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AN APPLICATION OF KALDOR'S GROWTH LAWS IN SOUTH EAST ASIA: A TIME SERIES CROSS SECTION ANALYSIS

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Abstract

This study revisits Kaldor's growth laws and provides some empirical views of the sources of South East Asian growth for the last 30 years. In particular, the results suggest that manufacturing output growth is prominent in influencing the total output growth as compared to other sectors in the process of growth and development in Indonesia, Malaysia, Philippines, Singapore and Thailand. Besides, it is found that the growth of the manufacturing sector will lead to the transference of labour from other sectors in the economy which raises productivity in these sectors. However, the agricultural and service sectors do not offer the same scope for the division of labour and specialisation within the sectors themselves. Various factors have been postulated as factors manufacturing output growth. It is suggested in this study that the governments of South East Asian should encourage the transfer of resources from agriculture to industry in order to move into higher stage of growth and development.

Keywords: Kaldor's growth laws; South East Asia; Manufacturing; Agriculture; Economic growth; Time series cross section

1. Introduction

One of the most important factors to economic growth and lead to higher per capita income is that the industrialisation process. There is even evidence in most countries that manufacturing sector is an engine of growth. To what extent is the growth performance of South East Asian economies related to the industrial characteristics? Two types of empirical studies have been conducted in most previous literature on the growth and development process in East Asia. The first type of study involves cross-country regression covering a large number of countries. The second type of study has been growth accounting exercises, which calculate total factor productivity (TFP) growth using country specific time-series. However, none of these approaches pick out any one particular sector as the driving force behind growth, yet in practice the

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growth of any country will be linked to the growth of its most dynamic sector. It was always the contention of Nicholas Kaldor that the manufacturing sector is the engine of growth and that conventional studies of growth are far too aggregative in their approach.

This paper aims to study and test the Kaldorian approach to South East Asian economic growth using the applied econometric technique of Time Series Cross Section (TSCS). The purpose is to investigate whether the Kaldorian interpretation of the growth and development process is supported by data taken from the Asian Development Bank (ADB) on South East Asian economic growth. This should help us to understand whether the manufacturing sector has played a major role as an engine of growth as proposed by Kaldor. The study will cover the period of 1972 to 2000 for 5 countries, i.e., Indonesia, Malaysia, Philippines, Singapore, and Thailand.

2. The Nature of South East Asian Growth

Over the years, a large number of studies have been undertaken to explain the growth of the East Asian economies. Most of these works have used either of two approaches; cross-country regression or growth accounting exercises[1]. To date, there is no unanimity on why the economies of South East Asia, particularly Indonesia, Malaysia, Philippines, Singapore, and Thailand have grown so spectacularly over the past generation. The disagreements and differences on the factors that drove the growth of the economy in South East Asia can be categorised as government and market-orientated economy, demand and supply sides, factor accumulation and technical progress, etc. The debate on the issues has led to a large body of literature on trying to answer the questions about the sources of growth in the region and the future.

It is possible to conclude all these studies in the same manner as in Barro and Lee (1994) such that the successful positive analysis of economic performance is a prerequisite for the design of policies that would improve a country's well being. This is where we could use the results on the determinants of the economic growth to construct useful policy recommendations. For example, the positive relationship between growth and investment might warrant government subsidies or additional public projects.

Finally, it is our objective to try to put all these issues (production function and cross-country approaches) into some perspectives. There is no simple answer, but it is useful just to discuss some ideas. One of the things that is interesting about these subjects is that many of the issues that arise when you think about countries also pertain to the performance of firms or sectors in the economy, which leads us to the next section.

Criticisms of both approaches are that in theory both are very aggregative and neither identifies a leading sector that has been dominant in the growth process. This leads us to consider another approach in the next chapter attributed to Kaldor which identifies industrialisation and particularly manufacturing industry as the engine of growth.

[1] Fukuda and Toya (1998) also argue that most previous literature on the East Asian growth has been using the two techniques.

3. Kaldor's Growth Laws and Supportive Analysis

Nicholas Kaldor is particularly recognised for his contribution to growth and development theory based on his challenge to the neo-classical theory of growth and distribution. He also thought it was important to distinguish different sectors of the economy, each with different production characteristics.

A complete Kaldor model consists of several propositions, which include his three growth laws. Kaldor put forward the laws in his Inaugural Lecture in 1966 in Cambridge, entitled *The Causes of the Slow Rate of Economic Growth of the U.K.*, and later at Cornell University which was published as *Strategic Factors in Economic Development* (1967). In his inaugural lecture, he attempted to explain growth rate differences among developed countries. In his study, he found that the manufacturing sector plays an important role in the process of development. From his study, he concluded that manufacturing is the most dynamic sector in the economy and the 'engine of growth'.

The three growth laws presented by Kaldor are:

1. There is a strong positive association between the growth of manufacturing output and the rate of growth of total output or gross domestic product (GDP),
2. There is a positive correlation between the growth of manufacturing output and the growth of labour productivity in manufacturing, and
3. There is a positive correlation between the growth of overall productivity and the rate of growth of manufacturing output and a negative relation with the growth of employment outside the manufacturing sector.

These laws have been tested and scrutinised continuously since they were suggested and Kaldor himself clarified the laws after first publication. We will now examine each of these laws in turn.

