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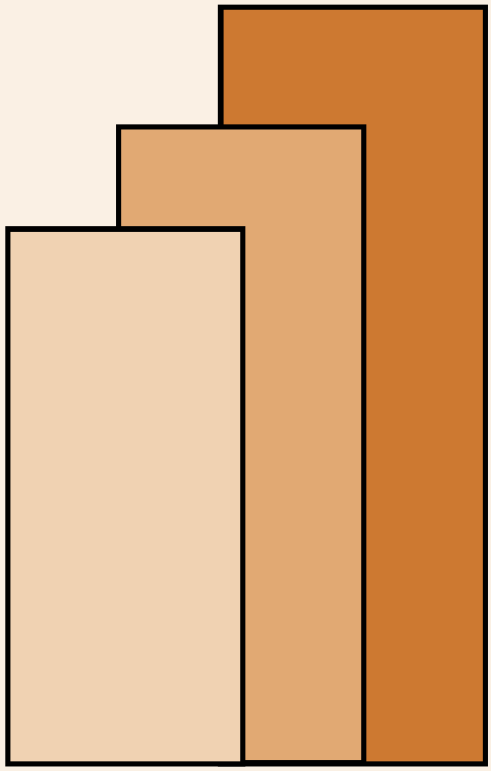

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For comments, suggestions or further inquiries please contact:
The Research Information Staff, Philippine Institute for Development Studies
3rd Floor, NEDA sa Makati Building, 106 Amorsolo Street, Legaspi Village, Makati City, Philippines
Tel Nos: 8924059 and 8935705; Fax No: 8939589; E-mail: publications@pidsnet.pids.gov.ph
Or visit our website at http://www.pids.gov.ph

Productivity Growth in the Philippines After the Industrial Reforms[1]

Myrna S. Austria[2]

Past studies have shown that productivity growth in the Philippines has been low compared to the other members of ASEAN. The country experienced positive productivity growth in the early 1950s but this has been declining and even registered negative growth in some periods. The poor productivity performance was attributed to the inward looking industrial policies of the country which prevented the efficient allocation of resources. The experience of developing Asian and Latin American countries who opted for outward oriented policies shows high productivity growth and hence, high and sustained economic growth.

Among the many policy instruments, trade and investment liberalization policies are considered to be the most important ones conducive to long term growth. However, whether the effects of trade and investment liberalization policies on economic growth are large and sustained depends on whether increases in trade and investments are accompanied by improvements in productivity.

Productivity is a crucial factor leading to sustainable economic growth. An economy will grow even without an increase in factor inputs if there is an increase in productivity. The negative and declining productivity growth of the country is a major policy concern, especially in the light of the issue of whether or not the favorable growth performance of the country in the last three years could be sustained. The experience of the exports sector in the recent past has also shown that higher productivity, and not the peso depreciation, is the key to the country's international competitiveness.

The country has embarked on major trade reforms since the 1980s by lowering tariff rates and removing import restrictions. The reforms were made, both as a unilateral effort of the government and as part of the country's commitment to WTO, APEC and AFTA. Investment reforms also started in the 1990s liberalizing the entry of foreign direct investments. This paper will examine the country's productivity performance and analyze whether or not trade and investment policies have had a significant impact on productivity growth. Specifically, has there been an improvement in TFP during the industrial and investment reform period? What explain changes in TFP growth?

The next section of the paper presents a review of existing literature on the productivity performance of developing countries, focusing on the ASEAN, and the effects which their trade and investment policies have had on their productivity growth. This is followed by the

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theoretical specification of the model and a discussion of the estimation results, including the factors affecting TFP growth. The policy challenges beyond 2000 are then addressed.

A Supply-side Analysis of Factors Affecting Economic Growth

Studies in the 1950s and 1960s on the causes of the wide variation in economic performance between countries have followed the pioneering work of Solow (1957) and Denison (1968) who emphasized the role of primary factor endowments (labor and capital) and productivity. The latter is measured as the difference between the growth of real output and the weighted growth of factor inputs. Hence, it is sometimes called the 'residual' since it includes anything not accounted for by factor inputs.

However, the debate in the 1970s on the relatively large magnitude of the unexplained residuals paved the way for considering non-factor inputs in a production function type of relationship that might have affected the differences in growth experience. The hypothesis on the externality effects of exports was very popular in the 1970s and 1980s (Balassa 1978, 1985; Michaely 1977; Heller and Porter 1978; Feder 1982). The technological spill-over hypothesis which argues that the technically backward countries (followers) tend to grow faster because they have greater potential for copying or transferring technology from the relatively advanced countries (leaders), also gained recognition in the 1980s as a factor explaining growth (Abramovitz 1986; Baumol 1986; Dowrick and Nguyen 1989; Dowrick and Gemmel 1991; Austria 1992). Other studies have also looked at macroeconomic factors (Kormendi and Miguire 1985; Austria and Martin 1995).

The different approaches to modelling growth, however, yield a common finding. That is, for the developed countries, TFP has been a substantial source of growth. For the developing countries, however, the contribution of factor inputs to growth has been much more important than that of TFP. These findings are also supported by the results of a recent large-scale World Bank study (1991). As shown in Table 1, capital accumulation accounts for about 65 percent of output growth of developing countries; labor contributes 23 percent and TFP 14 percent.

More recently, however, the findings of Young (1992) and Kim and Lau (1994) who examined the factors that brought about the economic miracle in East Asia, have caused increasing concern on the relatively low contribution of TFP to the growth of developing economies. Specifically, their finding that TFP has been zero, if not negligible, in Singapore has ignited debate in the literature as to its long run implications on economic growth (Krugman 1994). The argument goes that because of diminishing returns, countries whose growth relies on factor accumulation will not be able to sustain their economic growth. Thus, the increasing concern for productivity.

Table 1. Contributions of capital, labor and TFP to output growth (percent).

Region	Capital	Labor	TFP
Developing countries, 1960-87	65	23	14
Africa	73	28	0
East Asia	57	16	28
Europe, Middle East, and North America	58	14	28
Latin America	67	30	0
South Asia	67	20	14
Selected Developed countries, 1960-85			
France	27	-5	78
West Germany	23	-10	87
Japan	36	5	59
United Kingdom	27	-5	78
United States	23	27	50

Source: Lim (1994), Table 1.

The studies of Young (1992) and Kim and Lau (1994) on Singapore does not cover the 1990s. A more recent study by Rao and Lee (1995) on Singapore, however, showed an increased contribution of TFP in the more recent past. Specifically, TFP contributed 30 percent to the 1987-1994 output growth of Singapore which was slightly higher than the contribution of labor of 28 percent. While their finding is clearly a big departure from the findings of earlier studies, Rao and Lee (1995) expected the results they got considering the period covered by their study. They argued that the increased contribution of TFP during the period was the result of the economic restructuring in the 1980s, notwithstanding the 1985/1986 recession, and to the high calibre manpower in recent years. Based on their findings, they concluded that the Singapore growth experience showed that capital accumulation should be given priority during the initial stages of a country's development. Once the capital formation reaches a respectable rate and when growth appears to be slackening, higher education and skills expansion should characterize the next phase. This sets the stage for a high TFP growth and the process of maturing into a developed economy begins.

