

NBER WORKING PAPER SERIES

THE TYRANNY OF NUMBERS:
CONFRONTING THE STATISTICAL
REALITIES OF THE EAST ASIAN
GROWTH EXPERIENCE

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Working Paper No. 4680

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
March 1994

This paper was supported by a grant from the MIT-NTU Collaboration Agreement and an NBER Olin Fellowship. I am indebted to Chris Paxson for providing data tapes on Taiwan, to Chan Wing-Kwong, Chao Bi-Tsy, Ho Kun-Lon, Peter Kisler, John Sharon and Woo Hyun-Sook for help in gathering and entering data, and, most especially, to Ho Veng-Si and Yang Shin-Kyu for extraordinary research assistance. Thanks are due the governments of Hong Kong, South Korea and Taiwan for providing unpublished data and answering queries. Special appreciation is due the government of Singapore which, while disagreeing with most of my analysis and all of my conclusions, has generously supplied me with both published and unpublished data on the Singaporean economy. This paper is part of NBER's research programs in Growth and International Trade and Investment. Any opinions expressed are those of the author and not those of the National Bureau of Economic Research.

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ABSTRACT

This paper documents the fundamental role played by factor accumulation in explaining the extraordinary postwar growth of Hong Kong, Singapore, South Korea and Taiwan. Participation rates, educational levels and (with the exception of Hong Kong) investment rates have risen rapidly in all four economies. In addition, there have been large intersectoral reallocations of labour, with (again, excepting Hong Kong) non-agricultural and manufacturing employment growing one and a half to two times as fast as the aggregate working population. Thus, while the growth of output per capita in these economies has averaged 6% to 7% per annum over the past two and a half decades, the growth of output per effective worker in the non-agricultural sector of these economies has been only 3% to 4% per annum. If one then allows for the doubling, tripling and even quadrupling of the investment to GDP ratio in these economies, one arrives at total factor productivity growth rates, both for the non-agricultural economy and for manufacturing in particular, which are well within the bounds of those experienced by the OECD and Latin American economies over equally long periods of time. While the growth of output and manufacturing exports in the newly industrializing economies of East Asia is virtually unprecedented, the growth of total factor productivity in these economies is not.

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Table 1-1: Growth Rates (%)						
	Hong Kong (1966-1991)			Singapore (1966-1990)		
	N	D	N-D	N	D	N-D
GDP per Capita:	7.3	1.6	5.7	8.5	1.9	6.6
GDP per Worker:	7.3	2.6	4.7	8.5	4.5	4.0
Excluding Agriculture	NA	2.8	NA	8.6	4.6	4.0
Manufacturing	NA	1.3	NA	10.1	6.2	3.9
Δ Participation Rate:	.38 → .49			.27 → .51		
	South Korea (1966-1990)			Taiwan (1966-1990)		
	N	D	N-D	N	D	N-D
GDP per Capita:	8.5	1.8	6.9	8.6	1.8	6.8
GDP per Worker:	8.5	2.8	5.7	8.6	3.1	5.5
Excluding Agriculture	10.4	5.4	5.0	9.4	4.6	4.9
Manufacturing	14.1	6.3	7.8	10.8	5.9	4.9
Δ Participation Rate:	.27 → .36			.28 → .37		
N = Numerator; D = Denominator; NA - The Hong Kong government has yet to develop constant price estimates of GDP by sector. GDP measures are at market prices, i.e. including indirect taxes and import duties.						

Table 1-2: Educational Attainment of the Working Population (%)								
	Hong Kong		Singapore		South Korea		Taiwan	
	1966	1991	1966	1990	1966	1990	1966	1990
None	19.2	5.6	55.1	↓	31.1	6.4	17.0	4.5
Primary	53.6	22.9	28.2	33.7	42.4	18.5	57.2	28.0
Secondary+	27.2	71.4	15.8	66.3	26.5	75.0	25.8	67.6
Notes: Self taught are included under primary. Hong Kong, Korean and Taiwanese data refer to highest level of education "attended" rather than completed. All percentages calculated net of those reported as "unknown".								

