Capacity Utilization in Manufacturing Industries: Evidence from Nigerian Firm Level Data

Okechukwu Chima Christian

Submitted to the
Institute of Graduate Studies and Research
in partial fulfillment of the requirements for the Degree of

Master of Science
in
Economics

Eastern Mediterranean University
June 2012
Gazimağusa, North Cyprus

Approval of the Institute of Graduate Studies and Research

Prof. Dr. Elvan Yılmaz
Director

I certify that this thesis satisfies the requirements as a thesis for the degree of Master of Science in Economics.

Prof. Dr. Mehmet Balcilar
Chair, Department of Economics

We certify that we have read this thesis and that in our opinion it is fully adequate in scope and quality as a thesis for the degree of Master of Science in Economics.

Assoc. Prof. Dr. Cem Payaslioğlu
Supervisor

Examining Committee

1. Assoc. Prof. Dr. Cem Payaslioğlu _____
2. Assoc. Prof. Dr. Salih Katircioğlu _____
3. Asst. Prof. Dr. Çağay Coskuner _____

ABSTRACT

This thesis examines the determinants of Capacity Utilization among manufacturing firms in Nigeria. Using manufacturing firm level survey conducted by Enterprises Survey under the auspices of the World Bank, we attempted to identify these determinants within the framework of an economic model, using two separate cross-sectional data garnered from surveys in 2010 employing the robust Quantile Regression technique. Our analysis and findings provides evidence that the duration of power outages in Nigeria accounts for a large chunk of capacity under-utilization among manufacturing firms. The percentage of skilled production workers that a firm has also plays an important role in its utilization of capacity.

Recommendations to improve and build upon the existing capacity among firms were made, this is inspired by the important functions that manufacturing industries play in any economy, which determines to a large extent, the flexibility of that economic system to meet future requirements for the objective of being productive, efficient and competitive. It is hoped that the policy suggestions therein would help make Nigerian industries better equipped to face challenges amidst global competition.

Keywords: Capacity Utilization, Quantile Regression, Nigerian Manufacturing, Enterprises Survey.

ÖZ

Bu tez çalışmasında Nijerya'nın imalat sanayi şirketlerinin kapasite kullanımını etkileyen faktörler incelenmektedir. Çalışmada Dünya Bankası'nın şemsiyesi altında başlatılan İşletmeler Anket Projesi kapsamında elde edilen 2010 yılına ait mikro veriler kullanılarak Kantil Regresyon Metoduna dayanan bir model kullanılmıştır. Elde edilen bulgular Nijerya'daki elektrik kesintileri sürelerinin işletmelerdeki kapasite kullanımının yetersizliğini açıklayan baş etken olduğuna işaret etmektedir. Firmalarda çalışan vasıflı işçilerin sayısının da kapasite kullanımını olumlu etkileyen faktörler arasında olduğu görülmektedir.

Bu bağlamda firmaların mevcut kapasite kullanım oranlarını artırabilmelerine yönelik öneriler getirilmektedir. İmalat sanayi firmalarının ekonomideki ağırlıklı durumları gözetildiğinde bunların ekonominin verimlilik, etkinlik gibi gereksinimlerine cevap verebilecek esnek bir ekonomik yapının temel taşları olduğu açıktır. Çalışma sonuçlarına dayanarak küresel rekabet ortamında Nijerya şirketlerinin daha donanımlı olmalarına yönelik politikalar da ortaya konmaktadır.

Anahtar Kelimeler: Kapasite Kullanımı, Kantil Regresyon, Nijerya İmalat Sanayi, İşletmeler Anketi.

To my Parents

Benedict & Ngozi Okechukwu

And

Favour Omohwovo

ACKNOWLEDGMENT

I bestow all honor and adoration to my Lord and Savior Jesus Christ; the author and finisher of our faith; the source of all knowledge and wisdom for giving me the privilege and fortitude to embark and successfully accomplish this work.

My profound gratitude goes to my amiable supervisor Assoc. Prof. Dr. Cem Payaslioğlu for his patience, support, and immense assistance which led to the timely completion of this thesis.

I would also like to seize this opportunity to express my earnest appreciation and gratitude to all my instructors without any concessions. In particularly I would like to acknowledge the chair of the department Prof. Dr. Mehmet Balcilar, the departmental head of post graduate studies Assoc. Prof. Dr. Sevin Uğural, Assoc. Prof. Dr. Gulcay Payaslioğlu and all the departmental assistants.

Finally I wish to acknowledge the valuable inputs of my friends, too numerous to mention towards making this work a success and my educational pursuit in general, the Lord will continue to be your strength.

Okechukwu Chima Christian

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1

INTRODUCTION

1.1 A Background to the Study

Sustainable social development and rapid economic growth makes up the fabrics of economic policies across the globe. The growth and development of an economy's industrial sector has always and will continue to play a pivotal role in the accelerated advancement of that economy. The comparative relevance of small and medium scale enterprises which constitutes majority of firms in developing nations has always played a pivotal role in the acceleration of growth and development in countries where its importance have been accorded a prime position in the scheme of economic planning policies.

Aremu (2004) advanced the opinion that manufacturing companies play an imperative role in the economy of any country in accordance with their relative levels of development. Further, (Gunu, 2004 and Aremu, 2010)submitted that manufacturing industries particularly the small and medium ones, provide personal income, savings, create employment opportunities and drive the real sector of the economy. These firms are regarded as the locomotive that speeds up entrepreneurial capabilities and local technological advancements necessary for capacity utilization. The growth in income per capita for Sub Saharan Africa has been on the negative trend (Sachs et al. 2004). In spite

of the fact that Nigeria's population has been on the increase; which should translate to a high potential for manpower in the manufacturing sector, this has not been the case as the firms themselves lack the capacity or wherewithal to cater or utilize this surging growth in human labor. And considering the fact that most firms in the country are labor intensive as opposed to their peers in more developed countries that are more mechanized and less labor intensive, it should be expected that there should be a low level of idle capacity in the economy. Globally, medium and small sized enterprises are being regarded as compelling force used to reduce in poverty and stimulate economic development.

Various authors submit that they (SMEs) have been the channel through which augmented rapid industrialization and economic growth have been achieved. Despite the fact that the input of the manufacturing firms are widely recognized; industrialists are faced with numerous obstructions that constrain their advancement and survival. Untill recently, not much work has been undertaken in the Nigerian manufacturing industry especially as it regards the components and determinants of full or optimal Capacity Utilization. This is imperative due to the fact that every firm has its distinct characteristic and thus grouping them all in an aggregated whole will not give us a true picture of the variations that we are positive exists amongst these firms and thereby proffering specific and tangible resolutions that will spearhead a quick and appreciable transformation of this burgeoning sub-sector.

Manufacturing activities can only thrive in a good investment atmosphere. Typical of such are stable financial market systems-for accessing micro credit, standard and reliable

physical infrastructure, general security of lives and property and a good government administration devoid of mismanagement, inflated contracts, bribery, and widespread corruption. This creates the enabling environment necessary for firms to invest, thereby influencing their motivation to engage in productive investments which in turn create jobs and raise the living standards of a vast working population in Nigeria. According to the McGraw-Hill utilization survey, capacity in manufacturing has grown slowly in recent years, at about 2.8 percent annually since 1969.

1.2 Aims and Objectives

The role that Capacity Utilization plays in evaluating and stimulating economic activities by process of elucidating the behavior of productivity, investment and output is well recognized and acknowledged. Manufacturing, which some economists refer to as the wealth-producing sector of an economy (David, 2006) acts as a catalyst to transform a country's economic composition, from modest, plain agrarian societies to more sophisticated, productive and technology-driven economies.

This thesis seeks to among other things; attempt to identify the determinants of Capacity Utilization-which is the proportion of the actual capacity utilized to some measure of probable output in manufacturing industries in Nigeria within the framework of an economic model. Unearth the reasons why excess idle capacity exists when it is evident that these firms have not attained their optimal capacity level.

1.3 Significance of the Study

This research is inspired by the important function that manufacturing firms play in an economy, which determines to a large extent, the flexibility of that economic system to

meet future requirements for the objective of being productive, efficient and achieving the set macro-economic goals that expressly translate to better living standards for the populace. Empirical research into the rate of Capacity Utilization especially among manufacturing firms in developing countries like Nigeria has been relatively scant; a justification for this appears to be lack of credible and adequate data. Nigeria's laudable medium term strategy document (National Economic and Empowerment Strategy – NEEDS) affirms that the manufacturing sector has enormous potential for employment generation, wealth creation and also poverty alleviation (Borodo, 2009).

With the rapid technological changes, extensive liberalization and proliferation of internalized production; manufacturing has become the catalyst for developing countries like Nigeria to benefit from globalization thus bridging the gap with the high income industrialized world (Mike, 2010). Further, optimal capacity utilization among firms is vital in the expansion process and continues to command considerable attention in modern economic literature not only as it concerns developing countries but also in the developed ones as well.

1.4 Structure of the Study

This study will be divided into six broad chapters. Chapter one will dwell on the introductory aspect of the study, giving us an idea of why we intend to investigate Capacity Utilization in manufacturing firms. Chapter two will focus on the survey of a plethora of available literature on the concept of CU, productivity, manufacturing amongst others. The third chapter will include the Data and modeling description, description of variables used; survey type and so on. The fourth chapter concentrates on modeling and estimation of the data from the previous chapter while chapter five will

comprise of interpretation of results. The final chapter will include the conclusion and policy recommendations.