The study of Kawai (1994) shows that the Asian countries which experienced the highest GDP growth rates (Korea, Taiwan, Thailand and China) also registered the highest TFP growth rates (Table 2). Of the ASEAN countries, only Indonesia and the Philippines registered negative TFP growth rates for the period 1980-1990. The findings of Collins and Bosworth (1997) also show negative TFP only for the Philippines among the ASEAN-Four (Table 3). These recent studies on the Philippines reinforced the common findings of earlier studies that the average productivity growth of the country has been declining and even negative in various periods (Lampman 1967; Williamson 1969; Sanchez 1983; Patalinghug 1984; Austria and Martin 1995).

Table 2. Growth of GDP and TFP for selected developing countries in Asia and in Latin America (percent).

	GDP		TFP	
	1970-80	1980-90	1970-80	1980-90
Asia				
Korea	8.3	8.9	0.8	2.8
Taiwan	9.3	7.4	5.1	3.9
Singapore	8.6	6.8	0.7	1.6
Thailand	6.5	7.5	1.2	2.6
Malaysia	7.6	5.8	2.5	0.7
Indonesia	7.0	5.5	3.1	-0.1
Philippines	5.7	1.6	0.8	-2.2
India	3.0	5.4	-0.9	2.1
China	6.0	8.3	1.1	2.8
Latin America				
Chile	2.5	2.8	0.5	-0.1
Argentina	2.6	-1.2	0.1	-1.6
Mexico	6.4	1.6	1.1	-2.1
Brazil	8.2	1.5	0.4	-1.9
Colombia	5.3	3.4	0.8	0.4
Peru	3.7	-1.1	0.3	-3.0
Venezuela	3.1	0.7	-2.4	-0.6

Source: Kawai (1994), Table 1.

Table 3. Annual growth rate of TFP, ASEAN (percent).

Period	Philippines	Malaysia	Indonesia	Thailand
1960-73	0.7	1.0	1.1	1.4
1973-94	-1.1	0.9	0.7	2.1
1973-84	-1.3	0.4	0.5	1.1
1984-94	-0.9	1.4	0.9	3.3
1960-94	-0.4	0.9	0.8	1.8

Source: Collins and Bosworth (1997) as quoted in Felipe (1997).

Table 4. Average annual growth rate of real GDP, selected countries, 1965-1995 (percent).

Country	1965-70	1970-75	1975-80	1980-85	1985-90	1990-95
Indonesia	5.9	8.0	7.4	5.6	5.6	7.1
Malaysia		7.5	7.3	5.6	5.6	8.9
Philippines	5.1	5.8	6.3	-0.2	2.7	2.8
Singapore	12.9	10.3	7.8	6.8	6.9	9.0
Thailand	9.4	6.4	7.4	5.5	10.1	9.9
China				9.7	9.5	11.5
India	4.9	3.5	4.6	5.6	6.2	5.4
Korea	10.4	8.9	7.5	6.7	9.5	7.8

Source: International Financial Statistics, April 1997.

There has been a lot of considerable debate on the measurement of TFP since differences in methodology, especially in the methods of handling data and in the perception of where adjustments are needed, generate different results (Nadiri 1970; Felipe 1997). Nevertheless, the studies of Kawai (1994) and Collins and Bosworth (1997) which applied the same methodology for the countries covered and hence, yield comparable results, are consistent in their findings that TFP in the Philippines has been declining and that it is lower than the other ASEAN. Since sustainable growth requires continued improvements in productivity, the low and declining productivity in the Philippines has drawn considerable concern among policy makers in the country. The concern is also compounded by the fact that the country has the lowest GDP growth rate in the region (Table 4).

Trade and investment policies and productivity

Past studies have shown that the expansion of exports and imports and the increased inflow of foreign direct investment (FDI) resulting from trade and investment liberalization have contributed to the increase in productivity growth of the developing Asian and Latin American countries. On the other hand, import substitution resulted in the reduction of productivity growth in most cases in these countries.

Trade and investment liberalization policies influence productivity through various channels. The common argument stems from competitive pressure arising from the increase in imports and foreign companies that accompanies liberalization. To be able to cope with exposure to foreign competition and survive, domestic industries are forced to improve on their productivity through the development of new production techniques or making efficient use of factors of production. This is in contrast to a protectionist regime where the absence of foreign competition results to inefficient production of domestic industries. Likewise, the expansion of market across international borders permits industries to achieve economies of scale and hence, lower average costs, leading to higher productivity. Liberalization also forces industries to refrain from rent-seeking activities which, under protectionist policies lower productivity as resources shift away from productive activities.

Trade liberalization also offers a wider choice of high quality imported intermediate

inputs at lower prices resulting in improved productivity. On the other hand, the entry of foreign companies brings in technology and management know how which contributes to increasing productivity. FDI also increases the productive capacities of domestic industries if foreign companies are complementary to local companies.

The ASEAN, which are now regarded as newly industrializing countries by the World Bank (except the Philippines) because of their astonishingly high GDP growth rates in the late 1980s, have introduced if not accelerated trade liberalization policies and eased restrictions with respect to entry and capital ownership of foreign companies. To what extent have liberalization policies of the ASEAN contributed to their TFP growth? For Malaysia, although there was no clear-cut effect of import liberalization policy on TFP, the increased inflow of FDI resulting from FDI liberalization policies contributed to the increase in TFP (Okamoto 1994). The level of TFP was also higher for foreign than domestic companies but the gap has narrowed over time because of the transfer of efficient technologies from foreign to domestic companies through spill-over effects.

Trade liberalization in Thailand, on the other hand, generated a positive impact on TFP growth (Urata and Yokota 1994). As the country's trade liberalization efforts advanced in the 1980s, TFP improved through the intensity of domestic and international competitive pressure, wider choice of intermediate goods, expansion of output and R&D expenditures. For Indonesia, although TFP growth went up as a result of trade and investment liberalization, the improvement in TFP growth benefitted more from trade liberalization than from FDI liberalization (Osada1994). The study by Kajiwara (1994) on the Philippines covering the period 1974-1988, however, shows that trade and investment liberalization policies have not resulted to significant improvements to TFP. His finding is consistent with the fact that most of the significant reforms were made in the late 1980s up to the present.

Modelling Growth and Technological Progress: A Dynamic Approach

The empirical research on the sources of growth in the country have used the factor shares approach of decomposing growth into components due to factor accumulation and productivity. The factor shares approach assumes that production takes place in equilibrium at full employment so that shares of GDP accruing to each factor can be imputed. However, the macroeconomic crisis in the 1980s and the energy crisis in the early 1990s present particular difficulties in using the factor shares approach. The different crises the economy experienced have consistently put the economy out of equilibrium. The labor force, for example, does not appear to have been utilized at anything near full employment.

This paper uses cointegration techniques to allow inferences to be made about the long run structural relationships between output and its determinants while taking into account the dynamic influences which lead to short run deviations from equilibrium. The approach is intended to lead to a model which is both consistent with the theory and with the properties of the data. The following discussion draws heavily from an earlier work, Austria and Martin (1995).

