

**COMPETITIVE BEHAVIOUR
DETERMINANTS OF MARKET POWER IN MALAWI'S
MOBILE TELECOMMUNICATION INDUSTRY**

MASTER OF ARTS (ECONOMICS) THESIS

ALAN CHIMWEMWE WITTIKA

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MASTER OF ARTS (ECONOMICS) THESIS

By

ALAN CHIMWEMWE WITTIKA
Bachelor of Commerce (BBA), University of Malawi

Submitted to the Department of Economics, Faculty of Social Science, in partial
fulfilment of the requirements for a Master of Arts Degree in Economics

University of Malawi
Chancellor College

November, 2017

DECLARATION

I, the undersigned hereby declare that this thesis/dissertation is my own original work which has not been submitted to any other institution for similar purposes. Where other people's work has been used acknowledgements have been made.

ALAN CHIMWEMWE WITTIKA

Full Legal Name

Signature

Date

CERTIFICATE OF APPROVAL

We certify that this thesis is the student's own work and acknowledgements have been made where the work of other people has been used. We further certify that it has not been submitted to any other university for any degree and is therefore submitted with our approval.

Signature: _____ **Date:** _____

Ben Kaluwa, PhD (Professor of Economics)

Main Supervisor

DEDICATION

This thesis is dedicated to my precious family; your love and consistent support made me who I am and am grateful to you for that.

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To my family, Mum, Dad, Asante, Dingaana and Comfort, thank you very much for your consistent support and understanding even during the times that I seemed selfish with my work. Last but not least, to God be the glory; nothing is possible without his hand and presence.

ABSTRACT

Over the last decade, the telecommunication industry has been an emerging and important economic sector with immense impacts on the social and economic structures of Malawi. Despite some entry of new providers the industry is still concentrated and there are fears of collusive pricing. This study uses panel data for the period 2004 to 2014 for four mobile telecommunications operators to investigate the determinants of market power in the industry using the Lerner Index and Cost Price Mark-up and operator-specific, industry-specific and macroeconomic factors as determinant variables. The findings suggest that market power is positively influenced by low market penetration and foreign exchange fluctuations but negatively influenced by market concentration.

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LIST OF ABBREVIATIONS AND ACRONYMS

ACL	Access Limited
Airtel	Airtel Malawi Limited
CAMA	Consumer Association of Malawi
CDMA	Coded Division Multiple Access Wireless Network
CFTC	Competition and Fair Trade Commission
CL	Clustered Linear Model
DEPD	Department of Economic Planning and Development
EV-DOT	Evolution Data Optimised Technology
Exrate	Exchange Rate
FDH Bank	First Discount House Bank
FReserves	Federal Reserves
GLS	Generalised Least Square
GDP	Gross Domestic Product
G-Mobile	Global Mobile Limited
HHI	Hirschman- Herfindahl Index
ICT	Information Communication Technology
ISDN	Integrated Services Digital Network
IT	Information Technology
MACRA	Malawi Communications Regulatory Authority
MPTC	Malawi Post and Telecommunications Company Limited
MSB	Malawi Savings Bank
MTL	Malawi Telecoms Limited
NSO	National Statistics Office or Number of Service Outlets
OECD	Organisation for Cooperation and Development countries
OS	Ownership Structure
OLS	Ordinary Least Squares
RBM	Reserve Bank of Malawi
SAT	Saturation
SCP	Structure Conduct and Performance
TNM	Telecom Networks Malawi Limited
WIP	Work in Progress
WLS	Weighted Least Square

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Telecommunication refers to the specific services that support the exchange of information over significant distances by electronic means. It includes the activities of providing telecommunications and related service activities such as transmitting voice, data, text, sound and video). The transmission facilities that carry out these activities may be based on a single technology or a combination of technologies (International Telecommunication Union, 2010).

The term telecommunications was first used for wired telephony. Today, telecommunications are one of the most important of the contemporary Information and Communications Technology (ICT). They include wired and wireless telephony; different mobile services, such as cellular telephones and paging; voice and data transmission; and Integrated Services Digital Networks (ISDN), which provide a very high quality of voice as well as high data communication rates.

Over the past fifteen years Malawi's telecommunications industry has experienced rapid growth in its operations. The industry is contributing significantly to the nation's economy through job provision, aiding entrepreneurial ventures, contributing to the nation's revenue through tax remits and license fees, and more importantly through its key role in facilitating effective and efficient communication for different business activities nationwide (DEPD 2013). Thus, the performance of the industry has become critical to the performance of the economy and society at large.

For a long time, offering direct phone calls was the industry's major area of business. Recently, however, we have seen the industry's operators diversifying into data (internet service) business to increase their portfolio offerings while keeping up with the Information Communication Technology (ICT) demands.

Until 1994, Malawi's telecommunications industry was monopolized by Malawi Post and Telecommunications Company (MPTC), a state-owned telecommunications company, which mostly focused on ground line mode of service provision for local, long distance, and international calls. Considering that MPTC operated as a department of the ministry of information it doubled as a regulator of the industry (Clarke, Gebreab and Mgombelo 2003). By 1995, specifically after the liberalization of the economy, an additional licence in mobile telecommunications was issued to Telecom Networks Malawi (TNM) co-owned by MPTC and Malaysia Telecom respectively, which owned 40% and 60% of the company's shares respectively. The introduction of TNM, however, did not make much difference to the question of competition because the company was still under the umbrella of MPTC. However, following pressure from the donor community to reform the industry, a second mobile telecom licence was issued to Celtel Group, later renamed Airtel, a British mobile telecommunications firm with the aim of increasing competition. Furthermore, around the same period, restructuring and privatization had been initiated at MPTC in an effort to improve the company's efficiency in its service offerings (Clarke, Gebreab and Mgombelo 2003). Later, the passing of the 1998 Telecommunications Act relieved MPTC of its regulatory duties and facilitated the formation of an independent regulatory body, Malawi Communications Regulatory Authority (MACRA) which became responsible for managing affairs of the telecommunications industry. By 2002, MPTC had been split into two companies, namely Malawi Telecoms Ltd and Malawi Post Corporations with the former being partly privatized as an organization. With the new regulatory body in place, one of its major roles was that of bridging an existing ICT penetration gap across the economy. This development meant creating competitiveness within the industry which, in turn, would influence the conduct and performance of those involved.

By 2009, MACRA had issued three more telecommunications licences to Access Malawi (ACL), G-mobile and Celcom. Practically, however, the country had only four operators namely: MTL, TNM, Airtel and ACL because G-mobile and Celcom never rolled out their operations. Furthermore, TNM and Airtel dominated both market share and penetration. For example, Airtel and TNM collectively held 83% of the market share, (MACRA Report 2011).

With a few players within the telecommunications industry, policies and regulations have been set to monitor the conduct of the major players. The major role of MACRA within the telecoms industry is to ensure fair trade and quality service delivery by the players through controls that target tariffing, network coverage, availability and quality. This is also achieved through partnering with institutions which target operations within the industry. For example, MACRA benefits from Competition and Fair Trade and Commission (CFTC) whose main aim is to ensure competitiveness and efficient service delivery.

1.2 Problem Statement and Relevance

A MACRA commissioned study by Dymond (2015) highlighted lack of competitiveness among players as an important challenge facing Malawi's telecommunications industry. For example, the industry is characterized by high tariffs. As a matter of fact, Market Analysis and Competition Assessment Report (2014), ranked Malawi at number six on the list of African countries characterized by high telecommunications tariffs. Malawi's high telecommunications tariffs are mainly attributed to the industry's oligopolistic structure; firms offer products that are similar and tend to have non pricing competition.

The conduct of firms in oligopolistic markets has been a heated subject of debate as its players are highly prone to unfair trade practices such as collusion in pricing decisions on product offerings and service provision due to existing market power. The presence of market power in an industry disadvantages consumers through higher pricing, and existing players can be unnecessarily influential on new entrants and future competitiveness.

Malawi is experiencing lack of research analysing the existence of market power or firm's dominance within its telecommunications industry. Despite the existence of a telecommunications regulatory body with published performance reports by industry players, to the researcher's knowledge, no study has been conducted on determinants of market power in the country's telecommunications industry let alone on increased influence amongst the players. Ironically, all studies about industry market power in

Malawi concern the country's banking industry (Kaluwa and Chirwa 2014) especially concerning the relationship between a highly concentrated market and market power.

1.3 Motivation for the Study

The present research has been motivated by the absence of research that clearly highlights the conduct of telecommunication operators since the opening up of markets within Malawi's economy in 1994. The study aims at filling the research gap by exploring the existence of market power and its determinants amongst operators in a presumably highly concentrated industry, which if not properly monitored, would have adverse impacts on low return sectors of the economy, and on low income earners who form a majority in Malawi's economy. The study may also be utilised as a basis for developing the relevant institutions for regulating the industry. For example, policies developed can be used to maintain a competitive environment, while promoting free market principles aimed at distributing goods and services through the interaction of forces of demand and supply.

1.4 Objectives of the Study

The main objective of the study was to empirically examine the determinants of market power in Malawi's telecommunications industry with regards to industrial operator's pricing in a highly concentrated market which can be susceptible to collusive behaviour. The study particularly sought to:

- i. Determine the impact of industry specific factors (which will include industry concentration – HHI index) on market power.
- ii. Determine the impact of operator specific factors on market power.
- iii. Determine the impact of macroeconomic factors on market power.

1.5 Hypothesis of the Study

The following are testable null hypothesis;

- i. **Industry specific factors;**
 - a. Industry Concentration (HHI Index) does not have an impact on market power within Malawi's telecommunication industry.
 - b. Market saturation or penetration does not have an impact on market power within Malawi's telecommunication industry
- ii. **Operator specific factors;**
 - a. Number of employees within a firm does not have an impact on market power within Malawi's telecommunication industry.
 - b. Ownership Structure of a firm does not have an impact on market power within Malawi's telecommunication industry.
- iii. **Macroeconomic factors;**
 - a. Inflation does not have an impact on market power within Malawi's telecommunication industry.
 - b. Exchange rate fluctuations do not have an impact on market power within Malawi's telecommunication industry.
 - c. Foreign reserves within the economy do not have an impact on market power within Malawi's telecommunication industry.

1.6 Significance of the Study

A number of studies on the behaviour of players in different industries have been carried out with the aim of establishing their conduct. However, so far, no study has been conducted to establish whether levels of concentration in telecommunications can lead to the existence of market power, and to establish determinants of the power in question in a developing economy context like Malawi's. Thus, the significance of the present study to policy and institutional development that may assist with regulating Malawi's telecommunication's industry cannot be over-emphasised.

1.7 Organisation of the Study

As indicated above, the remainder of the Thesis is organised as follows: Chapter Two provides the overview of the telecommunication in Malawi. Chapter Three gives theoretical and empirical literature and research review in line with the study objectives. Chapter Four describes the research methodologies and other applicable techniques of analysis that have been employed to determine the results of the study. The Chapter will also examine the sources and appropriateness of the data, collection and analytical methodologies. Thereafter, Chapter Five will provide a detailed review of the findings of the study. The study conclusion shall be under Chapter Six where a review of the findings' implications and the policy recommendations shall be considered.

CHAPTER 2

OVERVIEW OF THE TELECOMMUNICATIONS INDUSTRY

2.1 Introduction

This chapter will highlight the importance of telecommunication and economic development in broader sense thereafter the discussion concerns itself with the Malawi context with specific interest on developments in the country's telecommunication industry. Section 2.1 tackles Telecommunications and Economic Development while Section 2.2 covers the overview of Malawi's telecommunication sector. Section 2.3 summarizes the Chapter.

2.2 Telecommunication and Economic Development

In recent years, the role of telecommunications infrastructure and operations in enhancing economic growth has been a subject for discourse in the economic literature. Some scholars argued that adequate telecommunication infrastructure is a prerequisite for the growth and development of a modern nation to its full potential. In other words, the development of telecommunication infrastructure and operations has the potential to boost economic growth and development. In light of this argument, a number of advanced economies chose to deregulate their telecommunication sectors to call for more investments with impressive outcomes: improved telecommunication capabilities, more foreign investment, and boom in private sector development, more employment opportunities, and better education and training facilities (Tella, Amaghionyeodiwe and Adesoye (2007). However, all this was achieved over time with different reforms being implemented at different stages.

2.2.1 Overview of the Telecommunications Industry

The telecommunications industry has gone through some significant and revolutionary changes in the past two decades the world over, and Malawi has not been exempted from the reforms. Before the 1980s, the industry used to be regarded as a natural monopoly globally. This is mainly due to exceptionally large

infrastructure requirements of delivering telephone services right into households if the service was to be accessed. The monopolistic nature of the industry also meant that the provider would charge excessive prices responsible for monopoly profits. Thus, globally, state-owned monopoly companies became responsible for providing telecommunication services, although the services were in some cases subsidised (Bandaranayke, 2005). The need for price regulation was apparent.

The need for price regulation, however, was not an isolated issue. Generally, problems associated with state-owned enterprises created an essential need for reform. A combination of restructuring, privatization and establishing regulatory mechanisms was adopted in reforming the public enterprises (Kessides, 2004). The restructuring started in US in 1980s where monopolist AT&T was dismantled into a number of smaller companies. Competition was introduced into long distance communications and, later, to local communications. Furthermore, companies were allowed to operate in broadcast and communications markets simultaneously.

The next country to embark on the reforms was the United Kingdom which started with opening up its market which was hitherto monopolized British Telecom. Many European Union countries followed suit and, in turn, inspired the rest of the world to embrace the change by the early 2000s (Bressie et al, 2005). It is against this background that in the 1990s MTL was privatized after disbanding MPTC to create competition in line with the 1998 Communications sector policy statement and the newly passed 1998 Communications Act, bringing the total number of private telecommunication companies to three after TNM and Celtel Malawi Limited (Clarke, Gebreab and Mgombelo 2003).

The telecommunications industry has become a vital revenue generation sector. At the end of 2008, worldwide mobile service revenues stood at USD 912.1 billion; outperforming the respective revenues generated by pharmaceutical, IT hardware, and semi-conductor sectors. While software and services generated more revenue than mobile services, mobile surpassed this sector in terms of year-on-year growth. Mobile services were also the only industry of the aforementioned five to register double digit growth (of 17.4 percent) in terms of overall revenue between 2007 and 2008. It was

estimated that by the end of 2008, worldwide mobile subscribers would total 4.6 billion (International Telecommunication Union, 2010).

2.2.2 Telecommunication and Economic Performance

An important advantage of the service sector is that services are a means to an end as opposed to being an end themselves. Thus, services are vital inputs for the production and trade of most goods. Telecommunication sector as a service sector is considered a development tool because of its broad range in its service offerings. By facilitating the dissemination of information and communication (through direct phone calls or internet services) it avails people the opportunity to participate more actively in the social, economic and political life of a community.

