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PRICE DYNAMICS AND COMPETITION IN ETHIOPIAN MANUFACTURING INDUSTRIES

BY
ABENEAZER ADAM

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Price Dynamics and Competition in Ethiopian Manufacturing Industries

Abeneazer Adam Admassu

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This is to certify that the project prepared by Abeneazer Adam, entitled: Price Dynamics and Competition in Ethiopian Manufacturing Industries and submitted in Partial Fulfillment of the Requirements for the Degree of Master of Arts in Economics (Competition Policy and Regulatory Economics) complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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Tekie Al[signature]	[signature]	12/06/2012

Abstract

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Abeneazer Adam
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This paper explores the effect of market structure on price dynamics in 47 (ISIC-4) Ethiopian industries. A number of researches, notwithstanding the theoretical ambiguity, tend to confirm that the speed at which industry prices adjust to market fluctuations is a negative function of the degree of industrial concentration. That is industries in a more competitive market are expected to instantly respond to cost and demand shocks, whilst those industries in a concentrated market structure are assumed to adopt price smoothing strategies which manifests in less frequent price adjustments. The purpose of this paper is to provide evidence on the much implied systematic variation in price adjustment associated with difference in the degree of market competitiveness. The partial adjustment model, following Encoua and Geroskie (1986), is used to analyze how industry prices react to cost and demand shocks. The empirical results seems to indicate that (1) sluggish price adjustment only prevail in moderately competitive industries; (2) Prices in all groups appeared to be more sensitive to cost shocks but virtually not at all to demand shocks.

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Acronyms

2SLS: Two Stage Least Square

C_{IT} : Rate of Change in Cost

CR2: Two firm Concentration Ratio

CSA: Central Statistical Agency

Dem_{IT}: Demand Index

GLS: Generalized Least Square

ISIC: International Standard Industry Classification

IV: Instrumental Variable

OECD: Organization for Economic Cooperation And Development

OLS: Ordinary Least Square

P_{IT}: Rate of Change In Price

SCP: Structure-Conduct-Performance

SKTEST: Skewness Kurtosis Test

CHAPTER ONE
INTRODUCTION

1.1 Statement of the problem

The tie between market structure and pricing behavior of firms has long been a central issue in industrial economics. Ever since Means (1935) administered price hypothesis, numerous researchers attempted to provide theoretical and empirical evidence on the relationship between industrial concentration and the speed of price adjustment in response to economic fluctuations. According to Means (1935), administered prices result from having few firms dominating a given market, making price adjustment less frequent by collective action in highly concentrated industries.

When there are shocks that affect the cost structure or the demand for their products, firms must figure out how to respond. One response variable is the price that firms charge on their final product. Assuming a profit maximizing firms in a monopolistically competitive environment, market fluctuations with respect to average cost and demand are expected to be addressed by price adjustment. However, price alteration might not be instantaneous. Without the need to be exclusive, information asymmetry, long term contract with customers, fear of breaking cartel arrangements, menu costs and delayed decision making in state owned enterprises might holdup immediate response.

In macro economics, the effect of unexpected changes is dealt under the sticky and flexible price models paradigms (Geroski, 1992). Under the assumption of market clearing prices are presumed to move quickly to restore market equilibrium. In the Walrasian realm, for market clearing to hold, prices must be flexible to instantly adjust to demand and supply shocks. Straining on sticky prices, the "new Keynesians", assume market imperfections: effected when prices are set by long term contracts, costly information, menu cost and the like. Paradoxical to the roots of price stickiness, in a price setting survey regarding the relative importance of various theories of price rigidity, firms attach momentous value to "customer relation" devising menu cost and information cost relatively less important (Kleschelskiy and Nicolas, 2007).

This inclination towards customers can be explained by the urge of firms to maintain their relative position in the market. The structure of the market imposing its own influence, Alvarez (2006) and Geroski(1992), firms with market power are likely to have low rate of time preference: placing more emphasis on long term returns, thus adopting pricing policies that smooth out expected fluctuation in cost and demand. Inferring that, firms in a more competitive industry facing unrestrained rivalry, have the incentive to alter prices in response to shocks. These firms are more likely to adopt pricing policies which reflect variations in cost and demand by equating, at each period, marginal costs and revenues as future market position is uncertain (Encaoua and Geroski, 1983).

Post Second World War, the structure-conduct-performance paradigm was dominant in systematically analyzing the relationship between market structure and firms behavior (Martin, 1993). Market structure, expressed in terms of number of firms, product differentiation, entry barriers, and vertical integration between upstream and downstream firms, set an influence in firms conduct (pricing behavior, marketing strategies and research and innovation) which intern determine their performance (profit, production and allocative efficiency).

Pricing behavior of firms is relevant for long run market structure developments as it can reveal important insights into the competitive situation on the markets (Smolny, 2011). According to Fabiani (2005), pricing behaviour of firms may broadly be categorized in to two broad groups: time dependent and state dependent pricing. In the time dependent model of Calvo (1983), firms could not change their prices whenever they like, rather should hold prices constant for some given stochastic period of time. In contrast, in the state dependent model, pricing decision is endogenous and firms will alter their prices instantaneously after a shock provided the benefits from price change exceeds the adjustment cost.

At the same time, Bilnder (1982) and Amihud and Mendelson (1983), provided theoretical treatment of pricing behavior by considering inventory adjustment. They emphasized that "price smoothing" does not necessarily mean lack of responsiveness to market fluctuations, it rather meant an optimal choice of firms to moderate these fluctuations through the use of inventories and backlogs.

However that might be, it is noticeable the co-existence of markets exhibiting highly contrasting degrees of price flexibility. Respective studies found systematic and contrasting inter- industry variations on the way prices respond to shocks.

Results from Domberger (1979), Geroski (1992), Crlton (1986) and Alvarez (2006) conveys strong correlation between market concentration and price rigidity. That is, industries with high level of concentration – those considered to be relatively uncompetitive- tend to take longer to adjust prices. While the conventionally termed competitive markets-on the base of industrial concentration- are characterized by high degree of price responsiveness.

On the other hand, Shaanan and Feinberg (1995) and Oladunjoye (2006), proposed the effect of market structure is not economically significant to warranty policy intervention. Suggesting, perhaps the notion of concentration might not capture all dimension of market structure.

Based on this, the purpose of this paper is to provide evidence on the much implied systematic variation in price adjustment associated with difference in the degree of market competitiveness. Previous studies in this area were conducted in advanced economies with a relativity well functioning market. In contrast, the majority of manufacturing industries in Ethiopia are state owned with only a recent history of private sector participation. Further, in developing countries where antitrust laws governing market conduct are missing; concentrated industries may have the audacity to coordinate their actions to achieve collusive equillibra. For instance, oligopolistic theories suggest that firms might be reluctant to constantly alter prices with the caution of avoiding price wars. Absence legal restriction and proper enforcement mechanisms might allow firms to have some coordinating mechanism which can facilitate quick price response without the fear of staring price wars. Arguing that there might not be significant systematic difference in price dynamics attributed to market structure.

This study is destined to answer the following research questions. are there evidences for intertemporal price smoothing policy? Are there inter-industry differences in the way prices respond to shocks? Are prices more sensitive to demand shocks viz-a-viz cost shocks?

1.2 Objective of the study

1.2.1 General objective

The overall objective of the study is to assess the effect of market structure on the speed of price adjustment to cost and demand shocks. The purpose of this paper is to provide evidence on the much implied systematic variation in price adjustment associated with difference in the degree of market competitiveness.

1.2.2 Specific objectives

The specific objectives are to analyze

- speed of adjustment of current price to the target
- sensitivity of the target to current imported cost variations
- sensitivity of the target to current domestic cost variations
- sensitivity of the target to current demand pressure

- rate of growth of the target independent of current cost variations

1.3 Hypothesis of the study

In this study it is hypothesized that:

- Considering the aforementioned market condition of the country, firms in the economy, whether in a competitive market structure or otherwise, are expected to instantaneously adjust output prices rather than adopting price smoothing policy in an inter-temporal framework.
- Bearing in mind how the rise in domestic demand is being accounted chronicled to the rising inflation, price adjustments are expected to be more sensitive to demand shocks viz-a-viz cost shocks.

1.4 Methodology and Data

1.4.1 Methodology

The partial adjustment model, following Encoua and Geroskie (1986), is used to analyze how industry prices react to cost and demand shocks on an unbalanced panel data collected for the period 2004-2010. Much of the literature on the rate of price adjustment and market structure depends on the partial adjustment model, where current price is treated as a weighted average of previous price and the target price or the long run equilibrium price.

To identify the market structure the conventional concentration ratio is used. This index is not available from official source, thus was constructed for all the periods from 2004-2010 using large and medium scale industry surveys collected by the Central Statistics Agency.

1.4.2 Data

The sample to determine the speed of price adjustment comprised a total of forty-seven Ethiopian manufacturing industries identified as large and medium scale at Four-digit International Standard Industry Category (ISIC) level during the period 2004 to 2010. The data used to construct series for industry price, average unit cost, and demand index and within industry competitiveness are obtained from Ethiopian Central Statistics Agency. This study utilizes an unbalanced panel data because industries die out and new industries emerge during the study period. The minimum and maximum period of observation being 2 and 7 years respectively, and 25% of the observation having the maximum period

1.5 Limitation of the study

This research paper is expected to face certain slowdowns. One is the shortage of literature on the subject in less industrialized and ill structured market systems, specifically on Africa. The other hindrance might be the lack of data on each and every sector of Ethiopian industries, concentration ratio and other indicators of market condition. In addition, some industries do not report their performance indicators with full accuracy. All these problems are expected to hinder this research paper's flawless progress.

1.6 Organization of the paper

The rest of the study proceeds as follows. Chapter two will be the review of literature where the theories on speed of price adjustment as well as some empirical studies will be discussed. Chapter three will be the data analysis followed by the final chapter which concludes and state the policy implications of the study.

CHAPTER TWO:
REVIEW OF LITRRATURE

Theoretical Literature

2.1.1 The structure-conduct-performance paradigm

The relationship between firm behavior and market structure has been centric in the field of industrial organization. The methodology of the structure- conduct- performance framework dominated industrial economics post second world war century (Martin, 1993). It provides a systematic way of analyzing markets and industries.

