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Industrial Policy, Trade and Productivity Gains: South Korean Evidence*

Youngil Lim**

Reviews briefly the historical role of government policies for industrialization emphasizing (1) aspects of structural change (e.g. output composition), (2) export promotion and selective import-substitution measures, (3) pursuit of gains in dynamic efficiency at the expense of static efficiency during 1965-1985 period. Empirical evidence is presented in order to help evaluate growth-efficiency performances by estimating the Caves-Uekusa model and Solow's total factor productivity index. *Ad hoc* regression exercises yield evidence lending support to the hypothesis that localization (*via* import substitution) programs have contributed toward strengthening the technological base of South Korean industry.

I. Introduction

This paper is concerned basically with two questions: (1) what role did Korean government policy play in bringing about the rapid change in industrial structure since the 1960s? (2) Was the resultant resource allocation efficient? The South Korean industrialization has been characterized by speedy capital formation, output and export growth and deepening of industrial base (or restructuring toward capital and skill-intensive sectors). The process of restructuring has registered a faster pace than any developing economy. The government policy appears to have contributed to the hastening of the process.

The paper argues that South Korean policy makers have been more concerned with dynamic efficiency gains than static efficiency. They have

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** Professor of Economics and Technology Management, Institute for Advanced Engineering and Ajou University Graduate School.

used the policy tools known as price distorters such as subsidized loans, tax reductions, accelerated depreciation, foreign exchange controls, tariffs and import quotas. However, these tools were used to promote exports, new product development, innovation, and modernization of the industrial base (e.g., toward higher level technology). Also, the policy makers adopted both export-promotion and import substitution strategies in tandem. Products for import substitution were selected, based on backward linkages to support export. The record of cumulative exports provided a clear-cut performance criterion for the government to award incentive benefits to an enterprise. Thus, the stringent market test, to produce quality output at an acceptable price in international market, was adopted. The record of industrial growth and total factor productivity suggests that dynamic gains in efficiency have more than offset losses in static efficiency (i.e., price distortion effects).

By way of presentation, the second section shows some quantitative indicators regarding compositional change in manufacturing output and physical capital stock. The third section presents a result of Richard Caves' allocative efficiency test. The test provides some evidence that sectoral industry profits have been earned by price-distorting effects of various industrial policy measures. This analysis is conducted in an essentially static framework. The fourth section reports on the Robert Solow's total factor productivity test. This provides some evidence concerning gains in dynamic efficiency arising from development strategies such as export promotion and import substitution. And the concluding section considers the South Korean experience in light of the current debates on "State and the Market."

II. Industrial Policy and Changes in Manufacturing Composition

South Korea has gone through altogether six Five-Year Economic Development Plans beginning from 1962. One of the major themes common to all the documents emphasized upgrading the industrial structure so as to sharpen the international competitiveness of South Korean industry. This means that each plan period envisaged a set of priority manufacturing sectors and projects. For instance, the first, second and third Five-Year Economic Development Plan documents indicate iron and steel, cement, fertilizer, chemicals and machines as the priority sectors.

The record of plan implementation shows that the planned targets have usually been fulfilled or exceeded by a wide margin in industrial output, export and investment. The achievement has been usually attributed to strategies to promote export. However, as the following sections show,

import substitution activities have also played an important role to bring about an upgraded industrial structure and gains in productivity at the same time.

Basically, various strategies were to serve the overriding objective of the structural goal in industrial composition. Both export-promotion and import-substitution policies must be understood in this larger framework. The export-oriented shift of policy stance in the mid-1960s did not mean discarding of import-substitution activities. Indeed, the latter went on along with the export-led strategy. Export expansion and import substitutions were not contradictory but complementary to each other. Expansion of export production required ever increasing demand for imported intermediate inputs, parts and machines. The policy makers were quick to notice import substitution possibilities for those imports.

The most serious concern and determination to launch a wholesale import substitution project came in the early 1970s when the rapid export growth brought chronic trade-deficit problems especially with Japan. Technological ties with Japan meant that production for soaring exports required ever increasing imports of Japanese machineries, intermediate inputs and parts, while major markets for Korean exports lied elsewhere, namely, the United States, Southeast Asia and Europe.

The policymakers deciced to correct the trade balance problem in part by producing at home (replacing imports from Japan and elsewhere). Apparently, policymakers realized that a general devaluation of the won alone would not be able to correct the bilateral trade imbalance with Japan. Furthermore, the particular product group provided an opportunity to "deepen the industrial base." In 1973 a "Heavy and Chemical Industry Development Plan" was announced to guide the expansion of heavy industrial sectors for the period of 1973-1981. A series of projects were formulated in priority sectors including iron and steel, nonferrous metals, petrochemicals, fertilizer, machinery, electronics and shipbuilding. These sectors represent Hirschman's backward-linkage import substitution (Hirschman (1978), pp. 113-116) to support labour-intensive export sectors in South Korea (except shipbuilding). Uninterrupted supply of these products from domestic sources with less market volatility was thought to be crucial for continued export-led growth.

By upgrading thus the industrial base from the dominance of light (labour-intensive) industries by adding heavy (capital and skill intensive) industries, South Korea could meet also several other problems simultaneously; (1) other developing countries with still lower wage rates than South Korea were increasing competitive pressures in the area of light industries; (2) South Korean wages were rising rapidly; (3) protectionism

has been threatening the future export prospect of South Korea (Republic of Korea (1971), p. 105). To these must be added another imperative need, that is to nurture defense-supporting industries for the obvious reasons of geo-politics. Structural change has been an ongoing process owing to these conditions.

With the 1980s, priority candidates for import substitution shifted to "engineering industries" from the "heavy and chemical" orientation in the 1970s. By "engineering industry" is meant assembly type of manufacturing plus parts production (SITC 381, 382, 282, 284 and 385) or sometimes referred to a capital goods.

As in the case of basic industrial materials earlier (e.g., iron and steel, non-ferrous metals, petrochemicals, etc.), Korea's trade balance with Japan deteriorated again during the mid-1970s and early 1980s because of heavy dependence on Japanese components and parts for the assembly manufacturing (e.g., automobiles, colour TV sets, home appliances, VTRs, industrial machines, etc.). The government initiated the programme for "localization" of parts and components production: — another wave of backward linkages a lá Hirschman.

