0002

Source: STATA/IC 13.1 output from ES(2007 & 2013) data set

Thepost-estimationresultssee the OLS inappropriate for interpretation. The hausman test has a significant p-value at one per cent and hence, it is expedient to interpret coefficients for the fixed effects model. The full fixed effect table is presented below:

Table 19: ***Fixed EffectsRegression Results for Total Number of Employees on TFP of Small Firms***

TFP	Coefficient	Standard Error	t	P> |t|
NumEmp_Cnt	0.9584564	0.3963143	2.42	0.060
Age	0.9057371	0.2217489	4.08	0.009
NumEmp_Age	-0.0518316	0.0175445	-2.95	0.032
Labr_Prod (log)	1.838305	0.6779774	2.71	0.042
Skl_Int	-8.161176	4.92142	-1.66	0.158
Cap_Util	-0.0865128	0.0678852	-1.27	0.259
TangAssets	-7.515076	3.892173	-1.93	0.111
Sales_Growth	-0.5953715	1.758989	-0.34	0.749
_cons	-23.70189	12.92532	-1.83	0.126

Source: STATA/IC 13.1 output from Enterprise Survey for Ghana(2007 & 2013)

The variables that had significant effect on total factor productivity are number of employees, age, the interaction term (number of employees and age) and labour productivity. Labour productivity is once again logged following the justification given for logging variables by ChawsheenandLatif(2006).

Number of employees was one of the proxies for frim firm size found in the literature. The coefficient of number of employees is positive and statistically significant at ten per cent. The implication is that an increase in number of employees has positive effects on TFP of small manufacturing firms. That is, a unit increase in the number of employees may increase TFP by about 1 per cent in a year. Nonetheless, the coefficient cannot be directly interpreted as is seen in Table 19 because of the interaction term (number of employees and age). It has to be interpreted by dealing with the partial effect of number of employees on TFP as given in the equation below:

$$\frac{\partial TFP}{\partial NumEmp\_Cnt} = NumEmp\_Cnt \quad NumEmp\_Age(Mean\ of\ Age) \ldots (14)$$

Where "*NumEmp_Cnt*"represents the coefficient of number of employees, "*NumEmp_Age*" represents the coefficient of the interaction term (number of employees and age) and "*Mean of Age*" represents the mean value of the age of the firm. Mean value of firm age as seen in Table 4 is 18.78313 years.The result of equation (14) is -.01510328. This reflects the true coefficient of the variable "number of employees". Hence, it can be agreed that a unit increase in the number of employees may reduce TFP of small firms by about 0.015per cent in a year. Thisis contrary to the positive effects of size on firm performancewhich has been hypothesised and empirically established by the studies of Baumol(1959), Hall and Weiss (1967), Berk(1997), Majumdar(1997) and Cassarand Holmes(2003).

In the case of age of the firm, the coefficient cannot also be directly interpreted as is seen in Table 18. It has to be interpreted by dealing first with the partial effect of age on TFP as given in the equation below:

$$\frac{\partial TFP}{\partial Age} = Age \quad NumEmp\_Age \ (Mean\ of\ NumEmp\_Cnt) \ldots \ldots (14a)$$

Where "*Age*"represents the coefficient of firm age, "*NumEmp_Age*" represents the coefficient of the interaction term (Number of employees and Age) and "*Mean of NumEmp_Cnt*" represents the mean value of number of employees. Mean value of total number of employees is 51.35837. The result of equation (14a) is -1.7562494. This reflects the true coefficient of the variable "age". Hence, it can be agreed that aunit increase in the age of smallfirms may decrease TFP by about -1.7562494 in a year when size is measured by total number of employees. This is different when firm size is measured by total assets but confirms the findings of Majumdar(1997).

Labour productivity was significant at five per cent and has a direct effect on TFP of small manufacturing firms in Ghana.

Table 20 analyzes the effect of total number of employees on TFP of medium manufacturing firms in Ghana.

Table 20: ***Regression Results for Total Number of Employees on TFP of Medium Firms***