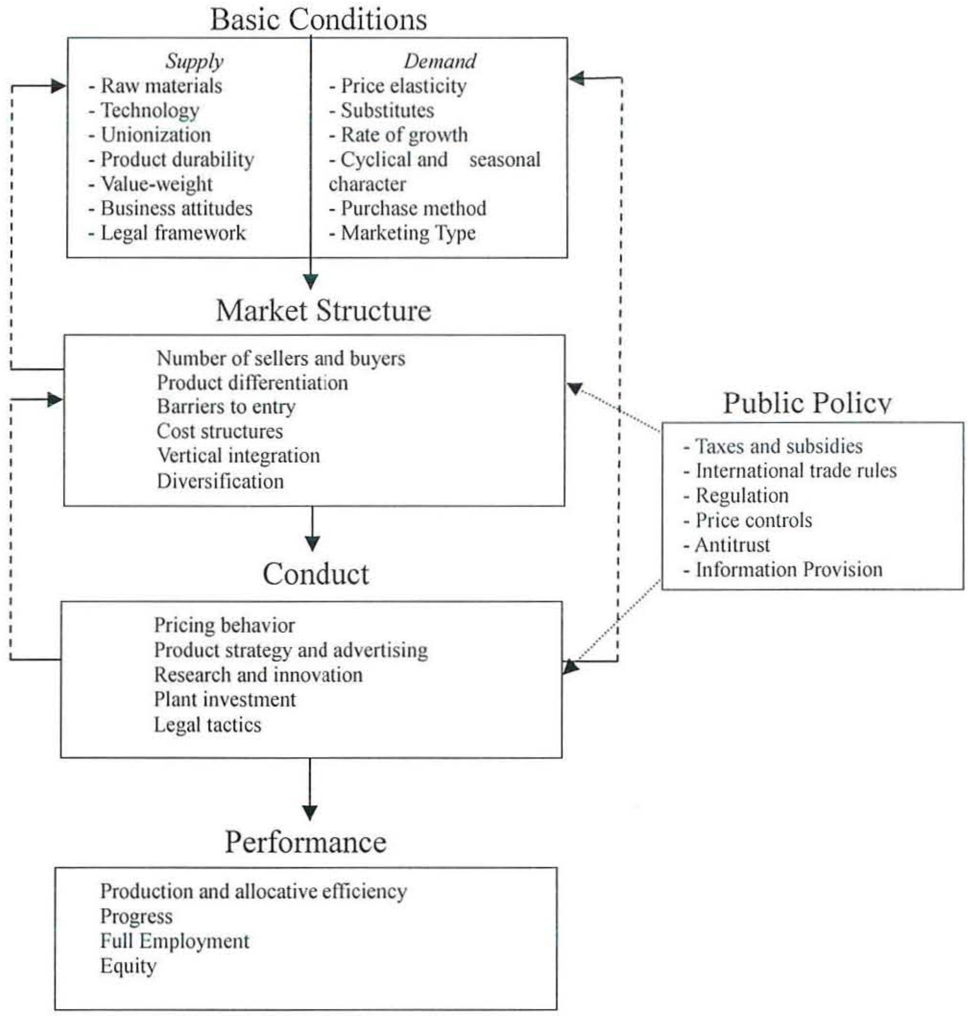

Figure 1. The structure-conduct-performance paradigm

source: Scherer, F. M., & Ross, D. (1990)

"The central hypothesis (of the SCP framework) is that observable structural characteristics of a market determine the behavior of firms within that market, and that the behavior of firms within a market, given the structural characteristics, determines measurable performance." (Cassey Lee, 2007)

The SCP hypothesis posits casual relationship between market structure, firm behavior and their performance; that, market structure determines conduct and conduct in turn influence performance.

The analysis of the determinate of market structure is the base to the study of market conduct. According to Heywood (2006), "a market is usually defined as a region within which and a group of varieties for which prices tend to equality, adjusting prices for difference in cost of supply and for differences in product characteristics". Market structure, which is the environment within which firms operates, is composed of two class of variables (Casey lee, 2007): intrinsic variables, which are determined by the nature of products and the production and marketing technologies, and derived variables, those determined by firms and government .

The traditional approach of examining market structure is to measure the number and size distribution of firms. Concentration perhaps being the most prominent aspect of market structure, analysis of condition of entry and exit is central to the structure-conduct paradigm. As Martin (1993), market characteristics sought to include the ease and difficulty with which new firms could come into the market.

As Bhandari (2010), conduct is the behavioral rules followed by various market agents or even the potential entrants to choose the variables under their control. It can be rephrased as a firm's policies toward its market and toward the moves made by its rivals in that market. Conduct determines pricing and non pricing strategies: such as, research and development, collusion, mergers, product strategies and advertising.

The commonly known market structures are perfect competition, monopoly, oligopoly and monopolistic competition. Firms in the competitive market tradition of the neo-classical tradition are price takers, an institutional framework which ensures perfect price flexibility, whereas in quasi-competitive markets price adjustments are carried out by each firm unilaterally though not in isolation from its rivals (Domberger, 1979). The prevailing conception is that, imperfect competition provides firms the ability to have some degree of control over their prices. In addition, firms in a more concentrated market structure are expected to lag behind in adjusting their prices as response to fluctuations in market conditions.

2.1.2 Market structure and price dynamics

"*Whether or not price rigidity is efficient, one common conclusion emerging from models with price rigidity is that markets with rigid prices behave very differently than markets with flexible prices*"

Carlton, 1986

The gist of market structure on price dynamics have long been a contentious topic in industrial economics. The theoretical relation between industrial concentration and the speed of price adjustment dates back to Means' (1935) administered price hypothesis. An administered price, resulting from having few entities dominating a given market, is a price which is set by administrative action and held constant for a period of time (R. Kamerschen, 1999). The implication is, firms in a highly concentrated market change their prices less frequently than competitive firms. An alternative explanation provided by P. Cagan (1975) is that, prices of concentrated industries are slow to respond to shifts in demand and tend to lag behind inflationary movements. Recent works by P. Cagan (1973), L.A. Winters (1981), Encoua and Geroski (1986), Bedrossian and Moschos (1988), Shaanan and M. Feinberg (1995), J. Álvarez and Hernando (2006) and Matsuoka (2011) seem to confirm the inverse relation between concentration and speed of adjustment. However, there is no consensus on a theory to explain why prices in some industries are inflexible (Shaanan and M. Feinberg, 1995).

For long, though not clear cut, several alternative theories have been put forward in an attempt to explain nominal price rigidities in concentrated markets. Without being exclusive, the kinked demand theory, full cost pricing, long term contractual agreement, limit pricing, price leadership and collusive agreements are proposed with their own virtues and criticism.

Sweezy's (1939) kinked demand theory of oligopoly upholds that rivals follow price decrease but not price increase (Kamerschen, 1999). The argument goes, individual firms face kinked demand curve at the existing price level and as a consequence, prices will not change for small variations in cost and demand (Sen, 2004).

In the Keynassian macro model prices are considered to be sticky and adjust gradually in response to different type of shocks. Various explanations for nominal price rigidity has been put forward. the most common are, as sited in sauce (2011),imperfect competition and market structure (Stiglitz (1984), collusion (Athey *et al.* (2004), goods heterogeneity, (temporary) monopoly rent, entry barriers, sunk costs, menu costs (Akerlof and Yellen (1985) and Mankiw (1985)), coordination failure (Cooper and John (1988), Ball and Mankiw (1994) and costly information acquisition (Kiley (2000).

In a price setting survey conducted by Kleschelskiy and Nicolas (2007), the main reason why firms keep prices stable is that they are concerned about losing customers or market share. Invariable empirical result was also found by Alvarez et.al (2005) underlying that "implicit contacts" ranks first among the explanations. The theme behind "implicit contract" is that firms want to establish long-run relationship with their customers biding to make their future sales more predictable

However that might be, it is though apparent the co-existence of markets exhibiting highly contrasting degrees of price flexibility, from nearly-perfectly flexible to nearly-fix prices. A pile of researches, Domberger (1979), Canton (1986), Geroski (1992), Smolny (2001), Alvarez and Hernando (2006) and Dias et al (2009), on price adjustment and market structure found substantial degree of heterogeneity in the frequency of price adjustment across products and markets. There is also pervasive evidence of asymmetry in response to changes in costs during high inflation which tends to disappear during low inflation (Buckle, 1996)

Relaying on the SCP paradigm, Encoua and Geroski(1986) implied that markets that are structurally concentrated tend to take longer time to respond to shocks; as they expect to rip the benefits in the future with some certainty about the security of future market position than those firms in a more competitive Environment. Under such circumstances, Encaoua and Geroski pin point that price smoothing policy is optimal than instantaneous adjustment. When facing increasing costs of adjusting price, firms set their current price as a weighted average of lagged and future expected price; thus, the smaller are the benefits from adjusting more rapidly relative to the cost of adjustment, the more slowly firms adjust their price towards the optimum (Small and Yates, 1999).

Alvarez (2011) further highlights that firms in a highly competitive markets are more likely to adjust their prices in response to shocks, since the opportunity cost of setting non-optimal prices is higher for a given cost of price adjustment, competition should make it more likely that prices will change in response to shocks (Small and Yates, 1999).

In like manner, Saouc (2011) plowed the rational for entrepreneurs to aim at the long term survival of the firm and pegged the exploitation of short term and ephemeral profit opportunities scant. Based on Lachmann's work on capital and structure in 1956, sauce drew a distinction between two ideal types of economies; the first mainly aim to maximize stock turnover, the other aim of maintaining a unitary margin between the average total cost of production of the commodity and its selling price. In the later, "mark up" pricing policy is adopted where the adjustment variable is not the selling price, but the quantity produced. Hence demand shocks for the industrial goods does not cause a fluctuation in their price.