At a more mundane level, telecommunications exert direct effects on productivity growth; it increases the efficiency of service providers and provides new markets by reducing distances. It is a growing sector that creates new activity in itself by contributing to economic growth and employment generation. Its beneficial effects on other sectors are also substantial. The contribution of the telecommunications sector to growth comes from the private return to capital and from the output generated via externalities (Jacobsen, 2003). Therefore, a positive link exists between development of telecommunications infrastructures and economic growth due to network externalities.

It is argued that a greater part of the contribution of telecommunications sector to economic growth comes from infrastructure investments in the sector. Economic theory, explains that these investments can lead to economic growth in several other ways. While expanding the telecommunication networks, these investments can naturally increase the availability of telecommunications products and motivate higher demand. Also in the view of network economics literature, these investments while motivating higher demand, can amplify the network externalities which may in turn increase the efficiency of firms in the economy and lead to economic growth (Jerbashian, 2011).

It has to be noted, however, that much as adequate investment in telecommunication can propel economic growth, poor institutions and regulations would have an adverse effect on the demand side of the economy. Unregulated pricing and collusive behaviour by industrial agents can lead consumers being unfairly charged for services rendered.

Furthermore, asset pricing basis for the higher risk-higher returns expectation and the market structure/market power explanation also have credibility in the sense of high barriers to entry accounting for high levels of concentration which facilitate and sustain high levels of profitability. Concentration can itself be facilitated by a combination of the barriers to entry from a perceived risky environment for operations and regulation that hinders arbitrage as a form of entry through diversification (Kaluwa and Chirwa 2014). From the telecommunications perspective, high pricing can be justified through reinvestment in infrastructure to enhance network coverage and quality of service rendered to end users as well as unstable economic conditions.

2.3 Malawi Context

Although Malawi is one of the world's least developed countries, its GDP growth has been strong in recent years with the exception of 2012 when it fell to 1.9%. The GDP growth recovered in 2013 reaching 5.2% and was expected to have increased to 5.7% in 2014. The telecommunications industry was affected by the currency devaluation imposed in mid-2013 which delayed the ability to fund network upgrades by most local players within the industry. In addition, the government in mid-2013 instituted a tax on internet services, consequently transferring to consumers the additional cost of services.

Nevertheless, as depicted in the Tables 1 and 2 below, over the years the telecommunications industry has been growing and its contribution to GDP has been increasing steadily.

Table 1: GDP by Activity at Constant Prices (in MK' Million)

Constant 2010 Prices (in MK' Million)					
Sector	2012	2013	2014	2015*	2016*
Agriculture, Forestry and Fishing	326,761	347,179	368,910	389,013	412,397
Mining and Quarrying	11,240	12,021	11,467	11,695	12,067
Manufacturing	104,303	110,096	116,921	123,891	132,000
Electricity, Gas and Water Supply	14,331	15,118	15,624	16,186	16,990
Construction	32,344	32,980	34,986	36,834	38,558
Wholesale and Retail Trade	169,568	182,885	193,304	203,606	219,217
Transportation and Storage	29,591	31,168	32,861	34,938	36,726
Accommodation and Food Services	20,989	22,065	23,397	24,124	25,298
Information and Communication	42,150	45,292	50,343	53,603	56,762
Financial and Insurance Services	56,060	58,171	60,103	64,131	69,021
Real Estate Activities	90,735	92,962	94,462	96,607	99,366
Professional and Support Services	3,245	3,422	3,605	3,828	3,996
Public Administration and Defence	28,127	29,651	31,706	33,780	35,901
Education	28,127	29,651	31,706	33,780	35,901
Health and Social Work Activities	29,424	30,911	32,557	34,556	36,729
Other Services	53,288	56,225	59,282	62,769	67,065
GDP at Constant Market Prices	1,091,543	1,159,845	1,229,714	1,296,312	1,380,883
GDP at Current Prices	1,425,230	1,927,840	2,529,951	3,106,220	3,706,311

Source: National Statistical Office (NSO) and Department of Economic Planning and Development (DEPD). Projections*

Table 2: Sectorial Shares to GDP (In Percentage)

Constant 2010 prices (in K'million)					
Sector	2012	2013	2014	2015*	2016*
Agriculture, Forestry and Fishing	29.9	29.9	30.0	30.0	29.9
Mining and Quarrying	1.0	1.0	0.9	0.9	0.9
Manufacturing	9.6	9.5	9.5	9.6	9.6
Electricity, Gas and Water Supply	1.3	1.3	1.3	1.2	1.2
Construction	3.0	2.8	2.8	2.8	2.8
Wholesale and Retail Trade	15.5	15.8	15.7	15.7	15.9
Transportation and Storage	2.7	2.7	2.7	2.7	2.7
Accommodation and Food Services	1.9	1.9	1.9	1.9	1.8
Information and Communication	3.9	3.9	4.1	4.1	4.1
Financial and Insurance Services	5.1	5.0	4.9	4.9	4.0
Real Estate Activities	8.3	8.0	7.7	7.4	7.2
Professional and Support Services	0.3	0.3	0.3	0.3	0.3
Public Administration and Defence	2.0	2.0	2.0	2.0	2.0
Education	2.6	2.6	2.6	2.6	2.6
Health and Social Work Activities	2.7	2.7	2.7	2.7	2.7
Other Services	4.9	4.8	4.9	4.9	4.9

Source: National Statistical Office (NSO) and Department of Economic Planning and Development (DEPD). Projections*

On the onset, it was the failure of Malawi Posts and Telecommunications Corporation (MPTC) as an initial sole telecommunications company to offer reliable and adequate services that led to the rapid growth of the mobile telecommunications industry. The mobile service offered an alternative solution to the previous one which required a stationed base in order for it to operate. Average waiting time for line installation and minimum network coverage across the country were some of the contributing factors a few years after the first mobile telecommunication company was launched. This is evidenced in the table 3 below.

Table 3: Telephone penetration in Malawi

Telecom Performance Indicators		
Indicator	2000	2001
Fixed line network		
Lines Connected	48,805	54,107
Equipped Capacity	93,117	93,117
Waiting List	18,739	20,075
Average waiting time for line installation	Up to two years	
Teledensity	0.48	0.52
Digitalization Switching (%)	92%	92%
Number of staff	3,008	2,423
Mobile Network(s)		
Number of Mobile Operators	2	2
Total Mobile Subscribers	36,100	50,000
Teledensity	0.35	0.48

(Source: Mbendi.com. Telecommunication in Malawi)

Table 4 : Telephone penetration in Malawi

Number of digital leased lines		
International	3	5
Local	427	470
Number of Public Telephones	571	571
Number of internet accounts	2,400	5,000

(Source: Mbendi.com. Telecommunication in Malawi)

Mobile penetration still remains way below the African average, a situation which allows for considerable opportunities for further growth. To some extent, the market still remains a duopoly between Bharti Airtel (formerly Zain) and Telecom Networks

Malawi (TNM), given the failure of the third and fourth mobile operators, G-Mobile and Celcom Malawi, to launch services.

To encourage additional market competition, the government followed in the footsteps of several of its neighbours and introduced a converged licensing regime which allows the two fixed-line operators; Malawi Telecommunications (MTL) and Access Communications (ACL) to enter the mobile market as well. Both operate Coded Division Multiple Access Wireless network (CDMA)-based fixed-wireless networks which support full mobility and broadband access using Evolution Data Optimised (EV-DO) technology.

Table 5: Estimated Market Penetration Rates in Malawi's Telecommunications Sector – End - 2014

Market Penetration rate against total Population.	
Mobile	36%
Fixed	1.90%
Internet	6.10%

(Source: Budde Comm based on various sources)

Much as the introduction of the mobile telecommunication companies increased the penetration, the sector's mobile services remained highly priced for the average consumer with the service provider's profitability soaring over the years. The effects of such a practice deprive the economy from growth as not many would afford the service. Only through reforms in institutions and regulations within the industry, can economic growth be attained through proper pricing of its services. The general argument underlying these reforms thrives on the fact that efficient institutions in the telecommunication sector spurs growth of the sector and generate externalities that trigger growth in other sectors of the economy. This should, in turn, propel economic performance (African Partnership Forum (2008).

However, the case is different in the context of Malawi with continuous increase on tariffs (pricing) of services by the country's two major service providers. Their

perceived dominance can be argued to have demonstrated collusive behaviour with their changes in pricing not being far apart as illustrated by tables 5 and 6, and figures 1 and 2 below.

Table 6: Telecommunication Services Structure 2014

Provider	Size Infrastructure Sites	Subscribers	Market Structure %Market Share
TNM	477	2,498,117	49.35
Airtel	524	2,502,641	49.44
MTL	110	73,766	1.46
ACL	20	12,674	0.25
Total	1131	5,061,850	100

Source: Based on MACRA Publications 2014

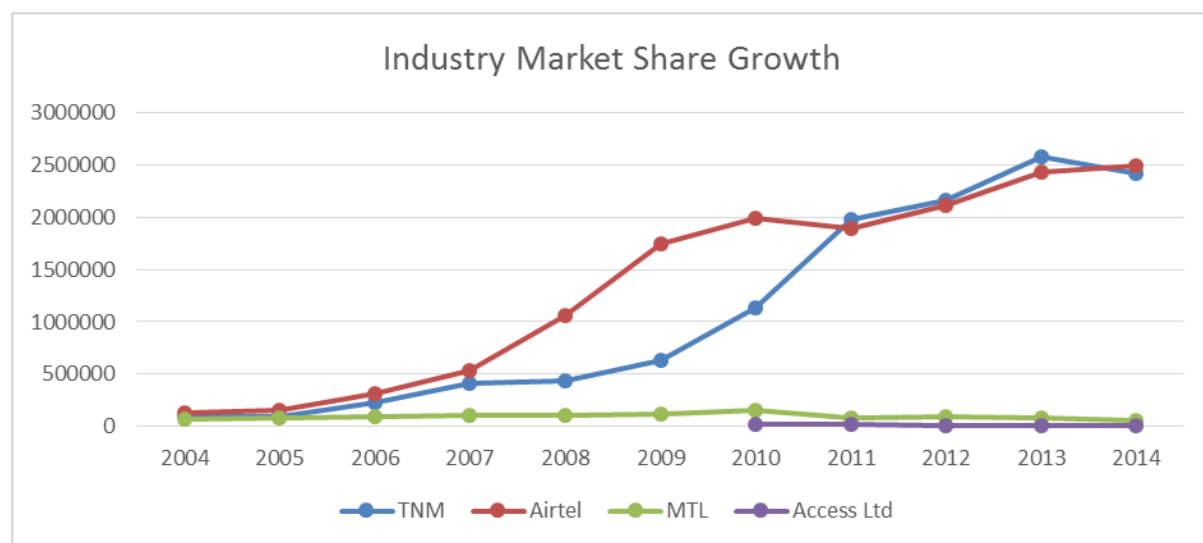


Figure 1: Industry Market Share Growth

Sources: MACRA Statistics

Table 7: Mobile Service Providers Pricing per Minute Call Spanning 4 Years

PEAK PER MINUTE	Airtel	On- Net(AIRTEL- AIRTEL)	Off Net(Other Networks)	TNM	On- Net(TNM -TNM)	Off Net(Other Networks)	Average Pricing On Net	Average Pricing Off Net
1	2011- Jan	39	49	2011- Jan	35.5	27	27.5	38
1	2011- Dec	43	54	2011- Dec	38.4	35	30.7	44.5
1	2012- Jan	48	60	2012- Jan	45	49	46.5	54.5
1	2012- Dec	53	67	2012- Dec	50	54	51.5	60.5
1	2013- Jan	59	74	2013- Jan	52.2	64.8	55.6	69.4
1	2013- Dec	65	82	2013- Dec	66	79.8	65.5	80.9
1	2014- Jan	72	93	2014- Jan	72	90	72	91.5

Source: Based on MACRA publications 2014

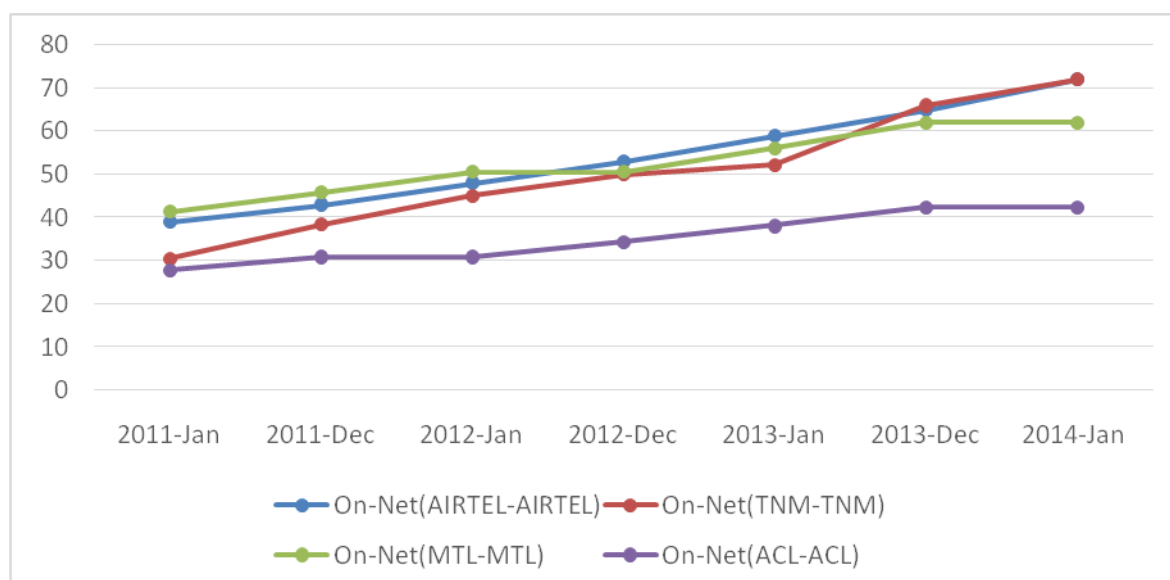


Figure 2: Pricing Changes for TWO LARGEST Providers On Net (calls within the same network)

Source: MACRA Statistics.