Dependent Var = Firm Performance (TFP) Explanatory Variables	(1) OLS	(2) FE	(3) RE
NumEmp_Cnt	0.0075638	0.007834***	0.0075638*
	(0.0065011)	(0.0028898)	(0.0042346)
Age	0.0077573	0.0070311	0.0077573
	(0.0103504)	(0.0052138)	(0.0076394)
Labr_Prod (log)	0.0107258	0.3786955***	0.0107258
	(0.0259964)	(0.0494306)	(0.0281346)
Skl_Int	0.0139941	0.0759863	0.0139941
	(0.4232253)	(0.2579137)	(0.3777889)
Cap_Util	0.0082909	0.0104066***	0.0082909
	(0.0051615)	(0.0033952)	(0.0049606)
TangAssets	-0.2375694	-0.4885849**	-0.2375694
	(0.3160349)	(0.2230625)	(0.323697)
Sales_Growth	0.0021333	-0.0534749***	0.0021333
	(.0162667)	(0.0164551)	(.0219026)
_cons	-0.1716851	-5.806898***	-0.1716851
	(0.6650103)	(0.8663372)	(0.7528706)
Observations	64	64	64
R-Squared	0.1191	0.0244	0.1191
Number of id		32	32
Time Period		2	2

Standard errors are in parenthesis; P-values 1%-***, 5%-**, 10%-*

Post-Estimation Tests

Omitted Variable Test: F(3, 53) = 3.44 Prob> |F| = 0.0231

Hausman Test: chi2(7) = 79.93 Prob> chi2 = 0.0000

Source: STATA/IC 13.1 output from Enterprise Survey for Ghana(2007 & 2013)

The same argument follows as was observed in the post-estimationresults of the effect of total number of employees on TFP of small firms. The hausman test once again has a significant p-value at one per cent and this means it is appropriate to interpret coefficients for the fixed effects model. The full fixed effects table is presented below.

Table 21: ***Fixed EffectsRegression Results for Total Number of Employees on TFP of Medium Firms***

TFP	Coefficient	Standard Error	T	P> |t|
NumEmp_Cnt	0.007834	0.0028898	2.71	0.009
Age	0.0070311	0.0052138	1.35	0.183
Labr_Prod (log)	0.3786955	0.0494306	7.66	0.000
Skl_Int	0.0759863	0.2579137	0.29	0.769
Cap_Util	0.0104066	0.0033952	3.07	0.003
TangAssets	-0.4885849	0.2230625	-2.19	0.033
Sales_Growth	-0.0534749	0.0164551	-3.25	0.002
_cons	-5.806898	0.8663372	-6.70	0.000

Source: STATA/IC 13.1 output from Enterprise Survey for Ghana(2007 & 2013)

The variables that had significant effect on total factor productivity are number of employees, labour productivity, capacity utilization, tangibility of assets and sales growth.

The coefficient of number of employees is positive and statistically significant at one per cent. The implication is that an increase in number of employees has positive effects on TFP of medium manufacturing firms. That is, irrespective of the initial number of employees, a unit increase in the number of employees may increase TFP by about 0.007834per cent in a year. This finding is in line with the positive effects of size on firm performance which has been hypothesised and empirically established by the studies of Baumol(1959), Hall and Weiss (1967), Berk (1997), Majumdar(1997) and Cassarand Holmes (2003).

Labour productivity, capacity utilization and sales growth were all significant at one per cent. Tangibility of assets was significant at five per cent level of significance. Both labour productivity and capacity utilization have direct effects on TFP of medium manufacturing firms whereas sales growth and tangibility of assets both have indirect effects on TFP of manufacturing firms in Ghana.

Table 22analyzes the effect of total number of employees on TFP of large manufacturing firms in Ghana.

Table 22: ***Regression Results for Total Number of Employees on TFP of Large Firms***

Dependent Var = Firm Performance (TFP) Explanatory Variables	(1) OLS	(2) FE	(3) RE
NumEmp_Cnt	0.0014911	0.0027179**	0.0014911
	(0.0016001)	(0.0010114)	(0.0014754)
Age	0.0058964	0.0014677	0.0058964
	(0.0109766)	(0.006862)	(0.0102122)
NumEmp_Age	-0.0000292	-0.0000489***	-0.0000292
	(0.0000264)	(0.000017)	(0.0000249)
Labr_Prod (log)	-0.0411844	0.4685767***	-0.0411844
	(0.0553924)	(0.1022206)	(0.0451828)
Skl_Int	0.1171064	0.7873168*	0.1171064
	(0.554817)	(0.4204059)	(0.6003666)
Cap_Util	0.003231	-0.0018683	0.003231
	(0.0101315)	(0.0060089)	(0.008892)
TangAssets	1.268565	0.3215226	1.268565
	(0.547099)	(0.4112864)	(0.5535382)
Sales_Growth	0.1427027	0.0186347	0.1427027
	(0.1608272)	(0.0884177)	(0.1277215)
_cons	0.4781623	-6.697646***	0.4781623
	(1.368322)	(1.624076)	(1.296162)
Observations	30	30	30
R-Squared	0.4198	0.0671	0.4198

Table 22, continued

Number of id	15	15
Time Period	2	2

Standard errors are in parenthesis; P-values 1%-***, 5%-**, 10%-*

Post-Estimation Tests

Omitted Variable Test: F(3, 18) = 4.18 Prob> |F| = 0.0207

Hausman Test: chi2(7) = 74.93 Prob> chi2 = 0.0000

Source: STATA/IC 13.1 output from Enterprise Survey for Ghana(2007 & 2013)

The omitted variable test has a p-value less than five per cent and this means the OLS model is not good for interpretation. The hausman test has a significant p-value at one per cent and this means coefficients for the fixed effects model should be interpreted. The full fixed effects table is presented below.