Kaldor's first law states that the faster the rate of growth of the manufacturing sector, the faster will be the rate of growth of GDP. Kaldor argued that the manufacturing sector plays an important role in explaining growth since it enjoys static and dynamic increasing returns to scale. The manufacturing sector also absorbs the surplus labour from other sectors of the economy and hence increases overall productivity. This relationship between growth of total output and rate of growth of the manufacturing sector shows the importance of the manufacturing sector in the process of economic growth. Using a reduced form model:

$$G_{gdp} = \alpha_1 + \beta_1 G_m + \varepsilon \ , \qquad (1)$$

where G_{gdp} is the growth of GDP, G_m is the growth of manufacturing output and ε is the error term.

In emphasising the importance of manufacturing, he found an insignificant relation between the growth of GDP and other economic activities such as agriculture and mining, because the agricultural sector exhibits diminishing returns to scale. The correlation between the growth of GDP and that of the services sector is almost equal to one, but Kaldor argues that the direction of causality is the reverse. This is an interesting subject on the issue of deindustrialisation in showing to what extent these two sectors, that is, service and manufacturing, are integrated.

Almost all the studies done on Kaldor's growth laws on different regions or countries provide support for the first law. The importance of the manufacturing sector as an 'engine of growth' has also been discussed by other economists such as Hirschman (1958) with his idea of forward and backward linkages. Others include Rosenstein-Rodan (1943), Rostow (1960), and Solow (1970)[2].

Kaldor's initial finding has been subject to an enormous amount of criticism and debate related to the simple econometric model he used and associated problems. One criticism is that Equation (1) is a spurious regression because the manufacturing sector contributes a large part of GDP. To overcome this problem, Kaldor also performed the following regressions:

$$G_{nm} = \alpha_2 + \beta_2 G_m + \varepsilon , \qquad (2)$$

and

$$G_{gdp} = \alpha_3 + \beta_3 (G_m - G_{nm}) + \varepsilon , \qquad (3)$$

where G_{nm} is the growth of non-manufacturing output. His results show a positive and significant relation, which therefore provide stronger support for Kaldor's first growth law, especially Equation (3). Kaldor argued that this relationship was largely due to two main factors: firstly that labour drawn from other sectors leads to an increase in productivity growth outside the manufacturing sector, and secondly the existence of increasing returns, both static and dynamic, in the manufacturing sector itself. This leads us to Kaldor's second law.

The second Kaldor growth law is also known as Verdoorn's law after the Dutch economist P.J. Verdoorn. The Verdoorn's formulation is

$$P_m = \alpha_4 + \beta_4 G_m + \varepsilon , \qquad (4)$$

where P_m is the rate of growth of labour productivity in the manufacturing sector.

Verdoorn's 1949 paper did not receive much attention until Kaldor presented his Inaugural Lecture in 1966. Kaldor ran two regressions on his data for 12 OECD countries. The first Equation is (4) and the second is:

$$E_m = \alpha_5 + \beta_5 G_m + \varepsilon , \qquad (5)$$

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[2] Rosenstein-Rodan (1943) discussed the process of industrialisation in Eastern and South Eastern Europe, Rostow (1960) with his stages of development process, and Solow (1970) with his argument of industrialisation process in developed and developing countries.

since, $G_m = P_m + E_m$, where E_m is the rate of growth of employment in manufacturing[3].

Kaldor's estimate of Verdoorn's law gave the following results where he argued that a one percent increase in output induces roughly a 0.5 percent increase in the rate of growth of productivity and a 0.5 increase in employment. This result by Kaldor has been found in other studies such as Cripps and Tarling (1973), McCombie and de Ridder (1984) as well as Hansen and Zhang (1996). Kaldor believes that the basis of the Verdoorn relation was static and dynamic returns to scale partly based on learning.

A recent study by Fingleton and McCombie (1998), show that the preferred specification of Verdoorn's law exhibits strong increasing returns to scale. Meanwhile, Leon-Ledesma (2000) tests the law across the regions of Spain. He shows that there are substantial increasing returns in the manufacturing sector, and to a lesser extent in the services sector. His estimate of Verdoorn's coefficient across the regions is 0.50, and Kaldor's second law of growth seems to be confirmed as far as the Spanish regions are concerned.

Kaldor's original work on Verdoorn's law also came under attack. The first major attack concerned the specification of the right hand side variable. The second major attack concerns the direction of causation. The third major attack concerns the use of time series data.

The third law is based on the assumption that outside the manufacturing sector, diminishing returns prevail so that the marginal product is below the average. It is hypothesised that productivity growth in the non-manufacturing sector will therefore be positively correlated with the growth of output in the manufacturing sector as labour is drawn away from non-manufacturing. Thus, the model suggested by Kaldor is as follows;

$$P_{nm} = \alpha_6 + \beta_6 G_m + \varepsilon , \quad (6)$$

where P_{nm} is the growth rate of productivity in the non-manufacturing sector. However, it is difficult to measure productivity in many sectors outside of manufacturing, so in most literature, the usual formulation of Kaldor's third law is stated as;

$$P_{gdp} = \alpha_7 + \beta_7 G - \delta_7 E_{nm} + \varepsilon , \quad (7)$$

where P_{gdp} is overall productivity growth and E_{nm} is employment growth in non-manufacturing. This is the specification first used by Cripps and Tarling (1973).

Thus, it is hypothesised that the growth rate of total productivity will be positively correlated with the rate of growth of manufacturing output (or employment), and negatively correlated with the rate of growth in employment outside the

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[3] This law can also be specified to include capital stock in order to reflect a production relation such as a form of technical progress function. This has been done in several studies such as Fingleton and McCombie (1998) and Leon-Ledesma (2000). See later in this chapter.

manufacturing sector. Cripps and Tarling's study confirmed the third law for both periods 1951-65 and 1965-70.

