Market Structure and Competition: Assessment of Malaysian Pharmaceutical Industry based on the Modified Structure-Conduct-Performance Paradigm

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Abstract
This study assesses the market structure and competitiveness of Malaysian pharmaceutical industry. A panel analysis of 41 pharmaceutical manufacturing firms over 2004-2012 is conducted founded on the modified Structure-Conduct-Performance (SCP) framework. Our study reveals that the Malaysian pharmaceutical industry is highly concentrated (oligopoly) and the major findings are threefold. First, anti-competitive practices subsist among the pharmaceutical firms. Major players may have greater control over the markets and potentially colluded to gain better profits. Second, selling intensity is evident to raise the firms' business performance, suggesting that advertisement, marketing campaigns, product differentiations and distribution efforts could be effective in building competencies over the rivals. Third, the study has tackled the endogeneity problem of traditional SCP with dual causal effects found between business conduct and business performance. Firms and authorities should consider the interactive mutual influences of structure-conduct-performance when formulating their respective management decisions and regulatory rules.

Keywords: Modified Structure-Conduct-Performance, Pharmaceutical Industry, Competition, Panel Regression, Panel Causality

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Introduction

Pharmaceutical industry is of strategic importance for the development of health care sector with high potential growth in both global and local platforms due to its relation with the public welfare and wellbeing. In Malaysia, the production, imports and sales of pharmaceuticals including traditional medicines are regulated by Ministry of Health. There are currently 251 manufacturers licensed by the Drug Control Authority (NPCB, 2013). Of these, only 74 are licensed to produces pharmaceuticals including for veterinary and OTC external while the remaining of 177 manufacturers licensed to produce traditional medicines.

At present stage, there are no policies to regulate medicines pricing as Malaysia practices 'free-market economics' where manufacturers, distributors and retailers are free to set their own prices without government control (Babar et.al, 2007). Nevertheless, complaints arise from industry players as there are anti-competitive practices along the pharmaceutical supply chain. Some of the big buyers get their products at an extremely low price and sell to the public with only small markup in the short run, causing the small pharmacies with sole ownership losing competency. Further, dominant multinational pharmaceutical manufacturers solely sell the higher dose of certain medicines to clinics, although it is an over-the-counter product and that is anti-competitive practices (NST, 2011). Manipulations in prices are also found among different sectors and geographical areas. For instance, the high price variations are observed for some identical products in private pharmacies and dispensing doctors' clinics (Babar et.al, 2007).

Persisting of anti-competiveness issues in the pharmaceutical market may form unfair competition for the existing small and medium size manufacturers when competing with the big players. This scenario may demotivate them from investing and expanding their business and creates barriers for new entrants. This unhealthy condition can retard economic development and growth in the pharmaceutical industry.

In addition, without proper regulation it is foreseen once the small players lost their battles, big players will look for instant elevated profits with high mark-ups. Such move will drive up the medicines price by sellers and make medicines less affordable to people in need especially those at the bottom millions. The implication on both economic development and public welfare should alert the regulatory authority to impose laws that promote vigorous and

healthy competition within the pharmaceutical industry. But in order for the law enforcement to be effective, a thorough and in depth study is required to examine the pharmaceutical market structure and the firms' business behavior in achieving their profitability.

The most commonly used model to tackle such issue is the Structure-Conduct-Performance (SCP) paradigm. SCP is one of the structural approaches which was derived from neoclassical analysis of market competition and originally used by the US government in crafting antitrust regulations (Shaik, et. al, 2009). There is a strand of literature devoted to the discussion and application of the modified SCP on various industry structures. Nevertheless, the growing literature mostly focuses on the developed countries and banking sector such as Athanasoglou et.al (2006), Maniatis (2006), Mensi & Zouari (2011), Park (2012), Behname, (2012) and Ferreira (2014). Lesser attention has been paid to the developing nations. Among them, Tung et. al (2010) studied the hotel industry in Taiwan, Ding, et. al (2011) employed modified SCP on the China automobile industry, Lee (2012) explored the causal relationship of SCP on the Taiwanese CPA industry, whereas Sarita et al (2012) and Sahoo & Mishra (2012) examined the Indonesian and Indian banking sector respectively. Their findings have generally supported the modern SCP but the causal effects across elements of structure-conduct-performance are rather indecisive and vary by industries.

