

## Decomposing and Analyzing Korea's Declining GDP Growth: Some Cautions and Suggestions

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### Abstract

Chin Hee Hahn and Sukha Shin (2007) have developed new decompositions of Korean economic growth from 1990 to 2004. They find that Korea's declining GDP growth has been accompanied by a sharp decline in capital deepening and an increase in total factor productivity. By contrast, Jorgenson and Vu's (2007) decompositions of Korea's GDP growth find that total factor productivity decreased over this period. This paper compares the two decompositions; evaluates Hahn and Shin's hypothesis that competition from Chinese imports may be driving the decline in GDP growth; and briefly presents four other candidates (decline in Korean savings, business cycle effects, weak IT investment, and regulatory and wealth redistribution initiatives) that could be partially responsible for the slowdown in Korean GDP growth.

Key Words: GDP, TFP, China, Korea, capital, labor, decomposition, productivity.

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## **I. GDP Decompositions: Methodology and Verification**

Chin Hee Hahn and Sukha Shin (2007) have embarked on a classic research enterprise: decomposing a country's GDP growth into (1) changes in the quantity and quality of capital and labor used by firms to produce their outputs and (2) changes in total factor productivity.<sup>1</sup> Their decomposition of Korea's GDP over the 1990-2004 period could have important ramifications, as politicians and social scientists frequently use trends in capital deepening, labor quality, and total factor productivity to evaluate past government policies and to formulate new government policies on such issues as capital formation, education, and research and development. Research teams have competed to incorporate more detailed categories of factor inputs, to obtain better estimates of critical parameters (e.g. capital usage intensity and asset depreciation) and to obtain accurate sectoral breakdowns. As a result research on GDP decompositions has converged around a general methodology while becoming much more detailed and complex. Nonetheless, differences in GDP decompositions are to be expected from different research teams, as they may have access to different sets of data, use different methodologies to measure a country's capital stock, base their decompositions on price levels in different base years, and treat thorny problems, e.g. the productivity of the large Korean army, differently. The different results can matter, as they often allow for very different interpretations of the proximate causes of GDP changes.

Hahn and Shin's project is particularly likely to produce estimates at variance with those of other research teams, as they (p. 10) not only decompose Korean GDP for 1990 to 2004, but also GDP for 83 other countries from 1960 to 2004. Hahn and Shin's

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decompositions for Korea are reported in Table 1. Three trends are notable. First, there has been a striking decline in capital deepening between the 1990-1995 period (3.1%) and the 2000-2004 period (1.3%). Second, there has been an increase in total factor productivity, from 0.8% in the 1990-1995 period, to 1.0% in the 1996-2000 period, and to 2.0% in the 2001-2004 period. Third, there has been a deep decline in the growth of weighted capital inputs, from in the 1990-1995 period, to 1.6% in the 1996-2000 period, and to 1.3% in the 2001-2004 period. From their vantage point, the proximate cause of Korea's declining GDP growth rate is the decline in capital deepening and weighted labor inputs, a decline that is only partially offset by the increase in total factor productivity.

How do Hahn and Shin's GDP decompositions for Korea and the 83 other countries compare to results from other research teams? Hahn and Shin note that their results are similar to those reported in Kim (2006). Since Kim does not use detailed breakdowns of particular types of capital and labor, this comparison is not particularly useful as a verification of the reliability of their estimates. With respect to their decompositions of GDP for the other 83 countries, they fail to compare their decompositions with those published by other researchers.

There are, however, other prominent research teams who have conducted similarly detailed analyses over the 1960-2004 period. Consider the GDP decompositions of Dale Jorgenson's team for Korea and 132 other countries for the 1960-2004 period. Some of the differences in results obtained by the two teams are striking. For example, over the 2000-2004 period, Hahn and Shin estimate Korean TFP growth=2.0%, world TFP growth=.4%, and G7 TFP growth=.2%. For the 2001-2004 period, Jorgensen, Stiroh, and Ho (2007) estimate Korean TFP growth=1.74%, world TFP growth=1.4%, and G7 TFP growth=.89%.

Such large differences raise serious questions as to the sources of these differences. Hahn-Shin need to take a close look at their data and the methodology used to produce their decompositions and to document it more closely in their paper.