Table 1 provides sectoral shares at ISIC three-digit classification of South Korean manufacturing for 1970 and 1986. The difference between these two years shows relative sectoral advances and lags in output structure. Striking is the fact that the so-called modern sectors or engineering-intensive sectors gained at the expense of traditional sectors (e.g., food, textiles, etc.). The leading sectors include Electrical Machinery (+17.5 percentage points), Transport Equipment (+4.29 percentage points), Non-electrical Machinery (+4.18 percentage points), Iron and Steel (+3.56 percentage points), etc.

These shifts in output structure were facilitated by investment in the manufacturing subsectors. Table 2 shows the diverse pace at which physical capital stock has been accumulated by subsectors and subperiod between 1966 and 1985. As expected, highest average annual growth rates were in electric machinery (26.8 per cent), iron, steel and metals (22.7 per cent), non-electrical machinery (20.2 per cent), metal products (19.5 per cent), other manufactures (19.3 per cent) and transport equipment (18.9 per cent).

The channelling of investment resources, however, was implemented with a highly controlled banking system in South Korea. It is well documented that the financial market has been "repressed" under government control although the degree of repression has been gradually lifted (Cho (1989)). To many observers, the South Korean financial market

Table 1

SECTORAL SHARES OF MANUFACTURING OUTPUT, SOUTH KOREA, 1970 AND 1986

Manufacturing	Output share in 1970	Output share in 1986	Change 1070-1986
311 Food manufacturing	8.89	6.31	-2.58
313 Beverages	2.91	1.28	-1.63
314 Tobacco manufactures	1.04	0.29	-0.75
321 Textiles	13.57	8.99	-4.58
322 Wearing apparel	2.16	4.26	2.10
323 Leather and fur products	0.03	0.64	0.61
324 Footwear, excl. rubber/plastic prod.	0.72	0.84	0.12
331 Wood and wood products	2.86	0.49	-2.37
332 Furniture and fixtures	0.72	0.40	-0.32
341 Paper and paper products	2.27	1.93	-0.34
342 Printing and publishing	4.74	1.50	-3.24
351 Industrial chemicals	10.85	5.79	-5.06
352 Other chemical products	4.75	4.21	-0.54
353 Petroleum refineries	6.71	2.13	-4.58
354 Misc. petroleum and coal products	2.05	1.20	-0.85
355 Rubber products	2.38	2.72	0.34
356 Plastic products n.e.c.	2.42	1.63	-0.79
361 Pottery, china and earthenware	0.73	0.28	-0.45
362 Glass and glass products	2.14	1.10	-1.04
369 Other non-metallic machinery	7.41	3.59	-3.82
371 Iron and steel	2.96	6.52	3.56
372 Non-ferrous metals	0.61	1.67	1.06
381 Metal products excluding machinery	1.48	3.70	2.22
382 Non-electrical machinery	4.63	8.81	4.18
383 Electrical machinery	2.61	20.11	17.50
384 Transport equipment	1.76	6.05	4.29
385 Professional and scientific goods	0.66	1.01	0.35
390 Other manufactures	5.93	2.53	-3.40

Source: UNIDO database.

Table 2

ANNUAL AVERAGE GROWTH RATES OF PHYSICAL CAPITAL STOCK BY SECTOR IN SOUTH KOREAN MANUFACTURING, 1966-1985

		1966-85	1966-70	1971-75	1976-80	1981-85
311	Food manufacturing	11.7	7.9	17.3	11.4	9.6
313	Beverages	7.3	7.7	6.9	14.1	4.2
314	Tobacco manufactures	7.7	2.8	9.7	9.8	8.8
321	Textiles	12.8	10.7	13.7	7.9	3.0
322-4	Apparel and footwear	16.0	15.4	24.7	12.7	6.9
323	Leather	18.7	10.4	37.7	13.9	7.1
331	Wood and cork	6.5	14.1	6.1	7.9	-1.4
332	Furniture	12.1	7.7	9.4	21.2	14.1
341	Paper and paper prod.	10.4	3.8	12.9	15.0	11.3
342	Printing and publishing	10.8	9.4	15.8	9.1	8.3
351-2	Industrial chemicals	10.1	6.1	14.3	11.1	7,5
353-4	Petroleum refining	13.9	18.7	18.7	7.8	6.0
355	Rubber products	15.2	11.9	23.2	17.8	8.5
361-2	Earthenware and non-metal	16.1	30.2	12.3	13.9	9.3
371-2	Iron and steel and metal	22.7	25.9	38.6	15.7	5.6
381	Metal products	19.5	18.2	25.9	23.4	10.9
382	Non-electrical machinery	20.2	14.7	26.4	25.6	8.9
383	Electrical machinery	26.8	22.1	57.6	14.5	17.7
384	Transport equipment	18.9	12.6	26.5	18.5	12.1
390	Other manufactures	19.3	17.8	34.5	13.7	9.5
	TOTAL	14.1	13.3	21.8	15.4	8.4

Source: Pyo, 1988.

could have become a breeding ground of distortion, inefficiency, rent-seeking, all causes of hindering growth (Shaw (1973), McKinnon (1973) and Fry (1988)).

What, then, are the sources of efficiency (or inefficiency) in resource allocation? More specifically, was concentration, by providing barriers to entrance for competition, a source of profitability? Were large firms more profitable than small ones in exploiting economic of scale? Was export-oriented industry, favoured by the government policy, more profitable than other industries? Was protection of domestic market by tariff a source of profit?

III. Caves' Test of Allocative Efficiency

In an attempt to answer those question, the method adopted by Caves and Uekusa (1976, chapter 5) is borrowed for application to South Korean data. However, the regressions presented here include some additional variables deemed relevant because of the policies and institutions specific to the South Korean situation.

The following equation is regressed:

$$NPA = F(GRS, RFC, NWA, TOA, ADV, ERP, CNR, EXS, SIZ)$$

where:

NPA = net (of tax) profits over total assets
GRS = growth rate of sales
RFC = financial costs (interest payments and discounts) over total liabilities
NWA = net worth over total assets
TOA = ratio of sales over total assets
ADV = advertising expenditures over total sales
ERP = effective rate of protection (tariff)
CNR = concentration ratio
EXS = exports of sales
SIZ = size of enterprise (assets per firm)

The reasons for including these variables follow:

Growth rate of sales (GRS). The first variable, growth rate of sales, is included in the regression to remove any "windfall" from a specific industry's profits. Growth rate of sales differs from industry to industry as does an industry's ability to adjust output capacity. To the extent that the adjustment involves substantial lags, an unexpected increase in sales would bring windfall profits, especially in the short run (as in a one-year period).