II. Methodology

The Translog Index of Total Factor Productivity Growth

Consider the translogarithmic value added production function:

$$(2.1) \quad Q = \exp[\alpha_0 + \alpha_K \ln K + \alpha_L \ln L + \alpha_t t + \frac{1}{2} B_{KK} (\ln K)^2 \\ + B_{KL} (\ln K) (\ln L) + B_{Kt} \ln K \cdot t + \frac{1}{2} B_{LL} (\ln L)^2 + B_{Lt} \ln L \cdot t + \frac{1}{2} B_{tt} t^2]$$

where K, L and t denote capital input, labour input and time, and where, under the assumption of constant returns to scale, the parameters α_i and B_{ij} satisfy the restrictions:

$$(2.2) \quad \alpha_K + \alpha_L = 1 \quad B_{KK} + B_{KL} = B_{LL} + B_{KL} = B_{Kt} + B_{Lt} = 0$$

First differencing the logarithm of the production function provides a measure of the causes of growth across discrete time periods:

$$(2.3) \quad \ln\left(\frac{Q(T)}{Q(T-1)}\right) = \bar{\Theta}_K \ln\left(\frac{K(T)}{K(T-1)}\right) + \bar{\Theta}_L \ln\left(\frac{L(T)}{L(T-1)}\right) + TFP_{T-1,T}$$

where $\bar{\Theta}_i = \frac{\Theta_i(T) + \Theta_i(T-1)}{2}$

and where the Θ_i 's denote the share of each factor in total factor payments. The translog index of TFP growth ($TFP_{T-1,T}$) provides a measure of the amount the log of output would have increased had all inputs remained constant between two discrete time periods. In essence, the translog production function provides a theoretical justification for the use of average factor shares and log differences as a means of extending the continuous time Divisia analysis of

III. Hong Kong

Table 3-1 below presents estimates of total factor productivity growth in Hong Kong. With the exception of the 1981-1986 period, when business activity was depressed by the Anglo-Chinese negotiations over the future of the colony, Hong Kong sustained total factor productivity growth rates of 2% or more in each of the five year periods, averaging 2.3% over the 1966-1991 period as a whole. As one would expect, given the constancy of the post-1966 investment to GDP ratio, there is little evidence of capital-deepening, with weighted capital input growing only .7% faster per annum than output during the 1966-1991 period. Surprisingly, the weighting of capital and labour input has little effect on the estimates of the growth of these factors of production, with the growth rate of the "raw" inputs (the simple sum of the sub-components) closely approximating that of the weighted inputs (weighting each sub-component by its average factor share). In the case of labour input, this is simply due to the fortuitous cancelling of various effects, with adjustments for sex, hours of work and age (prior to 1976) lowering the growth rate of labour input, and adjustments for education and age (after 1976) raising the growth rate of labour input. The net effect is, however, important in individual sub-periods and, in particular, is substantially positive during the late 1980s, when the stabilization of female participation rates, ageing of the labour force, and rising educational attainment, all served to increase measured labour input. This pattern is repeated in the other economies and, for reasons of space, will, in general, not be commented upon further.²⁰

²⁰ Tables detailing the impact of each adjustment (age, sex, etc) in each sub-period for the four economies are available upon request from the author.

Table 3-1: Total Factor Productivity Growth - Hong Kong							
	Annual Growth of:						
Time Period	Output	Raw Capital	Weighted Capital	Raw Labour	Weighted Labour	TFP	Labour Share
61-66	0.109	0.169	0.162	0.032	0.025	0.035	0.643
66-71	0.065	0.075	0.078	0.025	0.024	0.023	0.660
71-76	0.081	0.075	0.080	0.033	0.024	0.039	0.662
76-81	0.099	0.093	0.098	0.051	0.064	0.022	0.617
81-86	0.058	0.078	0.079	0.019	0.027	0.009	0.593
86-91	0.063	0.062	0.066	0.005	0.022	0.024	0.609
66-91	0.073	0.077	0.080	0.026	0.032	0.023	0.628
"Raw" inputs - the arithmetic sum of sub-components, with no adjustment for hours of work; "Weighted" - translog indices of factor input growth, with labour services measured by hours of work.							

