THE EFFECT OF ECONOMIC INTEGRATION ON ECONOMIC GROWTH: EVIDENCE FROM THE APEC COUNTRIES, 1989-2000

Donny Tang, University of Toronto, Canada

ABSTRACT
This study adopts the modified growth model to examine whether the APEC integration would promote economic growth among the member countries during 1989-2000. It also compares whether the developed and developing member countries would derive different growth-enhancing effect from the integration. To control for the endogeneity problem, this study re-estimates the modified growth model using the two-stage least squares method. First, the APEC integration has accelerated growth only among the developed countries. The developed countries with better infrastructures would derive higher growth effect from the integration than the developing countries. Second, the open trade facilitated by the APEC integration has contributed to higher growth in the developed rather than developing countries. The developed countries with tradable manufactured products would benefit more from trade increase than the developing countries with raw material products.

I. INTRODUCTION
During the 1990s, we witnessed major developments in economic integration in two continents. In Europe, the European Union (EU) has achieved a higher level of economic integration by adopting the common currency “Euro” in 2002. In the Asia-Pacific region, the Asia-Pacific Economic Cooperation (APEC) grouping has agreed to form a free trade area in 2010. The APEC includes all the major trading countries from three regions: America, Pacific, and Asia. Given its rapid integration in the past decade, the APEC has the full potential to become one of the largest trade blocs in the world.

There are two objectives in this study. First, it will focus on the effect of APEC integration on economic growth among the member countries. Specifically, the modified growth model will be developed to examine whether the APEC integration has facilitated higher growth among the member countries during 1989-2000. To control for the endogeneity problem of the explanatory variables, this study will re-estimate the modified growth model using the two-stage least squares method. Second, due to difference in infrastructure and technology, the developed and developing countries may derive different growth

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effect from the APEC integration. To account for this possibility, this paper will compare the growth-enhancing effect between the developed and developing member countries.

The contribution of this paper is two-fold. First, this will be the first empirical study to examine the APEC integration effect on economic growth. While most of the research on APEC has primarily focused on the trade effect, there has been no similar work on the growth effect to date. Given the APEC countries accounting for more than half of the world’s gross domestic product by the late 1990s, it is important to examine whether the APEC integration would promote higher economic growth among the member countries. Second, this study will further investigate whether the growth-enhancing effect of the integration may vary between the developed and developing member countries. While most of the previous studies have analyzed the growth effect on all countries in general, there has been a lack of in-depth study on the two country groups in particular. This paper will try to fill this literature gap by comparing the level of growth effect between the developed and developing member countries.

The remainder of the paper is organized as follows. The next section describes the latest development of the APEC integration. Section III reviews the literature related to the effect of economic integration on economic growth. Section IV outlines the methodology and data sources used in this study. Section V presents the empirical results and discusses their implications in light of the APEC integration for the past decade. Finally, section VI provides conclusions and suggestions for future research in this area.

II. OVERVIEW OF THE APEC DEVELOPMENT

The APEC was formed originally as a trade facilitation grouping for the Asia-Pacific countries in 1989. Adopting open regionalism principle, the objective of the APEC is to promote trade and investment liberalizations for both member and non-member countries. The APEC would extend the tariff reduction measures to member and non-member countries unconditionally. The APEC includes twenty-one major trading nations from three continents: North and South America (United States, Canada, Mexico, Chile, and Peru), Pacific (Australia, New Zealand, and Papua New Guinea), and Asia (Japan, South Korea, Singapore, Taiwan, Hong Kong, Malaysia, Thailand, Indonesia, Philippines, China, Russia, Brunei, and Vietnam). Given its rapid trade integration, the APEC will likely emerge as the most influential trade bloc in the world. In fact, its share of world trade has already surpassed that of the EU by the late 1990s, as it increased from 39 percent in 1990 to 47 percent in 1999 (World Bank, 2001a).

After merely five years since its formation, the APEC has achieved higher integration by committing to a free trade area (FTA) in the 1994 summit meeting. The APEC countries have shown their serious commitments in trade liberalization in the three summit meetings between 1994 and 1996. In 1994, the APEC clearly outlines the main objectives and time frame of launching the
FTA. At the subsequent summit in 1995, they specify more detailed procedures necessary to implement the objectives of the FTA. In sum, the FTA provisions consist of two major components: trade liberalization and economic and technical co-operation. The trade liberalization process includes a comprehensive coverage of border and domestic measures. In particular, it involves policy measures on tariff and non-tariff reductions such as custom procedures, rules of origin, standards and conformance, and competition policy. The subsequent provisions include the procedures to complete the implementation of the full-scale FTA by the year of 2010. In general, the major impact of the APEC FTA would not only limit to trade and welfare gains from the elimination of trade barriers, but also involve the harmonization of existing trade policies among the member countries (Ethier, 1998). The FTA would further promote trade among the member countries as it can replace the various trade preferences with standardized trade liberalization measures under the FTA provisions (Lloyd, 2001). The FTA will be first implemented by the developed countries in 2010 and subsequently by the developing countries in 2020 (Scollay, 2001). Nonetheless, some of these provisions will start to become effective in the late 1990s.

III. LITERATURE REVIEW

A number of empirical studies have examined the effect of economic integration on economic growth. These studies focus on whether higher trade facilitated by integration would promote economic growth among the integrating countries. In particular, Frankel and Romer (1999) test the effect of trade openness on growth. To resolve the potential endogeneity problem of trade variable, they use the instrumental variable (IV) method to estimate the trade effect on growth. The result indicates that high trade openness would indeed accelerate economic growth. Several recent studies also reach similar conclusion on this issue. Irwin and Tervio (2002) replicate the work of Frankel and Romer by using a much larger and more updated dataset covering 1913-1990. They find that countries with higher trade tend to grow faster than those with lower trade. A more comprehensive study by Frankel and Rose (2002) estimates the effect of trade openness on growth for 200 countries during 1970-1995. Using the IV technique, they confirm that countries with open trade orientation would experience higher growth than those with closed trade orientation. The study by Vamvakidis (2002) also supports this argument and further argues that the positive relationship between trade and economic growth only appears recently especially after 1970.