Thus far, there are limited studies on pharmaceutical industry in developing nations. Among the cited studies are Zhang, et al. (2009), Mishra & Chandra (2010), Mishra & Vikas (2010) and Vyas et al. (2012) but only works by Mishra & Chandra (2010) and Mishra & Vikas (2010) are related to the SCP paradigm. Zhang, et al. (2009), for instance, surveyed the human resource perception on work practices and firm performance of pharmaceutical industry in China while Vyas, et al. (2012) scrutinized the determinants of merger and acquisition (M&A) in Indian pharmaceutical industry over 2001-2010 using logit analysis. A more relevant study by Mishra & Chandra (2010) on 52 Indian pharmaceutical companies revealed that firms with greater selling efforts were found to have significant and positive influences on firms' profitability. Higher expenses spent in the selling strategies such as advertising to disseminate the information and better reach to consumers will result in higher profit margin. Based on modified SCP, Mishra & Vikas (2010) assessed 176 pharmaceutical companies and, agreed that selling intensity is positively related with the firm profitability but firms' profitability also shows negative effect to the selling intensity. The finding implies

two-way correlation between conduct and performance variables which in turns support the modified SCP paradigm.

To our best knowledge so far, there is no SCP related study being conducted for the Malaysian pharmaceutical industry. Babar et. al (2007) did a comprehensive study on medicine prices and drug costs and their availability and affordability in Malaysia but did not assess the market structure and organization behavior of the pharmaceutical industry. This paper therefore contributes as pioneer study that fills an important gap in existing literature that allows a better and updated analysis of the pharmaceutical industry dynamics, which demonstrates how exogenous structural changes feed into the competition process in Malaysia. This will help the Malaysian regulatory authorities to formulate policies that would improve and sustain healthy competition among the pharmaceutical players, and hence enhance the public welfare.

This paper is structured into four sections follows: Section 2 presents the modified SCP theoretical framework and methodology applied, which include the three functional models, measurements of the variables and data used; Section 3 then discusses the empirical results; Section 4 concludes the paper.

Theoretical Framework and Methodology

The SCP framework is widely adopted to evaluate the competitive industries by investigating the structure of industry relates to the firm behaviours (conduct) and performance (Umar Mu'azu, 2013). But the unidirectional relationship of structure-conduct-performance in the traditional SCP entailed with endogeneity problem has raised many criticisms by economic theorists. With successive development in the industrial organization literature, the modified or modern SCP paradigm suggests dual or multi causalities exist between variables of market structure, business conduct and business performance. The interdependencies amongst these variables make them endogenous in nature (Sahoo & Mishra, 2012; Umar Mu'zu, 2013). Inclusion of public policies with relates to taxes, subsidies, international trade, investment and other terms is another important development in the modern SCP paradigm. The modified SCP which addresses the shortcomings of traditional SCP is adopted as the key theory of the present research. However, assessment of public policies is not included in our analysis because the industry is far from being regulated and the 2010 Competition Act was

only implemented since January 2012 that the impact is still unforeseen. Figure 1 depicts the modified SCP paradigm that shows multidirectional relationship among the variables.

[Figure 1]

Data

In this study, the three functional models specified in the next section are estimated with panel dataset of 41 pharmaceutical firms operating in Malaysia for the period of 2004-2012. These data are sourced from the firms' annual reports submitted to Company Commission of Malaysia (CCM). The data availability for the years of 2004, 2005, 2006 and 2012 are inconsistent, therefore, this study has to work with an unbalanced panel data set for the period of 2004-2012. The data are reviewed and crosschecked before relevant values are extracted and used for empirical analysis.

Measurement of Variables

Various measurements are being used in numerous SCP studies. This study adopts the measurements that are relevant and fit most to the research. Details of the variables are presented in Table 1.