Jorgenson and Vu (2007) have also decomposed Korea's GDP growth rate, and their results (reported in Table 2) differ substantially from those of Hahn and Shin, particularly with respect to trends in capital deepening and total factor productivity. While their results also show a decline in capital deepening growth, the decline—just 1.0%—is much less pronounced than in Hahn and Shin (1.8%). More importantly, Jorgenson and Vu report a decline in productivity growth, from 2.7% in 1990-1995 to 1.7% in both the 1996-2000 period and the 2001-2004 period. The differences are important: the Hahn and Shin results would tend to focus policymakers on the decline in the growth rate of capital deepening, while the Jorgenson and Vu results would change their gaze to the decline in productivity growth. Before too many conclusions follow from these studies, it is important to fully understand why they differ so much.

## **II. Hahn and Shin's Analysis of Their GDP Decompositions**

Hahn and Shin begin their analysis by investigating whether the decline in Korea's aggregate and per capita GDP growth over the 1996-2004 period is merely due to Korea's convergence with high-income countries. Neoclassical growth theory—in a variety of models—predicts that as a country's per capita income converges with the per capita incomes of high-income countries, per capita GDP growth and capital deepening will both decline (Barro, 2004, ch.2). Their regressions testing this hypothesis closely follow the analysis set forth in Collins and Bosworth (2003). Their empirical results strongly support

the hypothesis that the decline in Korean GDP is not inherently worrisome, as recent growth rates are close to the growth rates predicted in the neoclassical growth model for a converging country.

Hahn and Shin (pp. 15-21) also investigate whether the decline in growth in capital deepening in Korea can be attributed to the increasing competition from China exports faced by thousands of Korean firms operating in labor-intensive industries. Consider this brief overview of the astonishing growth in trade between China and Korea over the last 17 years.

- Korean imports from China as a share of total Korean imports increased from 3.2% in 1990, to 13.2% in 2004, and to 14.7% in 2006.
- Korean exports to China as a share of total Korean exports rocketed from 0.9% in 1990, to 19.6% in 2004, and to 26.8% in 2006.
- Korea, a country of just 40 million people, has become the #2 export supplier to China (Japan is #1) and the #4 importer from China (behind the United States, Japan, and Hong Kong).
- Korea's merchandise trade with China has moved from deficit to surplus in the last 17 years, with exports reaching US\$ 89.8b and imports US\$ 44.5b in 2006.

Hahn and Shin's regressions relating Chinese exports to investment by Korean firms in the import-competing sector are intriguing. Of course, such an effect is an implication of Heckscher-Ohlin trade theory: the opening of trade will reduce the relative size—and sometimes the absolute size—of a country's import-competing sector. It is also important to recognize that some Chinese imports may not be displacing Korean products, but may be

displacing the labor-intensive exports of other developing countries, particularly those in Southeast Asia.

It is also important to consider the flip side of imports—exports, as Korea's exports to China have grown much faster than Korea's imports from China. If US\$ 44.5b in imports reduces investment by import-competing firms, shouldn't US\$ 89.8b in exports increase investment by firms exporting to China? Or, perhaps much of the increased volume of exports consists primarily of intermediate goods from Korean factories that used to supply these goods to domestic assembly plants which have now relocated to China? In any case, the two sectors should be examined in tandem.

### **III. Other Potential Explanations for Korea's GDP Slowdown**

There are at least four other candidates for Korea's GDP slowdown beyond those offered by Hahn and Shin. First, elements of the slowdown could stem from business cycle dynamics. The 2000-2004 period contains one crisis years and two years during which the economy underwent considerable restructuring and institutional change. Such discussions of business cycle effects, e.g. procyclicality, dominate the U.S. literature on this topic (Gordon 2007; Jorgenson, Ho, Stiroh 2007) and deserve more consideration in analyzing Korea's GDP fluctuations.

Second, changes in investment in IT capital (Basu et al. 2003) can affect both producers of IT capital and their users. Basu and Fernald (2006) argue that IT investment by IT-using industries facilitates future innovation. Corrado, Hulten, and Sichel (2006) argue that IT investment stimulates investment in intangible capital—which is often poorly measured.

Jorgenson and Vu (2007) divide overall Korean investment into “IT” and “other” investment and report these trends (Table 3). Their data inform us that IT capital deepening has been slowly advancing, while capital deepening for all other types of capital fell both during and after the Asian Crisis. How does the Korean performance in this area stack up to other countries? It is notable that IT investment in Korea during the 2001-2004 period (.39%) was slightly less than the world average (.42%).

Third, the decline in TFP could stem in part from policy initiatives by the Korean government to redistribute wealth and to increase the regulatory burden on various industries. In-depth consideration of this argument is beyond the scope of this comment.