While a number of previous studies examine the effect of economic integration on economic growth, very few attempts have been made to analyze whether the growth-enhancing effect from integration may be different between developed and developing countries. Henrekson et al. (1997) conclude that the European integration has promoted economic growth among its member countries as expected. They also note that the developed countries generally derive higher growth effect from integration than the developing countries.
However, a more recent study by Greenaway et al. (2002) seems to contradict this result. Using the dynamic panel technique, they find that the developing countries are equally likely as the developed countries to achieve higher growth from trade expansion. Nonetheless, they point out that the growth-enhancing effect would take a while to appear as there may exist a time lag for the trade liberalization measures to take effect. In sum, most of these studies provide clear evidence that open trade facilitated by economic integration would have a positive effect on growth among the developed and developing countries (Frankel and Rose, 2002; Vamvakidis, 2002). This is especially true as more countries have adopted open trade policy to promote and sustain their economic growth during the 1990s.

IV. METHODOLOGY

**Modified Growth Model**

This paper will utilize the growth model to examine whether the APEC integration would facilitate higher economic growth among the member countries. The typical growth model would include three conventional variables to explain growth: initial GDP per capita, human capital, and population growth (Greenaway et al., 2002). In addition to these conventional variables, this study will modify the growth model to examine the effects of the APEC integration, trade openness, and investment on economic growth among the member countries. The basic specification of the growth model is first developed by Levine and Renelt (1992). The modified growth model derived in this study will be estimated by the ordinary least squares (OLS) method for 21 countries during 1989-2000. In sum, the use of the modified growth model in this study has two distinct features. First, this study is the first major attempt to examine the growth effect of the APEC integration on the developed and developing countries respectively. Trade would generally promote growth. The developed countries with better infrastructures would benefit more from trade increase than the developing countries. Therefore, trade openness enhanced by the APEC integration may lead to higher economic growth in the developed rather than developing countries. To test for this possibility, this paper will compare the level of growth effect between the two country groups. Second, to control for the cyclical effects in the data, the modified growth model will be estimated for the full period (1989-2000) and the three sub-periods (1989-1992, 1993-1996, and 1997-2000). For the past decade, a number of financial crises may have affected the trade and economic growth performances among the member countries. Specifically, the recession in North America and Asia during the early 1990s may decrease the trade flows and possibly impede economic growth among these countries. Furthermore, the Asian financial crisis in 1997 may worsen their economic growth performance by the late 1990s given their high trade and economic linkages. Hence, the subperiod estimation would allow us to determine whether certain subperiods (1989-1992 and 1997-2000) may be subject to the adverse effect of the financial crises.
The modified growth model used in this study is given as:

$$\log(GDP/Pop)_t = B_0 + B_1 \log(GDP/Pop)_{80,i} + B_2(Sch)_i + B_3(Pop%)_i + B_4 \log(Gov/GDP)_i + B_5(APEC)_i + B_6[APEC(DC)]_i + B_7[APEC(LDC)]_i + B_8\log[(X+M)/GDP]_i + B_9[APEC*\log(X+M)/GDP]_i + B_{10}[APEC(DC)*\log(X+M)/GDP]_i + B_{11}[APEC(LDC)*\log(X+M)/GDP]_i + B_{12}\log(Inv/GDP)_i + B_{13}[APEC*\log(Inv/GDP)]_i + B_{14}[APEC(DC)*\log(Inv/GDP)]_i + B_{15}[APEC(LDC)*\log(Inv/GDP)]_i + e_i$$  (1)

where

- $(GDP/Pop)_t$ = gross domestic product per capita of country $i$,
- $(GDP/Pop)_{80,i}$ = initial GDP per capita of country $i$ in 1980,
- $(Sch)_i$ = secondary school enrollment rate of country $i$,
- $(Pop%)_i$ = population growth rate of country $i$,
- $(Gov/GDP)_i$ = ratio of government expenditure to GDP of country $i$,
- $APEC_i = 1$ if country $i$ is APEC country and 0 otherwise,
- $[APEC(DC)]_i = 1$ if country $i$ is developed country of the APEC and 0 otherwise,
- $[APEC(LDC)]_i = 1$ if country $i$ is developing country of the APEC and 0 otherwise,
- $[(X+M)/GDP]_i$ = ratio of total trade (i.e., export plus import values) to GDP of country $i$,
- $[APEC*(X+M)/GDP]_i$ = interaction term between APEC dummy variable and trade openness of country $i$; APEC = 1 if country $i$ is APEC country and 0 otherwise,
- $[APEC(DC)*(X+M)/GDP]_i$ = interaction term between APEC dummy variable and trade openness of country $i$; APEC(DC) = 1 if country $i$ is APEC developed country and 0 otherwise,
- $[APEC(LDC)*(X+M)/GDP]_i$ = interaction term between APEC dummy variable and trade openness of country $i$; APEC(LDC) = 1 if country $i$ is APEC developing country and 0 otherwise,
- $(Inv/GDP)_i$ = ratio of gross domestic investment to GDP of country $i$,
- $[APEC*(Inv/GDP)]_i$ = interaction term between APEC dummy variable and investment of country $i$; APEC = 1 if country $i$ is APEC country and 0 otherwise,
- $[APEC(DC)*(Inv/GDP)]_i$ = interaction term between APEC dummy variable and investment of country $i$; APEC(DC) = 1 if country $i$ is APEC developed country and 0 otherwise,
- $[APEC(LDC)*(Inv/GDP)]_i$ = interaction term between APEC dummy variable and investment of country $i$; APEC(LDC) = 1 if country $i$ is APEC developing country and 0 otherwise, and
- $e_i$ = error term.

