Economic Linkages among the Northeast Asian Economies: A Multi-Country Model Analysis

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This paper considers the linkages of the East Asian economies by means of a multicountry Johansen type econometric model. The intra country and cross country impact on GDP, employment, import, capital accumulation, interest rate and consumption as a result of changes in technical change, wage rate, export and standard monetary and fiscal instruments were estimated. Furthermore, the model enables the conduct of simulations in assessing the formation of free trade area among the northeast Asian economies and trade liberalizing measures granted from one trade bloc to another. (*JEL* Classifications: F15, F17)

I. Introduction

Over the last three decades, economies in Northeast Asia have been able to achieve economic growth rates which are among the highest in the world. Japan has been hailed as an economic "miracle" after its economy was devastated during the second world war. Its example has been closely followed by Taiwan and South Korea giving rise to an East Asian style industrial policy (see for example, Inoue, Kohama and Urata, eds. 1993). The Chinese economy has successfully adopted market reform and since 1978 and attracted a large influx of foreign investments in recent years. It had recorded double-digit growth rates in the first decade of its reforms and is presently constrained only by its domestic constraints of resource mobilization and infrastructure more than lack of prospects or opportunities. Regional cooperation is much stimulated by the formation of growth triangles or economic zones such

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as the Tumen Jiang Economic Zone and the Pan Japan Sea Economic Zone.

In this paper, given the increasing economic interaction among the Northeast Asian economies, we attempt to construct a multicountry model to derive empirical estimates of the impact of policy variables within and outside the region.

There has been a rapid growth in the number of multicountry models in recent years. Artis and Holly (1992) note that the activity reflects an increasing interest in, and concern with, the international transmission of shocks, and the role that increasing interdependencies among countries from growing trade, capital market integration and foreign investment play in reducing the discretion of individual governments. It is in the same spirit and objective that we endeavor this paper on a Northeast Asian model.[1] The economies included in the model are Japan, China, South Korea, Taiwan and Hong Kong.[2]

The paper is organized as follows. Following this introduction, the methodology used in constructing the model is presented. In section III, the Hong Kong economy is used an illustration in interpreting the results. This paved the way for the discussion of the interlinked model specifications and results in Section IV. Section V concludes the paper by summarizing the major findings and drawing some implications.

II. Methodology

The model to be presented is a Johansen-type model[3]. The distinguishing characteristic of this type of model is that it is written as a system of linear equations in percentage changes of the variables. Rather than writing:

[1]Some examples of multi-country models include the Project Link (presently sponsored by the United Nation), IMF-MULTIMOD, MSG2 (McKibben-Sachs global model), OECD-INTERLINK. A more recent effort is that of ICSEAD World Link Model (Inada and Fujikawa, 1993). A good review of the characteristics of multicountry models can be found in Whitley (1992).

[2]This is part of a wider Asia Pacific link model covering countries in the Northeast Asia, in the Association of Southeast Asian Nations (ASEAN), and the North American group of countries (US and Canada). In this paper, ASEAN and the North American group are treated as two separate destinations for trade expansion and no explicit model is assumed for each of the group.

[3]Examples of Johansen-type models include Johansen (1960), Dixon *et al.* (1983), Taylor and Black (1974) and Staelin (1976).

$$Y = f(X_1, X_2), \tag{1}$$

where Y is output and X_1 and X_2 are inputs, in a Johansen model we use the linear percentage change form:

$$y - \varepsilon_1 x_1 - \varepsilon_1 x_2 = 0, \tag{2}$$

where ε_i is the elasticity of output with respect to inputs of factor i, and y, x_1 and x_2 are percentage changes in Y, X_1 and X_2

In matrix notation, a Joansen model can be represented by

$$A \cdot z = 0, \tag{3}$$

where A is a matrix of coefficients and z is the vector of percentage changes in the model variables.

For our model which consists of five Northeast Asian economies, A is a 50×93 matrix, that is, it has 50 equations and 93 variables. Because the A matrix is assumed fixed, equation (3) provides only a local representation of the equations suggested by economic theory. This disadvantage must be weighed against the computational advantage and flexibility of log-linear models.[4]

In our multicountry model, the same structure is imposed for each economy included. However, the empirical estimates of the model parameters are allowed to differ. For the ease of exposition, we first consider the macro model for an individual economy, Hong Kong and then discuss how the individual economy models are linked.

