THE PHILIPPINE REVIEW OF ECONOMICS
Vol. XLIV No. 1 June 2007 p. 125-150

Export-led growth hypothesis: new evidence from Thirlwall's idea

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This study reexamines the relationship between exports and economic growth in ten East Asian and Pacific economies by building upon Verdoorn's [1941] idea. The cointegration tests indicate the existence of long-run and stable relationships between economic growth, exports, imports, capital, and labor in each economy. Granger-causality tests indicate short-run causality (either export-led growth or growth-driven exports) in most economies. Besides, among the long-run estimated coefficients between exports and imports, Fiji, Hong Kong, Japan, Malaysia, and the Philippines satisfy the intertemporal budget constraint—that is, these economies have an effective international trade policy to balance their trade position. The findings are in line with traditional trade theories and some recently developed endogenous growth theories.

JEL classification: F1, O57
Keywords: exports, growth, cointegration, causality

I. Introduction

Exports have played a crucial role in economic performance by contributing to gross domestic product (GDP) directly, and indirectly through their contributions per medium of spread or carryover effects. This linkage is widely known as export-led growth (ELG) hypothesis. Some influential researchers have begun to draw attention to the contribution of export in promoting economic growth and the channels of the linkage. Researchers have also slowly

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acknowledged the significance of exports in the process of economic growth for the following reasons: (a) exports exploit economies of scale in small open developing countries [Helpman and Krugman 1985]; (b) exports relax the binding foreign exchange constraint to allow increases in imports of capital goods and intermediate goods; and (c) exports contribute to the diffusion of technological knowledge by means of foreign buyers' suggestions and learning by doing [Grossman and Helpman 1991].

Balassa [1985], for example, argued that, in general, the production of export goods is focused on those economic sectors that are already more efficient. Therefore, export expansion helps to concentrate investment in these sectors, which in turn increase the overall total productivity of the economy. Moreover, the growth of exports has a stimulating effect on total productivity of the economy as a whole through its positive impact on higher rates of capital [Kavoussi 1984]. Others, however, question whether the causality may run from output to export (growth-led export [GLE]). Lancaster [1980] and Krugman [1984] say that economic growth leads to enhancement of skills and technology, thereby creating a comparative advantage for the country that facilitates exports. They conclude that there is one-way causality from output to exports and argue that output growth has a positive impact on productivity growth and improved productivity, while cost reductions in labor and capital are expected to promote exports. In line with this, Bhagwati [1988] postulates that GLE is likely to occur.

Apart from these two competing hypotheses, Helpman and Krugman [1985] and Bhagwati [1988] propose a feedback relationship between exports and output: exports may rise from the realization of economies of scale due to productivity gains; the rise in exports may further enable cost reductions, which may result in further productivity gains. They assert that increased trade produces more income, which leads to more trade and so on.

Empirical investigation of the export-growth nexus has begun to appear in the past few decades. The evidence, however, is mixed and contradictory. While some studies provide strong evidence of export-led growth (Balassa [1985]; Ram [1987]; Chow [1987]; Fosu [1990, 1996]; Giles, Giles, and McCann [1992]; Bahmani-Oskooee and Alse [1993]; Arnade and Vasavada [1995]; Thornton [1996]; Doyle [1998],) some found contrasting evidence that export is Granger-caused by economic growth (Henriques and Sadorsky [1996]; Al-Yousif [1999]). A number of models that find support for the bidirectional relationship between these variables (Dutt and Ghosh [1994]; Thornton [1997]; Shan and Sun [1998]) have been advanced. On the other hand, a number of

studies do not find evidence to support this hypothesis (see Granger [1969]; Jung and Marshall [1985]; Darrat [1986]; Hsiao [1987]; Ahmad and Kwan [1991]; Dodaro [1993]; Shan and Sun [1998]; Giles and Williams [2000a, 2000b]). The results of studies that investigated the export-growth nexus in an attempt to establish the causality directions are no less confusing.

The study aims to examine the export-led growth hypothesis in selected countries in East Asia and Pacific by incorporating the idea of Verdoorn's law. Verdoorn [1941] argued that an expansion of exports might stimulate specialization in the promotion of export products, which in turn may boost productivity levels and cause a rise in the general level of skills (labor) in the export sector. Consequently, this may lead to a reallocation of resources from the (relatively) inefficient non-trade sector to the more productive export sector. This process of specialization will promote productivity and lead to output growth.[1] Furthermore, the foreign exchange earnings generated by export expansion can then be used to import more capital goods and thus promote domestic production capacity. Production and export expansion will allow the export sector to experience economies of scale and the use of more efficient technology.[2] This is consistent with Thirlwall and Sanna's [1996] conclusion that the growth of exports plays a major role in the growth process by stimulating demand and encouraging savings and capital accumulation, and because exports increase the economy's supply potential by raising the capacity to import. In an open economy, this would suggest that the inclusion of exports and imports in analysing economic growth rate is a must. This is consistent with the influential work of Kaldor [1966] and Dixon and Thirlwall [1975], which assumed that output growth would be demand-determined.

This study investigates the relationship between output, exports, and imports in ten economies in East Asia and Pacific region. The success of utilizing export to enhance economic growth in the Asian newly industrializing countries (NICs)—particularly Hong Kong, Singapore, Korea, and Taiwan—and the second-generation NICs (Malaysia and Thailand) may be related to their import-substitution and export-promotion policies, along with other macroeconomic policies. As the largest economy in the developing world, China is the latest country to join this group. Findlay and Watson [1996:4] noted, "China's experience during the 1980s and 1990s tend[s] to support the

[1] This effect is sometimes called Verdoorn's Law. For a discussion about the relevance of the Verdoorn's Law, see Mamgain [1999] and Leon-Ledesma [2000].

[2] Kaldor [1966] conceives increasing returns as a macroeconomic phenomenon based on the interaction between activities in the process of general economic expansion.

argument that openness to trade is a mechanism for achieving more rapid and efficient growth and better distribution of domestic resources". The neoclassical school, for example, reveals that growth can be achieved by export-led growth. The World Bank [1993] stresses that the experiences of these countries can be viewed as a model for development. Feder [1983], Hart [1983], and Ben-David and Loewy [1998] illustrate the close link between export and economic performance for a few countries. Broadly speaking, the emphasis of the ELG debate is on whether a country is better served by orienting trade policies to export promotion or to import substitution in the East Asian countries (Balassa [1985]; Singer and Gray [1988]; Greenaway and Sapsford [1994]).