Kaldor's growth laws were first presented by Kaldor to provide an explanation of the different economic performance of the advanced industrialised nations. The main implication from the discussions above is to show the importance of the manufacturing sector in the process of economic growth because of the different production characteristics of different sectors of an economy.

4. Econometric Models

This section attempts to offer insights into the development process for South East Asian countries by looking at the role of Kaldor's growth laws. The purpose is to investigate whether Kaldor's growth laws can explain differences in the growth performance of this region. The study tries to examine the validity of the laws by using the TSCS technique over the period of 1972-2000. The data are drawn from the ADB Key Indicators for various years. The countries covered are Indonesia, Malaysia, Philippines, Singapore and Thailand.

Total GDP, manufacturing output, agricultural output, mining output, services output and non-manufacturing output are based on data at constant prices of different base years for each country. The output for non-manufacturing is the difference between total GDP and manufacturing output. The data for employment are also drawn from the same source. The data for employment consists of total employment in the economy, employment in manufacturing, employment in agriculture and employment in non-manufacturing. The employment in non-manufacturing is the difference between the total labour employed in the economy and manufacturing employment. Productivity in all sectors is calculated as the total output divided by the total employment in the sector.

The calculation of growth rates are as follows: real GDP growth (G_{gdp}) – the first difference of the log of the real GDP times one-hundred, real manufacturing output growth (G_m) – the first difference of the log of the real manufacturing output times one-hundred. The calculations are the same for real agricultural output growth (G_a), real mining output growth (G_{mi}), real services output growth (G_s), real non-manufacturing output growth (G_{nm}), employment growth in manufacturing (E_m), employment growth in agriculture (E_a), employment growth in non-manufacturing (E_{nm}).

The productivity growth in all sectors (P_t) is the difference between rate of growth of output and growth rate of total employment. The growth of productivity in manufacturing (P_m) is the difference between rate of growth of manufacturing output and growth rate of employment in the manufacturing sector. We also measure capacity utilisation (CU) which is calculated as the actual total GDP divided by the potential total GDP in the economy. The potential total GDP is calculated as the moving average of the actual total GDP using the Hodrick-Prescott (HP) procedure.

Harvey and Jaeger (1993) show that for coefficient = 1,600 the transfer function for the HP-filter peaks around 30.14 quarters (approximately 7.5 years). This suggests using the value of coefficient = 7 for annual observations.

The ordinary least squares (OLS) technique is used as a basis for the regression analysis using the TSCS approach. In this manner, we will use Equation (1) to (7).

The first estimating methodology that we are going to use is the TSCS technique. TSCS estimates a form of panel data model in which data are (typically) observed for a relatively large number of periods for a relatively small number of cross sectional units. The model is:

$$y_{it} = \beta X_{it} + \varepsilon_{it}; \quad \text{for } i = 1,...,N \text{ and } t = 1,...,T \tag{8}$$

The subscript *i* indexes groups or units, whereas *t* indexes periods. X_{it} is a vector of one or more (*k*) exogenous variables and observations are indexed by both unit *i* and time *t*. The coefficient vector β is assumed to be constant over time and for all groups. The models for TSCS often allows for:

- groupwise heteroscedasticity, $E[\varepsilon_{it}, \varepsilon_{it}^{'}] = \sigma_{ii}$,
- cross group correlation, $Corr(\varepsilon_{it}, \varepsilon_{jt}) = \sigma_{ij}$,
- within group autocorrelation, $\varepsilon_{it} = \rho_i(\varepsilon_{i,t-1}) + v_{it}$, where v_{it} is the stochastic error term.

For the non-autocorrelated models, the estimator may be two-step generalised least squares (GLS) or iterated GLS that produces a maximum likelihood estimator. For the models with autocorrelation, the estimator may be three-step GLS or iterated GLS.

'Pooling' is the critical assumption of TSCS models. This is where all units are characterised by the same regression equation at all points in time. Having this assumption, and referring to Equation (8), the exogenous variables may contain unit specific dummy variables, allowing intercepts to vary by unit. This model is called a fixed effects model. Fixed effects present no special problem for TSCS models because the number of unit specific dummy variables required is not large[4]. In general, we denote the matrix of independent variables for all observations as ***X*** and the vector of observations on the dependent variable as ***y***. The data are stacked by unit or country[5].

In theoretical analysis, the use of OLS is problematic due to both the temporal and spatial properties of TSCS data. If the errors are assumed to be generated in an uncomplicated (spherical) manner, the OLS is optimal for TSCS models. In this case, we need to assume that all the error processes have the same variance

[4] In this study, we do not consider random effects models, which are heavily used in panel data models (Greene, 1999)

[5] The data are ordered so that the second observation is the observation on unit (or country) 1 for the second time period and in general the observation following unit (or country) *i* for time period *t* is the observation for unit (or country) *i* for time *t+1* (Greene, 1999)

(homoscedasticity) and that all of the error processes are independent of each other. From the later assumption, we can break down the assumption that errors for a particular unit (or country) at one time are unrelated to errors for that unit (or country) at all other times or no serial correlation, and error for one unit (or country) are unrelated to the errors for every other unit (or country) or no spatial correlation. Therefore, if these assumptions hold, the TSCS models should be estimated by OLS and OLS standard errors are correct.

Then, in the presence of nonspherical errors, the OLS is not optimal in the sense that there will be other estimators that make more efficient use of the data. However, if the errors are not spherical, there is no warranty that the OLS standard errors will be accurate.