Basically for an individual economy, the macro model consists of nine equations. We have intentionally kept the number of equations for each country model to a minimum. Hence, disaggregation such as consumer durable versus consumer non-durables, private versus public investments which would be much desired in an exclusive econometric modelling effort for an individual country, is not considered here. This is to ensure that our model is compact and yet can answer the questions that we like to pose.

The nine equations are:

$$n = (1/\beta_1) \cdot (y - \beta_2 k - \varepsilon) \tag{4}$$

[4]Another advantage of the Johansen class of model is that elaborate and tedious calibration needed in the Shoven-Whalley type of CGE model is avoided. It only requires matrix inversion and that parameters are econometrically estimated using time series information. Empirical Shoven-Whalley type of CGE often uses parameter values from "guesstimates" or studies of other economies.

$$p = (1 - \beta_1)\, n - \beta_2 k - \varepsilon + w \tag{5}$$
$$\rho = p + y - k \tag{6}$$
$$c = \gamma_1 y - \gamma_2 p_c + \gamma_0 \tag{7}$$
$$p_c = \alpha_1 p + \alpha_2 p_m;\quad \alpha_1 + \alpha_2 = 1 \tag{8}$$
$$k = -\mu_1 r + \mu_2 y + \mu_0 \tag{9}$$
$$r = -\lambda_1\, (ms - p) + \lambda_2 y + \lambda_0 \tag{10}$$
$$m = \phi_1 y - \phi_2\, (p_m - p) + \phi_0 \tag{11}$$
$$y = s_c c + s_I\, \delta \cdot (K/I) \cdot k + s_G g + s_X x - s_M m, \tag{12}$$

where s_C, s_I, s_G,, s_X, and s_M are respectively, the shares of consumption, investment, government expenditure, exports and imports in GDP. All parameters, with the exception of the intercepts, γ_0, μ_0, λ_0, and ϕ_0 are expected to be non-negative. δ is the rate of depreciation of capital stock and is assumed to be 5%.

Equation (4) is derived from the Cobb-Douglas production function:

$$Y = A \cdot N^{\beta_1} K^{\beta_2} e^{et},$$

where N and K are respectively, labor and capital inputs. The growth rate of the variables Y, K and N are denoted by the small letters y, k and n respectively.

Constant returns to scale is assumed and thus $\beta_1 + \beta_2 = 1$. The parameter ε is a measure of the rate of technical progress. The second equation (5) is obtained by equating the marginal productivity of labor to real wage rate. The nominal wage rate is assumed exogenous in this model. Similarly, the third equation (6) is derived by equating the marginal productivity of capital to the real rental price of capital, ρ.

The growth in consumption given in equation (7) is specified as a function of the growth in income (y) and growth in consumer prices (p_c). The latter is defined as a weighted average of the domestic price (p) and the import prices (p_m). The growth in the capital stock, k is specified to be dependent on the interest rate and growth in income. The supply of money, MS, is considered exogenous. The interest rate (r) is thus specified as dependent on the real money supply and national income. The specification of the import (m) demand equation is conventional. It is dependent on income and the price of import relative to the general price level proxied by the GDP deflator. The exchange rate whose variation would lead to changes in the relative price of imports is assumed exogenous.

The penultimate equation describes the import demand function. It is dependent on income and the price of import relative to domestic

TABLE 1
ESTIMATED VALUES OF PARAMETERS, HONG KONG, 1990

Production Function	β_1	0.577	β_2	0.423
Consumption	γ_1	0.322	γ_2	0.278
Capital	μ_1	0.018	μ_2	0.153
Interest Rate	λ_1	0.140	λ_2	0.220
Imports	ϕ_1	1.480	ϕ_2	1.206
Price Index of Consumption	α_1	0.643	α_2	0.357

price. The final equation (12) is derived from the income-expenditure identity. The growth in income is the weighted sum of the final expenditure components in the national account. We have equated the growth of investment to that of the growth in capital stock. This basically invoked the steady state assumption when the capital investment is purely for replacement.

III. Estimating the Parameters

The parameters of the model (4) to (12) are estimated using data from the period 1978 to 1992, shown in Appendix.

