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Korea's Capital Investment:

Returns at the Level of the Economy, Industry, and Firm

Arthur Alexander

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KOREA'S CAPITAL INVESTMENT:
Returns at the Level of the Economy, Industry, and Firm

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Preface

The Korea Economic Institute (KEI) is pleased to issue the second of its new "Special Studies." In contrast to KEI's other publications, which generally take the form of a compilation of relatively short articles on analytical and policy issues by a number of authors, this series affords individual authors an opportunity to explore in depth a particular topic of current interest relating to Korea.

In this book, Dr. Arthur Alexander makes use of his extensive experience in economic analysis of other Asian countries, particularly Japan, to examine and assess productivity and the return on capital investment in Korea, in both absolute and relative terms. He has compiled and examined extensive data from official and company statistics, and has reached a number of insightful conclusions and informed judgments. Importantly, he has done so in a manner that is academically rigorous but accessible to the general reader.

KEI is dedicated to objective, informative analysis. We welcome comments on this and our other publications. We seek to expand contacts with academic and research organizations across the country and would be pleased to entertain proposals for other "Special Studies."

Joseph A. B. Winder
President
November 2003

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Introduction

Korea's real return on its aggregate nonresidential capital was at very high levels in the post–Korean War period; it then declined for the next 50 years. It appears to have held steady between the late 1990s and today, mid-2003. Such a long-term fall in returns is an expected consequence of high rates of investment and increasing capital per unit of labor, especially for a developing country that is catching up to the world's technological leaders. Investment is one of the chief ways in which an economy absorbs technology and increases productivity. However, as domestic capabilities approach the global frontier, further progress usually becomes more difficult. Diminishing marginal returns and technological catch-up combine to drive down returns as an economy's capital expands.

Because of the unsurprising quality of this long-term descent, it is informative to consider Korea's returns in comparison with other countries at similar levels of income and capital. Here we have some cause for concern. Korea today is not getting as much output from its inputs as it could, a conclusion based on evidence from countries as diverse as Hong Kong, the United States, the United Kingdom (UK), France, and Germany. Nevertheless, Korea's returns remain robust, if not quite as good as may be feasible.

Korea's development path has followed Japan's, whose growth has depended more on the growth of inputs, especially capital, than on productivity. In the past few years, evidence suggests that Korea may be departing from this investment-led strategy; more time will be required to verify this trend.

Financial data from Korean corporations suggest that nominal returns are comparable with those in the United States and are higher than in Japan. Nominal returns, however, have not improved with the financial and economic reforms ongoing in Korea. Real returns, though, are sharply higher over the entire 1990–2001 period, except for the Asian crisis years of 1997 and 1998. Real returns have risen largely because inflation has slowed while nominal profit has remained stable or has dropped only slightly. In fact, real returns were negative from 1990 to 1995. Some industries, mainly traditional

ones, were chronically sick; mining and fishing were among the worst performers in most years. In contrast, electronics, computers, chemicals, and computing services turned up often on the high-returns list.

The main conclusion from financial information on Korean companies and industries is that they have paid more attention to their balance sheets than to their bottom lines. Leverage (the ratio of liabilities to shareholder equity) has fallen significantly since the Asian financial crisis, which reminded managers and financial markets alike of the risk of borrowing. Korean managers have restructured their balance sheets much more aggressively than have their Japanese counterparts, who have reduced leverage in their companies only half as much. No longer can Korean industry serve as an example of excessive borrowing and weak equity financing.

The spread of returns is widening among firms and industries as markets and managers are creating greater divergence between winners and losers. At the same time, leverage is narrowing as debt is reduced, as equity is increased, and as bankruptcy eliminates the most dangerously indebted companies.

Comparative evidence from other countries and tests of the effectiveness of Korea's industrial policy indicate that returns in the favored heavy industries were not sufficient to cover the costs of capital. Neither did the country benefit from higher productivity. Moreover, the distortions created by force-fed capital injections financed largely by debt sowed the seeds of political instability and economic weakness in the 1990s.

Korean companies and workers have demonstrated their ability to take advantage of new opportunities and to produce higher incomes for the hard-working, high-saving Korean people. In the coming years, if economic reforms continue, perhaps Korea will realize even greater benefits from its citizens' sacrifices.

2

Capital, Growth, and Rates of Return in Korea

Why Analyze Rates of Return?

It is a truism of economic growth theory that economic development requires investment—in infrastructure, plant and equipment, production processes and software, and also in human capital. Flowing from the centrality of investment to development is the notion of diminishing returns: as capital is accumulated and as its abundance relative to other contributors to production increases, the benefits from additional increments become smaller. The evidence for the centrality of investment to development and for falling returns is clear. A review of the economic development literature (Temple 1999, 137) attests to the robust correlation between investment rates and growth and also notes: "The strongest result in the investment-growth literature is that the returns to physical capital are almost certainly diminishing."

Some scholars argue, however, that investment is only a proximate source of growth and that other factors that influence investment may be thought of as ultimate sources. Rodrik (1997, 13), for one, argues that, although the best single predictor of the growth of an economy remains its investment rate, even among the high-investing, fast-growing East Asian economies there are differentials that seek explanations. Rodrik highlights the contributions of the quality of institutions (such as the competence of governments) and the initial conditions of income and education. In fact, cross-country statistical analyses of eight East Asian economies using just these three variables and omitting investment have just as much explanatory power as investment alone.

Therefore, caution is required when considering the importance of capital; investment should not become the single focus of growth policy. Other attributes of national life may be just as important in achieving the objective of improved economic welfare. In fact, an overzealous targeting of investment may waste resources and leave the population worse off than it might otherwise be.

The allocation of resources to wealth-enhancing uses can be accomplished with varying degrees of efficiency. The chief means for assessing the efficiency of investment is the rate of return on capital. Rates of return below the cost of capital indicate that resources are being wasted. Returns below those earned elsewhere—in other firms, industries, or countries—suggest problems in managing investment resources. Persistent differences in returns often lead to a flow of capital from low-return targets to those with higher returns. Low returns are typical of mature economies (for example, Great Britain in the 50 years preceding World War I or Switzerland and Japan now); however, they would indicate trouble for a developing economy like Korea's.

Business investments that do not pay back the cost of funds inevitably lead to insolvency, which occurs when the value of a firm's assets becomes smaller than its liabilities. If such a condition is camouflaged, the eventual adjustment grows larger and politically more unpalatable as the gap between assets and liabilities grows wider. This fate is now occurring in Japan as several decades of falling returns have generated a crisis that expands daily. Because much of Korea's growth strategy was based on perceived notions of Japan's experience, potential dangers to further growth may be lurking behind Korea's investment experience, however successful it has been in making Korea's economy among the world's high-growth miracles.

Before proceeding, it might be useful to define the meaning of capital as used here and in most other studies. Some writers define capital as those assets that meet three criteria: means of production, produced means of production, and durable. This definition rules out housing, consumer durables, human capital, nonproduced assets such as natural resources, and such things as social capital or institutional capital (as useful as these concepts may be for other purposes) (Pyo 1998, 8–10; Triplett 1998). Assets that meet the three criteria include such durable goods as nonresidential structures, machinery, and equipment.

Korea's growth experience fits the standard theory. ***Figure 1*** plots a 1990 cross section for 59 countries of gross domestic product (GDP) per capita against the amount of capital invested per worker. Also in Figure 1 is the time series data for Korea from 1965 to 1990. Korea's experience falls right on the curve of the other countries.

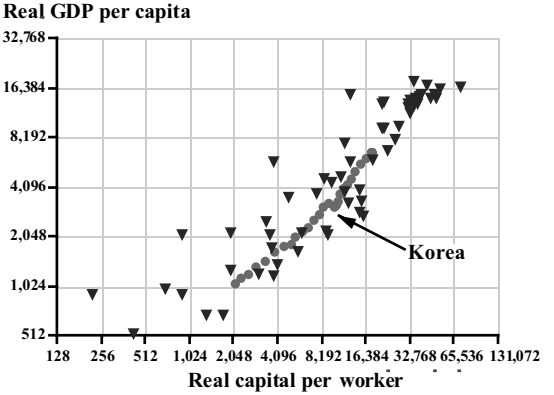
According to Figure 1, economic development certainly is associated with higher levels of capital, and Korea is marching along the same basic path as the rest of the world's economies. While some countries seem to get more GDP per capita from the same amount of capital as employed by Korea, others get less. It is not possible from only these data to decide how well Korea is using its resources, although it may be hard to argue against any process that has enlarged real output per person by a factor of almost 10 in 25 years.

The Role of Capital in Korea's Growth

Seeking the relative contributions of capital and productivity change to growth has become a small industry, and the literature is extensive. One recent study (Kumar and Russell 2002) points out one technique developed to examine this issue and draw a few conclusions.

One of the sources of dispute about the relative contributions of capital and productivity to growth is the econometric modeling challenge inherent in estimating complex production functions.[1] The mathematical formulations of the production functions usually do not allow essential parameters to be estimated independently of one another. In addition, the data usually are not of sufficient quality to distinguish among alternative mathematical formulations in order to make definitive assertions. The recent work by Kumar and

Figure 1: **Real GDP per Capita and Real Capital per Worker, Korea 1965–90 and 59 Other Countries in 1990; in 1985 dollars at PPP**



Source: Summers et al. 1994.

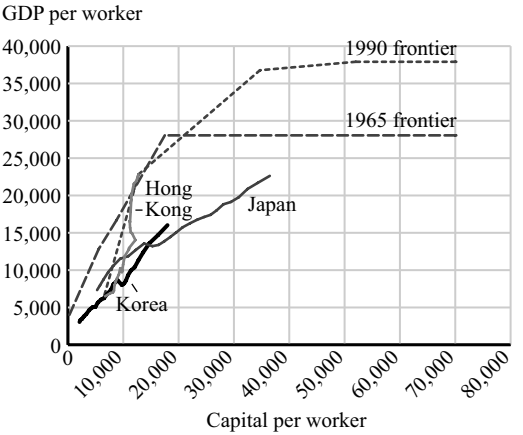
Russell (2002) has tried to get around these problems by ranking individual country experiences relative to the shifts over time of the global efficiency frontier. Their basic idea is to envelop the data in the smallest or tightest-fitting area; the upper boundary of this set then represents the best-practices production frontier.

1. A simplified representation of a production function shows output (Q) related to the flow of capital services obtained from the capital stock (K), labor (L), and possibly other inputs. Productivity, usually measured by a time trend, is frequently included in the function. If the flow of capital services is a fixed proportion of the capital stock, then K can be proxied by the capital stock. Focusing on just capital and labor, the production function is: $Q = f(K, L)$.

Their sample consists of 57 countries over the period 1965–90 and uses data from the Penn World Table (PWT) version 5.6 (Summers et al. 1994). They look at real GDP per worker as a function of real nonresidential capital stock per worker, and they construct production frontiers for 1965 and 1990. ***Figure 2*** reproduces their frontiers, together with the 25-year experience of three countries: Korea, Japan, and Hong Kong.

One of the findings of Kumar and Russell is that the expansion of the frontier is not neutral with respect to capital but instead strongly favors capital-rich countries. This effect can be seen in Figure 2 as the 1990 frontier moves outward at capital levels greater than $20,000 per worker (1985 prices) but inward at low levels of capital. The authors conjecture that this apparent backward movement of technology may come from their assumption of constant returns, which may not be tenable for very poor countries, or a possibly nonexistent best practice among the group of poor countries. In other words, even the best of the very poor countries may not be operating at the available levels of best practice.

Figure 2: **World Production Frontiers, 1965 and 1990; and Growth Paths of Korea, Japan, and Hong Kong, 1965–90, in 1985 dollars at purchasing power parity**



Source: Summers et al. 1994.

Japan's growth as shown in Figure 2 was dominated by capital deepening. Korea's path was somewhat less efficient than Japan's until the end of the 1980s, when Korea was able to generate more GDP than Japan from its capital stock at the same capital-labor ratio. However, the star performer in this analysis was Hong Kong. Although it was substantially below the frontier in 1965 (Hong Kong's performance was slightly inferior to Korea's at the start of the period in Figure 2), Hong Kong became by 1990 one of the frontier economies and helped to define best practice.

Kumar and Russell (2002, 534) use an economy's distance from the frontier and its relative movement to separate the effects of productivity and capital deepening. They decompose an individual country's change of GDP per worker into three components:

- Change in efficiency, measured by the change in the vertical distance from the frontier between periods;
- Technology change—the vertical shift in the frontier itself; and
- Effect of change in the capital-labor ratio—in other words, the movement along the frontier.

The decomposition can be carried out along two paths that vary according to whether the first-period frontier or the second is the base for the calculation. This decomposition is shown in ***Table 1*** for Korea, Japan, Taiwan, and Hong Kong; the table uses both 1965 and 1990 as base years. In separate data appendices, Kumar and Russell report results based on different assumptions about scale economies; the results vary little for these countries.[2]

One can conclude from Table 1 that most of the growth of output in Korea, Taiwan, and Japan came from increasing the capital stock. Hong Kong, in contrast, moved onto the frontier; its growth of GDP per worker, which was even greater than Japan's, depended relatively little on increasing capital intensity. In fact, Kumar and Russell conclude that most worldwide productivity improvement was attributable to capital accumulation. Moreover, it appears that countries that are already rich in capital have benefited more from technological progress than from investment. The anomalies include Japan—which has achieved rich-country status but continues to grow by capital accumulation—and Hong Kong—a relatively undeveloped country that has grown by increasing its productivity rather than its capital. It remains to be seen how Korea will evolve.

2. To produce the percentage change in output per worker from the contributing factors, divide each number in the table by 100 and add 1.0. Then multiply these new change factors together to obtain the change in output per worker.

Table 1: **Decomposition of Output Growth per Worker in Korea, Japan, Taiwan, and Hong Kong, 1965 to 1990**

Country	Change in output per worker (%)	Contribution to percentage change in output per worker					
		1965 base year			1990 base year		
		Change in efficiency (%)	Change in technology (%)	Capital Deepening (%)	Change in efficiency (%)	Change in technology (%)	Capital deepening (%)
Korea	424.5	31.7	–6.9	297.5	31.7	13.7	225.6
Japan	208.5	2.5	31.5	127.7	2.5	0.9	196.6
Taiwan	319.0	10.6	10.9	229.1	10.6	8.3	237.0
Hong Kong	251.1	120.0	3.7	53.8	120.0	1.1	57.9

Source: Kumar and Russell 2002, Appendix.

