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GOVERNMENT INTERVENTIONS AND PRODUCTIVITY GROWTH IN KOREAN MANUFACTURING INDUSTRIES

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ABSTRACT

This paper investigates the impact of government industrial policy and trade protection of the manufacturing sector in Korea. Empirical results are provided, using 4-period panel data for the years 1963-83, for 38 Korean industries in which trade protection reduced growth rates of labor productivity and total factor productivity, while industrial policies, such as tax incentives and subsidized credit, were not correlated with total factor productivity growth in the promoted sectors. The evidence, thus, implies that less government intervention in trade is linked to higher productivity growth.

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I. Introduction

During the past three decades, the economy of South Korea (henceforth Korea) has grown by more than 8 percent a year, making it one of the most rapidly growing economies in the world. This success is often attributed to a shift in government policy beginning in 1963 away from import substitution towards export promotion. Since that time, Korea has shown a remarkable export performance and has been considered a paragon of an export-oriented economy. Over the 1962-92 period, the nominal value of total merchandise exports increased by 24.2 percent a year. As a result, the share of exports in GNP jumped from 6.0 percent in 1962 to 29.5 percent in 1992.

The Korean experience of export-oriented industrialization has been analyzed in numerous studies, e.g., Hong (1979), Mason et al. (1980), Dornbusch and Park (1988), and Collins and Park (1989). A general consensus of the existing literature is that the Korean trade regime was far from a *laissez-faire* regime. The government combined many industrial policies and protection measures to yield an incentive structure that favored the export sector. Dornbusch and Park (1988) note that "The Korean strategy is much the same [as that of the Latin American countries], with pervasive protection of an infant-industry kind going hand in hand with favorable treatment of the export sector through tax incentives and credits".

Although there is no doubt about the presence of government intervention throughout the period of industrialization, there is no consensus about the extent or the role played by government policies in Korea's success. Many distinguished development economists have reckoned that Korean government intervention was an effort to maintain a rough neutrality between the incentives provided to the different industries, thus leading a virtual free trade

regime.[1] Lal (1985), for example, wrote, "the change in trade policies in the early 1960s from favoring import substitution to broad neutrality between import substitution and exporting...entailed the introduction of interventionist export incentives to counteract the effects of import controls." Recently the World Bank (1991) reaffirmed this view by declaring that in Korea "intervention was moderate in the sense that it did not lead to large price distortions" and thus success came from intervention which was "nondiscretionary", "time-bound" and ensured "neutral incentives". Another World Bank's recent study, *The East Asian Miracle* (1993), also asserts that rapid growth in the East Asian economies has been associated with "market-friendly" interventions.

Although the view of "neutral" or "market-friendly" intervention with respect to Korean trade policies has surely been popular, there have been an equal number of studies arguing that a more positive role was played by government in Korea's success. Streeten (1979) notes that Korea pursued not only export promotion but also massive import substitution and the government controlled most parts of the economy. He, thus, declares that, "Other factors apart from export promotion and policies other than the free play of market forces must therefore be responsible for Korea's success". Pack and Westphal (1985) also saw the Korean Government as an integrated decision maker that intervened both indirectly and directly to promote selected infant industries. According to them, the Korean Government has never "practiced neutrality in its incentive policies". Amsden (1989) went further by arguing that the Korean Government intervened to get the relative price "wrong" in order to overcome the penalties of late industrialization. According to her, the "wrong" prices were right in Korea because

[1]See Bhagwati (1978), Balassa (1988), Kruger (1978, 1990) and Lal (1985).

"government discipline over business has enabled subsidies and protection to be less than elsewhere and more effective".

Despite all the interest and controversy concerning the role of the Korean Government, surprisingly little empirical investigation has been done. Some previous studies have used macroeconomic data or have isolated the case of a particular industry to verify their arguments. But, interpretations of macroeconomic data or of the chosen industry were highly subjective and often served to reinforce the author's ideology. Some studies, including Mason, et al. (1980) and Nishimizu and Robinson (1984) have investigated the links between trade strategies and total factor productivity in Korean industries.[2] But their measures of trade strategies--change in sectoral export demand and import propensity--do not seem to fully capture the degree of government intervention.

In contrast, and as an attempt to fill the information gap, this paper uses direct measures of government interventions such as tariffs, import restrictions, credit allocation and tax incentives, all at the sectoral level. Using panel data on 38 Korean manufacturing industries covering four five-year subperiods from 1963 to 1983, the relationship between government intervention and sectoral productivity growth is tested. The main empirical results (detailed in Section IV) show that trade protections, such as tariffs and import restrictions, decreased growth rates of labor productivity and total factor productivity, while government industrial policies, such as subsidized credit and tax incentives, were not correlated with total factor productivity

[2] Dollar and Sokoloff (1990) investigate sources of productivity growth in 25 Korean manufacturing industries. But analyzing the role of government policies were not their main interest. Also see the World Bank (1993, ch.7) for a broad discussion about the role of industrial policies in promoting specific industries of the East Asian economies.

growth in the favored industries. Thus, in considering that fewer trade restrictions lead the economy closer to "free" trade, the Korean data present evidence that less government intervention in trade is linked to higher productivity growth.

The paper consists of six parts and an appendix. Section II gives a brief history of the Korean Government's intervention measures; Section III discusses a framework to measure sectoral productivity growth including empirical specification and data; Section IV presents the empirical results; and Section V discusses theoretical explanations of the empirical findings. And the concluding remarks follow in Section VI. Finally, the Appendix provides the specifics concerning the data and sources used in this paper.

II. Government Intervention Policies in Korea: A Brief History [3]

This section presents a brief summary of the various measures the Korean Government has used to foster export-oriented industrialization.