Initial model specification. The fundamental framework in specifying the long run output relationship in the Philippine economy is the neoclassical production function which explains output as a function of capital, labor and technology as shown by,

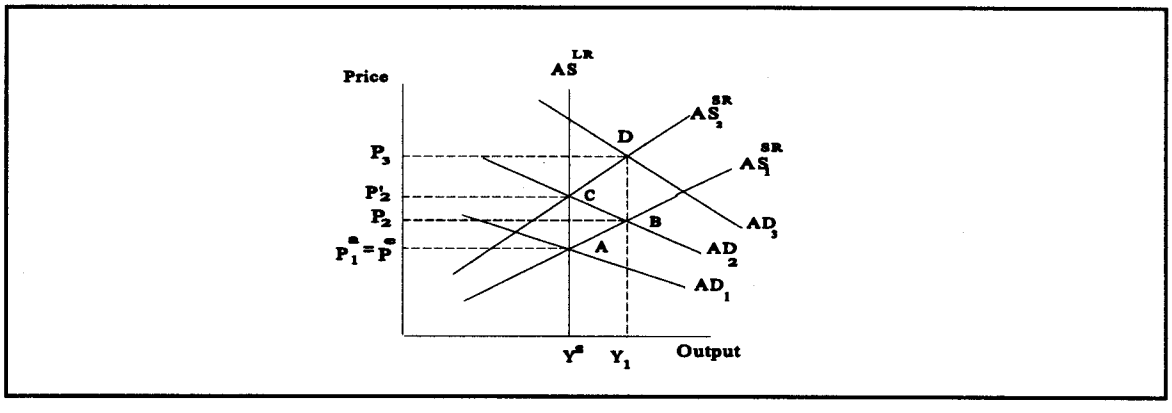
$$\log Y^s = a_o + \alpha \log K + \beta \log L + a_1 T \qquad (1)$$

where K, L and T are capital, labor and a trend variable designed to represent technology, respectively. However, this basic long run model is augmented to capture the dynamic effects of inflation on output. The supply hypothesis is that the deviation of actual employment from its natural level depends on the difference between actual prices and expected prices or between actual and expected inflation. In line with standard macroeconomic theory, changes in prices are postulated to affect real wages which in turn affect output.

Modern macroeconomic theory tells us that the effects of a price change on output depend on whether the price change is anticipated or unanticipated (Levacic and Rebmann 1982; Santomero and Seater 1978; Lucas 1973). Suppose the economy is initially in a long run equilibrium at point A, with output Y^s and with actual price P_1^a being equal to expected price P^e (Figure 1). At this price level, aggregate demand is AD_1 and the short run supply curve is AS_1^{SR}. Suppose there is an unanticipated increase in aggregate demand to AD_2 such that the increase generates a new price level P_2 while the expected price level remains P^e. Initially, price increases more rapidly than money wage and hence the real wage falls causing an increase in employment. Output expands along AS_1^{SR} and a temporary equilibrium occurs at B with output equal to Y_1.

After some period of time, wage bargainers adjust their expectations to conform with the new price level P_2 and hence demand a money wage increase. As the money wage rises to conform with the new price increase, the short run supply curve shifts to the left. Once the real wage has been restored to its desired level, the short run supply curve has shifted up to AS_2^{SR} and the economy moves to C with P_2' as the new price level. Output is back to its equilibrium level at Y^s.

Figure 1. Determination of aggregate output.



The adjustment towards C occurs so long as aggregate demand remains at AD_2. If, as the nominal wage adjusts to the new price level P_2, aggregate demand increases to AD_3, then the economy moves towards D (instead of B) with output still at Y_1 but with a higher price level, P_3. This process occurs so long as the money wage adjustment lags behind the price level change.

As shown in Figure 1, the long run aggregate supply is invariant with any steady state price level, giving rise to a vertical long run supply curve, AS^{LR}. The same analysis could be made assuming continuous inflation (Levacic and Rebmann 1982). The inflation rate is measured on the vertical axis instead of price. Each supply curve is associated with a particular expected rate of inflation. Output will rise if actual inflation exceeds expected inflation. If an increase in inflation is perceived immediately such that expected inflation increases by the same amount as the actual inflation, then there are no short run increases in output. Output remains at its equilibrium position.

The above theoretical relationships can be modelled by adapting the approach used by Helliwell *et al.* (1990) in modelling aggregate supply. In the short run, actual output is postulated to vary relative to steady state output in accordance with a Phillips curve type relationship. Inflation depends on the gap between actual and steady state output and expected inflation. In Helliwell *et al.* (1990), this is represented as,

$$\pi = \theta_1(\log Y - \log Y^s) + \theta_2\pi^e \qquad (2)$$

where π is the actual inflation rate, Y is actual output and π^e is the expected inflation rate. In fact, however, the theoretical discussion above makes it clear that it is output which depends upon changes in inflation rather than the reverse and so equation (2) is re-normalized to,

$$\log Y = (1 / \theta_1)\pi - (\theta_2 / \theta_1)\pi^e + \log Y^s \qquad (3)$$

Substituting equation (1) into equation (3),

$$\log Y = a_0 + \alpha \log K + \beta \log L + a_1 T + \kappa\pi - \zeta\pi^e \qquad (4)$$

where $\kappa = 1/\theta_1$ and $\zeta = (\theta_2/\theta_1)$. Equation (4) is an aggregate production function capturing the effects of actual and expected inflation on fluctuations in output.

If rational expectations are assumed, then $\theta_2 = 1$ and $\kappa = \zeta$. Equation (4) becomes,

$$\log Y = a_0 + \alpha \log K + \beta \log L + a_1 T + \upsilon(\pi - \pi^e) \qquad (5)$$

where $\kappa = \zeta = \nu$. In a stochastic world, there will generally be a divergence between the expected and the actual inflation rates in any particular time period. In the long run, expectations are always realized, that is, $\pi = \pi^e$; thus, equation (5) reduces to the standard neoclassical production function.

Dynamics. Our principal interest in the Philippine production function is in the long run relationship of the economic variables. However, the economy will not be in a long run equilibrium position at any particular time. This non-instantaneous adjustment to long run equilibrium values results primarily from costs of adjusting output in any given period to its desired level. Nickell (1985) has demonstrated that this factor can be modelled using error correction models (ECM). ECMs provide a way by which the dynamics of the adjustment process, both short run (changes) and long run (levels), can be modelled simultaneously. An important feature of this approach is that it ensures the consistency of the short run adjustment mechanism with the desired long run equilibrium position (Salmon 1982).

One simple first order ECM proposed by Nickell (1985) takes the form,

$$y - y(-1) = A[y^* - y^*(-1)] + B[y^*(-1) - y(-1)] \qquad (6)$$

where y is an endogenous variable (measured in logs); y^* is its desired long run equilibrium level; A is the coefficient of adjustment to short run changes; and B is the coefficient of adjustment to long run equilibrium changes or the coefficient of error correction (Murphy *et al*. 1986:18). For equations 4 and 5, the term $[y^*(-1) - y(-1)]$ in Equation (6) measures the deviation of actual output from its long run value.

