Are the Kaldor–Verdoorn Laws Applicable in the Newly Industrializing Countries?

Vaishali Mamgain*

Abstract
The Kaldor–Verdoorn “laws,” the focus of this work, are a set of stylized facts which attempt to describe growth in an economy. This paper tests these stylized facts using macroeconomic data from newly industrializing countries. Results show that high rates of growth of manufacturing do not translate to high productivity rates in Singapore, Indonesia, Thailand, and Mauritius, but they do so in South Korea. A negative relation exists for Malaysia. This work questions the operation of Kaldor’s laws in the context of globalization and suggests a revision of the laws.

1. Introduction
Economists, since the dawn of the discipline, have tried to answer the most important question of them all: What makes economies grow? Although as a profession we seem to have become better at modeling and measuring growth, the answer to the big question remains elusive. With the developed world worried about slowing growth rates and the vast proportion of the underdeveloped world looking to grow, much is at stake. Answers to the growth riddle have been modeled in different traditions. The earliest attempts at modeling growth formally can be attributed to Adam Smith (1880). The recent work on endogenous growth (Romer, 1986, 1990) has as its genesis the growth models of Harrod (1939), Domar (1946), Solow (1956), and Arrow (1962).

Kaldor’s laws, the focus of this work, are a set of stylized facts which attempt to describe growth in an economy. This set of laws has few of the microeconomic underpinnings associated with the work of Romer (1986, 1990), although Verdoorn (1949) did provide a microeconomic model as the basis of the Kaldor–Verdoorn “law.” McCombie (1982) has shown that the technical progress function underlying Verdoorn’s law can be derived from a Cobb–Douglas production function, although there exists a second-order identification problem. Notwithstanding, the Kaldor–Verdoorn laws have been used in theoretical models of growth by Thirlwall (1986) and Amable (1993).

In spite of (perhaps because of) the sophistication of recent models of endogenous growth, empirically testing knowledge spillovers and learning-by-doing is a daunting task—ultimately the very intangibles that make growth economics challenging to model make it impossible to estimate (Benhabib and Jovanovic, 1989). Perhaps that explains the enduring popularity of the Kaldor–Verdoorn law as a test of endogenous growth (Cripps and Tarling, 1973; Perelman, 1995). Do these laws provide insights into the economic miracle of Southeast Asia? This work tests the laws with respect to the newly industrializing countries of South Korea, Singapore, Malaysia, Indonesia, Mauritius, and Thailand. It starts by laying out Kaldor’s laws and the controversies surrounding the laws. The data used in this study are discussed in Section 3 and the

* Mamgain: University of Southern Maine, Portland, Box 9300, ME 04104-9300, USA. Tel: (207) 780-5807; Fax: (207) 780-5507; E-mail: vaishali@usm.maine.edu.
results for South Korea and Singapore are discussed in Section 4. The evidence from Indonesia, Malaysia, Thailand, and Mauritius is presented in Section 5.

2. A Restatement of Kaldor’s Laws

Kaldor’s laws are the stylized facts which Kaldor used to explain the process of growth in an economy. The three laws have an internal consistency—manufacturing growth drives growth of the gross domestic product, increased production rates in the manufacturing sector increase productivity in this sector, which in turn increases productivity in other sectors. A formal presentation of these laws follows.

The First Law: The growth rate of an economy is positively related to the growth rate of its manufacturing sector.

This law has been interpreted by Thirlwall (1983) as providing evidence for the importance of the demand factors and the supermultiplier in determining the rate of growth of output. The view that manufacturing is higher in productivity than agriculture may find its origins in Smith (1880, Book I, p. 8): “The division of labour, however, so far as it can be introduced, occasions, in every art, a proportionable increase of the productive powers of labour. . . . This impossibility of making so complete and entire a separation of all the different branches of labour employed in agriculture, is perhaps the reason why the improvement of the productive powers of labour in this art does not always keep pace with their improvement in manufactures.”

Manufacturing as an “engine of growth” also has been discussed extensively in the “development economics” literature. Hirschman (1958) analyzes the forward and backward linkages associated with manufacturing, and Allyn Young (1928) and Rosenstein-Rodan (1943) talk about the increasing returns associated with the growth of the firm and the industry as a whole. A dissenting view is that of Bacha (1980) who states: “Agriculture is often treated as inherently low in productivity, industry as high in productivity. Empirical misconceptions, ideological biases, and class interests mingle together to explain such an anti-rural attitude.”

