International Journal of Applied Econometrics and Quantitative Studies Vol.5-2 (2008)

COMPETITION AND GROWTH: A TIME SERIES ANALYSIS FOR SOUTH KOREA

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Abstract

By utilising South Korea's annual data from 1986 to 2004, the regression results are found to be consistent with the hypothesis that more intense competition makes a substantial contribution to real per capita income growth rate. It is also evident in the structural change analysis that competition has intensified due to the regulatory reform over the period 1999 to 2004, which in turn enhanced the real per capita income growth rate. It has been observed that competition is highly sensitive to real per capita income growth rate. Therefore, the choice of South Korea's policy instruments should be based upon the intensity of competition through the market monitoring mechanism of large companies (e.g., private lawsuits for damage compensation in antitrust cases) as well as regulatory reform.

JEL codes : C32, L16, O53

Keywords : Competition, Real Per Capita Income Growth Rate, Structural Break Analysis, Market Monitoring Mechanism

1. Introduction

A variety of empirical literature suggests that countries which are more competitive than the rest of the world improve the allocation of resources across national boundaries and thus result in faster growth. For example, using a qualitative variable, antitrust, as the measure of competition, Dutz and Hayri (1998) find that a 1-point increase in the perceived effectiveness of antitrust enforcement is associated with an increase of about 0.4 percentage points in the annual growth rate.

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Note: This work was supported by the Second Brain Korea 21 project in 2008.

Their econometric analysis is based on the data from the World Economic Forum (WEF) World Competitiveness Report across 52 countries in 1996. More specifically, they suggest that South Korea was ranked the 33rd of 49 countries in terms of anti-trust as of 1996, whereas it ranked the 3rd in growth residuals. This implies that South Korea has a lower level of competition as compared to the level of growth residuals. In contrast, the critical concentration level hypothesis states that industries with a concentration above a certain critical level will coordinate, showing a positive relationship between concentration and profits, while for the industries below the critical level, this relationship does not hold. For example, using the data on 109 industries at the five-digit level of the New Zealand Standard Industrial Classification conducted by the Department of Statistics, Ratnayake (1996) presents the Ordinary Least Squares (OLS) results of a concentration dummy in the profitability equation. It shows the concentration ratio of 95 appears to be the critical concentration ratio in terms of the highest t-ratio methodology, although the t-ratio is significantly high at the concentration ratios of 33, 35, 36, 59, 61, and 86. In the OLS estimation, advertising intensity, import penetration ratio, physical capital intensity, economies of scale, and industry growth are controlled for. On the other hand, Aghion *et al.* (2001) analyse that an increase in the intensity of competition can eventually reduce the economy's growth rate by reducing the probability of a neck-and-neck industry. They also note that product market competition is most likely to reduce growth when it is already very intense initially.

Thus, we seek to ascertain if the relationship between competition and real per capita income growth rate is supported by South Korea's annual time series data. With a unique business sector-level annual time series data for the period of 1986 to 2004 from South Korea, we first explore the possibility that competition differences are causal to the differentials in real per capita income growth rate. We further investigate whether or not there is a structural change in real per capita income growth rate caused by regulatory reform on competition. We use the concentration ratio for the top 100 leading companies as a proxy for competition (Encaoua and Jacquemin, 1980). To facilitate interpretation of the results, the competition variable is transformed into 100 minus the original concentration

ratio. This implies a positive effect, so that a higher value in the variable will be associated with a relatively more intense competition.

We organise the rest of the paper in the following way. Section 2 develops the analytical framework that highlights the effect of competition on growth rate and structural change analysis in real per capita income growth rate caused by regulatory reform on concentration ratio. Section 3 describes the data. Section 4 presents and discusses the empirical results. The short-run dynamic analysis in the relationship between competition and real per capita income growth rate is also conducted in this section. Finally, Section 5 presents the conclusions.

2. Model

In this section, we examine the possibility that a more intense competition has a positive effect on real per capita income growth rate. The model specification also examines if competition is influenced by regulatory reform. For this purpose, the model is modified appropriately to allow for such an analysis. In order to examine the possibility that competition differences are causal to the differentials in real per capita income growth rate ($g\text{FCY}_t$), the following function can be formulated:

$$g\text{FCY}_t = f(\text{COMP}_t, \text{RR}_t*\text{COMP}_t, X_t) \qquad (1)$$

where g denotes the growth rate in each variable (e.g., $g\text{FCY}_t$ denotes the growth rate of FCY_t), COMP_t refers to the level of competition, RR_t denotes a binary variable (1999-2004=1, corresponding to the period of regulatory reform enacted by the government; otherwise=0), and $\text{RR}_t*\text{COMP}_t$ denotes an interaction variable, that is, an interacted RR_t with COMP_t.

