Openness and Growth: Evidence from Korea for 1986-2004*

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By utilizing a unique annual series data of the Korean economy from 1986 to 2004, this paper discovers that differences between two indicators of openness (i.e., trade and finance) are causal to the differentials in real per capita income growth rate. The empirical evidence is consistent with the hypothesis that, with other factors given, greater openness to finance and trade makes a substantial contribution to higher real per capita income growth rate. Therefore, in order to increase real per capita income growth rate, Korean economic policies must pursue greater openness to trade and finance as well as regulatory reform.

Keywords: Trade Openness, Financial Openness, Growth Rate

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I. INTRODUCTION

Numerous economic literatures suggest that countries with greater economic openness tend to improve the allocation of resources across national boundaries, and thus result in faster economic growth.

For example, Edwards (1998), based on the instrumental weighted least squares estimate of the total factor productivity (TFP) growth, proposes that after controlling for the log of initial per capita Gross Domestic Product (GDP) and the initial level of human capital measured as the mean number of years of education, productivity growth appears to be faster and the trade openness tends to be higher. The *t*-value is estimated to be 1.95, which is significant at $\alpha = 10\%$ on a two-tailed test. For the empirical work, he uses an openness index, estimated by Leamer, as the average residuals from disaggregated trade flows regressions for the openness indicator. This has a positive effect, so that a higher value in the variable is associated with a relatively more trade openness. The raw data on total physical capital, human capital, and real GDP are taken from Neruh and Dhareshwar. The shares of the estimated factor are then used to construct annual estimates of the TFP growth. The average of the TFP growth in the 1980s is also calculated for thirty three countries.

On the other hand, statistical data of the Korean economy from 1986 to 2004, provided by the Korea National Statistical Office and Korea Institute for Industrial Economics and Trade, demonstrates that Korea recorded 1.29% in the rate of growth in openness to trade measured as the proportion of the sum of exports and imports of goods and services to total factor cost national income, whereas it recorded 5.81% in real per capita factor cost national income growth rate (hereafter real per capita income growth rate). This implies that Korea has a lower level of trade openness compared to the level of income growth rate.

The crux of the issue is whether more openness to trade causes higher real per capita income growth rate. Thus, the paper attempts to discover whether or not the positive relationship between trade openness and real per capita income growth rate is supported by the annual series data of the Korean economy. In this paper, the real per capita income growth rate is considered as one of the criteria of economic performance. For example, in investigating the adverse economic impact of corruption with cross-sectional data for twenty-five countries, Abed and Davoodi (2000) note that real per capita GDP growth rate has been widely used in the analysis for the impact of corruption on economic performance.

On the other hand, Rogers (2003) considers that trade openness is only one aspect of economic openness more broadly defined, arguing "openness to capital flows and knowledge flows are likely to be as important" (p.127). On the basis of his argument, the paper explores the possibility that differences between the two indicators of openness (i.e., trade and finance) are causal to the differentials

in the real per capita income growth rate.

In this paper, we use the proportion of the sum of exports, and imports of goods and services to total factor cost of national income as a proxy for the level of trade openness. We also use a financial openness binary variable (1998-1999 = 1, corresponding to the period of an increase in *inward* Foreign Direct Investment (FDI); otherwise = 0) due to the limitation of accessible financial openness indicator. To our knowledge, no study has shown empirical evidence on the relationship between the trade and financial openness indicators, and real per capita income growth rate including the *post*-Korean economic crisis of 1997-1998.

For the estimation, we utilize a unique annual series of Korean data from 1986 to 2004. We organize the paper in the following way. Section II develops an analytical framework that highlights the effects of the two indicators on the real per capita income growth rate. Section III describes the data. Section IV presents and discusses the empirical results. Finally, Section V draws a conclusion.

II. MODEL

In order to examine the effects of the two indicators of economic openness (i.e., trade and finance) on the real per capita income growth rate ($gFCY_t$), the following function can be formulated (Frankel and Romer, 1999; Hall and Jones, 1999):

$$gFCY_t = f(OPEN_t, INWARD FDI_t, COMP_t, GC_t, PC_t, GOVT_t, INV_t) \quad (1)$$

In this equation, g denotes the rate of growth in each variable (e.g., $gFCY_t$ denotes the growth rate of FCY_t). $OPEN_t$ indicates the level of trade openness. $INWARD FDI_t$ denotes a binary variable. It is the alternative for greater openness to finance. $COMP_t$ refers to the level of competition. Table 1 provides a description of the variables used in the model as well as their means and standard deviations (SDs).