The first three regressors are the conventional growth variables. First, the initial GDP per capita variable, $(GDP/Pop)_{80,i}$, tests whether countries with lower initial income would grow faster than countries with higher initial income. The low income countries may derive higher growth effect than the high income countries due to increasing returns to technology innovation and marginal productivity of capitals (Dobson and Ramlogan, 2002). It follows that the initial
GDP per capita variable should have a negative effect on growth. Second, the secondary school enrollment rate variable, (Sch), measures the amount of human capital investment of a country. While investment in human capitals may involve more than schooling, other measures such as primary school enrollment rate and literacy rate would yield similar results. In addition, the secondary school enrollment rate remains the most satisfactory measure for human capital investment as the data for other alternative measures such as training are unavailable (Levine and Renelt, 1992; Temple, 1999). As pointed out in the growth literature, countries with more educated labor force tend to have greater abilities to innovate and absorb new technology from other countries, which are highly beneficial to enhancing growth (Edwards, 1998). Hence, the school enrollment variable should have a positive effect on growth. Third, the population growth variable, (Pop%), measures the annual rate of population growth of a country. The neoclassical growth theory predicts that higher population growth may slow down economic growth if the population growth is not offset by the proportional increase in capital accumulation and innovation (Temple, 1999). To maintain steady growth, countries should control their population growth rates in the long run. Therefore, the population growth variable should have a negative effect on growth. Fourth, the government expenditure variable, (Gov/GDP), is included to measure the effect of government spending on growth. Higher government expenditure would normally require large amount of tax revenue, which would result in less efficient resource allocation (Levine and Renelt, 1992). In that case, countries with higher government expenditure may experience lower growth. Hence, the government expenditure variable should have a negative effect on growth.

A total of eleven regressors are constructed to examine the effects of the APEC integration, trade openness, and investment on economic growth. Specifically, three dummy variables are used to measure the effect of APEC integration on growth among the member countries: APEC, APEC(DC), and APEC(LDC). First, the dummy variable, (APEC), measures the effect of the APEC integration on growth among the member countries. The member countries that are more open to other countries would have greater access to foreign innovation and knowledge, which would enhance growth in the long run (Henrekson et al., 1997). Therefore, the APEC integration should have a positive effect on growth. Second, the latter two variables, [APEC(DC) and APEC(LDC)], measure the effect of the APEC integration on growth among the developed and developing countries respectively. The developed countries with better infrastructures would derive higher growth effect from the integration than the developing countries (Lutz, 2001). Therefore, the APEC integration may result in higher growth in the developed rather than developing countries.

One of most crucial variables in the modified growth model is the trade openness variable. The trade openness variable, [(X+M)/GDP], measures the impact of open trade on growth. Countries with open trade policy would generally experience higher growth than countries with trade protectionist policy. This occurs as countries that are more open to trade may gain better access to new innovations and ideas from other countries, which would help
accelerate growth in the long run (Frankel and Rose, 2002; Vamvakidis, 2002). Hence, the trade openness variable should have a positive impact on growth. Moreover, given the fact that the APEC integration would promote higher trade openness, three interaction variables are constructed to examine the trade openness effect on growth among the member countries: APEC*(X+M)/GDP, APEC(DC)*(X+M)/GDP, and APEC(LDC)*(X+M)/GDP. First, the trade openness interaction variable, APEC*(X+M)/GDP, measures the trade openness effect on growth among the member countries. High level of trade openness promoted by the APEC integration would generally accelerate growth. Therefore, the APEC countries that increase trade with both member and non-member countries would achieve higher growth. Second, due to difference in infrastructures, two trade interaction variables, APEC(DC)*(X+M)/GDP and APEC(LDC)*(X+M)/GDP, are included to measure the trade openness effect on growth among the developed and developing member countries respectively. A positive value implies that trade openness facilitated by the APEC integration would accelerate growth among the member countries. As pointed out by the growth studies, the developed and developing countries may derive different growth effect from trade due to different level of investment in infrastructures. The developed countries with tradable manufacturing goods would benefit more from trade increase than the developing countries with raw material goods (Temple, 1999). In that case, while both country groups are equally open to trade, the developed countries may derive higher growth effect from trade than the developing countries do.

Finally, the investment variable, (Inv/GDP), measures the effect of investment on growth. High investment in physical capitals would spur more innovation, which is very beneficial for growth (Temple, 1999). Therefore, the investment variable should have a positive effect on growth. Moreover, as most of the APEC countries have adopted the trade-oriented policy to boost their economic growth, these countries generally maintain high investment in order to remain competitive in the export markets. Three investment interaction variables are used to measure the investment effect on growth among the member countries: APEC*Inv/GDP, APEC(DC)*Inv/GDP, and APEC(LDC)*Inv/GDP. First, the investment interaction variable, (APEC*Inv/GDP), measures the investment effect on growth among the member countries. The APEC integration would expand the size of export market for the member countries, thereby bolstering the incentives for more investment in research and development. This would help to promote higher growth among the member countries (Henrekson et al., 1997). Therefore, investment should have a positive effect on growth among the member countries. Second, two investment interaction variables, [APEC(DC)*Inv/GDP and APEC(LDC)*Inv/GDP], are included to examine the different investment effect on growth among the developed and developing countries respectively. The developed countries with more advanced technology would generally derive more benefit from higher investment than the developing countries. Hence, given higher returns to investment, the developed countries may experience higher growth from increased investment than the developing countries.
Endogeneity Problem of the Regressors