In addition to the controversy about giving one sector pre-eminence over the other, the formulation of Kaldor’s first law also has been criticized. It is argued that since the manufacturing sector makes up a sizable part of the gross domestic product, regressing the latter on the output of the manufacturing sector may give rise to spurious correlation. A better specification to test whether the growth of the manufacturing sector drives the rate of growth of GDP may be to regress the growth of the nonmanufacturing sector on the growth rate of the manufacturing sector. The preferred formulation of the first law is

\[ g_{nm} = \alpha + \beta g_m + \epsilon, \]  

where \( g_{nm} \) is the growth rate of the nonmanufacturing sector, \( g_m \) is the growth rate of the manufacturing sector, and \( \epsilon \) is a normally distributed error term.

The Second Law: An increase in the rate of growth of manufacturing output leads to increases in labor productivity in that sector. In the literature this is known as the Kaldor–Verdoorn law.

This may be viewed as an argument for the existence of increasing returns to scale in industry due to learning-by-doing, efficiency changes, etc. Of his findings, Verdoorn says: “One would have expected a priori to find a correlation between labor productivity and output, given that the division of labor only comes about through increases
in the volume of production; therefore the expansion of production creates the possibility of further rationalization which has the same effect as mechanization”—quoted in Boulier (1984).

This stylized fact is the basis of some models of cumulative causation. An industrialized country which faces no demand constraint can exploit economies of scale and get on an explosive growth path. This “fact” also has some significance for developing countries attempting to modernize based upon agricultural exports. This law has been estimated by Verdoorn (1949) as

\[ p_m = \alpha + \beta g_m + \epsilon; \quad \epsilon \sim N(0, \sigma^2_\epsilon), \]  

where \( p_m \) is the rate of growth of labor productivity in the manufacturing sector and is defined as a residual (the difference between the rate of growth of output, \( g_m \), and the rate of growth of employment, \( e_m \), in the manufacturing sector; i.e. \( p_m = g_m - e_m \)), \( g_m \) is the rate of growth of output in the manufacturing sector, and \( \epsilon \) is a normally distributed error term with mean zero and variance \( \sigma^2_\epsilon \).

Kaldor disagreed with Verdoorn’s formulation, arguing that it gave rise to a spurious correlation. Kaldor’s version of the law is represented as

\[ e_m = \alpha + \beta g_m + \epsilon, \]  

where \( e_m \) is the rate of growth of employment in manufacturing. Kaldor stated that if \( \beta \) is significantly different from one, then for every 1% increase in manufacturing output, employment must grow by less than 1%. This would imply that productivity increased with the growth of output:

Learning is the product of experience—which means, as Arrow has shown, that productivity tends to grow faster, the faster output expands; it also means that the level of productivity is a function of cumulative output per unit of time. . . . It is a dynamic rather than a static relationship between the levels of productivity and the scale of output—primarily because technological progress enters into it, and it is not just a reflection of economies of large scale production. (Kaldor, 1966)

Although he cites Arrow who modeled learning as a function of cumulative output, Kaldor uses Verdoorn’s law to connect productivity to the growth rate of output, not cumulative output.

**The Third Law: The productivity in the non-manufacturing sector increases as the rate of growth of manufacturing output increases.**

The third law posits the transmission of productivity increases to the nonmanufacturing sector. The manufacturing sector, as its output increases, draws forth surplus labor employed in other sectors of the economy. This reduces disguised unemployment, thus raising productivity in these sectors. It is estimated in the following form:

\[ p_{nm} = \alpha + \beta g_m - \gamma e_{nm} + \epsilon, \]  

where \( p_{nm} \) is the rate of growth of productivity in the nonmanufacturing sector, \( e_{nm} \) is the rate of growth of employment in the nonmanufacturing sector, and \( g_m \) is as defined above.

Kaldor may have based his “law” on the Lewis (1954) model in which labor moves from the rural “noncapitalist” sector to the “capitalist” sector. Although Kaldor uses Verdoorn’s law to explain endogenous growth in the second law, in his explanation of the third law he does not rely on the assumptions made by Verdoorn. In particular, in Verdoorn’s (1949) model wage rates are positively related to productivity. Increased
productivity would imply higher wages which might result in decreased labor use. Contrary to this, Kaldor assumes that the existence of surplus labor in the non-manufacturing sector keeps the wages from rising in the manufacturing sector despite increases in productivity. Increased labor demand in the manufacturing sector would reduce surplus labor in the nonmanufacturing sector and increase productivity in accordance with Kaldor’s third law.11 This increase in productivity is predicated on the fact that population growth does not lead to a net increase in the level of surplus labor in the nonmanufacturing sector.