Corruption refers to a situation where an agent (an official), entrusted to carry out a task by the principal (the public), engages in some sort of malfeasance for private enrichment. Corruption in any form and shape is difficult for the principal to monitor (Bardhan 1997). In order to comply with this, we classify corruption into two categories, the public sector and the business sector. Given the accessible corruption indicators, the number of public workers exposed as a result of audit and inspection in the public sector, GC_t , refers to a proxy for corruption in the public sector, while the number of unfair business practices, PC_t , stands as a proxy for corruption in the business sector. INV_t indicates the real per capita investment. $GOVT_t$ denotes the size of government, while

t represents the year. Equation (1) stands for well-behaved production function exhibiting diminishing returns to inputs everywhere.

III. DATA

Data employed for this investigation comes from the Korea National Statistical Office, Korea Institute for Industrial Economics and Trade, the Korea Fair Trade Commission (KFTC), the Board of Audit and Inspection of Korea, and the Ministry of Planning and Budget for the period from 1986 to 2004. We have dealt with the issues of the functional form using the Theil maximum that is adjusted to multiple determination ($\text{Adj. } R^2$) criterion and have found the linear transformation suitable (Maddala 1992).

The real per capita total factor cost of national income, FCY, is expressed as the real per capita income (Nicholson, 1955). INV is the real per capita investment. FCY and INV are, respectively, the total factor cost of national income and the total investment measured in current Korean Won divided by population and converted to real 2000-levels by applying the GDP-deflator (see, e.g., Mahlberg and Url 2003).

TABLE 1. DEFINITION OF VARIABLES

Variable	Mean (SD)	RUNS Test ^a
$g \text{ FCY}^b$ = Real per capita income growth rate	5.809 (4.578)	Accept H_0
OPEN^c = The level of trade openness	75.764 (13.044)	Accept H_0
COMP^d = The level of competition	58.868 (3.023)	Reject H_0
GC^e = Public sector corruption	1057.737 (314.651)	Accept H_0
PC^f = Business corruption	0.277 (0.099)	Accept H_0
GOVT^g = The size of government	25.642 (4.154)	Reject H_0
INV^h = Real per capita investment	2.742 (0.689)	Accept H_0

NOTES: a The alternatives are: H_0 = Sequence generated by a random process, H_1 = Sequence generated by a process containing persistence. Cut point = mean. By "Accept H_0 " we strictly mean "cannot reject H_0 ." The α risk controlled at 0.01 on a two-tailed test. If p-value is smaller than α , H_0 is rejected.

b, c, g Unit: %.

d Scale of 0 to 100. Transformation: Value in this paper = 100 minus the original concentration ratio for the top 100 leading companies.

e The number of public workers exposed as a result of audit and inspection in the public sector.

f The number of unfair business practices with the unit of thousand.

h Unit: million Korean Won. Converted with GDP Deflator (base year = 2000).

SOURCE: b, c, h Korea National Statistical Office and Korea Institute for Industrial Economics and Trade.

d, f Annual Statistical Reports, The Korea Fair Trade Commission.

e Annual Audit Reports, The Board of Audit and Inspection of Korea.

g Ministry of Planning and Budget.

OPEN is the level of openness to trade. It is the sum of exports and imports of goods and services divided by the total factor cost of national income (e.g., Lederman et al. 2005; Serra 2006). We use the concentration ratio for the top 100 leading companies as a proxy for competition (KFTC Whitepaper 2007). To facilitate interpretation of the results the competition variable (COMP) is transformed into 100 minus the original concentration ratio (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.

GOVT is the proxy for the size of government. It is measured as general government expenditure as a percent of the total factor cost of national income. With two exceptions (COMP and GOVT), the variables used in the model in Table 1 under the column "RUNS Test" show that the observations are normally distributed and independent; thus stationary (Lessard, 2006).

IV. ESTIMATION RESULTS

The major objective of this section is to examine the possibility that the differences between the two openness indicators (i.e., trade and finance) are causal to the differentials in real per capita income growth rate. In Table 2, under the columns "OLS (Ordinary Least Squares)", "C-O (Cochrane-Orcutt)", and "P-W (Prais-Winsten)", the observed values of D.W. (Durbin-Watson) indicate that the null hypothesis of no serial correlation is not rejected at the 0.05 level of significance. This also suggests that each of the three regression equations is correctly specified.