Chapter 2

LITERATURE REVIEW

2.1 Introduction

The manufacturing sub-sector has substantial influence on the economic development of any country. They account in a significant percentage of total economic activities in developed economies. In Malaysia, this sub-sector accounts for about 27 percent of her GDP annually, about 32 percent and 23 percent in China and Germany respectively (UN data, 2008). While in Nigeria, it accounts for approximately 10 percent of total GDP in the same period. Thus the annals of modern industrialization in the country varies considerably from that of its equals in the advanced countries. While the prior is premised on producing, amassing and regenerating capital, the former is built on dependence from imports (Mike, 2010).

As regards employment generation, the manufacturing sub-sector accounts for almost 12 percent of the labor force in Nigeria as compared to 22 percent and 19 percent in Germany and Brazil respectively. Manufacturing endeavor can best thrive in a good investment climate. Characteristics of this business-friendly environment include the existence of dependable physical infrastructure, accessible and robust financial markets, astute and credible government administration- creating the favorable environment necessary for influx of foreign direct investment into the domestic economy.

Capacity Utilization (CU) is a central margin for understanding output fluctuations in output at the plant and aggregate level, and in a firms' decision about subtracting or adding from their stocks of factors of production and as well as for understanding and enhancing measures of productivity (Shapiro et al, 2011). The rate of CU is a fundamental productivity variable in economic analysis. It tends to measure the magnitude to which actual output varies from capacity or normal output. If actual output falls short of normal, it points to the fact that there exists underutilization of capacity while if actual capacity surpasses normal, we deduce that there is over utilization of capacity.

2.2 Empirical Literature on Capacity Utilization

Capacity in manufacturing has grown slowly in recent years-at only a 2.8 percent annual rate since 1969 (McGraw Hill utilization survey, 1973) . This has resulted in operating rates today being significantly higher than we might expect especially in the light of appreciable growth rate in industrial output over the same period.

Morrison (2002) further advocated that this complexity is compounded by issues peculiar to common pool industries. In spite of this, clear definitions and measures of CU are essential to facilitate understanding of capacity issues and eventually to guide firms' policy makers to monitor and reduce excess capacity mostly for those industries exploiting common pool resources (Catherine et al, 2002). Wen (1998) supports this stand and contends that since CU induces employment to move alongside with consumption under mild externalities, this will then intensely increase the marginal productivity of labor. It therefore follows that a rise in consumption demand encourages

accumulation of capital and expansion in output which satisfies consumers' buoyant expectations for raises in future incomes.

Benhabib and Farmer (1994) recognized that when more than one production sector is incorporated into the one-sector Real Business Cycle model, the degree of increasing returns to scale required to generate multiple equilibria can also be substantially reduced. Although CU assists in boosting the transmission mechanisms produced by increasing labor or human capital growth, it is not on its own a vital source of business cycle transmissions in the above model. Recent empirical findings by Shapiro et.al (1993) are coherent with the elasticity effect of CU. This arises because CU has a tendency to move alongside with labor and counter-wise with capital, the reason being that the net marginal gain of CU is an increasing function of labor but a decreasing function of the capital stock at the steady state (Wen, 1998).

Marris (1964) conducted an empirical research in the 1950s where he presumed that firm managers when planning their portfolio investments, usually form a mental idea of the number of productive hours there equipment and machinery are meant to work. Thus he argues that firms choose to operate at excess capacity, which will depend on the interaction between resilience and durability of the use of mechanization.

A perception also exists of the fact that aggregate output has both an alternative and a permanent factor which is consistent with a varying degree of theories in business cycles. In as much as the permanent part of output is noticeable in actual circumstances, vital information that will aid in predicting future changes in output can be obtainable from the cavity between permanent and current output. Cochrane (1994) substantiated

that the permanent composition of U.S real GDP can be closely approximated by mean-adjusted real household consumption of non durable services and goods, also the gap between current real output and mean-adjusted consumption has important marginal explanatory power for future output growth.

Delong and Summers (1988) suggested a procedure for approximately the permanent component of output using only current and lagged output observations.

Nadiri and Rossen (1969) studied CU in a model where firms are not explicitly forward-looking. Their study vigorously consisted factor demands for capital and labor where the level of utilization of both inputs are choice variables for the firm.

Recent empirical studies tend to suggest that some analysts view capacity majorly as a form of human capital relating to training and development of dexterity at the firm with also individual level. They argue that capacity issues goes beyond normal industrial training and technical skill acquisition, it also involves the ability to execute and deliver better. Others like Moore (1995) advocates that improving existing approaches to performance which includes institutional development, public sector reform and good governance.

Concomitant to this opinion includes a variety of concerns namely; commitment, rights, learning, collaboration, ownership, knowledge management, training, accountability, sustainability, participation, public sector reform and so on.

Statistics from the Nigerian Central Bank (CBN) indicates that level of manufacturing CU in the country has been on a decline and had dipped to about 38 percent in 2008. the

challenges facing this crucial sector of the economy has been protracted and this led to the demise and untimely closure of many production plants all over the country, while the vast remainder has relocated to neighboring countries as fundamental Infrastructural amenities such as dependable and reliable power supply has been on its lowest ebb in recent years in the country.

According to Martin (2008), about 80 percent of manufacturing companies merely operate on the survival fringe because a further adverse policy push can be the final blow- an unfortunate regular phenomenon in the nations' polity. It is also disheartening to note with dismay that while the fortunes of the manufacturing sector of the economy continue to dwindle, past and current government administrations have paid little to this situation rather had inadvertently taken to superficial policies, setting up agencies overseen by corrupt and ill-qualified officials, usually to settle political favors and motives. From the fore-going, the conduct of macroeconomic policies have been contorted in a way that they consistently wane the demand capacity and elicit associated uncertainties that alter relative prices and make a nonsense of economic planning and forecasts by firms.

2.3 Theoretical and Conceptual Literature Review

There is no generally acceptable definition for the concept of capacity. This stems from the fact that different disciplines such as political economy or organizational development views issues of capacity somewhat differently. Capacity Utilization (CU) and capacity are complicated in defining, let alone interpret and measure in a consistent coherent manner. Understanding capacity and its measurement is necessary to properly

design a capacity management program, especially when capacity is managed by explicit limitations (Kirkley, 2002).

The perception of capacity fundamentally relates to output. CU often arises in the discussions of applied and theoretical issues at both macro and micro economic levels as its importance is becoming more crucial for firms' decision makers. Among firms for example, the existence of excess capacity points to the fact there are elements of monopolistic tendencies within individual industries.

The foremost work on the economic concept of capacity is attributed to Cassel (1937), he made a clear distinction between excess capacity of fixed factors (short run cost curves) and excess capacity of all factors (long run cost curves). Cassel further pointed out that since the absolute technical upper limit of the output obtainable from the fixed factors is likely to lie far beyond the realm of practical economic operations, capacity output should be taken as that which the average total costs are at their minimum (Padma, 1991).

Klein (1960) one of the fore-runners of capacity, pointed out that 'economic analysis is replete with use of the term *capacity,* yet comparatively little attention is devoted to a precise theoretical statement of the concept. The term is used as a self-defining term and it may be taken for granted that there is harmony about its meaning. If we were to set out upon the task of measuring capacity, however, whether for r firm, industry or national economy we would be sure to encounter many theoretical difficulties and a clear conceptual basis would be necessary as a starting point'. As stated by Chamberlin (1935) one of the prime writers who devoted considerable interest on the notion of

capacity, excess capacity is as a result of imperfect competition that causes inefficiency in an economic organization. Klein (1960) and Hickman (1964) suggested that optimal capacity should be distinct and viewed as the level of output that is associated with the full competitive equilibrium.

However, Padma (1991) submits that empirical implementation of the economic notion of capacity runs into problems partly because of the problem of the estimation of a cost function and also as a result of crucial doubts that the long run average cost curve actually curves up.

Klein (1960) in trying to capture the concept of maximum output used the idea of an economic production function. He asserted that capacity is an index combination of all fully utilized factors including capital stock amongst other factors. Further, since capacity is not entirely a replacement for the capital stock as it depends on the other factors of production, this has helped to extend the concept of capacity in an economic sense.

Johansen (1968) another pioneer in the field of capacity, affirms the notion of Klein that plant capacity is analogous to the firm's maximum output. Similarly, more recent studies by Fare (1984) Fare and Grosskopf and Kokkenlenberg (1989) have acquired measures of utilization rates and firm capacity built upon previous definitions by Klein and Johansen.

Padma (2010) further suggests that, capacity can also be taken to refer a most efficient level of output where this suggests an economic capacity as it takes explicit account of economic factors like cost considerations which would hitherto be omitted by an engineering or technical conceptual definition.

For the Federal Reserve survey in USA, CU is derived using industry indexes. This capacity indexes endeavors to encapsulate the greatest level of output that a firm can maintain within the structure of a rational work program, assuming that there are ample availability of inputs to operate the equipment and machinery prepared and also taking note of routine downtime.

Longs et al, (1973) noted that the indirect use of capacity measures is important in the construction of econometric models and also serves as a validation test for the series actually being considered. Some of its uses include; capital and price formation models. Nevertheless, it should be noted that the explanations for capacity are by no means all encompassing and comprehensive.