This study will properly estimate the modified growth model given the endogeneity problem in some of the explanatory variables. First, the common problem in estimating the trade openness effect on growth is related to the reverse causality effect. Trade would generally promote growth. However, the reverse causality effect may occur as countries with higher growth tend to trade more (Frankel and Rose, 2002). To resolve the endogeneity problem of trade openness variable, this study will re-estimate the modified growth model by using the two-stage least squares (2SLS) method. The instrumental variables for trade openness will include the five basic gravity variables derived by Frankel and Wei (1998): distance, population, geographical area, common language, and common border. These gravity variables are highly correlated with trade openness but are very independent of growth. Hence, the first-stage regression will estimate the trade openness equation by using the five basic gravity variables. The first-stage regression for trade openness variable is given as:

$$\log\left(\frac{(X+M)_{ij}/GDP_i}{(X+M)_{ij}/GDP_j}\right) = C_0 + C_1 \log(Distance)_{ij} + C_2 \log(Pop)_i + C_3 \log(Area_i*Area_j)$$

$$+ C_4 \log(\text{Language})_{ij} + C_5 \log(\text{Border})_{ij} + e_i \quad (2)$$

where $$(X+M)_{ij}/GDP_i = \text{ratio of total trade (i.e., export plus import values) to GDP of country i}$$,
$$(Distance)_{ij} = \text{geographical distance between countries i and j}$$,
$$(Pop)_i = \text{population of country i}$$,
$$(Area_i*Area_j) = \text{geographical area of country i multiplied by geographical area of country j}$$,
$$(\text{Language})_{ij} = 1 \text{ if countries i and j share the same language and 0 otherwise}$$,
and
$$(\text{Border})_{ij} = 1 \text{ if countries i and j share common border and 0 otherwise}.$$ 

In the second-stage regression, the predicted trade openness values derived from equation (2) will be substituted for the trade openness variable in equation (1). If the 2SLS result indicates that trade openness appears to be a crucial determinant of growth, it clearly confirms that trade openness would indeed promote growth in the long run.

Second, the effect of government expenditure on growth may also be subject to the reverse causality effect. Lower level of government expenditure may promote growth. However, countries with high growth may likely reduce government expenditure in order to boost growth. To resolve the endogeneity problem of government expenditure variable, this study will re-estimate the modified growth model by using the 2SLS method. The instrumental variables for government expenditure include total export as a share of GDP, total population, and initial income. These three variables are highly correlated with government expenditure but are very independent of growth. Again, the first-stage regression will estimate the government expenditure equation by using the
three instrumental variables. The first-stage regression for government expenditure variable is given as:

\[
\log(\text{Gov/GDP})_i = D_0 + D_1\log(\text{X}_ij/\text{GDP}_i) + D_2\log(\text{Pop}_i) + D_3\log(\text{GDP/Pop})_{80,i} + e_i
\]

(3)

where \( (\text{Gov/GDP})_i \) = ratio of government expenditure to GDP of country i, 
\( (\text{X}_ij /\text{GDP}_i) \) = ratio of total export to GDP of country i, 
\( (\text{Pop})_i \) = population of country i, and 
\( (\text{GDP/Pop})_{80,i} \) = initial GDP per capita of country i in 1980.

In the second-stage regression, the predicted government expenditure values obtained from equation (3) will be substituted for the government expenditure variable in equation (1). The result would indicate whether the decrease in government expenditure would indeed lead to higher growth.

Finally, a number of previous studies have pointed out that endogeneity problem may exist in the two conventional variables in the growth model, particularly investment and population growth variables. Some of these studies have attempted to resolve this problem by simply excluding these variables from the estimation of growth model (Frankel and Romer, 1999; Hall and Jones, 1999). However, the exclusion of these variables would bias the estimation as it may overly attribute the growth-promoting effect to other major variables such as trade openness (Frankel and Rose, 2002). To control for the endogeneity problem, this paper will estimate the modified growth model with the inclusion and exclusion of these two variables. The comparison of the results would suggest whether the endogeneity problem exists in these variables. More importantly, the results would also indicate whether this analysis would have any major effect on other regressors in the modified growth model.

**Measurements of Variables and Data Sources**

The data set covers the data on GDP per capita for 21 countries from 1989 to 2000. The country sample includes 14 APEC countries and 7 EU countries respectively: developed APEC countries (United States, Japan, Canada, Australia, New Zealand, Hong Kong, and Singapore), developing APEC countries (Malaysia, South Korea, China, Mexico, Indonesia, Thailand, and the Philippines), and EU countries (United Kingdom, Germany, France, Italy, Belgium, Netherlands, and Spain). The APEC countries are classified as either developed or developing countries based on their per capita incomes. The data on per capita incomes are obtained from the *World Development Indicators* (World Bank, 1998). Moreover, the EU countries are chosen as non-APEC countries as they have traded extensively with the APEC countries for the past two decades. Thus, due to data unavailability, seven APEC countries (Taiwan, Russia, Chile, Peru, Brunei, New Guinea, and Vietnam) are omitted from this study.
The dependent variable is the GDP per capita values in nominal U.S. dollars. The GDP per capita values are computed from dividing the nominal GDP values by the total population. Then, the nominal GDP per capita values are converted to the real GDP per capita values by using the U.S. GDP deflators of 1995. The data on the GDPs and U.S. GDP deflators are all obtained from the World Development Indicators CD-ROM (World Bank, 2001a). It is worth noting that the GDP values in this study are measured in U.S. dollars rather than in purchasing power parity (PPP) values because the latter measure may give biased results in the estimation. Although the PPP-based GDP is a useful indicator to measure the real wealth of a country, it may not accurately reflect the export supply and import demand situations of a country. The total amount of goods and services that a country would trade with other country depends largely on the GDP in U.S. dollars (Gros and Gonzalez, 1996). In that case, the GDP in U.S. dollars would give a better estimate of trade potential of a country compared to the GDP in PPP values.

Moreover, the three main regressors that are divided by the GDP values to measure their share of GDP include the government expenditure, investment, and trade openness variables: Gov/GDP, Inv/GDP, and (X+M)/GDP. The data on government expenditures (Gov) and investments (Inv) are obtained from the World Development Indicators CD-ROM (World Bank, 2001a) while the data on export and import values (X+M) are obtained from the Direction of Trade Statistics (IMF, various issues). To adjust for inflation, the trade data are converted to the real values by using the U.S. GDP deflators of 1995. Moreover, the data on initial GDP per capita in 1980 and secondary school enrollment rates are drawn from the International Financial Statistics (IMF, various issues) and the World Development Indicators 2001 (World Bank, 2001b) respectively. The data on population growth rates are taken from the World Development Indicators CD-ROM (World Bank, 2001a).