The nonspherical of the errors of any regression model is always possible. In this manner, we might anticipate TSCS errors to be contemporaneously correlated in that large errors for unit (or country) *i* at time *t* will often be associated with large errors for unit (or country) *j* at time *t*. This is likely to occur in the regional context where the economies like South East Asian are linked. It is also a likely problem in other TSCS contexts, for example the study of disaggregated budgets, where large errors in one budget category may be associated with large errors in other categories in the same year. These contemporaneous correlations may differ by unit (or country). For example the errors in the South East Asian economies may be linked together but the errors remain independent.

When the variances of the error process differ from unit to unit (or country to country), the errors in TSCS models might show the ‘panel heteroscedasticity’. The panel heteroscedasticity occurs when the scale of the dependent variable may differ between countries, for example the errors of cross-national panel study.

5. Results and Analysis

The specification of Kaldor’s growth laws discussed earlier was estimated with TSCS and SURE estimations. Since regression results may be valid only when the variables are stationary, tests have been developed for testing the stationarity or non-stationarity of individual variables. The Dickey-Fuller (*DF*) and Augmented Dickey-Fuller (*ADF*) tests that we employed show that we only have a problem of non-stationarity in the following variables; G_{gdp} for Philippines and Thailand, G_m for Indonesia and Thailand, G_a for Philippines and Singapore, G_{mi} for Singapore, and G_s for Indonesia and Singapore. This may simply be due to structural breaks and not unit roots (for example the recession of mid 1980s and the Asian financial crises in 1997). All other variables for each country are stationary. This may suggest to us that our regressions would be free of spurious regression problems. Having these results, further testing for cointegration is not needed.

The results in Table 1 show the estimation using the TSCS technique. In general, the coefficient of Kaldor’s first law shows little variation across all the estimations allowing for group wise heteroscedasticity with impressive *t*-statistics. This could be due to the structure of the assumed error process. In particular, we could assume that for any given unit or country, the error variance is constant, so that the only source of heteroscedasticity is differing error variances across units or countries.

Table 1
Group Wise Regression Model for Pooled and Fixed Effects Regressions for Kaldor's First Law [Equation (1)]

Dependent Variable	G_{gdp}		
	Model 1	**Model 2**	**Model 3**
Pooled Regression			
Intercept	0.2585 (8.834)***	0.2556 (9.366)***	0.2632 (9.918)***
G_m	0.3965 (17.336)***	0.3771 (15.992)***	0.3604 (15.670)***
Homoscedasticity Test	27.3169 (*LM*)	134.6691 (*Wald*)	--
Autocorrelation Test	--	9.0590 (*LM*)	12.7569 (*L*)
Log-likelihood Function	8.1851	25.2586	31.6370
Fixed Effects Regression			
Intercept			
1. Indonesia	0.0930 (1.922)*	0.1359 (2.933)**	0.1582 (3.492)**
2. Malaysia	0.1931 (4.181)***	0.2297 (5.902)***	0.2490 (6.272)***
3. Philippines	0.2881 (6.379)***	0.3218 (4.813)***	0.3394 (4.875)***
4. Singapore	0.4073 (9.357)***	0.4356 (10.711)***	0.4503 (11.218)***
5. Thailand	0.2174 (5.137)***	0.2410 (8.617)***	0.2533 (9.013)***
G_m	0.4147 (19.784)***	0.3827 (17.006)***	0.3660 (15.811)***
Homoscedasticity Test	39.5745 (*LM*)	16.0487 (*Wald*)	--
Autocorrelation Test	--	16.6932 (*LM*)	14.9511 (*L*)
Log-likelihood Function	23.869358	49.388884	48.598312

Notes: Model 1 refers to homoscedastic regression with nonautocorrelated disturbances. Model 2 refers to groupwise heteroscedastic regression with nonautocorrelated disturbances. Model 3 stands for groupwise heteroscedastic and correlated regression with nonautocorrelated disturbances. *t*-statistics are reported in parentheses. ***, ** and * indicate the coefficient is significant at 1, 5 and 10 percent level respectively. *LM*, *Wald* and *L* stand for Lagrange multiplier test, Wald test and likelihood test respectively.

These results provide support for Kaldor's proposition. In all regression estimations, a one percent increase in real manufacturing growth leads to a rise in real GDP growth of between 0.360 and 0.397 percent. The results obtained indicate that for this particular cross-section data, the results seem to be robust to the estimation techniques used. The test for homoscedasticity in all estimations shows that we do not have any problem with heteroscedasticity. This is because for OLS to be optimal it is necessary to assume that all the error processes have the same variance (homoscedasticity) and that all of the error processes are independent of each other.

The first law is also estimated using fixed effects model as showed in Table 1. The results do not differ greatly from the pooled data regression. We can see that there is a high fixed country effect in Singapore; the lowest is in Indonesia We may interpret it to mean that with zero manufacturing output growth, total output will grow due to exogenous impact outside the manufacturing sector. This must come from other sectors of the economy. This estimation, that is, pooled with fixed country effects, produced no problems with autocorrelation[6] except in two countries, Philippines and Singapore, and hence this study would give meaningful results. In all, the TSCS estimates show significant slope coefficients.