3

Estimating Aggregate Rates of Return

Capital Elasticities and Share of Output

The method used here to estimate economy-wide rates of return makes use of production functions, which describe outputs as a function of inputs.[3] The particular objective of the use of this method is to obtain the change of output related to changes in capital, holding other inputs constant. For aggregate production functions, this quantity can be interpreted as the economy-wide real return to capital.

Used here, in particular, is a parameter often included explicitly in production functions: the elasticity of output with respect to capital. This elasticity is defined as the ratio of the percentage change in output attributable to a percentage change in capital. If we had an estimate of the elasticity, multiplying this estimate by the ratio of GDP to capital stock would result in the indicator sought: the change of output attributable to increased capital stock.

The job looks easy: get an estimate of the elasticity of output with respect to capital and multiply the estimate by the ratio of GDP to the capital stock. Scores of studies on productivity growth use production functions as their theoretical foundation; it would seem, therefore, that elasticity estimates should be readily available for the purposes here. For example, a review of productivity studies for Korea can be found in Sung (2000). However, not many studies actually estimate this elasticity in fully articulated production functions even though that concept motivates the analysis; the reason that economists have moved away from estimating production functions stems

3. If the production function is $Q = f(K, L)$, where Q is output, K is capital, and L is labor, then the change of output related to changes in capital, holding other inputs constant, is the partial differential of Q with respect to K, or $\partial Q/\partial K$. The elasticity of output with respect to capital is $e = (\partial Q/Q)/(\partial K/K)$. If we multiply this elasticity by the ratio of output to capital, we get the desired partial differential of output with respect to capital: $e\ (Q/K) = (\partial Q/Q)/(\partial K/K)\ Q/K = \partial Q/\partial K$.

from their goal of separating the contributions of capital to income growth from the contributions of productivity to income growth. These calculations are bound up with the particular functional form of the production function assumed in the empirical estimation procedure. Identifying the separate contributions of capital and productivity often is not possible without making explicit assumptions about the key parameters of the production function, such as returns to scale or the elasticity of output with respect to capital. Therefore, it is often simpler to make these assumptions explicitly and use simpler techniques to arrive at the desired productivity trends.[4]

If it is assumed that the production function has an elasticity of substitution equal to 1.0, that inputs are paid their marginal product (an assumption about the competitiveness of factor markets), and that there are neither economies nor diseconomies of scale, then the elasticity of output with respect to capital is constant and equal to capital's share of output. For elasticity of substitution values less than 1.0, a situation thought to be the case for developing countries, the share of capital in national income declines as capital grows relative to labor.

Rather than laboriously estimating production functions, for which—in any event—it is often impossible to pin down the essential parameters with any precision, many economists have taken the short cut of assuming values for these parameters on the basis of their readings of the data. In their study of productivity, for example, Collins and Bosworth (1996, 154–5) assume that capital's share of GDP is 0.35 for all 88 countries. Their review of the literature suggests that the share tends toward constancy and is somewhere between 0.3 and 0.4, perhaps somewhat higher in the fast-investing Asian countries. They also note that some authors find the share to be declining in a subsample of the high-investment economies. However, they argue that assigning the same value to all countries reduces the problems of measuring productivity change across countries and that the assumption does not do great violence to their data. Nevertheless, if the several conditions necessary to make the simplifying assumption that the labor share is equal to the elasticity of output with respect to capital are not true, the resulting estimates will be incorrect.

4. Chang-Tai Hsieh (2000) shows how, with different assumptions about the elasticity of substitution, the same data can generate variations in the estimates of productivity change. For example, Korea's average annual growth rate of total factor productivity computes to 3.25 percent if the elasticity of substitution is 0.3, but only 1.31 percent if the elasticity of substitution is 1.3. The elasticity of substitution is a measure of the ease with which inputs can be substituted for each other. If L is the flow of labor inputs and K represents the flow of capital services, the elasticity of substitution is the percentage of change in K/L for a 1 percent change in $\partial K/\partial L$, while production is held constant. This measure can range from zero (no substitutability) to infinity (perfect substitutability).

In contrast, economists Jong-Il Kim and Lawrence Lau (1994) formally test the simplifying production function assumptions for a group of advanced and developing Asian countries. They find that the assumptions can be rejected: the elasticity of substitution is less than 1.0, returns to scale are diminishing, and factors are not paid their marginal product. Their results show that the elasticity of output with respect to capital declines with the capital intensity of production.[5] Therefore, because the elasticity of output with respect to capital falls rapidly with the accumulation of capital, rates of return calculated with these Kim and Lau elasticities will demonstrate rapid declines from high initial levels.

A study by Nazrul Islam (1995, 1145 [Table 3]) was consistent with Kim and Lau (1994) in finding that capital elasticities are lower for richer countries than for poorer countries. Islam combined time-series data for individual countries with cross section information across 96 countries; his estimate of the capital elasticity for the entire group was around 0.44, whereas the value for the 22 developed OECD countries was a much lower 0.30. Although Islam assumed a standard production function with a coefficient of substitution equal to 1.0 and constant returns to scale, estimates for the separate samples suggest that capital elasticity declines with capital intensity.

Several authors have assumed constant returns to scale and competitive factor markets but find a falling capital share of output; this implies an elasticity of substitution less than 1.0. However, estimating capital shares is not without its own set of problems. A widely used strategy is estimating the labor share of national income from the amount of employee compensation in GDP. The share going to capital is then taken to be the residual. The apparent stability of shares in the United States led Cobb and Douglas (1928) to come up with their eponymous production function as one that would preserve a constant labor share regardless of changes in relative factor prices. Moreover, the apparent stability of shares in other advanced countries led to the easy acceptance of the simplifying assumptions mentioned above.

As data on developing countries improved, however, international cross sections showed wide disparities in labor shares across countries (Gollin 2002). In particular, the labor share seemed to increase with real per capita GDP, although there is great dispersion among the poorer countries. Gollin and others have pointed out that the main reason that labor shares apparently rise with income is because there is a larger fraction of self-employed in poorer countries; their compensation is incorporated in the national-income term "operating surplus" rather than under "employee compensation." Several activities generate the incomes of these workers: entrepreneurial activities,

5. According to Kim and Lau (1994), the elasticity, e, of output with respect to capital decreases as K/Q increases—a result that comes from their finding that the elasticity of substitution is less than 1.0.

capital investments, and pure labor income. The analytical issue is to separate out the labor portion of their income. When such adjustments are made, labor shares across countries with real per capita GDP greater than $4,000 lie within a narrow range of approximately 0.66. However, the considerable number of countries below this income threshold continues to exhibit a wider range of outcomes (Gollin 2002, 472).

In principle, therefore, we have at least two approaches to obtaining the elasticity of output with respect to capital:

- Values obtained from full production function estimations, and
- Capital share of national income, generally derived as the remainder after the labor share has been estimated.

With the elasticity in hand, it is then possible to calculate the return to capital.

For Korea (***Figure 3***), the plotted 1990 capital shares and elasticities, as well as those not plotted, lie between 0.25 and 0.35. All the estimates that allow for change over time show a declining trend.[6]

To make meaningful comparative statements about rates of returns, we need some reference values. Finding that returns in Korea are, say, 13 percent really tells us very little without some comparisons—comparisons, for example, with the cost of capital, with past returns, or with the values in other countries that are at various stages of development. There is a problem, though, in comparing across studies: because each study uses its own equations, estimating methods, and data sources and definitions, meaningful comparisons across studies are problematic. Thus, if one study produces a value of the rate of return for Korea and a different study generates estimates for Japan, it would be difficult to make other than gross comparative statements about the

6. While extending the Pilat (1994) estimates from 1990 to 2002, I discovered an error in the original compilation. National income typically is divided into employee compensation and operating surplus. As mentioned, part of operating surplus can be attributed to the labor of family businesses and other owner-operated firms. To get a true labor share, part of the operating surplus should be attributed to the labor input of owner-operated businesses and the remainder to capital. Pilat imputed 50 percent of the average annual wage rate of wage and salary workers (for whom there is reported data) to the self-employed, and 25 percent to unpaid family workers. The sum of these labor categories, plus a constant 5 percent attributed to land income, was tallied as the labor share of national income at factor cost. Pilat, however, inadvertently used national income at market prices instead of national income at factor costs. This might seem to be a trivial point, of interest only to national income accountants, except that it changes the capital share by a substantial 5 to 12 percentage points. In Figure 3, I plot corrected and updated figures instead of the original figures; in addition, to make the numbers comparable with the other estimates, I assumed only two factors of production and did not deduct a 5 percent payment to land.

two countries. One way to reduce many of the potential sources of incomparability and overcome this problem is to search for studies that include a sample of several countries.

Kim and Lau (1994) estimated production functions for five developed countries and four fast-growing Asian ones, including Korea. Their explicit purpose was to compare the growth and productivity experiences of these countries. They make none of the simplifying assumptions typical in the literature; instead they estimate the parameters of a fully specified production function. They allow their elasticities to vary across countries and over time to account for changing structures of production.

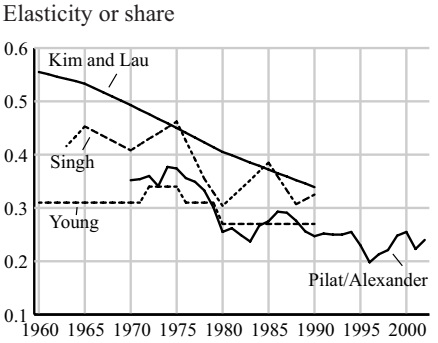
Measuring Capital Stock

Three approaches are commonly used to estimate the national stock of capital:

- Surveys of enterprises,
- Perpetual inventory method that sums up past investment while continually depreciating each vintage of capital, and
- Perpetual inventory method without depreciation that assumes stable output until the life of the item expires.

Angus Maddison (1995) has favored the last method in his attempts to create standardized capital estimates for several countries. The PWT uses the perpetual inventory method with annual depreciation.

Figure 3: **Alternative Elasticities or Capital Shares, Korea, 1960–2002**



Sources: Kim and Lau 1994; Pilat 1994, Annex Table 1.7; Singh 1998, 132; Young 1995, 660.Note: Used here are Kim and Lau elasticities and capital share estimates by Pilat, Singh, and Young. The results by Pilat (1994) have been corrected by the author; see footnote 6. Two other estimates are not shown in this figure because they did not vary over time: Collins and Bosworth (1997) assumed a constant value of 0.35 for their entire sample over all years, and Gollin (2002) calculated an adjusted share for many countries, including Korea, for a single year. Gollin's 1991 value for Korea is 0.303.

The survey method can produce inconsistent estimates because of incomplete coverage and problems encountered in answering complex questionnaires (Timmer and van Ark 2002). Pyo (1998, 39–40 [Table 10]), using surveys in benchmark years and a perpetual inventory method for intercensus periods, has constructed capital stock estimates for Korea. Discovering deficiencies in Korea's earlier wealth surveys, Pyo adapted his estimation methods to help overcome them. Pyo's gross stock estimates, which remove investments from the pool on the basis of assumed lifetimes of different classes of assets, are similar in spirit to Maddison's. Net capital stock is calculated by depreciating the gross figures; Pyo estimated depreciation rates by calculating the pattern of depreciation that would make the surveys consistent with intercensus investment.

Maddison constructed standardized estimates of capital stock for several countries. He did not rely on data reported by national statistical organizations because he observed that official estimates of asset lives vary more among countries than seems legitimate. For example, asset lives for nonresidential structures vary from 39 years in the United States, to 57 years in Germany, to 66 years in the UK. National statistical authorities in neighboring Finland and Sweden assume an average service life of buildings in manufacturing of 42 years and 70 years, respectively. Maddison (1995, 138) notes: "When countries, which, by world standards, are so similar have very different assumptions about virtually identical assets, it seems likely that there is a significant element of incomparability."

Maddison's standardized estimates assume asset lives that approximate as closely as possible those in the United States: structures are given 39-year lifetimes, and equipment is given 14 years. One of his findings from the standardized capital stock figures for the United States, the UK, France, Germany, Netherlands, and Japan is that the ratio of nonresidential capital to GDP has not been stable over the long term and has varied among countries; this observation, he notes, contradicts the widely shared assumption that the ratio has been steady in advanced economies.

It is particularly easy to calculate the capital stock according to the Maddison scheme: simply add up the real investment for the number of years that correspond to the lives of the different asset classes. This measure of the gross stock of capital is the cumulative value of past investment still in existence. The problem with this approach is that, to produce a stock estimate, it requires a stream of data at least as lengthy as the longest-lived asset. The other problem is that the productive quality of assets generally decays over time, and this method does not take the deterioration into account. This deficiency is not an issue if investment is stable; but if it grows rapidly—as is common in fast-developing economies—the capital stock figure may be distorted.

Timmer and van Ark adopted Maddison's method in their estimates of Korea's and Taiwan's capital stock. These authors performed sensitivity analy-

ses to test the implications of their choice of asset lives. For example, if, instead of their chosen lives of 39 years for structures and 14 years for equipment, the lifetimes were 30 and 10 years, the aggregate capital stock at the end of the period in 1997 would have been 9 percent smaller; if the assets were longer lived than assumed—45 and 19 years—the stock of capital would be 9 percent greater. They conclude that such variations in lifetimes have a limited effect on the absolute value of the capital stock and an even smaller effect on its growth rate (Timmer and van Ark 2002, 13 [Table 4]).

Timmer and van Ark (2002, 14) also estimate what they call the productive capital stock. They apply an annual rate of depreciation to gross investment; their effective rate of efficiency decay is 11.8 percent per year for equipment and 2.3 percent for nonresidential structures.

Used here are the Maddison capital estimates for the United States and Japan and the Timmer and van Ark capital stock figures for Korea, all updated to 2002 from recent national accounts data.[7] The capital stock data are converted to a real 1990 base. For comparison, I also use the PWT approach to measuring capital stock, based on continuous depreciation to test the sensitivity of the rate-of-return figures to different capital assumptions. The PWT compilers in their 5.6 version use annual depreciation rates of 3.5 percent for structures, 15 percent for machinery, and 24 percent for transportation equipment. In the data appendix to PWT 5.6 (Summers et al. 1994), the compilers note:

> The present capital stock estimates will tend to be considerably lower than alternative measures that use [Maddison's] one-horse-shay measure of gross capital stock. The latter estimates will retain the full value of past investments in the capital stock for the average service life of the asset. A rationale for this approach is that until it is scrapped a piece of equipment is contributing to production at a constant rate. In the approach we have used, the assumed contribution of equipment to production is much less if it is 10 years old than if it is 5 years old. The measure we have provided is much closer to the value of capital at any point in time. Whatever the merits of alternative approaches, the user should not be surprised if our capital per worker estimates are often half those of alternative measures.