Rate of financial costs over total liabilities (RFC). The rate of financial costs refers to the ratio of total interest paid (including discounts) over total debts (short-term plus long-term debts). As such, the ratio expresses an average rate of interest. It has been alleged that the pressure of interest burdens an enterprise, especially a financially weak one that has little collateral to offer (presumably because it is smaller). Some evidence has also been cited indicating that smaller enterprises rely on high-cost sources of loans, including the curb market, more than larger enterprises. This variable may pick up such vulnerability, particularly when the money sup-

ply is tight; therefore, a negative correlation is expected. This is included in our analysis because the view is widely held among business people and news media.

Net worth over total assets (NWA). This ratio measures the extent of the enterprise's own capital, including retained earnings, as a proportion of total assets. Hence, the lower the proportion of net worth, the higher the assets financed by loans from the banking system and other loan markets (often called indirect financing). Much of the net worth is owned by either the entrepreneurs themselves or their family members, as the securities market is not yet well developed, especially by the standards of Western economies. In other words, the shareholders are not diffused among the citizens at large, and hence the consequences of risk taking are not passed on to general shareholders. What Harvey Leibenstein's X-efficiency theory calls the "effort-responsibility-consequences" connection is kept within the appropriate decision-making unit. He argues that if these consequences are not kept within that unit, irresponsibility increases the costs of production and decreases the profitability of enterprises — with important consequences for development.

The above hypothesis contrasts with the views held for industrialized countries. Caves and Uekusa argue in effect that the larger the ratio of net worth to total assets, the smaller the risk exposure. Hence, under these conditions, they claim smaller profits. It seems just the opposite, especially for Korea.

Turnover ratio of total assets (TOA). This variable measures total sales over total assets, indicating how many times the total assets are used per year for production and sales. The variable is used to test whether and to what extent "stretching capital" adds to profits. Thus it has often been recommended that work shifts be increased so that scarce capital in less developed countries can be economized.

Perusal of the sample data indicated a wide variation in the capital-turnover ratio (or the sales-to-assets ratio) among industries and among different sizes of enterprises. This variable is supposed to pick up that effect on profitability and is expected to have a positive correlation.

Advertising expenditures over total sales (ADV). Advertising functions as a means for disseminating information about the product and for product differrentiation (real or imagined), which thereby increases entry barriers. Although it is not always clear which of these augments the profit, conventionally the latter is thought to be the more relevant item the variable is supposed to be represent. Conceptually, however, the function of information dissemination can be said to increase awareness of com-

peting products especially where ignorance is prevalent, as in developing economies, and hence advertising can be a market-perfecting activity. In contrast, product differentiation by advertising in developed countries can be a barrier-creating activity. Nevertheless, since operationally it is impossible to distinguish the two different effects of advertising, we include the variable as an independent one and not as a proxy for entry barrier, as in some existing studies.

Effective rate of protection (ERP). Developing countries often utilize protection from international competition with a high tariff as a means of industrialization. Korea is no exception in spite of its outward-looking polices. The effective rate (or value-added rate) of protection could be as high as 400 percent for certain industries at the four-digit level of industrial classification. Hence, the degree to which they are effectively protected could be a source of differential profit rates among different industries. To the extent that this variable is significant, resources could be misallocated in a static sense, although a dynamic efficiency effect could be positive if a protected industry is truly an infant industry made viable under such protection. See the next section on this issue.

Concentration ratio (CNR). This is a conventional variable (proportion of output by the three largest enterprises) used to test the effect of market power on the profit rate (and resource misallocation due to the monopolistic rent that results).

Exports over sales (EXS). Ordinarily, in a free-enterprise system the distinction of sales between the domestic market and overseas market should not arise. However, the export-led growth policy indirectly introduced subsidies for exporters, subsidies that included low-interest loans, reduced taxes, rebates on public utilities, and tariff-free imports of raw materials. Under the policy, exporters would equate marginal costs and marginal benefits, including policy-contrived marginal gains. The latter would add to the profitability of an exporter over nonexport enterprises. This variable, then, is included to pick up the effect of such incentives for exports on profits, prompting us to expect a positive coefficient.

Size of enterprise (SIZ). The size variable represents an entry barrier due to the extent of scale economies in various senses. A large firm can do anything that a small firm can, but not vice versa. For instance, large borrowers can command lower interest rates due to lower risk to the lender, bargaining power, ability to discriminate against small firms, or even the various government policies favouring large firms. An empirical question arises then as to whether the rationale of scale economies is borne out by high profitability.

The result of the regressions for 1981, 1982, 1983 and 1984 data and also 1976 to 1978 are presented in Table 3 (1976-1978 regressions are reproduced from Lim (1981)). These are the years in which the world recession (1981-82) hit the South Korean economy but began recovering in 1983 and 1984. The manufacturing sector slumped to a 4.1 per cent growth in 1982 from a 7.5 per cent growth in 1981. But the sector bounced back to a double-digit growth of 12.2 per cent and 14.8 per cent in 1983 and 1984 respectively.

The equation deals with the interindustry variation of profits for sixty-eight industry classifications in manufacturing. The data set is based on a sample of 938 manufacturing enterprises selling 100 million won (W) of output or more. The sample is random but stratified by industry classification and also by establishment size (thus excluding many small-scale enterprises). These data are published by the Bank of Korea in *Financial Statement Analysis* annually.

The regression indicates that the variable of growth rate of sales (GRS) has no statistical significance in all four years. This gives a contrast to the significant result obtained in 1977 and 1978. Apparently, the world recession and the recovery between 1981 and 1984 did not provide much room for gaining windfall profits.

The financial costs over total liabilities (RFC) picked up statistical significance suddenly with negative signs in 1982 and 1983. Obviously, many firms had to borrow heavily to tide over the recession period from high-cost sources unless the firms were in line with government priorities.

The ratio of net worth over total assets (NWA) shows a positive coefficient and is very significant and robust among all the variables for all the years. The X-efficiency hypothesis appears to be amply supported by these findings. The hypothesis is that the larger the net worth (private ownership) relative to total assets, the greater the entrepreneurial efforts, thus making enterprises more profitable.

The turnover ratio of total assets (TOA) shows a significant positive coefficient for all years except in 1983. The latter year is associated with one of the highest rates of inventory reduction while the economy began recovering from the impact of the world recession. Otherwise, along with net worth over total assets, the capital turnover ratio as a measure of entrepreneurial effort proved quite significant.