The "C-O" estimation omits the first observation and uses the first order serial correlation, whereas the "P-W" estimation uses the first observation. Nineteen years do not generate a sufficient number of observations. Therefore, we use the "C-O" and "P-W" regression methods. We select the econometric results from both the OLS and C-O estimates, since the estimated coefficients on public sector corruption (GC_t) are significant at $\alpha = 10\%$ and $\alpha = 5\%$, using the two-tailed test, respectively. In a comparison of the OLS and C-O estimates, the observed value of R^2 (the coefficient of multiple determination) in the latter is greater than in the former, revealing better fit. On the basis of this, we concentrate on an analysis of the econometric results from the C-O estimates.

The degree of openness to trade ($OPEN_t$) is positively and significantly associated with the real per capita income growth rate. For example, a coefficient of 0.286 suggests that a 10% increase in the sum of exports and imports of goods and services measured as a share of total factor cost of national income, other things being equal, increases the real per capita income growth rate by 2.86%.

The financial openness binary variable ($INWARD FDI_t$) is positive and significant, as expected; the real per capita income growth rate is increased by 15.456% 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 investments (Rogers 2003). This reflects that more financial openness leads to higher growth rate. In sum, greater openness, whether it is to trade or to finance, has a significant impact on income.

On the other hand, competition ($COMP_t$) is not significantly related to real per capita income growth rate ($gFCY_t$) when using the individual t-test. The estimated coefficient of corruption in the public sector and corruption in the business sector (PC_t) maintains a theoretically expected sign and is statistically significant. For example, Lee (2005) presents the evidence that, in Korea, a 10 point increase in public sector integrity and business integrity increases real per capita income by U.S.\$1,934 and U.S.\$2,476, respectively. His estimations are based on the cross-sectional data of thirty-two countries from the 2002 opacity index and the 2003 corruption perception index that have been conducted

TABLE 2. ESTIMATES OF THE REAL PER CAPITA INCOME GROWTH RATE EQUATION^a

Independent Variables	Dependent Variable: $gFCY_t$			
	OLS	C-O	P-W	ML
$OPEN_t$	0.272 (0.073)***	0.286 (0.074)***	0.236 (0.065)***	0.234 (0.062)***
$INWARD FDI_t$	14.313 (4.406)***	15.456 (4.557)***	12.454 (4.073)**	12.279 (3.956)**
$COMP_t$	0.452 (0.739)	0.840 (0.837)	0.563 (0.700)	0.567 (0.684)
GC_t	-0.006 (0.003)*	-0.006 (0.003)**	-0.004 (0.003)	-0.004 (0.003)
PC_t	-30.772 (7.692)***	-29.959 (7.741)***	-35.107 (7.480)***	-35.772 (7.351)***
$GOVT_t$	-2.075 (0.503)***	-1.902 (0.532)***	-1.785 (0.451)***	-1.766 (0.436)***
INV_t	6.371 (1.778)***	7.261 (1.992)***	5.482 (1.737)**	5.389 (1.697)**
Constant	7.910 (56.755)	-23.218 (64.882)	-1.514 (53.440)	-1.990 (52.169)
R^2	0.869	0.874	0.932	—
F	(7, 11) = 10.412***	(7, 10) = 9.891***	(7, 10) = 19.685***	—
D.W. ^b	2.453	2.333	2.498	—

NOTE: a 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.

b D.W.; D.W._U = 2.396 with $k' = 7$ at $\alpha = 5\%$. The estimated D.W. values under the columns "OLS", "C-O", and "P-W" suggest that the null of no serial correlation is not rejected, since the observed D.W. value is larger than the tabulated upper boundary value (D.W._U) or since it lies between D.W._U and the value of 4-D.W._U.

by the Price Waterhouse Coopers (PWC) and the Transparency International (TI). To facilitate the interpretation of the results, the variables are transformed into 100 minus the original PWC opacity index and 10 times the original TI corruption perception index.

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 large government *per se* may not necessarily raise economic growth rate. This is primarily due to red tape. Thus, it should be well run with an efficient judiciary. In Table 2, under the column "C-O", the real per capita investment variable (INV_t) presents a statistically significant coefficient with the predicted positive sign. For example, Rogers (2003) argues that investment and growth are closely linked, and that policies that hinder investment may well reduce economic growth.