McCombie (1981) has shown that the third law is nothing but a misspecified identity. His criticisms about the formulation, however, do not undermine the transmission of productivity that is supposed to drive the third law. If the level of manufacturing productivity is higher than the level of agricultural productivity, any movement of resources from agriculture to manufacturing must increase the overall productivity of the economy regardless of the growth rates of productivity in the different sectors. However, if the level of surplus labor in agriculture does not change, either because of an increased labor supply or due to the fact that increased wages in the manufacturing sector inhibit demand for labor, higher productivity in the manufacturing sector may not imply increasing productivity in agriculture.

In his critique of the third law, McCombie (1981) has looked at OECD data and shown that the manufacturing sector’s share of the total labor force and the total output produced are equal and about 0.35. In his dataset, the ratio of total to manufacturing productivity is close to one, which implies that there is not much scope for productivity to increase by a transfer of resources from the low-productivity to the high-productivity sector. However, in the data for the newly industrializing countries examined here, the level of productivity in manufacturing is consistently higher than the level of productivity in agriculture. The ratio of total to manufacturing productivity varies greatly between countries. For Singapore the ratio is close to one, whereas for South Korea it was 0.74 in 1981, 0.95 in 1989 and 0.70 in 1997. For Thailand the ratio ranges from 0.30 to 0.43. The same variability is observed in the share of manufacturing as a proportion of total output. For instance, in South Korea in the period 1960–88, the share of manufacturing in total output increased from 7% to 38%, while in Malaysia it increased from 14% to 25%, and in Thailand from 11% to 23%.

In this paper, no attempt is made to estimate the flawed specification of Kaldor’s third law. However, the differences in the level of agricultural and manufacturing productivity do lead us to believe that if labor was moving into the manufacturing sector the overall productivity of the economy would rise. This movement might be inhibited if there was a concomitant rise in wages in the manufacturing sector. The relationship between productivity and wages in the manufacturing sector is estimated since a positive relationship might imply a weak demand for surplus labor from agriculture with negative implications for agricultural productivity.

While the generality of the laws makes them easy to apply and interpret, the lack of a microeconomic model on which to base estimation leaves them open to interpretation and refutation. A major problem when running cross-country regressions is the assumption one makes about the level of technology extant in the countries studied. Rowthorn (1975a) points out that increased productivity may be due to the diffusion of technology from the more-industrialized to the less-industrialized country and may have little to do with any inherent characteristics of the manufacturing sector. See McCombie (1983) and Thirlwall (1983) for detailed critiques of the specification and estimation of these laws.
3. Data and Estimation

As economies which have experienced rapid rates of growth of manufacturing output, the newly industrializing countries seem natural candidates to test the validity of the Kaldor–Verdoorn laws. This section discusses these laws with respect to two sets of countries. The first group consists of Singapore and South Korea, the second group comprises the Mini Dragons—Malaysia, Indonesia, Thailand, and Mauritius. The choice of countries for the first group is forced by the availability of data from the same source. The dataset does not have a series for Taiwan, and has no data on productivity for Hong Kong. In the second group, the choice of Mauritius may be surprising. Its inclusion in this group is dictated by its aggressive move towards a light manufacturing sector such as textiles.

This estimation uses macroeconomic data that were collected by the World Bank for the period 1960–88. The first dataset has 117 observations, although productivity data are available for only 48 observations. The second dataset has 156 observations but only 65 have productivity statistics. (To update the information, supplementary data from the Asian Development Bank has been used. This covers the period 1980–97. However, it is not possible to compare the sources of data in the two series, so no claims are made about the comparability of the series. Unless otherwise stated all results are from the World Bank data.) The variables used in the analysis are the value added to manufacturing, agriculture and services at constant prices. The variable productivity is calculated by the compilers of the dataset as “Manufacturing Output per Person Employed.” As with all macroeconomic data, these variables are aggregate values and hence may not be the best tools to pinpoint the determinants of growth. Since the original laws were predicated and tested using aggregate data (Kaldor, 1966; Cripps and Tarling, 1973), this study follows suit. The more compelling reason for using macroeconomic data, however, was the lack of access to the Bank of Korea’s Census of Manufacturers microeconomic data. The third law has not been tested in its original formulation. The variables to do so are not included in the dataset. Figures for “Employment in Manufacturing” are given but “Total Labor Force Employed” is not available. Attempts to use other sources to complement these data were not successful.12