[Table 1]

Establishment of Functional Models

Modified SCP deals with multidirectional effects, thus all three elements of market structure, business conduct and business performance can act as dependent variables as well as independent variables respectively. The three equations and related variables that applied in the functional models can be rewritten as follows:

i) *Market structure:* $S_i = a_0 + a_1 CAP_{it} + a_2 SELL_{it} + a_3 ROS_{it} + a_4 ROA_{it} + e_1$

where market structure (HHI, SHARE) is dependent variables and there are four independent variables in this model; $i = 1,2$; $S_1 = HHI$, $S_2 = SHARE_{it}$; a_0 is the intercept; $a_1,....,a_4$ are the parameters of the regression model; e_1 is the error term.

ii) *Firms' conduct:* $C_i = b_0 + b_1 HHI + b_2 SHARE_{it} + b_3 ROS_{it} + b_4 ROA_{it} + e_2$

where business conduct (CAP, SELL) is dependent variable and there are four independent variables in this model; i = 1, 2;$C_1 = CAP_{it}$, $C_2 = SELL_{it}$; b_0 is the intercept; b_1,....,b_4 are the parameters of the regression model; e_2 is the error term.

iii) *Firms' performance:*$P_i = c_0 + c_1 HHI + c_2 SHARE_{it} + c_3 CAP_{it} + c_4 SELL_{it} + e_3$

where business performance (ROS, ROA) is the dependent variable and there are four independent variables in this model; $i = 1,2$; $P_1 = ROS_{it}$, $P_2 = ROA_{it}$; c_0 is the intercept; c_1,....,c_4 are the parameters of the regression model; e_2 is the error term.

Empirical Results and Discussion

Classification of Market Structure

Following established literature, Herfindahl-Hirschman Index (HHI) is employed to measure the degree of market concentration in Malaysian pharmaceutical industry. Figure 1 depicts the HHI trend of 41 pharmaceutical firms over 2004-2012. Meanwhile, Table 2 classifies the market structure by HHI in accordance to the US Merger Guidelines. Apparently, the pharmaceutical manufacturing firms fall in the HHI range of 2240-2616 with an upward trend. This postulates a highly concentrated market (oligopoly) that may encourage dominant firms to collude through unofficial collaboration and thus weaken the market competition. A warning sign arises that the 2010 competition act failed to avert the HHI from growing. Such finding implies a low consumer bargaining power that allows major firms to gain greater profits by charging higher prices of medical drugs and pharmaceutical products. The fact is also supported by Babar et.al (2007)'s earlier arguement that anti-competitive practices presence along the pharmaceutical supply chain, creating barriers for the small and medium size manufacturers to compete with the big players.

[Figure 2]

[Table 2]

The following Table 3, 4, and 5 demonstrate the panel regression of three SCP functional models. Each of these models employs two dependent variables to represent the SCP elements of market structure, business conduct and business performance. HHI and market share (SHARE) embody the market structure, capital intensity (CAP) and selling intensity (SELL) exemplify the business conduct, whereas return on sales (ROS) and return

on assets (ROA) correspond to the business performance. Together, there will be six equations to be estimated.

Before we proceed, a few scientific points are worth notified. First, R^2 has a very modest role in the panel regression. Neither is a high value of R^2 evidence in favour of a model nor is a low value of the R^2 evidence against it (Gujarati & Sangeetha, 2007; Sahoo & Mishra, 2012). Second, since our panel dataset has greater *N* than *T* (cross sectional units > time series units), we select our panel regression from two alternative models namely the Fixed Effect (FE) model and Random Effect (RE) model is highly suggested in the literature. Hausman test is therefore conducted as diagnostic test and depicted in Table 3, 4, and 5. It is observed that the RE estimate of the cross section variance term is zero, so that there do not appear to be RE in all three functional models. Thus, null hypothesis is rejected and FE panel regression is more appropriate to be employed in this study.

[Table 3]

Market structure equations report interesting results via Table 3. When HHI is treated as dependent variable, it is significantly affected by the lagged return on sales (ROS) but none of the business conduct variables (CAP, SELL) shows significant influence. Still, no direct or clear conclusion can be drawn due to the miniature and indecisive coefficients of negative ROS (-1) and positive ROS (-2).