2.1.3 Price setting behavior: time-dependent verses state-dependent

Pricing behavior of firms is relevant for long run market structure developments as it can reveal important insights into the competitive situation on the markets (Smolny, 2011). Firms operating in a competitive environment are expected to employ a flexible pricing strategies which gives them greater ability to respond to changes in the market. Under perfect competition, prices are set at a unique market clearing level which is equal to the marginal cost of production. However, Alvarez (2005), under the new keynassian framework firms is assumed to operate in monopolistic markets; consequently, most of them possess some degree of price setting autonomy. In support of this assumption, empirical evidence by Fabiani(2005) of pricing behavior in euro area conveys that firms operate in a monopolisticaly competitive market; where prices are mostly set following the mark up pricing rule. In the literature, pricing behavior of firms may broadly be categorized in to two broad groups; time dependent pricing and state-dependent pricing.

Time dependent models are characterized by the fact that agents decision of changing prices is exogenous: prices change independently of the state of the economy at a fixed (Taylor, 1980) or randomly (Calvo, 1983) selected times (Dias, 2005). Clavo (1983); assuming price-change signal is "stochastically independent across firms", those which received a signal can change its price optimally at period ***(t)*** but must maintain that price for *(periods* > ***t)*** until the next signal is received. Clavo developed the random duration model of staggered price model where some fixed percentage of firms change their price in every period (Benkovskis, 2011). Time dependent models imply that firms could not change their prices whenever they like or at every point in time, rather should hold prices constant for some given or stochastic period of time.

In state dependent models, price change decision is endogenous and firms review their prices only when there is a sufficiently large shift in market conditions (Alvarez, 2005). Firms facing constant adjustment cost will change prices if the difference between its actual price and its desired price exceeds a given threshold: the larger is the tolerated difference between the frictionless optimal price level and the actual price level

(Aucremanne, 2005). At every moment, firms can adjust their prices on the evaluation of the costs and benefits of price change (Dias, 2005). Under the state dependent rule, Benkovskis (2011), the probability of changing prices depends on the state of the economy; on variables describing the last price change, inflation and demand. Therefore, firms will adjust their prices instantaneously after a shock given that the benefits from price change exceeds the adjustment cost.

Though theoretical explanations are not definitive as to which of the pricing mechanisms firms follow, various empirical researches provides evidence for both types of pricing strategies. Fabiani(2005) provides evidence that firms in euro area follow both time-dependent and state-dependent strategies; where, one third of the companies follow mainly time dependent pricing while the remaining uses pricing rules with some elements of state-dependence. Kwapil (2005), while investigating price setting behavior of Austrian firms, also found evidence that firms in the sample follow time-dependent as well as state-dependent pricing rules. Pattern which is well-matched with the existence of both types of pricing setting characteristics is also found in Belgian industries (Cornille, 2006). Conversely, Dias (2005) inferred that, time dependent models are unable to adequately describe the pricing setting behavior of Portuguese firms. On the other hand, Benkovskis *et.al* (2011) pointed out that time dependent models are quite popular among Latvian firms. All in all, it can be said that firms pricing has both time-dependent and state-dependent elements.

2.1.4 Price smoothing and inventory

Papers by Bilnder (1982), Amihud and Mendelson (1983) and S.Lai (2001) provided theoretical treatment of pricing behavior by considering a multi period profit maximizing firm. Blinder(1982) highlighted that, firms with steep marginal cost schedules will display strong price response and weak output response, whilst those with flat marginal cost curve will display weak price response and strong output responses. He further surmised, both price and output adjustment becomes smaller as the less persistent the demand shock and the less costly it is to vary inventories.

Amihud and Mendelson (1983) derived the optimal multi period policy of an expected-profit-maximizing firm under uncertainty in both output and demand. They considered firm which produce a homogeneous product, has an option to hold inventories or create backlogs (unfilled orders) and has to decide in each period on the sale-price and the expected level of production. The firm incurs three type of cost: "production cost", "inventory holding cost", and "shortage penalty cost". They derived the optimal policy of the firm on price and expected level of production by optimizing a discounted dynamic programming problem. They demonstrated that price smoothing as an optimal policy.

"*That is, an increase in the quantity at hand.... induces the firm to increase its sales through lowering prices (since q is a strictly decreasing function of p). Note that the sales-adjustment is only partial,...... This is because even when the quantity at hand is unexpectedly high, the firm will not "dump on the market" the whole quantity since this requires an undesirably sharp price decline. Similarly, when there is an unexpected shortage, the firm will reduce expected sales only by a fraction of this shortage to take advantage of the higher prices.*"
source: Amihud and Mendelson (1983)

They further emphasized that "price smoothing" does not imply lack of fluctuation in response to market conditions, rather, it is optimal for firms to moderate and restrain these fluctuations through the use of inventories and backlogs.

Blinder(1982) supported Amihud and Mendelson's (1983) argument by confirming firms whose marginal costs of inventory holding are fairly constant will undergo little price and output adjustment, relaying on inventory arrangements to observe the shocks. Both works showed that firms ability to hold inventories has a smoothing effect on prices, inventories can take up the slack between the quantity available for sale and the quantity produced.

2.1 Collusion and price rigidity

Firms can also have some control over prices if they act in a collusive manner. In oligopolistic industries, collusive firms are often observed to be reluctant to change prices in response to market fluctuations. one rational provided by Stigliz (1986) is that, firms cannot differentiate between cases when rivals change their prices to cheat on the collusive arrangements, and when the change is a response to demand fluctuation. Traditional models of stable prices have been based on the assumption that oligopolies try to avoid frequent price adjustment because it might signal potential defections in the "informal" agreement on prices (Ross and Wachter, 1975). Repeated game theoretic approaches by Athey *et al* (2002), Garrod (2011) and Hanazono and yang (2005) have demonstrated that a price rigidity scheme, under certain conditions, is optimal in collusive arrangements.

Athey et al (2002) focused on symmetric perfect public equilibria (SPPE), where firms only use only publicly available information at each point to coordinate their pricing schedule and any punishments are borne equally by all firms. They considered an infinitely repeated Bertrand game in which prices are publicly observed and each firm receives a privately observed i.i.d cost shocks in each period. Under the assumption of inelastic demand they established that, if firms are sufficiently patient and the distribution of cost is log-concave, optimal symmetric collusion is characterized by price rigidity.

Similarly Hanazono and Yang (2005) considered symmetric perfect public equilibria (SPPE) in an infinitely repeated Bertrand game in which an i.i.d demand shock occurs in each period. They focused on how information asymmetry among firms limits colluding firms' ability to respond to shocks. They proposed that, if the accuracy of private demand predictability is low, the optimal collusion a class of systematic equilibria exhibits price rigidity. The intuition provided is, if signal accuracy is low, informational gain is lower than coordination costs, hence pooling (rigid price) is better.

Garrod (2011) provided a game theoretic support to the kinked demand curve results by analyzing an infinitely repeated game where unit cost fluctuate stochastically over time and firms price-matching strategy. The expectation that deviation prices will be matched can lead to price rigidity during collusion. Garrod concluded that, the best collusive prices can be rigid over time when cost fluctuation is sufficiently small.

2.2 Empirical Literature

Much of the work on the effect of market structure provides empirical evidence than a clear cut theoretical explanation. Market theories falling to bring home the bacon, the nature of relationship between market structure and price dynamics is much more of an empirical question than a theoretical debate. Diverse studies posit mixed evidence concerning the relationship between the speed of price adjustment and industrial market concentration. Though most of the results initiate concentrated industries to lag behind in their price adjustment, studies by the likes of Domberger(1979) and Bhattacharya and Olive (2007) found some positive causality.

Encaoua and geroski (1986) examined price dynamics and competition in five OECD countries (Canada, Japan, United States, United Kingdom and Sweden). They alleged concentrated industries to extensively smooth their prices as their market power ensures stability of future market position, while more competition induces less power to ensure persistence of market position, thus greater emphasis is placed to current returns. considering price smoothing as adjustment to a moving target in a partial adjustment framework, they estimated the "speed of adjustment of current prices to the target", "sensitivity of the target to current cost and demand variations" and the "rate of the growth of the target independent of cost variations". They pooled time series and cross section data on price, cost, output and inventory, by allocating industries to fairly broad "industry group". For instance, where concentration ratios were used, industries were grouped into: low, medium and high concentration classes. The results from Japan, United States and United Kingdom strengthen the hypothesis that concentrated markets exhibit inflexibility in their prices adjustment to current demand and cost fluctuations. They also observed cross-country heterogeneity in the speed of adjustment; Sweden seems to be highly inflexible in more closed sectors, in Canada the important feature of sluggish sectors is that they are heavily dominated by foreign-owned firms.

Bedrossian and Moschos (1988) queried the speed of price adjustment for Greek manufacturing sector (two digit ISIC) using quarterly data for the period 1963.Q1-1977.Q4. Their empirical analysis is based on the familiar partial adjustment mechanism which is conducted using two-step estimation procedure; where, the first step is concerned with fitting a set of price adjustment equation to time series data to obtain the speed of price adjustment coefficients and the second step examines the effects of industrial concentration on the price adjustment speed by means of cross-section analysis. Their findings from the data convey that the length of the production period and industrial concentration exerts negative effect on the speed at which prices adjust to changes in cost. They further highlighted that; the size of the concentration index coefficient on speed of adjustment is not *a priori* predictable unless the industry profitability and the leadership effect are distinguished

Shaanan and Feinberg (1995) analyzed the effect of dynamic competitive factors on price adjustment for a sample of 31 four digit U.S manufacturing industries over two time periods using non-linear (Gauss Newton) estimation. The target price is described as a function of cost, demand and market structure with the introduction of dynamic elements of competition plumbed by several disaggregated measures of domestic and import entry. They reasoned that their line of approach is different from the like followed by Encaoua and Gerski, claiming the later to bear particular attention to static competitive factors such as: market concentration, import ratios and degree of foreign ownership. The outcomes of their estimation tip concentration to have the expected negative effect on the speed of price adjustment, though the coefficients are barely significant. The effects of disaggregated domestic entry vary considerably by the type of entry, whilst import entry has a more clearly marked negative upshot on the speed of price adjustment. Shaanan and Feinberg painted the picture that, when investigating price flexibility, the inherently static notion of concentration does not capture all dimensions of competition.

Similar conclusion was reached by Oladunjoye (2006) while investigating the effect of market structure on speed of price adjustment in the U.S wholesale gasoline market. The results proposed that the effect of market structure is not economically significant enough to warranty policy intervention in the Gulf coast and New York wholesale gasoline spot market.

