DETERMINANTS OF ECONOMIC GROWTH IN KOREA

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ABSTRACT

Using quarterly time series data for the period 1970–2007, this paper examines the determinants of economic growth in Korea. A statistical analysis of data on 151 observations validates the findings in the literature of empirical studies of economic growth except financial development. We find that capital formation and total trade lead to an increase in economic growth in Korea. We also find that financial development and inflation have negative effect on growth.

Keywords*: Economic Growth; Capital Formation; Total Trade; Financial Development; Inflation*

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1. Introduction

The growth position of the less developed countries today is significantly different in many respects from that of the presently developed countries on the eve of their entry into modern economic growth.

- Simon Kuznets, Nobel Laureate, Economics

Professor Simon Kuznets has cleared a country's economic growth as a long-term rise in capacity to supply increasingly various economics goods to its population, this growing capacity based on advancing technology and the institutional and ideological adjustments that it demands.

Economic growth is important for society as it increases real income and consumption, both in absolute and per capita terms, and hence makes us materially better off. Even minute increases in a country's growth rate can result in dramatic changes in living standards over just one generation. Economic growth refers to the steady process by which the productive capacity of the economy is increased over time to bring about rising levels of national output and income (Todaro, 1997).

Prior to the economic crisis of 1997, Korea's impressive growth performance was part of what has been described as the East Asian miracle. The three decades of extraordinary growth that transformed Korea from one of the poorest agrarian economies to the 11th largest economy and exporting country in the world, culminated in its accession to the Organization for Economic Cooperation and Development (OECD) on December 12, 1996. Korea's rapid development was driven by very high rates of savings and investments and a strong emphasis on education, which boosted the number of young people enrolled in universities to among the highest levels in the world.

This paper is organized as follows. Section II presents the framework and empirical evidence on the determinants of economic growth. Section III discusses the methodology and data. Section IV presents the discussion on empirical results. Conclusion is presented in Section V.

2. Framework And Empirical Studies

A framework for determining growth is briefly provided by Barro (1997). In this model,

$$g = f(y, y^*)$$

where g is the growth rate of per capita output (e.g., Gross Domestic Product), y is the current level of per capita output, and y^* is the steady-state level of per capita output. At the steady-state level, the level of output per worker still increases because of exogenous labor-augmenting technological innovations, although the output per effective labor will remain constant. In such an economy, output, consumption, and investment will be able to grow at the same rate. It should be understood that steady-state growth is a useful concept only in understanding economic growth. In reality, it is rather difficult to determine if steady-state growth has been obtained. The steady-state level of output is determined by economic, social, cultural, demographic, and political structures. It depends on, among other factors, savings and consumption patterns. For a society with a propensity toward consumption and an aversion to savings, that country's steady level of output is lower, keeping everything else constant, than a country that saves and invests a lot.

In addition to economic and demographic factors, the output at the steady-state level is determined also by political and social institutions including tax rates, the extent of distortions in markets and business decisions, maintenance of the rule of law and property rights, and the degree of political freedom (Barro, 1997). Given the steady-state level output y^*, an increase in output decreases its growth rate because of diminishing returns (i.e., $(\partial g)/(\partial y) < 0$). Given the current output level y, an increase in the final equilibrium level of output y^*, as a consequence of improvements in exogenous conditions favorable to the economy, will increase the growth rate of output (i.e., $(\partial g)/(\partial y^*) > 0$).

Many economic variables are considered important for economic growth, including investment, human capital, international trade, and inflation. In Levine & Renelt's (1992) systematic study of numerous economic factors that may account for long-run aggregate economic growth, trade and investment are identified as major inputs for growth, although the effect of trade on growth weakens when controlled by investment. They also find that the initial level of development has a negative effect on growth, conditional upon the level of human capital. Human capital always is found to exert a positive impact on growth, although this effect

does not hold over the period of 1974-1989. Barro (1991, 1997) identifies that among a multitude of variables, initial levels of GDP, initial levels of human capital, fertility rates, government consumption, the rule of law index and trade all have some effects on growth.

Chirinko & Morris (1994) suggest that there is a positive long-run relationship between capital formation and per capita growth. Capital formation is measured by domestic real gross investment's share of real GDP. Economic growth is measured by the percentage change in per capita real GDP. Their proposals stem from heightened concerns that the U.S. economy has been growing by less than its long-run potential, and from the judgment that this sub average growth is due in part to scarce capital formation.