When market share (SHARE) is taken as dependent variable, ROA coefficient is positive and significant but small in value (0.01), suggesting that pharmaceutical firms with better financial performance specifically higher return on assets tend to raise their market share in the industry at small proportional rate. Other firms with lower financial performance may find it difficult to grow and the growth of market share creates some barriers for new entrants. Though the impact is small, the positive relationship is in line with the view of SCP literature (Mishra & Chandra, 2010; Lee, 2012). But again, the business conduct variables are absent from the direct effects on market share. In brief, the firms' business performance has some but minor impacts on the market structure of pharmaceutical industry.

[Table 4]

The results of the business conduct equations are presented in Table 4. We observe that out of the two market structure variables (HHI, SHARE), only HHI shows negative and

significant impact on SELL but not on CAP. This postulates that pharmaceutical firms in highly concentrated market tend to reduce the expenses on selling strategies. It is possible as higher concentration leads to less competition, causing complacent among the major firms and they feel unnecessary to invest or put in more efforts on selling strategies. On the other hand, ROS shows negative and significant impact on CAP but not on SELL, implying higher return on sales leads to lower capital investment. However, ROA has no significant effect on either CAP or SELL. Overall, the results of business conduct in Table 4 suggest that a highly concentrated pharmaceutical market with less competition but with better return on sales would have less motivation to inject more capital investment and selling expenses.

The finding of business performance is depicted in Table 5. HHI and SHARE show significant and positive effect on ROS and ROA respectively. This may suggests that firms in more concentrated market gain better return on sales, whereas firms with larger market share create better financial performance in term of return on assets and it is in line with the general perception of SCP. In addition, the panel regression reveals that SELL has significant positive influence on both ROS and ROA. The higher the expenses spend on the selling strategies such as advertisement, marketing promotion, product differentiations and distribution related efforts help to raise the financial performance of pharmaceutical firms as selling strategies is one of strategic behaviour in creating competitive edges over the rivals. For instances, advertisement and marketing promotion assist in building brand image advantages and product differentiations, which in turn generate greater businesses and profits to the firms. In contrast, CAP – the business conduct variable, shows significant but negative effects of on both ROS and ROA. This postulates that the more intense the capital invested by pharmaceutical firms, the lower returns on sales and assets. This may be possible due to the under-utilization of capital investment to generate higher productivity or to create better profits. In a nutshell, the structure of pharmaceutical industry and the firms' operations do shed some impacts on their business performance, but at different manner.

[Table 5]

So far, our panel regression has analyzed and contextualized the competitive conditions of the Malaysian pharmaceutical industry by examining how the underlying market structure was related to, and affected the conduct and performance of pharmaceutical firms. Nonetheless, regression does not tell about the causal effects among the variables. Yet, the modified SCP paradigm proposes dual or multidirectional causalities among the structure-

conduct-performance relationship. In other words, the three elements of SCP are no longer exogenous. Instead, the whole SCP is influenced by the demand and supply related conditions that in turn depend on the market structure and firms' conduct, as well as the firms' performance. Besides, the modern SCP relationship may not necessarily be instantaneous in nature as there may be existed of lagged relationship among the variables. For instance, the market structure may be influenced by the lagged conduct or performance over a period of time making the relationship dynamic in the nature (Mishara & Behera, 2007).

Our study stands out differently from the previous studies that applied simultaneous equations for modified SCP (see Mishra, P. & Vikas, 2010; Tung et. al, 2010; among others). Instead, Panel Granger Causality test (with lagged effect) is employed in this study to examine the causality relationship, following the recent study by Ferreira (2014) who explores bank efficiency and market concentration in the European Union. Panel Granger Causality tests the causality running within and between the six variables in the three SCP functional models. Together, there will be 15 combinations of Granger-typed null hypotheses to be estimated.

The panel causality results are summarized and graphically represented by Figure 3. While causal effects are more evident among variables of business conduct and business performance, the market structure variables are rather weak and exogenous in causalities. For instance, there is only one-way causality running from market share to capital intensity whereas the HHI is totally absent from the causal effect. Such result is somewhat consistent with the earlier panel regression reported. On the other hand, business conduct appears to be Granger-caused by business performance and vise versa. Both capital intensity (CAP) and selling intensity (SELL) are Granger-caused by return on assets (ROA) by lagged one-period effect. At the same time, there is one-way causality running from return on sales (ROS) to SELL while two-way causal effect is confirmed between CAP-ROA at 1% significant level. In addition, we also observe causality effects present within the business variables and business performance, e.g. one-way causality from CAP to SELL and two-way causality between ROS-ROA. In brief, the findings imply at least dual causal effects appear among the business conduct and business performance in the pharmaceutical industry. This in fact verifies the modified SCP paradigm and tackles the endogeneity problem of the conventional SCP approach.