When the PWT method is applied, capital stock estimates are 50–60 percent of the value compiled according to the Maddison method from the same data. Consequently, rates of return computed from the PWT capital figures will be roughly twice as high as those from the Maddison figures.

7. Because of data revisions since Maddison's original work, I updated the U.S. data from 1982.

Considered here are several estimates of Korea's capital stock: Timmer and van Ark's perpetual inventory figures with no depreciation; Timmer and van Ark's "productive" capital series based on a perpetual inventory method with annual depreciation; Pyo's approach based on benchmark surveys filled in with annual investment in a perpetual inventory method, both gross (without depreciation) and net (with depreciation); and the PWT approach of perpetual inventory, with their annual rates of depreciation applied to updated investment series. International comparisons will be performed with the Maddison-style nondepreciated figures and with PWT depreciation.

Figure 4 shows these various measures of the stock of nonresidential capital. The three net estimates based on annual rates of depreciation are relatively similar to each other; the two gross figures are considerably larger than the depreciated stocks as well as different from each other. Timmer and van Ark note that Pyo's gross figures appear to be too high and that the estimated depreciation parameters are often implausible, a situation that casts doubt on the consistency of the various benchmarks. For the following Korean returns, I use the Timmer and van Ark capital figures calculated with the Maddison lifetime assumptions, and my capital figures calculated with the PWT assumptions. It should be underlined that both series are based on the same historical investment data.

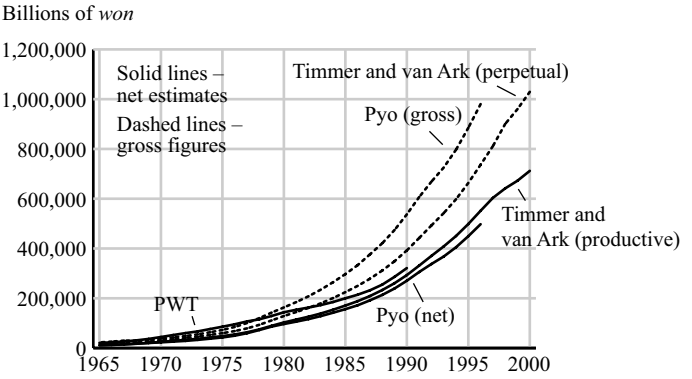
Estimating Korean Returns

Figure 5 shows returns on economy-wide nonresidential capital; these are based on Timmer and van Ark's nondepreciated capital series, estimated according to the Maddison assumptions.[8] For comparison, I use three elasticities or capital shares that span the sample described above: Kim and Lau's elasticity estimated from a production function, Collins and Bosworth's constant capital share, and my adaptation of Pilat's capital share. Although there are differences in the results for the earlier years, the overall pattern of change is quite similar. Moreover, the more recent years show strong convergence. To simplify the results even further, Kim and Lau's elasticities are extended to 2002 at the same value estimated for 1990, the last year of their sample; for comparison, I use my recalculated Pilat share because it represents the lower bound of share or elasticity estimates.

In ***Figure 6,*** using the two elasticities and the two capital series based on Maddison and PWT depreciation assumptions, I plot four different rate-of-return series. In addition, a market-based, real rate of return calculated by Hsieh (2002, 507) is included for comparison. Hsieh sought the returns of an

8. GDP data came from Korea's national accounts and from those of Japan and the United States. Price level–adjusted time-series data of real GDP with different base years were converted to a standardized 1990 base.

Figure 4: **Alternative Measures of Korea's Nonresidential Capital Stock, 1965–2000, in billions of 1990 *won***



Sources: Pyo 1998, Summers et al. 1994, Timmer and van Ark 2002.

asset whose price is correlated with the returns of the country's capital stock. For Korea, he chose the unregulated curb market rate and deflated it with the average rate of asset price deflation.[9]

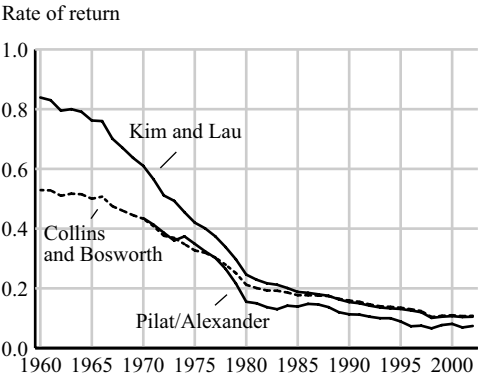
Several points can be drawn from these alternative renderings of Korea's real rate of return on aggregate capital:

- Returns have fallen sharply over the years as capital has accumulated under Korea's high savings and investment regime; the declines range from 35 to 55 percentage points;
- PWT depreciation assumptions, as expected, lead to lower levels of capital and higher returns than do the Maddison fully-productive-life assumption;
- The rate of decline became less steep after 1980 and probably flattened between 1998 and 2002; and
- Returns during the first and second decade following the end of the Korean War were extraordinarily high, no matter how measured; the Kim and Lau elasticities produced the highest estimates, possibly because their procedure allowed the elasticity of substitution to be less than 1.0, which may have forced a high capital elasticity in the postwar days when much capital had been destroyed. Hsieh (2002, 503) summarizes:

9. Hsieh wanted to determine whether capital stock is being correctly measured; he found that Korea's investment data appear to be consistent with other evidence but that Singapore's national accounts significantly overstate the amount of investment spending.

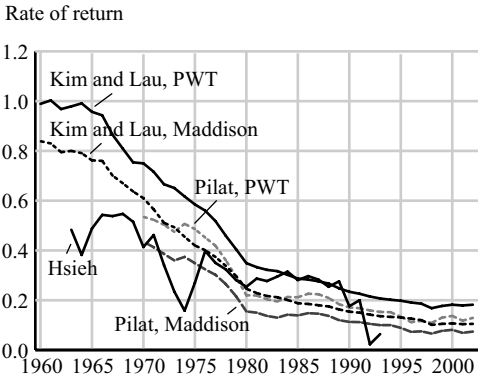
[T]here is overwhelming evidence that the marginal product of capital has fallen by the extent implied by the national accounts. All three measures [of the marginal product of capital in Korea] indicate that it has fallen dramatically since the 1960s.

Figure 5: **Rates of Return on Nonresidential Capital, Korea, 1960–2002**



Sources: Collins and Bosworth 1996, Kim and Lau 1994, Pilat 1994.Note: The results by Pilat (1994) have been corrected by the author; see footnote 6.

Figure 6: **Rates of Return on Nonresidential Capital in Korea, 1960–2002**



Sources: Hsieh 2002, Kim and Lau 1994, Maddison 1995, Pilat 1994, Summers et al. 1994.

Note: Maddison and PWT assumptions for depreciation; Kim and Lau and Pilat elasticities; and Hsieh real returns based on curb rate.

A pattern similar to Korea's very high postwar rates followed by steep declines was seen in Europe and Japan following World War II. The explanation for this is that these countries had preserved their human capital and institutions from the earlier period but lacked the capital that had been destroyed during the war. Consequently, the economies were in severe disequilibrium since the proportions of their productive inputs had been selectively altered; when investment recovered, the returns to the new additions to capital were very large. As the capital stock rose to equilibrium levels, however, returns declined to levels appropriate to the mix of human, physical, and institutional capacities. Because Korea had not been a rich country before the Korean War, it also benefited from starting from a particularly low level of capital and output.

Figure 7 zooms in on the portion of Figure 6 for the years after 1980; this will allow a clearer examination of the period when the decline in the rate of return decelerated. Two main features stand out: returns remain high (8–16 percent) despite almost 50 years of fast-paced investment; and the downward trend may have been reversed following the reforms of the Asian financial crisis.

In addition to the production function method of calculating returns, scholars have used the simpler ratio of output to capital (Q/K) that describes the amount of capital in use in an economy in relation to the value of output; this ratio takes no account of other sources of output—it holds nothing else constant. In particular, the output-capital ratio does not tell how much more output might be expected from an increase in the capital stock.

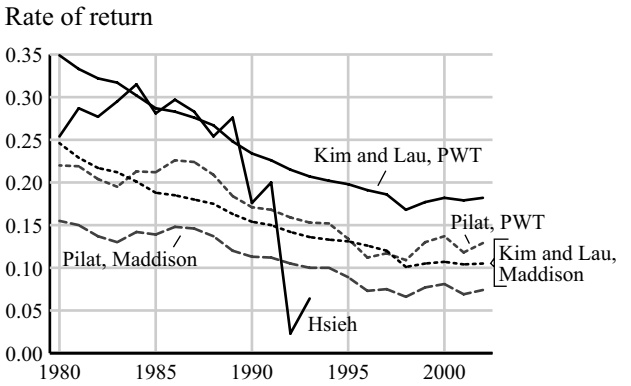
The ratio of the change of output to the change in the capital stock—the incremental output-capital ratio—is somewhat closer to the goal of attributing marginal changes in output to marginal increases of capital. If capital were the only factor experiencing change, $\Delta Q/\Delta K$ would be sufficient; however, this ratio does not account for other variables that also may be affecting output. Therefore, the preferred measure in this chapter—the partial differential $\partial Q/\partial K$—yields theoretically more satisfying estimates of rates of return. ***Figure 8*** shows these three output-capital measures.

The three ratios paint the same qualitative picture: very high levels following the recovery from wartime devastation in the early 1960s and subsequent declines as capital-fueled economic development went into high gear. The large swings in $\Delta Q/\Delta K$ arise from the year-to-year cyclical fluctuations in investment. Because the other measures are based on ratios of the annual flow of GDP to the stock of capital, neither of which changes by more than a few percentage points, the trends are considerably smoother.

International Comparisons

We can now compare the returns in Korea with returns in other countries. Returns for Japan and the United States were calculated with elasticities from Kim and Lau extended through 2002 plus capital stock figures based on both

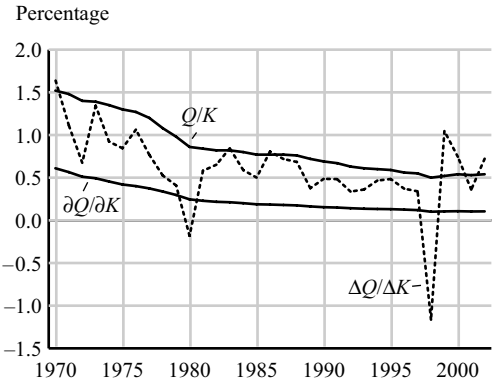
Figure 7: **Rates of Return on Nonresidential Capital in Korea, 1980–2002**



Sources: Hsieh 2002, Kim and Lau 1994, Maddison 1995, Pilat 1994, Summers et al. 1994.

Note: Maddison and PWT assumptions for depreciation; Kim and Lau and Pilat elasticities; and Hsieh real returns based on curb rate.

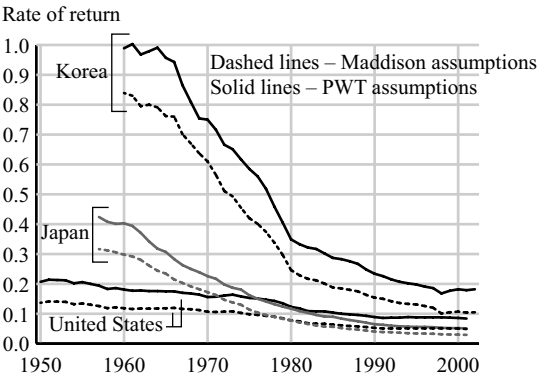
Figure 8: **Alternative Measures of the Capital and Output Relationship, Korea, 1970–2002**



Sources: Kim and Lau 1994, Maddison 1995.

the Maddison and PWT assumptions (shown in ***Figure 9***). Japan, like Korea, earned high returns in the years after World War II. By the end of the period, however, Japan's rates had fallen substantially below U.S. rates. In contrast, according to these estimates, Korea's returns are still well above U.S. returns. Although the difference between Japan and the United States does not

Figure 9: **Rates of Return on Nonresidential Capital, with Maddison and PWT Assumptions; Korea, Japan, and the United States, 1950–2002**



Sources: Kim and Lau 1994, Maddison 1995, and Timmer and van Ark 2002.

seem to be very great at the scale of Figure 9, Japanese returns in 2001 were 40 percent less than the U.S. estimate under both capital assumptions.

Returns in the United States have been relatively stable compared with those in the other two countries, both of which experienced recovery from war followed by unprecedented investment-led growth. Nevertheless, U.S. returns of 15–20 percent in the 1950s were still high for the world's most advanced economy. The United States had experienced a dearth of investment because of the Great Depression that was followed by the diversion of resources to the World War II effort. The accumulation of new technology and the almost 20-year investment drought plus the revival of postwar demand generated high returns.

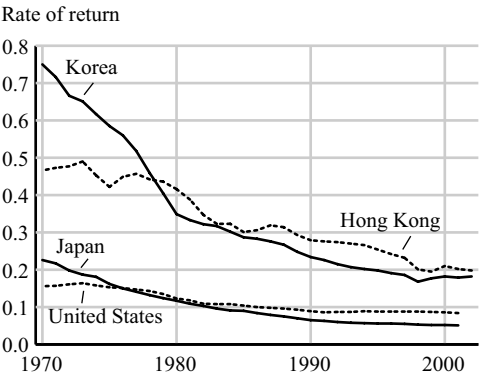
Figure 10 shows the same countries as shown in Figure 9 with the addition of Hong Kong (C&SD 2003). What may be surprising is the considerably slower decline of returns in Hong Kong, which have been substantially above returns in Korea.[10] The main reason for Hong Kong's high returns is the relatively low level of investment that has been required to produce a high level of GDP per capita. In an attempt to explain this seemingly divergent experience, Rodrik (1997, 25–8) cites the absence of government intervention policies:

10. According to the original PWT 5.6 investment and capital figures (Summers et al. 1994), returns actually increased in Hong Kong to the end of the data series in 1992. However, revised investment data recently published in Hong Kong are inconsistent with the PWT 5.6 investment trends. I re-estimated the capital stock using the new data, with the results shown in Figure 10.