Álvarez and Hernando (2006) explores a number of factors explaining cross industry heterogeneity in the degree of price stickiness using information provided by surveys on pricing behavior in nine euro area countries. Their result substantiates, the pricing policies of firms operating in a more competitive environment demonstrates greater flexibility. They concluded that the price setting strategies of firms in a more competitive market structure provide them with greater capacity to promptly respond to shocks. Álvarez, Hernando and Burriel (2011) lighted, from policy perspective, the relevance of evaluating the response of the economy to changes in the degree of market competition.

Adopting the long-familiar partial adjustment framework, Domberger (1979) investigated price adjustment for twenty-one British industries using quarterly manufacturing data from 1963-1974. In the regression equation, wholesale price index is expressed as a function of its lag, material and fuel cost, unit labor cost and the adjustment coefficient which was then liked to indicators of industry structure. Expecting price adjustment in engineering industries to be significantly different from non engineering sectors, on account of divergence in gestation period, Domberger included a dummy variable for engineering industries. Changes in concentration were also included as additional explanatory variables to inflict the potential influence of changes in industrial structure, the 1963 merger boom, on the adjustment coefficient, which represent an average for the period1963-74. Based on the two-stage generalized least square estimation, Domberger's finding negates the administered price hypothesis, pin pointing more concentrated industries were able to raise their prices more quickly than less concentrated industries.

Winters (1981), in his comment on Domberger's (1979) work on price adjustment, contended that Domberger neither specified nor estimated his concentration-adjustment link correctly. Winter raised two questions regarding the specification. The first pertains the treatment of industrial structure change brought by the merger boom of the 1960s. Winters pointed out that, Domberger estimates a single, average, value of the adjustment coefficient for each industry and tries to relate this to changes in concentration. Winters insisted that, an average adjustment coefficient should be related to an average concentration, not to change in concentration.

The second concerns the inclusion of engineering dummy variable. Winters Repudiated Dombergers rational by stating that his notation implies that the desired prices adjust more slowly, not that actual price approaches desired price more slowly.

Winter re-estimated the adjustment concentration equation for engineering industries accounting for the two concerns. The results refuted Domberger's hypothesis that industrial concentration raise the speed with which prices respond to market fluctuations.

In his work on industry structure and speed of price adjustment, Dixon (1983) investigated the relationship between the lag (adjustment) parameters, and various explanatory variables: length of production period, industry concentration and degree of interdependence between firms in an industry. He used the weighted least square estimation to account for the heteroscedasticity introduced because of the fact that the dependent variable, the lag parameter, "is itself a coefficient estimated from its own 'fitted' equation". The result displays, though insignificant, concentration ratio has a negative coefficient, whilst the coefficient on production period (negative) and interdependence between firms (positive) are significantly different from zero at the 10% level. Dixon postulates, the higher the concentration ratio and the smaller the number of firms the lower the value for the lag parameter, thereby, the slower is the rate of adjustment.

CHAPTER THREE

METHODOLOGY AND DATA ANALYSIS

3.1 Methodology

Much of the literature on the rate of price adjustment and market structure depends on the partial adjustment model, where current price is treated as a weighted average of previous price and the target price or the long run equilibrium price.

$$P_t - P_{t-1} = \lambda(P^*_t - P_{t-1})$$

or equivalently

$$P_t = \lambda P^*_t + (1 - \lambda)P_{t-1}$$

As justified by Amihud and Mendelson (1983) price smoothing is an optimal inventory policy of an inter-temporal profit maximizing firm operating under demand and output uncertainty. Following Encoua and Geroskie (1986) price smoothing can be viewed as the adjustment of current price to a moving target. The model assumes prices at any time *t* moves towards their long run market clearing value with incomplete adjustment in each period. There are two transmission channels in which current shocks in cost and demand are translated into current price change. First current shocks affect the target price level and, then, changes in the target are passed in to current price. Thus, the price smoothing model is composed of two equations:

$$(1) \qquad P_{it} = \lambda_{it}P_{it}^* + (1 - \lambda_{it})P_{it-1}$$

$$(2) \qquad P_{it}^* = m_{it} + k_{it}$$

Where P_{it}^* is the 'rate of change of target', 'm_{it} is the rate of change of desired mark-ups', 'k_{it} is the rate of change of normalized unit cost' and λ_{it} is the 'speed of adjustment of price to target'. The speed of adjustment parameter λ_{it} lies between 0 and 1 and should be expected to vary from industry to industry on ground of the level of inter-industry competitiveness (Martin, 1993). The closer λ_{it} is to 0, the more sluggish prices adjust to the target price and vice verse.

Adding to the cost based pricing theory, where input price is the major determinant of firms' price, this model provides room for demand to play its role through mark-ups. This can shed some light in analyzing the recurring inflation in Ethiopia which is "largely attributed to rising demand".

The variables m_{it} and k_{it} are unobservable thus must be replaced with proxies. m_{it}, as asserted by Encoua and Geroskie, depends on the first instance on demand conditions. With the intention of avoiding endogenity problem arising from the inclusion of demand variables: they suggested the ratio of inventory to the sum of production and stock or alternatively the rate of growth of sales can be used to provide sensible information on demand shocks. However, as pointed out by Ahmud and Mendelson(1986), inventory adjustment moderates downward pressure on price in times of low demand but could not counteract upward pressure. The experience in Ethiopian industries is that most of the manufactures are not operating at full capacity. A report by Central Statistical Agency displays; next to shortage of raw materials, absence of market demand is the major reason for under capacity operation. Assuming that it would take time to respond to shocks by increasing capacity, it is expected that inventory adjustment (hereafter denoted DEMit) would serve well in both scenarios. Then:

(3) $$m_{it} = \delta_{it} DEM_{it}$$

In like manner, the rate of change of normalized unit cost k_{it} is specified as a function of rate of change of current cost and other factors.

(4) $$K_{it} = \beta_{it} + \alpha_{it} C_{it}$$

Where C_{it} is the rate of change current unit cost including unit labor and material cost. The parameter α_{it} is expected to be between zero and one. The closer is α_{it} to zero the more extensive the normalization of costs. The term β_{it} captures all the variation in normal cost emanating from changes in other factors. Geroskie (1992) stated, under the normal cost pricing firms distinguish transitory from permanent cost shocks and chose to respond only to the later. Studies by Berdosian and Mosch (1988), Domberger (1979) and Geroskie (1992) decomposed current unit cost in to material and fuel cost and unit labor cost. As indicated in Ethiopian Central Statistical Agency manufacturing survey, in the year 2007/2008 more than half of material cost is attributed to imported raw material cost. In addition most of the domestic inputs are expected to be unprocessed agricultural products and cost variations are assumed to be transitory in nature arising manly due to seasonal fluctuations. Thus, Imported unit cost and domestic unit cost are distinguished on their impact on current period cost shocks. Thus:

$$(5) \qquad K_{it} = \beta_{it} + \rho_{it}C_{it}$$

To estimate these equations substitute equation (5) and equation (3) in to (2) and subsequently in to (1)

$$(6) \qquad Pit = (1-\lambda_{it})pit\text{-}1 + \lambda_{it}\,[\ \beta_{it} + \rho_{it}C_{it} + \delta_{it}DEM_{it}\,]$$

Adding the error term and assuming time invariant parameters the statistical equation can be specified as:

$$(7) \qquad P_{it} = \theta_i^{0} + \theta_i^{1}P_{it-1} + \theta_i^{2}C_{it\ t} + \theta_i^{3}DEM_{it} + \varepsilon_{it}$$

Then the parameters of interest can be obtained by identification

- speed of adjustment of current price to the target: $\lambda_i = 1 - \theta_i^1$
- sensitivity of the target to current cost variations: $\rho_i = \theta_i^2 / 1 - \theta_i^1$
- sensitivity of the target to current demand pressure: $\delta_{it} = \theta_i^4 / 1 - \theta_i^1$

3.2 Data Source

The sample to determine the speed of price adjustment comprised a total of forty-seven Ethiopian manufacturing industries identified at large and medium scale at Four-digit International Standard Industry Category(ISIC) level during the period 2004 to 2010. The data used to construct series for industry price, average unit cost, demand index and within industry competitiveness are obtained from Ethiopian Central Statistical Agency. This study utilizes an unbalanced panel data because industries die out and new industries emerge during the study period. The minimum and maximum period of observation being 2 and 7 years respectively, and 25% of the observation having the maximum period.

The dependent variable in the regression equation was the rate of change in manufacturers price calculated from price quotation by manufacturers in the large and medium scale industry survey available yearly since 2004 and published in Central Statistical Agency. Yearly average price of all firms is collapsed into wide industry group (ISIC 4) to generate the average industry price.

On the independent variable side, the rate of change of average industry unit cost (Cit) is calculated as composite of unit labor cost and unit raw material. The unit labor cost (ULC) was based the total yearly expenditure of firms for employee wage available from the LMMIS survey from 2004-2010. Unit raw material cost is ratio of total industry expenditure on local and imported raw material to total quantity produced in the given year.

The proxy index for demand, according to Encoua & Geroski(1986), is measured as change in inventories divided by the volume of supply, as slackening of demand is liable to be accompanied by a rise in inventories. The change in inventories is directly available from the survey, whilst, volume of supply is the sum of total production and beginning inventory.

The conventional concentration ratio is used to identify industrial structure. This index is not available from official source, thus was constructed for all the periods from 2004-2010 using industry census report collected by the Central Statistics Agency. Taking in consideration of the industrialization level of the country a two-firm concentration ratio is used so us to have a fairly equivalent number of industries in each group: high, medium and low concentrated industries. No other criteria are used to assess the market structure as it is ultimately restricted by the availability of data.

3.3 Data Exploration

Cameron and Trivedi (2009) advised that summarizing and having an understanding of the data is a necessary step before any regression analysis. This section summarizes and explores the statistical properties of the data.