Table 2
GroupWise Regression Model for Pooled Regressions of Side Tests for Kaldor's First Law [Equations (2) and (3)]

Dependent Variable	G_{nm}		
	Model 1	**Model 2**	**Model 3**
Equation (2)			
Intercept	0.3053 (7.351)***	0.2792 (7.443)***	0.2891 (8.643)***
G_m	0.3285 17.336)***	0.2974 (9.413)***	0.2752 (9.528)***
Homoscedasticity Test	32.6417 (LM)	165.4827 (*Wald*)	11.9974 (*L*)
Autocorrelation Test	--	9.6138 (*LM*)	--
Log-likelihood Function	-30.4941	-8.8214	-2.8227

Dependent Variable	G_{gdp}		
	Model 1	**Model 2**	**Model 3**
Equation (3)			
Intercept	0.5482 (15.040)***	0.5237 (17.575)***	0.5390 (18.464)***
$(G_n - G_{nm})$	0.3088 (6.461)***	0.2434 (5.615)***	0.1693 (5.449)***
Homoscedasticity Test	61.8111 (*LM*)	192.0107 (*Wald*)	--
Autocorrelation Test	--	30.7905 (*LM*)	42.7713 (*L*)
Log-likelihood Function	-51.728666	-23.547391	-2.161742

Note: Refer to Table 1.

We also carried out tests for other sectors in the economy to show the significance of the estimation on Equation (1) and to assess whether the manufacturing sector is unique or not. We examine the relationship between G_{gdp} and agriculture (G_a), G_{gdp} and mining (G_{mi}), and G_{gdp} and services (G_s) sectors. The results in as summarised Table 3 below shows that the manufacturing output growth is still prominent in

[6] Autocorrelation is where the basic assumption that $Cov(\varepsilon_t \varepsilon_s) = 0$ for $t \neq s$ is violated, that is, disturbances are autocorrelated. The consequences are that least squares estimates remain unbiased (in static models) but are inefficient. More importantly, because standard errors are biased, then *t*-ratios and *F*-statistics are also biased and cannot be relied upon. Although autocorrelation is not normally expected in cross-sectional data regression or time series cross sectional data regression, it may arise when data are arranged in a certain way, for example, if neighbouring countries with similar economic characteristics are placed subsequent to each other in the database.

determining the growth rates in the other non-manufacturing sectors as well as the growth rate of the whole economy.

Kaldor's finding showed that there is no correlation between the rate of growth of GDP on either agriculture output or mining, whereas the correlation between the growth of total output with the growth of services output is virtually one to one. Our results below show that this is not the case for the South East Asian economy. In fact, all sectors appear to be significant.

Table 3: Group Wise Regression Model for Pooled Regressions for G_{gdp} and G_a, G_{gdp} and G_{mi}, G_{gdp} and G_s

Dependent Variable	G_{gdp}		
	Model 1	**Model 2**	**Model 3**
G_{gdp} and G_a Relationship			
Intercept	0.6001 (16.916)***	0.5681 (20.524)***	0.5612 (18.113)***
G_a	0.2153 (5.118)***	0.1907 (4.365)***	0.1201 (3.099)***
Homoscedasticity Test	54.3175 (*LM*)	176.866 (*Wald*)	--
Autocorrelation Test	--	37.8291 (*LM*)	39.8782 (*L*)
Log-likelihood Function	-58.0358	-31.5594	-11.6203
G_{gdp} and G_{mi} Relationship			
Intercept	0.6324 (18.051)***	0.6216 (24.516)***	0.5956 (18.333)**
G_{mi}	0.02641 (4.098)***	0.02245 (2.525)**	0.0130 (1.932)*
Homoscedasticity Test	67.5281 (*LM*)	131.4708 (*Wald*)	54.4382 (*L*)
Autocorrelation Test	--	55.1587 (*LM*)	--
Log-likelihood Function	-61.8037	-35.7815	-8.5624
G_{gdp} and G_s Relationship			
Intercept	0.6029 (15.487)***	0.5954 (21.234)***	0.5818 (17.976)***
G_s	0.05479 (3.573)***	0.0332 (2.856)**	0.0245 (3.476)***
Homoscedasticity Test	69.9654 (LM)	164.1572 (*Wald*)	--
Autocorrelation Test	--	49.8090 (LM)	53.6551 (L)
Log-likelihood Function	-63.5796	-34.5563	-7.7241

Note: Refer to Table 1.

The relationship between the GDP growth with agriculture shows a parameter coefficient (β) approximately between 0.120 to 0.215 which implies that a one percent increase in agricultural output leads to an increase in total output in the economy by 0.120 to 0.215 percent. The parameter coefficient for mining sector is very small but still statistically significant. The regression on services sector also shows significant results but the parameter coefficient is very low roughly between 0.024 to 0.055 which implies that the services sector only contribute relatively a small share in the process of total output growth in the economy. It may well be that there is strong group heterogeneity and that is driving the results. This is probably where the variances of the error process differ greatly from country to country. Overall, these results provide further support for Kaldor's proposition of the significance of the manufacturing sector.

The estimations using the TSCS method show no problems with autocorrelation and heteroscedasticity. So, the above analysis appears to confirm Kaldor's assertion that the higher the manufacturing output growth, the higher the growth rate of total output.

We test the second law by using the pooled data regression and pooling with fixed effects model. Both Equations (4) and (5) are two ways of looking the Verdoorn relation in the economy. In this case, we will get the relationship where $\beta_4 + \beta_5 = 1$ because $G_m = P_m + E_m$.

The original results by Kaldor in 1966 show that the constant parameter, α_i , is according to the theoretical predictions. This is where the constant parameter, α_4 , expected to be positive and α_5 is negative. However, based on our estimations, we obtained contradictory results such that our result on α_4 is negative and positive for α_5 which is very unlikely to happen as far as the interpretations are concerned. Yet, it is the slope parameter, β , that matter.