> Hong Kong presents a clear case of a noninterventionist policy regime—in fact, as clear-cut a case as one can find anywhere in the world. . . .It is the only country in the region that has not experienced steady and sustained increases in investment as a share of GDP since the early 1960s. . . .One interpretation of this divergent experience is to claim success for the strategy of laissez faire. After all, Hong Kong grew at a high rate in spite of flat investment. . . .However, there is an alternative explanation, one that is kinder to industrial policy. Hong Kong was already a relatively rich country in 1960, with a per capita income that South Korea and Taiwan would not reach for at least another decade. Hong Kong's transition to high investment appears to have taken place largely during the 1950s.
>
> Hence, one could argue that Hong Kong did not face the central challenge of economic development—how to transform a low-saving, low-investment economy into a high-saving, high-investment one. . . .The other countries of the region (save for Japan) started from considerably lower levels, and needed their governments to give accumulation a push.

Rodrik's argument in favor of government investment policy seems strained when he addresses the Hong Kong example. Not only did Hong Kong require 40 percent less capital to produce a unit of GDP than did Japan in 2001, but also its real per capita income was higher than Japan's, and its returns to capital were barely falling. Although Hong Kong's situation may

Figure 10: **Rates of Return on Nonresidential Capital, with PWT Depreciation Assumptions; Korea, Japan, the United States, and Hong Kong, 1970–2002**



Sources: C&SD 2003, Kim and Lau 1994, Maddison 1995, and Timmer and van Ark 2002.

not be directly comparable with situations of larger countries, its experience cannot be dismissed out of hand. High income, moderate investment, and high returns appear to be compatible outcomes.

Returns in Development Perspective

Are Korea's earnings commensurate with its relative position as a still-developing economy, given the amount of capital that it has invested? We can portray Korea's returns relative to its capital depth and compare its trend with those of other countries. For such comparisons, capital stock per capita, rather than capital per worker, is a good measure of capital deepening because different employment regimes can create variations in the participation rate that are independent of capital efficiency; normalizing capital stock by the total population avoids such distortions.[11]

The analysis so far has been in terms of ratios of domestic currencies. To compare countries in a common currency, it is necessary to convert exchange rates. Because capital and GDP have been measured in 1990 values, all that is required is 1990 purchasing power parity (PPP). Here, separate PPPs for GDP and investment are taken from PWT 6.1 (Heston et al. 2002) to convert into 1990 dollars. The PPPs used to make the conversion are shown in ***Table 2.***

The results for Korea, Japan, and the United States are in ***Figure 11;*** the two panels show the results when the capital stock is estimated according to the Maddison and the PWT depreciation assumptions. The two approaches to estimating the capital stock produce almost identical qualitative results; the one difference, as seen earlier, is that returns with the PWT assumptions are higher because the estimated quantity of capital is lower. Until the early 1990s, Korea's returns were slightly below Japan's at the same level of capital per person; Korea's downward course flattened in the 1990s, and by around 1994 its returns for a given level of capital surpassed Japan's experience of 30 years earlier. Japan's returns, in turn, have been a bit below the U.S. value at almost all levels of capital stock per person, with the gap growing in recent years. Korea is following Japan's example of a high-capital country; its 2002 value of capital per capita surpassed the U.S. value of only 10–15 years earlier.

The similarity of Korea's investment-led development path to Japan's path is apparent in the ratio of GDP per capita as a function of capital stock per capita (***Figure 12***). The first thing to note in Figure 12 is that Korea's expansion path overlays Japan's. The second thing is that U.S. growth after the early 1950s jumped to a new, productivity-based economic model. These results indicate that Korea has used more capital than the United States to produce each unit of GDP at comparable levels of capital intensity, or, alter-

11. Calculations using capital stock and GDP per worker show that U.S. productivity is considerably greater than both Korea's and Japan's, and that Japan's is greater than Korea's (see Figure 14 on page 27).

natively, that Korea has generated less output per unit of capital. Nevertheless, Korea earns higher returns on capital when estimated by the production function approach. The difference must come from those other things that are being held constant in the latter method.

Table 2: **Exchange Rates and PPPs for Korea and Japan, 1990**

Country	Exchange rate (U.S. $)	GDP PPP	Investment PPP
Korea	707.8	474.2	467.1
Japan	144.8	183.9	166.5

Source: Heston et al. 2002.

The other things influencing capital returns are mainly high labor inputs. McKinsey and Company (MGI 1998) has studied Korean productivity at the macroeconomic and industry levels, and its study compares Korea with Japan and the United States. One of its central analytical methods relates labor and capital inputs to productivity to arrive at GDP per capita, as shown in ***Table 3.*** The table shows that Korea's economy in the 1993–95 period had invested only 47 percent as much capital per capita as the United States, but it used 40 percent more labor in producing GDP. Korean capital productivity was estimated to be 5 percent greater than the U.S. value, but labor productivity was only 36 percent as great.

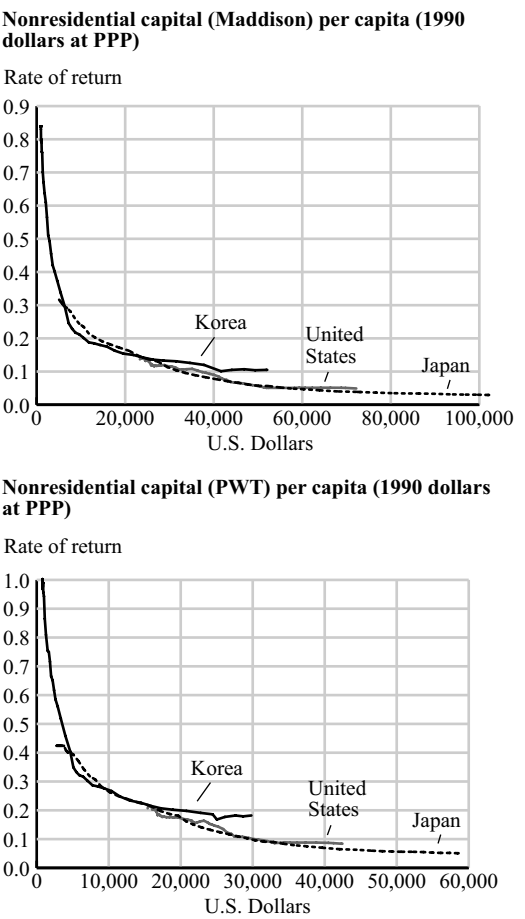
Baily and Zitzewitz (1998, 256–7) used the McKinsey study to generate additional analysis. When they turned their attention to disaggregated manufacturing and service sectors, they found capital productivity in Korean services to be 50 percent greater than in the United States and manufacturing

Table 3: **Factor Inputs, Productivity, and GDP in Korea and Japan, 1993–95**

Factor inputs	Korea	Japan
Capital per capita	47	135
Labor per capita	140	120
Total factor inputs per capita	98	126
Productivity		
Capital productivity	105	60
Labor productivity	36	70
Total factor productivity	51	63
GDP		
GDP per capita	50	80

Source: MGI 1998.
Note: Labor and capital aggregated according to a Cobb-Douglas production function, with labor share of 66 percent. Korea and Japan indexed to U.S. 1993–95 average = 100.

Figure 11: **Rates of Return and Capital Stock per Capita, with Alternative Depreciation Assumptions; Korea, Japan, and the United States, 1950–2002**

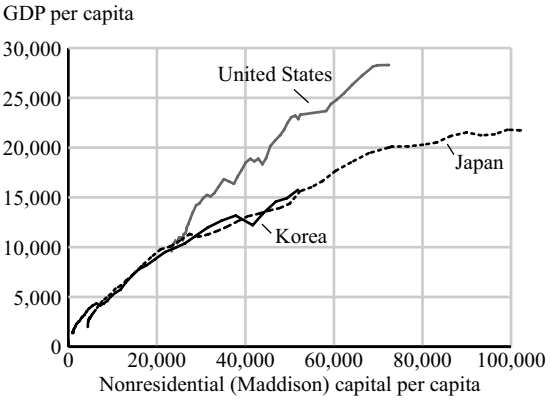


Sources: Maddison 1995; Summers et al. 1994.

capital productivity to be 20 percent below the U.S. level. They attributed the higher returns in services to the fact that services had been starved of capital under Korea's state-led industrialization process, whereas manufacturing received subsidized capital injections.

Indeed, according to Baily and Zitzewitz, industrial companies in Korea did not earn enough on their capital to pay their cost of funds. Moreover,

Figure 12: **GDP per Capita versus Capital Stock per Capita; Korea, Japan, and the United States, 1950–2002, 1990 dollars at PPP**



Sources: Maddison 1995, Timmer and van Ark 2002.

estimated corporate returns in the United States were considerably higher than returns in Korea.

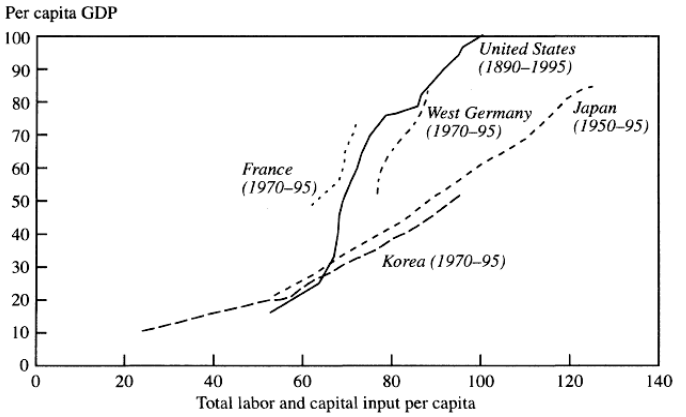
The inability of manufacturing companies to earn their cost of capital is supported by another study that looked at productivity in Korea's economy. Park and Kwon (1995, 342) found that throughout the 1980s the price of capital in heavy industry was greater than its marginal product; light industry, in contrast, more than made its capital costs.

Baily and Zitzewitz (1998, 254) summarize their macroeconomic conclusions by plotting per capita GDP as a function of labor and nonresidential capital, combined according to a Cobb-Douglas production function with a labor share of 66 percent. They compare Korea with long term-series data for the United States, Japan, France, and Germany. Their chart is reproduced as ***Figure 13,*** in which both GDP and factor inputs are indexed to the 1995 U.S. values.

The central point of both the McKinsey study and the Baily and Zitzewitz study is that, by 1995, Korea and Japan had reached or exceeded the levels of inputs of the other economies, but on a flatter, lower productivity path. Korea's GDP per capita of about 50 percent of the United States in 1995 was achieved with about the same level of inputs, albeit with a very different mix—more labor and less capital. (Baily and Zitzewitz 1998, 254)

Baily and Zitzewitz conclude that the United States, Germany, and France followed a productivity-oriented growth path, with much higher levels of output at each level of input than the two Asian economies.

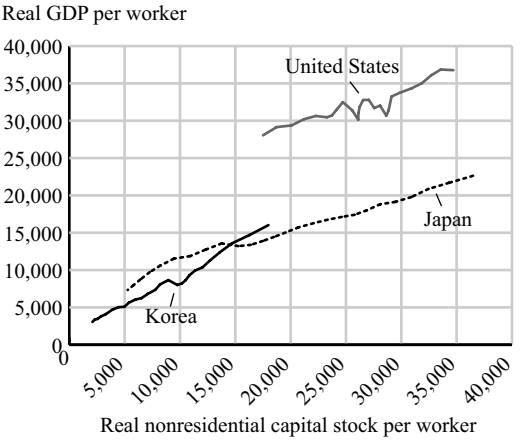
Figure 13: **GDP and Combined Inputs per Capita; Korea, United States, Japan, Germany, France, various years ending 1995; U.S. 1995 = 100**



Source: Baily and Zitzewitz 1998, 255 (Figure 2).

These points are buttressed by a comparison of the plots of GDP per worker against capital per worker with the similar plots of per capita ratios of Figure 12. Because of high U.S. productivity in the use of labor, both the Korea and Japan curves of ***Figure 14*** are considerably below the U.S. curve; the output produced by a unit of combined capital and labor is much greater in the United States than in the other two countries.

Figure 14: **PWT 5.6 GDP per Worker versus Capital Stock per Worker; Korea, Japan, United States, 1965–90, 1985 dollars at PPP**



Source: Summers et al. 1994.

Japan has yet to make the transition from an input-dependent growth path to one that relies on productivity. Korea is following in Japan's footsteps but is not as advanced as Japan. Korea is still earning returns greater than the other countries considered here. Its future path, however, remains uncertain.

4

Rates of Return in Korean Corporations

Because the financial accounts of many Korean companies sometimes disguise grim financial realities, the use of company figures in any analysis is open to question. Two responses to this legitimate concern may serve to reduce reasonable objections to the methods used here,[12] although they cannot ultimately guarantee unqualified support of the conclusions. First, this paper reports averages and medians of hundreds of companies rather than the figures for any single one. Unless phony reports were the rule across most companies and unless these manufactured numbers grossly distort the underlying reality in a nonrandom way, the results shown here should still be valid. Second, this paper provides statistical tests of differences between *chaebol*-related and non-*chaebol*-related companies.

The large business groups of industrial and financial firms, called *chaebol* and often in the past controlled by a family founder, have been notable for the problems revealed in the wake of Korea's severe business contraction in 1997 and 1998. If financial reporting errors reside mainly in large *chaebol* groups, as presumed by many scholars on Korea's economy, direct comparisons of the two groups of companies may identify real issues. The analysis

12. For this paper, data on fiscal year (FY) 1997 through FY 2001 rates of return for Korean corporations came from the Korea Information Service (KIS 2002), which provides financial information of all companies listed on the Korea Stock Exchange as reported to Korea's Financial Supervisory Service. I selected for analysis all nonfinancial companies with reported profit and assets. The number of companies varied from year to year—from 458 companies in FY 1997 to 491 companies in FY 2001. Fiscal year can vary from company to company. To assign a fiscal year to a calendar year for analytical purposes, I set the calendar year equal to the fiscal year if the fiscal year ended in the second half of the calendar year; otherwise I set the fiscal year to the previous year. Thus, if the fiscal year ended on 31 July 2001, I assigned it to calendar year 2001; if it ended on 30 April 2001, I placed it in calendar year 2000.

that I describe at the end of this chapter did not uncover any obvious problems. Of course, if all types of companies are guilty of misreporting, such tests will not reveal it.