The precise dynamic specification can take several forms and the appropriate choice depends on the dynamic properties of the variables (Salmon 1982). Discussion of the data and the data sources is found in the Appendix. The data were first tested of their order of integration using the augmented Dickey-Fuller (ADF) test[3]. The ADF tests show that output, labor and capital have exactly two unit roots, that is, they require second differencing before they are stationary series with constant mean and variance. On the other hand, inflation, expected inflation and the difference between inflation and expected inflation are integrated of order one. However, since these variables do not affect the long run estimates of the parameters, they do not need to be of the same order as the other explanatory variables.

Likewise, the ADF tests using the Hansen (1990) approach led to the conclusion that there is a cointegration between GDP and the explanatory variables. Therefore, a dynamic relationship among the variables which is not liable to the problem of spurious regression can be expected to exist.

Error correction models (ECMs). An error correction model of order two was applied to both equations (4) and (5). Following Murphy's *et al*. (1986:20) extension of Nickell (1985), a general ECM(2) is specified as,

$$y - y(-1) = A_1[y^* - y^*(-1)] + B_1[y^*(-1) - y^*(-2)] + C_1[y^*(-1) - y(-1)] + D_1[y^*(-2) - y(-2)] \qquad (11)$$

3In recent years, a concensus view has emerged that most macroeconomic variables are integrated of order one, that is, they require first differencing before they are stationary series with constant mean and variance. Failure to consider this property of the variables may lead to spurious regressions and hence, to misleading results.

Based on the above equation, ECM(2) for equations (4) and (5) are specified as follows:

$$CLGDP = A_1*[a_1 + \kappa C\pi + \zeta C\pi^e + \alpha CLK + \beta CLL] + B_1*[\kappa C\pi_1 + \zeta C\pi^e_1 + \alpha CLK_1 + \beta CLL_1] + C_1*[a_0 + \kappa\pi_1 + \zeta\pi^e_1 + \alpha LK_1 + \beta LL_1 + a_1T_1 - LGDP_1] + D_1*[a_0 + \kappa\pi_2 + \zeta\pi^e_2 + \alpha LK_2 + \beta LL_2 + a_1T_2 - LGDP_2] \quad (4a)$$

$$CLGDP = A_1*[a_1 + \upsilon CDIE + \alpha CLK + \beta CLL] + B_1*[\upsilon CDIE_1 + \alpha CLK_1 + \beta CLL_1] + C_1*[a_0 + \upsilon DIE_1 + \alpha LK_1 + \beta LL_1 + a_1T_1 - LGDP_1] + D_1*[a_0 + \upsilon DIE_2 + \alpha LK_2 + \beta LL_2 + a_1T_2 - LGDP_2] \quad (5a)$$

where a C in front of a variable name denotes a change in that variable (e.g. CLGDP denotes change in the log of GDP); a number at the end of a variable name denotes the order of lag (eg LK_1 denotes log of capital lagged by one year) and DIE is the difference between inflation and expected inflation rate.

A_1 and B_1 are the coefficients of adjustment to short run changes while C_1 and D_1 are the coefficients of adjustment to long run changes. κ and ζ measure the response of output to actual and expected inflation, respectively; α and β are the output elasticities with respect to capital and labor, respectively; υ is output's response to price surprises; a_1 is a measure of technological change or productivity; and a_0 is a constant.

The above ECM forms combinations of variables which are stationary and hence should allow valid inferences. In a steady state, no changes occur in the economy. Hence, the first and second terms in equations (4a) and (5a) become zero. The terms related to C_1 and D_1 are therefore the coefficients that measure the long run behavior of output.

Empirical Findings

Since the model is non-linear in parameters, equations (4a) and (5a) were estimated using a non-linear least squares (NLS) estimation technique (Table 5). Estimation was also done under the assumption of constant returns to scale Cobb-Douglas production function. Thus, the sum of output elasticities was constrained to unity.

The estimates of equation (4a) are all significantly different from zero. The larger magnitude of A_1 and B_1 relative to C_1 and D_1 indicates that the economy adjusts faster in response to short run changes or exogenous shocks than it does towards its long run equilibrium. The effect of a 10 percent increase in actual inflation rate is to lower output by 0.13 percent. This implies that the money wage adjustment is higher than the price level change. This increases the real wage and hence, lowering the output.

On the other hand, a 10 percent increase in expected inflation rate increases output by 0.16 percent. In the neoclassical sense, output increases only if inflation is unanticipated. However, an increase in output could occur if actual inflation rate is higher than the increase in expected inflation rate.

Table 5. Estimation results.

Variable	Equation (4a)	Equation (5a)
κ	-0.0013 (-1.89)***	
ζ	0.0016 (2.74)**	
υ		-0.0014 (-2.09)**
α	0.648 (8.75)*	0.649 (7.78)*
a_1	-0.004 (-2.58)**	-0.004 (-2.21)**
a_0	2.94 (3.96)*	2.94 (3.51)*
A_1	0.997 (6.5)*	0.99 (3.62)*
B_1	0.99 (5.65)*	0.98 (6.67)*
C_1	-0.38 (-3.27)*	-0.38 (-2.22)**
D_1	0.83 (5.82)*	0.82 (5.76)*
DW	2.07	2.07
R^2	0.73	0.73

Note: Number in parenthesis are t-ratios. Significance at 1, 5, and 10 percent are indicated by *, **, ***, respectively.

The elasticity of output with respect to capital is 0.65. Given the assumption of constant returns to scale, the output elasticity with respect to labor is 0.35. The higher estimates for α than β indicates that output increases by a greater amount with a unit increase in capital than with a unit increase in labor. The robustness of the estimates are shown not only by their significant t-values but also by their similarities with the average factor shares computed from the national income accounts. Labor's average share in GDP is also 0.35 for the period 1960-1996.

The estimate for a_1 shows that the average total factor productivity (TFP) growth for the country during the period 1960-1996 is -0.4 percent. The estimate is the same as that estimated by Collins and Bosworth (1997) for the period 1960-1994. While the estimate still supports a negative TFP growth for the country, the growth has improved as compared to the estimate of Austria and Martin (1995) of -0.6 percent for the period 1950-87. As will be discussed later in the paper, TFP growth has substantially improved during the past 10 years.

The estimates for equation (5a) are all significant also. The effect of the difference between actual and expected inflation on output as measured by υ, is -0.14 percent. This implies that the expected inflation rate exceeds the actual inflation rate thereby causing no price surprises resulting to a decline in output. The other coefficients are almost the same as those for equation (4a); thus, inferences about the results are the same.

The equality of κ and ζ was tested using an F-test based on the residual sums of squares (RSS) of the two equations. The test shows, at 1 percent significance level, that the hypothesis that these coefficients are equal cannot be rejected. Thus, equation (5a) in which this restriction was imposed is preferred over equation (4a).

Sources of growth. The findings show that growth in the country during the period 1960-96 is capital-driven, with capital contributing 75.9 percent to the 3.78 percent growth of output during the period (Table 6). This result is consistent with those obtained by earlier studies that by far, the most important source of growth in developing countries is capital accumulation. Labor, on the other hand, accounted for 26.7 percent and total factor productivity growth, -2.7 percent, of the total output growth.

Table 6. Sources of economic growth, Philippines, 1960-1996.