Using time-series data to estimate Verdoorn’s law to make a claim about returns to scale in industry is fraught with difficulty. Kaldor indicates that increasing returns to scale may be inferred if, upon regressing the rate of growth of employment on the rate of growth of output, the coefficient is about one-half. However, McCombie (1983) has pointed out that this result may be due to Okun’s law, and to infer anything meaningful about the returns to scale one would have to correct for variations in capacity utilization. It has not been possible to make these adjustments to the data since the author could not procure estimates of capacity utilization for the countries analyzed. Some of the objections to the specification of Verdoorn’s law have been addressed by Harris and Lau (1998). In their analysis of British industry, using time-series data, they have used error correction models to generate long-run estimates of capital and labor elasticity for British industry. They calculate the returns to scale for different regions and their results do show support for the Verdoorn thesis that there exist increasing returns to scale in the manufacturing industry. Given the data constraints, this approach was inappropriate in this paper. In particular, there are no data detailing sector-specific capital stocks or investment. (The variable available is economy-wide “Constant Price Gross Domestic Investment.”) While one could make the assumption that the entire investment was in the manufacturing sector, it would be
unwarranted and any attempts to deduce the elasticity of capital in manufacturing by estimating the coefficient of any capital stock based on “Gross Domestic Investment” is likely to be off the mark. Thus, although preliminary tests to check for cointegration, using the Johansen (1988) and the Johansen and Juselius (1990) methodology, yield that the system has two cointegrating vectors, the lack of sector-specific data makes any inference impossible.

4. Kaldor’s Laws in Singapore and South Korea

The First Law

The estimates for the first law are

\[ g_{GDP} = 0.04 + 0.377 g_m \]  
\[ (4.59) \quad (7.28) \]

\[ R^2 = 0.49, \quad DW = 1.54, \quad F(1,54) = 52.93, \quad P > F = 0.000, \]  

(5)

where \( g_{GDP} \) is the rate of growth of GDP, and \( g_m \) is the rate of growth of the manufacturing sector, and the \( t \)-statistics are in parentheses. The Ramsey \( \text{RESET} \) test was used to test the null that there are no omitted variables in the model: \( F(3,51) = 0.38, \quad P > F(3,51) = 0.76; \) we fail to reject the null, but since there is a large degree of collinearity in the specification this is not a surprising result. The data exhibit heteroskedasticity, and the feasible generalized least-squares estimates are presented below:

\[ g_{GDP} = 0.04 + 0.38 g_m \]  
\[ (4.69) \quad (7.41) \]

\[ \chi^2 = 54.98, \quad P > \chi^2 = 0.000, \]  

(6)

where the figures in parentheses are \( z \)-values and all other variables are as described above. To see whether South Korea and Singapore are significantly different, a dummy variable approach is used in the FGLS estimation:

\[ g_{GDP} = 0.023 + 0.16 DS + 0.41 g_m \]  
\[ (2.42) \quad (2.12) \quad (7.99) \]

\[ \chi^2 = 64.14; \quad P > \chi^2 = 0.000, \]  

(7)

where \( DS \) is the dummy variable for Singapore and all the figures in parentheses are \( z \)-values. Since GDP may be collinear with value added in manufacturing, the first law is also estimated as the relationship between the rate of growth of the nonmanufacturing sector and the manufacturing sector. The two countries in this sample appear to have different error structures and are estimated separately.\(^{13} \) The estimates for South Korea are given by the following equation:

\[ g_{nm} = 0.03 + 0.26 g_m \]  
\[ (2.15) \quad (3.12) \]

\[ DW = 1.5, \quad R^2 = 0.24, \]  

(8)

where \( g_{nm} \) is the rate of growth of the nonmanufacturing sector and \( g_m \) is as defined above. The \( \text{RESET} \) procedure was performed and we reject the null that there are no omitted variables. The data exhibit heteroskedasticity and correcting for this yields the estimates given below:
The data for Singapore exhibited serial correlation and the Cochrane–Orcutt procedure was used to correct for this:

\[ g_{nm} = 0.03 + 0.26 g_m \]

(2.23) (3.24)

\[ \chi^2 = 10.52, \ \text{P} > \chi^2 = 0.001, \] (9)

Thus, for Singapore and South Korea, the first law is significant in both specifications.

The Second (Kaldor–Verdoorn) Law

Verdoorn’s law is estimated for each country separately. It was found in preliminary data work that the nature of the relationship differed greatly between the two countries. The results for Korea are presented below:

\[ p_m = 0.002 + 0.52 g_m \]

(0.06) (2.35)

\[ R^2 = 0.17, \ DW = 2.3, \ F(1, 21) = 5.53, \ \text{P} > F = 0.03, \] (11)

where \( p_m \) is the rate of growth of productivity, \( g_m \) is the rate of growth of output in the manufacturing sector, and the figures in parentheses are t-statistics. The null of homoskedasticity was not rejected and the reset procedure was used to test the validity of the specification. \( H_0: \) There are no omitted variables in the model. This was tested using fitted powers of \( p_m \), \( F(3, 18) = 1.39, \ \text{Prob} > F = 0.28; \) the null in the model could not be rejected.