The rate of change in price vary greatly across individual, with a standard deviation of 14.5, which is almost twice the mean (7.6). The median of 3.1 is much smaller than the mean, reflecting the skewness of the data. Accordingly, as reported in the summery statistics Table A1(see appendix), all variables have a non normal distribution: have right skewed and leptokurtic distributions. For instance, the rate of change in price has a skewness and kurtosis of 4.8 and 32.2 respectively. The rate of change in cost, likewise, has 5.4 and 39.2 skewness and kurtosis respectively.

After this inspection, it is necessary to test if the variables under consideration are from a normally distributed population. To this end, Kernel density, Box plot and skewness kurtosis test for normality are employed.

A skwness- Kurtosis test, making use of the skewness and kurtosis statistics, formally evaluates the null hypothesis that the variable at hand has a normal distribution. The skewness test is asymptotically distributed as a chi-square and the null hypothesis will be rejected if the calculated statistic is greater than the tabulated values of the chi square.

H_o: Normally distributed

H_1: Not H_o

Looking at the result, the test reject normality, all variables appear significantly non-normal in skewness (P=0.0000), kurtosis (P=0.0000), and in both statistics considered jointly (Table A3). Thus, it can be said that the variables show non-normal distribution.

Non linear transformation such as square root and logarithm are often recommended to change distributions' shape. Cameron and Trivedi (2009), a standard solution is to transform the data by taking the natural logarithm. By doing so, the variables show an improvement in their distribution. The scatter plots for all variables reveal that the variables are uniformly scattered (Figures A4-A7). The kernel density indicates that most of the variables are now close to normal distribution (Figure A10). Most of all, the skewness kurtosis test of the log transformed values are now closer to the normal distribution (Table A4). Consequently, the paper will utilize the log transformed values of the variables for estimation.

3.4 **Diagnosis and Estimation Procedure**

In order to proceed with our estimation, we need to diagnose our estimation procedures so that it would be possible to identify which estimation technique fits our model and data well. Therefore, the important panel data tests are discussed accordingly.

3.4.1 Fixed Versus Random effect model

The fundamental distinction between the fixed and random effects models is the assumption whether the unobserved individual heterogeneity are correlated with the rest of the regressors or not. If the industry specific effects are correlated with the regrssors, fixed effect estimates are consistent but the random effect estimates are not consistent. If the regressors are uncorrelated with the u_i, both fixed and random effect estimators are consistent, while the random effect estimators are efficient (Wooldridge, 2004).

The Haussman-test can be used to test whether fixed or random effect estimators are statistically different. The notion for choosing between fixed or random effect model is to test the null hypotheses that the extra orthogonality condition imposed by the random effect estimators are valid (Baum, 2006). As seen in Verbieek (2000) the test statistics is presented as

$$Chi^2(k) = (\hat{\beta}_{FE} - \hat{\beta}_{RE})'[\hat{V}\{\hat{\beta}_{FE}\} - \hat{V}\{\hat{\beta}_{RE}\}]^{-1}(\hat{\beta}_{FE} - \hat{\beta}_{RE})$$

Where $\hat{\beta}_{FE}$ and $\hat{\beta}_{RE}$ are the coefficient and $\hat{V}\{\hat{\beta}_{FE}\} - \hat{V}\{\hat{\beta}_{RE}\}$ are variance estimates obtained using the fixed and random effect models respectively. Under this test the hypothesis is

H_o: Difference in coefficients is not systematic

H_1: There is a systematic difference in coefficients

The output from Hausman-test provides a side by side comparison (Table A11). For the coefficient of the regressor Pit_1, a test of random effect against fixed effect yields t=7.03, a highly statistically significant difference. And the overall statistics has a p-value = 0.000. Thus, the Hausman-test null hypothesis that the random effect provides consistent estimate is statistically rejected.

Then fixed effect test is performed to answer the question of whether to use fixed effect or pooled OLS. According to Cameron and Trivedi (2009), the F test following the fixed effect regression indicates that there are no significant individual (industry level) effects at 5% significance level, implying using OLS would be appropriate (Table A12).

3.4.3 Breusch-Pagan / Cook-Weisberg test for Heteroskedasticity

One of the basic assumptions for the ordinary least squares regression is the homogeneity of variance of the residuals. If the conditional variance in the error term changes with any of the three explanatory variables (Pit_1,Cit and Dem), then heteroskedasticity is present. Though heteroskedasticity does not cause inconsistency in estimators, it leads to bias in the formula for the variance which in turn invalidates the standard errors, introducing inefficiency in OLS estimators (Green, 2003). When the usual assumption of homoskedasticity is not meet, the test statistics used to test hypotheses under the Gauss-Markov assumptions are no longer valid (Wooldridge, 1999).

A simple test for heteroskedastic disturbance in a linear regression model is developed using the framework of the Lagrangian multiplier test (Breusch and Pagan, 1979). Under this test the hypothesis is

H_0: Homoskedasticity
H_1: Not H_o

Based on the test statistics a p-value of less than 0.001 and the rvfplot (residual-versus-fitted plot) we reject the null hypothesis of homogeneous variance of residuals. The Breusch-Pagan test shows the existence of hetroskedasticity (Table A13).

3.4.3 Test for serial autocorrelation

When the error terms of a regression model are correlated among themselves across time, then they are said to display serial correlation or autocorrelation (Davidson and Mackinnon, 1999). Ignoring serial correlation when it is present results in consistent but inefficient estimates of the regression coefficients and biased standard errors (Baltigi, 2008).The null hypothesis is:

H_0: No first order autocorrelation

H_1: Not H_0

Clearly, the test statistics strongly reject the null hypothesis at 1% significance level (Table A14). The Wooldridge test for autocorrelation indicates the prevalence of serial autocorrelation.

3.4 Test for Endogenity

When working with price equations, demand variables are difficult to construct as they are liable to be endogenous. Thus, there is a need to check if the constructed demand index proxy is exogenous as intended.

The preceding test treats the demand proxy variable as endogenous. Cameron and Trivedi (2009), if instead the variable is exogenous, then Instrumental Variable (IV, 2SLS, or GMM) estimators are consistent, but they can be much less efficient than the OLS estimators.

The Hausman-test can be applied to test whether a regressor is endogenous. If there is no considerable difference between OLS and IV estimators, it can be concluded that the demand proxy is exogenous. The Hausman-test statistics as Cameron and Trivedi (2009) is:

$$T_H = (\hat{\beta}_{IV} - \hat{\beta}_{OLS})^2[\hat{V}\{\hat{\beta}_{IV}\} - \{\hat{\beta}_{OLS}\}]^{-1}$$

Under this test the null hypothesis

H_o: Regressor is exogenous

H_1: Not H_o

Based on the test statistics we fail to reject the null hypothesis that the demand proxy is exogenous with p - value = 0.000 (Table A15). Thus, conclude that there is no endogeneity.

3.5 Estimation Results and Interpretation

For the reasons aforementioned in the previous sub-section, the generalized least square (GLS) will be used to estimate the price adjustment model equation (7). GLS estimators are appropriate when one of the assumptions of homoskedasticity and noncorrelation of regression errors fail (Cameron and Trivedi, 2009). They suggested, under such circumstance GLS is more efficient than OLS estimation, leading to smaller standard errors, narrower confidence intervals and larger *t* statistics.

The dependent variable is the rate of change in price explained by its lagged value, the rate of change in average unit cost and a demand proxy. Industries are classified in to three groups (High, Medium and Low) by inter industry degree competitiveness. Two firm concentration ratio criteria is used determine the market structure. The estimation result for the three groups is presented below

TABLE 3.1: Estimation result for Low dominance market (0<CR2<50)

Independent Variable	*Coefficient*	*z-ratio*	*p-value*
Pit_1	0.0924603	0.77	0.442
Cit	0.9379619	7.71	*0.000*
Dem	-0.1102553	-1.30	0.192
Constant	-0.8160965	-1.16	0.246

Number of observations = 46

Number of groups = 12

Wald $chi^2(3) = 203.47$

Prob $> chi^2 = 0.000$

TABLE 3.1: Estimation result for Low dominance market (50<CR2<80)

Independent Variable	*Coefficient*	*z-ratio*	*p-value*
Pit_1	0.3415322	3.49	0.000
Cit	0.4649668	4.22	*0.000*
Dem	-0.0249515	-0.24	0.814
Constant	0.3008558	0.31	0.757

Number of observations = 58

Number of groups = 18

Wald $chi^2(3) = 82.7$

Prob $> chi^2 = 0.000$

TABLE 3.1: Estimation result for Low dominance market (80<CR2<100)

Independent Variable	*Coefficient*	*z-ratio*	*p-value*
Pit_1	0.1128703	1.80	0.071
Cit	0.8658762	12.80	*0.000*
Dem	-0.0068504	-0.15	0.880
Constant	0.2923463	0.69	0.489

Number of observations = 104

Number of groups = 26

Wald $chi^2(3) = 718.52$

Prob $> chi^2 = 0.000$

From the estimation result, in all the three groups, the variables are jointly significant. It is tested using the Wald test statistics which is computed to be 203, 82 and 718 for low, medium and highly dominated industries, with a p-value of zero at 1% significance level. It is not surprising, considering the level of industrialization in the economy that the number of observations (industries) has increased from 46 in less dominated industries to 104 in highly dominated market. This is an indication that Ethiopian industry is characterized by high level of dominance even at two firm concentration criteria.

The speed of price adjustment among the three groups of industries can be identified using the estimated coefficient from each regression.

$$P_{it} = \theta_i^0 + \theta_i^1 P_{it-1} + \theta_i^2 C_{it} + \theta_i^3 DEM_{it} + \varepsilon_{it}$$

- speed of adjustment of current price to the target:
  $\lambda_i = 1 - \theta_i^1$

- sensitivity of the target to current imported cost variations:
  $\rho_i = \theta_i^2 / 1 - \theta_i^1$

- sensitivity of the target to current demand pressure:
  $\delta_{it} = \theta_i^4 / 1 - \theta_i^1$

Table 4.1. Speed of price adjustment from 2004 to 2010. Pooled analysis by class of industries according to degree of concentration (CR2)

	0<CR2<50	50<CR2<80	80<CR2<100
λ_i	0.9 p-value=0.442	0.65 p-value=0.000	0.88 p-value= 0.071
ρ_i	1.0 p-value=0.000	0.7 p-value=0.000	0.97 p-value=0.000
δ_{it}	-0.11 p-value=0.19	-0.02 p-value= 0.81	-0.006 p-value=0.48

The partial price adjustment parameter λit is expected to lie between zero and unity, with a value closer to one implying an instantaneous price adjustment. The conventional believe is that, prices are expected to be less flexible in less competitive markets. From the above table it can be seen that the speed of adjustment parameter is in accordance with its theoretical bound for all groups. For the least dominated sectors [column (1)], λ= 0.9 on average over the cycle and is not significantly different from unity: a result perfectly in accord with competitive environment. This value fails to 0.65 in moderately concentrated markets and surprisingly rise to 0.88 in the most dominated sectors. Interestingly in this case, the rate of adjustment decline in moderately competitive market and increases in highly dominated sectors.