Table 23: ***Fixed EffectsRegression Results for Total Number of Employees on TFP of Large Firms***

TFP	Coefficient	Standard Error	t	P> |t|
NumEmp_Cnt	0.0027179	0.0010114	2.69	0.014
Age	0.0014677	0.006862	0.21	0.833
NumEmp_Age	-0.0000489	0.000017	-2.87	0.009
Labr_Prod (log)	0.4685767	0.1022206	4.58	0.000
Skl_Int	0.7873168	0.4204059	1.87	0.076
Cap_Util	-0.0018683	0.0060089	-0.31	0.759
TangAssets	0.3215226	0.4112864	0.78	0.444
Sales_Growth	0.0186347	0.0884177	0.21	0.835
_cons	-6.697646	1.624076	-4.12	0.001

Source: STATA/IC 13.1 output from Enterprise Survey for Ghana(2007 & 2013)

The variables that had significant effect on total factor productivity are number of employees, the interaction term (number of employees and age), labour productivity and skill intensity.

The coefficient of number of employees is positive and statistically significant at five per cent. Hence, an increase in number of employees has positive effects on TFP of large manufacturing firms. An increase in the number of employees may increase TFP by about 0.0027179 in a year. Nonetheless, the coefficient cannot be directly interpreted as seen in Table 23 because of the interaction term (number of employees and age). It has to be interpreted by dealing first with the partial effect of number of employees (measuring size) on TFP as given in the equation below:

$$\frac{\partial TFP}{\partial NumEmp\_Cnt} = NumEmp\_Cnt \quad NumEmp\_Age(Mean\ of\ Age) \ldots (15)$$

Where "*NumEmp_Cnt*"represents the coefficient of number of employees, "*NumEmp_Age*" represents the coefficient of the interaction term (Number of employees and Age) and "*Mean of Age*" represents the mean value of the age of the firm. Mean value of firm age as seen in Table 3 is 18.78313. The result of equation (15) is .00094263. This reflects the true coefficient of the variable number of employees (measuring size). Hence, it can be agreed that a unit increase in the number of employees may increase TFP by about .00094263 per cent in a year. Thus, a positive relationship between number of employees and TFP of large manufacturing firms in Ghana was realized.

Labour productivity and skill intensity were significant at one per cent and ten per cent respectively and have direct effects on TFP of large manufacturing firms in Ghana.

Discussion of Results

The earlier sections of this chapter presented and analyzed the empirical statistical effects of firm size on TFP in the manufacturing sector of Ghana. Two different static panel regression equations were analyzed in response to the two proxies of size employed.

Tables 7, 8 and 9 analyzed the differences in TFP across the firm size categories. The results indicated that there is significant difference in TFP among firm sizes (especially small and medium sized firms as well as small and large sized firms) which is confirmed in Figure 1. Medium and large sized firms did not have so much significant difference in TFP. This outcome supports the first hypothesis of the study at five percent significance level as shown by the bonferroni test.

Tables 18 to 23 analyzed the effects of size on firm performance (TFP) when size is proxied by total number of employees in a firm. The outcome provided statistical and empirical support to the second hypotheses of the study. The first outcome was that size (measured as number of employees) has direct effect on firm performance of the medium and large manufacturing firms in Ghana. This finding provides support to the second hypothesis and is in line with the findings of Becker-Blease et al.(2010) and Lafrance(2012) both of which discovered an inverted U-shaped relationship between size and financial performance when size is proxied by number of employees.The small size category, on the other hand, saw an inverse relationship. This might be because small firms are less labour intensive and hence, extra unit additions of labour might reduce firm level productivity.

Tables 11 to 16 analyzed the effects of size, measured as the value of total assets on firm performance (TFP). The outcome of this measure of size was the direct opposite of the outcome when size is measured as total number of employees. The results indicated that increase in the value of total assets has a negative effect on firm performance (TFP). This outcome supports the third hypothesis of the study and confirms the earlier empirical work of Goddard et al.(2005).