For behavioral equations, growth rate of the variables are first computed before being used in the regression. The parameters for the production function are estimated as the factor shares in the national income. Capital stock series is absent for many countries. The accumulated real capital formation from 1968 to 1977 is used to provide a benchmark for the capital stock figure in 1978. Using a depreciation rate of 5%, the capital stock series is estimated by the perpetual inventory method.

As an illustration, the estimated values of the parameters for the Hong Kong economy are shown in Table 1.

The set of equations (4) to (12) can be arranged into the following form in matrix notation:

$$A \cdot v = B \cdot z, \tag{13}$$

where A is a 9×9 matrix relating to the endogenous variables, and B is a 9×10 matrix relating to the exogenous variables. The vector v consists of the 9 endogenous variables, while z is a vector of exogenous variables. Since A is a square matrix and when it is of full rank, we can write:

$$v = A^{-1} \cdot B \cdot z = H \cdot z \tag{14}$$

where $H = A^{-1} \cdot B$

The matrix A is:

	n	p	ρ	c	pc	k	r	m	y
n:	1	0	0	0	0	β_2/β_1	0	0	$-1/\beta_1$
p:	$-(1-\beta_1)$	1	0	0	0	β_2	0	0	0
r:	0	-1	1	0	0	1	0	0	-1
c:	0	0	0	1	γ_2	0	0	0	$-\gamma_1$
pc:	0	$-\alpha_1$	0	0	1	0	0	0	0
k:	0	0	0	0	0	1	μ_1	0	$-\mu_2$
r:	0	$-\lambda_1$	0	0	0	0	1	0	$-\gamma_2$
m:	0	$-\phi_2$	0	0	0	0	0	1	$-\phi_1$
y:	0	0	0	$-s_c$	0	$-s_I\delta\,(K/I)$	0	0	1

The matrix B which relates to the relevant exogenous variables can be written as:

	ε	w	pm	ms	g	e
n:	$-1/\beta_1$	1	0	0	0	0
p:	-1	1	0	0	0	0
ρ:	0	0	0	0	0	0
c:	0	0	0	0	0	0
pc:	0	0	α_2	0	0	0
k:	0	0	0	0	0	0
r:	0	0	0	$-\lambda_1$	0	0
m:	0	0	$-\phi_2$	0	0	0
y:	0	0	0	0	s_G	s_X

Taking 1990 as the reference year, we compute the shares of the final demand components in the national income. Together with the estimated parameters, the matrix H is derived and tabulated in Table 2. The elements in matrix H are to be interpreted as elasticities.

IV. Interpreting Hong Kong's Results as an Illustration

A. Technical Progress

Looking at the first column of Table 2 for Hong Kong, we note that

TABLE 2
MATRIX *H*: ELASTICITIES OF ENDOGENOUS VARIABLES WITH RESPECT TO EXOGENOUS VARIABLES

	Exogenous variables					
	ε	w	pm	ms	g	e
n	-0.0047	—0.7279	0.6576	-0.0034	0.0285	0.6837
p	-0.0121	0.6959	0.2829	-0.0105	0.0123	0.2941
pc	-0.0078	0.4477	0.5387	-0.0068	0.0079	0.1892
ρ	-0.0049	0.2803	0.6696	-0.0249	0.0290	0.6961
c	0.0045	-0.2609	-0.0289	0.0042	0.0030	0.0730
k	0.0001	-0.0082	-0.0120	0.0215	-0.0005	-0.0125
r	-0.0001	0.0044	0.1220	-0.1401	0.0053	0.1268
m	-0.0037	0.2119	-0.3102	-0.0021	0.0389	0.9314
y	0.0073	-0.4238	0.3747	0.0072	0.0163	0.3895

positive growth in the technical progress will have negative impact on the labor employment (n), the GDP deflator (p), the consumption price index (pc), the rental price of capital (ρ), interest rate (r) and import (m). Positive technological growth will increase output (y), consumption (c) and the capital stock (k).

Numerically, a one percent improvement in the technological growth rate, for example, an increase from 2% annual growth to 3% annual growth, will result in a 0.0047% decline in labor employment, 0.0121% decline in price level, 0.0078% decline in the consumption price, 0.0049% decline in the rental price of capital, 0.0001% decline in interest rate and 0.0037% decline in imports. Income will grow by 0.0073%, consumption grows by 0.0045% and capital by 0.0001%.