To the best of my knowledge, all previous studies reported either insignificant difference in all groups or a progressively declining/increasing speed of adjustment with higher value of concentration ratio. In the highly concentrated market, two firms have more than 80% share of the market and therefore this inconsistency may be explained by the possibility of collusive or cartel outcome which might have been the result of missing competition policy in the country. The fewer the number of firms the easier it is to coordinate decisions. According to Garrod (2011), when cost fluctuation is sufficiently large at times of inflation, the best collusive prices can be flexible over time. Another possible explanation might be, concentration ratio alone might not be sufficient in explaining the degree of competitiveness ill regulated market system.

The rate at which current cost shocks are transmitted into price in each industry group respectively: 1, 0.7 and 0.97 shows the same pattern like the speed of price adjustment parameter. This implies that price smoothing policy is more developed in moderately concentrated industries than highly dominated firms and as expected more than competitive markets.

The demand effect appears to be less important in explaining price adjustment in all industry groups. It is worth noting that the proxy for demand variable is not significantly different from zero in all market structure. However, this does not necessarily mean that industry prices are not responsive to demand shocks. It could be that, inventory adjustment,which is used to generate the proxy, is less developed among Ethiopian firms. For instance, for the year 2010, out of the total 2197 firms 324 firms did not keep inventory and 143 firms reported no change in the level of inventory at the end of the year.

In summary, Ethiopian industries moderately dominated by two firms have a much slower price adjustment to normalized cost and a much slower conversion of current costs into normalized costs than less and highly dominated markets where adjustment is almost instantaneous. The results suggest a clear sluggishness in response of current prices to cost shocks in reasonably dominated sectors. The extremely dominated markets are as much responsive as the competitive industries.

CHAPTER FOUR
CONCLUSION AND POLICY IMPLICATION

4.1 Conclusion

The purpose of this paper is to investigate the effect of market structure on pricing behavior, in particular the speed at which firm prices respond to market fluctuation with respect to changes in demand and cost of production. The empirical analysis is based on pooled data regression for a class of 47 large and medium scale Ethiopian manufacturing industries. The sample of industries is grouped into three groups, on bases of the level of competition determined using two firm concentration ratio.

Industry average rate of change in price is expressed in-terms of its lagged value, rate of change of average cost and demand variables. The generalized least square procedure is utilized to account for serial correlation coupled with the existence of lagged dependent variable.

The results cast doubt on the proposition that more concentrated markets tend to smooth their prices to changes in economic fluctuations. Though the finding suggests the importance of market structure in determining the speed of price adjustment, it is only in moderately concentrated industries that some degree of price smoothing is observed. Contrary to the long standing belief, there appears to be tiny difference in the rate of price adjustment between competitive and concentrated industries.

To summarize in terms of the questions posed in chapter one, the results suggest:

1. There appears to some indication of price smoothing policy but only in moderately concentrated industries
2. There is significant inter-industry variation in the way prices respond to economic shocks: prices of less competitive and more competitive industries appeared to respond more rapidly than moderately competitive markets.

3. Prices in all groups appeared to be more sensitive to cost shocks but virtually not at all to demand shocks.

4.2 Recommendation

The study reveals the importance of market structure in determining the speed at which industry prices respond to economic fluctuation. Interestingly, when considering two firm concentration ratios, the competitive and least competitive industries exhibit virtually identical rate of response. The implication being, either the concentration ratio was not sufficient enough to capture the competitive nature of the market or the absence of market regulation that facilitated oligopoly markets to coordinate their actions.

Though concentration is the most prominent indicator of market structure, analysis of conditions of entry and exit is central to understand the degree of competition in a market.

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Appendix

TABLE A1: SUMMARY STATISTICS OF THE LEVEL VARIABLES

pi

	Percentiles	Smallest		
1%	.1996014	0		
5%	.6465445	.1869033		
10%	1.088649	.1996014	Obs	275
25%	2.159295	.2262944	Sum of Wgt.	275
50%	4.32639		Mean	10.59774
		Largest	Std. Dev.	19.09302
75%	12.77302	93.46582		
90%	21.68411	109.227	Variance	364.5433
95%	36.71888	151.8681	Skewness	4.865852
99%	109.227	162.723	Kurtosis	32.25527

ct

	Percentiles	Smallest		
1%	.100555	0		
5%	.6253279	.0931216		
10%	.88253	.100555	Obs	275
25%	1.583947	.2054777	Sum of Wgt.	275
50%	3.108514		Mean	7.631562
		Largest	Std. Dev.	14.56547
75%	7.894276	85.02047		
90%	16.55157	85.13746	Variance	212.1529
95%	27.9681	116.4915	Skewness	5.474388
99%	85.13746	132.2423	Kurtosis	39.22915

dm

	Percentiles	Smallest		
1%	.0000104	6.22e-06		
5%	.0000378	8.73e-06		
10%	.0000559	8.93e-06	Obs	323
25%	.0001008	.0000104	Sum of Wgt.	323
50%	.0001857		Mean	.000371
		Largest	Std. Dev.	.0007004
75%	.0003945	.0044271		
90%	.0007734	.0045895	Variance	4.91e-07
95%	.0009754	.006458	Skewness	6.962559
99%	.0044271	.0076473	Kurtosis	61.98996

TABLE A2: SUMMARY STATISTICS OF THE LOG TRANSFORMED VARIABLES

Pit

	Percentiles	Smallest		
1%	-1.485919	-1.677164		
5%	-.3823566	-1.611433		
10%	.1387519	-1.485919	Obs	274
25%	.770153	-1.171214	Sum of Wgt.	274
50%	1.468485		Mean	1.584207
		Largest	Std. Dev.	1.223253
75%	2.547335	4.537596		
90%	3.07658	4.693428	Variance	1.496348
95%	3.603291	5.023012	Skewness	.1390045
99%	4.693428	5.09205	Kurtosis	3.078517

Cit

	Percentiles	Smallest		
1%	-1.582418	-2.373849		
5%	-.4537107	-2.297051		
10%	-.0836514	-1.582418	Obs	274
25%	.4665197	-1.516889	Sum of Wgt.	274
50%	1.144183		Mean	1.268828
		Largest	Std. Dev.	1.187917
75%	2.066138	4.442892		
90%	2.806481	4.444267	Variance	1.411147
95%	3.331064	4.757819	Skewness	.2102592
99%	4.444267	4.884636	Kurtosis	3.326998

Dem

	Percentiles	Smallest		
1%	-11.47298	-11.9873		
5%	-10.18375	-11.649		
10%	-9.792592	-11.62654	Obs	323
25%	-9.202439	-11.47298	Sum of Wgt.	323
50%	-8.591147		Mean	-8.527138
		Largest	Std. Dev.	1.070732
75%	-7.83784	-5.420008		
90%	-7.164659	-5.383989	Variance	1.146468
95%	-6.93266	-5.042442	Skewness	.0963276
99%	-5.420008	-4.873402	Kurtosis	3.689067

TABLE A3: SKEWNESS/KURTOSIS TESTS FOR NORMALITY– FOR LEVEL

Skewness/Kurtosis tests for Normality

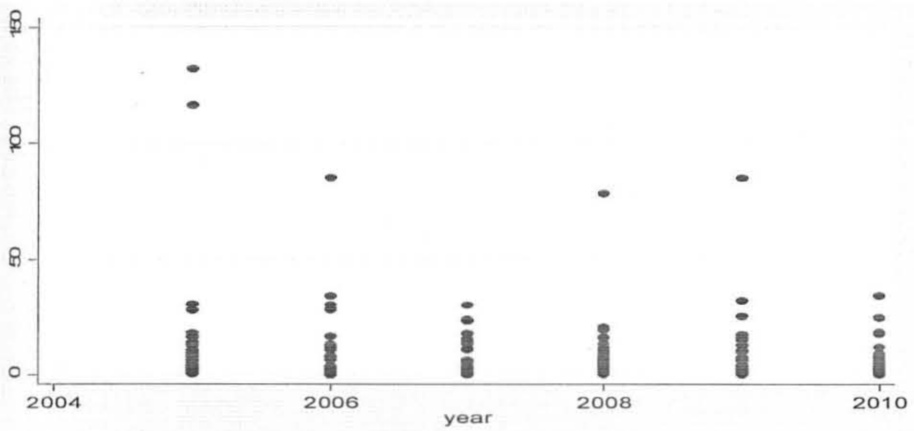
				joint	
Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	adj chi2(2)	Prob>chi2
pi	275	0.0000	0.0000	.	0.0000
ct	275	0.0000	0.0000	.	0.0000
dm	323	0.0000	0.0000	.	0.0000