It is believed that the lack of effective trade policy makes it difficult to distinguish between the effects of exports and imports on economic performance, thereby contributing to the controversial argument of causality issue [Noland 1997]. Furthermore, after taking into account the diversity of countries and the various forms of trade policies implemented, it is difficult to observe a consistent cross-country relationship between trade policies and economic growth—there may not be enough cross-country variation to fully control for such heterogeneity as there are many developing countries still pursuing import substitution and an export-promotion strategy. The World Bank [1993:6], for example, discusses an alternative methodology to avoid the identification problem that haunts the literature: "It is very difficult to establish statistical links between growth and a specific intervention [especially trade policies], [and it is] even more difficult to establish causality. Because we cannot know what would have happened in the absence of a specific policy, it is difficult to test whether interventions increased growth rates. [W]e cannot offer a rigorous counterfactual scenario."

This paper contributes to the evaluation of trade policy by including both exports and imports in the model. The inclusion of imports is also based on the argument of Riezman, Summers, and Whiteman [1996] that imports are crucial in testing this hypothesis to avoid producing spurious causality. They also pointed out that finding no cointegration between exports and output may be due to the omitted variable such as imports. Besides, Abu-Qarn and Abu-Bader [2004] reveal that the inclusion of imports in the system captures the role of promoting exports in the accumulation of foreign exchange, which makes it easier for the economy to finance the importation of capital goods, thereby boosting economic growth. Hence, by incorporating imports as a third variable in the system, it allows not only for a direct effect of exports on economic growth but also for an indirect effect that involves imports. Moreover,

considering the fact that export externality effects are possibly due to the role of exports in relieving constraints on foreign borrowing [Serletis 1992], the influence of imports is expected to be significant in the analysis.

This study also contributes to the use of cointegration procedures in estimating export-led growth framework. Cointegration techniques are increasingly used in economics to examine the linear relationship among various economic variables (see, for example, Engle and Granger [1987]; Johansen and Juselius [1990]; Davidson and MacKinnon [1992]; and Johansen [2000]). The techniques are estimated with the method of maximum likelihood, and the procedure has the advantage of permitting the joint determination (endogeneity) of economic growth and exports, taking into account the short-run dynamics of the variables while permitting the system of variables to return to long-run equilibrium. Indeed, the literature to date has offered a variety of advantages in terms of order of integration, identification procedure, endogeneity, and simultaneity problems [Johansen 2000].

Section 2 of the paper reviews the theoretical model of export-led growth. Section 3 explains the sources of data and the setup of the econometric methodologies used. Empirical results are discussed in section 4. The final section summarizes some conclusions from the results and discusses some implications of the findings.

2. Theoretical model of export-led growth hypothesis

To investigate the relationship between exports and economic growth, we propose a framework based on the conventional neoclassical one-sector aggregate production function in which we treat output (Y) as a function of capital (K) and labor (L). Assume in the autarky economy:

$$\begin{aligned} Y &= f(L, K, E) \\ &= AL^{\alpha}K^{\beta}E^{(1-\alpha-\beta)} \end{aligned} \tag{1}$$

where E is the externality effect generated by the international trade effect, or balance of payment

According to Kennedy and Thirlwall [1979], the rate of economic growth is highly dependent on the external sector or balance of payment. The idea of this framework is simple and direct: a positive (negative) external balance—that is, exports more than imports (exports less than imports)—will increase (decrease) a country's rate of economic growth. Resulting from the balance

of payment surplus (deficits), it promotes (restricts) the rate of growth to the level that is consistent with a sustainable position in the external sector. This effect is called balance of payment equilibrium growth rate [Thirlwall 1979, 1997, 1999].

The externality effect, E, can be represented by the following Cobb-Douglas production function:

$$E = f(L, K, X^{\gamma}, M^{\rho})^{\gamma} \tag{2}$$

where

γ and ρ are the marginal elasticities of exports and imports, respectively

γ is the intertemporal elasticity of substitution between exports and imports.

If γ and ρ are positive, a higher quantity of exports and imports generates a positive externality to the economy. This also implies that imported goods and services tend to be capital-intensive. If $\gamma > 0$, the foreign exchange earnings generated by export expansion can then be used to import more capital goods to promote domestic production capacity (intertemporal complementarity prevails).

Combining equations (1) and (2), we obtain

$$\begin{aligned} Y &= AL^{\alpha}K^{\beta}(L^{\lambda}K^{\lambda}X^{\gamma\lambda}M^{\rho\lambda}) \\ &= AL^{\alpha+\lambda(1-\alpha-\beta)}K^{\beta+\lambda(1-\alpha-\beta)}X^{\gamma\lambda(1-\alpha-\beta)}M^{\rho\lambda(1-\alpha-\beta)}. \end{aligned} \tag{3}$$

A standard growth accounting equation can be derived by taking logarithms and time derivatives of equation (3) to generate the following dynamic production function:

$$\begin{aligned} g_Y = {} & g_A + [\alpha + \lambda(1-\alpha-\beta)]g_L + [\beta + \lambda(1-\alpha-\beta)]g_K \\ & + \gamma\lambda(1-\alpha-\beta)g_X + \gamma\rho(1-\alpha-\beta)g_M \end{aligned} \tag{4}$$

where

g_i is the growth rate of γ, A, L, K, X *and* M.

Equation (4) states that (given γ, ρ, λ, and are positive) international trade will augment the elasticities of output with respect to labor and capital by a factor $\lambda(1-\alpha-\beta)$.

The most general formulation of the dynamic production function is given below:

$$\Delta Y_t = \alpha + \beta_1 \Delta L_t + \beta_2 \Delta K_t + \beta_3 \Delta X_t + \beta_4 \Delta M_t + \varepsilon_t . \quad (5)$$

All variables are expressed in the logarithms; Δ is the difference operator and ε is the white-noise error term. It is expected that β_1, β_2, and β_3, are positive and β_4 can be either positive or negative depending on whether the imported goods and services are capital-intensive or consumption-intensive.