In order to reinforce the conclusions stated above, the tests for causality are also adopted and the results are summarized in Table 3. For example, to test whether $OPEN_t$ causes $gFCY_t$, we regress $gFCY_t$ on two lags of $gFCY_t$ and a lag of $OPEN_t$ (Wooldridge 2000). The estimated absolute t-value on $OPEN_{t-1}$ is 2.218, which is significant at 5% level on a two-tailed test. Therefore, we reject the null that $OPEN_t$ does not cause $gFCY_t$, suggesting that real per capita income growth rate increases with trade openness.

In Table 2, competition has neutral effect on real per capita income growth rate. In order to confirm this, the tests for causality are executed by regressing $gFCY_t$ on two lags of each of $gFCY_t$ and $COMP_t$. The estimated absolute t-values on $COMP_{t-1}$ and $COMP_{t-2}$ are greater than the critical value at the 0.01 level of significance on a two-tailed test. Therefore, we reject the null that $COMP_t$ does not cause $gFCY_t$, implying that more intense competition enhances real per capita income growth rate.

Based on a single cross-sectional data for thirty-four 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 Purchasing Power Parity (PPP) by 0.28% at the 1% level of significance. The observed values for R^2 , F , and $D.W.$ 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.

Adopting the causality test we also reject the null hypothesis at the 0.10 level of significance that each of GC_t and PC_t does not cause $gFCY_t$. An implication of this is that corruption in the public sector and corruption in the business sector have detrimental effects on real per capita income growth rate.

TABLE 3. TESTS FOR CAUSALITY BETWEEN gFCY AND EACH OF INDEPENDENT VARIABLES: OLS ESTIMATES^a

		Independent Variables				
OPEN _{t-1}	COMP _{t-1}	COMP _{t-2}	GC _{t-1}	PC _{t-1}	GOVT _{t-1}	INV _{t-1}
2.218**	4.030***	3.488***	2.027*	1.980*	4.036***	3.382***

NOTE: a gFCY_{t-1} and gFCY_{t-2} are controlled for. The t-statistic denotes the estimated absolute value. ***, **, and * denote significance at the 1%, 5%, and 10% levels on a two-tailed test, respectively. For the test procedure see Wooldridge (2000). To test whether GOVT causes gFCY, conditional on two indicators of corruption, we regress gFCY_t on gFCY_{t-1}, gFCY_{t-2}, GC_{t-1}, PC_{t-1}, and GOVT_{t-1} and do significance test on GOVT_{t-1} (Stock and Watson 1989).

V. CONCLUSIONS

Using the annual series of data for the Korean economy from 1986 to 2004, the Cochrane-Orcutt estimates suggest that greater openness to finance and trade makes a substantial contribution to higher real per capita income growth rate. In the estimation, competition, public sector corruption, business corruption, the size of government, and investment are controlled for. Each of their estimated coefficients is statistically significant and as predicted by all previous studies. For example, public sector corruption and business corruption have detrimental effects on real per capita income growth rate. We found that the real per capita income growth rate appears to be higher when the size of a government is smaller. It also implies that the higher the real per capita investment, *ceteris paribus*, the higher the real per capita income growth rate. It is also evident in the causality tests that competition differences are causal to the differentials in real per capita income growth rate.

A higher elasticity is associated with a higher real per capita income growth rate. In Table 4, the elasticity indicates that, with one exception (i.e., GOVT), openness to trade (OPEN) is more sensitive to real per capita income growth rate (gFCY_t) than the control variables; a 10% increase in trade openness enhances

TABLE 4. THE CETERIS PARIBUS ELASTICITY OF gFCY WITH RESPECT TO INDEPENDENT VARIABLES^a

A 1 per cent increase in:	Percentage Change in real per capita income growth rate
OPEN	3.730
GC	-0.006
PC	-1.429
GOVT	-8.396
INV	3.427

NOTE: a The elasticity can be calculated as: the C-O estimates in Table 2 under the column "C-O"*(mean of each independent variable/mean of gFCY_t) where mean value are given in Table 1. For example, the elasticity of gFCY_t with respect to OPEN_t can be obtained as: 0.286*75.764/5.809 = 3.730.

real per capita income growth rate by 37.3%. Therefore, in order to enhance real per capita income growth rate, economic policy makers of the Korean government should consider the fact that greater openness to trade and finance as well as regulatory reform.

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