Advertising expenditures over total sales (ADV), an impotant determinant of profits in normal growth years as in 1981, lost suddenly statistical significance in subsequent years. Apparently, advertizing became ineffective to lure buyers in recession-afflicted markets. The variable had

Table 3

REGRESSION OF NET PROFIT OVER TOTAL ASSETS

	Variable	Coefficient	T-ratio	Standardized Coefficient
1976	GRS	0.014	0.837	0.077
	RFC	−0.196	−0.956	−0.103
R^2 = .50	NWA	0.208	6.296	0.561
D.F. = 58	TOA	2.442	3.216	0.294
	ADV	0489	1.690	0.186
	ERP	0.426	3.068	0.301
	CNR	−0.156	−0.463	−0.041
	EXS	−0.004	−0.059	−0.005
	SIZ	0.000	0.367	0.035
	Intercept	−3.940	−1.657	
1977	GRS	0.056	3.287	0.336
	RFC	0.209	0.764	0.095
R^2 = .32	NWA	0.108	2.381	0.250
D.F. = 58	TOA	2.032	2.003	0.221
	ADV	1.002	2.383	0.286
	ERP	0.271	1.578	0.167
	CNR	−1.975	−0.722	−0.084
	EXS	0.115	0.922	0.972
	SIZ	−0.000	−0.034	−0.419
	Intercept	−5.732	−1.612	
1978	GRS	0.045	2.911	0.252
	RFC	−0.405	−2.205	−0.220
R^2 = .54	NWA	0.227	6.389	0.548
D.F. = 58	TOA	−0.116	−0.126	−0.014
	ADV	0.997	3.495	0.315
	ERP	0.277	2.223	0.189
	CNR	2.025	1.063	0.095
	EXS	−0.093	−0.545	−0.047
	SIZ	−0.000	−1.461	−0.157
	Intercept	−1.285	−0.422	
1981	GRS	0.009	0.417	0.033
	RFC	−0.112	−0.835	−0.068
R^2 = .73	NWA	0.276	8.035	0.603
D.F. = 55	TOA	4.459	7.030	0.555
	ADV	0.685	3.415	0.256
	ERP	0.000	0.464	0.034
	CNR	0.005	0.322	0.026
	EXS	3.140	1.989	0.162

Table 3 (Continued)

	Variable	Coefficient	T-ratio	Standardized Coefficient
	SIZ	-0.000	-0.125	-0.010
	Intercept	-11.852	-4.704	0.000
1982	GRS	-0.025	-1.431	-0.123
	RFC	-0.539	-3.097	-0.291
$R^2 = .62$	NWA	0.237	6.442	0.555
D.F. = 55	TOA	2.997	3.973	0.386
	ADV	-0.039	-0.213	-0.019
	ERP	-0.000	-0.142	-0.012
	CNR	0.011	0.670	0.066
	EXS	2.778	1.750	0.162
	SIZ	0.000	0.510	0.047
	Intercept	-3.947	-1.538	0.000
1983	GRS	0.042	1.872	0.198
	RFC	-0.524	-3.255	-0.321
$R^2 = .52$	NWA	0.155	6.329	0.655
D.F. = 55	TOA	0.095	0.495	0.048
	ADV	0.284	1.796	0.181
	ERP	-0.000	-1.341	-0.128
	CRN	-0.003	-0.188	-0.021
	EXS	0.656	0.467	0.049
	SIZ	0.000	0.580	0.061
	Intercept	1.968	1.289	.000
1984	GRS	0.019	0.821	0.066
	RFC	-0.235	-1.506	-0.117
$R^2 = .70$	TWA	0.204	9.786	0.764
D.F. = 55	TOA	1.294	2.550	0.202
	ADV	0.198	1.441	0.113
	ERP	0.000	0.130	0.010
	CNR	0.002	0.194	0.017
	EXS	0.461	0.374	0.031
	SIZ	-0.000	-0.499	-0.043
	Intercept	-3.014	-1.798	0.000

Source: Basic Data from Bank of Korea. Data on effective rate of protection were provided by the Korea Development Institute and the Federation of Korean Industries (unpublished data).

statistical significance at 1 per cent level for 1978 and at 2 per cent level for 1977.

The effective rate of protection (ERP) does not appear to be a source of profit making during the 1981-1984 period, but the variable had the 1 percent level of significance for 1976 and at the 5 per cent level for 1978. This suggests that business condition influence the level of protection benefits.

The concentration ratio (CNR) is insignificant for all the years tested, contradicting both theoretical expectations and a widely held view. Caves and Uekusa's explanation for the Japanese case appears to apply to the Korean case as well: during a period of explosive growth (and perhaps fluctuation too), concentration would fail to significantly influence profits, and windfalls through a high rate of sales would dominate over concentration.

Exports over sales (EXS) do not explain the variation in profit rates at all, contradicting our expectation of a positive coefficient. This appears to support the allegation that Korean enterprises do export in order to receive subsidized credit although exporting per se might be unprofitable. Export price which is lower than the price for dometic sales, corroborates the findings here.

The size of enterprise (SIZ) shows no significance in explaining the variation of interindustry profit rates. An explanation for this finding might be similar to that offered for the insignificance of the concentration variable. In a rapidly growing economy, potential entry barriers would not matter: Market opportunities could be captured by entrepreneurs regardless of firm size. The finding suggests that the Korean emphasis on large-scale enterprises, based on the rationale of scale economies, might have been overemphasized.

Overall, these regressions offer little support for profit making through subsidized export activities, concentration-based monopoly rent, and scale economies (entry barriers). The variable of the export-sales ratio bears little statistical significance inspite of the policy measures that provide hordes of incentives to export. Some argue that exporting to the world market enables firms to exploit economies of scale; hence, the efficiency and profitability of exporting firms should have been one of Korea's main sources of growth. However, our findings fail to support this view. Indeed, as some critics have pointed out, enterprises might export to receive incentive benefits such as subsidized bank credits that are often used for domestic speculation, including the purchase of land, because funds are fungible in use. More lucrative business is to be found in the

tariff-protected domestic market than in the export market, in which a business must compete with more efficient foreign producers. This view seems borne out by the statistical significance (t-value) of the variable representing the effective rate of protection. Though quantitatively not overwhelming, some market distortions and consequent inefficiency in a static sense should be recognized here.