Fourth, changes in Korean saving rates could be a factor behind the decline in the growth rate of capital deepening after 1995. If international capital markets functioned perfectly, a decline in domestic saving in a small open economy like Korea would not affect domestic investment, as foreign capital would flow in and completely fill the gap. Feldstein and Horioka (1980) and numerous follow-up studies have found, however, that international capital markets did not completely fill these gaps, as declines in domestic saving were not fully offset by capital flows. Figure 1 plots Korean savings as a percentage of Korean GDP. Between 1999 and 2003, Korean saving declined from ~37% to ~30%. Because of the magnitude of this decline, further investigation of this hypothesis is surely warranted.

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**Table 1: Hahn-Shin Decompositions of GDP Growth Rates in Korea, 1989-2004**

<b>Growth Rates</b>			
	<u>1990-95</u>	<u>1996-00</u>	<u>2001-04</u>
Korea GDP	7.4	4.3	4.4
GDP Per Capita	7.0	3.6	4.0
Capital/Worker	3.1	2.1	1.3
Weighted Labor	4.2	1.6	1.3
TFP	0.8	1.0	2.0

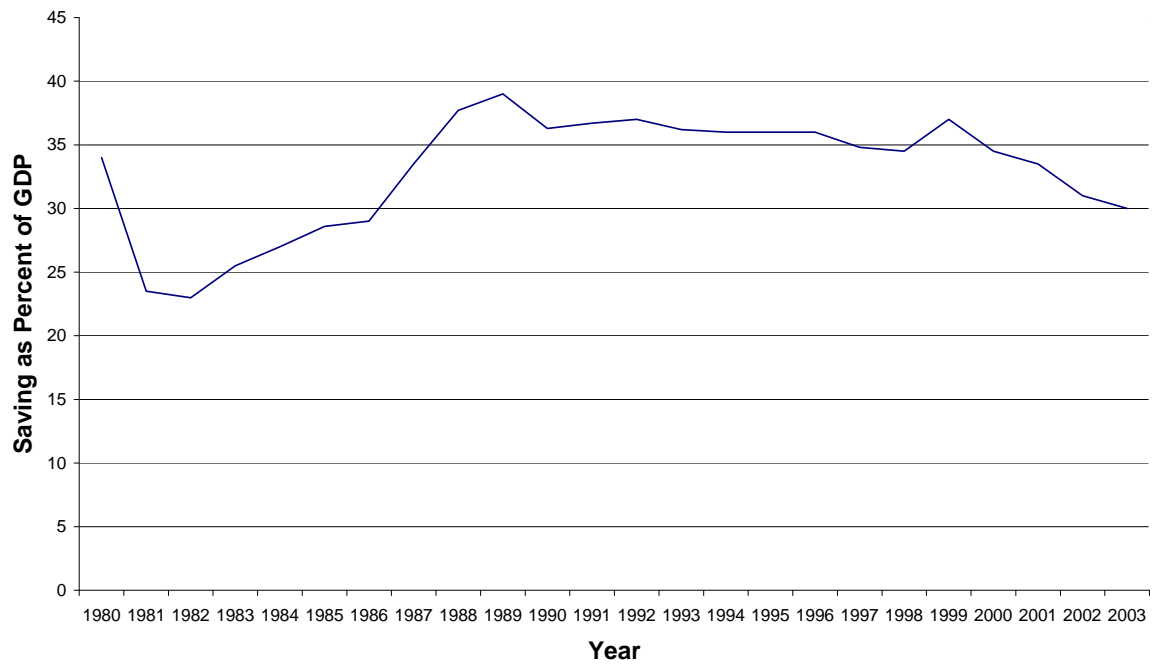
**Table 2: Two Decompositions of GDP Growth Rates in Korea, 1989-2004**

<b>Growth Rates</b>			
	<u>1990-95</u>	<u>1996-00</u>	<u>2001-04</u>
GDP Per Capita	7.0	3.6	4.0
<i>Hahn-Shin</i>			
Capital/Worker	3.1	2.1	1.3
TFP	0.8	1.0	2.0
<i>Jorgensen-Vu</i>			
Capital/Worker	2.2	1.6	1.2
TFP	2.7	1.7	1.7

**Table 3: Jorgenson-Vu Measures of the Growth of IT Capital and Other Capital in Korea, 1989-2004**

	<u>IT</u>	<u>Other</u>
1989-1995:	0.2%	2.0%
1996-2000:	0.3%	1.3%
2001-2004:	0.4%	0.6%

**Figure 1: South Korea Saving, 1980-2003  
(percent of GDP)**



Source: Korea National Accounts.