Average Annual Growth Rates (%)	
GDP	3.78
Labor	2.88
Capital	4.42
Growth Rates by Source (%)	
Capital	2.87
Labor	1.01
TFP	-0.10
Percentage Contribution to GDP Growth (%)	
Capital	75.93
Labor	26.72
TFP	-2.65

Productivity performance. This section examines the TFP performance vis-a-vis the different industrial regimes in the country. A detailed discussion of the industrial regimes is covered in Medalla (1998) which is also part of the same PIDS study mentioned earlier in the paper. But very briefly, during the period 1960-1980, the country was a classic case of the 'import substitution syndrome' based on the expansion of consumer goods production for the domestic market behind high protective walls, giving rise to import-dependent, inward-looking capital intensive industries. In the early 1980s, attempts were made towards opening up the economy and promoting exports but still, the overall industrial environment was highly protectionist.

The period 1986-1996, however, saw the gradual reduction of tariffs and the removal of import restrictions. There was a clear-cut change in trade policy in the 1990s as shown by the move towards a uniform tariff rate and the commitments of the country in WTO, APEC and AFTA. The liberalization of investments in the early 1990s was apparent as shown by the change in restrictions with respect to entry and foreign capital ownership. These reforms were also accompanied by the foreign exchange liberalization in 1992 and the continued deregulation in the services sector, making all the more clear the likely future direction of economic policies in the country.

While the average TFP growth during the period 1960-96 was negative, the annual performance shows a higher growth during the trade liberalization period (Figure 2). The productivity performance of the country was indeed low and declining during the trade protectionist regime. The growth of TFP was 0.185 percent during the period 1960-65; -0.186 percent during the period 1965-70; and 0.093 percent during the period 1970-1980 (Table 7). The improvement in TFP performance during the latter period could be due to the export promotion efforts in the late 1970s.

TFP growth worsened to -2.89 percent during the period 1980-86. While this period covers the first phase of the Tariff Reform Program, it was also a period of macroeconomic and political crisis for the country. The crisis brought uncertainty to the trade regime and unpredictability to the incentive structure. The uncertainty caused industries reluctant to

Figure 2. Annual TFP growth rate, Philippines, 1960-1996 (percent).

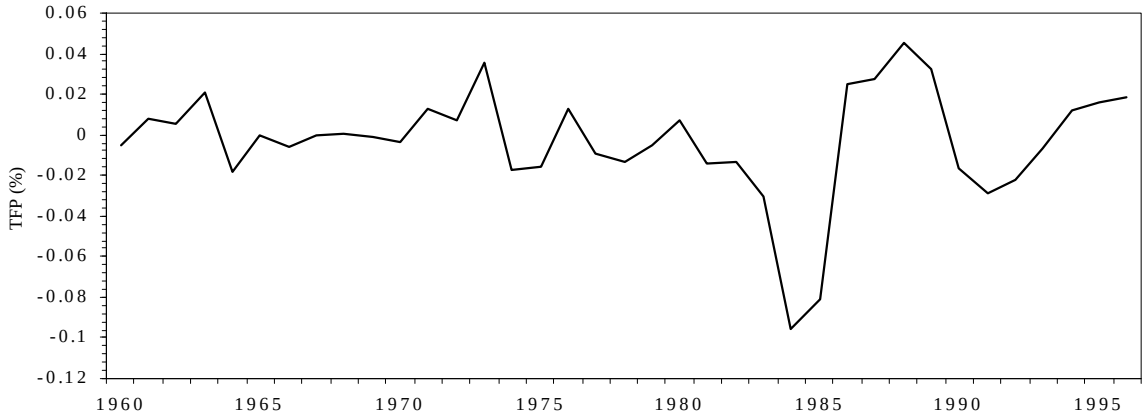


Table 7. TFP growth rate, by industrial regime.

Period	Industrial regime	TFP estimate (%)
1960-65	Decontrol	0.185
1965-70	Trade protection	-0.186
1970-80	Trade protection Export promotion	0.093
1980-86	Trade protection - TRP, Phase 1 Macroeconomic crisis Political crisis	-2.89
1986-96	Trade liberalization Investment liberalization Foreign exchange liberalization Energy crisis	0.93 2.12*

* Excluding 1990-1992.

incur the sunk cost of adjustment and hence, failed to adjust their productive capacity and production strategies to the new trading environment. The failure to adjust and the overall uncertainty of the macroeconomic environment resulted to the poor TFP performance.

The trade and investment liberalization period of 1986-96, however, is characterized by an improvement in TFP growth to 0.93 percent. TFP growth is much higher, however, at 2.12 percent if the energy crisis period of 1990-92 is excluded. While the period 1986-1996 covered two government administrations, the commitment for trade and investment reforms are more credible and stable. This credibility and stability of the reforms created an environment where firms and industries adjusted their productive capacities in response to the emerging trading environment, both local and international. The adjustment in turn facilitated an improvement in their productivity.

What Explain Changes in TFP Growth?

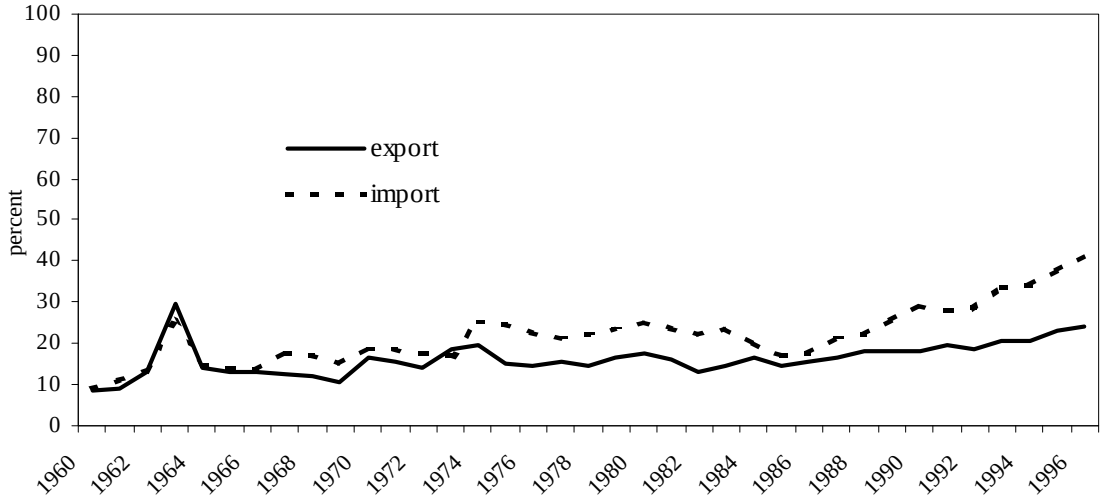
This section looks at how trade and investment policies affect TFP growth rates. To do this, TFP was regressed against trade and investment policy indicators. Again, the period covered was 1960-1996. The indicators include tariff rates, share of exports to GDP, share of imports to GDP, and foreign direct investments. The share of imports to GDP is used to capture the effects of trade liberalization not only by reducing tariff rates but also by reducing non-tariff measures.