IV. Solow's TFP Test

The causes of productivity gains (e.g., growth of total factor productivity) are a controversial issue. Oli Havrylyshyn gives an excellent survey on the issue (see his work (1990)). Especially, whether export activities raise "automatically" TFP level is a question requiring further research. Henry Bruton, for instance remarks: "Given our understanding of how export expansion can generate growth, it is difficult to believe that Korea (TFP) grew as it did simply because it followed an outward looking, export expansion policy" (see Bruton (1989), p. 1621). Evidence that follows lends suport for an infant-industry-protection argument.

The magnitude of estimated total factor productivity growth have been shown to be sensitive to (1) production function adopted, (2) price index used with different base year and weights to deflate time series, (3) capital stock estimates, (4) period chosen for measurements and other relevant assumptions on e.g., capacity utilization, input specifications e.g., man-hour vesus man-year and so on. Nevertheless, it seems useful to delve further into disaggregated TFP growth patterns for sub-sectors and sub-periods in order to gain insights. Evidence so generated could help to answer such questions as: was the structural shift from light industries to heavy industries implemented at the cost of productivity losses (or gains) over time? Was the emphasis of iron and steel or machines a mistake because productivity gains could have been larger elsewhere?

Table 4 reports a measurement of TFP (Solow index) for Korean manufacturing covering the period 1966 to 1985. For the 19-year period, the TFP grew on average y a 5.9 percent annually, not a mean achievement. TFP measured with a translog production function shows a smaller growth (Kim and Park (1988)). Although the total factor productivity growth shows an uneven pattern across different subsectors, positive growth is widespread with only one negative growth sector (i.e., petroleum refining). Furthermore, note that the time patterns of subsectors do not look alike. Varieties of growth magnitude by subsectors and sub-periods seem to suggest complex casual factors of productivity growth.

Table 4

ANNUAL AVERAGE TFP* GROWTH RATES
IN SOUTH KOREAN MANUFACTURING, 1966-1985

Sector	ISIC Code	1966-1985	1966-1970	1971-1975	1976-1980	1981-1985
1 Food	311/12	7.3	21.4	-2.7	11.8	1.8
2 Beverages	313	7.9	22.9	6.0	-0.0	5.7
3 Tobacco	314	13.4	30.1	3.6	24.8	-1.5
4 Textiles	321	10.7	16.6	11.5	9.5	6.5
5 Leather	323	12.6	2.9	39.0	-8.0	14.3
6 Wood and cork	331	9.4	13.7	11.3	2.0	11.5
7 Furniture and fixtures	332	12.1	2.1	7.7	28.5	8.0
8 Paper	341	8.2	11.7	3.8	13.1	4.9
9 Printing and publishing	342	10.7	14.7	-0.8	22.4	7.5
10 Chemicals	351/52	13.1	39.5	6.5	10.3	1.7
11 Petroleum and coal	353/54	-0.3	21.4	11.5	-8.5	1.7
12 Rubber	355	11.4	17.4	8.2	23.0	-1.8
13 Earthenware and non-metal	361/69	2.8	-3.9	6.4	4.9	2.7
14 Iron and steel and metals	371/72	3.7	-0.7	0.0	5.8	8.7
15 Metal products	381	7.6	8.1	1.6	11.7	9.2
16 Non-electrical machinery	382	8.0	-0.3	9.0	12.5	9.3
17 Electrical machinery	383	10.7	15.7	3.4	16.4	8.5
18 Transport equipment	384	11.2	21.7	-2.6	18.4	9.6
19 Other manufactures	390	7.5	27.8	-8.9	8.1	7.3
Total manufacturing**	3	5.8	15.3	-1.1	5.4	5.7

* Total factor productivity is measured using a Cobb-Douglas production function (i.e., Solow index).

** Not an average of individual sectors but an independent estimate based on aggregate data.

Source: Basic data on capital stock by sector comes from Pyo (1988). Other basic data (manufacturing value added and employment) from UNIDO databank.

Note for instance that TFP growth of the iron and steel sector has improved gradually from -0.7 percent in the 1966-1970 period to 8.7 percent annual growth in the 1981-1985 period. Likewise, TFP growth of non-electrical machinery sector has improved from -0.3 percent to 9.3 per cent annual growth in the corresponding periods. These sectors represent major import substitution industries as designated by the Third-Five-

Year Plan (1972-1976). Subsequently, they were often blamed as wrong (capital intensive) sectors to be chosen against the principle of comparative advantage. But productivity gains through learning new technology could change the existing comparative advantage into a new pattern.

Indeed, as conventionally measured, TFP is a mixed bag of many dynamic elements such as increasing level of skills through education and training, injection of superior technology imported (learning-by-imitating) or domestically invented (learning-by-doing), successful introduction of new products, particularly with higher income elasticities, new ways of organizing factory floors, improved organization of workers (X-efficiency) and management hierarchy, upgrading of output mix by an industry as well as by the manufacturing sector as a whole, etc., etc. in addition to usual macro-influences. Such seems to be what has been taking place in South Korea. Technology policy deserves special attention if the structural change and productivity gains are to be understood.

There are a number of studies on science and technology policy in South Korea (Enos and Park (1989), Kim and Cho (1989), Kim (1980), Kim (1986), Lee (1986), Lo (1985) and Westphal, et al. (1984)). It suffers here only to point out that the government has been constantly introducing new institutions and incentive measures needed to achieve the goal. The main purpose of the measures was to entice private enterprises to increase risk-taking in going up the technology ladder. A brief review of policy changes follows.

During the 1960s, the government had been restrictive in technology imports just as many other developing countries, to protect domestically developed technology. The scarcity of foreign exchange was an added reason for restriction.

But gradually the restrictions have been removed since the early 1970s. The rapid growth of heavy and chemical industries required an ever increasing number of technology imports. Technology transfer has come to be regarded as a strategic policy variable for upgrading the industrial base. Thus, many import restrictions were abolished including the ceiling on royalties, limit on contract duration, and disapproval of export restriction under the licensing contract. Furthermore, a Technology Development Promotion Law (1972) was enacted, providing tax incentives, subsidizing loans for investment in or imports of technology, free information and consultation center, etc. See Table 5 for a variety of measures that are available today.