One other potential source of financial reporting errors must be considered. The data analyzed in this and the next chapter are only for non financial firms. If *chaebol* hide debt or off-balance sheet obligations in the financial affiliates belonging to the group, they would not be on the books of the companies that I investigate. Close scrutiny of companies that have gone into bankruptcy such as Daewoo have tended to find more liabilities than had been reported on the balance sheet. Until we get consistent and reliable consolidated financial reporting that include financial and nonfinancial group accounts, the results obtained here will have to be considered as tentative.[13]

Measuring Profit

The first issue in estimating returns is the selection of a particular definition of profit from among the several alternatives in the data: operating income; ordinary income; net income before taxes; and net income after taxes. The relationship among these measures is shown in ***Table 4.***

Operating income represents profit generated in a company's main line of business; it fits the standard notion of profit as equaling revenues minus production costs. *Ordinary income* includes nonoperating income and expenses that are unrelated to the main line of business. For example, it includes gains and losses on currency transactions. *Net income before taxes* adds in extraordinary, one-time transactions. Finally, *net income after taxes* subtracts the company's income tax liabilities.

To calculate returns, I used operating income and net income after taxes. Operating income is recorded after depreciation but before payments and receipts of interest and dividends. A central assumption about an ongoing establishment is that profit represents a payment to capital. If depreciation were not deducted from the income stream, it would be equivalent to generating income by selling the capital stock.

Another reason I used operating income is that it is recorded before the payment of interest. Because the income generated by the capital stock is central to this study, the cost of a large part of that capital should not be deducted prematurely in the analysis. This consideration is especially important in Korea, where interest on borrowing is a major element of the cost of capital.

Net income after taxes is the income available to one particular class of capital providers: shareholders. This measure of income is what is left after paying off everyone else—the government, providers of current inputs such

13. This issue was pointed out by Edward M. Graham in a review of an earlier draft.

Table 4: **Relation among Items in Income Statements of 491 Korean Companies, 2001, in billions of *won***

Total	Income statement items
483,950	Sales
400,178	Costs of sales
83,770	Gross profit or loss
56,970	Selling and administrative expenses
	Salaries
	Retirement allowance
	Other employee benefits
	Utilities
	Taxes and dues
	Rent
24,169	Depreciation
	Entertainment
	Advertising
	Ordinary R&D expenses
	Insurance
	Transport, handling, warehousing, packing
	Bad debt expense
	Amortization of intangible assets
	Amortization of development costs
	Other selling & administrative expenses
26,798	Operating income or loss
22,280	Nonoperating income
	Interest income
	Dividend income
	Gain on foreign currency transactions
	Gain on foreign currency translation
	Gain on valuation of marketable securities
	Gain on disposition of tangible assets
	Other nonoperating income
41,123	Nonoperating expense
	Interest expense
	Loss on foreign currency transactions
	Loss on foreign currency translation
	Loss on valuation of marketable securities
	Loss on disposition of tangible assets
	Other nonoperating expenses
7,956	Ordinary income or loss
4,228	Extraordinary gain
1,430	Extraordinary losses
10,755	Net income or loss before income tax expenses
5,675	Income tax expenses
5,078	Net income or loss after income tax

Source: KIS 2002.
Note: The items in the table that show accompanying monetary amounts are available as data for individual companies.

as labor and materials, and other suppliers of capital such as banks. Net income after taxes will be used to measure the returns to shareholder equity.

Table 5 gives the mean and median of the various profit indicators. The reason for considering the median (the middle value in a distribution, above and below which lie an equal number of observations) is the great range of company sizes, from the giant *chaebol* to their small suppliers. Outliers, particularly very large firms, distort averages as measured by the mean and may camouflage changes among the large number of smaller companies.

Table 5: **Alternative Definitions of Korean Corporate Profit, 1997–2001, in billions of *won***

Year	No. of firms	Operating income	Ordinary income	Net income before taxes	Net income after taxes
Mean					
1997	458	56.6	5.0	5.0	1.4
1998	481	46.6	4.9	–6.1	–11.6
1999	482	55.3	42.1	42.9	29.9
2000	487	74.9	33.4	31.8	17.5
2001	491	54.6	16.2	21.9	10.3
Median					
1997		8.3	2.8	2.8	2.0
1998		8.1	3.0	3.2	2.3
1999		8.6	6.4	7.1	5.1
2000		9.2	4.9	5.2	3.8
2001		8.8	5.1	5.2	4.0

Source: KIS 2002.

The first thing to notice about Table 5 is the large differences between mean and median. The median is much smaller and exhibits less variation over time. For example, the order-of-magnitude increase in the mean value of ordinary income from 1998 to 1999 is subdued in the median. These differences suggest that ordinary averages may hide more than they reveal. It will be instructive, therefore, to examine more extensive representations of the distributions rather than to focus on any single number.

Measuring Assets

Just as there are alternative definitions of profit, assets also may be described in several ways. The most inclusive measure is total assets, which incorporates financial assets, inventories, and fixed assets such as plant and equipment. Because all of these assets enter the production of goods and services and because payments to these assets must be generated by profit, I use total

Table 6: **Relation among Items on Balance Sheets of 491 Korean Companies, 2001, in billions of *won***

Total	Balance sheet items
134,703	Current assets
102,654	Quick assets
13,276	Cash and cash equivalents
3,920	Marketable securities
46,540	Trade receivables
	Other quick assets
32,048	Inventories
	Finished or semifinished goods
	Raw materials
	Other inventories
	Noncurrent assets
124,294	Investments
	Investment securities
219,957	Tangible assets
	Land
	Buildings and structures
	Machinery and equipment
	Ships, vehicles and transportation equip.
	Construction in progress
	Other tangible assets
8,906	Intangible assets
	Development costs
488,192	Total assets
149,657	Current liabilities
38,316	Trade payables
32,677	Short-term borrowings from banks
32,625	Current maturities of long-term borrowings
	Current maturities of bonds payable
	Other short-term borrowings
	Other current liabilities
	Long-term liabilities
62,487	Bonds payable
24,825	Long-term borrowings from banks
	Other long-term borrowings
	Liability provisions
	Other long-term liabilities
267,997	Total liabilities
220,192	Stockholders' equity
50,454	Capital stock
103,490	Capital surplus
62,977	Retained earnings
3,253	Capital adjustment

Source: KIS 2002.

assets as the denominator of the rate-of-return ratio; operating income is the numerator. Shareholder equity will be used in the calculation of returns to shareholders.

Macroeconomic measures of economy-wide returns typically use the capital stock of plant and equipment in their measurements, as I did in Chapters 2 and 3. These aggregations of physical capital omit the financial assets that I include when measuring private returns. In the balance sheets of Korean companies, investment in plant and equipment is represented by tangible assets, which are only 45 percent of total assets. The relation among the various items of the balance sheet is shown in ***Table 6.***

Why not use physical capital instead of the more inclusive total assets to calculate company returns? The main reason is that a firm is not a country. If a corporation cannot repay its lenders and shareholders, its long-term survival is doubtful. However, if all balance sheets were consolidated in an economic system without cross-border capital flows, the financial entries would cancel out because the assets on one balance sheet would be matched by liabilities on others. After netting, aggregate national nonfinancial investments would remain on one side of the balance sheet and the nation's savings on the other.

Table 7 presents means and medians of selected balance sheet items. As with income, outliers dominate the means, which are approximately five to six times greater than the medians. Over the five years from 1997 through 2001, median liabilities have fallen, equity has risen, and assets have grown. These trends mark the cleaning up of corporate balance sheets as companies took steps to reduce their borrowing from previously dangerous levels.

Table 7: **Selected Balance Sheet Items of Korean Companies, 1997–2001**

Year	Total assets *won*, billions	Total liabilities *won*, billions	Shareholder equity *won*, billions	Leverage[a]
Mean				
1997	877.9	663.0	214.8	3.03
1998	886.8	621.1	265.6	1.98
1999	1,021.4	583.5	437.9	5.80
2000	1,063.1	634.1	429.0	2.18
2001	994.3	545.8	448.5	2.24
Median				
1997	144.0	95.4	49.0	2.06
1998	155.2	89.6	58.9	1.46
1999	175.3	89.9	75.9	1.10
2000	186.6	93.4	80.9	1.10
2001	183.2	84.4	83.5	1.02

Source: KIS 2002.
a. Ratio of total liabilities to shareholder equity.

Table 7 also shows Korean corporations' average leverage, defined as the ratio of total liabilities to shareholder equity. Because of outliers, the mean ratio of liabilities to equity does not show a clear trend. The median value, however, has fallen steadily in the past five years, and in 2001 it was half its 1997 value. Highly leveraged financing (bank loans that were insufficiently backed by equity capital) was one of the leading causes of Korea's economic crisis in 1997–98.

Average Rates of Return

Now that we have selected measures of profit and capital, we can calculate rates of return for Korean companies for 1997 through 2001. ***Table 8*** presents nominal returns on total assets and shareholder equity.

Table 8: **Nominal Rates of Return on Total Assets and Shareholder Equity of Korean Companies, 1997–2001**

Year	No. of corporations	Aggregate operating income to to total assets (%)	Aggregate net income after tax to shareholder equity (%)	Mean operating income to total assets (%)	Median operating income to total assets (%)	Median income after tax to shareholder equity (%)
1997	458	6.4	0.7	5.5	5.7	3.4
1998	481	5.3	–4.4	4.1	5.4	4.0
1999	482	5.4	6.8	4.9	5.2	6.3
2000	487	7.0	4.1	5.4	5.2	5.1
2001	491	5.5	2.3	4.7	4.9	4.6

Source: KIS 2002.

There are several ways to measure average returns. In Table 8 and Table 9 (on page 36), the first measure is the sum of operating income divided by the sum of total assets (column 3). This simple ratio is equivalent to the weighted mean across the observations where the weights are the proportion of each company's assets to the sum total. The same ratio is calculated for net income after tax to shareholder equity (column 4).

The next average (column 5) is the mean of all company returns. Because the mean treats each company equally, small companies with extreme values can produce distortions. Medians are shown next to the mean (column 6); as mentioned earlier, outliers do not affect the median.

The mean value of the return on equity is so dominated by outliers that it is not even shown in the table. The reason for the extreme variability is that equity capital was wiped out for a significant number of Korean companies in the aftermath of the Asian financial crisis in 1997–98 and the subsequent

Table 9: **Real Rates of Return on Total Assets and Shareholder Equity of Korean Companies, 1997–2001**

Year	Inflation, GDP deflator (%)	Aggregate operating income to aggregate assets (%)	Aggregate net income after tax to shareholder equity (%)	Mean operating income to total assets (%)	Median operating income to total assets (%)	Median income after tax to shareholder equity (%)
1997	3.2	3.2	–2.5	2.3	2.6	0.2
1998	5.0	0.3	–9.4	–1.0	0.4	–1.0
1999	–2.0	7.4	8.8	6.9	7.2	8.3
2000	–1.1	8.1	5.2	6.5	6.3	6.2
2001	1.3	4.2	1.0	3.5	3.6	3.3

Source: KIS 2002.

collapse of the Korean *won*. Consequently, in many cases, equity was very close to zero on both the positive and negative sides; a denominator near zero causes very large positive and negative ratios. For example, the return on equity in 1999 ranged from minus 161,000 percent to a positive 1,720 percent; including such values in a mean so distorts the result that it would not be meaningful to include it. Instead, I used the median figures (column 7).

Is there evidence in Korea's corporate data of any trend, or signs, that corporate reforms have helped to push up returns? Nominal operating income to total assets (column 3, Table 8) shows a downward trend over the five years. Although the evidence for a negative slope is weak, it is supported by the regression equation at the end of the chapter in which other variables are accounted for.

Shareholders' returns (column 4, Table 8) have been particularly erratic. Net income after taxes tends to be more volatile than operating income. Extraordinary losses and gains unassociated with a company's main line of business can be particularly large in severe downturns as capital losses and other financial reverses overwhelm ordinary profit. Thus, aggregate losses in 1998—when the full effects of the Asian crisis were felt—were followed by a sharp recovery the next year. The difference in returns on shareholder equity between those two years amounted to more than 10 percentage points. However, the median company—the company in the middle of the pack—showed much less volatility.

Another approach to assessing the possibility of trends is to examine what happened to individual companies. I separately created a matched set of 457 companies that existed in both 1997 and 2001. The median change of returns to total assets was negative: –0.4 percent. On the other hand, the median return to shareholder equity rose by 0.7 percentage points. The same

mixed pattern can be seen in aggregate, rather than median, returns. On an individual company basis, there was no clear sign of improved returns in 2001.

If corporate returns are adjusted by the inflation rate of the GDP deflator (***Table 9***) it shows that 1999–2001 are better by all the measures than 1997. Falling prices in 1998 and 1999 pushed up real returns in those two years, and low inflation in 2001 helped to continue making real returns a bit better than in the years of faster price increases.

How do returns in Korean corporations compare with those earned elsewhere? It is a difficult question to answer because corporate financial reporting is not standardized across countries; even within a country, financial data often do not fit economic definitions.

Keeping these concerns in mind, I tried to generate figures for the United States and Japan that may be compared with figures for Korea.[14] The comparisons are shown in ***Table 10.*** All the figures are based on ratios of aggregate profit to aggregate assets. The main difference across the country comparisons is that Korea's data are based on companies listed on the major

Table 10: **Corporate Rates of Return in Korea, Japan, and the United States, 1990–2001**

Year	Korea: operating income to total assets (KIS) (%)	Japan: operating income to total assets (MOF) (%)	Japan: operating surplus to total assets (ESRI) (%)	U.S.: operating income to total assets (IRS) (%)
1990		4.9	3.6	6.9
1991		4.5	3.7	
1992		3.5	3.6	
1993		2.9	3.4	
1994		2.9	3.0	
1995		3.0	3.2	7.1
1996		3.2	3.4	7.1
1997	6.4	3.2	3.5	7.1
1998	5.3	2.4	3.2	4.6
1999	5.4	2.8	3.0	4.3
2000	7.0	3.4	3.0	3.6
2001	5.5	2.9	2.8	

Sources: IRS 2001, KIS 2002, MOF 2002, ESRI 2002.

14. Japanese data came from two sources: MOF (2002) and ESRI (2002). Because the operating surplus in the Japanese data includes some labor income, the calculated returns are too high. U.S. data are from IRS (2001); changes in U.S. definitions in 1998 mark a break in the data.