The results on the control variables shed light on some of the firm-level performance in the Ghanaian context. For instance, firm age was discovered to have positive effect on firm performance (TFP) for all firm size categories. This finding was at variouslevels of significance. This finding is in line with the work of Michaelas et al.(1999). On the other hand, when number of employees is used as a proxy for size, the small sized manufacturing firms saw an inverse relationship between firm age and firm performance. The coefficients of the control variables are broadly in line with expectations and reflect the impact of the institutional environment.

The outcomes of the two proxies for size suggest that the measure adopted for size may have a significant role to play in establishing the relationship between firm size and firm performance.

Conclusion

This chapter empirically tested the stated hypothesis of the study using the proposed methodology. The outcome analyses found support for all the hypotheses. Since the hypotheses were derived from the research objectives of the study, it follows that the research objectives have been achieved successfully. Hence, it can be concluded that the study has successfully achieved its main objective and specific objectives. The next and final chapter contains the summary, conclusions and policy recommendations based on the findings from the summary statistics and the regression analyses.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

The purpose of this final chapter is to present the summary, conclusions and recommendations of the study. The summary presents a brief overview of the study which encompasses the research problem, objectives, methodology and findings while the conclusions capture the overall outcomes regarding the findings of the study in the light of the hypotheses. The recommendations also present specific remedies to be implemented by specific bodies based on the tested hypotheses. The chapter also presents the limitations and direction for future research which further enforces the recommendations of this study.

Summary

The relationship between firm size and firm performance is usually treated as given in the Economies of Scale Theory of the firm which is one of the most established theories of the firm in mainstream Economics. According to the Economies of Scale Theory of the firm, firms enjoy cost advantages due to the size, output, or scale of operation, with cost per unit of output generally decreasing with increasing scale as fixed costs are spread out over more units of output.

Thus, though expansion is associated with both economies and diseconomies of scale in the long run, firms shall always strive to project economies of scale over diseconomies of scale at any given point in time. The implication then is that expansion shall always be beneficial so that large firms shall exhibit superior firm performance as compared to small firms. Based on this conventional knowledge of the theory of the firm, all support policies in the manufacturing sector of developing countries like Ghana have the main objective of helping micro and small industries to expand with the hope that they will create more jobs as they expand in size.

Also, the Neo-Classical Theory of the firm takes transaction cost as given which according to Transaction Cost Economics (TCE) is deficient since the transaction cost of economic activities are not zero. Thus, the relationship between size and profitability becomes open as both small and large firms can enjoy superior financial performance based on how well they manage agency cost and transaction cost of operations. The Williamson's Framework, therefore, put forward the concept of the limit of firm size which was adopted in this study to analyze the effects of firm size on the firm performance of manufacturing firms in Ghana. The major proposition of the Williamson's Framework was that economies of scale are counter by diseconomies of scale, agency cost and transaction cost so that a weak relationship exists between size and firm performance of firms.

It is also an established fact that firms undergo well defined stages in their life cycle which affects their performances. Since age is one of the few firm specific variables that the firm cannot control, it was not proper to analyze the effects of size on performance while holding age constant.

The outcomes of the study were presented and discussed in the Chapter Four as summarized below:

The results from the analyses indicated that firm size is an important variable in explaining the firm performance of manufacturing firms in Ghana. However, the effect of size on firm performance depends on the type of proxy used to measure size. When total number of employees is used to proxy size, there exists a significant positive effect of size on financial performance. That is, increase in number of employees by one employee increases firm performance of small firms.

The effect is however negative when size was proxied by the value of total assets. Thus, increase in the value of total assets may have negative consequences on firm performance of manufacturing firms in Ghana. The analyses also show that firm age has direct effect on financial performance.

Conclusions

The study analyzed the effects of firm size on firm performance of the manufacturing firms in Ghana for 2007 and 2013. The regression analyses led to the following empirical findings:

1. There exist significant differences in firm performance across the various firm size categories but not so significant between medium and large firms.
2. Number of employees of firms has significant direct effect on firm performance.

3. The real value of total assets of firms has significant negative effect on firm performance.
4. The effect of size on firm performance is sensitive to how size is measured. That is, contradictory results were obtained when size was measured in two different ways as either the number of employees or the real value of total assets of respective firms.

The empirical findings above clearly establish the hypothesis of the study and therefore lead to the conclusion that the main and specific objectives of the study have been achieved successfully. The empirical findings above were tested at the mean size of the respective size categories of manufacturing firms in Ghana and below were the observations made:

1. Expansion is favorable to small enterprises than medium and large enterprises.
2. The rate of firm performance is diminishing in firm size in the Ghanaian manufacturing sector.