IV. Singapore

Table 4-1 below presents estimates of total factor productivity growth in Singapore. Although the late 1960s appear to have been a period of rapid productivity growth, these gains were lost (and then some) during the 1970s and 1980s. With weighted capital input growing an average of 3.0% per annum faster than output and output per unit of effective labour input growing only 2.8% per annum, the total factor productivity residual for the aggregate economy averages an extraordinary -0.3% per annum *over a twenty-four year period*, a virtually unprecedented record of productivity regress.²¹ Interestingly, although the growth of capital input has slowed down over time (as the investment rate has stabilized around 40% of GDP), the growth of human capital has accelerated. While weighted labour input grew 2.1% slower than raw labour in the late 1960s, it rose 3.0% faster in the 1980s (due to large increases in the age and educational attainment of the workforce). The changing role of physical and human capital accumulation in sustaining growth is reflected in the decline in the growth of output per effective worker, which went from 9.2% in the late 1960s, to 2.7% in the 1970s, to .2% in the 1980s.

²¹ I should emphasize to the reader that, as noted in section II above, I use data on cement imports to estimate extremely high levels of investment in durable structures during the 1950s (estimates which I have not been able to corroborate using other sources). If anything, the total factor productivity growth rates presented in table 4-1 are likely to be overestimates.

Table 4-1: Total Factor Productivity Growth - Singapore							
	Annual Growth of:						
Time Period	Output	Raw Capital	Weighted Capital	Raw Labour	Weighted Labour	TFP	Labour Share
Economy:							
66-70	0.125	0.119	0.133	0.054	0.033	0.039	0.467
70-80	0.085	0.122	0.138	0.050	0.058	-0.016	0.466
80-90	0.068	0.091	0.084	0.036	0.066	-0.007	0.477
66-90	0.085	0.108	0.115	0.045	0.057	-0.003	0.470
Manufacturing: [*]							
70-80	0.103	0.123	0.130	0.086	0.089	-0.009	0.423
80-90	0.067	0.090	0.094	0.021	0.051	-0.011	0.385
70-90	0.085	0.107	0.112	0.054	0.070	-0.010	0.404
(*) Only covering firms recorded in the Census of Industrial Production.							

Although the Singaporean national accounts do not estimate capital formation by sector, it is possible to make use of the annual Census of Industrial Production (CIP), which contains data on fixed assets, capital formation, employment, value added, output and production costs, to derive total factor productivity growth estimates for the manufacturing sector. The CIP is the principal source of information on Singaporean manufacturing and, along with departmental data on prices, forms the basis of Singapore's Index of Industrial Production (IIP), which in turn is the basis of the national accounts estimates of the constant price growth of manufacturing value added. I regret to inform the reader, however, that (i) 40% or more of the output recorded in the IIP is *undeflated*, i.e. for many manufacturing sub-sectors the "index" is simply the growth of nominal output; and (ii) the Singaporean national accounts use this *undeflated output index* as their measure of the constant price growth of manufacturing value added. Following the lead of the Singaporean statistical authorities, I use the IIP as my measure of the growth of value added

in the CIP firms.²²

As shown in table 4-1, over the 1970 to 1990 period as a whole total factor productivity growth in Singaporean manufacturing averaged -1.0% per annum, a performance approximately equal to that of the aggregate economy during the same period. As in the case of the aggregate economy, the principal source of low productivity growth in Singaporean manufacturing is the combination of a slow growth of output per weighted worker (1.6% per annum) and a rapid fall in output per unit of capital input (-2.7% per annum).²³ Given the IIP's questionable (i.e. non-existent) deflators, these estimates are clearly grossly inaccurate and are simply meant to show what can be accomplished at the sectoral level given the current state of Singaporean data.

²² Although much of manufacturing output is undeflated, the reader should not jump to the conclusion that the IIP overstates the growth of the manufacturing sector. While the undeflated items include many products whose prices have probably been increasing (e.g. printing and transport equipment), they also include many electronics products, whose prices have undoubtedly been declining. Interestingly, at one point the Singaporean statistical authorities, who were concerned about their methodology, sought the assistance of the Japanese on this issue, but were assured that non-deflation of manufacturing output was also common practice in that economy (!).