The opinion and decisions of firm owners and entrepreneurs in a single firm, different qualities of inputs, effect of managerial competencies and so on, all influence the capacity output. Panic (1978) captured it aptly when he said that "it can be argued for instance that managers of a firm are the best judges of what its 'capacity' is…" This then follows that capacity output is considerably swayed by the availability of variable inputs and their respective costs, managerial aims and abilities and partly influenced by fixed

stocks of capital. Therefore, it is safe to assume that management has the capabilities to vary the rate of capacity utilization depending on numerous factors.

Christiano (1981) contends that at the individual level of the firm, entrepreneurs may translate capacity to mean ‘practical’ or ‘preferred’ capacity. Where the former is regarded as the maximum output possible from a firm, given its fixed factors of production and other conditions relating to its operations. Preferred capacity on the other hand relates same as resulting from the level of market demand prevailing from what the firms wish to manufacture at such market conditions.

2.4 Measurement of Capacity Utilization

A good number of measures have been widely cited in most economic and financial literatures. However, it is worthy of mention that there is no undisputed harmony regarding which particular measure is most suitable for measuring Capacity Utilization (CU). Further, most of these measures provide scanty clarification as to why CU fluctuates overtime. Based on economic literatures, the following are some of the recognized measurements.

A. Survey-Based Measurement.

The widely accepted method of obtaining numerical ratios of Capacity Utilization is to inquire from firms for their own personal appraisal or evaluation of the magnitude to which their available capacity has been put to use in their diverse plants. Many financial institutions and governments include this query in their data gathering parameter; the Enterprises Survey an arm of the World Bank for example, includes

this variable in its survey list for enterprises across select countries all over the world.

Raimi and Adeleke (2009), asserts that two questions relating to CU as regards manufacturing productivity include; ranging from excessive; adequate; insufficient, firms should pick an option relating how they consider their present capacity, secondly, they should also indicate in percentage terms, what percent of capacity are they operating on currently. In as much as the first question might not result exact ratios of CU, it offers a general signal indicating the direction of changes in capacity utilization, thus making it presumptuous in nature. Reactions to the second question provide a ratio of CU which is also numerical in nature and is combined to impart industry wide dimensions.

Christino (1982) discovered that data based ration have a tendency to denote a lower level of surplus measurements as compared to surveyed measures. He asserts that most respondents tends to associate strong demand to high capacity and weak demand to low capacity, this leads to surveyed CU ratios exhibiting low fluctuations. Since these surveys are usually restricted to manufacturing, issues like errors in sampling are bound to exist which arises mainly from the different interpretations of capacity by the surveyed respondents.

B. Peak-to-Peak Measurement (Wharton Index)

This measurement originated from the works of Klein and Summers (1966). In the Irish manufacturing sector, this method of measuring capacity utilization was chosen by Nolan and O'Reilly (1979). This approach endeavors to quantify the intensity of input utilization by looking at varying levels of output overtime. The CU measurement according to this technique cannot be more than unity.

This approach has the advantage of easily deriving an important economic indicator. For some countries, this index is usually made accessible either monthly or quarterly. Raimi et al (2009) noted that this particular method does not require no data relating to inputs which is usually times a considerable period of time and its availability being unreliable. The simplicity of computation and partial data requirement makes this measurement very applicable.

C. The Production Function Measurement

This measurement denotes an effort to apply the industry production level with the intention of measuring capacity utilization. This approach was developed by Ball and Smolensky (1961), Klein and Preston (1967). In this instance, the concept of capacity that is implied here is the same as the conceptualization used by economists in the perception of maximum output corresponding to all factors of production, and consists of capital stock where the method of estimation relying on the production function. Taylor and Harris (1985) assumed an un-comprehensive method to capture measurements of capacity utilization for select industries in the UK.

This measurement approach borrows from the peak-to-peak method the empirical aim of striving to measure the level of capacity output that could possibly be produced given that all the available inputs are completely optimized. However, this method stands out in the sense that once an industry's or a firms' production function has been estimated, calculating capacity output then becomes easier as we simply evaluate the output at the points where all resources are fully utilized. It should be noted that measurement of CU using this approach signifies a substantial advancement from the above mentioned approaches.

D. The Shift working Measurement

This approach is used by a handful of countries as they usually collect data pertaining to shifts worked for a firm or industry. This measure was used variously by Winston (1974) for Pakistan. For the Indian firms, Paul (1974) used an adjusted engineering methodology starting from data on actual production and also on installed capacity, and re-computing installed capacity for the total number of shifts that was actually worked (Padma, 2010). This kind of shift working data usually illustrates the number of shifts workers accumulate in a day or a week period.

E. The Electricity Consumption Measurement

Yet another method of measuring capacity draws upon data from electric power consumption. This approach was developed by Foss (1964) and later propagated or

made popular by Jorgenson and Griliches (1967) for firms in the US, Heathfield (1972) for firms situated in the United Kingdom and Kim and Kwon (1977) for firms in South Korea.

The basis for this method stems from the fact that electric motors in firms explains a large proportion of mechanical work, thus the concentration of usage can be proven by simply looking at the intensity of usage of electric motors which drive the machinery (Padma, 2010). The rate of utilization is defined as ratio of the tangible number of hours worked during each period considering that equipments driven by electric motors are used in proportion to the existing number of hours within the same time frame.

Going by the above measurements, it becomes clearer that estimating CU by way of the production function approach is more suitable and practicable. This is also in line with basic economic reasoning.

Chapter 3

NIGERIAN ECONOMY AND MANUFACTURING SECTOR OVERVIEW

3.1 The Nigerian Economy

Nigeria gained her independence from the British colonial rule in 1960, and became a Republic three years later in 1963. It is the most populous country in sub-Saharan Africa, with an estimated population of 155 million people (World Bank, 2009), more than one-fifth of the entire continent's population, and with a growth in population which averaged 2.4% from 1989 to 1999. Combining these with vast agricultural landscape, enormous natural gas reserves, ample natural resources; the country has the potential to build a prosperous economy, provide good healthcare, reduce poverty and hunger drastically and provide employment for its huge inhabitants.

The country shares borders with Niger in the north, Benin in the west and Cameroon in the east. It is notable for a couple of fascinating geographical features that comprise of River Niger and Benue, Obudu Plateau, Mambilla and Adamawa highlands, Ikogosi and Panyam natural warm springs to mention but a few.

Nigeria being a tropical country has two climate types which range from a very longer damp season to a mild shorter dry season. Like most developing countries, the economy of Nigeria has been subdued by a myriad of challenges. In the early periods of 1960 and

1970, the GDP of the country recorded a 3.1 percent growth per annum. Further, during the oil boom period in the mid 1980s, GDP grew at a commendable 6.2 percent annually. Conversely, starting from the early 1980s, the country started to witness a negative rate of growth in her GDP.

During this period, often loosely referred to as 'the era of economic liberalization and structural adjustment', strongly advocated and favored by the Bretton Woods Institutions, the economy rather than progress moved in a fluctuating trend, rising in some periods and retrogressing in others.

In the years succeeding independence, the manufacturing and industrial sectors experienced a positive growth rate, with the exception of the period 1980 and 1988 where these sectors recorded a negative rate of growth of -3.2 and -2.9% respectively.

In the early 1960 to 1970, a low commodity price hit the agricultural sector of the economy coupled with the oil boom of the 1970s; these had a negative impact on activities of the agricultural sector. Prior to this period, this sector which had contributed about 63% of the GDP dipped to 34% in 1988 as a result of the negligence of the agricultural sector by the government administration. This marked the beginning of importation of basic food items by the country to meet with growing demand. Then the level of capacity and capital utilization in the industrial sector was unsatisfactory.

The World Bank development report indicated that inflation rate in Nigeria was about 14% in 1970, grew to 34% in 1975 and dropped to 10% and 7% in 1980 and 1985

respectively. However, in 1988 this rose to about 55 percent during the structural adjustment phases. It also worthy of mention that with the recent stable democratic reforms and policies, the rate of inflation in the economy has decreased to an all time low of 7% in 2001. A sudden rise in oil production attributed to an early decline in the share of agriculture as a percent of GDP, from a modest 29% to 16% in 2004.

Wada (2011) noted that unemployment has been one of the most crucial economic issues the country has been struggling with. Decades of civil and ethnic wars, rabid corruption, military rule, bribery and gross embezzlement of public funds have hindered economic growth of the country and this has negatively impacted the ability of firms to realize full capacity utilization. As a result of this, industries cannot employ the abundant labor and this is reflected in the high level of unemployment which was estimated at about 21.1 % in 2010. Though blessed with huge deposits of oil and gas, the wealth from these natural resources has not translated into a visible improvement in the standards of living of the vast majority of the population.

Recent indicators suggest that Nigeria's economic performance is improving partly because of recent steady transition of a democratic government structure, and the past 12 years have witnessed a steady implementation of homegrown reform program, which albeit is in harmony with the IMF. Real GDP for example increased by about 6 % in 2004, which when compared to her neighboring countries is quite modest. Also the same year saw a commensurate growth in non-oil sector exports which grew to about 8% as compared to about 5% in the previous year. But with a population rate of growth of 2.5

percent annually, the GDP growth rate is not adequate to alleviate intense poverty, which is one of Nigeria's most crucial problems.