Let us consider the results as follows. The estimations show that Equation (4) is significant and the results had no problems with autocorrelation and heteroscedasticity as shown in Table 4. The results provide further support for Kaldor's proposition that in all regression estimations, a one percent increase in real manufacturing growth leads to a rise in the rate of productivity growth in the manufacturing sector of approximately 0.804 to 0.842 percent in the South East Asian region with significant *t*-statistics.

The Verdoorn coefficient obtained in this study is very high compared to the results from other studies such as Leon-Ledesma (2000), who estimated the Verdoorn coefficient as similar to the result by Kaldor of roughly 0.50. However, the estimated Verdoorn coefficient of approximately between 0.804 to 0.842 reveals strong productivity effects of manufacturing growth in the manufacturing sector itself.

Then, the estimation on Equation (5) as in Table 5 shows that the coefficient is only significant with groupwise heteroscedasticity regression. This implies that the coefficient is significant when the variances of the error process vary from country to country. Since the estimations produced no problems with autocorrelation and heteroscedasticity, we can say that this finding would give meaningful results.

Table 4
GroupWise Regression Model for Pooled and Fixed Effect Regressions for Kaldor's Second Law [Equation (4)]

Dependent Variable	P_m		
	Model 1	**Model 2**	**Model 3**
Pooled Regression			
Intercept	-0.4464 (-2.746)**	-0.4400 (-3.194)**	-0.5508 (-4.159)***
G_m	0.8036 (6.660)***	0.8125 (8.596)***	0.8422 (9.680)***
Homoscedasticity Test	10.1414 (*LM*)	20.7744 (*Wald*)	--
Autocorrelation Test	--	14.8829 (*LM*)	23.6181 (*L*)
Log-likelihood Function	-207.4554	-201.9940	-190.1849
Fixed Effects Regression			
Intercept			
1. Indonesia	-0.1908 (-0.681)	-0.2017 (-0.713)	-0.2099 (-0.754)
2. Malaysia	-0.9174 (-3.431)***	-0.9268 (-4.276)***	-0.9337 (-4.378)***
3. Philippines	-0.2456 (-0.939)	-0.2542 (-1.380)	-0.2606 (-1.448)
4. Singapore	-0.3610 (-1.432)	-0.3682 (-1.588)	-0.3735 (-1.624)**
5. Thailand	-0.4821 (-1.968)**	-0.4881 (-1.595)	-0.4926 (-1.615)**
G_m	0.7968 (6.566)***	0.8050 (8.644)***	0.8110 (9.410)***
Homoscedasticity Test	12.4258 (*LM*)	22.9249 (*Wald*)	--
Autocorrelation Test	--	15.4287 (*LM*)	27.3339 (*L*)
Log-likelihood Function	-204.2852	-197.8258	-184.1588

Note: Refer to Table 1.

We examine the relationship of both Equations (4) and (5) for fixed country effects. The results are shown in the second part of Table 4 and Table 5. Our Verdoorn coefficient is reduced to 0.81 which indicates that by allowing for the fixed country effect, a one percent increase in manufacturing output growth will lead to an increase in productivity growth by 0.81 percent and raise employment by 0.19 percentage points.

Following the Verdoorn effect, we are able to say that an increase in one percent in the manufacturing output growth would lead to an increase in the productivity by approximately 0.840 percent whereas the employment effect is roughly about 0.160 percent.

The method suggested by McCombie and de Ridder (1983) that has been discussed earlier suggest that some adjustments need to be made to take into account the cyclical fluctuation of output growth. This is to avoid the confusion between Verdoorn's law and Okun's law. In justifying both Equations (4) and (5) and to examine whether our estimations have a problem of cyclical influences, we run pooled regression for Equations (4) and (5) with the additional variable of capacity utilisation (*CU*).

Table 5
GroupWise Regression Model for Pooled and Fixed Effect Regressions for Kaldor's Second Law [Equation (5)]

Dependent Variable	E_m		
	Model 1	**Model 2**	**Model 3**
Pooled Regression			
Intercept	0.4464 (2.746)	0.4400 (3.194)	0.5508 (4.159)
G_m	0.1964 (1.628)	0.1875 (1.983)**	0.1578 (1.814)*
Homoscedasticity Test	10.1414 (*LM*)	20.7744 (*Wald*)	--
Autocorrelation Test	--	14.8829 (*LM*)	23.6181 (*L*)
Log-likelihood Function	-207.4554	-201.9940	-190.1849
Fixed Effects Regression			
Intercept			
6. Indonesia	0.1908 (0.681)	0.2017 (0.713)	0.2099 (0.754)
7. Malaysia	0.9174 (3.431)***	0.9268 (4.276)***	0.9337 (4.378)***
8. Philippines	0.2456 (0.939)	0.2542 (1.380)	0.2606 (1.448)
9. Singapore	0.3610 (1.432)	0.3682 (1.588)	0.3735 (1.624)**
10. Thailand	0.4821 (1.968)**	0.4881 (1.595)	0.4926 (1.615)**
G_m	0.2032 (1.674)*	0.1950 (2.094)**	0.1890 (2.192)**
Homoscedasticity Test	12.4258 (LM)	22.9249 (Wald)	--
Autocorrelation Test	--	15.4287 (LM)	27.3339 (L)
Log-likelihood Function	-204.285154	-197.825781	-184.158818

Note: Refer to Table 1.

The method involves the use of potential output. In our case, we estimate the potential output by taking the moving average of actual total output growth using Hodrick-Prescott (HP) procedure as mentioned earlier. The additional equations are as follows:

$$P_m = \alpha + \beta G_m + CU + \varepsilon, \tag{4a}$$

and

$$E_m = \alpha + \beta G_m + CU + \varepsilon, \tag{5a}$$

The idea is that *CU* will take up the short run cyclical fluctuation in our estimations. The results are presented in Table 6.