1. Trade protection

a. Tariffs

Korea's tariff system has been reformed eight times between 1952 and 1984: in 1952, 1957, 1961, 1967, 1973, 1976, 1978 and 1984. Table 1 shows changes of tariff rates for selected years. It is shown that the simple average of tariff rates rose during the period of import substitution and has declined gradually since the tariff reform of 1962 when Korea switched its trade regime. The simple average of sectoral tariff rates rose from 25.4 percent to 39.9 percent

[3]See Frank, Kim and Westphal (1975), Hong (1978), Kim (1988), Nam (1981) and Collins and Park (1989), and Kim and Leipziger (1993) for a more detailed discussion.

during 1952-62 and then declined to 21.9 percent in 1984. The average level of tariffs, although declining gradually, has remained quite high during the period, and the tariff structure changed little, showing only a minor change in the coefficient of variation. It must be noted that while the average level of tariffs has been lowered, tariffs on some selected products were often raised (see Appendix Table 5). Also, because of various complicated special laws, such as tariff exemptions on imported materials for export firms and special import duties, the actual tariff rates have often differed from the official rates. For example, a special tariff law for the period from 1963 to 1973 entitled the Ministry of Finance to apply a special customs tariff of 70 percent or 90 percent to any import commodity that was regarded as "nonessential".

b. Import restrictions

The Korean Government used direct import restrictions in order to reduce balance of payments deficits and to protect domestic industries. From 1955 until 1967, the government kept the so-called "positive" list system, whereby only listed items were automatically approved for importation. A consistent trade liberalization started in 1967, when Korea changed its import licensing program to a negative system, whereby only prohibited or restricted import items were listed. Table 1 shows the degree of import restriction, which is measured as a percentage of the number of items requiring government's discretionary import approval in the total number of tariff lines. According to this measure, in the second half of 1967, with the introduction of the negative system import restrictions dropped dramatically from 94.4 percent to 49.9 percent. Nevertheless, discretionary import licensing schemes still prevailed afterward and rose slightly until 1978 when, for the first time, a substantial liberalization of import restrictions was implemented.

The reinforcement of import restrictions during the 1970s started as the government pursued the "big push" of heavy and chemical (HC) industries. With the establishment of a committee for the development of HC industries, the government launched various incentive programs including quantitative import restrictions. Appendix Table 6 shows the general trend of import restrictions by industry. According to the table, in the mid-1970s import restrictions increased in the HC industries, especially in the machinery industry, which consists of sector 26, 27 and 28.

2. Tax incentives

Korea has used a tax system that gives preferential treatment to "key" industries. Since initiating export-oriented industrialization, the tax system has repeatedly been revised to provide incentives for selected key import-substituting and export industries. There have been exemptions and substantial rebates of indirect taxes on inputs into export production and on export sales. Also imports of raw materials and capital equipment for export industries were exempted from tariffs. Collins and Park (1989) show that since 1965 the exemptions from indirect taxes and tariffs were the two most important export incentive schemes, and accounted for 10 to 20 percent of the official exchange rate.

After 1975, when a major reform of domestic tax schemes was implemented to give concentrated incentives to the crucial HC industries, domestic tax incentives including a special depreciation allowance and an exemption from corporate taxes became more important. Under the new Tax Exemption and Reduction Control Law, titled "Special Treatment for Key Industries," the government provided eligible firms in the key industries with either a tax holiday for five years (a 100 percent exemption for the first three years and a 50 percent exemption for

the next two years), or an 8 percent investment tax credit for machinery and equipment or an additional 100 percent special depreciation allowance.

Table 2 shows the trend of tax incentives that is derived as the difference between the legal marginal corporate tax rate and the effective marginal corporate tax rate in each industry. The effective marginal corporate tax rate comes from Kwack (1985), who used the method developed by Jorgenson and Sullivan (1981). The effective tax rate is estimated as a difference between the pre-tax return and the post-tax return divided by the pre-tax return. It counts all the various government tax incentives, such as rebates of indirect taxes, tax exemptions, special depreciation allowance, tax holidays, investment tax credits and others. But, it does not count tariff exemptions. According to Table 2, tax incentives jumped markedly from 1973 onwards with the initiation of HC industries promotion, in particular, in the machinery and chemical industries.

3. Financial incentives

Credit allocation and preferential interest rates have been a major incentive provided by the Korean government to key industries. Until 1982, Korea's financial institutions was strictly regulated by government, who was a major stockholder of the five nationwide commercial banks and also operated six specialized banks. The nominal interest rates on loans were kept low relative to inflation rates, thus creating a persistent excess demand for credit. Hence, allocation of cheap credit to favored industries served as one of the most powerful government incentive schemes. [4] During the period of industrialization, the government used these financial incentives

[4] Between 1973 and 1981, policy loans were about 60 percent of the total loans of Deposit Money Banks in Korea (World Bank [1993]).

to support export firms, which received preferential access to loans. Loans to export firms also carried a special, low interest rate. Table 3 shows by how much export loans were subsidized and the degree of preferential treatment accorded by the lower interest rates over the general lending rates, and especially (curb-)market interest rates.

III. Framework of the Empirical Analysis

We study in this section an empirical setup in order to investigate the effects of government intervention measures on sectoral productivity growth.

1. A growth accounting framework of productivity growth

Let us consider a constant-returns-to scale production function of value added in sector i:

$$Q_i = F(A_i, K_i, H_i, L_i), \quad i = 1.....N \tag{1}$$

where Q_i, K_i, H_i and L_i represent the quantities of value added, physical capital, human capital and raw labor input used in the production of good i. The level of technology in the sector i is denoted by A_i. The production function is simplified in terms of per labor input:

$$q_i = f(A_i, k_i, h_i) \ , \ i = 1.....N \tag{2}$$

where q_i ($= Y_i/L_i$) denotes labor productivity and k_i ($=K_i/L_i$) denotes capital intensity of industry i and h_i ($= H_i/L_i$) denotes the level of human capital stock per labor input.

The conventional growth accounting framework introduced by Solow and developed by Denison and others shows that the growth rate of value added in sector i can be decomposed into the contribution of increase in factor inputs plus a residual. This method is applied to the equation (2), which yields a form of growth accounting:

$$\dot{q}_i/q_i = \dot{A}_i/A_i + \alpha_K \dot{k}_i/k_i + \alpha_H \dot{h}_i/h_i \quad (3)$$

where the parameter α_j is the elasticity of output with respect to input j. Equation (3) decomposes labor productivity growth into a neutral technological progress, and the accumulation of physical and human capital stock.

One serious problem in empirically implementing equation (3) is that human capital "h" can not be adequately measured because of the limitation of data on human capital stock.[5] Considering this data constraint, the growth accounting of equation (3) can be modified in the following way:

$$\dot{q}_i/q_i = \alpha_K \dot{k}_i/k_i + \dot{TFP}_i/TFP_i \quad (4)$$

where the sum of $\dot{A}_i/A_i$ and $\alpha_H \dot{h}_i/h_i$ is put into a residual, which is typically referred to as growth of total factor productivity (TFP).