The favorable effects of the reforms on exports and imports are shown by their increasing share in GDP (Figure 3 and Table 8). The share of imports to GDP during the period 1990-1996

was more than twice compared to the period 1960-1970. The share of exports also increased from 13.8 percent during the 1960-1970 to 20.7 in 1990-1996. Due to the incomplete time series data on nominal tariff rate covering the period 1960-1996, tariff rates were proxied by the ratio of tariff revenue over merchandise imports. Figure 4 shows the declining trend of this ratio since the early 1980s. Likewise, the share of FDI to GDP has increased significantly starting the 1970s (Figure 5). If the reforms made a significant favorable impact on TFP growth, the expected sign is negative for tariff rates and positive for the other three variables.

Aside from trade and investment policies, past studies have noted that countries which experienced macroeconomic instabilities registered low GDP and TFP growth rates despite their outward oriented policies. Inflation rate is therefore used here as another variable to proxy for macroeconomic policy instability.

Figure 3. Share of exports and imports to GDP, 1960-1996 (percent).



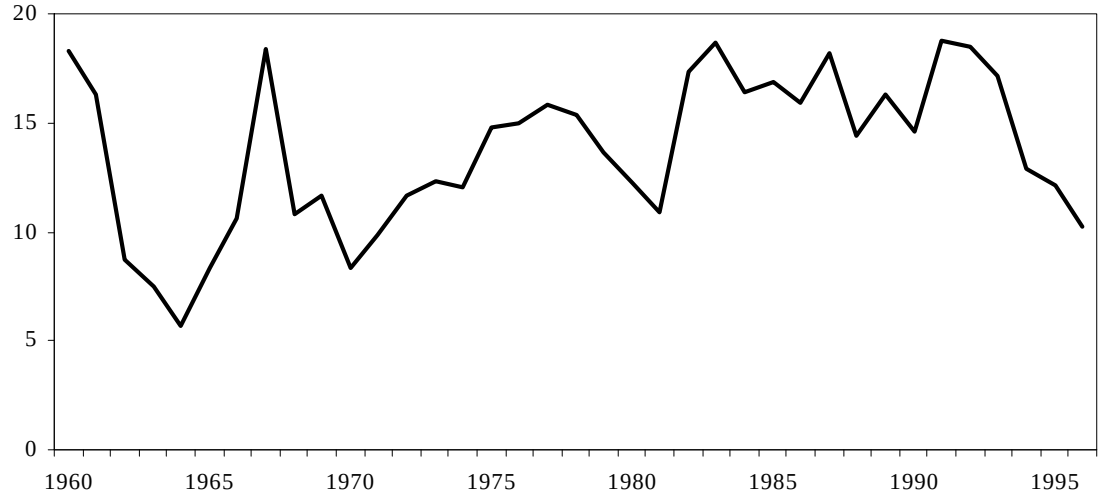
Source: National Income Accounts.

Table 8. Average share of exports and imports in GDP, 1960-1996 (percent).

Period	Exports	Imports
1960-70	13.8	15.4
1970-80	16.2	21.5
1980-90	16.4	22.4
1990-96	20.7	33.1

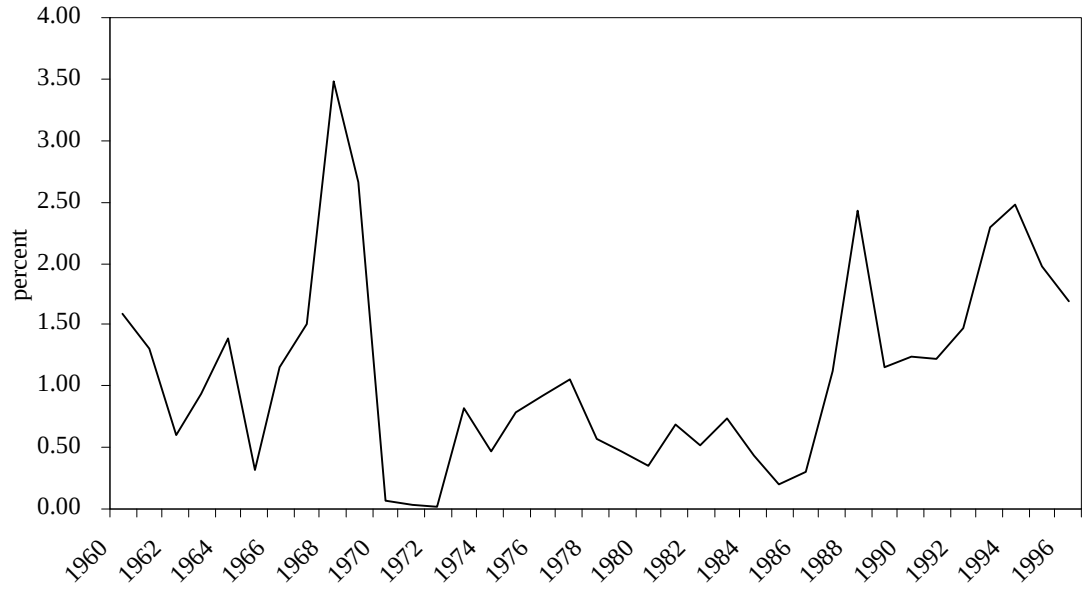
Source: National Income Accounts.

Figure 4. Tariff rates, 1960-1996 (percent).



Source: National Income Accounts.

Figure 5. Share of FDI to GDP, 1960-1996 (percent).



Source: Bangko Sentral ng Pilipinas; National Income Accounts.

Another factor influencing TFP is expenditures on research and development. However, this factor was not included in the estimation because of the non-availability of the data for the period covered.

The results show a significant positive impact of exports to TFP growth (Table 9). Contrary to what is expected, imports has a significant but a negative effect on TFP[4]. Why might this be so? Two possible explanations are raised here. First, an examination of the components of the country's merchandise imports shows that machinery, electrical machinery and transport equipment accounted for only a small portion of total imports. These are the type of imports which embody with them new techniques of production necessary for increasing productivity. These imports accounted for a combined share of 14 percent, 26 percent and 37 percent of total imports in 1985, 1990 and 1996, respectively. This implies that it is the type of imports and not the increase in imports per se that matters for imports to have a favorable impact on TFP growth. Second, while new production techniques are embodied in the imports of machineries and equipments, it is also equally important that there are corresponding manpower skills who can operate these machines and that capital utilization is maximized. Otherwise, they will just remain idle or inefficiently used. Considering that there are more capital costs to be paid by not operating the machines longer, productivity declines.

Tariff rate, on the other hand, has a negative, though rather weak, impact on TFP. It could be that the more relevant variable is the effective protection rate (EPR). Unfortunately, time series estimation of EPR are unavailable. Other studies have shown, however, that when protection is reduced at a moderate rate, the rise in productivity is highest; when protection is reduced at an excessively fast rate or when it is not reduced at all, the rise in productivity is low.

The coefficient for foreign direct investments has a positive value but it is insignificant (equation 1, Table 9). While it is argued that it takes sometime before FDI brings about productivity increases, the result of including a one-year lagged FDI as one of the determinants of TFP yields a positive though rather weak effect (equation 2). However, the effect of including both total FDI and FDI in manufacturing as determinants shows a significant positive effect of total FDI to TFP growth but a significant negative effect of FDI in manufacturing (equation 3). A possible explanation for the negative effect of FDI in manufacturing is that FDI may have led to oligopolies and that technologies transferred are labor-intensive. Also, it is possible that to the extent that multinational companies are oriented towards global rather than local profits, there may be less room for adaptation of technology to the local environment.