3. Data and methodology

3.1 Stationarity and order of integration

To avoid spurious regression, we need to discern the stationarity of the series. Thus we ensure the validity of the usual test statistics such as *t*- and *F*-statistics, and R^2 [Granger and Newbold 1974]. Stationarity could be achieved by appropriate number of differencing, which is called order of integration. We use augmented Dickey Fuller (ADF) [Dickey and Fuller 1979] and Ng and Perron [2001] unit root tests to check the stationarity of the variables. Even though the ADF test controls higher-order correlation by adding lagged difference terms of the dependent variable to the right-hand side of the regression, the usual Dickey-Fuller tests of the unit root null hypothesis can have little power when the root is very close to the unit circle and decreases as deterministic factors are added [Perron 1989]. As a result, Ng and Perron [2001] modified the Phillips-Perron's (PP) Z tests and built a group of unit root tests (called GLS-MZ tests) with good size and power. The proposed test has a high power in the local frontier in the presence of different estimates for deterministic factors and, accordingly, is highly appropriate for the purpose of the study.

3.2 Vector autoregressive model and vector error-correction model

The vector autoregression (VAR) model is generally used for forecasting a system of interrelated macroeconomic time series and for analyzing the dynamic impact of random disturbances on the system of variables. Following Johansen and Juselius [1990] and Johansen's [2000] remark, the specification of the sampling distribution for the export-led growth hypothesis, as stated in equation (5), is supposed to be five variables. Let $Z_t = (Y_t, L_t, K_t, X_t, M_t)'$ and assume that this vector is generated from a VAR (k) model with a constant term ϕ and Gaussian errors $\varepsilon_t \sim niid(0, \Sigma)$.

$$Z_t = \Pi_1 Z_{t-1} + \Pi_2 Z_{t-2} + ... + \Pi_k Z_{t-k} + \phi + \varepsilon . \quad (6)$$

Then, we rewrite equation (6) in the error correction form:

$$\Delta Z_t = \Pi Z_{t-1} + \Gamma_1 \Delta Z_{t-1} + \Gamma_2 \Delta Z_{t-2} + ... + \Gamma_{k-1} \Delta Z_{t-k+1} + \phi + \varepsilon_t \quad (7)$$
$$\Pi = I - \Pi_1 - \Pi_2 - ... - \Pi_k$$

where ΔZ_t contains the growth rates of the variables, the parameters (Γ_1,..., Γ_{k-1}) define the short-run adjustment to the changes of the process and are estimable parameters, whereas $\Pi = \alpha\beta'$ defines the short-run adjustment (α), and the long-run relations (β). Johansen [2000] proves that if $Z_t \sim I(1)$, Π has the reduced rank of r and can be represented as $\Pi = \alpha\beta'$. The parameterization in $\Pi = \alpha\beta'$ facilitates the investigation of the r linearly independent stationary relations between the levels of the variables, and the p-r linearly independent nonstationary relations. Thus, the representation of $\Pi = \alpha\beta'$ implies that the process ΔZ_t is stationary, ΔZ_{t-1} is nonstationary, but also that $\beta' Z_{t-1}$ is stationary [Johansen 2000]. We thus can interpret the relation $\beta' Z_{t-1}$ as the stationary relations among nonstationary variables, that is, as cointegrating relations. We can exploit the idea that there may appear co-movements in their behavior and possibilities that they will move together toward a long-run equilibrium state. Johansen [1991, 2000] and Johansen and Juselius [1990, 1992] developed the likelihood procedure for estimating the parameters, and testing the order of cointegration rank and the various hypotheses on the restrictions of parameters.

If two or more variables are found to be cointegrated, an error correction term (ECT) has to be incorporated into the short-run model in estimating causality [Engle and Granger 1987]. This is because according to the standard Granger causality tests, it is possible to find no causal relationship between two or more variables that are cointegrated [Granger 1988]. The inclusion of ECT reintroduces the information lost in the differencing process, thereby allowing for long-run equilibrium as well as short-run dynamics. On expanding equation (7), the model can be expressed as follows:

$$\Delta Y_t = \phi_1 + \sum_{s=1}^{p} \beta_{11,s} \Delta Y_{t-s} + \sum_{s=1}^{p} \beta_{12,s} \Delta L_{t-s} + \sum_{s=1}^{p} \beta_{13,s} \Delta K_{t-s}$$
$$+ \sum_{s=1}^{p} \beta_{14,s} \Delta X_{t-s} + \sum_{s=1}^{p} \beta_{15,s} \Delta M_{t-s} + \delta_1 ECT_{t-1} + \varepsilon_{1t} \quad (8)$$

$$\Delta L_t = \phi_2 + \sum_{s=1}^{p} \beta_{21,s} \Delta Y_{t-s} + \sum_{s=1}^{p} \beta_{22,s} \Delta L_{t-s} + \sum_{s=1}^{p} \beta_{23,s} \Delta K_{t-s} + \sum_{s=1}^{p} \beta_{24,s} \Delta X_{t-s} + \sum_{s=1}^{p} \beta_{25,s} \Delta M_{t-s} + \delta_2 ECT_{t-1} + \varepsilon_{2t} \quad (9)$$

$$\Delta K_t = \phi_3 + \sum_{s=1}^{p} \beta_{31,s} \Delta Y_{t-s} + \sum_{s=1}^{p} \beta_{32,s} \Delta L_{t-s} + \sum_{s=1}^{p} \beta_{33,s} \Delta K_{t-s} + \sum_{s=1}^{p} \beta_{34,s} \Delta X_{t-s} + \sum_{s=1}^{p} \beta_{35,s} \Delta M_{t-s} + \delta_3 ECT_{t-1} + \varepsilon_{3t} \quad (10)$$

$$\Delta X_t = \phi_4 + \sum_{s=1}^{p} \beta_{41,s} \Delta Y_{t-s} + \sum_{s=1}^{p} \beta_{42,s} \Delta L_{t-s} + \sum_{s=1}^{p} \beta_{43,s} \Delta K_{t-s} + \sum_{s=1}^{p} \beta_{44,s} \Delta X_{t-s} + \sum_{s=1}^{p} \beta_{45,s} \Delta M_{t-s} + \delta_4 ECT_{t-1} + \varepsilon_{4t} \quad (11)$$

$$\Delta M_t = \phi_5 + \sum_{s=1}^{p} \beta_{51,s} \Delta Y_{t-s} + \sum_{s=1}^{p} \beta_{52,s} \Delta L_{t-s} + \sum_{s=1}^{p} \beta_{53,s} \Delta K_{t-s} + \sum_{s=1}^{p} \beta_{54,s} \Delta X_{t-s} + \sum_{s=1}^{p} \beta_{55,s} \Delta M_{t-s} + \delta_5 ECT_{t-1} + \varepsilon_{5t} . \quad (12)$$