²³ Since the CIP does not contain any information on the age or educational characteristics of the workers in the firms surveyed, I use census data to adjust for the age and educational characteristics of the workforce under the assumption that the workers in the CIP shared the same age and education characteristics as similar sex persons reported as manufacturing workers in the census.

V. South Korea

Table 5-1 below presents total factor productivity growth estimates for South Korea. Although South Korea exhibits even more capital deepening than Singapore, with output per unit of effective capital input falling 3.3% per annum, the larger labour share and faster growth of output per worker (4.0%) combine to give the economy a considerably larger total factor productivity residual (1.6%). Productivity growth in the Korean economy appears to have improved over time, with the average 2.5% growth of the 1980s well above the .8% and 1% growth experienced during the 1960s and 1970s, respectively. Turning to the industry level analysis,²⁴ we see that manufacturing has had the highest average level of productivity growth. Productivity growth in manufacturing fluctuates dramatically from period to period, but averages 2% to 3% per decade. Productivity growth in other industry and services, while also volatile, has improved on a decade by decade basis, with, in particular, a dramatic rise in other industry from -2.2% in the 1960s to 1.9% in the 1970s and 4.0% in the 1980s. Although the results are not reported in the table, I should note that I have estimated productivity growth in the subsectors of other industry and services, finding average total factor productivity growth rates (during the 1966-1990 period) of -1.1% in mining, 5.1% in electricity, gas & water, 2.1% in construction, 3.3% in transport, storage & communications, and -0.1% in finance, insurance, real estate & business services (1970-1990).²⁵

²⁴ The Korean national accounts include data on capital formation by asset type and by industry, but not by asset type *and* industry. Consequently, my industry level estimates are based upon an aggregate (unweighted) capital input, undifferentiated by asset type, with depreciation rates based upon the average non-residential depreciation rate in the non-agricultural economy.

²⁵ The detailed tables are available upon request from the author.

Table 5-1: Total Factor Productivity Growth - South Korea							
	Annual Growth of:						
Time Period	Output	Raw Capital	Weighted Capital	Raw Labour	Weighted Labour	TFP	Labour Share
Economy - excluding agriculture							
60-66	0.077	0.069	0.069	0.062	0.072	0.006	0.673
66-70	0.144	0.167	0.197	0.095	0.103	0.010	0.673
70-75	0.096	0.121	0.118	0.052	0.055	0.018	0.644
75-80	0.094	0.158	0.176	0.040	0.052	0.001	0.670
80-85	0.087	0.102	0.100	0.031	0.047	0.024	0.701
85-90	0.109	0.105	0.107	0.061	0.072	0.026	0.713
66-90	0.104	0.129	0.137	0.054	0.064	0.016	0.680
Manufacturing:							
60-66	0.123	0.108	NA	0.115	0.115	0.011	0.504
66-70	0.204	0.213	NA	0.104	0.108	0.044	0.504
70-75	0.165	0.136	NA	0.084	0.088	0.052	0.477
75-80	0.127	0.210	NA	0.047	0.062	-0.009	0.503
80-85	0.106	0.076	NA	0.019	0.039	0.051	0.547
85-90	0.118	0.147	NA	0.069	0.082	0.008	0.572
66-90	0.141	0.154	NA	0.063	0.074	0.029	0.521
Other Industry:							
60-66	0.127	0.191	NA	0.082	0.097	-0.013	0.537
66-70	0.176	0.263	NA	0.165	0.166	-0.035	0.537
70-75	0.085	0.104	NA	0.006	0.014	0.028	0.528
75-80	0.117	0.181	NA	0.051	0.071	0.009	0.672
80-85	0.089	0.132	NA	0.051	0.051	0.014	0.693
85-90	0.119	0.058	NA	0.040	0.050	0.066	0.674
66-90	0.115	0.143	NA	0.058	0.067	0.018	0.624
Services:							
60-66	0.059	0.054	NA	0.040	0.054	0.005	0.804
66-70	0.118	0.147	NA	0.079	0.089	0.017	0.804
70-75	0.083	0.127	NA	0.043	0.042	0.023	0.782
75-80	0.073	0.141	NA	0.033	0.045	0.008	0.796
80-85	0.074	0.108	NA	0.034	0.047	0.017	0.828
85-90	0.099	0.097	NA	0.060	0.069	0.025	0.821
66-90	0.088	0.123	NA	0.048	0.057	0.018	0.806
Other Industry combines mining, electricity, gas & water and construction. Services combines wholesale & retail trade, restaurants & hotels, transport, storage & communications, finance insurance, real estate & business services and community & social services.							