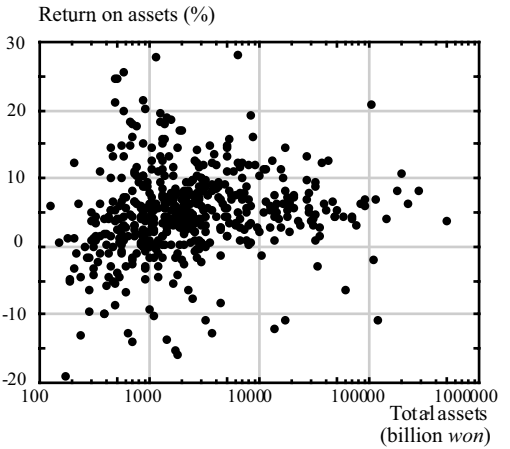
national stock exchange, whereas the Japanese and U.S. observations include all private, nonfinancial corporations.

Both the U.S. and Korean returns tend to be higher than the Japanese returns. Whether measured by the MOF (2002) or ESRI (2002), returns in Japan have been declining since before the 1990s; even at the height of the bubble in 1990, they were lower than returns in Korea after the Asian financial crisis. Although it is difficult to make fine comparisons, returns to Korean companies are roughly comparable with returns in the United States.

The Distribution of Returns and Leverage

One question often raised about Korea's economy is whether large size confers competitive or profitability advantage. The distribution of returns across an extremely wide range of asset sizes suggests that there is no simple relation between size and profitability. ***Figure 15*** shows a scatterplot of returns (operating income to total assets) versus total assets (on a logarithmic scale) for 2001. (Other years exhibit the same results.) The simple correlation between returns and assets is 0.03; with the log of assets, it is 0.15. These correlations are evidence of no relationship. The correlation between leverage and assets is even lower: –0.004, which is about as random a relationship as can be found. The regressions reported later suggest that the link between operating profitability and assets is slightly positive but insignificant, and that returns on equity are negatively, weakly, and insignificantly related to shareholder equity.

Figure 15: **Ratio of Operating Profit to Total Assets versus Total Assets for 491 Korean Companies, 2001**



Source: KIS 2002.

Another conjecture is that companies borrowed to finance profitable opportunities that could not be funded by the underdeveloped and overregulated Korean capital market. If so, there should be a positive relation between leverage and returns. This supposition is not supported by the data; the correlation between leverage and the return on total assets was –0.07 for 2001.

Another theory was that, by leveraging their investments, shareholders could enhance their own returns by adding borrowed funds to their invested capital. Again, this conjecture comes up short; the correlation between leverage and return on shareholder equity is significantly negative: –0.46. This result, however, is dominated by some extreme observations on returns, which—as noted above—can be very large or very small because of near zero values of equity. If the influence of outliers is suppressed by the removal of the 50 most extreme variables, the correlation falls, but to a still significant –0.22 for the remaining 450 firms. Taking the logs of both variables drops the correlation of the remaining 410 positive observations to an insignificant –0.07.

If leverage declined so noticeably, why did profit not increase to the same degree? After all, lower leverage means that borrowing (as a share of total funding) and its attendant interest costs must have declined. However, the first definition of returns—operating income to total assets—is calculated before interest payments; therefore, a change in debt and interest payments would not affect this measure of returns. The reason that returns on equity did not improve is that equity finance increased at about the same rate as profit. Moreover, although interest expense did fall by a percentage point or two as a proportion of sales, the industry data indicate that interest costs are only about 3 to 5 percent of total costs (see Chapter 5). Other items such as materials and personnel have a much greater impact on profitability.

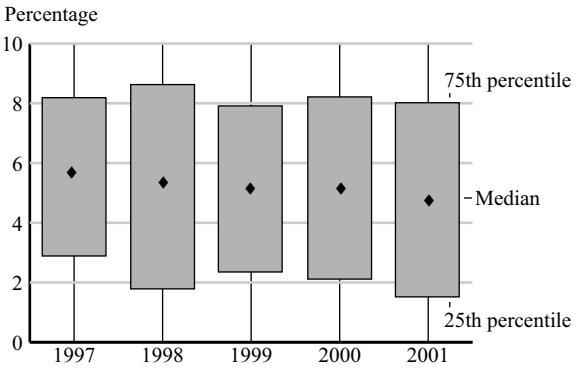
One way to visualize a distribution of observations in compact form is by plotting the interquartile range between the 25th and 75th percentiles, along with the median at the 50th percentile. This shows the center of the distribution along with a measure of its spread. The usual method of focusing on standard deviations is less useful in the situation here because of the very large outliers that distort the distributions' properties. Under the conditions here, percentiles are more meaningful.

Figure 16 shows the median and interquartile range of the rate of return as measured by the ratio of operating income to total assets. The additional information provided by the interquartile range is that it seems to have broadened and fallen slightly. The 25th percentile in 2001 is the lowest of the five years, and the 75th percentile is tied for the lowest value. However, as noted above, these differences are neither stark nor deeply informative of major transformations in Korean companies.

Figure 17 shows the same kind of information about leverage. Here, the story is more dramatic and more obvious. All parts of the distribution have shifted downward, and the range is quite a bit narrower. The median value of

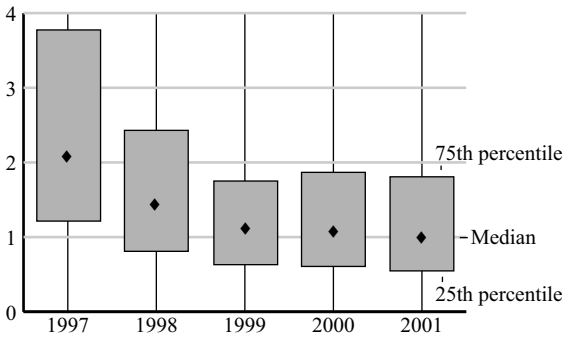
leverage fell by half as Korean firms reduced their borrowing and increased their equity capital. An additional indicator of the sharp reduction in leverage is the interquartile range. In 1997, these values were 1.2 and 3.8; by 2001, they had fallen to 0.6 and 1.8. In other words, a financially conservative company in 1997 at the 25th percentile had higher leverage than the median company five years later. By 2001, leverage in 75 percent of Korean companies was less than 2.0, a substantial improvement over their precrisis balance sheets.

Figure 16: **Median and Interquartile Range of Returns to Total Assets, 1997–2001**



Source: KIS 2002.

Figure 17: **Median and Interquartile Range of Leverage, 1997–2001**



Source: KIS 2002.

Classification by Returns and Leverage

Another way to look at trends is to add a measure of financial leverage to the comparisons of returns. Robert Feldman (2003), chief economist of Morgan Stanley Japan, has classified Japanese companies into four categories, depending on their combination of profitability and leverage. Feldman's definition of leverage is the same as that used here: the ratio of total liabilities to shareholder equity. Leverage acts as an indicator of the relative balance between borrowed capital and equity capital. A high proportion of borrowed funds makes a company particularly vulnerable to economic downturns when the mandated interest payments may not be adequately covered by profit. Feldman's definition of returns also is the same as that used here: operating income to total assets.

Feldman's four categories are based on a company's position relative to average returns and average leverage: companies with above average profit and low leverage are defined as "winners," low profit and low leverage are "plodders," high leverage and high profit are "daring," and low profit with high leverage are "losers." I used the median values for the entire period to classify companies: 5.3 percent return on assets and 1.3 for leverage, as shown in ***Table 11.***

Table 11: **Classification of Korean Companies by Profitability and Leverage, 1997–2001, percentage of total number of firms**

Year	Winner	Plodder	Daring	Loser
1997	13.5	13.8	40.4	32.3
1998	24.3	20.8	27.0	27.9
1999	30.1	29.5	18.9	21.6
2000	28.7	30.2	20.5	20.5
2001	29.5	30.6	17.7	22.2

Sorce: KIS 2002.

When leverage is combined with rate of return during 1997–2001, a clear pattern emerges. The percentage of winners more than doubles and the percentage of losers declines by one-third. This trend is dominated by the revolution in the balance sheet, which shows up in the fact that the share of plodders (low returns, but also low leverage) more than doubles.

This classification reveals that Korean companies seem to have been paying more attention to reducing their risks from overreliance on borrowing than to increasing the return on their total capital base. Indeed, the gains have been remarkable; and they parallel the course taken by Japanese companies, which have cut their leverage in half in the past 20 years (leverage at Japanese firms remains at a still dangerous 2.75, considerably higher than in

Korea). The next stage of corporate evolution could be higher returns through a combination of cautious investment and cost cutting to achieve greater efficiency and improved productivity. That possibility remains in the future, however.

Testing the Difference between *Chaebol* and Non-*Chaebol* Companies

Concern that the analysis of Korean firms may be colored by systematic misreporting of financial information, especially by companies associated with the large *chaebol*, led me to test this proposition. I divided the sample of companies into two subsamples, depending on *chaebol* membership. A company was assigned to the *chaebol* group if it identified itself as belonging to one of the top 20 *chaebol* as reported in the April 2003 Korea Fair Trade Commission list of business groups by asset size. In addition, I placed a company in the *chaebol* subsample if its main shareholder was a top-20 *chaebol* member. In 2001, 64 companies met these criteria. See ***Table 12*** for the differences between the median values of selected characteristics for *chaebol* and non-*chaebol* listed companies. Use of the first and last years in the total sample (1997 and 2001) detected changes over time.

Chaebol companies are roughly 10 times larger than non-*chaebol* companies in terms of assets and sales; however, there was little difference be-

Table 12: **Median Value of Financial Variables for *Chaebol* and Non-*Chaebol* Listed Korean Companies, 1997 and 2001**

Financial item	1997		2001	
	Chaebol	**Non-*chaebol***	***Chaebol***	**Non-*chaebol***
Total assets (*won*, billions)	147.2	12.1	160.4	14.6
Liabilities (*won*, billions)	116.8	7.6	107.6	7.0
Shareholder equity (*won*, billions)	28.6	4.3	56.0	7.2
Sales (*won*, billions)	101.0	10.4	160.7	12.8
Largest shareholder (%)	18.5	20.1	19.2	20.1
Operating income/total assets (%)	5.9	5.7	6.1	4.5
Operating income/ shareholder equity (%)	2.3	3.6	4.5	4.6
Leverage (ratio of liabilities to equity)	5.9	5.7	1.7	0.9
Number of firms	63	395	64	427

Source: KIS 2002.
Note: Firm is defined as *chaebol* member if it identified itself as belonging to one of the top 20 *chaebol* or if its main shareholder was one of the top 20. See text.

tween the two groups when it came to the holdings of their largest single shareholder: about 20 percent of company shares were held by a single entity.

If the books were being manipulated, one might expect profit to be particularly high or leverage low. Rate of return as measured by operating income to total assets was slightly higher among *chaebol* companies in 1997, and this increased in 2001; but non-*chaebol* returns on assets fell over the years. Returns to equity, however, moved differently; they were higher for non-*chaebol* companies in both years, but the *chaebol* members showed faster growth. Leverage was very high for both groups in 1997, but slightly higher among *chaebol* firms; it fell dramatically over the next five years, especially in the non-*chaebol* sample.

These data do not raise any alarm bells about inaccurate reporting. To investigate further, I performed statistical regression analyses on rates of return and leverage to detect differences that may be obscured when calculations do not control for characteristics such as firm size. The results are reported in ***Table 13.*** Explanatory variables include the year of the data, ranging from 1997 to 2001, the logarithm of total assets, the percentage of a firm's shares held by its major shareholder, the year the firm was established, and a dummy variable equal to 1 if the firm is a member of a top 20 *chaebol* group and zero otherwise.

The statistics indicate that being owned by another firm had a statistically significant and sizable effect on profitability; as ownership increased from, say, 10 percent to 20 percent, returns on total assets would rise by 0.2

Table 13: **Coefficients from Regression Analysis of Financial Results for *Chaebol* and Non-*Chaebol* Firms, 1997–2001**

Dependent variable	Year	Log total assets (100 million *won*)	Shares held by major shareholder (%)	Member of top 20 *chaebol*	Year est.	Intercept	R^2 adjusted
Operating income/ total assets (%)	–0.23	0.10	0.02	0.34	0.036	393	0.011
	(2.5)	(0.9)	(2.0)	(0.8)	(3.0)		
Net income after taxes/equity (%)	–0.08	–0.18	0.05	–0.78	0.110	–52	0.017
	(0.4)	(0.7)	(2.2)	(0.8)	(4.7)		
Leverage	–0.29	0.27	0.006	0.28	–0.004	587	0.132
	(11.5)	(8.8)	(2.0)	(2.3)	(1.5)		

Note: Number of cases = 1,964; *t* statistics in parentheses.

percentage points. Membership in a top-20 *chaebol* would raise returns on assets by 0.3 percentage points but cause a 0.8 percentage point fall in returns to equity, neither effect being statistically significant. It is interesting that profitability increases for newer firms; returns on equity would be 1 percentage point higher for a firm that is 10 years younger than another firms. Leverage rises modestly with *chaebol* membership and by very modest amounts with the percentage of shares held by a major owner. In short, this analysis of *chaebol* and non-*chaebol* firms does not reveal any suspicious difference in profitability or leverage that could be explained by accounting chicanery.

5

Rates of Return in Korean Nonfinancial Industries

Data and Definitions

The main source of data on Korean industries is the Bank of Korea (BOK 2002), which draws its sample from the National Tax Service file of corporations required to file a tax report. Industries are defined in accordance with the Korea Standard Industry Classification (SIC). The sample includes 37,024 corporations selected from the 1998 National Tax Service file of 168,803 corporations. The survey excludes several categories of corporations, including financial companies, nonprofit corporations, households, and small companies with sales of less than 2.0 billion *won*. All companies with annual sales of more than 70 billion *won* or that rank in the top five in their industry in terms of sales are included automatically. Other corporations in the survey are chosen by stratified random sampling.