Equations (8)-(12) exhibit the intertemporal interaction among output, labor, capital, exports, and imports included in the export-led growth hypothesis. Once the equilibrium conditions represented by the cointegrating relations are imposed, the vector error correction model (VECM) describes how, in each time period, the output adjusts toward its long-run equilibrium state. Because the variables are supposed to be cointegrated, then in the short term, deviation of output from its long-run equilibrium path will feed back on its future changes in order to force its movement toward the long-run equilibrium state. The cointegrating vectors from which the error-correction terms are derived each indicate an independent direction where a stable, meaningful long-run equilibrium state exists. The coefficient of the error-correction terms, however, represents the proportion by which the long-run disequilibrium in the dependent variables is corrected in each short-term period.

Using the model developed in equations (8)-(12), Granger causality tests between the variables can be examined through a joint *F*-test or a Wald test applied to the coefficients of each explanatory variable in one equation.

3.3 Data

In this paper, the real gross domestic product growth rate (RGDPGR), real exports, real imports, labor force, and gross fixed capital formation of each selected country are studied. The sample period selection for each country was constrained by data availability. We employ annual time-series data from the World Bank's *World Development Indicator 2003* CD-ROM. All the dependent and explanatory variables, except labor, are deflated by the consumer price index (CPI), in which the year 1995 has been treated as the base year (1995 = 100). Following the literature, the series was transformed into natural logs to help induce stationarity in the variance-covariance matrix [Chang, Fang, and Wen 2001].

4. Results and interpretation

The results of the ADF and Ng-Perron tests at level and first difference are reported in Table 1. Based on the ADF and Ng-Perron test, the test statistics for all series are statistically insignificant to reject the null hypothesis of nonstationary at 0.05 marginal level in the level form. Therefore, these variables contain a unit root process or share a common stochastic movement. We also provide ADF and Ng-Perron tests for all series in first differences. The results show that all series are stationary in their first differences, except for labor force in China, Indonesia, Korea, Malaysia, the Philippines, and Thailand where the ADF statistic indicates the presence of a unit root in first differences.[3] According to the Ng-Perron statistics, however, this is definitely not the case. Since ADF tests have little power when the root is very close to the unit circle and decreases as deterministic factors are added [Perron 1989], and Ng-Perron tests are superior in terms of power and size (that is, high power in the local frontier to unit in the presence of different estimates for deterministic factors [Ng and Perron 2001]), we can proceed on the working hypothesis that all series are I(1).

Table 2 provides the results of the cointegration analysis for ten economies under study. Both the trace and maximum eigenvalue statistics indicate a unique

[3] The nonstationary labor force in these countries is mitigated by the fact that ADF test generally has low power.

Table 1. Results of the unit root tests

Country/ variable	*ADF unit root test*		*Ng and Perron unit root test (MZa)*	
	Level constant with trend	*First difference constant without trend*	*Level constant with trend*	*First difference constant without trend*
Australia (Data period: 1961-2001)				
RGDPGR	-2.8439 (4)	-6.8834** (3)	-8.4258 (3)	-14.6656** (1)
EXPO	-2.6005 (2)	-9.6871** (1)	-14.1905 (1)	-37.4808** (0)
IMPO	-2.9822 (5)	-8.1320** (4)	-3.2953 (3)	-10.6076** (1)
CAP	-2.4975 (5)	-7.2120** (4)	-3.0298 (3)	-8.5273** (1)
LF	-2.1312 (3)	-3.3075** (3)	-4.2368 (3)	-8.3359** (2)
China (Data period: 1971-2001)				
RGDPGR	-2.8789 (2)	-5.7581** (1)	-10.9071 (1)	-10.1352** (0)
EXPO	-2.2646 (0)	-5.1151** (0)	-5.6003 (0)	-15.9323** (0)
IMPO	0.6022 (0)	-4.4709** (1)	-12.3954 (1)	-28.0236** (1)
CAP	-3.1563 (0)	-5.3923** (0)	-11.9938 (0)	-16.5752** (0)
LF	0.5476 (1)	-1.6397[a] (0)	1.3969 (0)	-38.8213** (4)
Fiji (Data period: 1968-2001)				
RGDPGR	-2.8394 (2)	-5.8021** (3)	-16.1833 (0)	-22.0191** (1)
EXPO	-2.1222 (0)	-5.4943 ** (0)	-6.7596 (0)	-16.4472** (0)
IMPO	-2.2311 (0)	-5.2491** (0)	-7.6529 (0)	-15.2093** (0)
CAP	-2.8230 (0)	-6.9621** (0)	-10.5523 (0)	-15.3115** (0)
LF	-2.1396 (1)	-3.1271** (0)	-7.1522 (1)	-12.0706** (0)
Hong Kong (Data period: 1970-2001)				
RGDPGR	-3.2752 (3)	-8.7958** (1)	-15.4536 (0)	-52.7426** (1)
EXPO	-2.3140 (0)	-5.3360** (0)	-4.8057 (0)	-16.3873** (0)
IMPO	-2.5280 (0)	-5.8500** (0)	-6.6884 (0)	-15.7134** (0)
CAP	-2.2539 (0)	-5.3173** (0)	-7.0055 (0)	-17.6927** (0)
LF	-0.9840 (0)	-3.5962** (0)	-3.6759 (1)	-12.1920** (0)
Indonesia (Data period: 1967-2001)				
RGDPGR	-1.3530 (3)	-5.4252** (2)	-16.6379 (0)	-16.9783** (0)
EXPO	-2.5193 (0)	-10.9912** (0)	-7.5499 (0)	-8.5748** (1)
IMPO	-2.6427 (2)	-14.9671** (0)	-15.1200 (0)	-11.6380** (1)
CAP	-0.3771 (1)	-3.5121** (0)	-9.8335 (1)	-76.0029** (3)
LF	-1.3587 (1)	-1.8799[a] (0)	0.0519 (0)	-18.0136** (0)