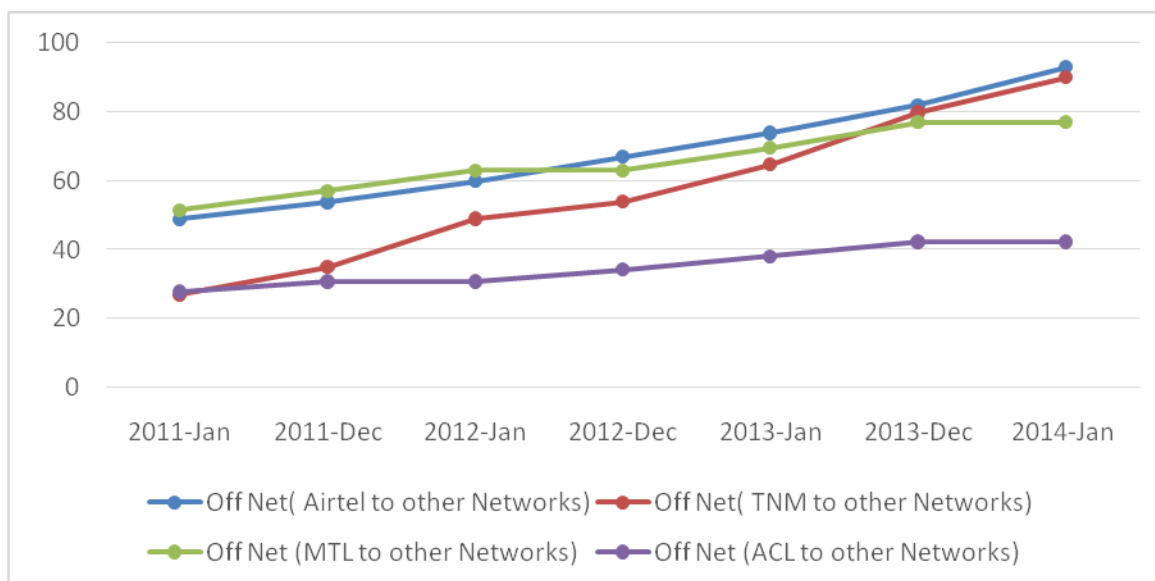


Figure 3: Pricing Changes for TWO LARGEST Providers Off Net (calls to other networks)

Source: MACRA Statistics.

Kaluwa (2016) argues that telecommunications is an industry that does not have and does not need to respond to an entrenched benchmark stimuli like the banking industry, figures 1 and 2 point to concentrated pricing in an industry which still has four established players and dominated by two. Here again, the structure which is probably worse than the banking industry in Malawi, would have made the market prone to collusion-based on price-leadership-followership as demonstrated by the converging trend in pricing.

He further states that, based on the off-net tariffing, there would be opposing expectations according to the market share of a service provider. There is a lock-in/lock-out expectation, where the provider has a position of market dominance and feels confident of a threshold market base required to lower (but not necessarily minimize) overhead costs. He challenges that the threshold base is used to either punish outsiders through higher connection fees or lure them into subscription (“join our large family”) through the competitive lowering of subscriber entry (SIM) costs and dual-SIM devices. The converse of this argument applies to the smaller providers with small subscriber bases which are limited by high barriers to entry required in

tower investments. These fringe players cannot afford to be too bold about either their on-net or their off-net tariff, hence their preference to be price followers and to operate at a much lower level to at least protect their market shares. In fact, they cannot afford to be too modest either lest they lower their profitability.

2.4 Conclusion

The chapter outlined an overview of the telecommunications industry and its impact in terms of economic performance both locally and internationally. It highlighted the contribution of the industry to economic performance and development world over. Furthermore, the chapter gave the current perspective of the telecommunications industry with its structure and pricing. In the next chapter, focus will dwell on different literature that has been written on different market structures and their conducts.

CHAPTER 3

LITERATURE REVIEW

3.1 Introduction

The present chapter reviews literature concerning theories about market structures and their conduct. The chapter also reviews empirical studies that have been advanced in different industries with an aim of understanding the conduct of economic agents within those industries. Specifically Section 3.1 focuses on theoretical literature while empirical literature is addressed in Section 3.2.

3.2 Theoretical Literature Review

The conduct of economic agent's within a market is dictated by the structure of the market and it in turn determines the performance of that agent. The present section reviews literature that highlights theories aimed at explaining the behaviour of economic agents applicable to different market structures. The discussion particularly concerns itself with the Structure-Conduct-Performance Paradigm and the Chicago School of Thought on Market Structures.

3.2.1 Structure-Conduct-Performance Paradigm

The Structure-Conduct-Performance (S-C-P) paradigm of strategy states that market structure would determine firm conduct which would in turn determine performance (Bain 1959). The SCP paradigm has two competing hypotheses, namely the traditional "structure performance hypothesis" and "efficient structure hypothesis". The structure performance hypothesis argues that the degree of market concentration is inversely related to the degree of competition because market concentration encourages firms to collude. More specifically, the standard SCP paradigm asserts that there is a direct relationship between the degree of market concentration and the degree of competition among firms (Edwards, Allen and Shaik 2006). This hypothesis will be supported if positive relationship between market concentration (measured by concentration ratio) and performance (measured by profits) exist, regardless of

efficiency of the firm (measured by market share). Thus, firms in more concentrated industries will earn higher profits than firms operating in less concentrated industries irrespective of their efficiency.

The efficiency structure hypothesis states that performance of the firm is positively related to its efficiency because market concentration emerges from competition where firms with low cost structure increase profits by reducing prices and expanding market share. A positive relationship between firm profits and market structure is attributed to the gains made in market share by more efficient firms. In turn, these gains lead to increased market concentration. That is, increased profits are assumed to accrue to more efficient firms because they are more efficient and not because of collusive activities as the traditional SCP paradigm would suggest (Molyneux and Forbes, 1995).

Traditionally, the two hypotheses are examined using the traditional measures of profit/profit margin as indicator of performance. In the efficiency/productivity literature there is increased emphasis on the use of efficiency as a measure to examine the economies of scale, economies of scope and both economies of scale and scope, accounting for risk, and policy implications (Edwards, Allen and Shaik 2006).

In the current study, both the structure performance hypothesis and the efficiency structure hypothesis could seem to be applicable to Malawi's telecommunication industry. It is an industry with very few players which makes it highly concentrated but at the same time amongst the few players, only two are deemed to be market leaders with over 89% of market share being commanded by them (MACRA 2014). It can be argued on one hand that the degree of market concentration within the industry allows market players to collude when setting their prices so that they redeem high profits. On the other hand, one can also argue that high profits attained by players within the industry are due to high market shares that a few players have due to their efficient operations which allowed them to set low prices on their services and thereby increase market share. Therefore it is only right to look at all aspects in both theories when analysing the contributing factors of market player's profitability within Malawi's telecommunication industry if one is to come up with reliable outcome.

3.2.2 Chicago School of Thought

The Chicago School of Thought developed as a critique of the SCP Paradigm. Bronfenbrenner (1962) distinguished at least two “Chicago School of Thought”. Both the First and the Second Chicago Schools believed in the efficacy of the market system of organizing economic activity and that the role of government should be as limited as possible, consistent with making the market system work. However, they advanced two different views regarding the minimum necessary role of the government. The First Chicago School advocated a laissez faire government policy, which according to Lange (1946) maintains the capitalist economy, provided it is not hampered by government planning, and spontaneously operates in such a way that it secures the maximum of public welfare. The theorists were also convinced that government should set the ground rules for private competition by means of a strong antitrust policy. Simons (1934) defended the market mechanism of resource allocation on the grounds that it was more effective than other systems and that it was essential for the preservation of a free society. He took the view that government had to play an affirmative (positive) role to maintain the functioning of a market economy.

The First Chicago School envisaged the need for government to make a clear distinction between parts of the economy where competition could be an effective resource allocation mechanism and parts of the economy where it could not. Where competition could be effective, the government should pursue an activist antitrust policy to ensure effective competition. Not only should the government prohibit collusion and punish it if detected; it should also control proactively the size of firms to maintain a market structure consistent with competitive outcomes. Where the underlying technology dictated that competition could not be an effective resource allocation mechanism, the policy choice as being between regulation and public ownership should come into effect. Bronfenbrenner’s (1962) view of regulation, based on observation of the way regulation worked in practice, was largely negative.

The Second Chicago School carried further the antipathy of its counterpart toward government involvement in the market place. It rejected any antitrust policy beyond a prohibition of collusion and mergers to monopoly or near-monopoly; government regulation of natural monopoly; and public enterprise.

Reder (1982) explains that the distinguishing characteristic of the Second Chicago School was the “Tight Prior equilibrium” assumption, the view that the economy could be treated as if it were essentially Pareto optimal. Decision makers allocated resources under their control and that there was no alternative allocation such that any one decision maker could have his expected utility increased without a reduction occurring in the expected utility of at least one other decision maker. The view that the economy can be treated as if it is Pareto optimal is informed by four assumptions;

1. Most individual agents treat the prices of all goods and services that they buy or sell as independent of the quantities that they transact.
2. The prices at which individuals currently agree to transact are market clearing prices that are consistent with optimization by all decision makers.
3. Information bearing on prices and qualities of all things bought and sold, present and future, is acquired in the quantity that markets its marginal cost equal to its price; this is to say that information is treated like any other commodity.
4. Neither monopoly nor governmental action (through taxation or otherwise) affects relative prices or quantities sufficiently to prevent either marginal products or compensation of identical resources from being approximately equal in all uses.

The foregoing points may be considered as are flection of evidence about the importance of economies of large scale production, or experience with the ability (or inability) of government to intervene effectively in the economy.

The SCP paradigm suggests that in order to fully understand the conduct of economic agents, the structure of their industry is very detrimental. Unlike the view advanced by the First Chicago School of Thought, the telecommunication industry does not have much government influence especially after the liberalization of the market in 1994 which later led to the privatization of the then state owned MTL. This can drive us to conclude that the Second Chicago School of Thought is more applicable to the telecommunication industry in Malawi since as highlighted above, the current regulators of the industry focus mainly on collusive behaviour amongst players and

strictly prohibit mergers with other antitrust policy not being advocated as was the case with the First Chicago School. The coming in of other private operators gave the industry an oligopolistic market structure which is assumed to be highly concentrated with some firms assuming dominance within the process (Kaluwa 2016). Such market structures have been heavily controversial in their operations with their product pricing decisions being questioned (Stigler, 1982).

3.2.3 The Nature, Causes and Measurement of Market Power

3.2.3.1 Defining Market power

The concept of market power applies to an individual firm or to a group of firms acting collectively. To the individual firm, it expresses the extent to which the firm has discretion over the price that it charges. This market power can be measured by the price-cost differential or Lerner Index which measures market power as the divergence between price and marginal cost, expressed relative to price.

$$L = \frac{(P - MC)}{P} \dots\dots\dots (3.1)$$

where L (the “Lerner Index”) is the indicator of market power, P is the price at which the firm sells its output, and MC is the marginal cost of the firm for the volume of output that the firm is selling. From Equation 3.1 we can construe market power as the ability of a firm to charge a price which is higher than the marginal cost.

Market power, which is a form of conduct, is related to the structure in which the firm operates. In perfect competition, where all firms that produce and sell a homogeneous product, there is no market power since all firms sell at an identical price that is equal to their marginal costs ($P = MC$) (Mankiw, 2006). In imperfect market structures, the price charged is higher than the marginal ($P > MC$) and the Lerner Index is positive. Thus, market power arises in contexts where the markets are less than perfectly competitive. Considering that the Malawian telecommunications industry is oligopolistic, the present study examines market power in an oligopoly.

3.2.3.2 Market Power in Oligopoly

Market power in an oligopoly is explained in game-theoretic terms since this market structure is inherently a setting of strategic interaction (Mas-Colell, Whinstone, and Green, 1995). The extent of market power will vary depending on a variety of factors such as: the number of firms in the industry (n); whether the firms are producing homogenous or differentiated products; whether firms compete over quantity (Cournot competition) or over prices (Bertrand competition), and whether the firms are involved in a static (single-shot) game or dynamic (repeated) games. The discussion begins with examining market power in a static game and in turn analyses dynamic games.

3.2.3.3 Single Short Games

Assuming a single shot game duopoly where the objective of each firm is profit maximisation, market power arises as Nash equilibrium both under Cournot and Bertrand competition. We assume that each firm i has constant marginal cost (c_i), so that the total cost for producing q_i units of output is

$$C_i = c_i q_i, \quad i = 1, 2 \dots \dots \dots (3.2)$$

Given the strategic interdependency in an oligopoly, inverse demand function for output of firm i is inversely related not only to its own output but also to that of its competitor and it can be written as:

$$p_i = \alpha_i - \beta_i q_i - \lambda q_j, \quad i, j = 1, 2 \quad i \neq j \dots \dots \dots (3.3)$$

Following from equations (3.2) and (3.3) the profit function for firm i ,

$$\pi(q_1, q_2) = p_i q_i - c_i q_i = (\alpha_i - c_i - \lambda q_j) q_i - \beta_i q_i^2 \dots \dots \dots (3.4)$$

The profit maximising output for each firm i given the output choice of firm j is

$$q_i = A_i - B_i q_j, \quad A \equiv (\alpha_i - c_i) / 2\beta_i; \quad B \equiv \lambda / 2\beta_i \dots \dots \dots (3.5)$$

Equation (3.5) defines each firm's best-response function

3.2.3.4 Cournot Model

The equilibrium under Cournot competition is found by solving simultaneously the best response functions for the two firms.

$$q_i^c = \frac{A_i - A_j B_i}{1 - B_i B_j} \dots\dots\dots (3.6)$$

If the products are homogeneous, the equilibrium quantity produced by each firm is

$$q_1^c = q_2^c = (\alpha - c)/3\lambda \dots\dots\dots (3.7)$$

Cournot justified this equilibrium as follows. If firm 1 chooses its initial output level, firm 2 will choose a profit maximising output on its best-response function. But once firm 2 has chosen its output level, firm 1 will choose a different output level along its best-response in order to maximise profit. Given the other firm's choice of output level, these adjustments in output level along each firm's best-response function will continue until each firm's output level is consistent with the other's profit maximising output level. However, as Gravelle and Rees (2006) argue, this justification is not convincing because it is inconsistent with the one-shot assumption because it requires that outputs be chosen sequentially over a (possibly infinite) number of time periods. Instead, they propose a game-theoretic explanation for the same equilibrium. Each firm chooses the output level that maximise its profit regardless of the output level by the other firm. This yields the Nash equilibrium. The quantities in this Nash equilibrium are the same as those proposed by Cournot.

Under this homogeneity assumption, then equation (3.2) becomes $p = \alpha - \lambda(q_i + q_j)$.

Substituting (3.6) into this new equation, one obtains

$$p = \frac{\alpha + 2c}{3} \dots\dots\dots (3.7a)$$

Since $\alpha > c$ for an active market, then we conclude that

$$p = \frac{\alpha + 2c}{3} > c \dots\dots\dots (3.7b)$$

That is, the firms have market power.

Mas-Colell, Whinstone and Green (1995) extend the analysis to differentiated products and yield a similar conclusion that firms exercise market power by charging a price higher than marginal cost.

Below is an illustration of what happens when an oligopoly has greater than two firms. Letting $n > 2$ denote the number of firms, $Q = \sum_{i=1}^n q_i$ denote industry output

and $s_i = \frac{q_i}{Q}$ denote the market share of firm i , he shows that the first order condition for profit maximisation is

$$p \left[1 + \frac{s_i}{\varepsilon} \right] = c_i, \quad \varepsilon < 0 \quad \dots\dots\dots (3.8)$$

where $\varepsilon < 0$ is the price elasticity of demand. Considering that this elasticity is negative, then (3.8) necessarily implies price charged is greater than marginal cost. Consequently, firms still exercise market power even when the number of firms increases beyond two.