2. Empirical implementation

In the growth accounting framework, described above, the growth rate of labor productivity is determined by the assumptions about the accumulation process of capital stocks and technological progress. In the simple Solow-type neoclassical growth model, where the technological progress is assumed exogenous, the growth rate of output per worker can be related to two sets of variables: first, initial levels of state variables, such as the stock of physical capital and the stock of human capital; and second, control or policy variables, which are considered to influence the steady-state level of per worker output, and thus change the

[5] Data on average year of education for workers, which is a conventional measure of human capital stock, are not available at the detailed sectoral level for the Korean economy.

growth rate over the transitional interval.[6]

The same framework can be applied to explaining growth of sectoral capital and output. Most of the Korean manufacturing industries seem to have had initial output and capital stocks that were far away from the steady-state ones. Hence, the sectoral output grows as the sector accumulates physical and human capital stocks to achieve its steady-state output. Thus, the growth rates of sectoral output and capital stocks are influenced by the initial level of the capital stocks. And the control variables, such as government industrial policies and trade protection, may affect growth rates of capital stocks and output by influencing both the steady-state level of capital stocks and the speed of accumulation.

Thus, based on this simple neoclassical growth model, the equation to be estimated is specified as follows:

$$Y_{it} = \beta_{it} + \gamma X_{it} + \phi Z_{it} + U_{it}, \quad i = 1....N, \ t=1,....T. \tag{5}$$

The dependent variable Y_{it} is either labor productivity growth ($\dot{q}_i/q_i$),or one of its components--growth of capital stock ($\dot{k}_i/k_i$) or growth of TFP ($\dot{A}_i/A_i + \alpha_H \dot{h}_i/h_i$)--in each period t. And the vector of independent variables X_{it} denotes a set of initial levels of state variables, while Z_{it} denotes a set of government policy variables.

The set of independent variables X_{it} include the following initial state variables:

$$X_{it} = [\log(q_{it}), \ \log(k_{it})] \tag{6}$$

where q_{it} is value added per work-hour in the initial year of period t, and k_{it} is capital stock per

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[6] For an exposition of the neoclassical growth model, see Barro and Sala-i-Martin (1994, chs 1 and 2). Empirical applications of the model can be found in Barro and Lee (1994), and Barro and Sala-i-Martin (1994, ch 12).

work-hour in the initial year of period t. Note that since data on human capital "h_i" is not available, $\log(k_{it})$ and $\log(q_{it})$ are included. [7] These variables are assumed to capture the effects of initial differences of capital stocks and output per worker across industries on the consequent sectoral productivity growth.

The set of government policy variables Z_{it} include the following variables:

$$Z_{it} = [NTB_{it}, TARIFF_{it}, TAXINC_{it}, CREDIT_{it}] \quad (7)$$

where NTB_{it} is a measure of non-tariff barriers; $TARIFF_{it}$ is an average tariff rate; $TAXINC_{it}$ is an estimate of tax incentives, and $CREDIT_{it}$ is an estimate of financial incentives that were provided for the industry i. The tariff rate is the nominal *ad valorem* rate for total import charge, and the measure of nontariff barriers is the coverage ratio, which indicates to what extent the tariff lines in the category of each industry are affected by import restrictions.[8] The tax incentive is estimated by the difference between the legal and the effective marginal corporate tax rate as shown in Table 2. Financial incentive is estimated by the ratio of bank loans to total assets in each sector. Thus, it captures the size of subsidized credit provided by the government to each industry.

The Appendix presents detailed information about data and sources used in this paper.

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[7] One controversy is to include both $\log(k_{it})$ and $\log(q_{it})$ variables together as the initial level variables in estimation. When only $\log(q_{it})$ variable is included in the regressions, there is no significant change in the empirical results following in the next section.

[8] It is well known that effective rate of protection is a better measure of trade policy distortions than nominal tariff rate or nontariff barrier measures. Unfortunately, I could not obtain data on effective protection rates, which are based on a consistent estimation method over the sample period, for the disaggregated Korean industries. Kim and Westphal (1976), and Nam (1981) provide estimates of effective protection rates based on comparisons between Korean domestic and international prices.

To carry out the investigation of the relationship between productivity growth and government intervention policies, a panel set of sectoral data on Korean manufacturing industry is constructed for the period from 1963 to 1983. The manufacturing industry is divided into 38 sectors and the period is divided into four five-year intervals (1963-68, 1968-73, 1973-78, 1978-1983). Appendix Tables 2-4 present estimates of annual rates of growth of labor productivity, per worker capital stock, and total factor productivity. Appendix Tables 5-7 present panel data on policy variables--nontariff barriers, tariffs, and bank loan.

The specification of equation (5) assumes that the intercept can vary over the industry and over the period. By assuming industry and time-specific fixed effects, the intercept is specified as follows:

$$\beta_{it} = \bar{\beta} + \mu_i + \lambda_t \qquad (8)$$

The industry and time-specific constant terms may capture unmeasured disturbances to growth of capital stocks or of productivity. The industry intercept μ_i is likely to capture unmeasurable industry-specific elements, such as the share of trade, and the geographical location of each industry. And the time intercept λ_t may reflect technological progress common to all industries and period-specific disturbances such as oil shocks in the 1970s.

By assuming that both time-specific and industry-specific error components remain fixed during the sample period, the equation is estimated by using weighted least squares (WLS) technique, which corrects for cross-equation heteroskedasticity. We also apply three-stage least squares (3SLS) technique in order to overcome the possible presence of endogeneity of the policy variables. One-period lagged policy variables are used as the instruments in the 3SLS

estimation.[9]

IV. Estimation Results

Using the constructed panel data on the Korean manufacturing industries, the impacts of government policies are tested on both the growth rate of sectoral value added and its components--the growth rates of capital stock and of total factor productivity.

Table 4 reports the estimation results on the effects of the government intervention policies on the growth rate of real value added per work-hour. The two estimation techniques--WLS and 3SLS--are applied to a panel data set for 38 industries over four five-year subperiods from 1963 to 1983. There are total 146 observations because data on financial incentive are not available for two industries.