Table 1. (continued)

Country/ variable	*ADF unit root test*		*Ng and Perron unit root test (MZa)*	
	Level constant with trend	*First difference constant without trend*	*Level constant with trend*	*First difference constant without trend*
Japan (Data period: 1971-2001)				
RGDPGR	-2.9230 (3)	-7.8312** (1)	-12.6510 (2)	-44.3552** (1)
EXPO	-2.1097 (0)	-5.9504** (0)	-6.2475 (0)	-20.7267** (0)
IMPO	-2.8174 (1)	-5.3190** (0)	-15.5975 (1)	-16.2187** (0)
CAP	-2.7990 (1)	-3.9989** (1)	-9.4860 (1)	-15.5635** (0)
LF	-1.3568 (1)	-8.4170** (0)	-7.7956 (1)	-9.9122** (0)
Korea (Data period: 1970-2001)				
RGDPGR	-2.7150 (3)	-5.4849** (3)	-15.4107 (0)	-12.1263** (0)
EXPO	-2.5653 (0)	-4.6643** (0)	-4.7227 (0)	-15.6798** (0)
IMPO	-1.9314 (0)	-4.6693** (0)	-5.2568 (0)	-14.2068** (0)
CAP	-1.3736 (0)	-5.0164** (0)	-5.0698 (0)	-14.1280** (0)
LF	-0.5163 (1)	-2.5798[a] (0)	1.0228 (0)	-10.5523** (0)
Malaysia (Data period: 1961-2001)				
RGDPGR	-2.4127 (3)	-5.5876** (2)	-5.0643 (6)	-41.6376** (1)
EXPO	-2.5959 (0)	-5.4826** (0)	-3.8895 (0)	-18.3299** (1)
IMPO	-2.5591 (0)	-5.5230** (0)	-5.3601(0)	-20.7736** (0)
CAP	-2.1726 (0)	-5.8873** (0)	-9.6703 (0)	-18.7521** (0)
LF	-3.1519 (1)	-2.5547[a] (0)	-2.6978 (0)	-10.3317** (0)
Philippines (Data period: 1961-2001)				
RGDPGR	-3.1970 (3)	-6.6597** (0)	-32.6074 (1)	-51.6874** (1)
EXPO	-3.0614 (0)	-3.6491** (4)	-11.1996 (0)	-12.7465** (1)
IMPO	-2.7310 (0)	-7.2537** (0)	-10.2036 (0)	-10.7645** (0)
CAP	-3.1357 (1)	-4.8583** (0)	-7.8170 (0)	-18.8871** (0)
LF	-2.1122 (1)	-1.9882[a] (1)	-11.8532 (1)	-9.5018** (2)

Table 1. (continued)

Country/ variable	*ADF unit root test*		*Ng and Perron unit root test (MZa)*	
	Level constant with trend	*First difference constant without trend*	*Level constant with trend*	*First difference constant without trend*
Thailand (Data period: 1969-2001)				
RGDPGR	-2.8175 (2)	-7.5272** (0)	-14.6097 (0)	-15.5527** (0)
EXPO	-2.1497(0)	-5.9410** (0)	-7.0519 (0)	-10.7472** (1)
IMPO	-2.7117 (0)	-5.7756** (0)	-9.9131 (0)	-15.7165** (0)
CAP	-1.4611 (0)	-4.8666** (0)	-5.4070 (0)	-14.5670** (0)
LF	0.1092 (1)	0.1084[a] (0)	1.3904 (0)	-15.0727** (0)

Note:

The null hypothesis is that the series is nonstationary, or contains a unit root for both ADF and Ng-Perron tests. The rejection of null hypothesis for the ADF test is based on the MacKinnon (1991) critical values, while the Ng and Perron test statistics are based on Ng and Perron (2001) critical value.

Figures in parentheses ( ) refer to the selected lag length. The number of lag was selected based on Schwarz Information Criterion (ADF test) and Spectral GLS-detrended AR based on SIC (Ng-Perron test) in order to avoid the problem of autocorrelation, which is to ensure the error terms are uncorrelated and enhance the robustness of the results.

** Indicates the rejection of the null hypothesis of non-stationary at 5 percent significance level.

[a] Indicates the rejection of the null hypothesis of non-stationary at 5 percent significance level at second difference.

Table 2. Results of multivariate cointegration test (Four-VAR Model)

Countries (Data period)	*Lag length*	*Null hypothesis H_0: rank=p*	*Maximum eigenvalue test*		*Trace test*	
			Test statistic	*Critical value (95%)*	*Test statistic*	*Critical value (95%)*
Australia (1961-2001)	4	$p = 0$	43.0558**	33.8769	83.3917**	69.8189
		$p \leq 1$	20.4770	27.5843	40.3359	47.8561
		$p \leq 2$	13.1323	21.1316	19.8589	29.7971
		$p \leq 3$	5.8594	14.2646	6.7266	15.4947
		$p \leq 4$	0.8671	3.8415	0.8671	3.8415

Table 2. (continued)