The Nigerian economy still suffers from two decades of poor economic performance and gross mismanagement after the collapse of the oil prices in the early 1980s, also, a string of corrupt military dictatorships flouted pragmatic macroeconomic policies and the nation's infrastructural development. In spite of the steady economic growth since 1999 when the military rule formally ended and a civilian dispensation was ushered in, per capita income in 2004 was only about $500 (in current US dollars), which is approximately one-quarter of its 1970s level.

The productivity of the labor and manufacturing sector continues to be of great trepidation, the country's growth in productivity was reported to as low as 1.2 % in 2001-2004. The level of private investment in the economy was 13. 2% of GDP in the same period under review, this indicates a weak likelihood for economic growth and employment generation.

3.2 Nigerian Manufacturing Capacity Utilization

For years Nigerian industries have faced a harsh business climate. A desperate shortage of energy and a dilapidated transportation network in addition to dwindling levels of quality education and the enduring unrest in the Niger Delta axis have all contributed to the deteriorating fortunes of the manufacturing sector and lower competitiveness. A report by the World Bank Investment Climate Assessment on Nigeria, asserts that the resilience of the private (manufacturing) sector promises a much improved performance,

on the condition that the government and the private sector can partner and collaborate to eradicate some of the largest obstacles to doing business.

Nigerian economy depends greatly on the gas and oil sector, which contributes about 90% of export revenues, 19% of the GDP and 80% of government revenues in 2009. Modern industrial development in Nigeria is generally a consequence of the expatriate preoccupation with focus on emerging markets and profit maximization. As a result of this, the evolution of industrialization in Nigeria is quite different from that of her counterparts in other parts of the world. While industries in East Asia focus on generating, accumulating and reinvesting capital, those in Nigeria were grounded on import-substitution (Ukaegbu, 1991).

The very First National Development Plan (1962-1968) laid emphasis on assembling and light industrial production. The second plan (1970-1975) had an analogous agenda, while the third development plan (1975-1980) emphasized on large heavy and mechanized industries, with projects initiated in the downstream sector, natural resources extraction and steel sectors. Also, other developmental activities were stunted by the exploitative activities of the Multinational firms that were involved in the execution of such plans, since local Nigerians lacked the required expertise then to manage those heavy mechanized industrial equipment and technology.

The concentration was on trade liberalization, privatization of previous government owned institutions, deregulation of the downstream sector and introduction of the Foreign Exchange Market in 1986. The target was to reduce the amount of government

intervention in the distribution of goods and services in line with the free market paradigm, which had the advantage of increasing competition, efficient allocation of prices and the nation's resources.

Manufacturing in developing countries generally and Nigeria particularly, involves majorly a couple of plants creating construction material, textiles, clothing, semi-pulverized foods, consumables and relatively easy machinery parts. Activities in the manufacturing sector of any economy covers a broad spectrum ranging from light agro-allied based industries to heavy steel and iron industries.

During the past era, Nigeria's manufacturing sector growth has stunted as productivity (measured in value added per worker) fall behind that of many comparable nations. A recent UNIDO survey study reveals that the productivity of Nigerian firms was only 10% of that of Botswana and 50% of Kenya and Ghana. This disparity can be attributed to numerous factors, which includes a poor investment climate and low utilization of capacity. Average CU in the industrial segment has decreased from a high of about 80% in 1978 to less than 30% in the early 1990s before rising marginally at the end of the decade; it still lingers at about 55% presently (ICA Report, 2009).

Statistics about Capacity utilization are quite imperative for evaluating economic activity since they connect firms actual output to potential full output at various levels of evaluation. The Enterprises Firm Survey program set up by the World Bank and funded by bilateral donor governments, collates data on select countries Capacity Utilization, and other investment climate indicators. We sample a couple of select

countries CU in sub-Saharan Africa so as to assess and measure up with Nigeria's CU. This will indicate the level of the manufacturing CU rate in the country with a view of charting the course towards achieving and attaining higher rates of CU.

Table 1: Capacity Utilization in (%) for select African countries. [Source: RPED Surveys]

Average Manufacturing Capacity Utilization (%)	**Annual Average**
Cameroon	48
Ghana	58
Eritrea	52
Ethiopia	41
Kenya	55
Mozambique	57
Senegal	68
Uganda	54
South Africa	73

Juxtaposing the table above with data obtained from the Nigerian National Bureau of Statistics suggests that the rate of CU among Nigerian firms have been at average levels as indicated from the table below-viz.

Table 2: Capacity Utilization by sectors in Nigeria. [Source: NBS, 2009]

Average Manufacturing Capacity Utilization (%)	**Annual Average**
Sub- Sectors	
Oils and Fats	60.88
Dairy Products	63.50
Grain Mills Products	42.30
Manufacture of Animal Feeds	56.20
Bakery Products	68.48
Manufacture of Sugar	24.00
Sugar/Confectionery	71.25
Spirit	67.58
Wine	49.38
Malt Liquors and Malt	66.50
Soft Drinks	76.91
Spin, Weaving and Finishing Textile	58.60
Made-up Textile Excluding Apparel	53.47
Carpets & Rugs	50.00
Cordage, Rope & Twine	82.50
Textiles N.E.C.	67.83
Wearing Apparel Excluding Footwear	67.01
Tan & Leather Finishing	30.50
Leather Products Excluding Footwear & Weaving Apparel	26.25
Footwear Excluding Rubber & Plastic	79.79

Sawmilling	60.56
Wood & Cork Products N.E.C.	61.00
Paper Articles N.E.C.	57.00
Printing & Publishing	44.82
Manufacture of Refined Petroleum Products	40.00
Basic Industrial Chemicals	61.88
Fertilizers & Pesticides	61.66
Paints, Varnishes & Lacquers	53.28
Drugs & Medicines	46.83
Soap, Detergents & Cosmetics	50.17
Rubber Products	41.13
Plastic Products	59.07
Glass & Glass Products	64.08
Manufacture of Refractory Ceramic Products	44.98
Forging, Pressing, Stamping and Roll-forming of Metal; Powder Metallurgy	65.95
Manufacture of Cutlery, Hand Tools and General Hardware	68.13
Metal Furniture and Fixtures	59.03
Motor Vehicles Assembly	15.50
Motorcycles & Bicycles	49.88
Manufacture of Wooden Furniture	60.95
Average	**55.14**
Weighted Average	**58.92**

Operating at the average level of capacity realization has been the norm for most industries in the recent past, institutional obstacles to doing business, as well as corruption in government administration, are crucial determinants of private sector development and projections for sustainable growth which Nigeria scores abysmally low on most indicators. The magnitude of bribery and corruption has eaten deep into the fabric of the economy.

The most recent Index (2011) from Transparency International ranks Nigeria 143th out of 183 countries in its annual Corruption Index. It further confirms that corruption continues to plague the nation's polity, with government aiding and abetting confirmed perpetrators of corrupt practices in most public offices and parastatal.

Chapter 4

DATA AND METHODOLOGY

4.1 Introduction

In order to critically study the rate of Capacity Utilization and its determinants among manufacturing firms in Nigeria, this thesis will seek to analytically and effectually identify the determinants of CU and certain key variables which have been found to account for the increase or otherwise of firm productive usage of installed capacity. This is stimulated by the important function that manufacturing firms play in an economy, which determines to a large extent, the flexibility of that economic system to meet future requirements for the objective of being productive, efficient and achieving the set macro-economic goals that expressly translates to better living standards for the populace.

The variables of interest include the duration of power outages, skilled manpower of firm workers, the size of the firm, and machinery replacement. These variables have been found from similar studies to account for a great deal of variation in Capacity utilization rates among firms.

Further, optimal CU among firms is vital in the expansion process and continues to command considerable attention in modern economic literature not only as it concerns developing countries but also in the developed ones as well.

4.2 Methodology

This thesis employs the quantile regression procedure, developed by Koenker and Bassett (1978) which offers a strong alternate to the method of ordinary least squares (OLS) especially when the errors are not normally distributed.

4.2.1 The Quantile Regression Process

Quantile regression extends classical OLS methods for estimating conditional mean functions by providing an array of techniques for evaluating conditional quantile functions, thus motivating the scholar to explore more comprehensively covariate effects. Whereas countless regression models are pre-occupied with evaluating the conditional mean of a dependent variable, interest has been growing recently on alternative modeling methods of conditional distribution. The QR technique has advantages of robustness in handling extreme value points and outliers inherent in firm level data, and also, QR estimators can be consistent under weaker stochastic assumptions than possible with least-squares estimation, and it also bares variances in the interactions linking the exogenous and the endogenous variable at diverse points.

Prominent examples using the QR estimation technique are the maximum score estimator of Manski (1975) for binary outcome models, and the censored least absolute deviations estimator of Powell (1984) for censored models.

4.2.2 The Quantile Regression Estimation

Our method like we stated earlier rests on linear quantile regression, which was advanced by Koenker and Bassett (1978). Using QR as an estimation technique has its major strengths as noted by McKelvey and Andriani (2005) who asserts that studies on

management are bound to focus on extreme values instead of banking on Gaussian statistical estimation. QR is the suitable means for handling such extreme values or outliers. Also, it reveals alterations in the relationships between dependent and the independent variable at diverse points of the conditional distribution of the endogenous variable.