For the United States, Silva & Leichenko (2004) report that increases in trade seem to be associated with a growth of inter and intrastate inequality, but that this outcome is far from being straightforward. Poorer rural areas and states generally benefit from cheaper exports, but are particularly hurt by cheaper imports. Richer urban areas and states, in contrast, benefit overall from cheaper exports and cheaper imports are associated with a rise in employment, but not in earnings (Leichenko & Silva, 2004; Silva & Leichenko, 2004). Empirical studies of the opening of the Mexican economy to trade have come out with similar results. For example, Hanson's (1996) study showed how a shift away from import substitution in Mexico precipitated a dispersion of manufacturing industry from Mexico City, conditions in principle conducive to a reduction in regional disparities.

The cross country study started by Goldsmith (1969) which shows graphically positive association between finance and growth has subsequently been followed by several cross-country studies. These add more countries, more variables for financial development and economic growth that are observed over longer periods. Studies with disaggregated data across industries and firms levels are also conducted. All those studies, while finding positive association between finance and growth, do not conclude on whether finance causes growth. In their influential cross-country study, King and Levine (1993), using data for 77 countries for the period 1960–89, shows strong and positive relationship between financial development and growth. While they show finance predicts growth, they do not deal formally with the issue of causality. Levine & Zervos (1998), using data for 42 countries over 1976–93, find positive relationship between stock market development and growth, capital accumulation, and productivity growth.

More recently, Khan & Senhadji (2000), in a cross-country and panel study, using data for 159 countries over 1960–99, find effect of financial development on growth is positive, but the size of the effect varies with different indicators of financial development, estimation method, data frequency, and the functional form of the relationship. They do not deal formally with the causality issue. Financial development is measured by credit to private sector, stock market capitalization, and bond market capitalization as a share of GDP.

It is generally thought that there is a negative relationship between inflation and long-term economic growth. However, the willingness of observers to express this hypothesis seems much stronger than the empirical evidence for it. Early empirical studies provide very mixed results with a variety of data sets and approaches that attempt to provide empirical substantiation for the hypothesis (Haslag, 1997). It is difficult to pin down a negative long-term relationship because in the short-run a Philips curve phenomenon can lead to a positive relationship between growth and inflation. Several influential studies in the early 1990s (Fischer, 1993 & Barro, 1996) provided the empirical basis for the widely supported negative relationship. More recently, Bruno and Easterly (1998) have provided a thorough examination that provides some

clarification. They conclude that the negative relationship between inflation and growth is due to high inflation episodes. Inflation has a negative impact on growth in the long run that is due to high inflation episodes; the threshold for an inflation effect on growth may be as high as 40 percent per year.

3. Methodology and Data

Based on earlier work, the empirical model is specified as follows:

$$\ln GDP_t = \beta_0 + \beta_1 \ln K\_FORMATION_t + \beta_2 \ln T\_TRADE_t + \beta_3 \ln FIN\_DEV_t + \beta_4 INFLATION_t + u_t$$

where GDP_t refers to real Gross Domestic Product, $K\_FORMATION_t$ refers to gross fixed capital formation, total trade (T_TRADE_t) is defined as the sum of exports and imports of goods and services, financial development (FIN_DEV_t) is measured by claims on private sector divided by real GDP, $INFLATION_t$ refers to inflation, and u, the error term. All variables are used in natural logs except inflation because that data in percentage and expressed in real terms.

This paper using quarterly time series data for the period 1970–2007, included 151 observations. These data found from IFS (International Financial Statistic) CD-ROM Version 1.1.82 (IFS March 2008). The list of variables used in the regressions is provided in Appendix (Table A). The software Eviews 5 was used for these tests.

The methodology used in this paper is based on ordinary least squares (OLS) estimation. For detecting autocorrelation, we used Durbin-Watson *d* test. From that result, we found that there is autocorrelation, therefore for correcting autocorrelation we used Cochrane-Orcutt iterative procedure (COIP) for estimating ρ. This is the method of generalized least squares (GLS). From the first round result COIP, Durbin-Watson *d* test shows that the autocorrelation still existing, than it needs to iterate the procedures OLS again to obtains the ε_t*. This iterative procedure can be stopped since the estimates of ρ from two successive iterations do not differ very much. From the second rounds result COIP, Durbin-Watson *d* test shows that do not reject the null hypothesis, which means no autocorrelation.

For testing heteroscedasticity, we focus on Park Test. If β_1 turns out to be statistically significant, it would suggest that heteroscedasticity is present in the data. If it turns out to be instatistically, we may accept the assumption of homoscedasticity.