B. Labor Employment

The elasticity of labor employment with respect to wage rate is negative for Hong Kong. Every one percent rise in the wage rate reduce the labor employment by 0.73% and increase the general price level by 0.695%. Increasing wage rate will also have negative impact on income, consumption and capital formation.

C. Monetary and Fiscal Policies

Perhaps the more interesting results concern the monetary and fiscal instruments which the government may have some control. However, as the model is more suited to provide short or medium term impact measure, the long run neutrality of monetary growth on real output

should be kept in mind. An increase in the money supply in Hong Kong is, as expected, expansionary in impact. Inflation rate is also expected to rise. However, the result shows otherwise. An increase in the rate of growth in money supply will result in the decline in the interest rate which in turn will encourage the growth in capital stock. Through the production function, labor will be displaced for a given level of output. Since the wage rate is given, in order for the marginal productivity of labor to be in line with the real wage, the price level will fall. The decline in price level encourages consumption and lowers import resulting in a higher GDP growth. This is the outcome indicated by the empirical model for Hong Kong.

Increase in the growth of government expenditure has the expected positive impact on all endogenous variables except the growth of the capital stock, k. The expansionary impact of growth in government expenditure will result in a higher inflation rate which in turn decreases the real money supply and pushes the interest rate to a higher level. A higher interest rate will deter the growth in the capital stock.

The growth in export has the same qualitative results as that for a growth in the government expenditure. In terms of the relative magnitude, a one percent growth in export will have a larger impact than a one percent growth in government expenditure.

V. Interlinking National Economic Models

In the literature, several approaches for linking the models for individual economies by trade flows have been devised. These include the constant value share approach (CVS), Hickman-Lau's approach and the Samuelson-Kurihara's approach. Due to the paucity of data, the present version of our model makes use of a modified version of the CVS approach. As noted in the individual country model, there is an equation specified for the aggregate import of merchandise into the economy. In the detailed version of the model, the type of tradable goods are divided into 10 categories according to the SITC 0 to SITC 9. Here, we only consider the aggregate export and aggregate import relationships.

For say, country 1, its export X_1 is the sum of the exports to other countries in the world:

$$X_1 = X_{12} + X_{13} + X_{14} + \cdots + X_{ROW}, \tag{15}$$

where X_{1j} is the export of goods from country 1 to country j and X_{ROW}

is the export to the rest of the world. If we assume that the export from country 1 to country j (which is the import of country j from country 1) is a constant proportion of the country j's import:

$$X_{1j} = \varphi_{1j} \cdot M_j. \tag{16}$$

In growth rate terms, the export of country 1 can be written as:

$$x_1 = \xi_{12}x_{12} + \xi_{13}x_{13} + \xi_{14}x_{14} + \ldots + \xi_{1ROW}x_{ROW}. \tag{17}$$

$$x_1 = \xi_{12}m_2 + \xi_{13}m_3 + \xi_{14}m_4 + \ldots + \xi_{1ROW}x_{ROW}. \tag{18}$$

where $\xi_{1j} = x_{1j}/x_1$.

The import function which is specified for the aggregate import is repeated below.

$$m = \phi_1 y - \phi_2 (p_m - p) + \phi_0. \tag{11}$$

Consider the total import of country 1, M_1 expressed as the sum of imports from the trading partners:

$$M_1 = M_{12} + M_{13} + M_{14} + \ldots + M_{ROW}. \tag{19}$$

where M_{1j} = import of country 1 from country j.

Expressed in growth form:

$$m_1 = s_{12}m_{12} + s_{13}m_{13} + s_{14}m_{14} + \ldots + s_{1ROW}m_{ROW}, \tag{20}$$

where $s_{1j} = M_{1j}/M_1$.