For the 2SLS estimation on trade openness and government expenditure variables, the data on total population and geographical area are obtained from the World Development Indicators CD-ROM (World Bank, 2001a). Thus, the data on geographical distances between countries are derived from the database on Surface Distance Between Points of Latitude and Longitude (Swedish University of Agricultural Science, 2001). Finally, the data on export values are taken from the Direction of Trade Statistics (IMF, various issues).

V. RESULTS

Equation (1) is estimated by the OLS and 2SLS methods respectively for the entire period and the three subperiods. The results are shown in Tables 1 and 2. The three conventional growth variables (initial income, school enrollment rate, and population growth) have the expected signs similar to those in previous studies. However, the two variables of most interest, trade openness and government expenditure, show very different results in both estimations. In particular, the 2SLS coefficient measuring trade openness consistently has higher magnitude than the OLS coefficient. The value of trade openness
coefficient substantially increases from 0.005 in OLS to 0.30 in 2SLS. The 2SLS result further supports the argument that countries with extensive trade would experience higher growth even after controlling for the endogeneity problem of trade openness variable. Moreover, similar result is also obtained for the government expenditure variable except with a more substantial increase in its magnitude. The value of government expenditure coefficient dramatically increases from 0.14 in OLS to 4.09 in 2SLS. The most interesting finding is that the use of 2SLS estimation actually increases the effect of trade on growth as opposed to the use of OLS estimation. To a certain extent, this may be attributed to the fact that the OLS estimation has somewhat understated the trade effect on growth. Trade may enhance growth through other interactions such as higher specialization in research and development and greater access to foreign innovation. In that case, the use of trade openness variable by itself may not fully reflect the growth-enhancing effects of these interactions on the member countries. Hence, the OLS estimation would likely understate the growth-enhancing effects of these interactions (Frankel and Romer, 1999).

To test for the endogeneity problem of the conventional variables, this study also estimates the modified growth model by excluding the investment and population variables. This would indicate whether the exclusion of these variables would affect the results on other crucial variables in the modified growth model. As expected, it has no major impact on the overall results previously obtained in Table 2. Specifically, the magnitude, signs, and significance of the three main variables (APEC membership, trade openness, and government expenditure) all remain the same for the entire period. All these suggest that the endogeneity problem does not exist in the investment and population growth variables. As mentioned earlier, the modified growth model should include the investment and population growth variables as their exclusion may lead us to overly attribute the growth-enhancing effect to other major variable such as trade variable (Frankel and Rose, 2002).

By and large, the 2SLS method would better estimate the modified growth model than the OLS method. The problem of two-way causality effect has been resolved by the use of 2SLS method for the four major variables (trade openness, government expenditure, investment, and population growth). As pointed out in previous studies, the instrumental variables used in this study are considered as good estimators for these major growth variables (Frankel and Wei, 1998; Frankel and Rose, 2002). The 2SLS results would reveal whether their strong relationships with economic growth could be largely due to the reverse causality effect. In fact, the 2SLS coefficients on trade openness and government expenditure consistently have higher magnitude than the OLS coefficients. This provides even stronger support for the substantial growth-enhancing effects of trade and government expenditure on the APEC countries. In addition, as reported in Tables 1 and 2, the 2SLS models clearly have higher explanatory power than the OLS models for the entire period (R² of 0.76 compared to R² of 0.73). Since the use of 2SLS in general would improve the estimation of the modified growth model, the rest of the discussions will focus on the 2SLS coefficients.
Conventional Growth Variables

As presented in Table 2, most of the conventional growth variables have the expected signs similar to those in previous studies. First, the result clearly supports the convergence hypothesis that poorer countries tend to grow faster than richer countries. The coefficient on $(\text{GDP/Pop})_{t0}$ is negative and statistically significant for the entire period, suggesting that the developing countries may achieve higher growth than the developed countries due to different returns to innovation and physical capital investment (Dobson and Ramlogan, 2002). This is especially true to the experience of the East Asian developing countries which have maintained higher growth for the past two decades. Second, the school enrollment rate has a positive effect on growth, as the coefficient on Sch is positive and statistically significant for the entire period. Those countries with more educated labor forces can quickly absorb new ideas and technology from other countries, which is highly beneficial for growth in the long run. In fact, the rapid growth in the APEC countries has been partly facilitated by their high investment in human capitals over the years (Nelson and Pack, 1999). Third, the only contrary result is that the population growth has a weak negative effect on growth. The population growth has positive rather than negative effect on growth for most of the periods, except for 1997-2000. To some extent, the common assumption that high population growth would be detrimental to growth may not be applicable to the APEC countries. Some studies even argue that other factors such as poorly implemented government policies may exacerbate the negative effect of population growth (Temple, 1999).

Finally, the result provides no evidence for the negative effect of government expenditure on growth. On the contrary, the increase in government expenditure has helped to promote growth among these countries, as the coefficient on Gov/GDP is positive and statistically significant for the entire period. This conclusion is further strengthened by the fact that the positive effect of government expenditure on growth actually increases after controlling for its potential endogeneity problem. The magnitude of the 2SLS coefficient on government expenditure is much larger than that of the OLS coefficient (4.09 compared to 0.15). This can be attributed to the fact that government expenditures may promote growth if they are allocated effectively (Levine and Renelt, 1992). When government expenditures are appropriately devoted to public goods that would enhance growth, they may help to accelerate growth among these countries in the long run.

Effects of the APEC Integration, Trade Openness, and Investment on Economic Growth

A central focus of this study is to investigate whether the APEC integration has promoted high growth among the member countries. When the member countries become more open to other countries, they may experience higher growth due to greater access to foreign innovation and investment (Henrekson et
As shown in Table 2, the APEC integration has not resulted in any growth-promoting effect on the member countries. Surprisingly, it has a negative rather than positive growth effect on the member countries right after its formation in 1989, as the negative coefficient on APEC is statistically significant during 1989-1992. Nonetheless, there seems to be a gradual decrease in its negative effect over time, as the coefficient changes from a statistically significant -1.79 in 1989 to a statistically insignificant -0.53 in 2000. This result is not entirely surprising given the fact that a number of APEC FTA provisions have started to take effect since 1996. More substantial growth-enhancing effect may gradually appear when more of these provisions become effective by the mid-2000s.