3.2.3.5 Bertrand Model

The Bertrand model advances the view that in the single-shot duopoly, firms compete over prices for differentiated products. The quantity demanded for output of firm i are dependent on both the price charged by that firm and that charged by its competitor. Therefore, the demand function can be written as:

$$q_i = a_i - b_i p_i - \gamma p_j, \quad a, b, \gamma > 0 \quad \dots\dots\dots (3.9)$$

For given prices charged by firm j , the profit maximising price is given by the following best price-response function,

$$p_i = \hat{A}_i + \hat{B}_i p_j \quad \dots\dots\dots (3.10)$$

where $\hat{A}_i = \frac{a_i + c_i b_i}{2b_i}$ and $\hat{B}_i = \frac{\gamma}{2b_i}$. The Bertrand-Nash equilibrium pair (p_1^B, p_2^B) is found by solving for the intersection of the best response functions for the two firms. For each firm we obtained;

$$p_i^B = \frac{\hat{A}_i + \hat{A}_j \hat{B}_i}{1 - \hat{B}_i \hat{B}_j}$$

As Osborne (2002) demonstrates, these equilibrium prices are greater than the constant marginal cost but are less than the prices in the Cournot equilibrium. That is, when firms compete over prices there is still market power only that it is less than what they would have if they competed over quantities. There is, however, a striking result under Bertrand competition if products produced by the two firms are homogeneous. A single shot Bertrand game with two firms yields competitive outcome (Varian, 1992; Mas-Colell, Whinstone and Green, 1995). In other words the

price charged is equal to marginal cost, which implies absence of market power in the situation. However, it has been shown that this competitive outcome is less likely when moving from single shot game to a dynamic Bertrand game with more than two firms. Results similar to those discussed under the single shot Cournot and Bertrand model for constant marginal cost would also hold with a general cost function specification (Mas-Colell, Whinstone and Green, 1995).

3.2.3.6 Dynamic Games

The static games reviewed in the preceding section provide a convenient starting point for understanding the conduct of firms but are usually not reflective of reality. In most real life situations, firms play their strategies repetitively, that is to say games are dynamic and hence the need to review an extension to the Cournot and Bertrand games in a dynamic context.

Elberfeld and Wolfstetter (1999) analysed the symmetric sub-game perfect equilibrium of a dynamic Bertrand oligopoly with entry. They explored mixed entry strategies in a two-stage oligopoly model with simultaneous entry decisions at stage one and simultaneous price decisions at stage two. They concluded that with more than two competitors, a competitive outcome is less likely. In other words, the best strategy for each firm will be to set the price above the marginal cost.

Similarly, Jannsen and Ramunsen (2002) examined Bertrand competition with uncertain demand in a context of product homogeneity. They found that in an equilibrium, each firm charges a price higher than the marginal cost and the price-cost differential is inversely related to the number of active firms in the market. Thus, market power is higher when the market is served by fewer firms and the power decreases as the number of firms in the market increases.

A result similar to that of Jannsen and Ramunsen (2002) was found by Ledvina and Sircar (2010) who considered a dynamic Bertrand game where firms produce similar goods, though not perfect substitutes. Their study revealed that each firm chooses a dynamic Markovian pricing strategy. Thus, in this case too, the Nash equilibrium involves setting a price higher than the marginal cost. Ledvina and Sircar (2011)

further found that, in the sense of a lower price-cost mark up, consumers benefit the most when a market is structured with many firms of the same relative size producing highly substitutable goods. However, a large degree of substitutability does not always lead to large price drops, for instance, when the sizes of two firms are largely different.

Ledvina and Sircar (2011) departed from Ledvina and Sircar (2010) by considering a dynamic Bertrand game with product differentiation rather than similar goods. The results show that product differentiation further insulates market power relative to the case with similar goods.

3.3 Empirical Literature

The need to understand market structures within an economy worldwide has inspired a number of studies with significant empirical results. In an effort to establish the existence of market power within their industries the studies have given considerable attention to the conduct of economic agents.

Ward (1995) adopted the Lerner Index, providing an estimate of the percentage price mark-up over marginal cost for an unconstrained, profit maximizing firm. This approach was carried out in long distance telecommunications in United States of America. Estimates of this price-cost margin provided the basis for measuring the potential deadweight loss from supra-competitive pricing. The study established the existence of market power that induces a potential deadweight loss of at most 0.36% of total industry revenues during 1988-1991.

Parker and Röller (1997) considered the impact of regulation policy limiting entries on the American mobile telephone market. The empirical analysis uses panel data over the period 1983-1988 covering different American telephone areas. Estimates of market power reveal that the prices are both higher than those of perfect competition and those of non-cooperative duopoly. In addition, there is evidence that situations of “cross-properties” (when a firm detains shares in its competitor) and multi-market contacts are strong determinants of the practice of non-competitive price.

Nunn and Sarvary (2004), resumed the same pattern as that of Parker and Röller (1997) relying on 10 OECD countries. Their results indicate that a larger number of operators in a country do not seem to result in any additional effects on market power. However, the anti-trust commitment of a country contributes to the decline of the market power. Finally, the authors identified the lasting reign of monopoly before opening up to competition as a factor contributing to the rise of the market power. They concluded that market power in various countries could be due to price collusion between operators.

Calvin and Zebaze (2009) used the Multiple-Indicator-Multiple Causes (MIMIC) model based on the aggregate data from 30 African countries (1997-2004) to assess the determinants of market power in telecommunications industry in Africa. A set of results very relevant to the present study emerged from the empirical analysis. It was, for example, noted that the African telecommunication industry faces significant market power practices and the main policy factors that seem to be affecting negatively the region's market power are the unilateral efforts in terms of liberalization (increasing number of operators) as well as strengthening of sectoral regulation of the industry.

Apart from the telecommunications, reference on the existence of market power maybe drawn from studies conducted in other industries to establish its determinants. This could help provide insight on policy implementation and regulation for such conduct.

Zulehner (2010), for example, employed the Lerner index to measure the existence of market power in the early US east-coast cane sugar refining industry. The results of the study show the existence of market power which was attained by constraining industry prices to prohibit both local and international new entrants. The oligopolistic nature of the market allowed agents to have control over prices through its trade union which was later dissolved by a law suit filed by the Federal Government.

Along the same vein, Appelbaum (1982) investigated four U.S. manufacturing industries: textiles, rubber, electrical machinery and tobacco. According to previous studies and prior notions, the textile and rubber industries were believed to be

competitive while the other two were not. Appelbaum was able to use the Lerner index to establish this by estimating the conjectural elasticity and price elasticity of demand. This is so because the Lerner Index is positively related to the conjectural elasticity, and is inversely related to the elasticity of market demand. However, his adopted methodology was criticized by Apichart Daloonpate (2002) for its assumption of homogeneous products within the industry which he argued caused him to disregard market power held amongst different brands. The estimated Lerner Index for each industry represented the degree of market power of that industry as a whole.

Schroeter (1988) extended Appelbaum study to investigate the monopsony structured beef packing industry in the United States of America. The results revealed small, but statistically significant monopoly/monopsony price distortions in the slaughtered cattle and wholesale beef markets. In spite of heightened concentration in the industry, it created no indication that performance had become appreciably less competitive. Nevertheless, Schroeter's study was criticized on the same bases as Appelbaum (1982).

Fernandez and Maudó (2006) used the Lerner Index to analyze the explanatory factors of market power in the Spanish banking system. The results of the study concluded that the factors that had the greatest explanatory power included size, efficiency and specialization. Market concentration was found to be an insignificant factor in determining market power within the industry.

Simpasa (2010) evaluated the intensity of competition by estimating a bank-specific and time varying Lerner Index as a measure of market power by Zambian banks in the post-reform period. Using a model of oligopolistic conduct, he showed that Zambian banks exercised market power in setting prices. Furthermore, market concentration, efficiency performance, diversity in revenue sources and regulatory intensity accounted for much of the banks' exercise of market power. However, the results indicate that credit risk and macroeconomic uncertainty such as inflation had a weakening effect on the banks' exercise of market power. The policy lesson from the analysis was that regulatory authorities should continue with the policy of opening up the industry to more players in order to foster contestability in the banking industry.

Kaluwa and Chirwa (2014) investigated the nature of competitiveness among banks in Malawi where the industry is concentrated and the institutional base is weak. The study used a model incorporating bank-specific, industry-specific and macroeconomic determinants of conduct and performance based on monthly data from January 2005 to March 2014. Key findings are of asymmetric conduct with collusive price leadership in lending rates and competitiveness in deposit rates and overall high spreads. Apart from dominance, collusive price leadership was facilitated by regulatory stipulations in pricing in banks' core and non-core business and an economic environment resulting in banks' high profitability and diminished competitive pressure in lending rates. Furthermore, monopolistic competition via outreach also put upward pressure on spreads most likely via costs as the literature suggests.

Athanasoglou, Brissimis and Delis (2005) aimed at examining the profitability behavior of bank-specific, industry related and macroeconomic determinants, using an unbalanced panel dataset of South Eastern European (SEE) credit institutions over the period 1998-2002. A key result is that the effect of concentration is positive, which provides evidence in support of the structure-conduct performance hypothesis, while at the same time some relevance of the efficient-structure hypothesis cannot be rejected. In contrast, a positive relationship between banking reform and profitability was not identified, whilst the picture regarding the macroeconomic determinants is mixed.

Athanasoglou, Brissimis and Delis (2005) examined the effect of bank-specific, industry-specific and macroeconomic determinants of bank profitability, using an empirical framework that incorporates the traditional Structure-Conduct-Performance (SCP) hypothesis. To account for profit persistence, they applied a GMM technique to a panel of Greek banks that covers the period 1985-2001. The estimation results showed that profitability persists to a moderate extent, indicating that departures from perfectly competitive market structures may not be that large. All bank-specific determinants, with the exception of size, affect industry profitability significantly in the anticipated way. However, no evidence is found in support of the SCP hypothesis.

3.4 Conclusion

The present chapter has reviewed the different literature where the different effects of market structures were highlighted in regard to economic agents' conduct within an industry. Reference has been made to studies conducted in various industries where results generated were able to support relevant theories. Therefore, the next chapter presents a methodology adopted by the present study to identify the determinants of market power within the telecommunications industry in Malawi. The analysis uses data sourced from current network operators within the industry, as well as from relevant stakeholders within the industry to afford the study a comprehensive analysis.

CHAPTER 4

RESEARCH METHODOLOGY

4.1 Introduction

This chapter presents the methodology used to achieve the objectives of the study. Firstly, it describes the econometric model used to identify determinants of market power. Then it discusses the diagnostic tests used and possible remedial measures to be taken to ensure validity of results. Finally, it explains the data sources. The study, which used quarterly data covering the period 2004 to 2014 had as its main focus aimed at establishing determinants of market of power within the telecommunications industry in Malawi.

4.2 Model Specification

In an effort to describe the determinants of market power, the study adopted a model that used panel data analysis. Particularly, it used quarterly data in order to have an adequate analysis over a space of 11years (2004-2014). Using a method used by Athanasoglou *et al* (2005) and Flamini *et al* (2009) industry-specific, operator-specific and macroeconomic determinants were adopted while the Lerner Index and Cost-Price Mark-up were used as measures of market power in the regression model. For an operator i in period t , the regression model was specified as follows:

$$M_{it} = \alpha + \sum_{n=1}^j \gamma_j X_{it}^n + \sum_{s=1}^N \beta_s X_{it}^s + \sum_{e=1}^M \delta_e X_{it}^e + \varepsilon_i + v_{it} \dots \dots \dots (4.1)$$

where X_{it}^n is a vector of operator specific variables; X_{it}^s is a vector of industry specific variables and X_{it}^e is the vector of macro-economic variables. The vector of operator specific variables includes number of service outlets (Nso), number of employees (Ne) and ownership structure - whether the industry player is foreign owned or locally owned (OS). The vector of industry specific variables includes HHI Index (calculated using the customer base of firms within the industry) and telecommunications market penetration/saturation (SAT). The vectors of

macroeconomic variables were Inflation, Exchange Rate (Exrate) and Foreign Reserves (FReserves).

In equation (4.1), ε_i is an individual-specific effect which is different across observation units but is time-invariant and V_{it} is the idiosyncratic error term that is assumed to be white noise.

Expanding equation (4.1) to include the specific variables, the following equation is generated:

$$M_{it} = \alpha + \gamma_1 Nso_{it} + \gamma_2 Ne_{it} + \gamma_3 OS_{it} + \beta_1 HHI_Index_{it} + \beta_2 SAT_{it} + \delta_1 Inflation_{it} + \delta_2 Exrate_{it} + \delta_3 FRe serves_{it} + \varepsilon_i + V_{it} \dots\dots\dots(4.2)$$

The Lerner Index of competition was used because it captures the disparity between prices and marginal costs in terms of prices, that is:

$$Lerner_{it} = (P_{it} - MC_{it}) / P_{it} \dots\dots\dots(4.3)$$

Where P is the price (tariff) of each operator and is measured per minute for a phone call made on each of the operator's network as the total revenue, and MC is the marginal cost of each operator which is derived (on the assumption that it is equal to average cost) from dividing the total network operating costs of each network operator by the total gross talk time in minutes for each network operator as well.

The Lerner Index model has been used in a number of earlier studies on market power within different industries including the Spanish banking system (Fernandez and Maudo 2006), the Austrian sugar industry (Zulehner 2010) and on Malawi's banking industry (Kaluwa and Chirwa 2014).

Cost-price Mark-up is the ratio or margin difference between the cost of a good or service and its selling price. It is expressed as a percentage over the cost. A mark-up is added onto the total cost incurred by the producer of a good or service in order to cover the costs of doing business and create a profit margin. The total cost reflects the total amount of both fixed and variable expenses to produce and distribute a product

or service. The mark-up can be expressed as a fixed amount or as a percentage of the total cost or selling price. The mark-up is calculated by subtracting the cost price of a product or service from its selling price and thereafter dividing it by the cost price.

$$Markup_{it} = \frac{SP_{it} - C_{it}}{C_{it}} \dots \dots \dots (4.4)$$

Where SP is the price (tariff) of each operator and is measured per minute for a phone call made on each of the operator's network as the total revenue, and C is the cost of each operator which is derived from the total network operating expenditure for each operator divided by total gross time in minutes and this gives us the total cost per unit (minute of talk time).

By using both the Lerner Index and the Cost-price Mark-up the study adopts a comprehensive analysis process which ensures reliable results since both methods have been used in other studies as a basis of measurement.

4.3 Variables Definitions and Expected Signs

The variables used in the regression above were segmented into three namely; industry specific, operator specific, and macroeconomic. This was adopted to have a clear understanding of how each segment affects/contributes to market power within the telecommunications industry in Malawi.