A series of data can often contain a structural break, due to a change in policy or sudden shock to the economy. In order to test for a structural break, Chow stability test with break point of the year 1997Q4 is performed (on October 1997, the Korean Stock Exchange began to fall followed by a sharp fall of the Korean Won against dollar).

Lastly, for the test of normality, we focused on Jarque–Bera (*JB*). The JB test of normality is an asymptotic, or large sample, test. It is also based on the OLS residuals. The JB test statistic has a chi-square distribution with two degrees of freedom. In practice, all we need to do is to compare the JB test value with the theoretical value of chi-square with 2 degrees of freedom, at a pre-specified level of significance. If the JB statistic is greater than the corresponding chi-square we reject the normality assumption. From the histogram, we found that the Jarque–Bera normality test does not reject the normality assumption.

4. Discussion on Empirical Results

Table 1 report statistical results using ordinary least square (OLS) estimation in Korea. For the first OLS in Column 1, all the variables are individually significant at 1% level of significance except financial development. The sign of estimated coefficients are consistent with theory except financial development. The goodness of fit is quite satisfactory, with an adjusted R^2 as high as 0.9968 and a standard error of regression as low as 0.1001. While capital formation and total trade have a positive effect on growth, financial development and inflation are found to have negative effect on growth. All these findings are consistent with theoretical expectations. According to Durbin-Watson statistic, there is positive autocorrelation (0.05 level of significance, d_L = 1.665, d_U = 1.802, k' = 5).

For the second OLS in Column 2, we used Cochrane-Orcutt iterative procedure (COIP) to estimate ρ for correcting autocorrelation. From the first round result COIP (OLS*), Durbin-Watson *d* test shows that the autocorrelation still exist.

For the third OLS in Column 3 (OLS**), we used COIP for the second round. According to decision rule for autocorrelation, Durbin-Watson *d* test shows that does not reject the null hypothesis, which means no autocorrelation. The goodness of fit is quite satisfactory, with an adjusted R^2 as high as 0.9277 and a standard error of regression as low as 0.0655.

Table 1: Estimates for the Growth equation in Korea

Variables	OLS	OLS*	OLS**
Intercept	1.4881	1.3524	1.1625 (36.9848)***
ln	(18.8476)***	(17.4938)***	0.0169 (0.4318)
$K\_FORMATION_t$	0.5167	0.4641	0.9299 (16.8748)***
ln T_TRADE_t	(13.4733)***	(10.7712)***	-0.7177 (-20.0555)***
ln FIN_DEV_t	0.4236	0.4938	-0.0051 (-2.2016)**
ln $INFLATION_t$	(10.1569)***	(10.4311)***	0.9296
R^2	-0.0359 (-0.8275)	-0.1451	0.9277
Adj R^2	-0.0062	(-3.0288)***	0.0655
σ	(-4.3119)***	-0.0067	1.9082
DW Statistic	0.9969	(-4.0556)***	150
Obs.	0.9968	0.9955	
	0.1001	0.9954	
	1.6529	0.0972	
	151	1.5919	
		150	

Notes: Numbers in parentheses are *t*-statistics based on the OLS estimates.
OLS* refers to GLS using Cochrane-Orcutt iterative procedure for the first round (ρ = 0.173175).
OLS** refers to GLS using Cochrane-Orcutt iterative procedure for the second round (ρ = 0.886199).
*** Indicates 1% level of significance.
** Indicates 5% level of significance.
* Indicates 10% level of significance.

According to Park Test, the result from OLS** estimation shows that do not reject the null hypothesis, which means no heteroscedasticity present in the data. Notice that the Chow test is highly significant for break point to the year 1997Q4. We found that the estimated parameters are not stable; therefore reject the null hypothesis, which means there is a structural break during the sample period 1970-2007. This is not a very surprising result given the state of the world at that time.

Lastly, the residuals from the economic growth regression seem to be symmetrically distributed. Application of the *JB* test shows that we do not reject the hypothesis that the error terms are normality distributed.

5. Conclusion

The studies of determinants of economic growth have been well conducted by many other scholars and organizations. Nevertheless, there is still more work needed to be done in these research areas. In this paper, we limited the study to a regression analysis of the effect of capital formation, total trade, financial development and inflation on growth. However, more in strength analysis would be interesting to explore empirically the role played by other variables like foreign direct investment, international trade, intellectual property rights, private and semi-private enterprises, higher education, fertility, and the presence of state-owned enterprises.

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