VI. Taiwan

Table 6-1 below presents total factor productivity growth estimates for Taiwan. With output per unit of capital input falling 2.7% per annum, but output per effective worker rising 4.5% per annum (the fastest growth in this sample of four economies, Taiwan exhibits an average rate of productivity growth comparable to that of Hong Kong (2.4%). As table 6-1 shows, the sectoral pattern of productivity growth in Taiwan is markedly different from that in Korea. In the Taiwanese economy manufacturing and other industry appear to be productivity laggards (with average growth rates of 1.5% and 1.2%, respectively), while services seems to have played the role of the productivity powerhouse (with an average growth of 3.4% per annum). Strong differences in the performance of Taiwan and Korea are also apparent within the more detailed sectors of "other industry". Thus, over the 1966-1990 period total factor productivity rose 3.7% per annum in Taiwanese mining (as compared with a decline of -1.1% per annum in Korea) and fell -0.3% per annum in Taiwanese electricity, gas & water (as compared with rapid growth of 5.1% per annum in Korea). Elsewhere, the performance of the two economies was more similar, with productivity in Taiwan rising 1.2% per annum in construction (2.1% Korea), 4.5% per annum in transport, storage & communications (3.3% Korea), and .1% per annum in finance, insurance, real estate & business services (-.1% Korea).²⁶

²⁶ The detailed sectoral estimates are available upon request from the author.

Table 6-1: Total Factor Productivity Growth - Taiwan							
	Annual Growth of:						
Time Period	Output	Aggregate Capital	Weighted Capital	Aggregate Labour	Weighted Labour	TFP	Labour Share
Economy (excluding agriculture):							
66-70	0.113	0.152	0.170	0.043	0.044	0.033	0.720
70-80	0.106	0.137	0.143	0.068	0.069	0.015	0.708
80-90	0.080	0.085	0.083	0.024	0.036	0.030	0.701
66-90	0.096	0.118	0.123	0.046	0.051	0.024	0.710
Manufacturing:							
66-70	0.168	0.207	0.214	0.078	0.075	0.031	0.558
70-80	0.121	0.145	0.146	0.100	0.103	-0.001	0.566
80-90	0.072	0.078	0.079	0.012	0.027	0.025	0.613
66-90	0.108	0.128	0.130	0.059	0.067	0.015	0.579
Other Industry							
66-70	0.104	0.177	0.190	0.100	0.096	-0.020	0.702
70-80	0.112	0.165	0.169	0.063	0.066	0.014	0.691
80-90	0.059	0.058	0.060	0.012	0.025	0.023	0.692
66-90	0.088	0.122	0.127	0.048	0.054	0.012	0.695
Services:							
66-70	0.087	0.145	0.162	0.018	0.023	0.040	0.828
70-80	0.094	0.134	0.139	0.049	0.051	0.028	0.827
80-90	0.090	0.094	0.092	0.036	0.041	0.037	0.777
66-90	0.091	0.119	0.123	0.038	0.042	0.034	0.811
Other Industry combines mining, electricity, gas & water and construction. Services combines wholesale & retail trade, restaurants & hotels, transport, storage & communications, finance insurance, real estate & business services and community & social services.							