We can specify that the growth of bilateral import of country 1 from country 2 is of the form:

$$m_{12} = \phi_1 y - \phi_2 (p_m^{12} - p) + \phi_0, \tag{21}$$

where p_m^{12} is import price faced by country 1 when importing from country 2. Similar specification can be made for m_{13}, m_{14}, and so on. Note that we have use the same income and price elasticities parameters (ϕ_1, ϕ_2). If we substitute the functional specification for m_{12}, m_{13}, ... into equation (20), the resultant equation will be consistent with equation (11) only if the import price, p_m is specified as the weighted average of the bilateral import prices:

$$p_m = s_{12}\, p_m^{12} + s_{13}\, p_m^{13} + s_{14}\, p_m^{14} + \ldots + s_{1ROW} p_m^{1ROW}.$$

As an illustration, the linking of two national models can be written in matrix form:

$$A = \begin{array}{ccc} A_1 & : & 0 \\ 0 & : & A_2 \\ & T_1 & \end{array} \qquad B = \begin{array}{ccc} B_1 & : & 0 \\ 0 & : & B_2 \\ & T_2 & \end{array}$$

Matrix A which refers to the endogenous variables is extended to include the sub-matrix T_1 which links the export of one country to the import of the other country. Similarly, matrix B is extended to include the sub-matrix T_2 which contains the export to the rest of the world.

In the Northeast Asian model, we have five national economies and their exports to countries outside Northeast Asia are divided into those to ASEAN, North America (US and Canada) and the rest of the world (ROW).

The reduced form matrix H for the multicountry model is computed. Its dimension is 45×53. Of particular interest are the elements of the H matrix which will indicate the impact of relative change in exogenous variables in one country on the endogenous variables in other countries.

We shall analyze the results from the interlinked model in six aspects, namely, the impact of:

(1) total factor productivity (TFP) growth
(2) nominal wage rate
(3) growth in money supply
(4) growth of government expenditure
(5) export growth in other parts of the world
(6) growth in import prices

A. Impact of Technical Progress

Table 3 shows that positive technical progress in Hong Kong, Taiwan, South Korea and Japan have negative impact on the labor employment, prices and rental price of capital in all the Northeast Asian economies. For instance, productivity growth in Hong Kong will reduce its inflation which will increase the relative price of imports leading to a reduction of imports into Hong Kong. The exports of Hong Kong's trading partners will decrease, consequently their output fall and labor employment contract. Surplus capital will also lead to lower rental price of capital.

The exception to the above observation is for China. Technological growth in China has a negative impact on its own labor employment, price level and rental price of capital. However, its impact on the other

TABLE 3

IMPACT OF TECHNICAL PROGRESS

		H.K.	Taiwan	Korea	China	Japan
On Employment						
H.K.	$n1$	–0.00478	–0.00004	–0.00001	0.00010	–0.00007
Taiwan	$n2$	–0.00021	–0.01173	–0.00001	0.00001	–0.00018
Korea	$n3$	–0.00008	–0.00003	–0.01215	0.00001	–0.00020
China	$n4$	–0.00022	–0.00000	–0.00000	–0.01251	–0.00007
Japan	$n5$	–0.00004	–0.00004	–0.00000	0.00001	–0.01079
On Price						
H.K.	$p1$	–0.01208	–0.00002	–0.00000	0.00004	–0.00003
Taiwan	$p2$	–0.00010	–0.01568	–0.00001	0.00000	–0.00009
Korea	$p3$	–0.00002	–0.00001	–0.01495	0.00000	–0.00005
China	$p4$	–0.00007	–0.00000	–0.00000	–0.01479	–0.00002
Japan	$p5$	—0.00001	–0.00001	–0.00000	0.00000	–0.01647
On Rental Price of Capital						
H.K.	ρ_1	–0.00493	–0.00004	–0.00001	0.00010	–0.00008
Taiwan	ρ_2	–0.00021	–0.01183	–0.00001	0.00001	–0.00018
Korea	ρ_3	–0.00008	–0.00003	–0.01907	0.00001	–0.00020
China	ρ_4	–0.00020	–0.00000	–0.00000	–0.01453	–0.00006
Japan	ρ_5	–0.00002	–0.00003	–0.00000	0.00000	–0.01416
On Consumption						
H.K.	$c1$	0.00451	–0.00000	–0.00000	0.00001	–0.00001
Taiwan	$c2$	–0.00003	0.00389	–0.00000	0.00000	–0.00003
Korea	$c3$	–0.00002	–0.00001	0.00255	0.00000	–0.00005
China	$c4$	–0.00009	–0.00000	–0.00000	0.00435	–0.00003
Japan	$c5$	–0.00000	–0.00000	–0.00000	0.00000	0.00850
On Capital Stock						
H.K.	$k1$	0.00014	0.00000	0.00000	–0.00000	0.00000
Taiwan	$k2$	–0.00000	0.00009	–0.00000	0.00000	–0.00000
Korea	$k3$	–0.00000	–0.00000	0.00692	0.00000	–0.00001
China	$k4$	–0.00002	–0.00000	–0.00000	0.00202	–0.00001
Japan	$k5$	–0.00001	–0.00001	–0.00000	0.00000	0.00337
On Interest Rate						
H.K.	$r1$	–0.00009	–0.00001	–0.00000	0.00002	–0.00001
Taiwan	$r2$	–0.00001	–0.00029	–0.00000	0.00000	–0.00001
Korea	$r3$	–0.00003	–0.00001	–0.01222	0.00000	–0.00009
China	$r4$	–0.00010	–0.00000	–0.00000	–0.00283	–0.00003
Japan	$r5$	–0.00000	–0.00000	–0.00000	0.00000	–0.00247
On Import						
H.K.	$m1$	–0.00377	–0.00006	–0.00001	0.00013	–0.00010
Taiwan	$m2$	–0.00044	–0.00398	–0.00003	0.00002	–0.00036
Korea	$m3$	–0.00007	–0.00003	–0.00161	0.00001	–0.00017