Regression results, presented in Table 4, reveal interesting results for the effects of government policy variables on sectoral labor productivity growth. In regressions 4.1 and 4.3, the results are not significantly influenced by the choice of estimation techniques. First, there was a strong negative effect of trade protection on the growth rate of value added. A 10 percent increase in nontariff barriers, on average, was associated with a 1.4 percent to 2.5 percent decrease in the growth rate of value added per year. Tariff rates were also negatively correlated with labor productivity growth at the sectoral level, although they were insignificant when the WLS estimation technique is used. Second, tax incentives had a strong positive effect on the

[9]Because sectoral data on government policies for the years before 1963 are limited, I used the 1963 figures for tariff and non-tariff barriers as the lagged values for the first subperiod, whereas a lagged tax incentive for the first subperiod was constructed by an average of tax incentives from 1960 to 1962.

growth rate of value added: an increase by 10 percent in tax incentive, which means lowering the effective tax rate than the legal tax rate, was associated with an increase of 2.4 percent to 3.1 percent in the growth rate of real per worker value added per year. Third, financial incentives were only insignificantly correlated with the sectoral growth rates of value added.

The growth accounting framework, presented in the last section, indicates that any correlation between a policy variable and output growth could come from two effects: First, the government policy may influence capital accumulation, and thus output growth. And second, the government policy could affect the output growth by influencing TFP growth. Regressions 4.2 and 4.4 investigates this issue by including growth rate of capital stock as an independent variable in the regressions. One interesting result is that the estimated coefficients on tax incentives become insignificant, while the coefficients on nontariff barriers are still strong significant. The fact that tax incentives have no significant effect on output growth after controlling capital accumulation suggests that they do affect the accumulation of physical capital, but not the TFP growth. In contrast, the strong correlation between import restrictions and output growth even after controlling capital accumulation indicates the significant effect of import restrictions on the TFP growth.

The independent effects of government policy variables on growth rates of capital stock and on the growth of TFP are more directly tested in the regressions of Tables 5 and 6. Table 5 show regressions in the same form as Table 4 for the growth rate of capital stock. The regressions in Table 5 show that non-tariff barriers had a significantly negative effect on the accumulation of physical capital, while tax incentives had a strong positive effect on capital accumulation. The regressions in Table 6 show the interactions between the policy measures

and the TFP growth. The estimated coefficient on the non-tariff barrier variable is negative and highly significant. And there is no significant effect of tax and financial incentive variables on the growth rate of TFP.

From the estimation results, therefore, we can conclude that tax incentives positively affect output growth rates by stimulating capital accumulation, but not by affecting TFP growth. In contrast, trade protections, especially non-tariff barriers, decrease the growth rates of output by decreasing both the TFP and the accumulation of physical capital.[10] And financial incentives had no significant effect either on capital accumulation or TFP growth.

V. Trade Protection and Productivity in Korea: Theoretical Explanations

Among the empirical findings in the previous section, the negative relationship between trade protection, particularly nontariff barriers, and the growth of labor and total factor productivity is perhaps surprising. There have been so many studies arguing in favor of "infant industry protection". However, the regressions, using the Korean industry data, show no evidence to support any positive contributions made by trade protection to sectoral productivity growth.[11] This section explores three possible theoretical explanations for these empirical findings.

1. Targeting the right infant industry

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[10] Lee (1993) also shows, in a cross-section data of 81 countries, that trade distortions, such as tariff rates and exchange controls, have influenced per capita income growth rates negatively by decreasing both the rate of capital accumulation and its efficiency.

[11] It may be possible for infant industry protection to contribute to productivity growth but with a long lag. However, when two-period lagged protection measures--tariffs and nontariff barriers--are included in the regressions, they had no significant effects on the growth rates of value added and of TFP.

Evidence from the Korean manufacturing industries seems to show the intrinsic difficulty of implementing infant industry protection. The popular argument for infant industry protection is that governments need to temporarily protect industries that have a potential comparative advantage in the future. While, in theory, protection of a few well-chosen industries can produce productivity gains, in Korea it brought about a loss in productivity and retarded technological progress. Thus, identifying and targeting the "right" infant industry is not an effortless task and it is perhaps impossible. The difficulty of protecting the right infant industry has been well perceived by economists. Kruger (1985), for example, argues that "It is impossible for a government to identify *ex ante* the industries that are likely to become successful exporters". Hong (1979, p.96) observed the same in Korea and gave a compelling argument:

> "in the actual execution of import controls, this concept of infant industry seems to have been used in the vaguest possible way in Korea. Instead of selecting an infant industry and protecting it, any protected industry seems to have been regarded as an infant industry".

2. Protection and inefficiency

Another plausible explanation for negative links between protection and productivity growth is that firms in the protected industry become inefficient. Although there is no theoretical consensus on the links between protection and efficiency, there is strong evidence indicating that excessive protection decreases competition and hence makes domestic firms "lazy" and inefficient.[12] For example, Nishimizu and Robinson (1984) conclude from the cross-country

[12]Havrylyshyn (1990) provides an extensive survey on this topic.

comparison of sectoral factor productivity growth that "export expansion leads to higher TFP growth through economies of scale and/or through competitive incentives...[and that] import substitution leads to lower TFP growth". Recently Grossman and Helpman (1990) provide another channel through which trade can influence productivity. In their model, the productivity of local firms depends on the general state of scientific, engineering, and industrial know-how in the economy. And the "stock of knowledge" spills over to the local firms as they interact with their counterparts in advanced countries. Thus, commodity trade, by increasing the number of contacts, is an important vehicle for the spillover of knowledge.

The hypothesis that protection, by decreasing competition, make firms inefficient is supported by a recent firm-level survey. S.G. Young (1992) reports a survey of 207 Korean firms producing 987 products and their adjustments to import liberalization. According to the survey, a near-majority of those import-competing firms strengthened their effort on the development of quality and productivity after the government liberalized imports of the same products.

3. Premature protection and low productivity growth

Another possible explanation is derived from Alwyn Young's (1993) model of "invention and bounded learning by doing", in which an economy's productivity change is determined by interactions between new technological development and the economy's cumulative learning experience. The economy moves to produce more sophisticated products as it invents (or imitates) new products, while the productivity of producing them depends on the economy's accumulated learning experience. Thus, if the rate of invention is too much faster than the society's speed of learning by doing, the rate of invention (and productivity growth) is paced by

the rate of learning. Alwyn Young (1992) uses this model to explain why growth rates of total factor productivity have been substantially lower in Singapore than in Hong Kong. According to him, Singapore's lower TFP growth is due to its industrial policies, which have often targeted premature industries. Thus, Singapore tended to move up the technology ladder at a pace that was beyond it's level of industrial maturity, which resulted in a fall in productivity.