It is important to note that part of the extraordinary performance of Taiwanese services is due to the unusual approach taken by the Taiwanese national accounts to the measurement of public sector output. Whereas most national accounts authorities deflate public sector output by the wages of different types of public sector employees, leading to an approximately zero growth in output per effective worker, the Taiwanese national accounts incorporate a "quality adjustment", allowing for the growing (unmeasurable) productivity of public sector employees. According to my estimates, between 1966 and 1990 output per effective worker in the Taiwanese public sector grew 4.4% per annum (6.5% per annum if one includes military personnel in the denominator).²⁷

Table 6-2 provides additional total factor productivity measures for Taiwan, where I have adjusted the national accounts measure of public sector output to conform to the more standard (zero growth) deflation technique. As the reader can see, this adjustment has a large impact on the aggregate non-agricultural economy, where productivity growth falls to an average of 1.9%, and an even stronger impact on services, where productivity growth now appears to have averaged 2.5% (which nevertheless remains higher than manufacturing and other industry). Table 6-2 also presents estimates for the non-public sector non-agricultural Taiwanese economy,

²⁷ The reason the Taiwanese national accounts make this adjustment is fairly obvious. With public sector employment stagnating and output per worker in all other sectors of the economy growing rapidly, backward extrapolation (at constant prices of the mid-1980s) using the standard deflation technique implies that the share of government in total output was about 50% in 1966. A similar problem exists in the U.S. national accounts, but is ameliorated by the fact that public sector employment is expanding rapidly, while the growth of the other sectors of the economy is more gradual than in Taiwan. The solution I employ (in table 6-2), is to estimate the growth of aggregate output as a Tornqvist index of the growth of the one-digit ISIC sectors (plus the public sector), with the (chain-linked) current price share of each sector taken as its weight. This approach is analogous to that used by Griliches and Jorgenson (1967) for the measurement of the output of the U.S. economy.

which side-steps these measurement issues by excluding the public sector from consideration.²⁸ I find that total factor productivity growth in the non-agricultural private sector Taiwanese economy averaged 2.1% per annum between 1966 and 1990. Interestingly both sets of estimates for the aggregate economy in table 6-2, both with and without the public sector, show a substantial improvement in productivity growth during the 1980s, which is reminiscent of the results for Korea.

²⁸ This approach is not entirely satisfactory either, since the public sector provides many unpriced services (e.g. roads & bridges) to the private sector. Variations across economies and across time in the quantity of capital and labour services provided (free of charge) by the public sector could potentially bias estimates of private sector productivity.

Table 6-2: Taiwan - Adjustment of Public Sector Output							
	Annual Growth of:						
Time Period	Output	Aggregate Capital	Weighted Capital	Aggregate Labour	Weighted Labour	TFP	Labour Share
Economy (excluding agriculture & with adjustment of public sector output):							
66-70	0.094	0.152	0.170	0.043	0.044	0.015	0.720
70-80	0.106	0.137	0.143	0.068	0.069	0.015	0.708
80-90	0.075	0.085	0.083	0.024	0.036	0.025	0.701
66-90	0.091	0.118	0.123	0.046	0.051	0.019	0.710
Services (with adjustment of public sector output):							
66-70	0.050	0.145	0.162	0.018	0.023	0.003	0.828
70-80	0.094	0.134	0.139	0.049	0.051	0.028	0.827
80-90	0.082	0.094	0.092	0.036	0.041	0.029	0.777
66-90	0.082	0.119	0.123	0.038	0.042	0.025	0.811
Economy (excluding agriculture & official public sector):							
66-70	0.121	0.173	0.187	0.069	0.072	0.013	0.678
70-80	0.115	0.141	0.145	0.072	0.074	0.017	0.660
80-90	0.082	0.083	0.081	0.024	0.037	0.030	0.662
66-90	0.102	0.122	0.125	0.052	0.058	0.021	0.667

Finally, I remind the reader that in the results reported above I have excluded the large conscript armies of Korea and Taiwan in measuring the growth of labour input in these economies on the grounds that the measured output of these military personnel (i.e. their wages) is a negligible proportion of total output. In the case of Taiwan, census sources provide information on the sex, age and educational characteristics of military personnel. To analyze the sensitivity of my results I make use of this information to incorporate military personnel into my estimates. As shown in table 6-3, including military personnel raises the rate of total factor productivity growth in the aggregate economy by .4%, to an average of 2.8% per annum.²⁹ However, if one considers military personnel as part of public sector employment, then the "quality adjustment" of public sector output in the Taiwanese national accounts appears to be even more exaggerated. Adjusting public sector output to standard deflation techniques yields an average total factor productivity growth rate of 2.1% (table 6-3), i.e. only .2% higher than that reported earlier (excluding military personnel) in table 6-2. Similiar estimates for services yield average rates of productivity growth of 3.7% and 2.3%, which are only .3% greater and .2% less, respectively, than the comparable figures reported earlier above. In sum, the estimates for Taiwan are not extremely sensitive to the inclusion of military personnel, particularly once one adjusts the growth of public sector output to international norms. The impact of military personnel in Korea, where they constitute a much smaller percentage of the working population, should be even smaller.