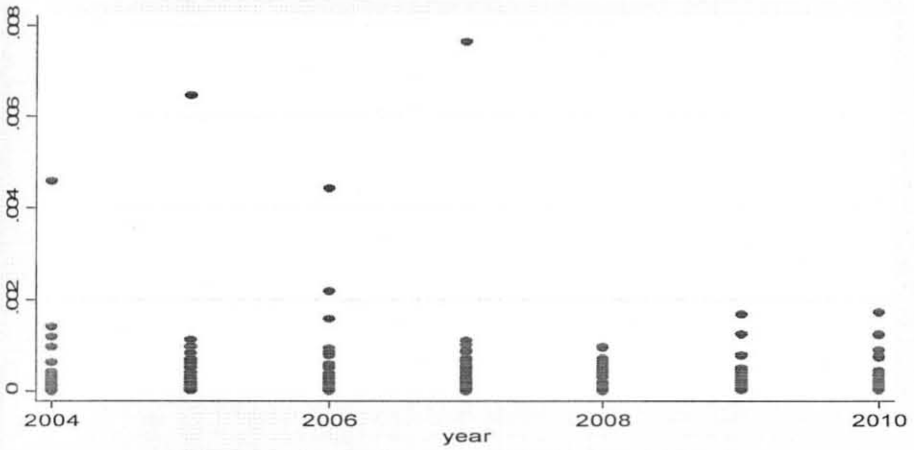
TABLE A4: SKEWNESS/KURTOSIS TESTS FOR NORMALITY– FOR LOG

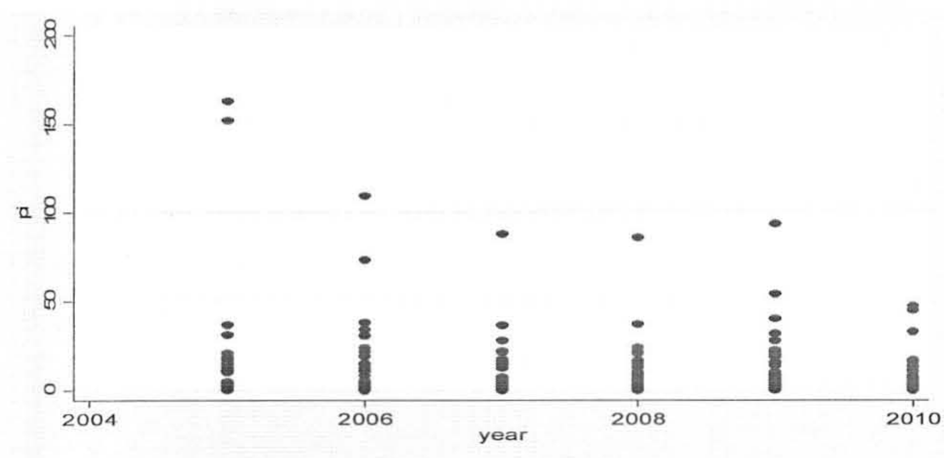
Skewness/Kurtosis tests for Normality

Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	joint adj chi2(2)	joint Prob>chi2
Pit	274	0.3374	0.6356	1.15	0.5617
Cit	274	0.1490	0.2283	3.56	0.1689
Dem	323	0.4710	0.0289	5.31	0.0702

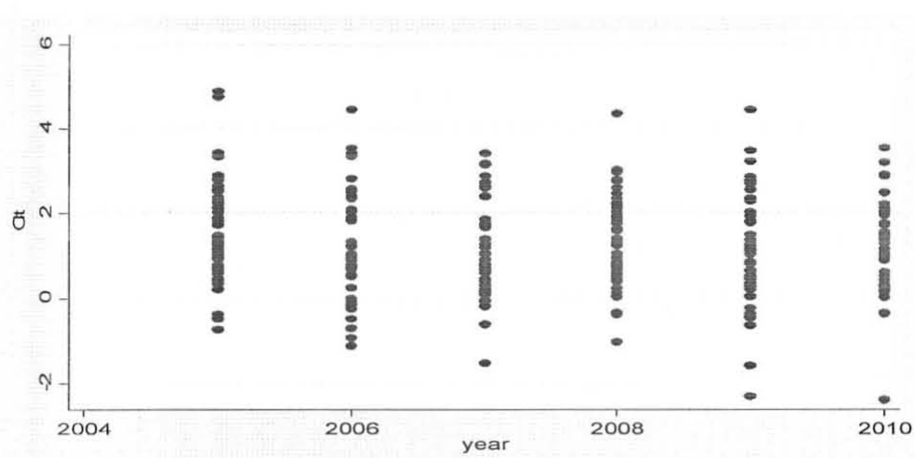
FIGURES A1-A3: SCATTER PLOTS OF THE VARIABLES IN LEVELS