Given the differences in infrastructures, this paper will further examine whether the APEC integration has resulted in different growth-promoting effect on the developed and developing countries respectively. As expected, the developed countries clearly show higher growth effect than the developing countries for the entire period. First, the growth effect on the developed countries has increased considerably since the APEC formation in 1989, as the positive coefficient on APEC(DC) increases from 1.80 in 1989-1992 to 2.38 in 1993-1996. However, the growth effect seems to diminish slightly in the late 1990s, although the negative coefficient is not statistically significant. The East Asian financial crisis in 1997 can be possibly related to the small reduction in growth effect from 1997 to 2000. Second, in contrast to the developed countries, the developing countries generally experience much lower growth effect over the entire period. The coefficient on APEC(LDC) is negative during most of the 1990s. In sum, the overall result indicates that the APEC integration has caused higher growth-enhancing effect on the developed rather than developing countries. This supports the prediction that the developed countries with better infrastructures would generally derive higher growth effect from more innovation, economies of scale, and investment (Lutz, 2001). While the developed countries have achieved high growth in the past, the on-going APEC integration would help to sustain their high growth performance in future. On the other hand, the developing countries may show higher growth effect in this decade. As some of these countries become more industrialized, it is likely that they will derive the same growth effect as experienced by the developed countries.

Another crucial issue in this study is to examine whether trade openness would facilitate growth. The result in Table 2 indicates that the trade openness has a positive effect on growth for the entire period, as the positive coefficient on (X+M)/GDP is statistically significant from 1989 to 2000. More importantly, this result is also confirmed by the 2SLS estimation, which finds that the magnitude of the trade openness coefficient substantially increases from 0.005 in OLS to 0.30 in 2SLS. This strongly supports the claim that countries with extensive trade would generally experience higher growth than countries with lower trade.

In light of the recent trade integration, this paper will further examine the impact of trade openness on growth among the APEC countries. The APEC
integration which promotes high trade openness would likely accelerate growth among the member countries. However, the result provides very mixed support for this argument. In fact, the trade openness seems to have a negative effect on growth among the member countries in general. The negative coefficient on APEC*(X+M)/GDP appears to be statistically significant for the entire period, but it is not statistically significant for the subperiods. The lack of growth-enhancing effect from trade may be related to the timing of the APEC FTA implementation. While only a limited number of the FTA provisions become effective since the late 1990s, it may take at least a while before any substantial growth-enhancing effect will appear.

The developed and developing countries may derive different growth-enhancing effect from open trade due to different level of investment in infrastructures. In light of this view, this paper will examine whether the trade openness facilitated by the APEC integration would cause different growth effect on both country groups. Overall, the trade openness has resulted in higher growth effect on the developed rather than developing countries. As seen in Table 2, although both country groups have positive value of trade openness coefficient, the coefficient is statistically significant only for the developed countries during the entire period. More importantly, the effect of trade openness on growth has increased considerably among the developed countries after the APEC formation in 1989. The magnitude of the coefficient on APEC(DC)*(X+M)/GDP increases from 0.09 in 1989-1992 to 0.12 in 1997-2000. In contrast, the developing countries have not experienced similar level of positive growth effect during the same period. Although the coefficient on APEC(LDC)*(X+M)/GDP is positive during 1989-1996, it is not statistically significant at all. In sum, the overall result strongly confirms the positive relationship between trade openness and growth among the developed countries. The developed countries with tradable manufacturing products would benefit more from trade than the developing countries with raw material products (Temple, 1999). More generally, the developed countries with better infrastructure and technology can further accelerate their growth rates through trade expansion. This result is very significant as it suggests that open trade policy rather than trade protection policy is a more effective strategy to promote high growth in the long run (Vamvakidis, 2002). In addition, the lack of positive trade-growth relationship for the developing countries may be attributed to their reliance on trade protection policy for facilitating growth. Some of these countries have adopted the import substitution and high tariff policies to protect domestic industries from foreign competition (Lutz, 2001). These measures are often undertaken by the developing countries to accelerate and sustain their high growth. This may somehow explain why trade openness may become a less crucial factor in promoting growth for these countries.

Finally, this paper will investigate whether high investment would promote growth. Countries with extensive trade tend to have higher investment since most of their exports mainly involve capital-intensive products. It follows that more investment would facilitate high growth among these countries through further trade increase. However, the result in Table 2 provides rather mixed
support for this view. Although the coefficient on Inv/GDP is positive, it is not statistically significant for the entire period. This result is in sharp contrast to the previous studies, which often find a strong positive relationship between investment and growth (Levine and Renelt, 1992).

As most of the APEC countries have adopted the trade-oriented growth policy, they usually allocate higher investment in capital-intensive exports. In light of this argument, this paper will examine the impact of investment on growth among the member countries. While most of these countries depend on trade for enhancing growth, they would increase the investment in physical capital in order to complement their growing exports. Hence, more investment would normally lead to higher growth among these countries through trade increase. However, the result provides no support for this argument. The coefficient on APEC*Inv/GDP is positive and statistically significant during 1989-1992, suggesting that the increase in investment may accelerate growth among the member countries only in the early 1990s.

Given different returns to investment, this paper will further examine whether the investment effect on growth differs between the developed and developing countries. The results reveal that the increase in investment may contribute to high growth only among the developing countries. However, this finding is largely inconclusive as the coefficient on APEC(LDC)*Inv/GDP is positive and statistically significant only during the early 1990s. Nonetheless, the increase in physical capital investment would lead to more innovation, which helps to sustain high growth among the developing countries for the past two decades (Nelson and Pack, 1999). In addition, contrary to the prediction, the developed countries do not derive any growth-enhancing effect from high investment for the entire period. In fact, the coefficient on APEC(DC)*Inv/GDP is even negative for some of the periods, although they are not statistically significant at all. The result directly contradicts with the claim that the developed countries with better infrastructures would achieve higher growth from more investment than the developing countries. The lack of positive investment effect on the developed countries may be explained by the fact that they are switching their main production from manufacturing to service industries. Compared to the other growth-enhancing factors, investment may become a less significant factor in promoting growth for these countries. As pointed out by previous studies, the relationship between investment and growth may be rather weak in the long run since the overall return of investment to growth will likely diminish over time (Temple, 1999).