While the estimator for ordinary least squares is found by minimizing the sum of squared residuals, the quantile regression estimator on the other hand is the vector β that minimizes:

$$\min_{\beta \in \mathrm{R}^k} \left[\sum_{i \in \{i: y_i \geq \bar{x}_i \bar{\beta}\}} \tau \left| y_i - \bar{x}_i \bar{\beta} \right| + \sum_{i \in \{i: y_i < \bar{x}_i \bar{\beta}\}} (1-\tau) \left| y_i - \bar{x}_i \bar{\beta} \right| \right] \qquad (1)$$

Usually, the equation objective function (1) denotes an unequal linear loss function. For example for the median $\tau = 0.5$, this becomes the total loss function determining the median regression. But if we decide to vary all τ parameters in the interval of between 0 and 1 creates all the various regression quantiles, detecting the conditional distribution of detecting the conditional distribution of *y* given *x*.

The empirical model seeks to explain the determinants of capacity utilization among Nigerian manufacturing firms using the application:

Capuse = a_1 + a_2Dsize + a_3Powerlong + a_4Skilldprdw + a_5ReplacemntInvt + ε

The explanatory variables represent factors responsible for determining the level of capacity utilization and will be properly defined in the next chapter.

4.3 The Wald Test

The Wald test is normally used to test the statistical significance of each coefficient (β) in the estimated model of an equation. It calculates a **Z** statistic, which can be denoted as:

$$z = \frac{\hat{\mathrm{B}}}{SE}$$

This **z** value obtained is now squared, which yields us a Wald test statistic with a chi-square distribution. The Wald test has been identified as been analogous to an F-test in a linear regression (Eric, 2009). It is a convenient method of testing the significance of particular explanatory variables in a statistical model.

If we find the Wald test for any particular explanatory variable or group of variables significant; then we can conclude that the parameters related with the variables are not zero hence, the variables should be included in the model. But if we find the variables not significant, then they should be omitted from the model. Further, for a single economic parameter, the Wald statistic is simply the square of the ***t***-statistic and thus should give precisely comparable results.

Chapter 5

ANALYSIS OF EMPIRICAL RESULTS

5.1 Introduction

This chapter begins with the introduction, formal definition and also statement of the prior expectations as regards the signs of the variables used in this thesis. We identify and espouse the following variables amongst many others as the most important determinants of Capacity Utilization in Nigeria.

Coupled with the fact that firm level data are heterogeneous in nature, we definitely cannot capture all the variables that account for the determination of CU among manufacturing firms in Nigeria.

5.2 Definition of Variables

The variables are skilled production workers, cost of replacing investment, duration of power outages and firm size.

5.2.1 Skilled Production Workers

This attempts to encapsulate the percentage of employees in Nigerian manufacturing firms that have either educational or technical skills relevant to their various job specifications. This is because the more skilled workers in a firm are, CU is expected to also increase since these group of workers are those involved in R&D, managerial supervision, technical and industrial engineering workers who play a part in effective

combination of resources used in manufacturing activities, thus we expect a positive relationship between skilled production workers and CU.

5.2.2 Power Outage Longevity

This is a most important explanatory variable that captures the impact of power outages in terms of its duration and how it influences CU. The International Finance Corporation's report of Doing Business in 2011, ranked acute power shortage as the key indicator that hampers ease of doing business in Nigeria. For this reason, we expect the variable to be negatively related to CU. Electricity is generally acknowledged as the driving force behind the Industrialization process of any economy.

Also unreliable power supply directly increases the cost of production for firms engaged in manufacturing activities since firms will have to source for alternative means to power their plants in order to meet up with growing market demand and competition from foreign competitors. Anthony (2006), argued that the un-competitiveness of made in Nigeria goods is basically due to the fact that aside other factors affecting the manufacturing sector, electricity instability has been hugely influential factor since firms are forced to use alternative sources of energy like running generators and installing solar panels.

5.2.3 Cost of Replacement Investment

This variable measures the cost the firm incurs in taking decisions about what time is appropriate to renew or replace a worn-out or deteriorating asset and get a new one in its stead which will produce either the same or above the former capacity of the old one. This is usually a proxy variable for measuring the level of investment among firms. It should be noted that this type of investment entails some level of uncertainty especially

in determining how long to keep existing plant and machinery or any asset critical to the expansion of capacity utilization.

According to Dobbs (2010), keeping plant for an additional period involves incurring extra overhead and the possibility of further losses in the salvage value of the asset, especially in instances where the lifespan of the asset has been expended. In this regard, we expect the relationship between cost of replacement investment and CU to be negative.

5.2.4 Dummy for Industry Size

The industry size is a dummy variable taking the value of 1 if the firm is a small sized enterprise and 0 if the firm is a medium sized enterprise. We take just two size structures because all of the firms in our samples are either small or medium sized firms. The defining characteristic for small firm in this context is based on the number of employees which is 5-19, and 20-99 for medium sized firms.

We further observed that the few large firms are usually Multinational Corporations who are always obliged to further the interests of their parent companies to the detriment of their host communities, thus contributing very little to the overall development of the manufacturing sub-sector in Nigeria.

One should expect that the larger the size of the firm, the larger should be its level of capacity utilization, thus we expect a positive relationship between this variable and CU. Thus, the above explanatory variables have been chosen in accounting for the determinants of CU among manufacturing firms in Nigeria.

5.3 Graphical Representation of Model Variables

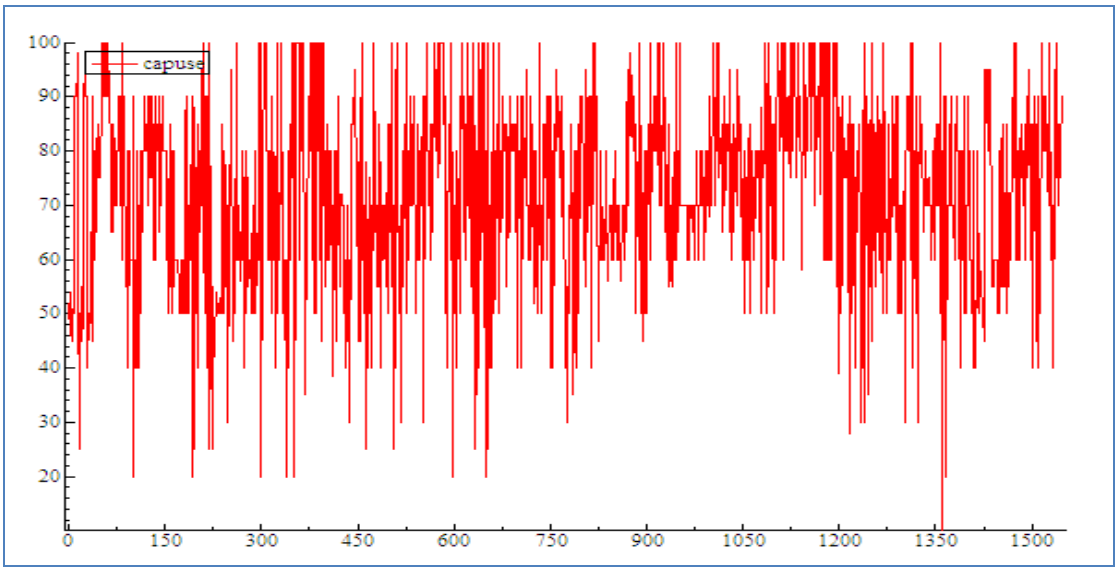

Figure 1: Average Capacity Utilization in Nigeria Manufacturing Firms.

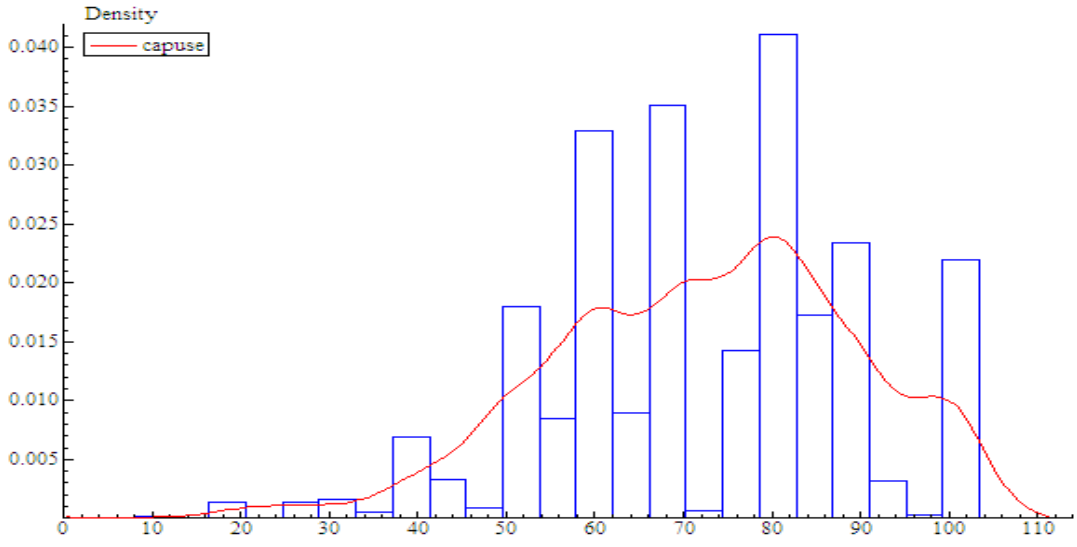

Figure 2: Density & Frequency Plots of Ave. Cap. Utilization among Firms.