The vector X_t includes the following control variables. OPEN_t denotes the level of trade openness. It is measured as the proportion of the amount of trade to the total factor cost of national income. $\textit{INWARD}\text{FDI}_t$ denotes a binary variable (1998-1999=1, corresponding to the period of an increase in *inward* Foreign Direct Investment; otherwise=0). It is the proxy for greater openness to finance. INV_t denotes the real per capita investment. GOVT_t denotes the size of government while t represents the year.

Equation (1) stands for well-behaved production functions exhibiting diminishing returns to inputs everywhere. An error correction model

(ECM) allows us to study the short-run dynamics in the relationship between real per capita income growth rate and competition. For example,

$\Delta gFCY_t = h(\Delta COMP_t, RR_t * \Delta COMP_t, \Delta X_t, S_{t-1})$ (2)

where Δ denotes the term "change in" (e.g., $\Delta COMP_t$ denotes a change in $COMP_t$) and S_{t-1} denotes the error correction term (Wooldridge, 2000).

3. Data

The data for this investigation comes from the Korea Fair Trade Commission, Korea National Statistical Office, Korea Institute for Industrial Economics and Trade, and the Ministry of Planning and Budget for the period 1986 to 2004. Table 1 provides a description of the variables used in the model as well as their means and standard deviations (SDs).

Table 1. Definition of variables

Variable	Mean (SD)	*Normality Test*[1]
FCY[2]=Real per capita factor cost of national income	7.488 (1.930)	*Accept H_0*
gFCY=Real per capita income growth rate	5.809 (4.578)	*Accept H_0*
COMP[3]=Competition	58.868 (3.023)	*Accept H_0*
NI[4]=The total factor cost of national income	297291 (158317)	*Accept H_0*
TRADE[5]=The sum of exports and imports of goods and services	234505 (147817)	*Accept H_0*
OPEN[6]=The level of trade openness	75.764 (13.044)	*Accept H_0*
INV[7]=Real per capita investment	2.742 (0.689)	*Accept H_0*
FISCAL[8]=Government expenditure	*81400.74 (51749.94)*	*Accept H_0* *Accept H_0*
GOVT[9]=Government size	*25.642 (4.154)*	

Notes: 1. Kolmogorov-Smirnov Test. The alternatives are: H_0=the fits of a normal distribution to the sample data is adequate and H_1=the fits of a normal distribution to the sample data is not adequate. By "Accept H_0" we strictly mean "cannot reject H_0". The α risk controlled at 0.05 on a two-tailed test. 2, 7. Unit: million Korean Won.

Converted with a GDP Deflator (base year=2000). 3. Scale of 0 to 100. 100 minus the concentration ratio for the top 100 leading companies. 4, 5, 8. Unit: billion Korean Won. 6. Unit: %. OPEN is the percentage of the sum of exports and imports of goods and services (TRADE) measured as a share of total factor cost of national income (NI). 9. Unit: %. GOVT is the percentage of the government expenditure (FISCAL) measured as a share of total factor cost of national income (NI). Source: 2, 4, 5, 6, 7. Korea National Statistical Office and Korea Institute for Industrial Economics and Trade. 3. *Annual Statistical Reports*, The Korea Fair Trade Commission. 8, 9. Ministry of Planning and Budget.

We restrict the estimations to a linear multiplicative functional form because this form has been empirically shown to be the most adequate. We have dealt with the functional form issue using the Box-Cox transformation framework and have found the linear transformation suitable. For example, the Box-Cox procedure involves dividing each *g*FCY by the geometric mean of the *g*FCY's. Then, we estimate the two equations and choose the one with the smaller residual sum of squares (RSS). The regression results indicate that the linear model is preferred to the double natural logarithmic model because the linear model RSS (10.01) is smaller than the double natural logarithmic model RSS (10.70). With one exception (i.e., *g*FCY), the variables used in the model are expressed as the level. The real per capita total factor cost of national income, FCY, is expressed as the real per capita income. INV is the real per capita investment. FCY and INV are, respectively, the total factor cost of national income (NI) and the total investment measured in current South Korean Won divided by population and converted to real 2000-levels by applying the GDP (Gross Domestic Product)-deflator (see, e.g., Mahlberg and Url, 2003). To facilitate interpretation of the results, the competition variable (COMP) is transformed into 100 minus the original concentration ratio for the top 100 leading companies (Encaoua and Jacquemin, 1980). This implies a positive effect, so that a higher value in the variable will be associated with a relatively higher level of competition. OPEN is the level of trade openness. It is the sum of exports and imports of goods and services (TRADE) divided by NI. GOVT is the proxy for the size of government. It is measured as a general government expenditure (FISCAL) as a percent of the total factor cost of national income. All the variables used in the model in Table 1 under the

column "Normality Test" show that the observations are normally distributed.