The BOK Internet site (www.bok.or.kr/svc/frame_eng.html) included data for the years 1990 to 2001 for 42 industries. Because of changes in industry definition and coverage, the number of industries varies by year. The online data include only certain financial and operating ratios, but linking several ratios made it possible to produce the same rates of return as used in the company analysis. More detailed data also are available at the BOK site, but data are provided for the most recent three years only. The sample industries are shown in ***Table 14.***

Rates of Return

Table 15 shows average nominal returns across industries in Korea for the years 1990 to 2001. The range of values that was so much a problem in the corporate data is greatly reduced in the industry sample because an industry comprises many firms, which averages out extremes. The Bank of Korea calculated industry figures from which the returns in Table 15 were estimated

Table 14: **Industries in Korea by SIC Code: Assets, Sales, and Average Rates of Return on Total Assets**

Code	Name of industry	2001 assets (*won*, billions)	2001 sales (*won*, billions)	Average return on total assets 1990–2001 (%)
B	Fishing	1,333	1,158	3.4
C	Mining and quarrying	3,765	1,704	–4.5
D15	Food products and beverages	36,516	37,317	6.4
D17	Textiles	34,810	32,813	4.5
D18	Sewn wearing apparel and fur articles	11,204	15,030	5.6
D19	Leather, luggage and footwear	4,361	7,226	5.6
D20	Wood and products of wood and cork, except furniture	2,628	3,059	5.6
D21	Pulp, paper and paper products	13,613	11,555	6.4
D22	Publishing, printing and reproduction of recorded media	8,481	8,637	4.8
D23	Coke, refined petroleum products and nuclear fuel	32,178	43,904	6.4
D24	Chemicals and chemical products	60,536	52,183	7.6
D25	Rubber and plastic products	12,858	12,454	6.7
D26	Nonmetallic mineral products	25,069	19,011	6.4
D27	Basic metals	52,640	42,215	5.9
D28	Fabricated metal products, except machinery and equipment	13,309	14,043	5.7
D29	Other machinery and equipment	21,567	19,692	6.3
D30	Computers and office machinery	10,925	11,357	6.6
D31	Electrical machinery and apparatuses, not elsewhere classified	12,804	13,109	6.5
D32	Electronic components, radio, TV, communication equipment	88,764	13,065	10.9
D33	Medical, precision and optical instruments, watches and clocks	5,239	4,349	6.1
D34	Motor vehicles, trailers and semitrailers	62,372	71,912	4.3
D35	Other transport equipment	28,303	1,773	6.1
D36	Furniture and manufacturing, not elsewhere classified	5,512	6,390	5.1

continued

Code	Name of industry	2001 assets (*won*, billions)	2001 sales (*won*, billions)	Average return on total assets 1990–2001 (%)
E40	Electricity, gas, steam and hot water supply	76,348	26,534	5.1
F	Construction	87,266	96,567	2.7
G50	Sale of motor vehicles, retail sale of automotive fuel	6,381	10,523	2.8
G51	Wholesale trade and commission trade	77,237	213,604	4.0
G52	Retail trade except motor vehicles	29,881	39,818	3.9
H551	Accommodation	13,894	4,037	2.8
I60	Land transport except railways	7,618	10,091	3.2
I61	Water transport	21,607	19,273	5.6
I62	Air transport	14,758	7,967	3.4
I63	Auxiliary transport activities and travel agencies	5,198	6,000	5.9
J642	Telecommunications	55,117	30,413	6.2
L	Real estate and renting and leasing	5,677	2,149	2.5
M72	Computer and related activities	11,065	13,679	5.7
M74	Professional, scientific and technical services	8,230	11,360	7.5
M75	Business support services	2,631	4,075	6.9
Q	Recreational, cultural and sporting activities	12,270	5,682	5.1
Q87	Motion picture, broadcasting and performing arts	4,307	3,416	8.9
Q88	Other recreational, cultural and sporting activities	7,963	2,266	2.7
R90	Sewage and refuse disposal, sanitation and similar activities	745	815	6.9

Source: BOK 2002.

as the ratio of aggregates instead of as the average of individual firm ratios; this procedure tends to reduce the influence of outliers. Nevertheless, even at the industry level, the ratio of net income to shareholder equity exhibited a wide range of values, largely because equity was wiped out for a significant number of firms as Korea's economy collapsed in 1998. For the same reason, the mean value of leverage surged in those years. These effects can be seen in Table 15 in the differences between the mean and median values.

Because of the remaining influence of outliers, even in these aggregated data, the median values provide a better view of underlying trends. The drift of median returns is downward. This direction may be due in part to the introduction of market pricing of assets (so-called mark-to-market valuations), but it is also consistent with the sharp deceleration of nominal GDP growth and the slowdown of real GDP.

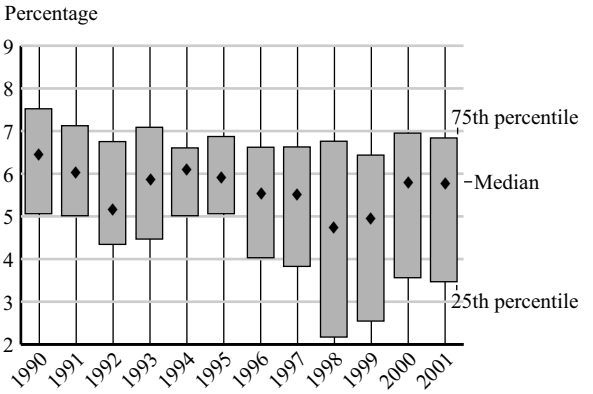
Table 15: **GDP Growth, Rates of Return, and Leverage in Korean Industries, 1990–2001**

Year	Growth rate, nominal GDP (%)	Growth rate, real GDP (%)	No. of industries	Operating income to total assets (%)	Net income after tax to shareholder equity (%)	Leverage	Operating income to total assets (%)	Net income after tax to shareholder equity (%)	Leverage
				Mean			Median		
1990	20.6	9.0	34	6.0	4.8	5.2	6.5	7.2	3.5
1991	21.1	9.2	34	5.7	4.6	4.7	6.1	6.7	3.7
1992	13.5	5.4	34	5.3	0.1	5.6	5.2	3.0	3.9
1993	12.9	5.5	34	5.3	0.8	5.1	5.9	4.9	3.6
1994	16.5	8.3	34	5.9	7.9	4.7	6.1	6.4	3.3
1995	16.7	8.9	35	5.9	7.1	4.2	5.8	7.6	3.4
1996	10.9	6.8	35	4.8	1.1	4.7	5.5	3.0	3.7
1997	8.3	5.0	35	5.0	–15.7	6.9	5.5	–4.6	4.5
1998	–2.0	–6.7	40	4.4	–18.3	9.7	4.7	–2.8	2.7
1999	8.6	10.9	40	4.4	–7.7	3.2	4.9	5.2	2.0
2000	8.1	9.3	42	5.7	–0.9	2.6	5.8	3.9	1.7
2001	4.4	3.0	42	5.1	1.5	2.3	5.8	4.4	1.5

Source: BOK 2002.

The 1998 profitability plunge was not fully balanced by increases in subsequent years. The trends can be seen more clearly in percentile charts. ***Figure 18*** shows the interquartile range and medians for operating profit to total assets. The widening of the distribution in 1998 persisted in the following years, implying that slower economic growth introduced a wider range of outcomes among Korean industries, mainly by punishing losers more harshly than in the earlier years of fast growth. Industries performing at the 75th percentile of returns are at about the same level during the latter half of the period as during the first half, whereas the 25th percentile industries are substantially below the earlier values. The widening of outcomes was not apparent in the shorter time span for data that we had for corporations.

Figure 18: **Interquartile Range and Median of Operating Income to Total Assets, by Industry, 1990–2001**



Source: BOK 2002.

Real returns have moved up since 1990, in contrast with the downward trend of nominal returns (see ***Table 16***). The driver behind the upward drift of real returns has been the decelerating pace of inflation; slowly falling nominal returns were converted into rising real returns as annual inflation fell from almost 11 percent in the early 1990s to low or negative rates by the end of the decade. Again, because of outliers, median figures give the best sense of the overall movement in Table 16.

The conversion of nominal to real rates reveals that the apparently healthy nominal returns of the precrisis period were somewhat of a mirage. For the first half of the 1990s, Korean companies were not earning enough to compensate for rising prices (as measured by the GDP deflator). Ironically, slower

growth and milder inflation have yielded higher real returns, which show up even for shareholders, who are doing better in real terms in the postcrisis period than they did in the earlier days when stock prices were rising faster.

Table 16: **Real Rates of Return on Total Assets and Shareholder Equity for Korean Industries, 1990–2001**

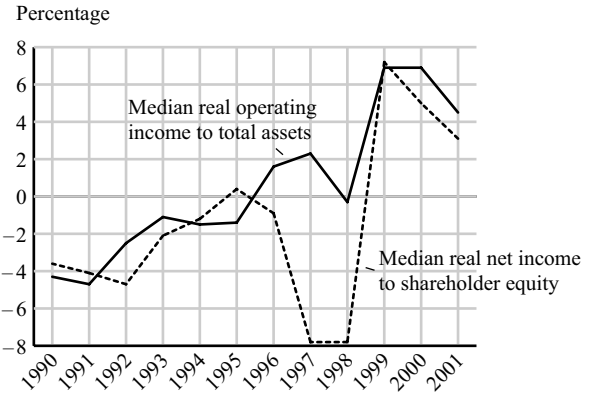
Year	Inflation rate, GDP deflator (%)	Mean operating income to total assets (%)	Median operating income to total assets (%)	Mean net income after tax to shareholder equity (%)	Median net income after tax to shareholder equity (%)
1990	10.8	–4.8	–4.3	–6.0	–3.6
1991	10.8	–5.1	–4.7	–6.2	–4.1
1992	7.7	–2.4	–2.5	–7.6	–4.7
1993	7.0	–1.7	–1.1	–6.2	–2.1
1994	7.6	–1.7	–1.5	0.3	–1.2
1995	7.2	–1.3	–1.4	–0.1	0.4
1996	3.9	0.9	1.6	–2.8	–0.9
1997	3.2	1.8	2.3	–18.9	–7.8
1998	5.0	–0.6	–0.3	–23.3	–7.8
1999	–2.0	6.4	6.9	–5.7	7.2
2000	–1.1	6.8	6.9	0.2	5.0
2001	1.3	3.8	4.5	0.2	3.1

Source: BOK 2002.

This trend in real rates shows up clearly in ***Figure 19,*** which plots real returns over time. Except for the collapse of shareholder returns in 1997 and 1998, the trend over the period has been solidly positive. Even the slowdown beginning in 2001 was not enough to return the figures to earlier levels.

In ***Table 17,*** the annual percentage change of the GDP deflator is subtracted from the U.S. and Japanese returns shown in Table 10. Comparisons among Korea, Japan, and the United States of real returns suggest that Korean companies in 2001 were generating higher earnings than their counterparts in the other two countries. Even in Japan, when deflation is added to that country's miserable nominal returns, the bottom line begins to look more competitive. Although these international comparisons can only be accepted as suggestive, Korean companies do seem to have improved their real returns markedly over the past decade; whether this has been the accidental side effect of more moderate price gains or a result of changes in corporate policy and governance remains unanswered.

Figure 19: Real Rates of Return in Korean Industries, 1999–2001



Source: BOK 2002.

Table 17: **Real Nonfinancial Industry Rates of Returns in Korea, Japan, and the United States, 1990–2001**

Year	Korea: median operating income to total assets (KIS) (%)	Japan: operating income to total assets (MOF) (%)	Japan: operating surplus to total assets (ESRI) (%)	U.S.: operating income to total assets (IRS) (%)
1990	–4.3	2.5	1.2	3.3
1991	–4.7	1.6	0.8	—
1992	–2.5	1.8	1.7	—
1993	–1.1	2.3	2.4	—
1994	–1.5	2.8	2.9	—
1995	–1.4	3.4	3.6	5.2
1996	1.6	4.0	4.1	5.2
1997	2.3	2.8	2.7	5.9
1998	–0.3	2.5	3.0	3.2
1999	6.9	4.2	4.3	2.2
2000	6.9	5.4	4.9	1.2
2001	4.5	4.3	—	—

Sources: IRS 2001, KIS 2002, MOF 2002, ESRI 2002.

Winners and Losers

Are there industries whose returns consistently have appeared at the top or bottom of the league standings? ***Table 18*** lists the number of times an industry appeared in the annual rankings of the five best and five worst performers (defined as the ratio of operating income to total assets). Two traditional industries—mining and fishing—were among the poorest performers. Out of a possible 12 appearances among the worst five, mining made it every year; in fact it was at the bottom of the list 10 times and never had positive returns over the entire 12 years. One possible explanation is that the mining sector requires high capital investment and has been plagued by falling commodity prices. The fisheries business has been affected by sharply falling yields as fishing grounds worldwide have been depleted. Other traditional industries—including leather and footwear, textiles, apparel, and construction—tend to make up much of the rest of the list of the worst-performing industries.

Table 18: **Lowest- and Highest-Performing Industries in Korea, 1990–2001**

Lowest-performing industries	No. of times on annual list	Highest-performing industries	No. of times on annual list
Mining	12	Electronics	11
Fishing	6	Chemicals	7
Motor vehicle sales	6	Computers	6
Real estate	5	Professional and	
Air transport	4	technical services	4
Computers	3	Computer services	3
Land transport minus		Movies, TV, theater	3
railroads	3	Nonmetallic products	3
Motor vehicles	3	Precision instruments	3
Computer services	2	Telecommunications	3
Leather and footwear	2	Other transport equipment	3
Publishing, printing	2	Paper and paper products	2
Recreation, culture	2	Rubber, plastic	2
Retail, excluding autos	2	Wearing apparel	2
Textiles	2	Basic metals	1
Construction	1	Electric machinery, other	1
Fabricated metal products	1	Fabricated metal products	1
Petroleum, etc.	1	Fishing	1
Precision instruments	1	Leather and footwear	1
Wearing apparel	1	Other machinery and	
Wholesale trade	1	equipment	1
		Petroleum, etc.	1
		Transport support, etc.	1

Source: Compiled from data at BOK 2002.
Note: Performance is defined as ratio of operating income to total assets.

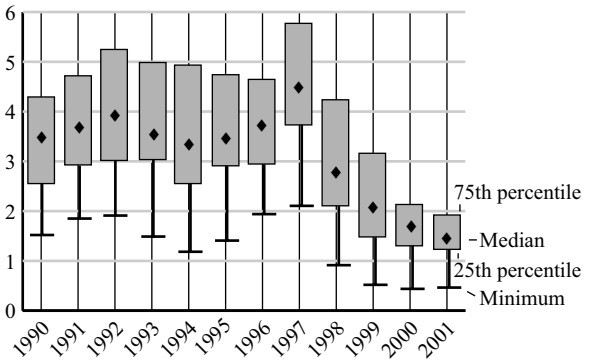
In contrast, the advanced technological industries of electronics, chemicals, and computers have been perennial occupants at the top of the league standings since 1990. In addition, technical services and entertainment generated high returns, reflecting the growth of services and the rise of new consumer products. Because of the electronics sector's cycles of technology and demand, however, computers, computer services, and precision instruments as well as electronics also appeared among the worst performers several times. The average return for electronics (industry D32 in Table 14) over the 12 years was 10.9 percent.