This law is also tested using data from 1980–97 obtained from the Asian Development Bank. For South Korea, the law is valid for this period too. The results are presented below:

\[ p_m = 0.05 + 0.32 g_m \]

(2.14) (1.77)

\[ R^2 = 0.12, \ DW = 1.58, \ F(1, 15) = 3.12, \ \text{P} > F = 0.0976. \] (12)

The Ramsey reset test yielded a test statistic of 1.17 and we fail to reject the null that there are no omitted variables. The data do not reveal the existence of heteroskedasticity. The results show that Verdoorn’s law does hold for South Korea, using both World Bank and ADB data. For Singapore, however, the model is wholly inadequate and this is exhibited in the estimates produced:

\[ p_m = 0.02 - 0.07 g_m \]

(0.48) (–0.25)

\[ R^2 = -0.04, \ DW = 2.02, \] (13)

where all the variables are as defined above and the negative \( R^2 \) is the adjusted \( R^2 \) value. The poor fit for Singapore may be explained by Alwyn Young’s (1995) findings. Questioning the “economic miracle” in Asia, he examines disaggregated data to find that rates of productivity growth have not been spectacular. Singapore, in particular,
is pointed out as a laggard in the productivity race. Young explains this by saying that in its effort to target “sunrise” industries the government in Singapore may be pushing firms to move up the technological ladder too fast for its workforce to take advantage of the learning-by-doing associated with producing technologically sophisticated products. Thus, firms evince lower productivity.

For Singapore, use of Asian Development Bank data (1980–97) reveals the cyclical nature of productivity. For the period 1980–85, the estimates of the Verdoorn law were similar to those obtained by using the World Bank data. However, there is a sharp divergence in the two series for the year 1986. For the ADB series, the rate of growth of productivity in 1986 was 10.87% whereas for the World Bank data it was –2.6%. Since there is a break in the ADB series in 1991–92, one cannot estimate Verdoorn’s law for the entire period. The estimates for the period 1980–91 are presented below:

\[
p_m = 0.02 + 0.27g_m
\]

\[
R^2 = 0.13, \quad DW = 1.41, \quad F(1, 8) = 2.41, \quad P > F = 0.16. \tag{14}
\]

The data do not reveal evidence of heteroskedasticity, but the Ramsey reset test rejects the null that there are no omitted variables. For Singapore, Verdoorn’s law does not hold even when the series is extended to 1991. However, on examining the data from 1993 to 1997, the most noticeable fact is the tremendous increase in the rate of growth of productivity. From negative rates of growth in the 1980s, the numbers range from 11.04% in 1993, 14.3% in 1994, 12.7% in 1995 after which they drop to 4.8% and 2.2% for 1996 and 1997, perhaps presaging the Asian crisis. Unfortunately, Verdoorn’s law could not be estimated since the series are I(2) and not enough observations exist to correct for this.

Since Verdoorn’s law has been so controversial, it has been respecified to incorporate exogenous demand and investment. These extensions of the model are presented below.

**Extensions**

An assumption of Verdoorn’s model was that the capital/output ratio was a constant. If one does away with that assumption (Rowthorn, 1979; McCombie, 1983), the model would include a term for the investment/output ratio. Although theoretical justification for using “Gross Domestic Investment” might be provided by Scott’s (1989) arguments that all forgone consumption constitutes capital stock, this author’s rationale for using the investment/output ratio is its use in the Kaldor–Verdoorn literature. For instance, McCombie (1983) has re-estimated the Kaldor and Rowthorn specification of the second law by including the investment/output ratio. The estimates for Korea are presented below:

\[
p_m = 0.05 + 0.61g_m – 0.05I/Q
\]

\[
R^2 = 0.16, \quad DW = 2.22, \quad F(2, 20) = 3.05, \quad P > F = 0.07, \tag{15}
\]

where \(I/Q\) is the investment/output ratio, all other variables are as described above, and the figures in parentheses are \(t\)-statistics. The rate of growth of output is still significant, but the investment/output ratio is not. Given that one does not have sector-specific estimates for investment, this result is not surprising. The reset procedure
rejects the model specification. For Singapore, including the variable investment/output in the model does not improve the fit of the Verdoorn law.