Recommendations

The following recommendations can be drawn based on the findings of the study.

- First, policies aimed at the manufacturing sector of Ghana must target firms of all size categories in terms of enhancing technology, productive efficiency, technical and managerial assistance.Total Factor Productivity in small firms may usuallybe below those encountered in larger ones as is seen in this study (mean values of TFP for small firms are lesser than that of mediumand large firms; refer to Table 8). Generally, these differentials in productivity have been linkedto the notion that smaller firms make use oftechnologies and techniques which areold-fashioned and thus, of lower productivity, but it is likewiselikely that firms of different sizes differ steadily either in their levels of employee experience or in the technology relationship between experience and productivity. Policies should be aimed at enhancing employee experience and improved technology in order to ensure higher productivity in the manufacturing sector.

- Firms may be content with their current size considering the negative consequences of expansion in size in terms of total value of assets. Therefore, a possible motivation for the firms to consider expansion shall be an introduction of supportprogrammes for firms that expand beyond theircurrentsize to be able to internalize the associated challenges. Capacity building in the manufacturing sector should aim at exposing firms to the various moderating factors so that medium and large enterprises, especially, may break away from the growth pain in order to enjoy positive economic profit and higher productivity as they move along their life span in business. In this case, small enterprises may not fear to expand or separate ownership from control. That is, the results indicate that the decreasing effects of expansion can be reversed even when size is already large but the issue has to do with the effectiveness of the moderating factors of the firms. Since the main aim of the Ministry of Trade and Industry has been job creation through size expansion, support programmes must target all firmsizes while creating the enabling environment for their survival.

- Emphasis must also be shifted from size of the firm to age of the firm in support programmes since age is what firms cannot control. The age of the firm suggests the accumulated experience in production and hence, exhibits a positive relationship between age and TFP as is seen in this study. Nonetheless, if newer plants embody higher productive capital, the age of the firm may have negative effects on TFP. Thus, older plants may be less productive than newer plants. It would be necessary that government support programmes target subsidizing import of newer plants or machinery to ensure higher productivity.
- At the firm level, management can adopt value-based compensation scheme such as Economic Profit Plan (EPP) to enhance value creation in the firms. A value based pay policy is known to boost management commitment and reduce agency cost and thereby, enhance financial performance.

Limitations of the Study

Despite the commitments made in the study to ensure that the results are reliable and objective, the study is faced with some clear limitations some of which are discussed below.

The most outstanding limitation of this study has to do with the period of the study which is only 2007 and 2013. This is in reference to the publically available data set, Enterprise Survey for Ghana, which was conducted in only 2007 and 2013. This means that there are missing data points for years between 2007 and 2013. The data set was,however, used based on it newness which makes it the most recentdata set on the manufacturing sector of Ghana.

Also, panel unit root testing is a modern requirement for using panel data.However, the unbalanced nature of the survey data set and the great loss of data compelled this study to overlook it. The results, however, were not affected greatly since the regression did not show any significant difference, especially, in terms of signs of the coefficients. Thus, this study dwelled more on the signs and functional forms rather than the magnitude of the coefficients.

Finally,in relation to the issue of model specification and estimation technique, the study employed a static model. This was done because the effect of firm performance on firm size in its lagged form would have given absurd results since the data points (2007 and 2013) are too wide. This does not totally invalidate the results since most firms in the manufacturing sector do not change size significantly even for some number of years.

Direction for Future Research

This study explored the dimensions of firm size and firm performance extensively which is its major contribution to the literature and also open doors for future studies. The results of the two measures of size in the same data set reveal that the effect of firm size on firm performance has not necessarily been mixed. Rather, studies that used total assets to proxy firm size only tells a different story from those that used number of employees so that the results cannot be viewed as contrary to each other. Thus, earlier studies can be replicated simply by changing the proxy for size since the outcome shall be expected to be unique.

Also, firms are known to pursue some courses of action along their life cycle which are either to seek profitability, efficiency or growth. This study only considered total factor productivity as a measure of firm performance which leaves room for the exploration of the firm size, profitability and growth relationship in the manufacturing firm of Ghana. Another possibility is to concentrate the study in a single industry for a more specific analysis of the effects of firm size and on firm performance. The study can also be replicated in different sectors such as the Banking or Service sector of Ghana. The use of a more recent data, as other panels grow, may also help test the relevance of the World Enterprise Survey data for Ghana and show the new dynamics of the firm size and firm performance relationship in the manufacturing sector of Ghana

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APPENDICES

APPENDIX A

OLS Regression for Assets on TFP of Small Firms

Linear regression

Number of obs	= 194
F(7, 186)	= 2.62
Prob > F	= 0.0132
R-squared	= 0.2933
Root MSE	= 1.9859