4.3.1 Industry Specific Variables

- HHI Index: This variable was used to analyse market concentration. Economic theory and considerable empirical evidence suggests that, other things being equal, the concentration of firms in a market is an important element of market structure and determinant of competition (Rhoades 1993). Calculated using the customer base of firms within the industry, which is done by dividing the customer base of an operator by the total customer base of the industry, we were able to derive the total market share of the operator against other operators. Based on a study by Parker and Röller (1997) which analysed the impact of regulation policy limiting entries on the American mobile telephone market, the variable is expected to have a positive relationship with market power as an influencing determinant.

- Telecom market saturation/penetration (SAT): The level of market saturation is a proxy by the penetration. The market saturation variable is expected to have a negative correlation with market power. The more a market is saturated, the more operators would have incentive to adjust their price in order to attract new customers from competition within the industry (Calvin and Zebaze 2009).

4.3.2 Operator Specific Variable

- Number of employees (Ne): The number of employees can also be translated as firm size. With increased number of employees comes increased productivity within a firm. But for this to be achieved, it requires labour force which is highly trained and specialised at all levels (management and operational work). This would have an impact on market power since it would provide competitive edge for an operator assuming the labour force is highly skilled and trained. However in most cases, firm size is often interpreted as a source of organizational costs (Shepherd 1972), or X-inefficiencies (Leibenstein, 1976). Hansen and Wernerfelt (1989), for example, found that the variable is negatively related to market power. In other words, an organisation might have an increased size as compared to its competition but that does not necessary contribute to the company's market power within an industry.
- Ownership structure (OS): This variable focused on whether the operator is foreign-owned or locally-owned and it is meant to capture the influence which a foreign-owned operator would pose and, in turn, measure the impact this would have together with its effects on their market power. This may be in the form of a global brand name having advantage over local competition by virtue of being an international brand or by virtue of its ability to adopt internationally successful strategies which could be used as a competitive advantage on the local market. In order to capture this variable, dummies had to be employed in the analysis process with a foreign-owned operator and a locally-owned operator being assigned dummy 1 and dummy 0 respectively. However, according to Anthanasoglou, Brissimis and Delis (2005) who

studied Greece's banking sector, the variable can be insignificant especially when measuring performance.

- Number of service outlets (Nso): As a variable, Nso is the outreach of the telecoms operator regarding their customer service shops (branches) across the country. It is aimed at capturing the operator's footprint or presence across the market in which they operate during the analysis. Increased footprint or presence can be deemed to increase market power through non price competition that may exist. A higher number of branches for a particular operator may demonstrate an effort to reach out and service a larger number of customers under the operator's umbrella. Based on findings of a study by Fernandez and Maudó (2006) on the banking system in Spain where the variable was used as a measure of outreach, Nso variable is expected to be negatively related to market power.

4.3.3 Macroeconomic Variables

- Inflation: As a variable, inflation is meant to capture the shocks it delivers within the economy due to its variations and how the operators are affected or how they react to the shocks. The variable always plays a key role within different industries of an economy especially in relation to price setting for different goods and services. Simpasa (2010) established that in the banking industry of Zambia, inflation proved to have a negative relation with market power and the same result is expected as the outcome during this study's results.
- Foreign Exchange Rate (Exrate): Bearing in mind that the telecommunications industry is heavily dependent on investment in technological equipment and facilities, importation of the same is paramount if they are to sustain their business. Continuous technological improvement translates into constant demand for foreign currency to bankroll technological investments. The industry is one of the heavy importers of IT and telecommunications equipment and various operational requirements such as scratch card vouchers. It is also an indirect heavy importer of fuel used for generating

power for transmitters (towers) in remote areas as well as a source of electricity back up in urban areas. Between 2005 and 2012, the foreign exchange rate regime moved from a flexible and market-determined rate to a virtual fixed one which culminated in overvaluation before the May 2012 devaluation and float (Kaluwa and Chirwa 2014). With this in place, it became imperative to capture the effects of the shocks of exchange rate fluctuations on an operator's market power since it forms a vital concept during their decision making process while doing business. In the light of Kaluwa and Chirwa (2014), Malawi's foreign exchange rate had a positive relation with market power within the banking industry in Malawi, hence the same expected result in the telecommunication sector.

- **Foreign Reserves (FReserves):** The overvaluation of the foreign exchange rate during the fixed rate regime contributed to foreign exchange reserve shortages in the face of the high import-dependence and a foreign aid squeeze after a fall-out with the IMF Extended Credit Facility in 2011. An unprecedented bank liquidity crisis ensued because without foreign reserves to sell, banks found themselves awash with idle liquidity, which, in turn, adversely affected other industries including telecommunications as a heavy importer (RBM, 2013). This led some operators to invest locally in non-traditional activities such as farm produce in order to safe guard their liquidity for long term usage (Airtel annual report 2012). According to results of a study of Kaluwa and Chirwa (2014) the variable is deemed to have a positive relation with market power as per the results.

The estimated model was based on an unbalanced panel of four telecommunication operators, namely Airtel, TNM, MTL and ACL. For some operators, their analysis is considered midway as their existence failed during the entire period of the study, 2004-2014. The estimated model was based on a panel of a non-random sample of the four licensed telecommunications operators and with 44 quarterly observations for TNM, Airtel and MTL collectively for the period January 2004 to December 2014. Access's operations only commenced in 2010 therefore it is presented from that time period. This provided a total of N=130 unrepeated observations for the dependent and operator-specific variables. Variables representing higher-level determinants such

as industry-specific and macroeconomic environments are shared by all the operators and are therefore, repeated appropriately.

4.4 Diagnostic tests

4.4.1 Hausman Test

The Hausman test is employed in order to determine whether regression equation (4.2) should be estimated using the fixed effects model or the random effects model. Essentially, the Hausman test verifies whether individual specific-effect ε_i is correlated with the regressors. In the event that ε_i is correlated with the regressors, the random effects model assumes that the individual-specific effect is not correlated with regressors while, in contrast, the fixed effects model assumes that such correlation does exist. If this assumption is wrong, the random effects estimator will be inconsistent but the fixed effects estimator is unaffected. Therefore, if the assumption is wrong this will be reflected in a difference between the two set of coefficients. The bigger the difference (the less similar the two sets of coefficients are) the bigger the Hausman statistic.

The null hypothesis is that the two estimation methods, fixed effects and random effects, are both consistent and therefore should yield coefficients that are "similar". The alternative hypothesis is that the fixed effects estimation is consistent and the random effects estimation is not. If this is the case differences between the two sets of coefficients are likely to occur.

A large and significant Hausman statistic means a large and significant difference hence the rejection of the null hypothesis that the two methods are consistent in favour of the alternative hypothesis that fixed effects are consistent while random effects are not.

4.4.2 Dealing with Problems of Heteroscedasticity and Autocorrelation

Panel data usually suffers from heteroscedasticity and autocorrelation which could potentially invalidated all hypothesis testing procedures. In order to deal with issues of heteroscedasticity and autocorrelation, two methods can be adopted, namely

Clustering method and the Generalised Least Square (GLS) method. The choice between Clustering method and Generalised Least Squares is determined by the outcome of the Hausman test. The former is used when fixed effects model is chosen while the latter is used when random effects are selected. Below is a brief description of these methods.

4.4.2.1 Clustering Method

For ease of exposition, we recast regression model (4.2)

$$M_{it} = X_{it}\beta + u_{it} \dots\dots\dots (4.5)$$

$$\text{Where } u_{it} = \varepsilon_i + v_{it} \dots\dots\dots (4.6)$$

where the observations belong to a cluster $i = 1, \dots, N$ and observations are indexed by $t = 1, \dots, T$ within their cluster. For notational simplicity, we can write (4.4) as:

$$M = X\beta + u \dots\dots\dots (4.7)$$

Where $M = [m_1' \dots m_G']$ is $N \times 1$, X is $N \times (K + 1)$ and u is $N \times 1$.

The clustering method is used when the individual specific effect is correlated with the regressors and so the fixed effects model is being used. The fixed effects modelling takes care of correlation between the individual specific effect and the regressors by time-demeaning the data. Since the correlation between the individual specific effect and the regressors has been removed, Ordinary Least Square (OLS) can be applied consistently. However, if OLS is used in this case, the standard errors are estimated incorrectly. Hence, hypothesis testing is rendered invalid.

The Clustering method corrects the estimated standard errors for the correlations. It proceeds on the following two assumptions namely; that the error term has a zero-mean and it is not correlated with the regressors within a cluster; and that the observations in one cluster are independent from observations in all other clusters.

Based on these assumptions, the Clustering method then computes the clustered errors as follows:

$$V(u_i | X_i) = \sigma^2 \Omega_i = \sigma^2 \Omega(X_i) \dots\dots\dots (4.8)$$

Thus, the error terms are allowed to have different variances and to be correlated within clusters. In other words, the clustered errors take into account the correlation between the individual specific effect and the regressors.

4.4.2.2 Generalised Least Square Method

Even in the event that individual-specific effect is not correlated with the regressors, OLS estimators are not efficient. The explanation is that there is serial correlation among the composite error terms and also possibly with heteroscedasticity. This loss of efficiency is resolved by implementing generalised least squares estimation. In this approach, the variables are transformed by dividing each observation with an appropriate weight to eliminate the serial correlation and in turn, an OLS is run on the transformed variables. The GLS estimators thus obtained are consistent, asymptotically efficient and proximately normally distributed.

4.5 Data Sources

The study used quantitative methods to analyse data obtained from the operators and regulators of the telecommunication and financial industries. This includes TNM, Airtel Malawi, Access Limited, MTL, MACRA, the Consumer Fair Trade Commission and the Reserve Bank of Malawi (RBM). As regulators, MACRA and Consumer Fair Trade Commission provided updated information on various aspects of controls and measures that are put in place within the industry to keep the operators in check and ensure fair competition. The operators on the other hand, provided information on their approved levels of pricing, customer database and trends on the fluctuations of the customer database over time. While RBM provided information on inflation, exchange rates and foreign reserves, Macroeconomic variables were used to measure the total market response in regards to price changes.

The information collected from the operators includes their pricing levels from the year 2004 to 2014. This information approved by MACRA and was published to the public as the official prices for tariffs offered by the operators. Information for the same period on gross talk time in minutes and customer databases for all the operators is collected with their varying trends in terms of increases or decreases. This was used to match the responses in pricing changes over a period of time.

4.5.1 Data Interpolation (Lisman and Sandee Method-1964)

Due to problems of unavailability of quarterly panel data on network operating expenses and telecommunication's market saturation (penetration) for Malawi, the study employed the Lisman and Sandee (1964) method of interpolation in Stata to convert annual data into quarterly data. Lisman and Sandee (1964) came up with a method through which quarterly data is obtained from yearly aggregates while at the same time ensuring variability. First, they came up with a 4 by 3 matrix whose elements are obtained by imposing restrictions based on prior assumptions about the trend of the quarterly figures. In their derivation, they assumed that the trend will be a *sinusoid* (see figure 4) which they termed "a quite reasonable and natural condition in the case of an alternating series of the quarterly figures" (Masiya, 2010)

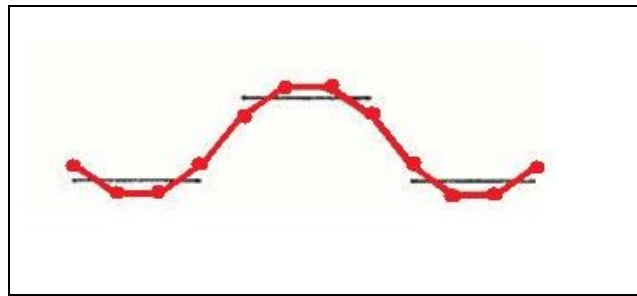


Figure 4: Lisman and Sandee Sinusoid Trend

Source: Masiya (2010).

With the restrictions that they imposed, they derived the following coefficients of a matrix which can then be used to generate quarterly estimates consistent with the annual aggregates.

$$L = \begin{bmatrix} 0.073 & 0.198 & -0.021 \\ -0.010 & 0.302 & -0.042 \\ -0.042 & 0.302 & -0.010 \\ -0.021 & 0.198 & 0.073 \end{bmatrix} \dots\dots\dots(4.9)$$

Starting from the first data, they grouped the observations in column vectors of order three for all successive years. For example, if X_1 , X_2 and X_3 were annual totals for X where 1, 2 and 3 are successive years, the vector would be:

$$Z = \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} \dots\dots\dots(4.10)$$

The quarterly data for the year whose annual total is in the middle position for the vector Z is obtained by pre-multiplying Z by the L matrix (Masiya, 2010). In the example below, the quarterly data obtained is for the year with an aggregate of X_2 .

$$\begin{bmatrix} Q_{12} \\ Q_{22} \\ Q_{32} \\ Q_{42} \end{bmatrix} = L * \begin{bmatrix} X_1 \\ X_2 \\ X_3 \\ X_4 \end{bmatrix} \dots\dots\dots(4.11)$$

where Q_{ij} is the i^{th} quarter observation for year j ; (here $j = 2$).

This method has a good property that the quarterly data it generates sums to exactly the annual totals. Its disadvantage, however, is that by the nature of the generation of the Z matrices, the method will not be able to generate the quarterly series for the first and last years of the sample period. This problem may be addressed by reversing the starting period and forwarding the end period of the sample (Masiya, 2010).

4.6 Conclusion

The main aim of the present chapter was to discuss the methodology that has been adopted to measure the determinants of market power within the telecommunications industry in Malawi. The study adopted Lerner equation model as well as the Cost-Price Mark-up both of which have been used in other studies and in different industries as a measure of market power. The section also went further to define the different variables that have been used within the study and their possible expected outcomes after analysis. Similarly, the diagnostic tests used in the study to deal with issues of heteroscedasticity as well as autocorrelation have been outlined. The Hausman test was employed to determine the issue of correlation of the error term.

During the study, no primary data was collected. All the information that has been used was sourced from the industry operators as well as different stakeholders of the telecoms industry. Furthermore, the study used STATA as an analysis tool with Lerner Index and Cost-Price mark-up margins as the methods, in order to establish the determinants of market power within the telecommunication industry in Malawi.

CHAPTER 5

EMPIRICAL RESULTS

5.1 Introduction

The present chapter presents the results of the econometric analysis as well as the diagnostic tests of the study using the methodology discussed in Chapter Four. The discussion begins with presenting descriptive statistics of the variables used in the study followed by results of the econometric analysis.

5.2 Descriptive Statistics

To probe into the events associated with market power within the telecommunication industry in Malawi, the study uses a multivariate regression analysis which begins by presenting the summary statistics of the variables used in the study. These summary statistics include the mean, standard deviation, minimum and maximum values assumed by the variables as shown in Table 8.