Since 1978, there has been further gradual liberalization. This change

Table 5

LIST OF SUPPORT SCHEMES TO REPLACE IMPORTS WITH LOCAL PRODUCTION AND TO UPGRADE INDUSTRIAL BASE IN SOUTH KOREA

A. **Financial Support Schemes:**
- Manufacturing Development Fund
- Industrial Technology Improvement Fund
- New Enterprise Creation Support Fund
- Technology Development Fund
- Venture Caiptal Fund
- Special Fund for Small and Medium Enterprise
- Equipment Fund for Export and Import Substitution in Raw Materials Component Parts
- Lease Fund
- Procurement Fund for Domestically Produced Machines

B. **Tax Benefit Schemes:**
- Income Tax Exemption for Foreign Engineers
- Exemption of Local Tax for Real Estate to Construct Research Institutes by Enterprises
- Tax Exemption for Income from Technology Sales
- Income Tax Exemption for Technology Intensive Enterprise Initiators
- Special Accelerated Depreciation Allowance for Projects using New Technology
- Tax Credit plus Accelerated Depreciation for Research and Development Equipment and Vocational Training Equipment
- Reserve Funds for R and D accounted as losses
- Tax Credit for Expenditures on R and D and Training
- Tariff Reduction (65-70 percent) on Imports of R and D Equipment
- Tariff Reduction (30-55 per cent) on Imports of High Technology Industrial Equipment

C. **Technology Support Schemes:**
- Special R and D Projects
- Basic Technology R and D Projects
- Technical Guidance on
  - long-term training of researchers
  - inplant technical manpower development
  - simplified automation project
  - invited foreign experts
- Free Technological Information Dissemination
- Free Use of Expensive Test Equipment
- Test of Precision Equipment and Repairs
- Quality Seal for Domestically Produced Machines, Parts and Raw Materials
- Support Measures for Obtaining Foreign Quality Seals

Table 5 (Continued)

D. Miscellaneous Support Schemes

- Comprehensive Support Package for Promising Small and Medium Scale Suppliers of New Products
- System of Identifying Promising List of New Exportable Products (i.e., free marketing research) and Priority Products for Import Substitution
- Exhibition of Domestically Produced Machines
- Government Preference to Procure Domestically Developed New Products
- Anti-dumping Tariff System
- Protection Schemes for Newly Developed Products with Domestically Developed Technology
- Monitoring System to Observe Impacts of New Products
- Fair Trade and Transaction Law
- Exemption of Military Services Requirements for Core Researchers
- Free Consulting Service for Promotion of Localization Programme

Source: K.R. Lee, et. al., 1990.

was necessitated by rapid demand for advanced technology supported by ballooning export earnings, shortening of product cycle period, etc. For instance in 1979, an automatic approval began to apply if a technology contract was for less than 10 years, if advance payment of fee was less than $800,000, and if patent royalty fee was less than 10 percent of sales annually.

In 1984, the approval system was changed to a reporting system. The government then turned to encourage domestic R and D by means of subsidized loans, tax holiday and special depreciation allowances for R and D related investments and training facilities. Competition among producers, particularly Chaebols, for innovation and new products along with these incentive measures forced enterprises to increase R and D expenditures. As a result, the government-private ratio of R and D expenditure reversed from 71-29 in 1970 (total 10.4 billion won or 0.4 percent GNP) to 20-80 in 1987 (total 1,878 billion in current price or 2.1 percent of GNP). See Table 6. See also Table 7 for sectoral distribution of technology indicators. It is to be noted that proportionately more technological resources have been allocated to chemicals, basic metals, electric and non-electric machineries and transport equipment.

Given the description of efforts to upgrade industrial base in fore-

Table 6

INDICATORS OF TECHNOLOGICAL CAPABILITY IN SOUTH KOREA, 1962-1989

	Number of R&D researchers	R&D Expenditure (% of GNP)	Government private ratio of R&D expenditure	Number of technology imports	Number of product items in export basket (CCCN 8-digit)
1962				7	69
1963	1,750	0.25	06: 4	3	119
1964	1,906	0.20	90:10	1	142
1965	2,765	0.26	90:10	4	350
1966	2,962	0.31	87:13	18	445
1967	4,061	0.47	88:12	36	513
1968	5,024	0.50	84:16	51	650
1969	5,337	0.54	76:24	59	822
1970	5,628	0.49	68:32	92	952
1971	5,320	0.40	66:34	47	983
1972	5,599	0.38	53:47	53	1,002
1973	6,065	0.37	66:34	67	1,059
1974	6,314	0.63	67:33	88	n.a.
1975	10,275	0.54	67:33	99	—
1976	11,661	0.58	56:35	127	—
1977	12,771	0.88	48:52	168	—
1978	14,749	0.83	49:51	297	—
1979	15,711	0.78	54:46	291	—
1980	18,434	0.86	52:48	222	n.a.
1981	20,718	0.90	44:56	247	4,356
1982	28,448	1.09	41:59	308	4,401
1983	32,117	1.23	27:73	362	4,434
1984	37,103	1.44	21:79	437	4,773
1985	41,473	1.77	19:81	454	4,850
1986	47,042	1.99	19:81	517	5,142
1987	52,783	2.12	20:80	637	5,270
1988	56,545			655	
1989				685	

Source: Ministry of Science and Technology, 1989; and Ministry of Commerce and Industry, 1989.

Table 7

SELECTED TECHNOLOGY INDICATORS
BY MANUFACTURING SUBSECTOR, 1987

	Number of R&D institutions	Ratio of R&D expenditure/ sales	Foreign technology imports (number)	Royalty Payments (mil US$)
Manufacturing	1,359			
Food, beverage, tobacco	109	0.68	169	26.0
Textile, apparel, leather	78	0.80	243	57.9
Wood, furniture	3	0.23		
Paper, printing, publishing	30	1.06	19	8.5
Chemicals, rubber, plastic	328	1.41	788	390.2
Industrial chemicals	75	1.16		
Other chemicals	176	2.20	121	20.8
Petroleum refining	9	0.50		
Misc. petroleum products	14	0.77		
Rubber	29	1.76		
Plastics	25	1.65		
Non-metallic minerals	53	0.89	130	46.8
Pottery, china	14	2.11	130	46.8
Glass	7	0.86		
Other non-metallic	32	0.83		
Basic metal	68	0.54	322	104.8
Iron and steel	32	0.37		
Non-ferrious	36	1.00		
Fabricated metallical machinery and equipment	690	2.95		
Fabricated metal	95	1.42		
Machinery	171	2.79	1,275	461.9
Electrical machinery	281	3.39	995	565.8
Transport	78	2.64	(163)*	(120.1)*
Medical, optical	36	3.16		
Other	29	1.22		

* Shipbuilding only.