VI. CONCLUSIONS

Using the modified growth model, this study examines whether the APEC integration would facilitate higher economic growth among the member countries during 1989-2000. Given the difference in infrastructures, it further compares whether the developed and developing member countries would derive different level of growth-enhancing effect from the integration. To control for the endogeneity problem of the explanatory variables, this study re-
estimates the modified growth model using the two-stage least squares (2SLS) method. First, the results indicate that the APEC integration has promoted higher growth only among the developed countries. The developed countries with better infrastructures would derive higher growth-enhancing effect from the integration than the developing countries. Second, the developed countries derive higher growth effect from open trade than the developing countries. The developed countries with tradable manufactured products would benefit more from trade increase than the developing countries with raw material products. This conclusion is further confirmed by the 2SLS estimation, which finds that the trade effect on growth has actually increased among the developed countries especially after the APEC formation in 1989. The overall result supports the hypothesis that countries with extensive trade would generally experience higher growth than those with lower trade. Finally, the result provides very limited support for the growth-enhancing effect of investment on the developed and developing countries. The positive investment effect on growth is found only among the developing countries during the 1990s. Thus, the lack of positive investment effect on the developed countries may be due to the fact that they have switched their main production from manufacturing to service industries. Hence, the argument that more investment may contribute to higher growth among the member countries is still inconclusive.

While this study sheds some light on the APEC integration effect on economic growth among the member countries, it also suggests two new topics for future research. First, as the APEC integration has moved toward substantial trade liberalization, their business cycles would likely become more similar as found in the EU countries. Given their high trade interdependence, future studies should analyze whether trade integration would lead to similar business cycles among the APEC countries. Second, the monetary integration would help to promote economic growth in the long run. Previous studies have found that the adoption of common currency “Euro” has boosted economic growth among the EU countries by more than twenty percent. Future research should investigate whether the APEC countries would equally benefit from higher growth if they adopt the common currency scenario similar to the experience of the EU countries.
Table 1  Effects of APEC Integration, Trade Openness, and Investment on Economic Growth (Ordinary Least Squares Estimation)

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>3.990*</td>
<td>6.419*</td>
<td>4.452*</td>
<td>3.979*</td>
</tr>
<tr>
<td>(GDP/Pop)$_{i}$</td>
<td>(0.463)</td>
<td>(0.446)</td>
<td>(0.433)</td>
<td>(0.231)</td>
</tr>
<tr>
<td>(Sch)$_{i}$</td>
<td>0.203*</td>
<td>0.109*</td>
<td>0.142*</td>
<td>0.166*</td>
</tr>
<tr>
<td>(Pop%)$_{i}$</td>
<td>(0.011)</td>
<td>(0.012)</td>
<td>(0.011)</td>
<td>(0.007)</td>
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<tr>
<td>(Gov/GDP)$_{i}$</td>
<td>0.044*</td>
<td>0.055*</td>
<td>0.044*</td>
<td>0.045*</td>
</tr>
<tr>
<td>(APEC)$_{i}$</td>
<td>-2.213*</td>
<td>-0.195**</td>
<td>-0.888</td>
<td>-1.177*</td>
</tr>
<tr>
<td>[APEC(DC)$_{i}$</td>
<td>1.241</td>
<td>1.445*</td>
<td>-0.195</td>
<td>2.340*</td>
</tr>
<tr>
<td>[APEC(LDC)$_{i}$</td>
<td>-3.626*</td>
<td>-0.678</td>
<td>0.507</td>
<td>-1.155**</td>
</tr>
<tr>
<td>[(X+M)/GDP)$_{i}$</td>
<td>(1.207)</td>
<td>(1.048)</td>
<td>(0.875)</td>
<td>(0.521)</td>
</tr>
<tr>
<td>[APEC*(X+M)/GDP)$_{i}$</td>
<td>0.018</td>
<td>0.040*</td>
<td>-0.012</td>
<td>0.005</td>
</tr>
<tr>
<td>[APEC(DC)*(X+M)/GDP)$_{i}$</td>
<td>(0.015)</td>
<td>(0.016)</td>
<td>(0.015)</td>
<td>(0.009)</td>
</tr>
<tr>
<td>[APEC(LDC)*(X+M)/GDP)$_{i}$</td>
<td>-0.070*</td>
<td>0.044</td>
<td>-0.053**</td>
<td>-0.059*</td>
</tr>
<tr>
<td>[APEC*(Inv/GDP)$_{i}$</td>
<td>0.089*</td>
<td>0.056</td>
<td>0.098*</td>
<td>0.112*</td>
</tr>
<tr>
<td>[APEC(DC)*(Inv/GDP)$_{i}$</td>
<td>(0.034)</td>
<td>(0.035)</td>
<td>(0.033)</td>
<td>(0.020)</td>
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<tr>
<td>[APEC(LDC)*(Inv/GDP)$_{i}$</td>
<td>-0.115**</td>
<td>0.002</td>
<td>-0.109**</td>
<td>-0.056**</td>
</tr>
<tr>
<td>(Inv/GDP)$_{i}$</td>
<td>-0.184</td>
<td>-0.610*</td>
<td>-0.163</td>
<td>-0.074</td>
</tr>
<tr>
<td>[APEC*(Inv/GDP)$_{i}$</td>
<td>0.513*</td>
<td>0.243</td>
<td>0.150</td>
<td>0.208**</td>
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<tr>
<td>[APEC(DC)*(Inv/GDP)$_{i}$</td>
<td>(0.170)</td>
<td>(0.154)</td>
<td>(0.175)</td>
<td>(0.090)</td>
</tr>
<tr>
<td>[APEC(LDC)*(Inv/GDP)$_{i}$</td>
<td>-0.180</td>
<td>-0.314</td>
<td>0.331</td>
<td>-0.486*</td>
</tr>
<tr>
<td>[APEC*(X+M)/GDP)</td>
<td>0.794*</td>
<td>0.146</td>
<td>-0.482</td>
<td>0.146</td>
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<tr>
<td>Sample Size</td>
<td>1,677</td>
<td>1,677</td>
<td>1,680</td>
<td>5,034</td>
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Notes: Standard errors are given in parentheses.
* significant at the 1 percent level.
** significant at the 5 percent level.
Table 2  Effects of APEC Integration, Trade Openness, and Investment on Economic Growth (Two-stage Least Squares Estimation)