Table 8: Summary Statistics of Variables

Variable (Units)	Obs	Mean	Std. Dev.	Min	Max
Industry Specific					
Mark-up (MK)	130	46.36971	17.45008	9.976212	85.21683
Lerner index	130	36.24581	23.11406	1.806045	108.8098
HHI Index	130	0.277054	0.3488779	0.027842	1
Tariff (MK)	130	48.37823	17.15934	15.5	86
Penetration	130	8.509215	5.798808	0.674	18.4
Customer base	130	776219.4	893378.1	38309	2572898
Macroeconomic Variable					
Inflation	130	14.58692	8.503784	6.3	36.4
Exchange rate	130	196.8797	106.2951	108.91	481.02
Foreign reserves	130	54497.41	63436.56	10497.34	276643.8
Operator Specific					
Service outs	130	11.73846	4.077835	5	21
Number of employees	130	556.4846	388.9653	169	1417

According to Table 7, with 130 observations analysed, tariffs charged ranged from MK15.5 to MK86 with a mean of MK48. Total customer base averaged 776,000 customers with a minimum of 38,000 and a maximum of 2,700,000 million subscribers respectively. Over the analysed period, telecommunication penetration averaged 17% within the total Malawi market. During the same period of analysis, the maximum exchange rate was MK481.00 while the minimum exchange rate was MK 108.91 with a mean of MK196.00. Inflation averaged 14.5% between the years 2004 to 2014. The number of employees as a variable averaged 556 with a minimum of 169 and maximum of 1417.

5.3 Econometric results

5.3.1 Model selection: Hausman Test

Table 9: Housman Test Results

Dependent Variable	Chi-Square Statistics	P-Value
Cost-Price Mark-up	15.12	0.0193
Lerner Index	645.62	0.000

As explained in Section 4.4.1, given the panel nature of the data, the Hausman test was conducted to test the assumption of no correlation between the individual specific effect and the regressors and in turn, decide whether fixed effects model or random effect model is more appropriate. Table 8 above shows the results of the test. From the results above, the P-values for both Lerner index and cost-price mark-up are less than 0.05, hence the rejection of the null hypothesis in favour of fixed effects model when presenting the results of the study.

5.3.2 Regression Results

The results of the Equation (4.2) from Chapter 4 are shown in Table 9 below.

The models estimated provide a good general fit of the phenomenon of market in Malawi's telecommunications industry. Based on the Adjusted R-squared, the Lerner Index explains 62% of the variability in the market power within the telecommunications industry while the Cost-Price Mark-up explains 94% of the results.

Table 10: Regression Analysis Results

			Market Power- Markup	Market Power- Lerner Index
Determinants	Variables			
Industry-Specific	HHI Index	hhi_index	-1.544*** (0.033)	-0.001* (3.105)
	Penetration/Saturation	SAT	-1.111*** (0.069)	-2.180** (0.221)
Operator-Specific	Number of employees	Ne	-0.016*** (0.000)	-0.012** (0.003)
	Ownership Structure	OS	0 (0.000)	0 (0.000)
Macroeconomic Determinants	Inflation	Inflation	-0.039 (0.06)	-0.532* (0.151)
	Exchange rate	Exrate	0.058** (0.013)	-0.03 (0.019)
	Foreign reserves	FReserves	0.000 (0.000)	0.000 (0.000)
		_cons	32.519*** -1.325	21.002** -3.838
		r2_a	0.94	0.62
		N	130	130
Standard errors in parentheses *p < 0.10, ** p < 0.05, *** p < 0.01				

With respect to industry specific determinants, two variables were used namely; the HHI Index and telecommunication's market penetration or saturation (SAT).

The HHI Index as a crucial measure of concentration in this study has proven to be negatively related to market power within telecommunications industry at 10% level of significance on the Lerner index as well as 1% level of significance on Cost- Price mark-up. Following this, we therefore accept the null hypothesis that HHI index does

not have an impact on market power within Malawi's telecommunications industry. This means that the more concentrated the market is, the higher competition within the industry with a few number of players fighting for market share. Specifically, a unit increase in the HHI index leads to a reduction in the market power by 1.544 using mark-up and 0.001 using the Lerner index. This is generally a contradiction to the aprior expectation based on the results that were found by Parker and Röller (1997).

There is a negative relationship between the two probably because of lack of collusion among the players and because price competition intensifies even with increased concentration in the industry. It is also likely that in the Malawian context where two firms are dominant and have roughly equal market shares, the competition for market share erodes market power as each firm tries to undercut the other in order to increase and/or defend its market share. The assumption is in line with the Bertrand competition model approach (1883) which states that interdependence between rival's decisions in terms of pricing decisions where undercutting competitors' prices, is meant to secure a higher market share with a full appropriation of the market, independent of its size. In a bid to control a larger market share, firms will tend to reduce their margins or mark-up. With increased market share, they are assured of large volume sales which in turn compensates for the larger margins which would have been earned by charging higher prices.

Finally, this negative relationship could reflect price regulation measures imposed by the regulatory bodies; MACRA and CFTC who have constantly checked and cautioned the activities undertaken within the industry regarding pricing. In 2015 the Communications Act was amended to include provision of tariff regulations. This was done at MACRA proposition since it had noted that operators never justified price changes for their services. In an industry with a few players chances are high that operators can collude to fix prices to the disadvantage of users. The need for price regulation ensures competitiveness and eliminates collusion within an industry. The results highlighted above clearly indicate that though the industry is concentrated, high regulations ensure competition thrives amongst the operators. In addition, price adjustments are closely monitored and require approval as per the amendment in the Communications Act.

It's important to mention that the foregoing finding is not new in the Malawian context. The results are in line with those of the country's banking industry by Kaluwa and Chirwa (2014) where a unit increase in the HHI index led to reduction in market power by 19.32 using mark up and 0.268 using the Lerner Index. On the international scene, Fernandez and Maudó (2006) similarly, concluded that market concentration was not a significant factor in determining a firm's market power within the banking industry in Spain. In this case, factors other than increased market concentration by individual firms translated into increased market power amongst the market leaders.

Market Saturation/Penetration (SAT) is inversely related to market power at 5% level of significance on the Lerner Index, and at 1% level of significance on the Cost-Price mark-up. Therefore, we reject the null hypothesis and conclude that indeed Market Saturation/Penetration does have an impact on market power within Malawi's telecommunications industry. To be precise, a unit decrease in penetration within the market leads to an increase of market power by 2.1 when using the Lerner Index while 1.1 when using markup. The results are in tandem with the empirical findings of Calvin and Zebaze (2009) and Nunn et al (2004). Calvin and Zebaze (2009) found that a unit increase in penetration led to 2.11 decrease in market power in 30 countries that were sampled in Africa. The finding also supports the theoretical hypothesis (Tirole, 1988) which states that; as the market grows to the saturation, the firms are likely to compete on price in order to gain new market share from the competition. In a setting where market power prevails amongst firms, prices are normally fixed through collusion with non-pricing competition flourishing. This would suggest that the high market power within the Malawi's telecommunications industry would be partly attributed to the low levels of penetration within the industry. In 2016, mobile telecommunication penetration in Malawi stood at 45%, which is considerably low compared to international standards (MACRA, 2016).

Number of Employees (Ne) is negatively related at 5% level of significance on the Lerner index, while on the cost-price mark-up it is also negatively related but at 1% level of significance. Therefore, we accept the null hypothesis and conclude that increased number of employees within a firm does not have an impact on the firm's

market power within the industry. As a matter of emphasis, one unit increase in N_e leads to a reduction in market power by 0.012 on the Lerner Index while 0.016 when using markup. These results are consistent with the results of a study by Hansen and Wernerfelt (1989) which found that a unit increase in size led to a reduction of 0.259 in power. The assumption was that the more outreach an industry player has, the more market power it would possibly have within the industry. However, the assumption is not supported by the findings of the present study. On the contrary, increased outreach decreases market power. This is possibly the case because with an increased number of employees, an operator would subsequently start experiencing X-inefficiency caused by lack of effectiveness within the firm while allowing average labour cost to increase as wages rise. With increased competition, the need to adjust prices might not be justified. This in turn may eat up on the operators markup due to increased costs experienced on the wage bill, hence the decrease in market power.

The other possibility is the existence of diseconomies of scale within the firm over time due to growth. With increased number of employees as a firm grows, comes bureaucratic process and complexity in operations which may lead to decreased efficiency in production. Eventually, this may lead to increased marginal costs caused by increased overheads that may eventually erode the firm's market power on the market. An empirical example within the telecommunications industry is how Malawi Telecommunications Limited (MTL) trimmed its number of employees from 1,417 staff members in 2004 to just a mere 535 staff members by 2010 in the midst of increased competition within the industry, citing as one of its reasons for restructuring, the need for improved efficiency in its operations through a highly skilled labour force. The data on numbers of staffing levels for the industry players in Malawi for the years 2004 to 2014 is presented in appendix Table B1.

The ownership structure emerged as an insignificant influence on market power within Malawi's telecommunication industry, therefore, we neither reject nor accept the null hypothesis. This is a striking result considering foreign firms would have been expected to have a competitive edge over local firms due to their international affiliation. Athanasoglou, Brissimis and Delis (2005) came up with similar findings in their study of the Greece banking sector. Thus, there is a possibility that firm ownership structure does not play a significant role in customer's decision making

process when choosing which operator to join. Issues to do with network coverage availability, network quality and easy access to recharge vouchers may top the list during the decision making process.

Number of Service Outlets (NSO) had insignificant results during the process of analysis and it caused the problem of multicollinearity with the variable Ne whose results are discussed above. With this result in place, we neither reject nor accept the null hypothesis.

Inflation was found to be significant at 10% on the cost-price mark-up but insignificant on the Lerner Index. However, the variable has a negative relationship with market power with a unit increase in inflation leading to 0.532 decrease in market power using markup which therefore leads us to reject the null hypothesis and conclude that indeed inflation does have an impact on industry players within the telecommunications industry. These results are consistent with those of Simpasa (2010) on the study of Zambia's banking industry which established that a unit increase in inflation was responsible for a reduction in market power by 0.232. Thus, increased inflation within an economy is presumed to have negative effects on operations of different business undertakings. This is the case because continuous price increment affects consumer buying power, which in turn influences the demand side of a particular good's demand and supply equation. With this in place, there is a possibility, that high inflation within an economy affects the market power of different industries since it tends to shift the buying priorities of consumers, with most important goods such as food being prioritised while other needs such as communications maybe on the decline. The decrease in demand on products and services offered by a particular telecom operator due to shift in consumer needs would cause the operator to lose grip on its market power.

In addition, increased inflation within an economy generally means total loss of control by firms on their pricing structures since general prices of goods and commodities are being determined by market forces. Possibly, this would in turn have an inverse effect on an operator's market power within its industry.

Foreign Exchange (Exrate) was significant at 5% level on the cost-price mark-up with a positive relation to market power but was insignificant on the Lerner Index. Therefore, this means that we reject the null hypothesis and conclude that Foreign Exchange rate does have an impact on market power within Malawi's telecommunication industry. A unit gain in Exrate leads to an increase in market power by 0.058 on markup. These results are consistent with the results established by Kaluwa and Chirwa's (2014) study on the Malawi's banking industry where a unit increase in foreign exchange triggered an increase in market power by 0.0302. The positive relation between market power and variations in the local currency's exchange rate could mean that the firms have the power to immediately pass on to end users the net exchange rate losses in the event that the Malawi Kwacha has depreciated.

As is always the case, net exchange rate gains are kept by the operators in the form of profits or can be used as incentives offered to customers through bonuses or prizes offered through different competitions as a way of increasing market share. Such is the possibility within an industry that is less saturated with the players competing to gain more market share through non price competition. But as the market reaches its saturation, firms will tend to compete using pricing structures in order to retain their share (Tirole 1988). Foreign exchange gains would be advantageous to the operators as it would create a cushion against initially planned costs with the excess funds being used for competitive advantage for the firms.

The last variable, Foreign reserves (Freserves), generated insignificant results during the process of analysis caused by the problem of multicollinearity with the variable Exrate whose results are discussed above. In this case we neither reject nor accept the null hypothesis.

The appendices section Table A1 and A2 contain results that were obtained after some of the variables mentioned above during the analysis were dropped due to problems of multicollinearity. However, the findings are similar to what has been presented here.

5.4 Conclusion

The present chapter aimed at providing results of an empirical analysis obtained from the current study. The results have shown that the main variable, HHI Index which measured market concentration, is negatively related to market power in the telecommunications industry. However, variations in the exchange rate and low levels of penetration within the industry enable the operators to exercise market power.

CHAPTER 6

CONCLUSION AND POLICY IMPLICATIONS

6.1 Summary

The main objective of this study was to empirically examine the determinants of market power within the telecommunications industry in Malawi. The Lerner Index and Cost-Price mark-up margin were adopted as measures of market power. Data used was from the period spanning Q1 2004 to Q4 2014. The primary purpose of the study was therefore two-fold: measuring the impact of concentration on market power in the telecommunications industry as well as measuring the influence of different determinants on the industry's market power.

From the results presented in chapter 5, high market concentration within Malawi's telecommunications industry does have a negative relation with market power even with a few individual firms dominating the market. Market saturation is inversely related to market power; when a market is less saturated (when penetration within a market is low), industry players have no incentive to adjust their prices in order to attract more customers from competition.

Operator specific factors had three variables that were tested, these were: number of employees, number of service outlets and ownership structure. Number of employees has been found to be negatively related to an operator's market power. This means that based on the sample used, the variable has less influence within the industry and therefore, an operator cannot rely on increased number of employees to gain competitive advantage within the market. Ownership structure had insignificant results, hence its influence on market power can be disregarded.

Macroeconomic factors had inflation, exchange rate and foreign reserves as its variables. Inflation inversely affects market power as it negatively affects business operations within an industry if it continues to increase and the case is no different in

telecommunications. Variations in the exchange rate is positively related to market power within telecommunications, as industry operators have the ability to pass on exchange rate losses to customers while exchange rate gains are kept as revenue.

The model estimated in this study was diagnosed for a number of problems that are associated with panel data and the model itself. All the tests showed that the model was robust enough such that the results from the models are reliable.

6.2 Policy Implications

The results of the present study suggest that there is need to continue up holding the competitive nature of the industry by developing strong policies and legislative frameworks aimed at governing the operations within the industry if the welfare of consumers and the nation's economy at large are to be met. The regulatory authorities; MACRA and CFTC are both on record expressing concerns over the dominance of the two firms, TNM and Airtel. In a bid to avoid unfair trading, MACRA has made efforts to allow entry of new players on the market by awarding licenses to potential operators. However, barriers to entry through large capital requirements needed to establish infrastructure to run the network as stated by the 1998 Communications Act have been a major setback for new license awardees - G-mobile and Celcom. How the vetting process by the regulatory authority enabled it to award licenses to firms which do not have the capacity to run a network is questionable and requires screening because it is symptomatic of weak institutional frameworks.