[Figure 3]

Conclusions and Implications

In the backdrop of free economic practices but unfair competition in the pharmaceutical industry, this study makes a pioneer attempt to assess its market structure and competitiveness using the modified SCP model. A panel analysis of 41 pharmaceutical firms over 2004-2012 was conducted. The major findings are threefold.

First, it is observed that the Malaysian pharmaceutical market is classified as highly concentrated (oligopoly) and the market concentration is significantly affected by the lagged return on sales while the firms' market share is driven by the return on assets. Somehow, the market structure is not influenced by the firms' business conduct but determined by their business performance. Major players in the pharmaceutical industry may have greater control over the markets and potentially colluded to manipulate medicine prices. Unfair competition for medium and small players in the industry may arise if the scenario persists. Furthermore, the high priced medicines and drugs may lead to social implication on the consumer welfare as they may suffer from buying expensive medicines which in turn increase their living expenses. Hence, it is necessary for regulation authority to implement some necessary measures to ensure a healthy competition in the pharmaceutical sector.

Second, in term of business conduct, selling intensity is evident to raise the firms' business performance. Thus, the selling strategies such as advertisement, marketing campaigns, product differentiations and distribution relation efforts could be effective tool for the pharmaceutical firms in creating competitive advantages over their rivals which in turn raise their return on sales. Third, active and two-way Granger-typed causal effects are found between the business conduct and the business performance of pharmaceutical firms. This verifies the modified SCP relationship and tackles the endogeneity problem of the traditional SCP approach. Firms and authorities should consider the interactive mutual influences of structure-conduct-performance when formulating respective management decisions and regulatory rules. The present study provides findings that shed new insights and valuable implications. They are useful not only for the policymakers but also for existing players, potential entrants and other stakeholders of the pharmaceutical industry.

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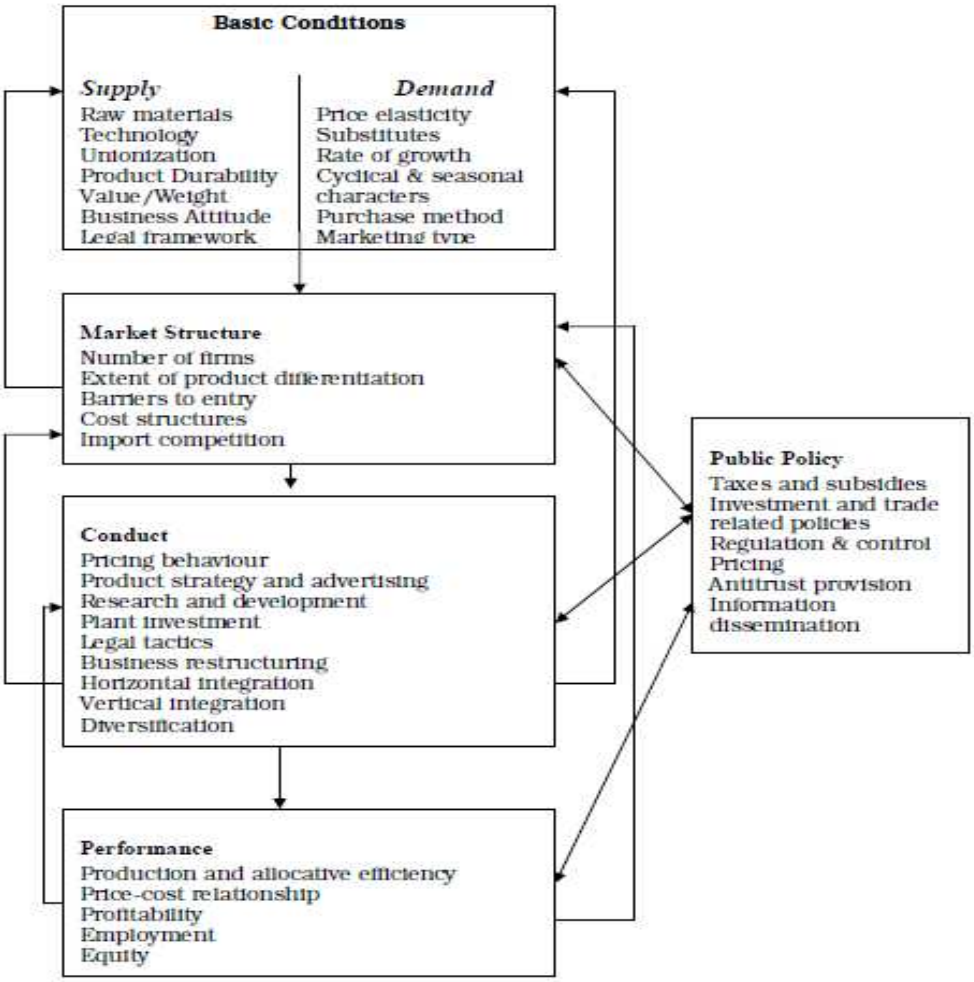
Figure 1: Modified Structure-Conduct-Performance-Policy Paradigm