4. Estimation results

The major objective in this section is to test the proposition that competition differences are causal to the differentials in real per capita income growth rate. It also reviews the test of structural change for the estimated regression on real per capita income growth rate, which is possibly caused by the regulatory reform on concentration ratio.

Table 2. Estimates of the real per capita income growth rate equation[1]

Independent Variables	Dependent Variable: $gFCY_t$			
	OLS	Cochrane-Orcutt	Prais-Winsten	ML
$COMP_t$	1.063	1.649	1.033	1.031
	(0.636)	(0.679)**	(0.661)	(0.661)
RR_t*$COMP_t$	0.195	0.197	0.195	0.195
	(0.033)***	(0.031)***	(0.035)***	(0.035)***
$OPEN_t$	0.216	0.241	0.213	0.212
	(0.071)**	(0.067)***	(0.073)**	(0.073)**
INWARDFDI_t	9.624	11.667	9.381	9.367
	(3.624)**	(3.556)***	(3.722)**	(3.719)**
INV_t	2.526	4.010	2.474	2.472
	(1.286)*	(1.466)**	(1.333)*	(1.333)*
$GOVT_t$	-1.798	-1.578	1.797	-1.797
	(0.475)***	(0.457)***	(0.486)***	(0.485)***
Constant	-38.400	-85.032	-36.236	-36.114
	(49.020)	(52.751)	(50.888)	(50.870)
R^2 (Adj.R^2)	0.849	0.875	0.847	—
	(0.774)	(0.807)	(0.749)	
F	11.285***	12.832***	10.123***	—
D.W.	1.763	1.564	1.806	—
SEE	2.175	2.014	2.267	2.267

Notes:1. Values in parentheses are the estimated absolute standard errors of the regression coefficients. ***, **, and * denote significance at the 1%, 5%, and 10% levels on a two-tailed test, respectively.

In a comparison of the standard errors of the estimates (SEE) for OLS, Cochrane-Orcutt, Prais-Winsten, and maximum likelihood (ML) estimates in Table 2, we choose the Cochrane-Orcutt estimates since it resulted in a smaller standard error. SEE indicates that the

smaller the variance of the sampling distribution, the greater the precision of the estimator. The use of SEE is also based upon the overall model performance. The Cochrane-Orcutt estimates on real per capita income growth rate (gFCY$_t$) suggest that a 10-point increase in competition (COMP$_t$) increases the real per capita income growth rate by 16.49 percent. These results imply that a more intense competition is associated with higher real per capita income growth rate. In order to confirm this, the tests for causality are also executed by regressing gFCY$_t$ on two lags of gFCY$_t$ and COMP$_t$ (Wooldridge, 2000). The estimated absolute t-values on COMP$_{t-1}$ and COMP$_{t-2}$ are 3.558 and 3.311, respectively. Therefore, we reject the null that COMP$_t$ does not cause gFCY$_t$. Based on a single cross-sectional data for 34 countries from the 2003 World Economic Forum by Porter (2003), we also find that a one-unit increase in competition index increases the per capita GDP converted with PPP (Purchasing Power Parity) by 0.28 percent at the 1% level of significance. The observed values for R^2, F, and D.W.(Durbin-watson) are 0.890, 19.488, and 1.753, respectively. The competition variable is measured as a quality of the national business environment ranking because it includes the competition as a primary ingredient. In the OLS estimates, the degree of openness to trade, foreign direct investment, business integrity, transparency, regulatory reform, education, health, and interaction variable are controlled for.

The degree of trade openness (OPEN$_t$) is positively and significantly associated with the real per capita income growth rate. Given that the percentage of the sum of exports and imports of goods and services measured as a share of total factor cost of national income is the proxy for trade openness (e.g., Lederman, Loayza, and Soares, 2005), trade openness may be a causal factor for higher real per capita income growth rate.

The financial openness binary variable (*INWARD*FDI$_t$) is positive and significant, as expected; real per capita income growth rate is increased by 11.667 percentage point during the period 1998 and 1999, corresponding to the period of an increase in *inward* FDI. Cross sectional evidence also shows that FDI is associated with growth and is more productive than domestic investment (Rogers, 2003). This reflects that more financial openness leads to higher

growth rate. To summarize, greater openness, whether it be to trade or to finance, is an important influence upon income.