<table>
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</tr>
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<tr>
<td>Constant</td>
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<td>-0.138*</td>
<td>-2.302*</td>
<td>-2.354*</td>
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<tr>
<td>(GDP/Pop)$_{i0}$</td>
<td>(0.727)</td>
<td>(0.754)</td>
<td>(0.666)</td>
<td>(0.399)</td>
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<tr>
<td>(Sch)$_{i}$</td>
<td>-0.039</td>
<td>-0.098*</td>
<td>-0.162*</td>
<td>-0.120*</td>
<td></td>
</tr>
<tr>
<td>(Pop%)$_{i}$</td>
<td>(0.025)</td>
<td>(0.026)</td>
<td>(0.024)</td>
<td>(0.016)</td>
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</tr>
<tr>
<td>(Gov/GDP)$_{i}$</td>
<td>0.042*</td>
<td>0.049*</td>
<td>0.041*</td>
<td>0.042*</td>
<td></td>
</tr>
<tr>
<td>(APEC)$_{i}$</td>
<td>0.016</td>
<td>0.240*</td>
<td>-0.085*</td>
<td>0.052*</td>
<td></td>
</tr>
<tr>
<td>[(APEC(DC))$_{i}$</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.0007)</td>
<td></td>
</tr>
<tr>
<td>[(X+M)/GDP]$_{i}$</td>
<td>3.492*</td>
<td>3.043*</td>
<td>4.332*</td>
<td>4.911*</td>
<td></td>
</tr>
<tr>
<td>[APEC*(X+M)/GDP]$_{i}$</td>
<td>(0.333)</td>
<td>(0.353)</td>
<td>(0.311)</td>
<td>(0.199)</td>
<td></td>
</tr>
<tr>
<td>[APEC*(Inv/GDP)]$_{i}$</td>
<td>1.797*</td>
<td>2.376*</td>
<td>0.626</td>
<td>2.405*</td>
<td></td>
</tr>
<tr>
<td>[(APEC(DC))*(X+M)/GDP]$_{i}$</td>
<td>(1.112)</td>
<td>(0.981)</td>
<td>(0.848)</td>
<td>(0.525)</td>
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</tr>
<tr>
<td>[(APEC(LDC))*(X+M)/GDP]$_{i}$</td>
<td>0.272*</td>
<td>0.255*</td>
<td>0.279*</td>
<td>0.298*</td>
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<tr>
<td>[APEC*(Inv/GDP)]$_{i}$</td>
<td>(0.026)</td>
<td>(0.026)</td>
<td>(0.024)</td>
<td>(0.015)</td>
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<tr>
<td>[APEC*(X+M)/GDP]$_{i}$</td>
<td>(0.026)</td>
<td>(0.026)</td>
<td>(0.024)</td>
<td>(0.015)</td>
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<tr>
<td>[APEC*(Inv/GDP)]$_{i}$</td>
<td>(0.029)</td>
<td>(0.030)</td>
<td>(0.028)</td>
<td>(0.017)</td>
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<tr>
<td>[APEC*(X+M)/GDP]$_{i}$</td>
<td>(0.026)</td>
<td>(0.026)</td>
<td>(0.024)</td>
<td>(0.015)</td>
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<tr>
<td>[APEC*(Inv/GDP)]$_{i}$</td>
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<td>(0.076)</td>
<td>(0.067)</td>
<td>(0.042)</td>
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<tr>
<td>(Inv/GDP)$_{i}$</td>
<td>-0.164</td>
<td>-0.186**</td>
<td>-0.059</td>
<td>0.046</td>
<td></td>
</tr>
<tr>
<td>[APEC*(Inv/GDP)]$_{i}$</td>
<td>(0.102)</td>
<td>(0.093)</td>
<td>(0.106)</td>
<td>(0.053)</td>
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<tr>
<td>[APEC*(Inv/GDP)]$_{i}$</td>
<td>0.358**</td>
<td>-0.024</td>
<td>0.006</td>
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<tr>
<td>[APEC*(Inv/GDP)]$_{i}$</td>
<td>(0.155)</td>
<td>(0.139)</td>
<td>(0.161)</td>
<td>(0.083)</td>
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<tr>
<td>[APEC*(Inv/GDP)]$_{i}$</td>
<td>(0.197)</td>
<td>(0.159)</td>
<td>(0.214)</td>
<td>(0.103)</td>
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<tr>
<td>[APEC*(Inv/GDP)]$_{i}$</td>
<td>0.549**</td>
<td>0.035</td>
<td>-0.141</td>
<td>0.249</td>
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<tr>
<td>Adjusted R$^2$</td>
<td>0.775</td>
<td>0.751</td>
<td>0.779</td>
<td>0.758</td>
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<tr>
<td>Sample Size</td>
<td>1,677</td>
<td>1,677</td>
<td>1,680</td>
<td>5,034</td>
<td></td>
</tr>
</tbody>
</table>

Notes: Standard errors are given in parentheses.
* significant at the 1 percent level.
** significant at the 5 percent level.
ENDNOTES

1. Results are available upon request.

2. An anonymous referee kindly points out this argument.
REFERENCES


International Monetary Fund. Direction of Trade Statistics (IMF, various issues).