TFP	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
lAssets	-1.092912	.3857474	-2.83	0.005	-1.853914	-.3319091
Age	.0282118	.0203785	1.38	0.168	-.0119909	.0684146
lLabr_Prod	1.157154	.4015931	2.88	0.004	.3648909	1.949417
Skl_Int	-.950558	.7230487	-1.31	0.190	-2.376989	.4758726
Cap_Util	-.007849	.0084617	-0.93	0.355	-.0245423	.0088443
TangAssets	6.119209	1.90882	3.21	0.002	2.353489	9.884929
Sales_Growth	.0244023	.0285423	0.85	0.394	-.031906	.0807106
_cons	-1.437953	1.555391	-0.92	0.356	-4.506429	1.630523

Random Effects Regression for Assets on TFP of Small Firms

Random-effects GLS regression		Number of obs	= 194
Group variable: year		Number of groups	= 2
R-sq:	within = 0.3001	Obs per group: min	= 37
	between = 1.0000	avg	= 97.0
	overall = 0.2933	max	= 157
		Wald chi2(7)	= 77.20
corr(u_i, X)	= 0 (assumed)	Prob > chi2	= 0.0000

TFP	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lAssets	-1.092912	.1316178	-8.30	0.000	-1.350878	-.8349455
Age	.0282118	.0145261	1.94	0.052	-.0002588	.0566825
lLabr_Prod	1.157154	.1332062	8.69	0.000	.8960745	1.418233
Skl_Int	-.950558	.5180738	-1.83	0.067	-1.965964	.064848
Cap_Util	-.007849	.0080062	-0.98	0.327	-.0235409	.0078429
TangAssets	6.119209	.8774924	6.97	0.000	4.399356	7.839063
Sales_Growth	.0244023	.061279	0.40	0.690	-.0957023	.1445069
_cons	-1.437953	1.081594	-1.33	0.184	-3.557839	.6819331
sigma_u	0					
sigma_e	1.9030023					
rho	0	(fraction of variance due to u_i)				

OLS Regression for Assets on TFP of Medium Firms

```
Linear regression                                      Number of obs =      72
                                                       F(  7,    64) =  133.48
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.6757
                                                       Root MSE      =  3.3886
```

TFP	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
lAssets	-2.828445	.4728889	-5.98	0.000	-3.773149	-1.883741
Age	.0717846	.0505147	1.42	0.160	-.0291302	.1726993
lLabr_Prod	2.801246	.4388641	6.38	0.000	1.924514	3.677978
Skl_Int	3.629955	1.822242	1.99	0.051	-.0103921	7.270303
Cap_Util	-.0698474	.0209812	-3.33	0.001	-.1117622	-.0279326
TangAssets	14.80836	2.639105	5.61	0.000	9.536138	20.08058
Sales_Growth	.0003105	.0005911	0.53	0.601	-.0008704	.0014915
_cons	2.290631	3.236332	0.71	0.482	-4.174686	8.755948

Fixed Effects Regression for Assets on TFP of Medium Firms

```
Fixed-effects (within) regression               Number of obs      =        72
Group variable: year                            Number of groups   =         2

R-sq:  within  = 0.6777                         Obs per group: min =        16
       between = 1.0000                                        avg =      36.0
       overall = 0.6183                                        max =        56

                                                F(7,63)            =     18.92
corr(u_i, Xb)  = -0.4088                        Prob > F           =    0.0000
```

TFP	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lAssets	-2.438361	.5065913	-4.81	0.000	-3.450703	-1.426019
Age	.0671989	.0376751	1.78	0.079	-.0080888	.1424865
lLabr_Prod	2.853852	.3155117	9.05	0.000	2.223352	3.484352
Skl_Int	3.899238	1.763661	2.21	0.031	.3748428	7.423634
Cap_Util	-.0618845	.023871	-2.59	0.012	-.1095869	-.0141821
TangAssets	12.18145	3.753131	3.25	0.002	4.68142	19.68149
Sales_Growth	.0002736	.0014037	0.19	0.846	-.0025315	.0030787
_cons	-4.647465	8.002277	-0.58	0.563	-20.63874	11.34381
sigma_u	2.6086543					
sigma_e	3.3900046					
rho	.37191888	(fraction of variance due to u_i)				

```
F test that all u_i=0:     F(1, 63) =     0.95              Prob > F = 0.3338
```

OLS Regression for Assets on TFP of Large Firms

Linear regression		
	Number of obs	= 40
	F(7, 32)	= 14.60
	Prob > F	= 0.0000
	R-squared	= 0.1864
	Root MSE	= 8.6477