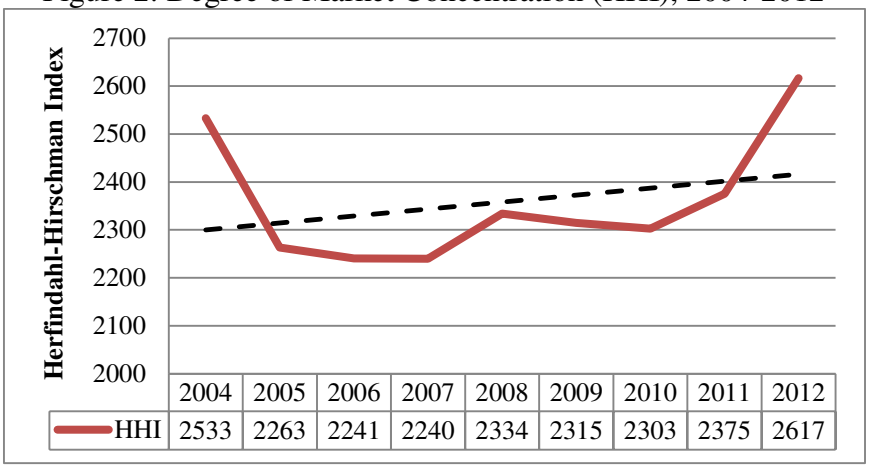
Source: Reproduced from Mishra & Vikas (2010)

Table 1: Definition and Measurement of Variables

SCP Elements	Variables	Definitions
Market Structure	$\text{HHI} = \sum_{i=1}^{n} SHARE_i^2$,	where SHARE_i is the market share of the *i*th pharmaceutical firm, and *n* is the total number of pharmaceutical firms for every year.
	$SHARE_{it} = \frac{REV_{it}}{\sum_{i=1}^{n} REV_{it}}$	where REV_{it} is the total sale revenues of the pharmaceutical firm *i* in year *t* and *n* is the total number of pharmaceutical firms for every year.
Business Conduct	$CAP_{it} = \frac{ASSETS_{it}}{REV_{it}}$	where ASSETS_{it} is the total assets of the pharmaceutical firm *i* in year *t* and REV_{it} is the total sales revenues of the pharmaceutical firm *i* in year *t* .
	$SELL_{it} = \frac{SE_{it}}{REV_{it}}$	where SE_{it} is the total expenses for selling purpose (advertisement, marketing and distribution) of the *i*th pharmaceutical firm in year *t* and REV_{it} is the total revenues of the *i*th pharmaceutical firm in year *t*.
Business Performance	$ROS_{it} = \frac{PBIT_{it}}{REV_{it}}$	where PBIT_{it} is the profit before interest and tax of the pharmaceutical firm *i* in year *t* and REV_{it} is the total sales revenues of the pharmaceutical firm *i* in year *t* .
	$ROA_{it} = \frac{PBIT_{it}}{ASSETS_{it}}$	where PBIT_{it} is the profit before interests and taxes of the *i*th pharmaceutical firm in year *t* and ASSET_{it} is the total assets of the *i*th pharmaceutical firm in year *t*.