The same reasoning can be adopted to explain why trade protection produced a decrease of technological progress in Korea. Trade protection perhaps targeted premature industries at a level of technical sophistication that may have been beyond the cumulative level of learned industrial maturity of the country and the new industries. As a result, the aggressive trade policies of the Korean government during the industrialization period caused a decline in the productivity of the protected sectors. Thus, Young's model of "bounded learning by doing" explains why the Korean trade policies were not very successful in promoting productivity growth, although they may have helped the structural transformation of the economy.

VI. Conclusion: "Lessons" from Korean Success?

What conclusions can be drawn from the Korean experience about the extent and role of government policies on economic growth? The empirical results show that excessive protection measures, such as nontariff barriers, and tariff rates, had strong negative effects on labor productivity and total factor productivity growth in the Korean manufacturing sector. And government industrial policies, such as subsidized credit and tax incentives, were not correlated with growth rate of total factor productivity in the promoted industries. Thus, the empirical results refute a popular version of "lessons" from Korea that recommends government

interventions. The Korean success could have been done stronger without government intervention. As succintly expressed by the World Bank (1993), success occurred "in spite of" rather than "because of" interventions.

In conclusion, the Korean experience provides evidence of the superiority of free trade over managed trade. The Korean success is likely to be attributed to the government interventions that ensured mostly "neutral" and "nonexcessive" incentives. The right "lesson" from the experience of Korea is, therefore, that less government intervention in foreign trade is better for growth although free trade is certainly not a sufficient condition.

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Table 1. Trend of Tariff Rates and Import Restrictions

Year	Legal Tariff Rates		Import Restrictions
	Simple Average(%)	Coefficient of Variation	(% of total items)
1952	25.4	.70	-----
1957	30.3	.70	93.4
1962	39.9	.77	94.4
1968	39.1	.71	49.9
1973	31.5	.70	55.3
1977	29.7	.61	59.2
1979	24.8	.69	43.2
1984	21.9	.61	25.0

Source: K.S.Kim (1988), and Collins and Park (1989)
Note: Import restrictions denote the percentage of the number of items requiring government's discretionary import approval in the total number of tariff lines in the second half of each year.

Table 2. Tax incentive in the Manufacturing Industries

Sector	1960-62	1963-67	1968-72	1973-77	1978-82
Light industry					
1-3	0.0034	0.0156	0.0772	0.0250	0.0296
4-9	0.0008	0.0200	0.1094	0.0426	0.0462
10-11	0.0048	0.0166	0.0968	0.0330	0.0320
12-13	0.0012	0.0104	0.0746	0.0242	0.0312
38	0.0162	0.0776	0.1670	0.0366	0.0382
Heavy and chemical industry					
14-19	0.0594	0.1802	0.1064	0.2446	0.2778
20-22	0.0438	0.0246	0.0782	0.0308	0.0312
23-24	0.1058	0.2468	0.1060	0.2886	0.3238
25-37	0.0572	0.1362	0.0924	0.2478	0.2450

Source: Kwack (1985)
Note: Tax incentive is measured by an annual average of the difference between the legal and the effective marginal corporate tax rate. See Appendix for the detailed explanation of data, and Appendix Table 1 for the explanation of sector code.

Table 3. Interest Rates, Selected Years (Percent Per Year)

Year	Loans on foreign trade bills	Discounts on commercial bills	Curb market rate (unofficial)
1961	13.9	13.9	----
1965	6.5	24.0	58.9
1972	6.0	15.5	39.0
1976	8.0	17.8	40.5
1979	19.0	18.5	42.4
1980	15.0	19.5	44.9
1981	15.0	16.5	35.2
1982	10.0	10.0	30.6
1984	10.0	10.0-11.5	24.8

Source: Collins and Park (1989)

Table 4. Panel Regressions for Growth Rate of Value Added Per Worker
: Four 5-year periods from 1963 to 1983 for 38 Korean Industries

Independent Variable	Coefficient (Standard Errors)			
Regression number	(4.1)	(4.2)	(4.3)	(4.4)
log(Initial value added)	-0.092	-0.109	-0.112	-0.163
	(0.017)	(0.014)	(0.019)	(0.014)
log(Initial Capital)	-0.050	0.094	-0.049	0.172
	(0.019)	(0.024)	(0.023)	(0.024)
Non-tariff Barrier	-0.144	-0.058	-0.251	-0.092
	(0.037)	(0.033)	(0.040)	(0.030)
Tariff	-0.035	-0.082	-0.111	-0.118
	(0.081)	(0.067)	(0.061)	(0.039)
Tax Incentive	0.239	0.011	0.312	-0.099
	(0.133)	(0.119)	(0.140)	(0.111)
Bank Loans	-0.083	-0.011	-0.110	-0.084
	(0.164)	(0.139)	(0.232)	(0.169)
Growth Rate of Capital Stock		0.693		0.990
		(0.086)		(0.092)
Estimation technique	WLS	WLS	3SLS	3SLS
Number of observations	146	146	146	146

Notes: The dependent variable is the annual growth rate of real value added per work-hour over each period (1963-68, 1968-73, 1973-78, 1978-83). There are 146 observations (38 industries and 4 time periods; 2 missing industries for 3 periods). Industry and period-specific effects are controlled. The weighted least squares (WLS) technique corrects for the cross-equation heteroskedasticity. The three-stage least squares (3SLS) technique uses log values of initial value added and capital, and one period lagged policy variables as instruments. (Continued.)

Notes to Table 4 (Continued)

The independent variables are as follows: *Initial Value Added* is real value added per work-hour in the initial year of each period; *Initial Capital* is real value of net capital stock per work-hour in the initial year of each period; *Non-tariff Barrier* is the ratio of tariff lines subject to discretionary import approval to the total number of lines in the mid-year of each period; *Tariff* is the output-weighted average of legal tariff rate in the mid-year of each period; *Tax Incentive* is the period average of difference between legal and effective marginal corporate tax rate; *Bank Loans* is the period average of ratio of subsidized bank loans to total assets; *Growth Rate of Capital Stock* is the annual growth rate of capital stock per work-hour over each period. See the Appendix for detailed explanation and data sources.