On the other hand, the estimated coefficient on the real per capita investment (INV_t) maintains a theoretically expected positive sign and is statistically significant. This implies that a higher real per capita investment is, as predicted by all previous studies, associated with a higher real per capita income growth rate. For example, Rogers (2003) argues that investment and growth are closely linked and that policies that hinder investment may well reduce growth.

It points out that greater government size ($GOVT_t$) has a negative effect on real per capita income growth rate. An implication of this is that a big government *per se* may not necessarily raise growth rate. This is primarily due to red tape. Thus, it should be well run with an efficient judiciary.

Table 3. Summary statistics for change in slope of competition in income growth rate function due to the regulatory reform dummy (RR_t): Cochrane-Orcutt Estimates[1]

Dependent Variable/ Coefficient of	Competition ($COMP_t$)	SEE	Chow test[2]
gFCY$_t$		2.014	t=6.425***
No RR	1.649		
RR	1.846		
Change in Coefficient	0.197		

Notes: 1. Summary statistics in Table 2 under the column "Cochrane-Orcutt". 2. *** denotes significance at the 1% level on a two-tailed test. For the test procedure see Dowrick (1993).

On the other hand, in Table 3, the observed Chow t-statistic of 6.425 is greater than the critical value of 3.106 with 11 degrees of freedom at the 1% level of significance using a two-tailed test, implying that the null hypothesis of no structural change in concentration ratio during the period of regulatory reform (1999-2004) is rejected (Dowrick, 1993). This suggests that there is strong evidence of structural change in real per capita income growth rate caused by regulatory reform on concentration ratio. This point is based on the view that regulatory reform is associated with a lower concentration ratio. With no regulatory reform, a 10-point increase in competition

caused a 16.49 percent increase in real per capita income growth rate versus an 18.46 percent increase with regulatory reform, ceteris paribus, implying that regulatory reform raises real per capita income growth rate through more intense competition.

Table 4. Estimates of the error correction terms[1]

Endogenous Variable	Constant	□Competition (□$COMP_t$)	Error correction Term: S_{t-1}	R^2 (Adj.R^2)
Income growth rate (gFCY$_t$)	-31.980 (6.354)***	0.935 (0.301)**	-0.584 (0.123)***	0.970 (0.951)

Notes: 1. RR_t*□$COMP_t$ and □X_t are controlled for.

The estimated ECM results in Table 4 under the column "Error Correction Term" indicate that the error correction coefficient is negative and significant. This implies, for example, that real per capita income growth rate in the previous period has overshot the equilibrium; real per capita income growth rate falls by 0.584% on average in the next year (Wooldridge, 2000). In Table 5, the elasticity indicates that competition ($COMP_t$) is more sensitive on real per capita income growth rate (gFCY$_t$) than the control variables; a 1% increase in competition enhances real per capita income growth rate by 16.711%. This suggests that competition should be intensified.

Table 5. The ceteris paribus mean elasticity of real per capita income growth rate with respect to competition and the control variables[1]

Endogenous Variable	Exogenous Variables			
	$COMP_t$	$OPEN_t$	INV_t	GOV_t
gFCY$_t$	16.711	3.143	1.893	-6.966

Note: 1 In absolute terms. The elasticity can be calculated as: the Cochrane-Orcutt estimates in Table 2* (mean of each exogenous variable/mean of gFCY$_t$), where the mean of gFCY$_t$ is 5.809. For example, the elasticity of gFCY$_t$ with respect to $COMP_t$ can be obtained as: 1.649*58.868/5.809=16.711.

5. Conclusion

Using the annual time series data from 1986 to 2004 in South Korea, the most important results and analysis of the Cochrane-Orcutt estimates can be drawn. First, the empirical results are consistent

with the hypothesis that more intense competition makes a substantial contribution to real per capita income growth rate. Second, it is evident from the structural change analysis that the concentration ratio has declined due to the regulatory reform over the 1999-2004 period, which in turn raises real per capita income growth rate. The level of openness, investment, and government size are held constant. A higher elasticity is associated with a higher real per capita income growth rate. Therefore, in order to enhance real per capita income growth rate, the choice of South Korea's policy instruments should be based upon the intensity of competition through the market monitoring system of large companies (e.g., private lawsuits for damage compensation in antitrust cases) as well as regulatory reform (Serra, 2006) and greater openness (Edwards, 1998).

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