One of the major changes in financial structure has been the decline of leverage among Korean companies. Because the corporate data went back only to 1997, it was not possible to see longer trends. However, industry leverage figures reveal that the downward trend really did not begin until 1998, following the financial devastation imposed on overleveraged companies.

This point is clarified in ***Figure 20,*** which shows the interquartile range for the 12-year period. Leverage actually climbed in 1997 on the eve of the financial crisis. It then fell very rapidly, and the dispersion among industries shrank. A telling point is that the 75th percentile in 2001 had an average value of leverage below the 25th percentile as recently as 1998; moreover, the 2001 median was less than the lowest figure 10 years earlier.

We can classify whole industries by profitability and leverage in the same way that was done for companies in Chapter 4. Recall that industries with above-average profit and low leverage are classified as winners; high-leverage and high-profit industries are daring; low profit and low leverage define plodders; and low-profit industries with high leverage are losers. With

Figure 20: **Median and Interquartile Range of Leverage for Korean Industries, 1990–2001**



Source: BOK 2002.

the same 1997–2001 average values for classifying industries as were applied in Chapter 4—5.3 percent return on assets and 1.3 for leverage—there were no winners in Korea until 1999, when leverage fell low enough to turn high-return industries into long-run bets (***Table 19***). The influence of high leverage in the classification can be seen in the column labeled Daring. More than 70 percent of the industries in 1990 had higher-than-average returns, but their leverage was high enough to make them risky, as events later in the decade would prove. The numbers in the losers column peaked in 1998 but then fell below the 1990 level.

Table 19: **Classification of Korean Industries by Profitability and Leverage, 1990–2001, percentage of annual total**

Year	Winner	Plodder	Daring	Loser
1990	0.0	0.0	70.6	29.4
1991	0.0	0.0	70.6	29.4
1992	0.0	0.0	44.1	55.9
1993	0.0	0.0	55.9	44.1
1994	0.0	2.9	67.6	29.4
1995	0.0	0.0	62.9	37.1
1996	0.0	0.0	54.3	45.7
1997	0.0	0.0	54.3	45.7
1998	0.0	2.5	40.0	57.5
1999	10.0	10.0	32.5	47.5
2000	9.5	14.3	42.9	33.3
2001	11.9	14.3	47.6	26.2

Source: Source: Compiled from data at BOK 2002.

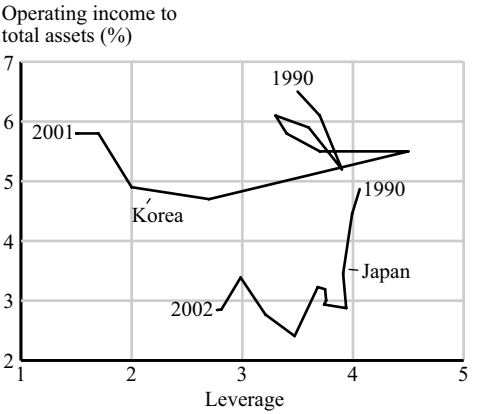
Only a single industry fell into the winner category on Table 19 for the three years for which there were winners (1999, 2000, and 2001): motion pictures, broadcasting, and performing arts. Business support services appeared in 2000 and 2001. No other industry appeared more than once.

Members of the daring category, home to almost half Korea's industries, have the advantage of relatively high returns, but they still carry dangerous levels of leverage. A brighter, and more secure, future lies ahead to the extent that companies can shed their liabilities, build up their equity, and increase their profit.

It is instructive to compare Korea's progress on returns and leverage with Japan's experience. Balance sheet reform in Japan has been similar to Korea's but not as deep. ***Figure 21*** shows the trend of return on assets versus leverage in both Korea and Japan since 1991. Nominal returns have fallen in

both places, and leverage has fallen significantly; Japanese companies, however, still have dangerously high levels of debt on their collective balance sheets and have not progressed as aggressively as Korean companies in building their equity and reducing their borrowing. This evidence suggests that companies and national policies on restructuring have made greater progress in Korea than in the country from which they have borrowed so many of their past policies.

Figure 21: **Rates of Return and Leverage in Korea and Japan, 1990–2002**



Sources: Table 15 and MOF 2002.

6

Returns, Productivity, and Policy

Productivity

Most economic growth studies examine productivity, not rates of return. Productivity can be defined simply as the ratio of outputs to inputs; total factor productivity includes all inputs in the calculation. Although productivity and rate of return share several attributes, they do not always tell the same story. For example, countries can have very different average productivity levels, and yet companies in these countries can compete fiercely across borders. The balancing factor is exchange rates, which can convert a company in a low-productivity country into an international competitor.

Even within a country, industries and products with fast-growing productivity are not necessarily profitable; one need look only at the airline industry in the United States or at semiconductor memory production almost anywhere to see two examples of the fastest-growing productivity and some of the worst profitability. In semiconductor DRAM memories, global productivity leader Micron has a 50 percent advantage over the average Korean, Japanese, and U.S. producer, but the company's profitability has consistently underperformed the U.S. market average. Within Korea, Samsung has the highest productivity and is profitable at 85 percent of the Micron standard, whereas the less productive Hyundai and LG produce losses at 60 percent and 45 percent of Micron's productivity, respectively (Baily and Zitzewitz 1998, 265). However, profitability of companies within an industry in a specific country will tend to be related to productivity. In the U.S. airline industry, Southwest Airlines is the most profitable and the most productive. The important point is that companies do not take productivity to the bank; they take their returns.

For Korea to join the ranks of the advanced European and North American economies, it will have to shift to a productivity-based growth path from its past reliance on mobilizing capital and labor. In particular, two problems emerge from studies on Korea's productivity: low labor efficiency and misallocated investment.

The labor productivity issue arises especially in Korean manufacturing. Timmer and van Ark (2002, 21 [fig. 3]) note that in manufacturing the gap in labor productivity between Korea and Taiwan on the one hand and the United States on the other is large. With the same amount of capital per hour worked, the United States generated approximately twice as much output in the 1960s as Korea and Taiwan did at the end of the 1990s.

Noland and Pack (2002, 43) present evidence showing that the rate of return to capital in the heavy and chemical industries—those favored by Korea's industrial policy—were substantially lower than in light manufacturing at the beginning of the high, forced-investment period of the early 1970s. Noland and Pack contend that plowing more funds into a sector that already had low returns was a costly misallocation of capital.

Studies on Korean productivity are fairly consistent from one to the other. One finding is the collapse of productivity growth during the heavy- and chemical-industry promotion period from 1973 to 1981. Park and Kwon (1995) estimated that productivity change turned sharply negative during this period as capital investment proceeded more rapidly than output. Timmer and van Ark (2002) also judged that productivity growth was a negative 0.4 percent annually during this period but that it turned to a positive 2.2 percent in 1985–96.

Park and Kwon find greater economies of scale in light industry than in heavy industry, suggesting that heavy industry has already exploited most of its advantages because of its preferred investment situation. Timmer and van Ark support this conclusion with their evidence that labor productivity for manufacturing is substantially lower than for the total economy.

The McKinsey case studies (MGI 1998) support these macroeconomic conclusions by supplying explanatory details at the industry and company levels. They found, for example, that automobile production companies in Korea invested in a capital intensity equal to that of the United States despite lower wage rates and higher interest rates. Another reason for low productivity among Korea's auto manufacturers is that the companies did not adopt the productivity-enhancing lean production methods, pioneered in Japan and adopted worldwide. McKinsey experts estimated that the workforce could have been reduced by 15 percent without substantial reorganization and loss of output, but unions made layoffs of excess workers impossible and even prevented reductions in hours. Managers were judged almost exclusively on output; consequently, defects were higher than in Japanese cars, and Korean cars sold for a 20 percent discount in the U.S. market, which had a severe effect on profitability. Korean companies could have taken advantage of foreign technology and techniques, but because of nationalism they did not link with foreign companies.

Why did these productivity-dulling practices exist in Korean auto production? The McKinsey analysts concluded that foreign competition was deliberately suppressed by high tariffs and barriers to foreign direct invest-

ment. Several nontariff barriers such as restrictions on foreign ownership of distribution channels and government lists of foreign car owners kept ownership of foreign cars to less than 1 percent of the market (MGI 1998, 5–10).

Policy Issues

Baily and Zitzewitz conclude, as do many writers on Korea, by emphasizing that most countries would be delighted to achieve Korea's growth, savings, investment, education, and income. Nevertheless, why did it not achieve even higher productivity? They conclude that Korea transferred technology embodied in capital goods but not management practice. Capital was misallocated owing to government policy influencing bank lending. Industrial policy was often rationalized by the assertion that immature and fragmented markets lack the capacity to make rational judgements because they cannot take into account the feedback, network effects, and long-term consequences of investments. However, Korean government policy did not make economically rational decisions. Partly this was due to moral hazard in finance; but equity, too, was put at risk. These were not gambles that went wrong; they would not have earned enough to cover the cost of capital even if all the plans had worked out (Baily and Zitzewitz 1998, 292).

These authors raise a critical question: Could Korea have grown as fast or faster if it had adopted a different development strategy? Korea followed the Japanese path of input-driven growth—with long work hours, high savings, channeled industrial investment, export orientation, limits on nonessential investment and inward foreign direct investment, and restrictions on retailing. That path carried penalties for productivity. Noland and Pack try to answer this question explicitly; they conclude that infant-industry arguments, potential gains from higher rates of return in preferred industries, and total factor productivity growth do not support the proposition that industrial policy worked or was essential to Korea's growth. "The evidence does not support the notion that selective intervention had a decisive (or even necessarily a positive) impact on the Korean economy (Noland and Pack 2003, 44)."

Edward M. Graham at the Institute for International Economics goes farther. His study concludes that the misallocation of capital, although creating much economic benefit for the Korean people, also produced political discontent and excess capacity financed largely by debt (high leverage). This dangerous combination sowed the seeds of political instability and change in the early 1990s and of bankruptcy, dissolution, and ongoing weakness among the leading *chaebol* later in the decade, both before and after the Asian economic crisis (Graham 2003, 79–87).

However, we do not know whether the long work hours and high savings could have been mobilized in a more open and consumer-oriented economy. We do not know whether more foreign direct investment or im-

ports competing against infant industries would have encouraged greater productivity or would have led to industrial infanticide, or whether killing off new industries might have been desirable.

The evidence from Hong Kong demonstrates that a high-productivity growth path is possible. Korean companies and workers have demonstrated their ability to take advantage of new opportunities and produce higher incomes for the hard-working, high-saving Korean people. In the coming years, if economic reforms continue, perhaps the Korean people will realize even greater benefits from their sacrifices.

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Arthur Alexander is presently a consultant to industry and government clients, and is a visiting professor at Georgetown University. He served as President of the Japan Economic Institute in Washington, D.C. from 1990 to 2000. His professional experience also includes teaching positions at George Mason University and the Johns Hopkins University School of Advanced International Studies, and analytical positions at the Rand Corporation, the International Institute for Strategic Studies in London, and IBM. His publications include a book on the Japanese economy, *In the Shadow of the Miracle*, published in 2002 by Lexington Books. Dr. Alexander earned a Ph.D. in economics from the Johns Hopkins University in 1968.

CORRIGENDUM

THIS CORRECTION APPLIES TO, Korea in Asia: Korea's Development, Asian Regionalism, and U.S.-Korea Economic Relations, by Claude Barfield, Korea Economic Institute, 2003, Special Studies Series: 1.

In the Acknowledgments section of the Foreword, "Robert Gordon" should read "Bernard Gordon." A corrected page is reproduced below.

Foreword

This study consists of five chapters. Chapter 1 is the introduction, and it covers the historical background of Korea's economic growth, its export growth, and U.S.-Korea economic relations since 1950.

Chapter 2 first traces the evolution of Korea's development strategies and phases beginning in the 1960s; it then describes the role of foreign investment and technology in the growth of Korea's economy. Chapter 2 concludes with a description and analysis of Korea's new development model, with its emphasis on science, the role of innovation, and the growth of service sectors.

Chapter 3 chronicles and analyzes Korea's trade and investment patterns since 1960, including assessments of Korea's growing position and competitiveness in world markets. Separate sections address the special place of the United States in Korea's trade relations and also Korea's recent increasing involvement with Asian trade and investment.

Chapter 4 deals with the impact of growing Asian regionalism over the past decade and with the substantial increase in proposals and negotiations for bilateral, subregional, and regional trading arrangements among both Asian nations and nations outside Asia. This chapter also analyzes the results of various simulation models of the welfare and trade impacts of proposed trade agreements; it uses proposed Korea-Japan and Korea-U.S. free trade agreements as key examples. It then explores the welfare effects on Korea and the United States of a number of other proposed bilateral and regional trade arrangements.

Chapter 5 presents conclusions and recommendations for future U.S. and Korea trade relations on three levels: how to reconcile common and competing goals in the World Trade Organization Doha Round; potential responses and priorities of Asian and non-Asian countries regarding future bilateral, subregional, and regional trade agreements; and, after describing in some detail current bilateral disputes, Chapter 5 suggests a new framework for dealing with these issues.

Acknowledgments

I would like to thank Cordula Thum for her indispensable research and drafting support throughout the manuscript, Sung Woo-lim for his painstaking and thorough numbers crunching, and Andre Zlate for his work on the U.S.-Korea bilateral trade disputes. I am also grateful for the thoughtful comments from three outside readers: Bernard Gordon, Nick Eberstadt, and Yang Jun-sok. Needless to say, any remaining errors in fact or interpretation are my responsibility.

Claude A. Barfield
August 2003

This rigorous yet accessible monograph gets below the surface, magnificently using firm-level data to examine the corporate restructuring that has occurred in South Korea since the crisis. Pulling together disparate information derived from existing studies and making original contributions, it will undoubtedly become a basic reference on the issue of capital accumulation, allocation, and rates of return in South Korea.
— Marcus Noland, Senior Fellow, Institute for International Economics.

Arthur Alexander has, with this original, informative study, made an important contribution to the difficult task of understanding the strengths and weaknesses of Korea's economic development in comparison to that of other countries. It also provides excellent background for serious students of the ongoing efforts to reform the corporate sector of Korea's econmy.
— Park Yung Chul, Professor of Economics, Korea University

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