Rowthorn (1975b) has criticized the endogeneity inherent in the Verdoorn specification. Does a faster rate of growth of manufacturing drive the rate of growth of productivity, or is the causation in the opposite direction? To counter these objections McCombie (1981) has suggested that instrumental variables be used to estimate the law. This approach was used for South Korea. The instrument used is the “Price Index of Manufactured Exports.” It is correlated with the rate of growth of manufacturing goods but not with the rate of growth of productivity. The use of this instrument presumes that South Korean exports are not substantial enough to affect export prices—an assumption which may be unwarranted. However, the data available do not yield a better instrument. The use of this instrument upholds the result for the Verdoorn law for South Korea. The estimation used feasible generalized least squares, and an $AR(1)$ error structure was corrected for:

$$g_m = 0.02 + 0.46\hat{g}_m$$

(16)

$$\chi^2 = 4.79, \quad P > \chi^2 = 0.03,$$

where $\hat{g}_m$ is the predicted values obtained by regressing the rate of growth of manufactures on the export price index, and $p_m$ is the rate of growth of productivity in the manufacturing sector. For Singapore, the variable “Price Index of Manufactured Exports” was found to be uncorrelated with the rate of growth in manufacturing and the instrumental variables approach could not be tried.

What role do markets play in influencing productivity?:

It is dangerous to assign any single factor the leading role in that continuing economic revolution which has taken the modern world so far away from the world of a few hundred years ago. But is there any other factor which has a better claim to that role than the persistent search for markets? No other hypothesis so well unites economic history and economic theory. (Young, 1928)

Kaldor assumed that output growth would be demand-determined, hence exogenous. In an open economy, this would include exports and imports into the country. Dixon and Thirlwall (1975) have put forth a demand-determined growth model, wherein they use the following propositions.

Proposition I: The rate of growth of productivity is a function of the rate of growth of output (Verdoorn’s law).

Proposition II: The rate of growth of output is driven by the rate of growth of exports.

Proposition III: This growth rate of exports is in turn a function of domestic and foreign prices and the importing countries’ income elasticity of demand for these exports.

If one uses the first two propositions one can infer the following relation:

$$p_m = f(x_m),$$

(17)

where $p_m$ is the rate of growth of productivity in the manufacturing sector, and $x_m$ is the rate of growth of manufactured exports. This relationship was estimated for South Korea and the FGLS estimates are presented here:
where $p_m$ is the rate of growth of productivity, $x_m$ is the rate of growth of manufacturing exports and the figures in parentheses are $z$-values.

The Third Law

Although the dataset does not have information on employment in the nonmanufacturing sector, it does allow us to test Kaldor and Verdoorn’s assumptions regarding the relationship between wages and productivity. Verdoorn’s model assumes that wages increase with productivity, whereas implicit in Kaldor’s formulation of the third law is the assumption that wage increases, if any, in the manufacturing sector do not deter employment growth.\textsuperscript{15} To check which of these assumptions is borne out, the rate of growth of real wages is modeled as a function of the rate of growth of productivity:

$$w_m = \alpha + \beta p_m + \varepsilon,$$

where $w_m$ is the rate of growth of wages in manufacturing, $p_m$ is the rate of growth of productivity in the manufacturing sector, and $\varepsilon$ is a normally distributed error term.

The structure of the data is very different for South Korea and Singapore so they are estimated separately. For South Korea, the relationship between productivity and wage growth is positive and is presented below:

$$w_m = 0.04 + 0.44 p_m$$

$$(1.54) \quad (3.56)$$

$R^2 = 0.35, \quad DW = 1.59, \quad F(1, 21) = 12.69, \quad P > F(1, 21) = 0.001,$

and all variables are as defined above. $H_0$: Constant variance: $\chi^2(1) = 0.26, P > \chi^2 = 0.61$; we fail to reject homoskedasticity. The Ramsey reset test was performed and the null that there are no omitted variables failed to be rejected. For Singapore, the data suggest no relationship between the rate of growth of productivity and wages in the manufacturing sector.

5. Kaldor’s Laws in the Mini Dragons

Next, we look at Kaldor’s laws in the context of Malaysia, Indonesia, Thailand, and Mauritius, the so-called Mini Dragons. The first law holds quite conclusively although dummy variables are not statistically significant when included. The fixed effects specification is the preferred one:

$$g_{nm} = 0.03 + 0.28 g_m$$

$$(5.19) \quad (5.56)$$

$R^2 = 0.26, \quad DW = 1.60, \quad F(1, 87) = 30.88, \quad P > F = 0.00,$

where $g_{nm}$ is the growth rate of the nonmanufacturing sector, $g_m$ is the growth of the manufacturing sector, and the figures in parentheses are $t$-statistics. In the pooled dataset Verdoorn’s law does not hold for these countries. When estimated separately for each country the Verdoorn law holds only for Malaysia, although the relationship is a negative one. These results are shown below:
where $p_m$ is the growth rate of productivity and $g_m$ is the growth rate of manufacturing output. The data do not show evidence of heteroskedasticity. The Ramsey reset test was performed and the null that there were no omitted variables could not be rejected. For Malaysia, including the investment/output ratio in the explanation of productivity change yields the following results:

$$p_m = -0.06 + 0.11I/Q - 0.71g_m$$

$$R^2 = 0.57, \quad DW = 2.03, \quad F(2, 10) = 8.88, \quad P > F = 0.006,$$

(23)

where $I/Q$ is the investment/output ratio, the figures in parentheses are $t$-statistics, and the rest of the variables are as defined above. The null of constant variance failed to be rejected and the Ramsey reset test was conducted using fitted values of $p_m$. The null that there are no omitted variables failed to be rejected. The results for the rest of these countries are not significant and are not reported here. They are available on request.

Productivity explains wage changes very strongly in Thailand. The model estimated here is to see if concomitant changes in wages and productivity decrease the flow of surplus labor from the farms to the factories:

$$w_m = -0.005 + 0.93p_m$$

$$R^2 = 0.65, \quad DW = 1.85, \quad F(1, 14) = 28.45, \quad P > F = 0.0001.$$

H$_0$: Constant variance: $\chi^2(1) = 0.11, \ P > \chi^2 = 0.74$; the null fails to be rejected. Ramsey reset test: $F(3, 11) = 1.10, \ P > F = 0.39$; the null that there are no omitted variables fails to be rejected.

This relationship need not invalidate Kaldor’s third law completely. As in the Lewis (1954) model, as long as the difference in wages is substantial enough to attract labor from labor surplus sectors and the increase in productivity (and wages) in manufacturing implies a sustained flow of labor, the law might still operate.

### 6. Conclusion

Kaldor’s laws, although controversial both theoretically and empirically, provide a good first step to analyzing the growth process in an economy. As with any other cross-country regression, one must be careful about making assumptions about whether different countries are at different technological or development levels. For both sets of countries tested the first law holds convincingly. The rate of growth of manufacturing does increase the growth rate of the nonmanufacturing sector.

For South Korea, the Verdoorn law holds in its original form and with the use of an instrumental variable to correct for simultaneity. In Singapore, the rate of growth of manufacturing has no effect on productivity, although the use of Asian Development Bank data does show a sharp increase in labor productivity in the early 1990s. Young (1995) finds negative Total Factor Productivity growth for the period until 1991. Is the high rate of growth of labor productivity from 1993 to 1995 mirrored in positive TFP growth? Further research is necessary to ascertain this.
In the case of the Mini Dragons, the first law is significant, but the Verdoorn law does not have much explanatory power for any country other than Malaysia. In the latter, the growth rate of productivity decreases with the increase in the rate of manufacturing output. An attempt was made to estimate the effect of productivity increases on wages in the manufacturing sector and a positive relationship was found for Thailand.

“What, then remains of the Kaldorian laws?” to paraphrase the debate in the Economic Journal in the 1970s. It may be time to recast the law, not in Kaldor’s but in his teacher Allyn Young’s image. I refer to Young’s handwritten comments in the manuscript of Frank Knight’s Risk, Uncertainty and Profit which might provide an excellent starting point:

[External economies] are the economies (in general) of greater specialization and div. of labour. They come with an increase of output in the industry. . . . An increased output means more plants, of course, but the important thing is that they are not “similar establishments” but, in general, more highly specialized establishments. (1972, typed mss 1; quoted in Blitch, 1983)

This, then, could be the flavor of the new Kaldor–Verdoorn law—one that predicates that output increases, if they are generated in specialized plants, will be productivity-enhancing. To test this hypothesis, one will need information on the number of plants a firm owns and whether the degree of specialization differs between plants. So as Griliches (1994) suggests, it may be time to look more closely at the data, perhaps collecting primary data, instead of relying on data from far-off institutions which do not permit such breakdowns. Combining this hypothesis with the techniques developed in the measurement of made-to-order production by Gulledge and Womer (1986) and Camm (1984) may be the future of the Verdoorn law.

The confusion between Kaldor’s and Verdoorn’s assumptions about the connection between wages and productivity may be a reason to re-examine the third law. In its current form, it depends on the manufacturing sector attracting surplus labor from the nonmanufacturing sector, thus raising productivity in the latter. But the existence of a positive relationship between productivity in the manufacturing sector and productivity in the nonmanufacturing sector may be nothing more than a manifestation of a dual-sector development strategy, well pursued.