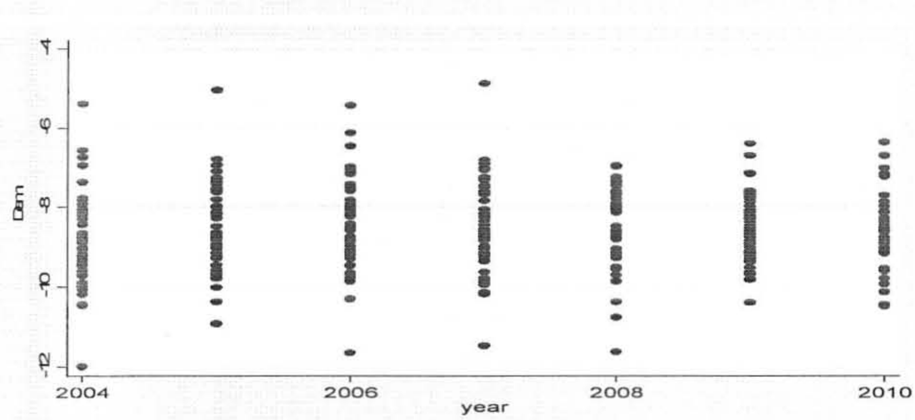


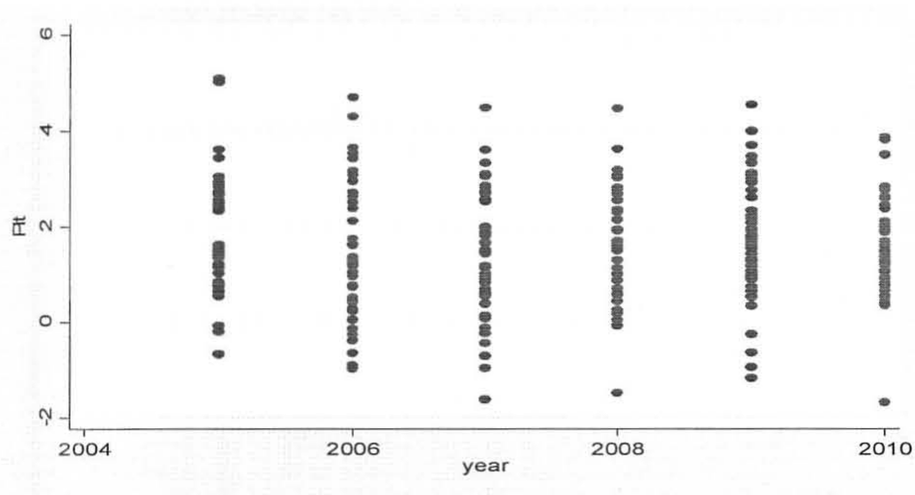




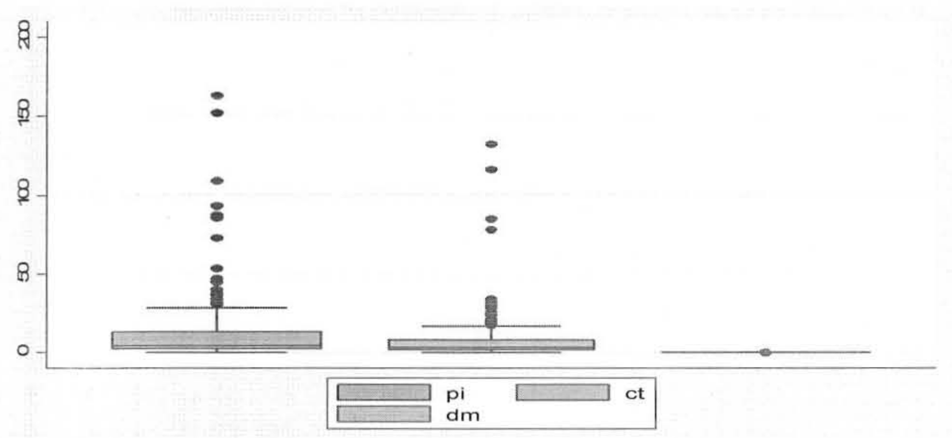
FIGURES A4-A7: SCATTER PLOTS VARIABLES IN LOGARITHMIC FORM







FIGURES A8: BOX PLOT OF THE VARIABLES IN LEVEL



FIGURES A9: BOX PLOT VARIABLES IN LOGARITHMIC FORM

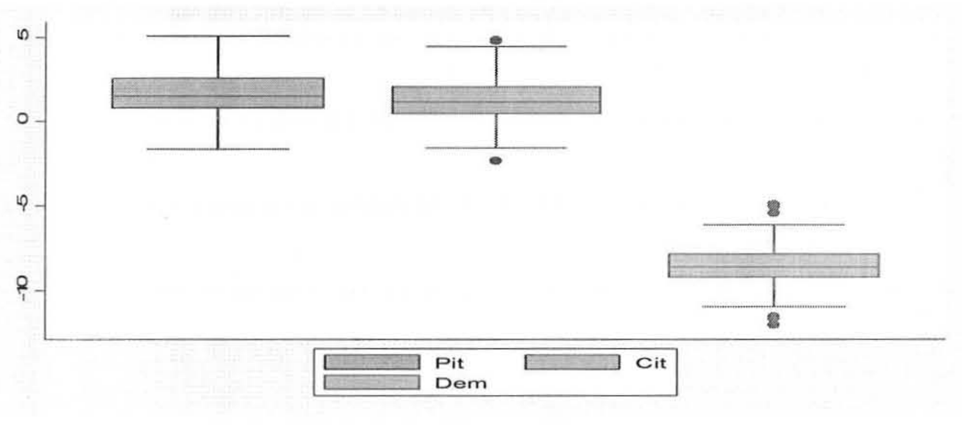


Figure A10-A13: KERNEL DENSITY

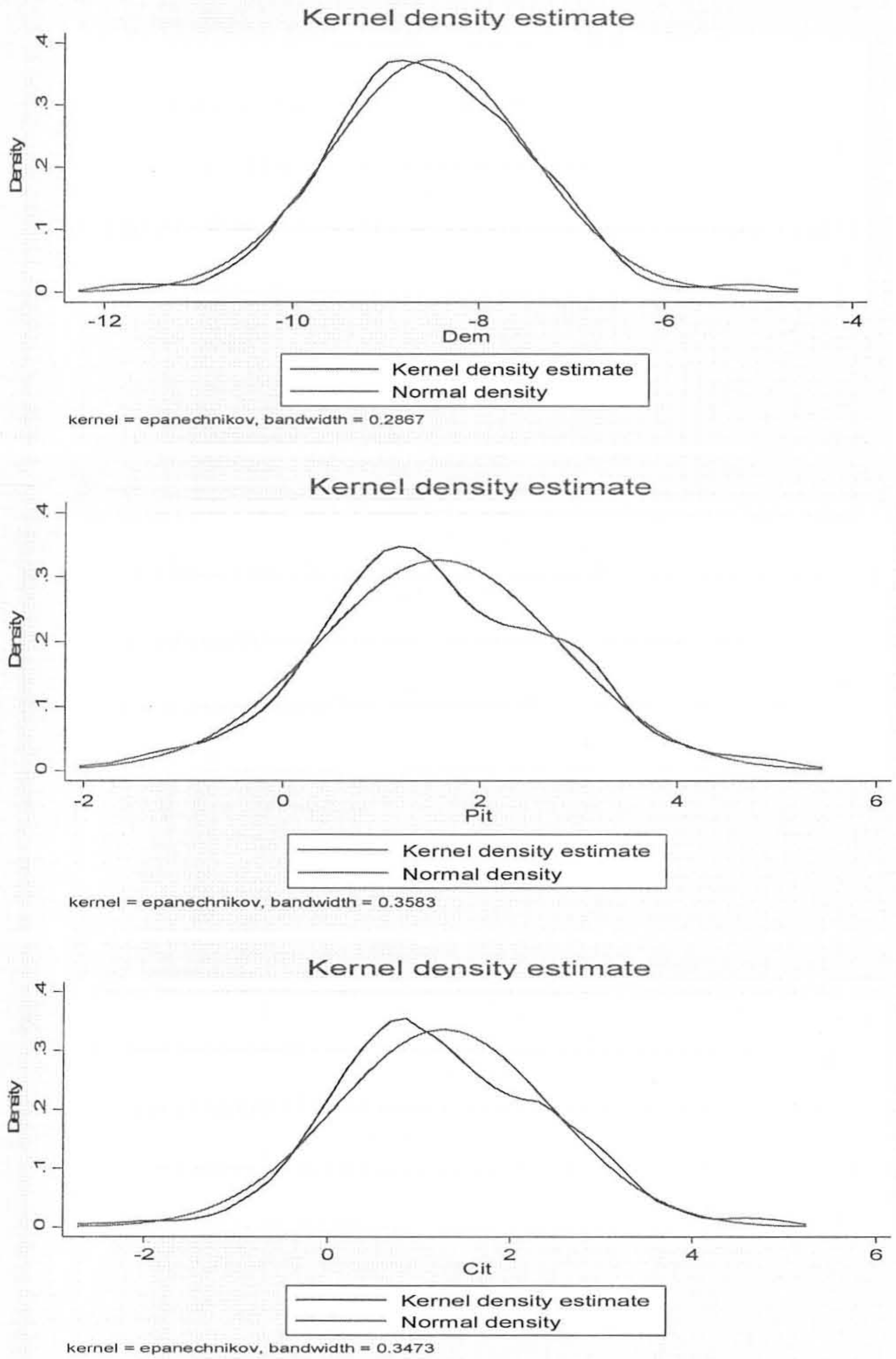


Figure A14: RVF PLOT FOR HETROSKEDASTICITY

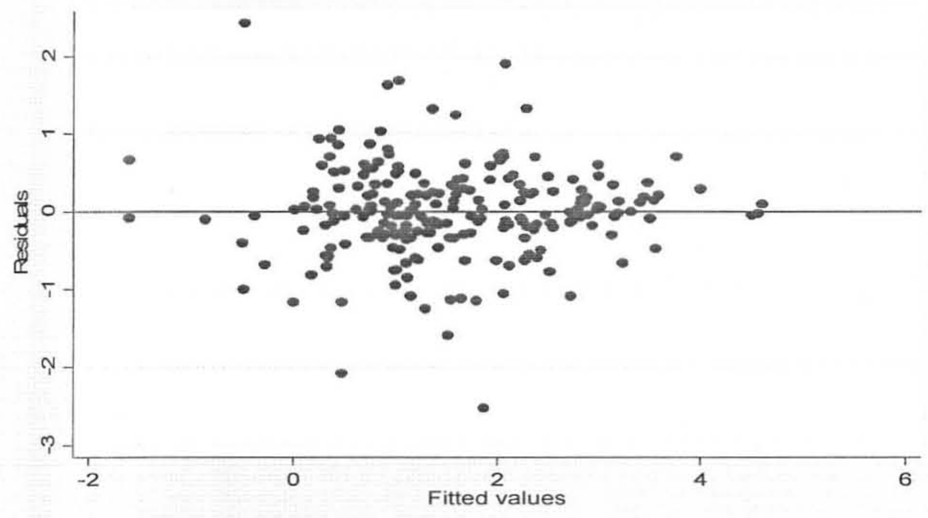


Figure A15: TWO FIRM CONCENTRATION RATIO BY ISIC

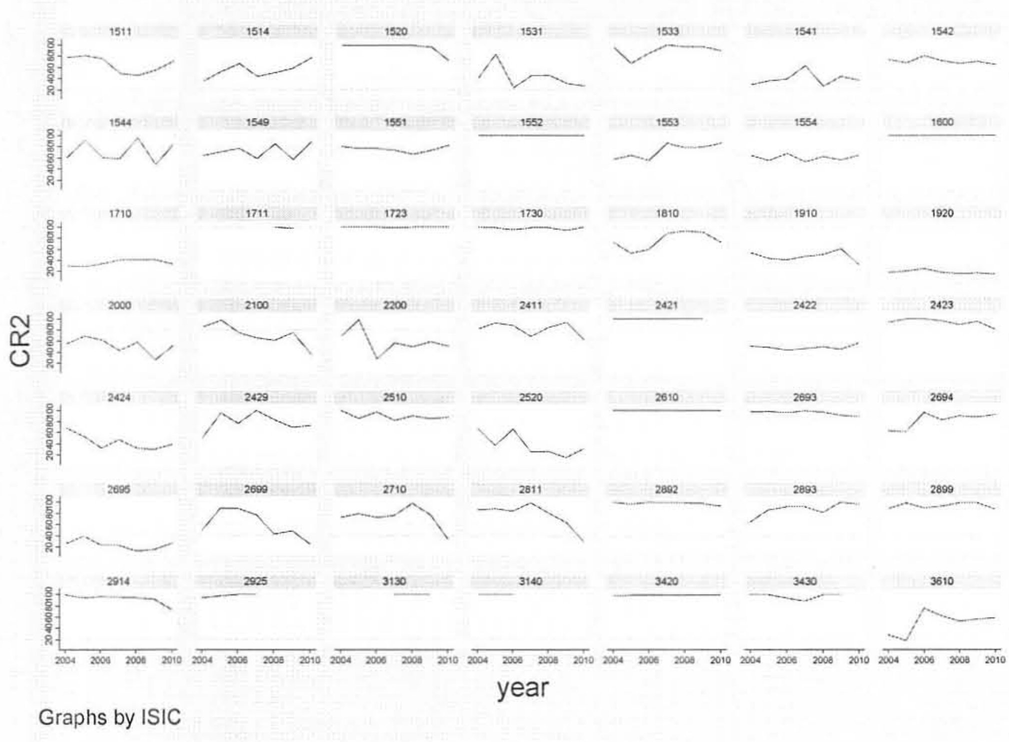


Table A11: **TEST FOR RANDOM OR FIXED EFFECT**

	(b) fix	(B) ran	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
	— Coefficients —			
Pit_1	-.0849575	.2065321	-.2914897	.0414621
Cit	.6810945	.7413648	-.0602703	.0399664
Dem	-.0750257	-.0465601	-.0284656	.0653918

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(3) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 72.52
Prob>chi2 = 0.0000

Table A12: **TEST FOR FIXED EFFECT**

```
Fixed-effects (within) regression               Number of obs      =       225
Group variable: ISIC                            Number of groups   =        47

R-sq:  within  = 0.3771                         Obs per group: min =         1
       between = 0.8902                                        avg =       4.8
       overall = 0.7094                                        max =         5

                                                F(3,175)           =     35.32
corr(u_i, Xb)  = 0.6130                         Prob > F           =    0.0000
```

Pit	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
Pit_1	-.0849575	.0645954	-1.32	0.190	-.2124438	.0425287
Cit	.6810945	.0665077	10.24	0.000	.5498342	.8123549
Dem	-.0750257	.0771611	-0.97	0.332	-.2273118	.0772604
_cons	.207974	.669318	0.31	0.756	-1.113	1.528948
sigma_u	.5415701					
sigma_e	.57803934					
rho	.46746135	(fraction of variance due to u_i)				

F test that all u_i=0: F(46, 175) = 1.42 Prob > F = 0.0569

Table A13: **TEST FOR HETROSKEDASTICITY**

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
        Ho: Constant variance
        Variables: fitted values of Pit

        chi2(1)      =    12.29
        Prob > chi2  =    0.0005
```

Table A15: **TEST FOR ENDOGENEITY.**

	Coefficients (b) ivreg	(B) glse	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
Pit_1	.2062744	.2031271	.0031472	.0110234
Cit	.7389617	.7316811	.0072807	.0251953

```
                b = consistent under Ho and Ha; obtained from xtivreg
    B = inconsistent under Ha, efficient under Ho; obtained from xtgls

Test:  Ho:  difference in coefficients not systematic

              chi2(2) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                      =        0.11
            Prob>chi2 =      0.9466
```

Declaration

I, the undersigned, declare that this project is my original work and has not been presented for a degree in any other university, and that all sources of materials used for the study have been duly acknowledged.

Declared by:

Name: Abeneazer Adam

Signature: ______________________

Date: 12/06/12

Confirmed by (Advisor):

Name: Tekie Alemu (PhD)

Signature: ______________________

Date: 12/08/12

Place and date of submission:

Addis Ababa University, 12/06/12