Countries (Data period)	*Lag length*	*Null hypothesis H_o: rank=p*	*Maximum eigenvalue test*		*Trace test*	
			Test statistic	*Critical value (95%)*	*Test statistic*	*Critical value (95%)*
China (1971-2001)	2	$p = 0$	38.8885**	33.8769	102.0030**	69.8189
		$p \leq 1$	35.8163**	27.5843	63.1144**	47.8561
		$p \leq 2$	15.6897	21.1316	27.2982	29.7971
		$p \leq 3$	9.7927	14.2646	11.6085	15.4947
		$p \leq 4$	1.8157	3.8415	1.8157	3.8415
Fiji (1968-2001)	2	$p = 0$	55.0384**	33.8768	101.8289**	69.8188
		$p \leq 1$	27.1977	27.5843	46.7905	47.8561
		$p \leq 2$	13.6502	21.1316	19.5928	29.7970
		$p \leq 3$	5.7572	14.2646	5.9425	15.4947
		$p \leq 4$	0.1852	3.8414	0.1852	3.8414
Hong Kong (1970-2001)	3	$p = 0$	46.6618**	38.3310	116.7427**	88.8038
		$p \leq 1$	30.4693	32.1183	70.0809**	63.8761
		$p \leq 2$	18.6799	25.8232	39.6116	42.9153
		$p \leq 3$	12.9339	19.3870	20.9317	25.8721
		$p \leq 4$	7.9978	12.5180	7.9978	12.5180
Indonesia (1967-2001)	1	$p = 0$	34.7542**	33.87687	80.7376**	69.8189
		$p \leq 1$	22.64575	27.58434	45.9834	47.8561
		$p \leq 2$	14.30009	21.13162	23.3376	29.7971
		$p \leq 3$	8.255694	14.2646	9.0376	15.4947
		$p \leq 4$	0.781858	3.841466	0.7819	3.8415
Japan (1971-2001)	2	$p = 0$	52.4823**	33.8769	97.6937**	69.8189
		$p \leq 1$	19.9445	27.5843	45.2114	47.8561
		$p \leq 2$	12.6034	21.1316	25.2670	29.7971
		$p \leq 3$	8.8416	14.2646	12.6635	15.4947
		$p \leq 4$	3.8220	3.8415	3.8220	3.8415
Korea (1970-2001)	2	$p = 0$	62.7104**	33.8769	130.1931**	69.8189
		$p \leq 1$	40.6021**	27.5843	67.4827**	47.8561
		$p \leq 2$	16.7235	21.1316	26.8806	29.7971
		$p \leq 3$	9.1599	14.2646	10.1571	15.4947
		$p \leq 4$	0.9973	3.8415	0.9973	3.8415
Malaysia (1961-2001)	2	$p = 0$	42.3195**	33.8769	82.2295**	69.8189
		$p \leq 1$	20.4302	27.5843	39.9100	47.8561
		$p \leq 2$	12.0992	21.1316	19.4798	29.7971
		$p \leq 3$	7.3782	14.2646	7.3806	15.4947
		$p \leq 4$	0.0024	3.8415	0.0024	3.8415

Table 2. (continued)

Countries (Data period)	*Lag length*	*Null hypothesis H_0: rank=p*	*Maximum eigenvalue test*		*Trace test*	
			Test statistic	*Critical value (95%)*	*Test statistic*	*Critical value (95%)*
Philippines (1961-2001)	2	$p = 0$	36.2009**	33.8769	82.0150**	69.8189
		$p \leq 1$	26.2258	27.5843	45.8141	47.8561
		$p \leq 2$	12.0167	21.1316	19.5883	29.7971
		$p \leq 3$	5.5995	14.2646	7.5716	15.4947
		$p \leq 4$	1.9721	3.8415	1.9721	3.8415
Thailand (1969-2001)	3	$p = 0$	58.9112**	38.3310	126.3907**	88.8038
		$p \leq 1$	28.0752	32.1183	67.4795**	63.8761
		$p \leq 2$	21.1700	25.8232	39.4043	42.9153
		$p \leq 3$	14.5228	19.3870	18.2343	25.8721
		$p \leq 4$	3.7115	12.5180	3.7115	12.5180

** Indicates the rejection of the null hypothesis of non-cointegration at 5 percent significance level.

cointegrating vector for Australia, Fiji, Indonesia, Japan, Malaysia, and the Philippines at the 95 percent level, while there are two cointegrating vectors as indicated by both test statistics in China and Korea. On the other hand, the trace statistic indicates a unique cointegrating vector for Hong Kong and Thailand at the 95 percent level, but maximum eigenvalue statistic shows two cointegrating vectors in these two economies.

The presence of two or more cointegrating vectors, as in the case of China and Korea, leads to the following question. Is it better to have many or only a few cointegrating vectors? Dickey, Jansen, and Thornton [1991:65] argued that cointegrating vectors might be seen as representing constraints that an economic system imposes on the behavior of its variables in the long run. As a result, they claimed that the more the cointegrating vectors are, the more stable is the system. That is, other things being constant, it is preferable for an economic system to be stationary in as many directions as possible. In contrast, Maddala and Kim [1998] argued that having more than one cointegrating vector raises the question of how to interpret the relationship among variables. For example, if there is only one cointegration relationship, then it may be easy to interpret it as a long-run relationship. However, if there is more than one cointegrating vector, there are problems of interpretation. In light of this argument, the trace and maximum eigenvalue test results could be attributed

to the possibility of two relationships existing, one determining economic growth and the other explaining export-import relationships. The second vector may describe a stable relationship between exports and imports (that is, relevant to the intertemporal budget constraint). In sum, we adopt the specification of one cointegrating vector for short-run causality analysis.

Table 3 reports the estimated cointegrating relationships normalized by the RGDPGR. Our results confirm the theoretical ambiguity regarding the effects of exports on economic growth. Typically, the improvement in exports leads to high-level economic growth. This relationship occurs in eight of the ten economies, except Hong Kong and Japan. Nevertheless, the negative sign on the exports and economic growth in Hong Kong and Japan does not necessarily contradict theory because the explanation of the theoretical literature for the effects of exports on growth is more complicated. First, the economies with a negative sign between exports and growth are open and trade mainly in

Table 3. Estimated cointegrating vectors (Five-VAR Model - Normalized on GDP)