²⁹ The reader may note that including military personnel lowers slightly the estimated share of labour. This follows from the fact that including the military lowers the ratio of the self-employed to the employed in the economy, implying (for a given aggregate wage bill) a lower implicit wage for the self-employed.

VIII. Summary and Conclusions

Underlying the pervasive influence of the East Asian NICs on both theoretical and policy oriented research in the economics profession lies a common premise: that productivity growth in these economies, particularly in their manufacturing sectors, has been extraordinarily high. The results of this paper, as summarized in table 8-1, suggest that this premise is largely incorrect. Over the past two and a half decades, productivity growth in the aggregate non-agricultural economy of the NICs ranges from a low of -0.3% in Singapore to a high of 2.3% in Hong Kong, whereas in manufacturing productivity growth ranges from a low of -1.0% in Singapore to a high of 2.9% in South Korea. For the purposes of comparison, table 8-2 reproduces the results of two detailed cross-country studies of productivity growth, with methodologies similar to that used in this paper. As the reader can see, it is not particularly difficult to find either developed or less developed economies whose productivity performance, over time periods spanning two decades or more, has matched or rivaled that of the NICs. Although, with the possible exception of Singapore, productivity growth in the NICs is not particularly low, it is also, by post-war standards, not particularly high.³⁶

The results of this paper should be heartening to economists and policy makers alike. If the remarkable post-war rise in East Asian living standards is primarily the result of one-shot increases in output brought about by the rise in participation rates, investment to GDP ratios, and educational standards and the intersectoral transfer of labour from agriculture to other sectors (e.g. manufacturing) with higher value added per worker, then economic theory is admirably well-equipped to explain the East Asian experience. Neo-classical growth theory, with its

³⁶ In this regard it is interesting to note that Lau and Kim (1992), using an econometric approach to the study of productivity growth, find that productivity growth in the NICs in the 1970s and 1980s was not significantly different from zero.

Table 8-1: Average Total Factor Productivity Growth (% per annum)				
	Hong Kong (1966-1991)	Singapore (1966-1990)	South Korea (1966-1990)	Taiwan (1966-1990)
Economy: [*]	2.3	-0.3	1.6	1.9
Manufacturing [#]	NA	-1.0	2.9	1.5
Other Industry	NA	NA	1.8	1.2
Services	NA	NA	1.8	2.5
Private Sector: [*]	NA	NA	NA	2.1
Notes: (*) In the case of Korea and Taiwan, excluding agriculture; (#) In the case of Singapore, 1970-1990.				

Table 8-2: Comparative Total Factor Productivity Growth (% per annum)					
Country	Period	Growth	Country	Period	Growth
Canada	1947-1973	1.8	Argentina	1940-1980	1.0
France	1950-1973	3.0	Brazil	1950-1980	2.0
Germany	1950-1973	3.7	Chile	1940-1980	1.2
Italy	1952-1973	3.4	Colombia	1940-1980	0.9
Japan	1952-1973	4.1	Mexico	1940-1980	1.7
Netherlands	1951-1973	2.5	Brazil (M)	1960-1980	1.0
United Kingdom	1955-1973	1.9	Mexico (M)	1940-1970	1.3
United States	1947-1973	1.4	Venezuela (M)	1950-1970	2.6
Notes: M = manufacturing alone; developed economies from Christensen, Cummings and Jorgenson (1980), less developed economies from Elias (1990).					

emphasis on level changes in income and its well-articulated quantitative framework, can explain most, if not all, of the difference between the performance of the NICs and that of other post-war economies.