TFP	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
lAssets	-2.363059	.869978	-2.72	0.011	-4.135146	-.5909716
Age	.0407853	.0507616	0.80	0.428	-.0626128	.1441834
lLabr_Prod	2.18305	.9850637	2.22	0.034	.1765412	4.189559
Skl_Int	3.976833	4.684063	0.85	0.402	-5.564292	13.51796
Cap_Util	-.0442582	.0581269	-0.76	0.452	-.1626589	.0741424
TangAssets	16.86586	7.423357	2.27	0.030	1.744973	31.98674
Sales_Growth	.000439	.0040778	0.11	0.915	-.0078672	.0087452
_cons	6.352045	7.201131	0.88	0.384	-8.316179	21.02027

Random Effects Regression for Assets on TFP of Large Firms

Random-effects GLS regression	Number of obs	= 40
Group variable: year	Number of groups	= 2
R-sq: within = 0.1665	Obs per group: min	= 13
between = 1.0000	avg	= 20.0
overall = 0.1864	max	= 27
	Wald chi2(7)	= 7.33
corr(u_i, X) = 0 (assumed)	Prob > chi2	= 0.3952

TFP	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lAssets	-2.363059	.9641235	-2.45	0.014	-4.252706	-.4734113
Age	.0407853	.0774621	0.53	0.599	-.1110376	.1926081
lLabr_Prod	2.18305	1.016643	2.15	0.032	.1904662	4.175634
Skl_Int	3.976833	5.462024	0.73	0.467	-6.728538	14.6822
Cap_Util	-.0442582	.091392	-0.48	0.628	-.2233832	.1348668
TangAssets	16.86586	7.488193	2.25	0.024	2.189267	31.54245
Sales_Growth	.000439	.0074582	0.06	0.953	-.0141788	.0150569
_cons	6.352045	10.39104	0.61	0.541	-14.01401	26.7181
sigma_u	0					
sigma_e	8.7840514					
rho	0	(fraction of variance due to u_i)				

APPENDIX B

OLS Regression for Total Number of Employees on TFP of Small Firms

Linear regression	Number of obs = 194
	F(8, 185) = 1.06
	Prob > F = 0.3951
	R-squared = 0.0477
	Root MSE = 2.3116

TFP	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
NumEmp_Cnt	.1204106	.0772043	1.56	0.121	-.0319034	.2727246
Age	.0724984	.0641588	1.13	0.260	-.0540786	.1990754
NumEmp_Age	-.0053925	.0041691	-1.29	0.197	-.0136176	.0028327
lLabr_Prod	.1479896	.0699537	2.12	0.036	.00998	.2859991
Skl_Int	-.1485999	.6600781	-0.23	0.822	-1.450848	1.153648
Cap_Util	.0021466	.008382	0.26	0.798	-.01439	.0186832
TangAssets	.5670121	.9791519	0.58	0.563	-1.364727	2.498751
Sales_Growth	.0258615	.0369577	0.70	0.485	-.0470512	.0987742
_cons	-2.961683	2.571555	-1.15	0.251	-8.035027	2.111661

Random Effects Regression for Total Number of Employees on TFP of Small Firms

Random-effects GLS regression	Number of obs = 194
Group variable: year	Number of groups = 2
R-sq: within = 0.0887	Obs per group: min = 37
between = 1.0000	avg = 97.0
overall = 0.0477	max = 157
	Wald chi2(8) = 9.26
corr(u_i, X) = 0 (assumed)	Prob > chi2 = 0.3211

TFP	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
NumEmp_Cnt	.1204106	.0681274	1.77	0.077	-.0131167	.2539378
Age	.0724984	.0408352	1.78	0.076	-.0075372	.152534
NumEmp_Age	-.0053925	.0032198	-1.67	0.094	-.0117032	.0009183
lLabr_Prod	.1479896	.0584137	2.53	0.011	.0335008	.2624783
Skl_Int	-.1485999	.6229985	-0.24	0.811	-1.369654	1.072455
Cap_Util	.0021466	.0092541	0.23	0.817	-.015991	.0202842
TangAssets	.5670121	.6697448	0.85	0.397	-.7456636	1.879688
Sales_Growth	.0258615	.0717981	0.36	0.719	-.1148602	.1665831
_cons	-2.961683	1.627225	-1.82	0.069	-6.150985	.22762
sigma_u	0					
sigma_e	2.0878063					
rho	0	(fraction of variance due to u_i)				