Countries (Data period)	*RGDPGR*	*EXPO*	*IMPO*	*CAP*	*LF*
Australia (1961-2001)	-1.0000	1.1668**	2.5301***	-2.0374***	0.2872**
		[2.5724]	[4.9244]	[-3.8571]	[2.5844]
China (1971-2001)	-1.0000	250.4217***	-112.2162***	638.0527	-592.8133
		[4.7352]	[-2.8649]	[7.8652]	[-4.7969]
Fiji (1968-2001)	-1.0000	91.1427***	-105.7539***	4.6667**	-5.6448
		[6.30055]	[-8.02615]	[2.27196]	[-1.62360]
Hong Kong (1970-2001)	-1.0000	-4.0108***	3.4802***	-1.6244***	0.0511
		[-5.59829]	[5.04174]	[-5.12461]	[0.54009]
Indonesia (1967-2001)	-1.0000	4.1049***	-8.8879***	-0.5468	4.2964
		[2.93378]	[-4.38952]	[-0.31251]	[1.75518]
Japan (1971-2001)	-1.0000	-13.2407***	14.1973***	3.0217**	6.5106***
		[-6.94126]	[8.28603]	[2.10621]	[4.10603]
Korea (1970-2001)	-1.0000	1.7483***	-4.0620***	0.2997	-1.1743***
		[6.21601]	[-8.70789]	[1.43762]	[-3.36926]
Malaysia (1961-2001)	-1.0000	1.4141**	-1.6878**	0.9821**	-0.5427
		[1.98079]	[-2.18547]	[2.23037]	[-1.63359]
Philippines (1961-2001)	-1.0000	17.6058***	-14.6836***	15.2805***	-4.3041***
		[5.35733]	[-4.40400]	[5.79609]	[-3.25823]
Thailand (1969-2001)	-1.0000	0.4576***	-0.0563	0.6098***	2.5603***
		[11.1197]	[-0.96161]	[18.9523]	[16.6331]

Note: The cointegrating vector for each country was normalized on the real GDP growth rate.
*, **, and *** indicate the rejection of the null hypothesis at 10 percent, 5 percent, and 1 percent significance levels.
Figures in brackets denote t-statistics.

service- or knowledge-based products. Second, the nature of these economies' activity is that they have a large component of services (nontraded goods) sector, which may display a low degree of substitutability. Third, the factors of endowment in these countries are scarce, limiting these economies' capacity for exporting their products (tangible). Sato [2002:222], for example, reveals that an important feature of Japan's foreign trade is an export surplus in merchandise trade and an import surplus in (nonfactor) service trade. He adds, "The increase in manufactured imports may be related to the contraction of manufacturing within Japan. A small part of manufactured imports [is] the result of what is called the boomerang effect."[4]

Results of the causality tests are presented in Table 4. Exports cause economic growth (RGDPGR) in six of the ten economies—Australia, China, Hong Kong, Korea, Philippines, and Thailand—while a unidirectional causality from economic growth to exports exists in Fiji and Malaysia. On the basis of these estimates, no causality exists between exports and growth in Indonesia and Japan. These causality relationships imply that some of the East Asian

Table 4. Results of short-run causality between FDI and GDP

Country (Data period)	*Wald test (F-Statistics)*		
	Export-led growth	*Growth-driven export*	*Lag*
Australia (1961-2001)	7.5248**	0.9669	1
China (1971-2001)	7.6818**	0.2894	1
Fiji (1968-2001)	0.4353	3.2086*	2
Hong Kong (1970-2001)	2.6803*	0.8200	2
Indonesia (1967-2001)	0.2233	0.4238	2
Japan (1971-2001)	0.9669	1.7536	2
Korea (1970-2001)	5.6258**	0.8237	2
Malaysia (1961-2001)	0.2401	2.4023*	2
Philippines (1961-2001)	5.1295**	1.8691	2
Thailand (1969-2001)	3.2023*	0.1689	3

Note: More detailed results of Granger causality test (such as the estimated coefficient and t-statistic) are available on request. *, **, and *** indicate rejection of the null hypothesis of no causality at the 10 percent, 5 percent, and 1 percent significance levels. The VAR and VECM were estimated including an optimally determined criteria—Akaike's FPE—lag structure for all lagged-differences.

[4] This effect refers to the situation in which many Japanese firms, directly or through subsidiaries, produce overseas for exports into Japan [Sato 2002:222].

and Pacific countries are affected by their aggressive export-promotion strategies, and some countries have indeed achieved rapid economic growth [Ahmad and Harnhirun 1996]. Moreover, Ahmad and Harnhirun conclude that the impressive economic growth of the region can be attributed to a variety of factors such as production for the domestic markets, foreign capital inflows and technological diffusion, rapid growth of the service sector, and the growth of labor productivity.

The findings of the study are crucial in several aspects. First, out of ten economies, eight exhibit some type of causal relationship between exports and economic growth. These countries are Australia, China, Fiji, Hong Kong, Korea, Malaysia, the Philippines, and Thailand. Second, the results demonstrate that export-promotion policies have contributed in stimulating economic performance in these economies. In Indonesia and Japan, such links cannot be seen. This might be explained by the fact that these countries have their own internal growth-stimulating limitation. For example, no major steps have been taken to revive Indonesia's economic performance after the East Asian financial crisis in 1997 and ensure political stability. On the other hand, although many radical economic revolutions (or economic systems) have been implemented to activate and promote economic growth, there has been strong resistance to such a move.[5]

Finally, the link between exports and growth seems to be weak in these economies. Two types of causality relationship between these two variables emerged. One is unidirectional causality running from exports to growth in Australia, China, Hong Kong, Korea, the Philippines, and Thailand; the other is unidirectional causality from economic growth to exports, which exists in Fiji and Malaysia. None of the bidirectional causality exists in any of these economies. This result is surprising because most of these economies experienced high economic performance during the sample period, which seems to have been stimulated by more international trade (exports and imports). In addition, an attractive economic environment with high growth rate provides the foundation for more investment opportunities, especially in the export-oriented sectors. A country will experience high exports resulting from high economic growth.

How do we interpret the relationship between exports and economic growth, especially the impact of exports on growth? Empirical evidence

[5] See Katz [1998] and Lincoln [2001] for recent critical discussions of Japan's ultra slow growth in the 1990s.

supports the hypothesis of export-led growth in six of ten economies, which indicates that the significant positive influence of exports on growth may depend on, among others, country characteristics such as export-promotion or/and import-substitution policies and other macroeconomic policies. Export-promotion strategy has been recognized as a growth-enhancing catalyst; however, this does not necessarily guarantee a strong positive relationship between exports and growth. It is easy to believe that the success of utilizing exports to promote economic performance by these economies may be related to their trade strategies (import-substitution and export-promotion policies since the 1970s).