However, the newly amended Communications Act 2013 which allows MACRA to use a licensing system where different entities other than the service providers are allowed to provide the infrastructure network and sell airtime on their behalf provides an ideal system. The system will help cut down cost duplications, thereby lowering operational costs for the firms. The system will allow greater efficiency, foreign exchange savings (steel, generators and fuel), and even outreach extension which would definitely cut off non-price competition and force price-competitiveness (Kaluwa 2016).

Having a specialized firm working on infrastructure alone within the industry would mean specialized operations while leaving the other consumer services to the operators. This would allow easy entry since new entrants would not be required to build their own infrastructure; they would simply rent tower space owned by the infrastructure firm. The old Communications Act required operators to build and operate a communication service system which has resulted in what are perceived to be high prices mostly contributed by cost-rising non-price competition of outreach extension via tower infrastructure. However, with the new changes, introduction of a tower company, a route that some of Malawi's neighbours, for instance Tanzania have adopted, would mean reduced operational cost to the mobile operators. This would in turn allow them to solely compete on pricing while encouraging new entrants who would bring in the much needed competition within the industry through increased service offering.

6.3 Limitations of the Study and Further Research Suggestions

The major limitation of the study is its omission of the effects of regulatory authority as an explanatory variable. The variable has a major impact on the operations of the operators since it would have demonstrated how the industry's market power responds to regulatory effects. The omission was necessitated by the fact that the information on the same was scarce because reports produced by the regulatory authority only focused on the technical parameters like network quality and availability while aspects of commercial measurements of the industry were limited.

With the introduction of mobile money facility within the telecommunications industry, it would be ideal to consider it as an area of further study, especially on its effects on market power since it is a product that has brought about a whole new dimension within the mobile telecommunication services. In addition, the service not only seems to have brought about competition within the telecommunications industry, but it has also emerged as a non-traditional banking system offering competition to the main stream financial sector service.

6.4 Conclusion

The results of the study suggest no significant existence of market power within the telecommunications industry in Malawi. Although the industry is highly concentrated with dominant firms in place, the relationship between the concentration and market power is negative. The dominant operators do not use their high market share position to influence prices charged. However, a strictly regulated environment maybe one of the major factors that ensures dominance by the firms is suppressed. Tariffs charged by firms are closely monitored and regulated and that allows the market to remain competitive. Apart from variations in the exchange rate and low levels of penetration within the industry that enable the operators to exercise market power, no other variable that was tested has proved to have influence on the industry's market power. While this is the case, the need for strong institutions and policies to guide the operations of the industry is of paramount importance if competitive behaviour is to continue being observed and adhered to.

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APPENDICES

Table A1: Regression Analysis Results after Dropping Some Variables

The study conducted an analysis after dropping some variables which either were insignificant or caused problems of multicollinearity. The results from this action are not very far from the results presented in the main text as shown below.

			Market Power- Markup	Market Power-Lerner Index
Determinants		Variables		
Operator- Specific	Number of Employees	Ne	-0.016***	0.012*
			0	-0.003
Industrial- Specific	HHI Index	hhi_index	-2.082**	-0.776
			-0.3	-3.334
	Penetration/Sat uration	SAT	-1.016**	-2.044***
			-0.111	-0.178
Macroeconomic Determinants	Inflation	Inflation	-0.140***	-0.678*
			-0.012	-0.221
	Exchange Rate	Exrate	0.096***	0.025
			-0.009	-0.023
	_cons		30.113***	17.528*
			-1.116	-4.425
	r2_a		0.93	0.61
	N		130	130
Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$				

Table A2: Regression Results using the Generalised Least Square Method (GLS)

			Market Power- Markup	Market Power- Lerner
Determinants		Variables		
Operator- Specific	Number of Employees	Ne	-0.018***	-0.018***
			-0.001	-0.005
	Ownership Structure	OS	4.573***	-18.856***
			-1.179	-4.138
Industrial- Specific	HHI Index	hhi_index	-0.598	-12.592***
			-1.344	-4.718
	Penetration/Saturati on	SAT	1.063***	1.541***
			-0.136	-0.476
Macroecono mic Determinants	Inflation	inflation	-0.033	-0.453
			-0.083	-0.29
	Exchange Rate	Exrate	0.057***	-0.033
			-0.016	-0.055
	Foreign Reserves	Freserves	0.000***	0.000*
			0	0
	_cons		30.499***	49.916***
			-1.47	-5.16
	r2_a		0.73	0.58
	N		130	130
Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$				

Table B1: Regression Data

Qu art er	Y e ar	Com pan y	Tarif f	CusBas e	inflatio n	Ex Ra te	FRes erves	Gross Talk Time In Minute s	Nos	Ne	OS	NOEQ	Penet ration %age
1	2004	1	32.00	38309.00	10.20	108.93	12337.13	20682603.00	7	333	1	93,600,000	0.72
2	2004	1	32.00	50837.00	11.30	108.91	10497.34	19525936.00	7	333	1	90,600,000	0.37
3	2004	1	36.00	67461.00	10.90	108.95	14487.18	21399422.00	7	351	1	90,000,000	0.30
4	2004	1	36.00	89552.00	13.70	108.94	14009.02	21080221.00	7	351	1	91,800,000	0.50
1	2005	1	36.00	91321.00	14.90	111.50	11111.70	24049539.00	7	351	1	93,300,000	0.69
2	2005	1	36.00	94087.00	15.90	122.99	14624.68	22971690.00	7	398	1	94,000,000	0.77
3	2005	1	40.00	96936.00	15.80	123.59	20591.42	24597037.00	7	398	1	95,000,000	0.89
4	2005	1	40.00	99881.00	16.50	123.78	19737.12	24800261.00	7	398	1	96,400,000	1.05
1	2006	1	41.00	104733.00	16.60	133.76	15361.50	27964581.00	7	398	1	97,700,000	1.22
2	2006	1	41.00	112455.00	15.30	138.99	20165.67	27025518.00	7	420	1	98,900,000	1.38
3	2006	1	41.00	189503.00	11.60	138.25	16341.87	28272457.00	7	420	1	100,000,000	1.51
4	2006	1	41.00	234389.00	10.10	139.34	18715.26	29176778.00	7	420	1	101,000,000	1.59
1	2007	1	41.00	263359.00	8.60	139.67	19107.64	32516955.00	7	421	1	103,000,000	1.61
2	2007	1	42.00	313663.00	7.70	140.66	28796.93	31848277.00	7	421	1	104,000,000	1.64
3	2007	1	42.00	373577.00	7.10	139.80	28250.36	32874951.00	9	421	1	105,000,000	1.85

4	2 0 0 7	1	42.0 0	410388 .00	7.50	14 0.3 2	3541 6.19	33926 487.00	9	421	1	106,000 ,000	2.20
1	2 0 0 8	1	42.0 0	415327 .00	8.20	14 0.4 8	2240 8.52	36129 951.00	9	433	1	106,000 ,000	2.61
2	2 0 0 8	1	48.0 0	422846 .00	8.50	14 0.5 1	3123 5.58	37032 881.00	9	433	1	107,000 ,000	2.96
3	2 0 0 8	1	48.0 0	430502 .00	9.30	14 0.5 8	2739 8.18	38226 619.00	9	473	1	108,000 ,000	3.18
4	2 0 0 8	1	48.0 0	443230 .00	9.90	14 0.6 0	3633 2.97	39913 515.00	9	473	1	111,000 ,000	3.25
1	2 0 0 9	1	48.0 0	470221 .00	9.50	14 0.6 1	1368 7.35	40143 391.00	9	473	1	114,000 ,000	3.23
2	2 0 0 9	1	48.0 0	513524 .00	8.40	14 0.6 0	2145 5.16	44086 764.00	9	473	1	117,000 ,000	3.26
3	2 0 0 9	1	48.0 0	561112 .00	7.50	14 0.6 1	3157 4.26	43438 862.00	14	494	1	118,000 ,000	3.55
4	2 0 0 9	1	48.0 0	627611 .00	7.60	14 6.0 0	2408 5.86	46957 077.00	14	494	1	118,000 ,000	4.06
1	2 0 1 0	1	46.0 0	718553 .00	8.30	15 0.8 0	3488 5.32	46678 362.00	14	494	1	112,000 ,000	4.63
2	2 0 1 0	1	46.0 0	855806 .00	7.50	15 0.8 0	3905 8.01	52484 244.00	14	494	1	106,000 ,000	5.11
3	2 0 1 0	1	46.0 0	101927 7.00	7.00	15 0.8 0	3306 5.60	49362 344.00	15	494	1	116,000 ,000	5.46
4	2 0 1 0	1	46.0 0	113368 8.00	6.30	15 0.8 0	4554 3.11	55901 283.00	15	494	1	140,000 ,000	5.67
3	2 0 1 1	1	46.0 0	159292 8.00	7.16	15 0.8 0	2915 7.01	54277 166.00	15	530	1	157,000 ,000	5.88
6	2 0 1 1	1	46.0 0	173885 6.00	7.04	15 0.8 0	3335 7.86	62481 242.74	15	530	1	168,000 ,000	6.15
9	2 0 1 1	1	52.0 0	185996 2.00	7.70	16 4.8 6	4415 5.82	56093 572.56	15	534	1	199,000 ,000	6.41
12	2 0 1 1	1	52.0 0	197269 9.00	9.80	16 4.6 5	3165 0.89	95638 474.63	15	534	1	248,000 ,000	6.66
3	2	1		193593		16	2353	83454		531	1		6.94

	0 1 2		52.0 0	9.00	11.40	6.2 6	2.19	576.62	16			301,000 ,000	
6	2 0 1 2	1	62.0 0	201012 8.00	21.10	27 0.6 2	2340 8.74	79389 680.78	16	527	1	346,000 ,000	7.21
9	2 0 1 2	1	62.0 0	216727 2.00	28.40	29 4.6 3	5431 1.42	10272 8327.6 0	16	535	1	385,000 ,000	7.44
12	2 0 1 2	1	62.0 0	215861 1.00	34.60	32 7.0 5	7591 8.29	10858 7995.0 7	16	583	1	415,000 ,000	7.61
3	2 0 1 3	1	62.0 0	213872 9.00	28.40	38 1.2 8	7632 8.49	95498 561.58	16	600	1	447,000 ,000	7.77
6	2 0 1 3	1	72.0 0	223724 0.00	34.60	34 1.6 6	1519 37.5 6	11147 8882.5 4	16	603	1	481,000 ,000	7.96
9	2 0 1 3	1	72.0 0	252465 5.00	36.40	34 1.0 7	1625 88.7 8	12274 7716.7 3	20	629	1	512,000 ,000	8.17
12	2 0 1 3	1	72.0 0	257289 8.00	27.90	42 1.3 3	1743 87.0 2	15831 4717.1 5	20	664	1	537,000 ,000	8.40
3	2 0 1 4	1	72.0 0	249811 7.00	21.70	41 8.1 1	1928 38.3 6	14103 5736.9 8	21	710	1	592,000 ,000	8.84
6	2 0 1 4	1	82.0 0	248604 7.50	23.50	39 3.4 9	1859 13.2 3	18017 1816.2 2	21	707	1	648,000 ,000	9.27
9	2 0 1 4	1	82.0 0	245060 8.20	24.00	39 5.9 9	1891 12.2 0	22380 4799.1 0	21	731	1	631,000 ,000	9.17
12	2 0 1 4	1	82.0 0	241516 8.90	22.50	48 1.0 2	2766 43.7 4	12645 8073.3 6	21	737	1	542,000 ,000	8.55
3	2 0 0 4	2	30.0 0	56748. 00	10.20	10 8.9 3	1233 7.13	24819 123.60	5	217	0	93,600, 000	0.72
6	2 0 0 4	2	30.0 0	75307. 00	11.30	10 8.9 1	1049 7.34	23431 123.20	5	217	0	90,600, 000	0.37
9	2 0 0 4	2	34.0 0	99933. 00	10.90	10 8.9 5	1448 7.18	25679 306.40	5	233	0	90,000, 000	0.30
12	2 0 0 4	2	34.0 0	132613 .00	13.70	10 8.9 4	1400 9.02	26350 276.25	6	233	0	91,800, 000	0.50
3	2 0 0 5	2	38.0 0	139492 .00	14.90	11 1.5 0	1111 1.70	28859 446.80	6	233	0	93,300, 000	0.69
6	2 0 0	2	38.0	147192 .00	15.90	12 2.9	1462 4.68	27566 028.00	6	233	0	94,000,	0.77

	0 5		0			9						000	
9	2 0 0 5	2	38.0 0	155127 .00	15.80	12 3.5 9	2059 1.42	29516 444.40	6	233	0	95,000, 000	0.89
12	2 0 0 5	2	38.0 0	160119 .00	16.50	12 3.7 8	1973 7.12	31000 326.25	6	233	0	96,400, 000	1.05
3	2 0 0 6	2	38.0 0	186762 .00	16.60	13 3.7 6	1536 1.50	33557 497.20	6	231	0	97,700, 000	1.22
6	2 0 0 6	2	40.0 0	235265 .00	15.30	13 8.9 9	2016 5.67	32430 621.60	6	231	0	98,900, 000	1.38
9	2 0 0 6	2	40.0 0	296365 .00	11.60	13 8.2 5	1634 1.87	33926 948.40	6	181	0	100,000 ,000	1.51
12	2 0 0 6	2	40.0 0	313044 .00	10.10	13 9.3 4	1871 5.26	36470 972.50	6	181	0	101,000 ,000	1.59
3	2 0 0 7	2	40.0 0	345131 .00	8.60	13 9.6 7	1910 7.64	39020 346.00	6	181	0	103,000 ,000	1.61
4	2 0 0 7	2	40.0 0	362388 .00	8.40	14 0.5 3	1563 3.83	31792 375.60	6	181	0	104,000 ,000	1.64
9	2 0 0 7	2	41.0 0	462507 .00	7.10	13 9.8 0	2825 0.36	39449 941.20	7	186	0	105,000 ,000	1.85
12	2 0 0 7	1	42.0 0	410388 .00	7.50	14 0.3 2	3541 6.19	33926 487.00	9	421	1	106,000 ,000	2.20
3	2 0 0 8	1	42.0 0	415327 .00	8.20	14 0.4 8	2240 8.52	36129 951.00	9	433	1	106,000 ,000	2.61
6	2 0 0 8	1	48.0 0	422846 .00	8.50	14 0.5 1	3123 5.58	37032 881.00	9	433	1	107,000 ,000	2.96
9	2 0 0 8	1	48.0 0	430502 .00	9.30	14 0.5 8	2739 8.18	38226 619.00	9	473	1	108,000 ,000	3.18
12	2 0 0 8	1	48.0 0	443230 .00	9.90	14 0.6 0	3633 2.97	39913 515.00	9	473	1	111,000 ,000	3.25
3	2 0 0 9	2	41.0 0	117355 9.00	9.50	14 0.6 1	1368 7.35	48172 069.20	7	194	0	114,000 ,000	3.23
6	2 0 0 9	2	41.0 0	135853 9.00	8.40	14 0.6 0	2145 5.16	52904 116.80	7	207	0	117,000 ,000	3.26
9	2 0 0 0	2	46.0 0	157267 7.00	7.50	14 0.6 1	3157 4.26	52126 634.40	9	207	0	118,000 ,000	3.55