TABLE 3
CONTINUED

		H.K.	Taiwan	Korea	China	Japan
China	*m*4	–0.00065	–0.00001	–0.00000	0.00095	–0.00020
Japan	*m*5	–0.00004	–0.00005	–0.00000	0.00001	–0.00315
On GDP						
H.K.	*y*1	0.00730	–0.00002	–0.00000	0.00006	–0.00004
Taiwan	*y*2	–0.00011	0.00395	–0.00001	0.00000	–0.00009
Korea	*y*3	–0.00006	–0.00002	0.00281	0.00000	–0.00015
China	*y*4	–0.00015	–0.00000	–0.00000	0.00228	–0.00005
Japan	*y*5	–0.00002	–0.00003	–0.00000	0.00000	0.00568
On Export						
H.K.	*e*1	–0.00012	–0.00007	–0.00001	0.00016	–0.00013
Taiwan	*e*2	–0.00053	–0.00001	–0.00003	0.00002	–0.00044
Korea	*e*3	–0.00023	–0.00009	–0.00000	0.00002	–0.00058
China	*e*4	–0.00164	–0.00003	–0.00000	0.00006	–0.00051
Japan	*e*5	–0.00022	–0.00023	–0.00000	0.00003	–0.00003

countries are positive. The price reduction as a result of Chinese productivity growth provides substantial encouragement to the increase in consumption and exports. The expanded national income fuels the increase in imports, overwhelming the negative price effect on imports. The overall increase in import by China will lead to increase in exports of China's trading partners. Output expand in these trading partners, resulting in higher employment, price and rental price of capital.

In this model we have not considered the possible diffusion of technological know-how from one country to another via trade linkages. The inclusion of this will lessen the negative impact of technical progress in one country on its trading partners but would foster positive learning effect, technological upgrading and even higher efficiency in resource allocation and welfare attainment. Lower price in the country experiencing technological growth will provide it with competitive advantage to expand its export market to other parts of the world.

Table 4 presents the impact of technical progress in absolute terms for 1990 and measured in million US dollars. For the Japanese economy, a one percent growth in the TFP will increase its GNP by US$ 170 million. For Taiwan, South Korea and China, their GDP will increase between US$5 to US$6 million. The smallest increase of US$4 million is recorded for Hong Kong. However, the spillover effect of a one percent increase in TFP for Hong Kong is the largest among the five

TABLE 4
ABSOLUTE IMPACT OF TECHNICAL PROGRESS, 1990

US$ MILLION

	H.K.	Taiwan	Korea	China	Japan
GDP					
Self	3.80	5.46	5.16	5.96	170.07
Other 4	-1.39	-0.82	-0.02	0.15	-0.55
Merchandise exports					
Self	-0.08	-0.01	-0.00	0.01	-0.11
Other 4	-1.70	-0.91	-0.04	0.26	-0.88
Merchandise imports					
Self	-2.51	-2.51	-1.09	0.19	-9.74
Other 4	-0.58	-0.20	-0.03	0.12	-0.45

economies. The GDP of the East Asian economies (excluding Hong Kong) will decline by US$1.4 million. This is much higher that than for the other economies in Northeast Asia.