Finally, as expected, inflation rate indicating the degree of macroeconomic instability has a significant negative effect on TFP.

[4]Total trade(exports plus imports) as a percentage of GDP was also used as one of the regressors, instead of export share and import share. The result shows a positive but insignificant relationship.

Table 9. Determinants of total factor productivity, 1960-1996.

	Equations		
Variables	(1)	(2)	(3)
Constant	-0.016 (-0.69)	-0.018 (-0.76)	0.034 (0.53)
Share of Exports to GDP	0.005 (3.41)*	0.005 (3.31)*	0.008 (2.41)*
Share of Imports to GDP	-0.003 (-2.27)**	-0.002 (-1.99)***	-0.004 (-3.46)*
Tariff Rate	-0.83E-04 (-0.07)	-0.15E-03 (-0.13)	-0.002 (-0.99)
Inflation	-0.002 (-4.62)*	-0.002 (-4.91)*	-0.002 (-5.46)*
Foreign Direct Investment (FDI)	0.12E-05 (1.26)		0.33E-05 (2.14)**
FDI_{t-1}		0.11E-05 (1.01)	
FDI in the Manufacturing Sector			-0.11E-05 (-1.85)**
DW Statistic	1.94	1.89	2.09
Adjusted R^2	0.53	0.52	0.67

Note: t-values are figure in parenthesis. *, **, *** indicates significance at 1, 5, and 10 percent levels respectively.

Beyond 2000: Challenges

From the analysis above, it has been shown that there has been an improvement in the country's total factor productivity growth, at least during the period of industrial reforms. Given the crucial role of productivity in the country's quest for sustainable growth in the next millenium, the next question is how to sustain the improved TFP performance.

Enhancement of the country's international competitiveness. From the trade and investment policy indicators examined above, only exports has a clear-cut positive effect on TFP growth. The challenge therefore is how to enhance the country's international competitiveness

to be able to increase exports. Since the Philippine peso has depreciated the least from the ongoing currency crisis in the region, measures have to be taken to make the country's exports compete against its neighbors with weaker currencies. One of way of doing this is to ensure that the devaluation is maintained in real term and does not get dissipated in the form of higher inflation and wages.

However, it is also argued that higher productivity and not the peso depreciation is the key to international competitiveness and hence, exports. While it is tempting to raise a "chicken and egg" issue here, it is more important to understand the exports-productivity virtuous cycle. Trade and investment liberalization increases production and exports which in turn contributes to improvements in productivity through economies of scale production and competitive pressures from abroad. With the foreign exchange earned from the increased exports, firms can import high quality components and machines thereby further promoting productivity.

Another way to enhance exports competitiveness is for domestic manufacturers to adopt certification standards. Manufacturers must begin to adopt and internalize quality and environmental standards and their relevant tools such as hazard analysis and critical control point (HACCP) and good manufacturing practice (GMP). Without this, industries are in danger of losing their markets. The certification would increase the confidence of importers that the country's exports meet international quality and environmental standards and hence, reduce the probability of exports being rejected at the border. Industries, in partnership with the government, should therefore invest in testing facilities for ISO 9000 and ISO 14000 in order to meet the international quality and environmental standard requirements and their conformity acceptance.

Investment in vocational and technical education. As noted earlier, it is equally important that there are required manpower skills to operate the machines. While the country has a relatively high literacy rate compared to other East Asian countries, the country's educational system puts greater emphasis on general education as opposed to vocational and technical education. What is important, however, is an educational level that is high and that has the correct mixture of skills. The government should therefore provide incentives to increase investment in the provision of specialized technical skills and to encourage the demand for vocational and technical trainings.

Partnership with multinational corporations via FDI. The best way of transferring technology is to forge partnership with multinational corportations (MNCs). This strategy will modernize production and improve productivity as MNCs adopt the technologies they are used to at home. Likewise, to offset wage increases in developing countries, MNCs constantly seek to increase productivity.

The country, however, has not been as successful as the other developing countries in attracting foreign investments because of poor infrastructure (Table 10). The country has been losing not only with the other ASEAN but also with China whose share in total FDI of ADB's developing member countries (DMCs) is almost 55 percent during the period 1990-1995. As the

next millenium approaches, by which time tariff protection would have gone down globally, the state of the country's infrastructure will become even more critical in determining the attractiveness of the country as an investment site in the region.

Table 10. Average share in total FDI of ADB's developing member countries, 1985-1995(%).

Country	1985-90	1990-95
Philippines	5.71	3.20
Indonesia	8.15	7.72
Malaysia	15.85	17.57
Thailand	13.89	9.69
Vietnam	0.11*	0.17
China	41.64	54.61

* 1988-1990 only.

Source: Key Indicators 1997, ADB.

Appendix

Data and Data Sources

The period of analysis is 1950-1996. Output is measured by gross domestic product (GDP) at constant prices while inflation is measured using the GDP deflator. Data for both variables were taken from various issues of the *Philippine Statistical Yearbook*. Since the definition of labor force in the Philippines have changed markedly over the period under analysis, the working age population (age 15-64) was used to represent the labor force. Labor was not adjusted for quality as measured by education for the following reasons:

- lack of a suitable series on investment in human capital;
- Patalinghug (1984) found that the role of improved labor force quality due to education does not appear to be a substantial source of growth in the Philippines; and,
- Sanchez (1983) also found that TFP estimates are insensitive to the choice of labor input used in the estimation.

Capital stock and the expected inflation rate were generated following methods discussed below.

Capital stock. The capital stock (K) was estimated using investment data at constant prices starting in 1959. The series was estimated using the perpetual inventory method,

$$K_t = (1 - h)K_{t-1} + I_t \qquad (1)$$

where K_t is the capital stock at the end of each period; I_t is investment in each period; and h is the depreciation rate. Due to the non-availability of data for the depreciation rate (h), the rate was assumed to be 5 per cent based on an estimate similar to that for Thailand (Limskul 1988).

An initial value of the capital stock is required for the estimation of equation (1). Following Martin and Warr (1990), the logarithm of investment was first regressed against a time trend to obtain its average growth rate and a trend value of investment at the beginning of the sample, I_0. Making the conventional assumption that the capital stock was in a steady state at time t_0, K_0 can then be estimated as,

$$K_0 = I_0 / (g + h) \qquad (2)$$

where K_0 is the initial capital stock; g is the estimated growth rate of investment; and h is the depreciation rate.

Expected inflation rate. Expected inflation was estimated based on the assumption that expectations are formed rationally. Following McCallum (1976), the expected value of a variable is specified as,

$$Z^*_{t+1} = E(Z_+ / \varphi) = Z_+ - \eta \qquad (3)$$

where Z^*_{t+1} is the unobservable value of Z expected at time t to prevail at time t+1; Z_+ denotes the one-period-ahead value of Z so that Z^* represents anticipated values of Z_+; φ represents the information available and utilized by market participants in forming their expectations regarding Z_+; η is a random vector that is uncorrelated with φ; and E is the expectations operator.