The results show that the inclusion of the additional variable, *CU*, did not affect the Verdoorn coefficient and the significance level. The coefficient of *CU* is not statistically significant and has been shown to have an insignificant effect on the parameters obtained for both specifications. The results above also suggest that, in Equation (4a), *CU* is statistically insignificant and shows the positive sign while, in Equation (5a), *CU* has the negative sign and still statistically insignificant. These results give us further support for the second law.

Table 6
GroupWise Regression Model for Pooled Regressions for Kaldor's Second Law with Capacity Utilisation [Equations (4a) and (5a)]

Dependent Variable	P_m		
	Model 1	**Model 2**	**Model 3**
Intercept	-0.4487 (-2.761)**	-0.4386 (-3.211)**	-0.5503 (-4.148)***
G_m	0.7984 (6.607)***	0.8086 (8.629)***	0.8392 (9.730)***
CU	0.0111 (0.575)	0.0116 (0.881)	0.0124 (1.037)
Homoscedasticity Test	10.3811 (*LM*)	23.0395 (*Wald*)	--
Autocorrelation Test	--	15.3485 (*LM*)	23.7690 (*L*)
Log-likelihood Function	-207.2938	-201.6059	-189.7214

Dependent Variable	E_m		
	Model 1	**Model 2**	**Model 3**
Intercept	0.4487 (2.761)*	0.4386 (3.211)**	0.5503 (4.148)***
G_m	0.2016 (1.668)*	0.1914 (2.043)*	0.1608 (1.864)*
CU	-0.0115 (-0.575)	-0.0116 (-0.881)	-0.0124 (-1.037)
Homoscedasticity Test	10.3811 (*LM*)	23.0395 (*Wald*)	--
Autocorrelation Test	--	15.3485 (*LM*)	23.7690 (*L*)
Log-likelihood Function	-207.2938	-201.6059	-189.7214

Note: Refer to Table 1.

The estimation of second law using the TSCS technique provides us supportive results. Therefore, the relationship between the productivity growth in the manufacturing sector to the growth of output in manufacturing seems to be confirmed. This leads us to the second approach of estimation.

Using the TSCS technique, the results for Equation (7) are presented in the Table 7. The results for Equation (7) show statistically significant coefficients. In general, we get strong support for this law in the region. We obtained the correct signs as predicted by the theory in the pooled regressions as well as the fixed effects model in the table below.

The result from the pooled TSCS regression imply that if the manufacturing output growth and non-manufacturing employment growth increases by one percent, the overall productivity will rise approximately between 0.276 to 0.330 and will decrease between 0.581 to 0.663 respectively. This significant correlation between output growth and the transfer of labour from diminishing or constant returns activities to the manufacturing sector are in line with the theory since the manufacturing sector is the most important sector in the economy as we have shown in the first law. This result can be used to illustrate the particular characteristic in the pattern of restructuring of the employment in the South East Asian economy.

Table 7
GroupWise Regression Model for Pooled and Fixed Effects Regression for Kaldor's Third Law [Equation (7)]

Dependent Variable	P_t		
	Model 1	**Model 2**	**Model 3**
Pooled Regression			
Intercept	0.1576 (3.768)***	0.1918 (5.401)***	0.2055 (6.441)***
G_m	0.3301 (11.893)***	0.2954 (10.677)***	
E_{nm}	-0.5805 (-9.031)***	-0.6691 (- 12.589)***	0.2765 (11.120)***
Homoscedasticity Test	35.7258 (*LM*)		-0.6631 (-
Autocorrelation Test	--	162.7215 (*Wald*)	13.781)***
Log-likelihood Function	-15.8484	6.8133 (*LM*)	--
		6.4562	7.6169 (*L*)
			10.2645
Fixed Effects Regression			
Intercept			
6. Indonesia	0.1010 (1.581)	0.1535 (2.896)***	0.1797 (3.595)***
7. Malaysia	0.0651 (1.038)	0.1217 (2.614)***	0.1426 (3.182)***
8. Philippines	0.2408 (3.723)***	0.3048 (3.575)***	0.3223 (3.685)***
9. Singapore	0.2475 (3.871)***	0.3091 (4.246)***	0.3226 (4.483)***
10. Thailand	0.1556 (2.728)***	0.1958 (5.379)***	0.2087 (6.022)***
G_m	0.34309	0.3147 (11.259)***	0.2937 (11.219)***
E_{nm}	(12.351)***	-0.7056 (-	-0.6955 (-
	-0.6320 (-9.629)***	13.429)***	14.125)***
Homoscedasticity Test			
Autocorrelation Test	38.9377 (LM)	158.8885 (Wald)	--
Log-likelihood Function	--	4.4150 (LM)	5.2874 (L)
	-11.325812	11.431837	14.075528

Note: Refer to Table 1.

The fixed effects model shows that our estimations are statistically significant and shows the correct signs for the parameter coefficients. The highest fixed individual effect is in the Singapore and the lowest is for Malaysia. This could mean that at zero manufacturing output growth and non-manufacturing employment growth, the overall productivity in the economy would rise approximately between 0.100 to 0.322 percent. This rise could be due to exogenous impact outside the manufacturing sector and intersectoral transfer of resources in the economy.