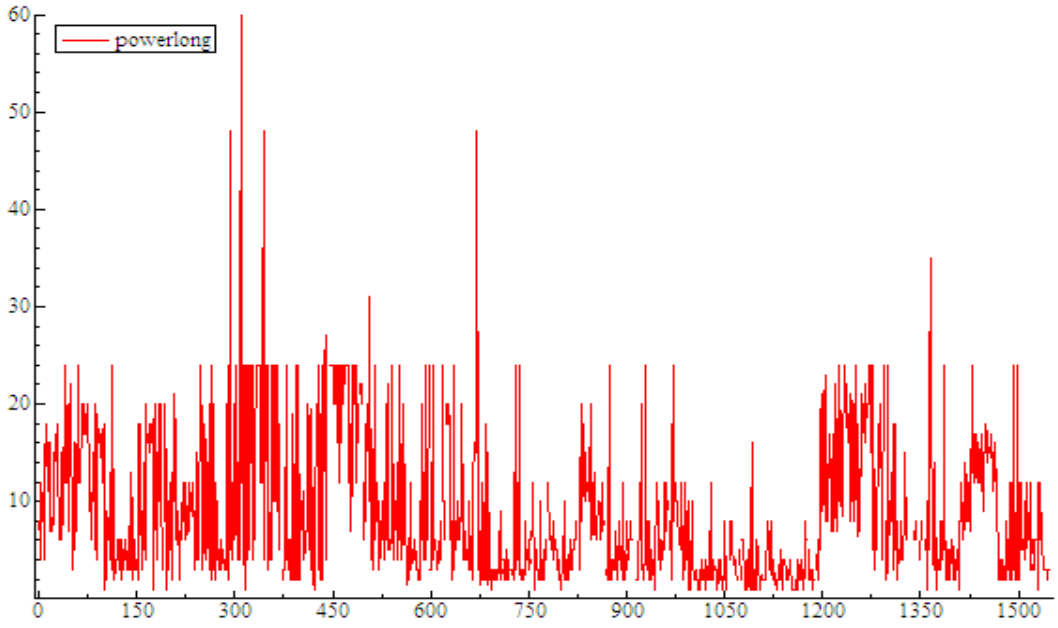

Figure 3: Longevity of Power Outage.

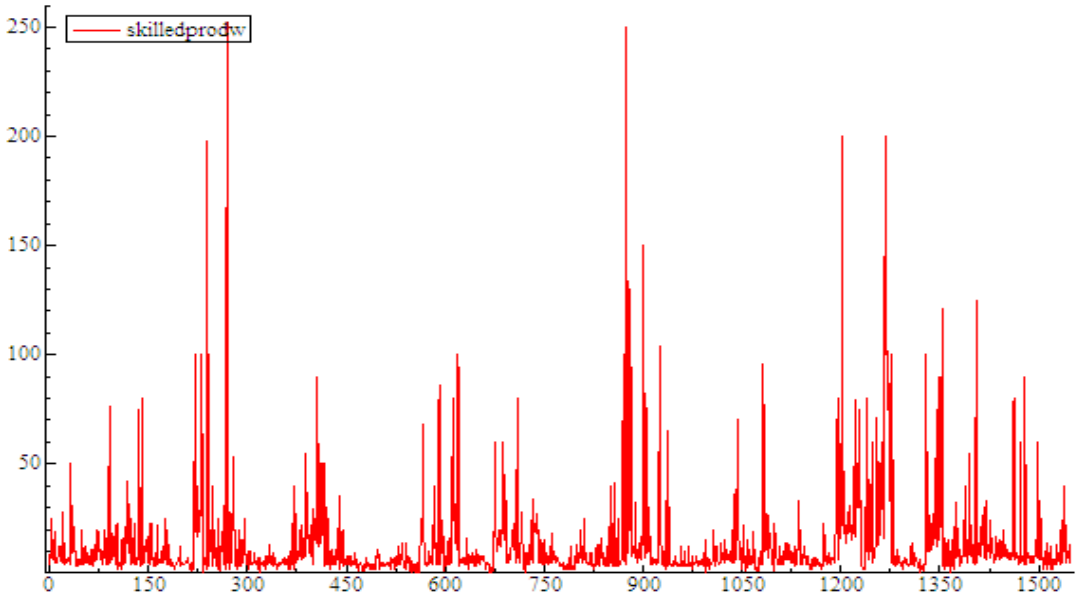

Figure 4: Skilled Production workers.

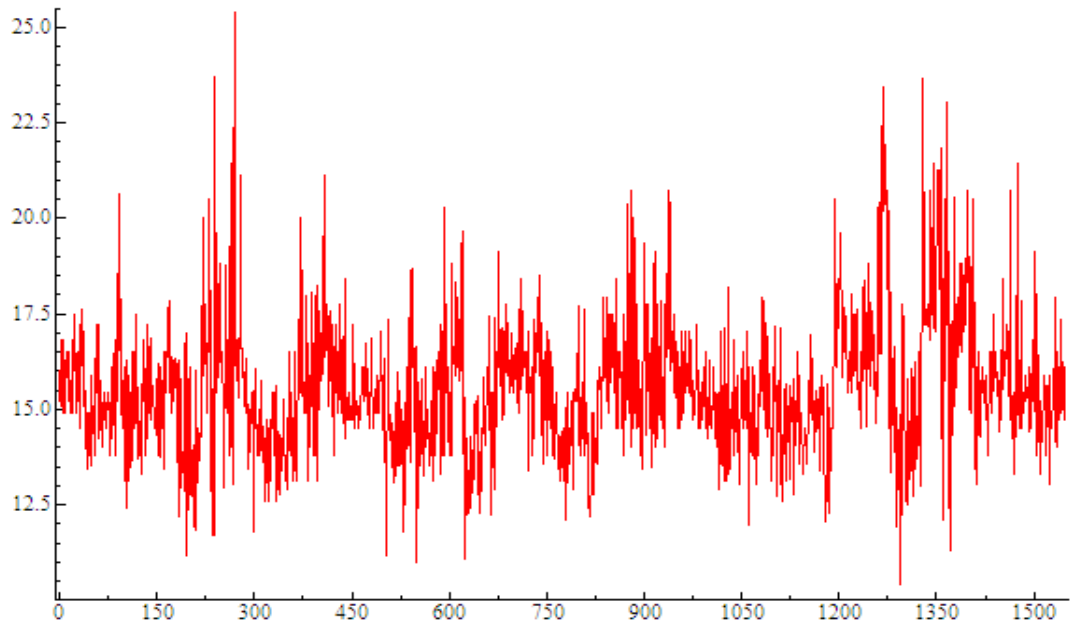

Figure 5: Cost of Replacement Investment.

5.4 Source of Data

This thesis utilizes firm level data from the database of the Enterprises Survey, an arm of the World Bank for the period 2010. These Surveys uses standardized instruments of survey and a uniform consistent method of sampling in order to abate the instances of measurement error and also produce data sets that will be analogous across different world economies.

The survey in this research was administered across 11 states in Nigeria with emphasis on the manufacturing sub-sector, the states in particular are those identified to possess high levels of industrial activities in their domain.

5.5 Quantile Regression Results

The reliability and dependability of our estimation estimates rests essentially on the specification of the model. The Quantile regression model estimates functional relations

between variables especially for the different probability portions of a distribution. We begin this section by presenting the results of the QR which were generated by E-views 7.0. In order to get a distinct evaluation of the results, it is useful to summarize the results in a tabular format.

Table 3: Quantile Regression Results- 2010 (No. of observations: 1446)

	Quantiles	
OLS	0.25	0.50
PowerOutage Long	-3.443(0.006)	-5.009(0.000)
Skilled Prdwr.	1.248(0.212)	2.265(0.023)
Replacement Invt.	-0.785(0.432)	-4.125(0.000)
Dummy Size	0.901(0.368)	-0.287(0.775)
Constant	67.44(0.000)	101.7(0.000)
F (4, 1547)	60.00(0.000)	75.000(0.000)

	Quantiles	
OLS	0.75	0.90
Power Outage Long.	-3.496(0.001)	-2.991(0.002)
Skilled Prdwr.	4.715(0.000)	0.944(0.345)
Replacement Invt.	-4.358(0.000)	-4.333(0.000)
Dummy Size	0.652(0.514)	2.219(0.026)
Constant	114.7(0.000)	119.8(0.000)

F (4, 1547)	85.00(0.000)	95.00(0.000)

Notes: p-values appear in parenthesis, and t-statistics were obtained by bootstrapping.

Also: Number of observations was reduced to 1446 after adjustments.

We observe that all the explanatory variables are consistent with our a-priori expectations and are also in uniform with economic theory, though the economic and / or statistical significance of some of the coefficients like the size dummy were in some instances trivial. In fact, the dummy variable for size which captured the relative size of the firms seems to only be significant at the highest quantile of 0.9, also skilled production workers seems to be less significant at the extremes of the quantile of 0.25 and 0.90.

A first attribute resulting from an inspection of the QR results above shows that the explanatory variable capturing the duration of power outage exhibits a monotonic behavior across all quantiles, with expected negative signs which are also significant. This establishes the fact that the duration of power outages has a negative and significant impact on the rate of CU among manufacturing firms in Nigeria. This is in line with the report of the IFC Doing Business in Nigeria which had identified as the key obstacle to ease of doing business in Nigeria. We further observed during the course of our empirical studies that since most of these firms are either small or medium scale, they do not have the sufficient capacity to cater for power outages, and when such cases of outages becomes persistent and enduring; their level of CU further decreases.