For South Korea and Thailand, this work shows that wages have been rising in consonance with productivity. At these rising wages, is demand for labor in the manufacturing sector still rising? If it is, then the rationale for Kaldor’s third law still holds. It is also possible that increased productivity in the nonmanufacturing sector may have more to do with the adoption of new techniques and inputs than the physical withdrawal of labor. Yet another scenario would unfold if increased wages prompted an industry to relocate to another country. Would Kaldor’s third law withstand the globalization of the economy?

References


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Notes

1. Rowthorn (1979) has shown that this microeconomic model yields, for the purpose of estimation, a system of equations that has problems of endogeneity.
2. McCombie (1982) distinguishes between the static and the dynamic versions of Verdoorn’s law. The former is a relationship between levels, the latter between rates of growth, of output and productivity.
3. This study was started well before the economic miracle of Southeast Asia was questioned by Young (1992) and Krugman (1994).
4. Smith (1880, Book I, p. 8) adds as a footnote to this comment: “It is one reason, but not the sole reason. The motive to improvement in the process of agriculture has been less energetic than in that of manufacture. For, first, the farmer is less able to appropriate the profit of an improved process but is constrained sooner to share it with the landlord; next, agricultural labor is ordinarily superabundant, and must be maintained out of the poor rate. Where land is plentiful, labor scarce, and the demand of the foreign market is considerable, the application of machinery to agriculture is as fully developed as it is to manufacture. Such is the case with the North-Western States of the American Union.”
5. It is not an uncontested idea and has been criticized by both neoclassical economists and the neo-Marxists. While neoclassical economists think that an undue emphasis on industrialization might lead to a misallocation of resources, the neo-Marxists think it leads to greater exploitation of the underdeveloped countries, by multinationals in the industrialized world.
6. Historically, one can look at the Meiji era policies in Japan as spurring growth by increasing agricultural productivity—thus producing a surplus for industrialization. In a theoretical model, Matsuyama (1992) shows that a precondition for increasing manufacturing productivity is an increase in agricultural productivity.
7. In a subsequent paper, Kaldor (1975) said that increasing returns to scale was not a precondition for the operation of the second or the third law. As long as industrial expansion represented a net addition to the effective use of resources and not just the transfer of resources, one could expect the laws to work.
8. Perhaps because of its simplicity, there has been furious debate about the specification of this law. For details see Kaldor (1975), Rowthorn (1979) and Thirlwall (1983).
9. “If $e_m = 0$ then there must be a perfect correlation between $p_m$ and $q_m$, but one which does not assert anything since it is the automatic consequence of measuring the same thing twice over” (Kaldor, 1975).
10. In his model, Lewis (1954) does state that the number of people working in the rural sector does not decline, perhaps owing to the increase in the number of working women. Since the
impetus to move to the capitalist sector was the difference in wages, Lewis’s condition of unchanging productivity in the rural sector might have been incorporated so as to keep the difference intact. (In both Kaldor’s and Lewis’ formulations, if productivity is measured as output per man-hour rather than output per man employed, one would not necessarily see an improvement in productivity.) The assumption of unchanging productivity may be too restrictive. As long as the level of productivity in the manufacturing sector exceeds the level of productivity in the agricultural sector, and hence the wage gap between the two sectors is maintained, the model would still work. Lewis was worried that decreasing the number of workers in the rural sector might reduce output which would turn the terms of trade against the capitalist sector. A view of the economy as a zero-sum game between agriculture and manufacturing could be too restrictive. It neglects the complementarity between the agricultural and industrial sector. Thirlwall (1986) has shown that higher rural incomes, by increasing the demand for industrial goods, may spur faster industrial growth.

11. Kaldor does not discuss what drives the flow of labor to the manufacturing sector when productivity in the nonmanufacturing sector increases. If withdrawing labor from the agricultural sector does not lead to a drop in output, labor productivity increases. Both average and marginal product are higher. Even though Kaldor does not ascribe to the marginal productivity theory of distribution, he must explain what sustains the flow of labor to the manufacturing sector, despite increasing productivity in the nonmanufacturing sector; i.e. what determines the reservation wage of migrant labor.

12. For instance, different sources did not agree about the number of labor employed in manufacturing, or total labor force employed.

13. The data for Singapore show serial correlation whereas the data for South Korea do not.

14. The null $H_0$: model has no omitted variables, $F(3, 17) = 2.5$, $P > F(3, 17) = 0.094$. The Cook–Weisberg test for heteroskedasticity was performed and the null of constant variance was not rejected.

15. I infer this from Kaldor’s work although, as discussed earlier, it is possible that increased wages in the manufacturing sector may not result in an absolute decline in labor employed. Increased labor use in the manufacturing sector is the key to the operation of the third law.