	9												
12	2009	2	46.00	1746902.00	7.60	146.00	24085.86	58696346.25	9	207	0	118,000,000	4.06
3	2010	2	46.00	1782014.00	8.30	150.80	34885.32	56014034.40	9	207	0	112,000,000	4.63
6	2010	2	46.00	1836010.00	7.50	150.80	39058.01	62981092.80	9	207	0	106,000,000	5.11
9	2010	2	46.00	1891642.00	7.00	150.80	33065.60	59234812.80	9	207	0	116,000,000	5.46
12	2010	2	46.00	1983676.00	6.30	150.80	45543.11	69876603.75	9	207	0	140,000,000	5.67
3	2011	2	46.00	1561859.00	7.16	150.80	29157.01	65132599.20	10	207	0	157,000,000	5.88
6	2011	2	54.00	1640093.00	7.04	150.80	33357.86	74977491.29	10	177	0	168,000,000	6.15
9	2011	2	54.00	1793820.00	7.70	164.86	44155.82	67312287.07	10		0	199,000,000	6.41
12	2011	2	54.00	1886828.00	9.80	164.65	31650.89	119548093.29	10	177	0	248,000,000	6.66
3	2012	2	54.00	1891153.00	11.40	166.26	23532.19	100145491.94	10	177	0	301,000,000	6.94
6	2012	2	64.00	1922375.00	21.10	270.62	23408.74	95267616.94	13	177	0	346,000,000	7.21
9	2012	2	64.00	2068020.00	28.40	294.63	54311.42	123273993.12	13	169	0	385,000,000	7.44
12	2012	2	64.00	2115120.00	34.60	327.05	75918.29	135734993.84	13	169	0	415,000,000	7.61
3	2013	2	64.00	2074124.00	28.40	381.28	76328.49	114598273.90	15	169	0	447,000,000	7.77
6	2013	2	76.00	2167343.00	34.60	341.66	151937.56	133774659.05	15	169	0	481,000,000	7.96
9	2013	2	76.00	2447045.00	36.40	341.07	162588.78	147297260.08	15	169	0	512,000,000	8.17
12	2013	2	76.00	2426270.00	27.90	421.33	174387.02	197893396.44	17	223	0	537,000,000	8.40

3	2 0 1 4	2	86.0 0	250264 1.00	21.70	41 8.1 1	1928 38.3 6	16924 2884.3 8	17	223	0	592,000 ,000	8.84
6	2 0 1 4	2	86.0 0	248490 6.30	23.50	39 3.4 9	1859 13.2 3	21620 6179.4 6	17	223	0	648,000 ,000	9.27
9	2 0 1 4	2	86.0 0	248705 5.20	24.00	39 5.9 9	1891 12.2 0	26856 5758.9 2	17	223	0	631,000 ,000	9.17
12	2 0 1 4	2	86.0 0	248920 4.10	22.50	48 1.0 2	2766 43.7 4	15807 2591.7 0	17	223	0	542,000 ,000	8.55
3	2 0 0 4	3	15.5 0	65252. 00	10.20	10 8.9 3	1233 7.13	59979 54.87	11	1417	1	93,600, 000	0.72
6	2 0 0 4	3	15.5 0	66845. 00	11.30	10 8.9 1	1049 7.34	54672 62.08	11	1417	1	90,600, 000	0.37
9	2 0 0 4	3	18.4 0	68685. 00	10.90	10 8.9 5	1448 7.18	66338 20.82	11	1417	1	90,000, 000	0.30
12	2 0 0 4	3	18.4 0	70574. 00	13.70	10 8.9 4	1400 9.02	63240 66.30	11	1417	1	91,800, 000	0.50
3	2 0 0 5	3	18.4 0	72357. 00	14.90	11 1.5 0	1111 1.70	69743 66.31	11	1412	1	93,300, 000	0.69
6	2 0 0 5	3	18.4 0	74347. 00	15.90	12 2.9 9	1462 4.68	64320 73.20	11	1412	1	94,000, 000	0.77
9	2 0 0 5	3	18.4 0	76393. 00	15.80	12 3.5 9	2059 1.42	76250 81.47	11	1412	1	95,000, 000	0.89
12	2 0 0 5	3	22.2 0	78494. 00	16.50	12 3.7 8	1973 7.12	74400 78.30	11	1,412	1	96,400, 000	1.05
3	2 0 0 6	3	22.2 0	81497. 00	16.60	13 3.7 6	1536 1.50	81097 28.49	11	1412	1	97,700, 000	1.22
6	2 0 0 6	3	22.2 0	85800. 00	15.30	13 8.9 9	2016 5.67	75671 45.04	11	1401	1	98,900, 000	1.38
9	2 0 0 6	3	30.8 7	90330. 00	11.60	13 8.2 5	1634 1.87	87644 61.67	11	1401	1	100,000 ,000	1.51
12	2 0 0 6	3	30.8 7	95100. 00	10.10	13 9.3 4	1871 5.26	87530 33.40	11	1401	1	101,000 ,000	1.59
3	2 0 0 7	3	30.8 7	96801. 00	8.60	13 9.6 7	1910 7.64	94299 16.95	11	1401	1	103,000 ,000	1.61

6	2 0 7	3	30.8 7	99462. 00	7.70	14 0.6 6	2879 6.93	89175 17.56	11	1401	1	104,000 ,000	1.64
9	2 0 7	3	34.3 0	102198 .00	7.10	13 9.8 0	2825 0.36	10191 234.81	11	1401	1	105,000 ,000	1.85
12	2 0 7	3	34.3 0	105009 .00	7.50	14 0.3 2	3541 6.19	10177 946.10	15	1401	1	106,000 ,000	2.20
3	2 0 8	3	34.3 0	106229 .00	8.20	14 0.4 8	2240 8.52	10477 685.79	15	1401	1	106,000 ,000	2.61
6	2 0 8	3	34.3 0	107838 .00	8.50	14 0.5 1	3123 5.58	10369 206.68	15	1401	1	107,000 ,000	2.96
9	2 0 8	3	38.1 2	109473 .00	9.30	14 0.5 8	2739 8.18	11850 251.89	15	968	1	108,000 ,000	3.18
12	2 0 8	3	38.1 2	111133 .00	9.90	14 0.6 0	3633 2.97	11974 054.50	15	968	1	111,000 ,000	3.25
3	2 0 9	3	38.1 2	112602 .00	9.50	14 0.6 1	1368 7.35	11641 583.39	15	968	1	114,000 ,000	3.23
6	2 0 9	3	38.1 2	114309 .00	8.40	14 0.6 0	2145 5.16	12344 293.92	15	968	1	117,000 ,000	3.26
9	2 0 9	3	38.1 2	116042 .00	7.50	14 0.6 1	3157 4.26	13466 047.22	15	968	1	118,000 ,000	3.55
12	2 0 9	3	42.3 5	117801 .00	7.60	14 6.0 0	2408 5.86	14087 123.10	15	535	1	118,000 ,000	4.06
3	2 0 1	3	42.3 5	137172 .00	8.30	15 0.8 0	3488 5.32	13536 724.98	15	535	1	112,000 ,000	4.63
6	2 0 1	3	42.3 5	150298 .00	7.50	15 0.8 0	3905 8.01	14695 588.32	15	535	1	106,000 ,000	5.11
9	2 0 1	3	42.3 5	164124 .00	7.00	15 0.8 0	3306 5.60	15302 326.64	15	535	1	116,000 ,000	5.46
12	2 0 1	3	51.4 2	160108 .00	6.30	15 0.8 0	4554 3.11	16770 384.90	15	535	1	140,000 ,000	5.67
3	2 0 1	3	51.4 2	89760. 00	7.16	15 0.8 0	2915 7.01	15740 378.14	15	535	1	157,000 ,000	5.88
6	2 0 1	3	51.4 2	89263. 00	7.04	15 0.8 0	3335 7.86	17494 747.97	15	535	1	168,000 ,000	6.15
9	2 0 2	3		86166.		16	4415	17389			1		6.41

	0 1 1		51.4 2	00	7.70	4.8 6	5.82	007.49	15	535		199,000 ,000	
12	2 0 1 1	3	56.8 8	82744. 00	9.80	16 4.6 5	3165 0.89	28691 542.39	15	535	1	248,000 ,000	6.66
3	2 0 1 2	3	62.9 3	91806. 00	11.40	16 6.2 6	2353 2.19	24201 827.22	15	535	1	301,000 ,000	6.94
6	2 0 1 2	3	62.9 3	88434. 00	21.10	27 0.6 2	2340 8.74	22229 110.62	15	535	1	346,000 ,000	7.21
9	2 0 1 2	3	62.9 3	89800. 00	28.40	29 4.6 3	5431 1.42	31845 781.56	15	535	1	385,000 ,000	7.44
12	2 0 1 2	3	62.9 3	94206. 00	34.60	32 7.0 5	7591 8.29	32576 398.52	15	530	1	415,000 ,000	7.61
3	2 0 1 3	3	69.6 1	95311. 00	28.40	38 1.2 8	7632 8.49	27694 582.86	15	530	1	447,000 ,000	7.77
6	2 0 1 3	3	77.0 0	95380. 00	34.60	34 1.6 6	1519 37.5 6	31214 087.11	15	530	1	481,000 ,000	7.96
9	2 0 1 3	3	77.0 0	89071. 00	36.40	34 1.0 7	1625 88.7 8	38051 792.19	15	530	1	512,000 ,000	8.17
12	2 0 1 3	3	77.0 0	85607. 00	27.90	42 1.3 3	1743 87.0 2	47494 415.15	15	530	1	537,000 ,000	8.40
3	2 0 1 4	3	77.0 0	73766. 00	21.70	41 8.1 1	1928 38.3 6	40900 363.72	12	552	1	592,000 ,000	8.84
6	2 0 1 4	3	77.0 0	67978. 30	23.50	39 3.4 9	1859 13.2 3	50448 108.54	12	552	1	648,000 ,000	9.27
9	2 0 1 4	3	77.0 0	61439. 20	24.00	39 5.9 9	1891 12.2 0	69379 487.72	12	552	1	631,000 ,000	9.17
12	2 0 1 4	3	77.0 0	54900. 10	22.50	48 1.0 2	2766 43.7 4	37937 422.01	12	552	1	542,000 ,000	8.55
3	2 0 0 4	4											0.72
6	2 0 0 4	4											0.37
9	2 0 0 4	4											0.30
12	2 0 0 4	4											0.50

	0 4												
3	2 0 0 5	4											0.69
6	2 0 0 5	4											0.77
9	2 0 0 5	4											0.89
12	2 0 0 5	4											1.05
3	2 0 0 6	4											1.22
6	2 0 0 6	4											1.38
9	2 0 0 6	4											1.51
12	2 0 0 6	4											1.59
3	2 0 0 7	4											1.61
6	2 0 0 7	4											1.64
9	2 0 0 7	4											1.85
12	2 0 0 7	4											2.20
3	2 0 0 8	4											2.61
6	2 0 0 8	4											2.96
9	2 0 0 8	4											3.18
12	2 0 0 8	4											3.25
3	2 0 0 9	4											3.23

6	2 0 0 9	4											3.26
9	2 0 0 9	4											3.55
12	2 0 0 9	4											4.06
3	2 0 1 0	4	27.7 9	18163. 00	8.30	15 0.8 0	3488 5.32	32674 85.34	2	23	1	112,000 ,000	4.63
6	2 0 1 0	4	27.7 9	19007. 00	7.50	15 0.8 0	3905 8.01	47235 81.96	2	23	1	106,000 ,000	5.11
9	2 0 1 0	4	27.7 9	19890. 00	7.00	15 0.8 0	3306 5.60	49362 34.40	2	30	1	116,000 ,000	5.46
12	2 0 1 0	4	27.7 9	20814. 00	6.30	15 0.8 0	4554 3.11	50311 15.47	2	30	1	140,000 ,000	5.67
3	2 0 1 1	4	27.7 9	11897. 00	7.16	15 0.8 0	2915 7.01	37994 01.62	2	30	1	157,000 ,000	5.88
6	2 0 1 1	4	27.7 9	13233. 00	7.04	15 0.8 0	3335 7.86	56233 11.85	3	30	1	168,000 ,000	6.15
9	2 0 1 1	4	27.7 9	15246. 00	7.70	16 4.8 6	4415 5.82	56093 57.26	3	44	1	199,000 ,000	6.41
12	2 0 1 1	4	30.8 7	16967. 00	9.80	16 4.6 5	3165 0.89	86074 62.72	3	44	1	248,000 ,000	6.66
3	2 0 1 2	4	30.8 7	16820. 00	11.40	16 6.2 6	2353 2.19	58418 20.36	3	44	1	301,000 ,000	6.94
6	2 0 1 2	4	34.3 0	15972. 00	21.10	27 0.6 2	2340 8.74	71450 71.27	3	44	1	346,000 ,000	7.21
9	2 0 1 2	4	34.3 0	14880. 00	28.40	29 4.6 3	5431 1.42	10272 832.76	3	49	1	385,000 ,000	7.44
12	2 0 1 2	4	34.3 0	14494. 00	34.60	32 7.0 5	7591 8.29	97729 19.56	3	49	1	415,000 ,000	7.61
3	2 0 1 3	4	38.1 2	13877. 00	28.40	38 1.2 8	7632 8.49	66848 99.31	3	49	1	447,000 ,000	7.77
6	2 0 1 3	4	42.3 5	13661. 00	34.60	34 1.6 6	1519 37.5 6	10033 099.43	5	53	1	481,000 ,000	7.96
9	2	4		13623.		34	1625	12274		53	1		8.17

	0 1 3		42.3 5	00	36.40	1.0 7	88.7 8	771.67	5			512,000 ,000	
12	2 0 1 3	4	42.3 5	13637. 00	27.90	42 1.3 3	1743 87.0 2	14248 324.54	5	53	1	537,000 ,000	8.40
3	2 0 1 4	4	42.3 5	12674. 00	21.70	41 8.1 1	1928 38.3 6	98725 01.59	5	60	1	592,000 ,000	8.84
6	2 0 1 4	4	42.3 5	12027. 50	23.50	39 3.4 9	1859 13.2 3	16215 463.46	5	60	1	648,000 ,000	9.27
9	2 0 1 4	4	42.3 5	11396. 30	24.00	39 5.9 9	1891 12.2 0	22380 479.91	5	60	1	631,000 ,000	9.17
12	2 0 1 4	4	42.3 5	10765. 10	22.50	48 1.0 2	2766 43.7 4	11381 226.60	5	60	1	542,000 ,000	8.55