Source: Reproduced and modified from Lee (2012), Sahoo & Mishra (2012) and Mishra & Vikas (2010).

Figure 2: Degree of Market Concentration (HHI), 2004-2012



Source: own calculation based on annual reports' sales figures.

Table 2: Classification of Market Structure by HHI

Type of Market Structure	Range of HHI
Highly Competitive Market	HHI < 100
Low Concentration Market	HHI < 1000
Moderately Concentrated Market	1000 ≤ HHI <1800
Highly Concentrated market	HHI ≥ 1800

Source: Adopted from Lu & Liu (2012), Ferreira (2014) and Tililayo and Victor (2014)

Table 3: Functional Model of Market Structure (HHI and Market Share)

Independent Variables	Dependent Variable			
	HHI		SHARE	
Intercept	-4.16	(-0.67)	0.03	(69.15)***
HHI (-1)	1.75	(2.26)**		
HHI (-2)	-0.21	(-0.90)		
CAP_{it-1} (-1)	-0.00	(-1.64)	-0.00	(-0.07)
CAP_{it-2} (-2)	0.00	(1.51)		
$SELL_{it-1}$ (-1)	0.01	(0.21)	0.00	(0.07)
$SELL_{it-2}$ (-2)	-0.05	(-1.62)		
ROS_{it-1} (-1)	-0.02	(-1.87)*	-0.00	(-1.11)
ROS_{it-2} (-2)	0.01	(2.49)**		
ROA_{it-1} (-1)	0.00	(0.10)	0.01	(2.83)***
ROA_{it-2} (-2)	-0.03	(-1.26)		
	Diagnostic Tests			
R^2	0.60		0.99	
Adjusted R^2	0.51		0.99	
F-Statistic	6.12		600.46	
FE Statistic	0.25		650.49	
Hausman χ^2	0.00		0.00	
N	246		324	

***, **, * Statistically significant at 1 percent, 5 percent, and 10 percent respectively. Reported in parentheses ( ) are t-statistics.

Table 4: Functional Model of Business Conduct (CAP and SELL)

Independent Variables	Dependent Variable			
	CAP		SELL	
Intercept	329.05	(1.44)	1.81	(2.19)**
HHI	-41.53	(-1.43)	-0.22	(-2.11)**
SHARE	9.71	(0.67)	0.06	(0.76)
ROS	-2.40	(-2.66)***	-0.00	(-0.79)
ROA	-39.44	(-1.12)	-0.12	(-0.79)
		Diagnostic Tests		
R^2	0.39		0.37	
Adjusted R^2	0.30		0.27	
F-Statistic	4.12		3.75	
FE Statistic	1.09		3.77	
Hausman χ^2	0.00		0.00	
N	324		324	

***, **, * Statistically significant at 1 percent, 5 percent, and 10 percent respectively. Reported in parentheses ( ) are t-statistics.

Table 5: Functional Model of Business Performance (ROS and ROA)

Independent Variables	Dependent Variable			
	ROS		ROA	
Intercept	-89.25	(-1.75)*	-0.72	(-1.28)
HHI	10.57	(1.66)*	0.10	(1.31)
SHARE	0.51	(0.12)	0.76	(4.71)***
CAP	-0.33	(-4.47)***	-0.01	(-3.44)***
SELL	90.95	(4.94)***	0.20	(2.11)**
		Diagnostic Tests		
R^2	0.68		0.58	
Adjusted R^2	0.63		0.51	
F-Statistic	13.75		8.72	
FE Statistic	5.52		8.28	
Hausman χ^2	0.00		0.00	
N	324		324	

***, **, * Statistically significant at 1 percent, 5 percent, and 10 percent respectively. Reported in parentheses ( ) are t-statistics.

Figure 3: Graphical Representation of Panel Granger Causality Effects