Table 5. Panel Regressions for Growth Rate of Capital Stock
: Four 5-year periods from 1963 to 1983 for 38 Korean Industries

Independent Variable	Coefficient (Standard Errors)	
Regression number	(5.1)	(5.2)
log(Initial value added)	0.035 (0.013)	0.025 (0.014)
log(Initial Capital)	-0.195 (0.015)	-0.209 (0.017)
Non-tariff Barrier	-0.131 (0.028)	-0.159 (0.028)
Tariff	0.056 (0.062)	-0.029 (0.038)
Tax Incentive	0.382 (0.122)	0.499 (0.105)
Bank Loans	-0.118 (0.138)	-0.019 (0.200)
Estimation technique	WLS	3SLS
Number of observations	146	146

Note: The dependent variable is the annual growth rate of net capital stock per work-hour over each period. See Appendix and also the notes to Table 4.

Table 6. Panel Regressions for Growth Rate of Total Factor Productivity
: Four 5-year periods from 1963 to 1983 for 38 Korean Industries

Independent Variable	Coefficient (Standard Errors)	
Regression number	(5.1)	(5.2)
log(Initial value added)	-0.144 (0.146)	-0.153 (0.015)
log(Initial Capital)	0.071 (0.017)	0.078 (0.018)
Non-tariff Barrier	-0.072 (0.032)	-0.167 (0.033)
Tariff	-0.079 (0.069)	-0.113 (0.048)
Tax Incentive	0.044 (0.110)	0.074 (0.113)
Bank Loans	-0.019 (0.138)	-0.123 (0.181)
Estimation technique	WLS	3SLS
Number of observations	146	146

Note: The dependent variable is the annual growth rate of total factor productivity over each period. It is derived from the growth accounting of value added. See Appendix and also the notes to Table 4.

Appendix: Data and Sources

To calculate labor productivity growth and its components for the four five-year sub-periods from 1963 to 1983, we need data on value added, labor input, capital input and factor shares. All data except capital stock are available from the Korean *Input Output Tables*.[13] Most national accounts data are adopted from Kim and Park (1988), who present Input-Output data for the 38 disaggregated manufacturing industries.

Growth rate of labor productivity

The growth rate of labor productivity is calculated by subtracting growth rate of total employment from growth rate of value added. The real value added in 1980 prices comes from Kim and Park (1988), who subtracted real intermediate input (deflated by estimates of intermediate input deflators) from real gross output (deflated by the wholesale price indices). Total employment data come from the *Input Output Tables*. For the sub-periods since 1973, the growth rate of sectoral employment incorporates the change in average workhours by industry.

Growth rate of capital per work-hour

The growth rate of capital stock per work-hour was calculated by subtracting the growth rate of employment from the growth rate of net capital stock. The time series of industry net capital stock are constructed by Kim and Park, who combine data from the *Report on Mining and Manufacturing Survey* with an earlier time series estimate by Choo, et al. (1982) which is based on 1968 and 1978 National Wealth Surveys. Capital stock consists of all tangible assets including land and inventory stocks. It was deflated to a 1980 constant value by estimated investment deflators by type of assets. Estimates of land deflators come from Kim and Park (1988).

Total factor productivity

The estimates of total factor productivity (TFP) are derived from growth accounting framework of industry value added. The growth accounting of sectoral value added gives TFP as follows:

$$\dot{A}_i/A_i = \dot{Q}_i/Q_i - \alpha_L \dot{L}_i/L_i - (1-\alpha_L) \dot{K}_i/K_i \qquad (10)$$

where Q is value added, and α_L is the elasticity of output with respect to labor input. The term α_L is measured by the share of total employees' compensation in value added (by an average of the initial and the last year's value), which comes directly from the *Input Output Tables*. The compensation of employees is adjusted by incorporating the estimated total wage for self-employees and unpaid family business employees in each industry.

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[13]The *Input Output Tables* is published by the Bank of Korea for the following years between 1960 and 1985: 1960, 1963, 1966, 1968, 1970, 1973, 1975, 1978, 1980, and 1983.

APPENDIX

Tariff rate

The tariff rate is defined by the nominal ad valorem import charge. It is constructed by averaging the legal tariff rates on imports at the CCCN 2-digit level, using the value of 1975 output as a weight. But for sectors 9, 16, 17, 26-32, the simple averaged tariff rates at the CCCN 4-digit level are used. Sourced from Kim (1988).

Non-tariff barrier(NTB)

This measure indicates the extent to which the tariff lines in the category of each industry are subject to discretionary import approval. Thus, it does not capture how intense the barrier is. Kim (1988) provides data for 1966, 1970, 1975 and 1980. The NTB for the year 1963 has been constructed from the Korean Traders Association, *Foreign Trade Yearbook*, 1964.

Tax incentive

The tax incentive is derived as the difference between the legal marginal corporate tax rate and the effective marginal corporate tax rate. The effective marginal corporate tax rate comes from Kwack (1985), who estimated it as a difference between pre-tax return and post-tax return divided by pre-tax return. It counts all of the various government tax incentives such as rebates of indirect taxes, tax exemptions, special depreciation allowances, tax holidays, investment tax credits and others. Because this estimate is available only for the broad classification of industries, as shown in Table 2, the same ratio for all the sectors within each broad industry is assumed.

Financial Incentive

The financial incentive provided by the government to each sector is measured by the ratio of total subsidized bank loans to total assets. The bank loans include both short-term and long-term loans that each sector received from the government-controlled specialized and commercial banks. The data come from the Bank of Korea, *Financial Statement Analysis*, various issues. The data are available from 1969. Thus, they are available only for three 5-year sub-periods. And data are also missing for two sectors --Tobacco (code 2) and Railroad (code 34)--, which are dominated by government enterprises in Korea.