In justifying our finding, other alternative versions of the third law were tested. We ran the following equation to test the significance and validity of the third law based on Equation (7). The equations are:

$$P_t = \alpha + \beta G_m + \varepsilon , \quad (7a)$$

and

$$P_t = \alpha + \beta G_m + \delta E_a + \varepsilon , \qquad (7b)$$

This is where we regress the growth of total productivity of the economy on manufacturing output as one model. Then we estimate the growth of total productivity on manufacturing output and replace the E_{nm} variable in Equation (7) with E_a. The results are presented in Table 8.

Table 8
GroupWise Regression Model for Pooled Regression for Alternative Versions of Kaldor's Third Law [Equations (7a) and (7b)]

Dependent Variable	P_t		
	Model 1	**Model 2**	**Model 3**
Intercept	-0.0155 (-0.326)	0.0149 (0.320)	0.0105 (0.281)
G_m	0.3023 (8.590)***	0.2550 (6.907)***	0.2364 (8.417)***
Homoscedasticity Test	20.4272 (*LM*)	50.7693 (*Wald*)	--
Autocorrelation Test	--	15.0292 (*LM*)	21.7676 (*L*)
Log-likelihood Function	-47.19546	-36.3622	-25.4784

Dependent Variable	P_t		
	Model 1	**Model 2**	**Model 3**
Intercept	-0.0177 (-0.375)	0.0116 (0.249)	0.0067 (0.179)
G_m	0.3026 (8.634)***	0.2562 (6.964)***	0.2386 (8.489)***
E_a	-0.0069 (-1.047)	-0.0063 (-1.078)	-0.0043 (-0.879)
Homoscedasticity Test	20.2826 (*LM*)	51.8366 (*Wald*)	--
Autocorrelation Test	--	14.5389 (*LM*)	21.2834 (*L*)
Log-likelihood Function	-46.6785	-35.8364	-25.1946

Note: Refer to Table 1.

The result for regression of total productivity (P_t) on manufacturing output growth shows satisfactory results. This imply that when the real manufacturing output growth increase by one percent, the total productivity growth in the economy will rise approximately between 0.236 to 0.302 percent. The parameter coefficient of G_m is highly significant. Therefore, manufacturing output growth is important for the total productivity growth in the economy. When we replace E_{nm} with E_a, the coefficient for E_a is statistically insignificant as an explanatory variable with the expected negative sign. However, the signs of the parameter coefficients are according to the theoretical expectation such that the total productivity growth in the economy is positively related with the growth of manufacturing output and negatively related to the employment growth in the agricultural sector. This will lead to an increase in the growth of productivity of agricultural sector due to transference of labours from agricultural to manufacturing sector. The third law is not unrelated to the famous Lewis (1954) model where labour moves from the indigenous subsistence sector to the modern exchange sector with the assumption that there are unlimited supplies of labour in the latter sector. The essence of the Lewis model depends on the capitalist surplus. If the surplus is reinvested, this will lead to greater capital formation and hence increase the total product of labour in the modern sector.

6. Conclusions

We have revisited Kaldor's growth laws and tested them for the South East Asian region. The study provides some empirical view of the sources of South East Asian growth for the last 30 years. The results confirmed the importance of the manufacturing sector in the process of growth and development in South East Asia particularly Indonesia, Malaysia, Philippines, Singapore and Thailand. Kaldor's three laws seem to give satisfactory analysis of the growth process as far as the region is concerned.

We attempted to formulate a uniform explanation for the growth of output and productivity in five South East Asian countries. Our results did reveal some degree of uniformity especially for the first law. Our econometric study based on different techniques of estimation showed that the basis of the Kaldorian framework of growth and development is confirmed. Manufacturing output growth is prominent in influencing the total output growth as compared to other sectors of the economy.

The growth of the manufacturing sector has a strong impact on productivity growth in the sector itself. The manufacturing sector in the region exhibits static and dynamic economies of scale. As far as the third law is concerned, we found the relevant signs of the coefficients as predicted by the theory in our estimations with statistically significant results. In all, there is strong support for Kaldor's third law that the growth of the manufacturing sector will lead to the transference of labour from other sectors in the economy which raises productivity in these sectors.

While we are focussing on the importance of manufacturing, we are not totally ignoring the other sectors in the economy such as agriculture and services. The difference is that the agricultural and service sectors do not offer the same scope for the division of labour and specialisation within the sectors themselves. There is one question which needs to be asked; "Why is it that some countries manage to increase their rate of manufacturing output or production faster while others still lag behind, or in other words, what accounts for growth rate differences of manufacturing output?"

The explanation given by Kaldor lies partly in demand and partly in supply factors, and both combine to make fast rates of growth of manufacturing. From here, we can identify three sources, which govern demand. First, the rise in the real income per head has the greatest influence on the behaviour of consumer demand. The second source of demand comes from domestic investment, and finally, it originates from the changing structure of foreign trade. These factors combine to determine the growth of manufacturing output.

However, the constraints from the supply side are inevitable. These can be either in the form of a commodity or labour constraint. A commodity constraint is associated with a balance of payments constraint. We also need to know whether the rate of growth in manufacturing output is governed by balance of payments constraint on demand or by labour supply constraint.

The extent of industrialisation in the region is quite clear. The South East Asian policy of export-led growth tended to support the expansion and diversification of the manufacturing sector. The governments of South East Asian should encourage the transfer of resources from agriculture to industry in order to move into higher stage of growth and development

The empirical study on the region based on the Kaldorian framework of growth and development is to a large extent conclusive. The study showed that the estimates were highly robust and significant. The significant results act as validation not only of the theory itself but also the underlying concept of the three Kaldor's growth laws. The different estimation techniques indicate that the role of the manufacturing sector, as the 'engine of growth' is not illusory but very real.

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