In order for us to get a more concise and detailed perception of the difference of behavior throughout the different quantiles, we conduct a pair-wise QR tests on the four

distinct quantiles we used in the preceding test and corresponding results are presented in the table below.

Table 4: Pair-wise Quantile Regression Results- 2010 (No. of observations: 1446)

	Quantiles		
OLS	0.25-0.50	0.50-0.75	0.75-0.90
PowerOutage Long	0.107(0.549)	0.084(0.013)	0.083(0.903)
Skilled Prdwr.	0.044(0.692)	0.031(0.792)	0.087(0.980)
Replacement Invt.	0.388(0.692)	0.386(0.369)	0.395(0.653)
Dummy Size	1.595(0.168)	1.398(0.343)	1.807(0.042)
Wald Test	11.690(0.01)	9.482(0.050)	18.91(0.015)

Notes: p-values appear in parenthesis, and standard errors were obtained by bootstrapping.

From the table above, the SE which is an estimate of the deviations from the mean across the various quantiles are computed alongside the probability values. The Wald test which is a method of testing the significance of specific explanatory variables in a statistical model, it also tests if the parameters related with a set of explanatory variables are zero.

The chi-sq statistic which is used to measure the Wald test is statistically significant at conventional test levels for all pair-wise sets of quantiles. This indicates that the coefficients differ across the different quantile values; also the conditional quantiles are not identical, that is, not zero (Koenker, R. 2005).

Focusing on the duration of power outage longevity, we observe that the *p*-value shows a higher significance level at the median and higher pair-wise quantiles, this could infer that at higher percentiles, the impact of the duration of power outages on firms CU is greater than on the lower quantiles. On the contrary, for the proxy for Investment, the pair-wise results across the sets are almost the same which suggests that the cost of replacement investment affects CU equally across the inter-quantile range. This is also the case with the skilled production workers as the range for the inter-quantile sets are similar.

Consequently, we can conclude that the longevity of power outages is the most influential variable among the determinants of CU.

The number of skilled production workers is also observed to be significant across all the tau especially among the intermediate quantile with the exception of the lowest quantile. This is in line with our expectations and further substantiates the evidence that the number of skilled production workers in a firm leads to a positive contribution in its level of CU.

The cost of replacement investment variable which we have chosen as a proxy to measure the level of investment in the firm is also significant across the median and higher quantiles, and is consistent with our expectations. The sign of the coefficient therefore supports our intuition that by adding an extra capacity to the existing capacity in the firm, the actual capacity utilization drops even further.

The use of QR asks the question, “How do the conditional mean of explained variable Y depend on the covariates of the explanatory variable X at each quantile?” Also, QR

results are robust in treatment of large outliers which results from large sample sizes like in our firm level study. From our empirical results thus far, evidence indicates that the most influential determinant of firm utilization of capacity is the duration of power outages. When firms have better alternatives to mitigate power outages; their level of CU increases. This invariably means that for firms to maximize their full capacity, they will have to incur extra energy costs since the government has not yet figured out effective means on how to provide constant supply of electricity to the national grid.

Chapter 6

CONCLUSION & POLICY RECOMMENDATIONS

6.1 Conclusion

The central objective of this research work has been to empirically investigate the determinants of Capacity Utilization among manufacturing firms in Nigeria.

We observe a blend of interesting relationship among our variables which are in line with economic theory and our intuitive expectations.

Like we mentioned earlier, the Nigerian economy is one that is heavily dependent on the gas and oil sector, this sector contributes about 96 percent of export revenues, about 84 percent of government revenues and a modest 19 percent of her Gross Domestic Product (GDP) in 2009. This has shifted governments focus from providing the enabling environment for firms to thrive and compete favorably in the global scene.

The estimated quantile regression results for the duration of power outages provides evidence in support of the notion that the level of capacity utilization is negatively affected by the longevity of power outage, especially in the case of Nigeria where firms are not adequately equipped to provide alternate sources of electricity to meet the short fall in supply from the national electric grid.

The variable capturing skilled production workers was also found to be significant especially across the median and higher quantile range of the distribution. The results

are statistically significant and are positively related with the level of capacity utilization. This is in line with our expectations and also supports economic theory as we expect the level of CU to increase if a firm has more skilled personnel in its workforce. It is an established fact that the more skilled workers a firm has, the more flexible the firm will be in terms of arranging the workforce to suit the specific needs of the firm, there is also reduction in the labor costs which arises from multi-skilled workers who are skilled in more than one segment in the production line.

The size of the industry dummy variable is statistically significant at the highest quantile; this justifies its inclusion in the model for capturing the size structure of the manufacturing industry in Nigeria. This implies that since most of the firms are either medium or small sized in structure, they have little or inadequate substitutes to augment the epileptic supply from the Power Holding Company of Nigeria (PHCN). We intuitively believe that a larger firm should have a more reliable alternative source of power supply; hence the need to apply same to our research work to find out if same applies to small and medium scale enterprises (SMEs).

From the results in our previous chapter, we observed some negative relationship between the size dummy and the level of CU at the median quantile. This indicates that small and medium sized firms have lower levels of CU since they are not probably equipped to handle other major determinants such as power outages.

6.2 Policy Recommendations

The major hindrances of the manufacturing sector in Nigeria are multidimensional and deep-rooted. Manufacturing activities can best thrive in a good investment climate with the necessary enabling features which are not limited to accessible financial markets, good and reliable infrastructure, good corporate governance-including incentives and opportunities for manufacturing firms to invest constructively and productively, thereby creating jobs for the teeming unemployed and maximizing social welfare.

The oil industry in Nigeria has dominated the bulk of economic activity since the 1970s when crude was discovered in commercial quantities to the detriment of the erstwhile thriving agricultural and manufacturing sectors. This is largely due to the lackluster attitude of the national government towards these sectors, and has even been boosted further with the ever increasing demand for crude and its related products.

This thesis recommends a sustainable and formidable macroeconomic management policy; that will be targeted at bringing to the barest minimum the cost of doing business in Nigeria. The manufacturing industry indeed is faced with crucial challenges but they can be managed and vanquished.

Manufacturers and entrepreneurs need to increase their investment levels and source for alternate ways of sourcing for funds, because the more funding they can secure; the more current and up to date will be there technological capacity, ability to venture into the areas of research and development to produce better products at cost efficient prices making them competitive in the global market. In this regard also, manufacturers can

take advantage of the financial institutions set up solely for such which are the Nigerian Bank of Industry (BOI) and the Nigerian Export and Import Bank (NEXIM).

We also recommend that manufacturers need to strive toward more synergies and collaboration. It has been observed that most firms tend to do things their own way since most of them are either small or medium sized. But if they should pool resources, technology, and act as a team, mergers and acquisitions will be the attendant result. With such fusion, firms become bigger and more equipped to handle the challenges of low capacity utilization, enjoy economies of large scale production and become better in facing foreign competition in the global market.

The national government has to play its part to bring all the parts into a meaningful whole. Suitable policy formulation and implementation should be the rallying point. Deliberate policies aimed at increasing our rate of industrialization should be vigorously pursued if the nation really wants to become one of the developed economies targeted at the year 2020.

The capital expenditure on infrastructure is grossly inadequate. Epileptic and unreliable electricity supply has been identified as the major constraint to the growth and expansion of manufacturing industries. Coupled with poor water supplies, shabby telecommunications system and a general bad condition of road network has adversely increased the cost of doing business and has even scared foreign investor who have to provide such infrastructures themselves if they intend on setting up businesses in Nigeria. The government should accord high priority to provision of these basic and

necessary facilities to enable firms cut down on their production costs and expand their ventures.

Furthermore, the financial institutions mentioned above who are vested with the responsibility of providing funding to firms should be adequately capitalized and monitored to ensure they adhere to strict due diligence before approving loans and credit facilities to manufacturing industries.

As a matter of urgency, the federal government should place an outright ban on all goods that can be produced in Nigeria especially consumables. Sensitization and awareness campaigns should be spread on the need to patronize made in Nigeria goods first before looking elsewhere, such policy will increase demand and speed up the industrialization process in the nation.

The government can also assist the industrial sector of the economy by upgrading her technological capacity. The technological standard in Nigerian firms is almost obsolete when compared with other developed economies. Most of our firms cannot afford such huge investment on technology capacity building, and credit finances are not adequate to cater for such massive investments. We believe that investment in technology will improve productivity in many ways including; helping to break through into completely new techniques of designing and producing products, reduction in production cost, time and manpower.

High productivity level through higher utilization of capacity has been identified as a solid means of improving economic growth and raising general living standards. Thus, designing and executing efficient and effective productivity structure will help to pull out the economy from its present state of gross under utilization of capacity and set it on the path of steady growth and advancement.

REFERENCES

Amadeo, E. J. (1986), The role of Capacity Utilization in the Long Period Analysis. Political Economy, 2(2):147–160

Barseghyan, L. (2008), "Entry Costs and Cross-Country Differences in Productivity and Output," *Journal of Economic Growth*, vol. 13, pp. 145-167.

Bartelsman, E., & M Doms., 2000, "Understanding Productivity: 'Lessons from Longitudinal Microdata', Journal of Economic Literature, vol.38, pp. 569-594.

Berndt, E. R & C. J. Morrison (1981), "Capacity Utilization Measures: Underlying Economic Theory and an Alternative Approach", *American Economic Review*, Papers and Proceedings, 71, pp. 48-52.