The available information (φ) consists of past and present values of both the variable concerned and other exogenous variables involved in the process of expectation formation,

$$\varphi = [Z, Z_{-1}, Z_{-2}, ...Z_{-n}, X, X_{-1}, ... X_{-n}] \qquad (4)$$

The expected value of a variable is then estimated as the 'predicted' Z_+ obtained from regressing Z_+ on a matrix, W, of variables selected from φ. Any set of variables from φ can give consistent estimates. However, the values from the distant past would typically be poorer instruments than the ones more nearly contemporaneous with Z (McCallum 1976). In this study, three lagged values of the actual inflation rate were used as instruments.

References

Abramovitz, M., 1956. "Resource and output trends in the U.S. since 1970", *American Economic Review*, 46(2): 5-23.

Austria, M. 1992. *"Exports, technological progress and growth: the use of panel data"*, Economics Division Working Papers No. 92/2, Research School of Pacific Studies, The Australian National University.

_____ and Martin, W., 1995.*"*Macroeconomic instability and growth in the Philippines, 1950-87: a dynamic approach*"*, *Singapore Economic Review 40(1):65-81*.

Balassa, B., 1978. "Exports and economic growth", *Journal of Development Economics*, 5:81-189.

_____, 1985. "Exports, policy choices and economic growth in developing countries after the 1973 oil shock", *Journal of Development Economics*, 18:23-35.

Denison, E.,1968. *Why Growth Rates Differ,* Brookings Institutions, Washington D.C.

Dickey, D. and Fuller, W., 1979. "Distribution of the estimators for autoregressive time series with a unit root", *Journal of the American Statistical Association*, 74(366): 427-431.

Dowrick, S. and Nguyen D., 1989. "OECD comparative economic growth 1950-1985: catch-up and convergence", *American Economic Review*, 79(5):1010-1030.

Feder, G., 1982. "An exports and economic growth", *Journal of Development Economics*, 12:59-73.

Felipe, J., 1994. *Testing Endogenous Growth Models For Southeast Asian Countries:Acointegration Approach*, Paper presented during the International Conference on Modelling the Asia Pacific Economy, 24-26 August, Sydney, Manila.

_____, 1997. *Total Factor Productivity in East Asia*, Mimeo, Asian Development Bank, Manila.

_____ and McCombie, JSL., 1997. *Some Methodological Problems with Recent Analyses of East Asian Miracle.* Mimeo, Asian Development Bank, Manila.

Fujita, N., 1994. "Liberalization policies and productivity in India", *The Developing Economies*, 32(4):507-521.

Heliwell, J., Meredith, G., Durand, Y. and Bagnoli, P., 1990. "Intermod 1.1 A G7 version of IMF's MULTIMOD", *Economic Modelling*, 7(1):3-62.

Heller, P. and Porter R., 1978. "Exports and growth: an empirical re-investigation", *Journal of Development Economics*, 5(2):191-193.

Hendry, D., 1986. "Econometric modelling with cointegrated variables: an overview", *Oxford Bulletin of Economics and Statistics*, 48(3).

Holley, R.,1968. "Long-term growth of the Philippine economy, 1902-1961", *The Philippine Economic Journal*, 7(1):1-24.

Intal, P. Jr., *"Sustaining The Philippine Economic Resurgence"*, Paper presented during the Symposium in Honor of Dr. Gerardo Sicat and Dr. Jose Encarnacion, Jr., Philippine Institute for Development Studies, September 23-25, 1997.

Kajiwara, H., 1994. "The effects of trade and foreign investment liberalization policy on productivity in the Philippines", *The Developing Economies*, 32(4):492-507.

Kawai, H., 1994. "International comparative analysis of economic growth: trade liberalization and productivity", *The Developing Economies*, 32(4):372-397.

Kim, J. II and Lau, L., 1994. "The Source of Economic Growth of the East Asian Newly Industrialized Countries", *Journal of the Japanese and International Economies*, 8:235-271.

Kormendi, R and Meguire P., 1985. "Macroeconomic determinants of growth: cross-country evidence", *Journal of Monetary Economics*, 16:141-163.

Krugman, P., 1994. "The myth of asia's miracle", *Foreign Affairs*, November/December, 62-78.

Kwak, H., 1994. "Changing trade policy and its impact on TFP in the Republic of Korea", *The Developing Economies*, 32(4):399-421.

Lampman, R., 1967. "The sources of postwar economic growth in the Philippines", *Philippine Economic Journal*, 7(1):1-24.

Levacic, R. and Rebmann, A., 1982. *Macroeconomics : An Introduction of Keynesian-Neoclassical Controversies*, Second Editon, London, McMillan Publishers Ltd.

Levine, R. and Renelt , D., 1991. "A sensitivity analysis of cross-country growth regressions", *American Economic Review, 82(4):942-963.*

Lim, D., 1994. *"Exploring the growth performances of Asian developing economies",Economic Development and Cultural Change*, pp. 829-844.

Murphy C.W., Bright, I.A., Brooker, R.J., Geeves, W.D. and Taplin, B.K., 1986. "A macroeconometric model of the Australian economy for medium-term policy analysis", *Technical Paper No. 2*, EPAC, Canberra.

Nickell, S., 1985. "Error correction, partial adjustment and all that: an expository note", *Oxford Bulletin of Economics and Business,* 47(2):119-129.

Patalinghug, E., 1984. "Labor quality and growth accounting: the Philippines", *Philippine Review of Economics and Business*, 21(3&4):201-217.

Okamoto, Y., 1994. "Impact of trade and FDI liberalization policies on the Malaysian economy", *The Developing Economies,* 32(4):461-477.

Okuda, S., 1994. "Taiwan's trade and FDI policies and their effect on productivity growth", *The Developing Economies,* 32(4):421-443.

Osada, H., 1994. "Trade liberalization and FDI incentives in Indonesia: the impact of industrial productivity", *The Developing Economies*, 32(4):479-491.

Sanchez, A., 1983. *Philippine Capital Stock Measurement and Total Factor Productivity Analysis,* Unpublished PhD Dissertation, Manila University of the Philippines.

Solow, R., 1957. "Technical change and the aggregate production function", *Review of Economics and Statistics*, 39:312-320.

Tsao, Y., 1994. "Growth without productivity", *Journal of Development Economics*, 18:25-38.

Tybout, J., *1992.* "Linking trade and productivity: new research directions", *The World Bank Economic Review*, 6(2):189-211.

Urata, S., 1994. " Trade liberalization and productivity growth in Asia: introduction and major findings", In *Journal of The Developing Economies*, 32(4): 363-371.

_____ and Yokota, K., 1994. "Trade liberalization and productivity growth in Thailand", *The Developing Economies*, 323(4): 444-459.

Williamson, J., 1969. “Dimensions of postwar Philippine economic progress”, *Quarterly Journal of Economics,* 83(1):93-109.

Young, A., 1992. “A tale of two cities: factor accumulation and technical change in Hongkong and Singapore”, *National Bureau of Economic Research Macroeconomics Annual*, pp.13-63.