Does this imply the ineffectiveness of these economies' macroeconomic policy, especially in trade? To answer this question, we normalized the long-run elasticity of export with respect to import, and the calculated long-run elasticities of these economies are reported in Table 5. Overall, our results suggest that all import elasticities are positive as expected—except for Australia, with an estimated coefficient of –2.1684.[6] Nevertheless, we found that the positive relationship between exports and imports is not one-to-one in the long run.[7] They range from 0.1230 for Thailand, to 2.3234 for Korea. It is believed that five out of ten economies are satisfying the condition of intertemporal budget constraint. These economies are Fiji, Hong Kong, Japan, Malaysia, and the Philippines. As the estimated coefficient of these economies fluctuates around unity (ranging from 0.8340 to 1.1936), these economies thus have effective macroeconomic policies in adjusting international trade relationship (Husted [1992]; Bahmani-Oskooee and Rhee [1997]).

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[6] The explanation for the negative sign, however, is not clear.

[7] The one-to-one long-run relationship between export and import exists only when a country satisfies the intertemporal budget constraint (Husted [1992]; Bahmani-Oskooee and Rhee [1997]). Husted [1992] has derived the theoretical relationship between exports and imports into a standard regression as follows:

$$X_t = a + b^* MM_t + e_t$$

where X is exports, MM is imports and e_t is a white noise error term and stationary. It is expected that $b = 1$ when a country is satisfying the intertemporal budget constraint. Therefore, if the estimated coefficient of imports (MM) is equal to unity, then we can say that a country has effective macroeconomic policies in international trade. Hakkio and Rush [1991] suggest another way to test whether a country satisfies the constraint or not. They reveal that if both dependent variable (exports) and explanatory variable (imports) are integrated in same order, that is, I(1), then a country satisfies the condition. However, if either one variable is nonstationary while another variable is stationary at level, then the country has failed to satisfy the constraint. For example, if imports are nonstationary while exports are stationary, there is no long-run relationship between these variables, and this implies that the country is violating its intertemporal budget constraint.

Table 5. Normalized coefficient between exports and imports

Country (Data period)	*Normalized coefficient on exports*	
	Exports	*Imports*
Australia (1961-2001)	1.0000	-2.1684
China (1971-2001)	1.0000	0.4481
Fiji (1968-2001)	1.0000	1.1603
Hong Kong (1970-2001)	1.0000	0.8677
Indonesia (1967-2001)	1.0000	2.1652
Japan (1971-2001)	1.0000	1.0722
Korea (1970-2001)	1.0000	2.3234
Malaysia (1961-2001)	1.0000	1.1936
Philippines (1961-2001)	1.0000	0.8340
Thailand (1969-2001)	1.0000	0.1230

As the normalized coefficients are greater than one, this means that these economies' policymakers are more likely to focus on export promotion rather than import substitution. In contrast, if the normalized coefficients are less than one but more than zero (for example, China and Thailand), they depend on import substitution rather than export promotion. If imports are more consumption-based, which does not generate income or revenue in the future—then the trade deficit will diverge to infinity. Consequently, the pressure to default grows and the governments will face increasing difficulty in marketing their goods or products [Hakkio and Rush 1991]. This violates the intertemporal budget constraint.

The validity of the estimated model in these economies has been confirmed by several diagnostic tests such as Breusch-Godfrey serial correlation LM test, ARCH test, Jacque-Bera normality test, and Ramsey RESET specification test. All these revealed that the model has desired econometric properties: the residuals are serially uncorrelated and normally distributed, homoscedastic, and have a correct functional form.[8] They can, therefore, be considered an adequate approximation of the data generation process [Spanos 1986].

[8] In addition to these diagnostic analyses, two tests were utilized to discern the stability of the parameters estimated. From both the Recursive Residual and CUSUM Square test statistics, we found that all estimated parameters are stable over time. These results are available from the authors upon request. Nevertheless, it is well known that in the presence of lagged dependent variables the CUSUM of Squares test only provides a guide since the confidence lines are not correct.

5. Conclusion and policy implications

This paper has drawn a number of conclusions from the analysis. First, there exists a stable long-run relationship between economic growth, exports, imports, gross fixed capital formation, and labor in ten East Asian and Pacific economies. Second, there is evidence in favor of the export-led growth hypothesis in Australia, China, Hong Kong, Korea, the Philippines, and Thailand, while evidence of growth-driven exports is confirmed in Fiji and Malaysia. In contrast, no causality relationship is found in Indonesia and Japan. Third, economic growth is positively correlated with exports in eight of ten economies and is negatively correlated with imports in seven of ten economies. Fourth and last, among the long-run estimated coefficients between exports and imports, we find that six countries satisfy the intertemporal budget constraint: Fiji, Hong Kong, Japan, Malaysia, and the Philippines. This implies that these economies have an effective international trade policy in balancing their trade position.

These findings have significant implications. First, the existence of cointegration and causality patterns between exports and growth in the economies under study confirms the benefits of export-promotion policy and growth-enhancing exports policy. Second, policymakers need to introduce measures to improve fundamental economic structures and pursue policies that strengthen international trade sustainability. This is to allay market sentiments to avoid future trade imbalances in a liberally integrated world. Third, the existence of significant causality relationships between exports and growth provides rationale for greater coordination of multilateral and regional action to improve their trade activities. Finally, we conclude that Verdoorn might have been right about the significance of international trade (exports and imports) for economic promotion. This export-growth link, however, is typically not the economic mechanism most closely associated with Verdoorn. Yet, an integral part of Verdoorn's Law is that manufacturing growth drives the GDP, and increases production rates and productivity in the manufacturing sector, which in turn increases productivity in other sectors. Combining the export-growth hypothesis and Verdoorn's proposition, we are proposing an alternative framework in testing the hypothesis of export-led growth.

Future research can investigate the sources of the causality relationships found in this study. Understanding the source and transmission mechanism of the causality relationship is crucial as it will help policymakers develop domestic and international policies to improve trade balance, or balance of payment position. Finally, future research can test for cointegration for a longer time span, taking structural break into account.

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