Source: Ministry of Science and Technology, 1989, pp. 210-214 and 254.

going pages, questions remain whether TFP growth orignates in the export sector, domestic sector or import substitution sector. In this regard Westphal, Rhee and Pursell wrote:

> "Merely by their export actvity, Korean firms have enjoyed virtually *costless access to a tremendous range of information,* diffused to them in various ways from the buyers of their exports. The minor innovations that have resulted have been significant in increasing *production efficiency, changing product designs, upgrading quality,* and *improving management practices.* Exporting thus appears to offer a direct means of improving productivity, in addition to the indirect stimulation that comes from trying to maintain and increase penetration in overseas markets. This beneficial *externality of export activity* has gone largely unnoticed in the literature on trade and development. But the Korean experience indicates that it is very real and is part of the explanation of why countries following an export-led strategy have experienced such remarkable success in their industrialization efforts" (emphasis added) (Westphal, Rhee and Pursell (1981)).

In order to test the "export-externality hypothesis" along with Verdoorn's Law, the following regression equation is estimated:

$$(\frac{dT}{T}) = C + A_1(\frac{dQ}{Q}) + B(\frac{dX}{X})$$

where (dT/T) : Growth rates of TFP (Solow index)
C : Constant
(dQ/Q) : Growth rates of gross output
(dX/X) : Growth rates of export

The result of the regression exercise (on 1966-1985 annual data) by manufacturing subsectors is reported in Table 8.

Note that TFP growth shows high correlation with output growth and little or no correlation with export growth in virtually all subsectors. In other words, Verdoorn's Law, not the "export-externality hypothesis," is supported. It is interesting to note that a similar result has been obtained in the case of the Taiwan experience (1968-82 period) (Chen and Tang (1990)).

The result suggests that dynamic scale economies have superior explanatory power compared with export expansion as described by the "export externality hypothesis." But the above regression test has nothing in the way of providing a clue to the role of import substitution (negatively or positive) affecting TFP growth. It is well known by now that South Korea has attempted to nurture infant industries through the 1970s and

Table 8

REGRESSION COEFFICIENTS EXPLAINING GROWTH RATE OF TOTAL FACTOR PRODUCTIVITY BY MANUFACTURING SUBSECTORS WITH EXPORT AND GROSS OUTOUT[a]

		C	A_1	B	
3	Manufactures	-6.938	0.982	-0.221	
		(-1.898)	(3.685)***	(-1.475)	[R^2 = .55]
311/2	Food	-4.632	0.801	-0.149	
		(-0.772)	(2.835)**	(-2.123)*	[R^2 = .38]
313	Beverage	-9.332	1.322	0.073	
		(-2.647)*	(7.098)***	(2.020)	[R^2 = .76]
314	Tobacco	-4.822	1.027	-0.003	
		(-1.245)	(7.643)***	(-0.417)	[R^2 = .79]
321	Textile	1.809	1.151	-0.579	
		(0.352)	(3.479)***	(-2.534)*	[R^2 = .44]
323	Leather	-3.645	0.552	-0.042	
		(-0.467)	(5.931)***	(-0.345)	[R^2 = .71]
331	Wood and cork	0.875	0.704	-0.054	
		(0.147)	(1.943)	(-0.221)	[R^2 = .36]
332	Furniture	-10.019	0.770	0.071	
		(-1.869)	(6.110)***	(1.916)	[R^2 = .71]
341	Paper products	-9.965	0.974	0.004	
		(-2.177)*	(4.716)***	(0.426)	[R^2 = .59]
342	Printing	-7.087	1.173	-0.037	
		(-2.207)*	(8.648)***	(-3.269)***	[R^2 = .86]
351/2	Chemicals	-14.210	1.029	0.066	
		(-2.679)**	(7.098)***	(1.214)	[R^2 = .76]
353/4	Petroleum refining	-5.987	0.200	0.013	
		(-1.072)	(1.342)	(1.498)	[R^2 = .24]
355	Rubber products	-0.432	0.563	-0.030	
		(-0.102)	(3.638)***	(-0.350)	[R^2 = .54]
361/2/9	Pottery, china	-10.091	0.826	-0.013	
		(-2.222)*	(3.599)***	(-0.510)	[R^2 = .46]
371/2	Iron and steel and	-13.700	0.954	-0.108	
	non-ferrous metals	)-2.101)	(3.919)***	(-1.916)	[R^2 = .49]
381	Metal products	-10.000	0.855	-0.083	
		(-2.388)*	(5.866)***	(-1.694)	[R^2 = .69]
382	Machinery	-8.761	0.627	-0.011	
		(-2.345)*	(6.899)***	(-0.177)	[R^2 = .78]

Table 8 (Continued)

		C	A_1	B	
383	Electrical machinery	−10.930 (−1.478)	0.358 (1.513)	0.164 (1.100)	[R^2 = .48]
384	Transport equipment	−7.747 (−1.113)	0.639 (3.193)***	0.002 (0.045)	[R^2 = .47]
390	Other manufactures	−2.246 (−0.287)	1.065 (2.051)	−0.527 (−1.154)	[R^2 = .26]

[a]Regression equation:

$$(\frac{dT}{T}) = C + A_1(\frac{dQ}{Q}) + B(\frac{dX}{X})$$

where (dT/T) : Growth rates of TFP (Solow index)
C : Constant
(dQ/Q) : Growth rates of gross output
(dX/X) : Growth rates of export

Date: Figures in brackets are t-values.
Data: Time series 1966-1985 in 1980 prices.
Source: The author's estimate

* Significant at 5 per cent.
** Significant at 2 per cent.
*** Significant at 1 per cent.

1980s even while success in export promotion overshadowed the growth of import-substitution or import-competing industries (e.g., iron and steel, chemical, machines, electronics, etc.).

In an attempt to address the latter issue, TFP growth rate has been regressed against a new set of explanatory varaibles — namely, export growth rate and growth rate of non-export production (i.e., gross output minus export). The result of the regression is reported in Table 9. Note that export growth "explains" little of TFP growth as compared with growth of non-export production. The latter includes import competing manufacturing and "purely domestic manufacturing," which I believe is quite rare in South Korea.