OLS Regression for Total Number of Employees on TFP of Medium Firms

Linear regression	Number of obs	=	64
	F(7, 56)	=	1.17
	Prob > F	=	0.3326
	R-squared	=	0.1191
	Root MSE	=	.61609

TFP	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
NumEmp_Cnt	.0075638	.0065011	1.16	0.250	-.0054594	.020587
Age	.0077573	.0103504	0.75	0.457	-.012977	.0284916
lLabr_Prod	.0107258	.0259964	0.41	0.681	-.0413514	.0628029
Skl_Int	.0139941	.4232253	0.03	0.974	-.8338281	.8618163
Cap_Util	.0082909	.0051615	1.61	0.114	-.0020489	.0186307
TangAssets	-.2375694	.3160349	-0.75	0.455	-.8706634	.3955246
Sales_Growth	.0021333	.0162667	0.13	0.896	-.0304528	.0347195
_cons	-.1716851	.6650103	-0.26	0.797	-1.503861	1.160491

Random EffectsRegression for Total Number of Employees on TFP of Medium Firms

Random-effects GLS regression	Number of obs	=	64
Group variable: year	Number of groups	=	2
R-sq: within = 0.1607	Obs per group: min	=	14
between = 1.0000	avg	=	32.0
overall = 0.1191	max	=	50
	Wald chi2(7)	=	7.57
corr(u_i, X) = 0 (assumed)	Prob > chi2	=	0.3720

TFP	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
NumEmp_Cnt	.0075638	.0042346	1.79	0.074	-.0007359	.0158634
Age	.0077573	.0076394	1.02	0.310	-.0072156	.0227302
lLabr_Prod	.0107258	.0281346	0.38	0.703	-.0444169	.0658685
Skl_Int	.0139941	.3777889	0.04	0.970	-.7264586	.7544468
Cap_Util	.0082909	.0049606	1.67	0.095	-.0014316	.0180134
TangAssets	-.2375694	.323697	-0.73	0.463	-.8720039	.3968652
Sales_Growth	.0021333	.0219026	0.10	0.922	-.040795	.0450616
_cons	-.1716851	.7528706	-0.23	0.820	-1.647284	1.303914
sigma_u	0					
sigma_e	.42041651					
rho	0	(fraction of variance due to u_i)				

OLS Regression;Total Number of Employees on TFP of Large Firms

Linear regression

Number of obs =	30
F(8, 21) =	2.79
Prob > F =	0.0283
R-squared =	0.4198
Root MSE =	.76559

TFP	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
NumEmp_Cnt	.0014911	.0016001	0.93	0.362	-.0018366	.0048187
Age	.0058964	.0109766	0.54	0.597	-.0169306	.0287234
NumEmp_Age	-.0000292	.0000264	-1.11	0.280	-.0000841	.0000256
lLabr_Prod	-.0411844	.0553924	-0.74	0.465	-.1563792	.0740103
Skl_Int	.1171064	.554817	0.21	0.835	-1.036699	1.270911
Cap_Util	.003231	.0101315	0.32	0.753	-.0178386	.0243007
TangAssets	1.268565	.547099	2.32	0.031	.1308106	2.40632
Sales_Growth	.1427027	.1608272	0.89	0.385	-.1917557	.4771612
_cons	.4781623	1.368322	0.35	0.730	-2.367418	3.323743

Random Effects Regression for Total Number of Employees on TFP of Large Firms

Random-effects GLS regression		Number of obs =	30
Group variable: year		Number of groups =	2
R-sq: within = 0.2197		Obs per group: min =	10
between = 1.0000		avg =	15.0
overall = 0.4198		max =	20
		Wald chi2(8) =	15.20
corr(u_i, X) = 0 (assumed)		Prob > chi2 =	0.0554

TFP	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
NumEmp_Cnt	.0014911	.0014754	1.01	0.312	-.0014006	.0043827
Age	.0058964	.0102122	0.58	0.564	-.0141192	.025912
NumEmp_Age	-.0000292	.0000249	-1.17	0.241	-.0000781	.0000196
lLabr_Prod	-.0411844	.0451828	-0.91	0.362	-.1297411	.0473723
Skl_Int	.1171064	.6003666	0.20	0.845	-1.05959	1.293803
Cap_Util	.003231	.008892	0.36	0.716	-.0141969	.0206589
TangAssets	1.268565	.5535382	2.29	0.022	.1836503	2.35348
Sales_Growth	.1427027	.1277215	1.12	0.264	-.1076268	.3930322
_cons	.4781623	1.296162	0.37	0.712	-2.062268	3.018593
sigma_u	0					
sigma_e	.51047472					
rho	0	(fraction of variance due to u_i)				