Appendix Table 1: Sector Classification in Korean Manufacturing

Code	KSIC Code*	Industry Name
1	311,312	Food
2	313	Beverages
3	314	Tobacco products
4	3211-3213	Fiber yarn, Textile fabrics
5	3215	Fabric products
6	3214,3216-3219	Other fabricated textiles
7	322	Wearing apparel
8	323	Leather and leather products
9	324	Footwear(leather)
10	331	Wood and cork
11	332	Furniture and fixtures
12	341	Paper and paper products
13	342	Printing and publishing
14	351	Industrial chemicals
15	352	Other chemicals
16	353	Petroleum refineries
17	354	Petroleum and coal products
18	355	Rubber products
19	356	Plastic products
20	361	Ceramics
21	362	Glass and glass products
22	369	Other nonmetal mineral products(cements)
23	371	Iron and steel
24	372	Nonferrous metal
25	381	Fabricated metal
26	3821,38411	Power generating machinery
27	3822-3824	Metalworking and industrial machinery
28	3825-3826,3829	Office and other general machinery
29	3831	Electrical industrial apparatus
30	3832,3834	Electronic and communication equipment
31	3833	Household electrical appliances
32	3839	Other electrical equipment
33	3841(-38411)	Shipbuilding and repairing
34	3842	Railroad vehicles
35	3843	Motor vehicles
36	3844-3845,3849	Aircraft and other transport equipment
37	385	Measuring,medical and optical instruments
38	390	Miscellaneous manufacturing
All Manufacturing		1 - 38
Light Industry		1 - 13, 38
Heavy Industry		14 -37

*KSIC stands for Korea Standard Industry Classification.

Appendix Table 2: Growth Rate of Value Added Per Workhour, Annual Average

Sector	1962-67	1968-72	1973-76	1979-83
1	-0.107	0.226	0.081	0.104
2	0.072	0.146	0.081	0.059
3	0.113	0.110	0.104	0.171
4	-0.107	0.168	0.160	0.030
5	-0.069	0.211	-0.037	0.169
6	0.054	0.067	0.226	0.028
7	-0.097	0.082	0.105	0.005
8	-0.095	0.262	-0.078	0.119
9	-0.024	0.105	0.160	0.015
10	0.030	-0.064	0.106	0.067
11	-0.064	0.170	0.218	0.164
12	0.102	0.125	0.203	0.011
13	-0.140	0.083	0.097	0.083
14	0.147	-0.004	-0.072	0.153
15	-0.004	0.129	0.232	0.081
16	0.524	0.085	-0.179	-0.074
17	-0.004	0.140	0.066	0.004
18	0.041	0.124	0.115	-0.032
19	0.163	0.108	0.131	-0.073
20	0.055	0.153	0.177	-0.049
21	0.042	0.189	0.095	0.044
22	0.051	0.170	0.112	0.026
23	-0.014	0.327	0.166	0.102
24	0.059	0.123	0.120	0.084
25	0.016	0.179	0.186	0.008
26	0.014	0.246	0.132	0.250
27	-0.010	0.138	0.161	0.011
28	0.388	0.230	0.189	0.089
29	0.004	0.156	0.255	0.000
30	-0.083	0.308	0.135	0.164
31	0.005	0.299	0.372	-0.009
32	0.044	0.111	0.108	0.157
33	-0.030	0.152	0.123	0.075
34	0.151	0.125	0.043	0.056
35	0.205	0.123	0.118	0.066
36	-0.228	0.537	-0.043	0.237
37	-0.117	0.315	0.065	0.186
38	-0.007	0.163	0.023	0.156

Note : See Appendix Table 1 for the classification of sectors.

Appendix Table 3: Growth Rate of Capital Per Workhour, Annual Average

Sector	1962-67	1968-72	1973-76	1979-83
1	-0.047	0.080	0.024	0.115
2	0.027	0.016	0.020	0.113
3	0.085	0.010	0.010	0.227
4	0.058	0.122	0.053	0.056
5	-0.138	0.115	-0.126	0.151
6	0.037	0.042	0.238	0.022
7	-0.105	0.060	0.069	0.087
8	-0.053	0.249	-0.315	0.111
9	0.012	0.111	0.137	0.045
10	-0.046	-0.064	0.098	0.098
11	-0.134	0.056	-0.132	0.124
12	0.092	0.010	0.119	0.011
13	-0.107	0.069	0.077	0.036
14	0.179	-0.064	0.108	0.158
15	-0.049	-0.080	-0.010	0.068
16	-0.288	0.037	0.101	-0.024
17	0.028	-0.069	0.134	0.045
18	0.045	-0.017	0.062	0.047
19	-0.034	0.169	0.110	0.005
20	0.208	0.208	0.041	0.005
21	0.398	0.051	-0.033	0.124
22	0.041	0.143	0.041	0.068
23	-0.055	0.053	0.198	0.130
24	-0.005	0.129	0.039	0.117
25	-0.006	0.060	0.082	0.034
26	-0.153	0.283	-0.261	0.174
27	-0.069	0.100	0.143	0.070
28	0.192	0.118	0.120	0.115
29	0.058	0.065	0.135	-0.006
30	-0.117	0.101	0.103	0.109
31	-0.009	0.272	0.116	0.012
32	0.079	0.070	0.053	0.133
33	-0.187	0.070	0.010	0.045
34	0.015	0.092	-0.018	0.061
35	-0.008	0.102	-0.008	0.135
36	-0.471	0.437	0.036	0.261
37	-0.038	0.141	0.027	0.152
38	0.015	0.036	-0.037	0.148

Note : See Appendix Table 1 for the classification of sectors.

Appendix Table 4: Growth Rate of TFP, Annual Average

Sector	1962-67	1968-72	1973-76	1979-83
1	-0.080	0.180	0.068	0.049
2	0.050	0.133	0.063	-0.039
3	0.037	0.100	0.094	-0.040
4	-0.144	0.087	0.127	-0.000
5	-0.004	0.150	0.033	0.091
6	0.037	0.045	0.103	0.017
7	-0.053	0.053	0.077	-0.022
8	-0.062	0.108	0.106	0.055
9	-0.027	0.067	0.103	-0.004
10	0.063	-0.021	0.056	0.025
11	-0.016	0.148	0.269	0.115
12	0.045	0.119	0.137	0.005
13	-0.107	0.061	0.072	0.072
14	0.024	0.040	-0.144	0.050
15	0.027	0.183	0.238	0.037
16	0.779	0.051	-0.271	-0.052
17	-0.020	0.179	-0.016	-0.022
18	0.019	0.132	0.087	-0.052
19	0.180	0.018	0.071	-0.076
20	-0.014	0.076	0.163	-0.050
21	-0.178	0.159	0.114	-0.021
22	0.025	0.079	0.086	-0.014
23	0.019	0.295	0.032	0.012
24	0.062	0.047	0.096	0.009
25	0.018	0.153	0.150	-0.005
26	0.077	0.120	0.266	0.155
27	0.015	0.097	0.094	-0.020
28	0.286	0.171	0.132	0.035
29	-0.027	0.121	0.192	0.003
30	-0.010	0.240	0.071	0.100
31	0.011	0.126	0.295	-0.018
32	-0.006	0.068	0.078	0.081
33	0.040	0.123	0.119	0.055
34	0.145	0.082	0.052	0.023
35	0.209	0.067	0.122	-0.009
36	0.027	0.274	-0.064	0.104
37	-0.101	0.247	0.052	0.116
38	-0.015	0.144	0.041	0.084

Note : See Appendix Table 1 for the classification of sectors.