Based on these findings, one could formulate an alternative, more comprehensive "hypothesis" to explain the South Korean experience. Export promotion made use of the existing comparative advantage — exporting labour intensive products, or whatever advantages that existed. But, import substitution policy was also used concurrently to nurture promising infant industries to become internationally competitive after a brief technology-learning period.

Table 9

REGRESSION COEFFICIENTS EXPLAINING GROWTH RATE OF TOTAL FACTOR PRODUCTIVITY BY MANUFACTURING SUBSECTORS WITH EXPORT AND NON-EXPORT PRODUCTION[a]

		C	A_2	B	
3	Manufactures	−7.751	0.763	−0.001	
		(−1.943)	(3.603)***	(−0.007)	[R^2 = .54]
311/2	Food	−3.573	0.653	−0.087	
		(−0.590)	(2.617)**	(−1.279)	[R^2 = .34]
313	Beverage	−9.344	1.322	0.075	
		(−2.646)*	(7.087)***	(2.074)*	[R^2 = .76]
314	Tobacco	−4.795	1.026	−0.003	
		(−1.239)	(7.642)***	(−0.407)	[R^2 = .79]
321	Textile	1.446	0.869	−0.294	
		(0.272)	(3.313)***	(−1.688)	[R^2 = .41]
323	Leather	−2.430	0.120	−0.021	
		(−0.285)	(5.121)***	(−0.163)	[R^2 = .65]
331	Wood and cork	2.438	0.284	−0.262	
		(0.408)	(1.564)	(−1.684)	[R^2 = .32]
332	Furniture	−7.384	0.439	0.116	
		(−1.302)	(5.339)***	(2.701)**	[R^2 = .65]
341	Paper products	−11.405	1.037	0.004	
		(−2.531)*	(5.101)***	(0.957)	[R^2 = .63]
342	Printing	−9.119	1.138	−0.003	
		(−2.544)*	(8.162)***	(−0.189)	[R^2 = .84]
351/2	Industrial and other chemicals	−13.506	0.968	0.096	
		(−2.458)*	(6.713)***	(1.688)	[R^2 = .74]
353/4	Petroleum refining	−5.834	0.197	0.013	
		(−1.053)	(1.346)	(1.511)	[R^2 = .24]
355	Rubber products	−1.173	0.520	−0.035	
		(−0.272)	(3.616)***	(−0.455)	[R^2 = .53]
361/2/9	Pottery, china	−8.382	0.685	−0.003	
		(−1.931)	(3.437)***	(−0.129)	[R^2 = .43]
371/2	Iron and steel and non-ferrous metals	−9.016	0.584	−0.011	
		(−1.235)	(2.703)**	(−0.178)	[R^2 = .32]
381	Metal products	−5.579	0.312	−0.115	
		(−1.396)	(5.403)***	(−2.411)*	[R^2 = .66]
382	Machinery	−8.753	0.520	−0.080	
		(−2.177)*	(6.271)***	(−1.303)	[R^2 = .74]

Table 9 (Continued)

		C	A_1	B	
383	Electrical machinery	−13.781 (−1.925)	0.335 (2.206)*	0.253 (2.601)*	[R^2 = .55]
384	Transport equipment	−0.760 (−0.122)	0.516 (2.931)***	0.022 (0.470)	[R^2 = .43]
390	Other manufactures	−2.746 (−0.357)	0.522 (2.267)*	−0.001 (−0.002)	[R^2 = .29]

[a]Regression equation:

$$\left(\frac{dT}{T}\right) = C + A_2\left(\frac{dD}{D}\right) + B\left(\frac{dX}{X}\right)$$

where (dT/T) : Growth rates of TFP (Solow index)
C : Constant
(dD/D) : Growth rates of non-export, domestic output
(dX/X) : Growth rates of export

Date: Figures in brackets are t-values.
Data: Time series 1966-1985 in 1980 prices.
Source: The author's estimate

* Significant at 5 per cent.
** Significant at 2 per cent.
*** Significant at 1 per cent.

V. Concluding Remarks

Evidence presented in this paper suggests that the rapid export growth in South Korea played an important role by creating effective demand for South Korea's exportables, and not a direct role of raising productivity growth *via* "export externality" route. The significant TFP growth came more likely from import-substitution activities which supported export growth *via* backward linkage (e.g., the localization programme of imported parts). The latter process involved importing and learning up-to-date technologies from abroad, and abundant export earnings supported enterprises to import them. Throughout the 1970s and 1980s, more and more sophisticated technologies have been imported enabling South Korean enterprises to go up the technology ladder step by step; and at the same time to add more and more new products in export baskets when technology-mastering reached the point where the output could compete in international markets. This process is a moving one, a dynamic path of efficiency creation through learning. If such learning combines with relatively cheap wages and salaries (e.g., of engineers and technicians) compared with those in industrialized countries, the competitive advant-

age so created becomes formidable. The government has been active to promote the industrial upgrading process by inducing private enterprises to take risks with a set of incentive measures. Chalmers Johnson advances the idea that there is a politico-economic paradigm common to Japan, South Korea and Taiwan Province; and he coins a term "development state," as contrated to "regulatory state" or "welfare state" (Johnson (1985), Shapiro and Taylor (1990) and Wade (1988)).

It must be emphasized also that Korean policy makers have seemingly been more concerned witn dynamic efficiency gains than static efficiency. They have used the policy tools well known as price distorters such as subsidized loans, tax reductions, foreign exchange and credit allocations according to priority set up, accelerated depreciation, tariffs and import quotas, etc. However, these tools were used not to prop up failing industries but to promote exports, new products, innovations, technology imports and adaptations so as to achieve an industrial base with higher level technology and more integrated structure. An export record (or even local letter of credit) provided a clear-cut performance criterion for the government to award incentive benefits to an enterprise. This aspect of incentive system provides a contrast to other developing countries where performance criterion is non-existent or loose (Lim (1989)). To wit, the stringent market test to produce quality output at an acceptable price in international markets was adopted. The record of industrial growth and productivity gains examined in this paper, and elsewhere, suggests that dynamic gains (e.g., learning) in efficiency have more than offset losses in static efficiency (i.e., adverse effect of price distortions).

Further studies seem warranted in order to refine the conclusions reached, namely (1) to expand studies analyzing welfare gains and losses under the government activism, (2) to develop a comprehensive model which could deal with both static and dynamic efficiency effects within a single framework of analysis, and (3) to check data reliability more thoroughly than has been done in this work, particularly for capital stock data.

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