Berndt, E. R & D. M, Hesse (1986), "Measuring and Assessing Capacity Utilization in the Manufacturing Sectors of Nine OECD Countries", *European Economic Review*, 30, pp. 961-89.

Berndt, E. R & M. A. Fuss (1986), "Productivity Measurement with Adjustments for Variations in Capacity Utilization and other forms of Temporary Equilibrium", *Journal of Econometrics*, vol. 33 pp.7-29.

Bhagwati, J.N & P. Desai (1970), India: Planning for Industrialisation, London, Oxford University Press.

Bhagwati, J.N& T.N Srinivasan (1975), Foreign Trade Regimes and Economic Development in India, New York, Columbia University Press.

Bloch, H & T. McDonald (2000), "Import Competition and Labor Productivity,"Melbourne Institute Working Paper, *Brookings Papers on Economic Activity* 1: 181-241.

Brown, R.S & L.R. Christensen (1981), "Estimating Elasticities of Substitution in a Model of Partial Static Equilibrium: An Application to US Agriculture, 1947-1974", in Berndt and Field (ed) *Modeling and Measuring Natural Resource Substitution*, MIT press, Cambridge, MA

Bulow J, Geanakoplos J. & Klemprer, P (1985), "Holding Idle Capacity to Deter Entry", *The Economic Journal*, 95, pp.178-82.

Burange, L.G (1992), "The Trends in Capacity Utilization in Indian Manufacturing Sector", *Journal of Indian School of Political Economy*, July-Sept, pp. 445-55.

Cassel, J.M (1937), "Excess Capacity and Monopolistic Competition", *Quarterly Journal of Economics*, 51, pp. 426-43.

Chen, T. & D. Tang (1987) "Comparing Technical Efficiency between Import Substitution-oriented and Export-oriented Foreign Firms in a Developing Economy," *Journal of Development Economics*, 26, 277-89.

Christiano, L. J (1981), "A Survey of Measures of Capacity Utilization", *IMF Staff Papers,* 28, pp. 144-99.

Dadi, M.M, & S.R Hashim (1973), Capital Output Rations in Indian Manufacturing, *1946-64,* M S University of Baroda, India.

Dixit, A (1980), "The Role of Investment in Entry-Deterrence", *The Economic Journal*, 90, pp. 95-106.

Dreze, J.H (1999), "On the Macroeconomics of Uncertainty and Incomplete Markets", *Presidential Address for the Twelfth World33 Congress of the International Economic Association*, Buenos-Aires, August 1999.

Enders, W. (1995). *Applied Econometric Time Series*. John Wiley & Sons, Inc.

Felipe, J. & F. M. Fisher. (2003). "Aggregation in Production Functions: What Applied Economists Should Know". *Metroeconomica* 54 (May): 208-262.

Fisher, F. M. (1969). "The Existence of Aggregate Production Functions." *Econometrica* 37 (4):

Foss, M. F. (1963). "The Utilization of Capital Equipment: Postwar Compared with Prewar." *Survey of Current Business,* 43:8-16.

Gabisch, G. & Lorenz, H.W. (1987). Business Cycle Theory*: A Survey of Methods and Concepts.* Berlin: Spinger-Verlag.

Garegnani, P. (1979). "Notes on Consumption, Investment, and Effective Demand: A Reply to Joan Robinson." *Cambridge Journal of Economics* 3: 181-187.

Gillman, J. (1958). The Falling Rate of Profit, Marx's Law and Its Significance to Twentieth Century Capitalism. New York:Cameron Associates.

Goldar, B.N, & V.S Ranganathan. (1991), "Capacity Utilisation in Indian industries", *The Indian Economic Journal*, 39 (2), pp. 82-90.

Government of India, *Annual Survey of Industries*, Various Issues, New Delhi, Central Statistical Organisation, Ministry of Planning. Government of India, *Input Output Transaction Matrix*, New Delhi, Ministry of Planning.

Hernandez-Cata, E. (1997), "Liberalization and Behavior of Output during the Transition from Plan to Market", *IMF Staff papers*, 44 (4), pp. 405-29.

Hertzberg, M.R, Jacobs, A. I, & Trevathan, J. E.(1974). "The Utilization of Manufacturing Capacity, 1965-73." *Survey of Current Business.*

Hickman, B G.(1964), "On a New Method of Capacity Estimation", *Journal of American Statistical Association*, 59, pp. 529-49.

Hulten, C.R. (1986), "Productivity Change, Capacity Utilization, and the Sources of Efficiency Growth", *Journal of Econometrics.* Vol.3, 181-187

Jorgenson, D. W. & Z. Grilliches.(1967). "The Explanation of Productivity Change." *Review of Economic Studies,* Journal of Economic Growth, vol. 13, pp. 145–167.

Kaldor, N. (1961). Capital Accumulation and Economic Growth. In Lutz, F. and Hague, D., editors, *The Theory of Capital: Proceedings of a Conference held by the International Economic Association*, New York, NY. St. Martin's Press.

Kaldor, N. (1966). Causes of the Slow Rate of Economic Growth of the United Kingdom: an inaugural lecture. Cambridge University Press, Cambridge, UK. *Reprinted in Kaldor* (1978).

Kang, J. & Kwon, J. (1993) Capacity utilization in Korean Manufacturing Industries, *International Economic Journal*, 7, 23-45.

Khan, A. R. & Hossain, M. (1989) The Strategy of Development of Bangladesh, Macmillan, London.

Klein, L. R. (1960) Some Theoretical Issues in the Measurement of Capacity, *Econometrica*, 28, 272-86.

Koenker, R., and G. Bassett, (1978), "Regression Quantiles," *Econometrica*, vol. 46, pp. 33–50.

Koenker, Roger (2005). *Quantile Regression*. New York: Cambridge University Press.

Koenker, Roger and Gilbert Bassett, Jr. (1982a). "Robust Tests for Heteroskedasticity Based on Regression Quantiles," *Econometrica,* 50, 43-62.

Koenker, Roger & Jose A. F. Machado (1999). "Goodness of Fit and Related Inference Processes for Quantile Regression," *Journal of American Statistical Association,*94, 1296-1310.

Koenker, Roger and Kevin F. Hallock (2001). "Quantile Regression," *Journal of Economic Perspectives,*15, 143-156.

Kurz, H. (1986). "Normal Positions and Capital Utilization." *Political Economy: Studies in the Surplus Approach* 2, 37-54.

Lee, Y. J. and Kwon, J. K. (1994) Interpretation and measurement of capacity utilization: the case of Korean Manufacturing, *Applied Economics,* 26, 981-90.

Liberman, M.B (1987), "Excess Capacity as a Barrier to Entry: An Empirical Appraisal", *Journal of Industrial Economics,* 35, pp. 607-627.

Little, I.M et al (1970), *Industry and Trade in Some Developing Countries: A Comparative Study*, Oxford University Press, Oxford.

Maddala, G. S. (1977) Econometrics, McGraw Hill, New York.

Marris, R. 1964. The Economics of Capital Utilization*: A Report on Multiple-Shift Work*. Cambridge University Press.

Mike, A. (2010). The structure of Nigerian manufacturing Industry- Paper presented at the workshop organized by National Office for Technology Acqusition and Promotion July 20-21, 2010. Ministry of Planning.

Morrison, C. J (1985), "On the Economic Interpretation and Measurement of Optimal Capacity Utilization with Anticipatory Expectation", *Review of Economic Studies*, 52 (169), pp.295-310.

Nelson, R A (1989), "On the Measurement of Capacity Utilization", *The Journal of Industrial Economics*, 37, pp.273-86. *New York Quarterly Review*.

Ocampo, J.A & Lance T. (1998), "Trade Liberalization in Developing Economies: Modest Benefits but Problems with Productivity Growth, Macro Prices, and Income Distribution," *Economic Journal*, 5. *Outlook* 71 (June). 17

Padma, M. (1991)" Economic Measures of Capacity Utilization in Some Selected Industries in India", 1960-61-1982-83,

Perlo, V. (1968). "Capital-Output Ratios in Manufacturing." *Quarterly Review of Economics and Business:* 29-42.

Porter M (1990), The Competitive Advantage of Nations, Macmillan Press, London.

Powell, J. (1986). “Censored Regression Quantiles,” *Journal of Econometrics*, 32, 143-155.

Raddock, R. D. & Forest, G. R.(1978). *Federal Reserve Measures of Capacity and Capacity Utilization.* Board of Governors of the Federal Reserve System Publication.

Ragan, J. M. (1976). “Measuring Capacity Utilization in Manufacturing.” *Federal Reserve Board,* New York Quarterly Journal.

Rost, R. F. (1980).“New Federal Reserve Measures of Capacity and Capacity Utilization.” *Federal Reserve Bulletin.*

Schnader, M. H. (1984). “Capacity Utilization.” *The Handbook of Economic and Financial Measures,* Dow-Jones Irwin.

Shaikh, A. (1987). “The Current Economic Crisis: Causes and Implications.” *The Imperiled Economy Book* 1. URPE, New York.

Shapiro, M. (1989). “Assessing the Federal Reserve's Measures of Capacity and Utilization.” *Brookings Papers on Economic Activity* 1: 37-54.

Tsaliki, P. & L. Tsoulfidis. (1999). “Capacity Utilization in Greek Manufacturing.” *Modern Studies Yearbook* 9:127-42.