Appendix Table 5: Average Tariff Rate, Period Average

Sector	1962-67	1968-72	1973-76	1979-83
1	0.680	0.770	0.600	0.490
2	1.180	1.170	1.140	1.110
3	1.970	0.910	0.910	0.830
4	0.430	0.640	0.560	0.330
5	0.970	1.280	0.970	0.600
6	0.760	0.900	0.710	0.550
7	0.960	1.300	1.000	0.600
8	0.650	0.770	0.710	0.510
9	0.920	0.940	0.750	0.600
10	0.410	0.440	0.400	0.330
11	0.770	0.820	0.730	0.520
12	0.580	0.680	0.560	0.390
13	0.300	0.270	0.260	0.150
14	0.180	0.200	0.220	0.240
15	0.390	0.430	0.390	0.300
16	0.190	0.280	0.220	0.130
17	0.190	0.140	0.120	0.060
18	0.700	0.720	0.580	0.470
19	0.380	1.000	0.650	0.450
20	0.620	0.740	0.600	0.400
21	0.540	0.550	0.510	0.400
22	0.450	0.500	0.480	0.300
23	0.340	0.380	0.360	0.240
24	0.420	0.460	0.430	0.280
25	0.630	0.790	0.670	0.380
26	0.180	0.240	0.200	0.170
27	0.240	0.290	0.230	0.200
28	0.360	0.350	0.290	0.290
29	0.330	0.360	0.280	0.250
30	0.430	0.330	0.270	0.290
31	0.800	0.730	0.570	0.440
32	0.340	0.380	0.350	0.270
33	0.230	0.270	0.190	0.070
34	0.000	0.070	0.040	0.080
35	0.610	0.570	0.480	0.410
36	0.000	0.000	0.000	0.050
37	0.400	0.460	0.400	0.370
38	0.730	0.760	0.730	0.560

Note : See Appendix Table 1 for the classification of sectors.

Appendix Table 6: Non-tariff Barriers, Selected Years

Sector	1963	1966	1970	1975	1980
1	1.000	0.855	0.868	0.776	0.625
2	1.000	1.000	1.000	1.000	1.000
3	1.000	1.000	1.000	1.000	1.000
4	0.975	0.975	0.662	0.675	0.222
5	1.000	1.000	1.000	0.833	0.667
6	0.976	0.976	0.902	0.854	0.182
7	1.000	1.000	0.833	0.833	0.294
8	1.000	0.846	0.692	0.577	0.368
9	1.000	1.000	1.000	1.000	0.000
10	1.000	0.923	0.462	0.359	0.069
11	1.000	1.000	0.857	0.857	1.000
12	0.971	0.971	0.600	0.800	0.368
13	1.000	1.000	0.727	0.455	0.091
14	0.811	0.811	0.615	0.650	0.675
15	0.917	0.917	0.567	0.483	0.451
16	1.000	0.875	0.937	0.875	0.875
17	1.000	0.727	0.000	0.000	0.000
18	1.000	1.000	0.647	0.471	0.118
19	1.000	1.000	1.000	1.000	0.000
20	1.000	1.000	0.286	0.357	0.286
21	0.923	0.923	0.333	0.410	0.306
22	0.941	0.941	0.176	0.176	0.000
23	1.000	0.951	0.354	0.329	0.158
24	0.835	0.835	0.241	0.266	0.119
25	1.000	0.967	0.667	0.667	0.296
26	1.000	0.882	0.353	0.471	0.385
27	1.000	0.833	0.500	0.708	0.523
28	1.000	1.000	0.167	0.833	0.833
29	1.000	1.000	0.667	0.889	0.778
30	1.000	1.000	0.778	0.889	0.714
31	1.000	1.000	0.833	0.833	1.000
32	1.000	1.000	0.800	0.700	0.444
33	1.000	1.000	0.167	0.333	0.400
34	1.000	1.000	0.000	0.000	0.000
35	1.000	1.000	0.685	0.789	0.714
36	1.000	1.000	0.000	0.000	0.000
37	1.000	1.000	0.559	0.721	0.625
38	1.000	1.000	0.831	0.862	0.556

Note : See Appendix Table 1 for the classification of sectors.

Appendix Table 7: Ratio of Bank Loans to Total Assets, Period Average

Sector	1969-72	1973-77	1978-82
1	0.320	0.433	0.212
2	0.327	0.310	0.162
3	----	-----	----
4	0.289	0.332	0.333
5	0.328	0.330	0.348
6	0.315	0.328	0.293
7	0.375	0.351	0.425
8	0.374	0.408	0.389
9	0.269	0.201	0.305
10	0.468	0.522	0.480
11	0.140	0.495	0.276
12	0.317	0.356	0.277
13	0.263	0.271	0.215
14	0.181	0.184	0.232
15	0.226	0.263	0.252
16	0.024	0.021	0.067
17	0.236	0.245	0.204
18	0.301	0.397	0.344
19	0.251	0.270	0.301
20	0.231	0.303	0.345
21	0.254	0.310	0.246
22	0.246	0.242	0.222
23	0.264	0.184	0.245
24	0.304	0.317	0.330
25	0.270	0.263	0.328
26	0.380	0.285	0.290
27	0.260	0.369	0.279
28	0.340	0.256	0.253
29	0.298	0.288	0.374
30	0.257	0.232	0.273
31	0.316	0.303	0.267
32	0.239	0.263	0.276
33	0.612	0.426	0.309
34	-----	-----	-----
35	0.274	0.203	0.275
36	0.391	0.433	0.369
37	0.280	0.261	0.304
38	0.247	0.279	0.331

Note : See Appendix Table 1 for the classification of sectors.