As noted earlier, China is the only exception among the five Northeast Asian economies to have positive impact for its own GDP and GDP of other economies when its TFP accelerates.

B. Impact of Growth in Nominal Wage Rate

For each individual economy, Table 5 shows an increase in wage will result in the decline of employment growth but increase in inflation and the rental price of capital. Higher price level will also lead to lower consumption growth and lower capital growth because of a higher interest rate.

Regarding the trade variables, both export and import growth are positive. The net effect on the output growth of the economy is negative for an increase in the growth of wage rate.

In terms of cross country effects, the increase in import growth will stimulate the positive growth of export of trading partners. The output of trading partners will rise resulting in increase in employment, prices, rental price of capital, capital stock and export.

In Table 6, a one percent increase in wage rate in Hong Kong has a much larger impact on the other economies in East Asia for GDP and exports but not imports. Using 1990 as the base year, wage rate increase in Hong Kong is detrimental to its output (US$ 221 million) but benefits the other Northeast Asian economies (US$ 80 million), probably, China in particular. This accounts for larger exports by the

TABLE 5

ELASTICITIES WITH RESPECT TO NOMINAL WAGE

		H.K.	Taiwan	Korea	China	Japan
On Employment						
H.K.	$n1$	–0.72375	0.00226	0.00057	–0.00659	0.00405
Taiwan	$n2$	0.01233	–0.39007	0.00099	–0.00053	0.00966
Korea	$n3$	0.00466	0.00168	–0.10084	–0.00044	0.01094
China	$n4$	0.01265	0.00022	0.00005	–0.16118	0.00367
Japan	$n5$	0.00204	0.00190	0.00002	–0.00036	–0.41436
On Price						
H.K.	$p1$	0.69768	0.00097	0.00024	–0.00283	0.00174
Taiwan	$p2$	0.00590	0.81499	0.00047	–0.00025	0.00462
Korea	$p3$	0.00117	0.00042	1.10685	–0.00011	0.00275
China	$p4$	0.00378	0.00007	0.00001	0.99147	0.00110
Japan	$p5$	0.00064	0.00060	0.00001	–0.00011	0.89421
On Rental Price of Capital						
H.K.	ρ_1	0.28452	0.00231	0.00058	–0.00671	0.00413
Taiwan	ρ_2	0.01228	0.61475	0.00098	–0.00053	0.00962
Korea	ρ_3	0.00452	0.00162	1.41135	–0.00043	0.01060
China	ρ_4	0.01147	0.00020	0.00004	0.97412	0.00333
Japan	ρ_5	0.00141	0.00131	0.00002	–0.00024	0.76855
On Consumption						
H.K.	$c1$	–0.26046	0.00024	0.00006	–0.00070	0.00043
Taiwan	$c2$	0.00200	–0.20204	0.00016	–0.00009	0.00157
Korea	$c3$	0.00126	0.00045	–0.18907	–0.00012	0.00295
China	$c4$	0.00548	0.00010	0.00002	–0.29179	0.00159
Japan	$c5$	0.00016	0.00015	0.00000	–0.00003	–0.46159
On Capital Stock						
H.K.	$k1$	–0.00827	–0.00004	–0.00001	0.00012	–0.00007
Taiwan	$k2$	0.00005	–0.00482	0.00000	–0.00000	0.00004
Korea	$k3$	0.00014	0.00005	–0.51219	–0.00001	0.00033
China	$k4$	0.00118	0.00002	0.00000	–0.13530	0.00034
Japan	$k5$	0.00064	0.00059	0.00001	–0.00011	–0.18291
On Interest Rate						
H.K.	$r1$	0.00519	0.00042	0.00010	–0.00122	0.00075
Taiwan	$r2$	0.00055	0.01522	0.00004	–0.00002	0.00043
Korea	$r3$	0.00202	0.00072	0.90428	–0.00019	0.00473
China	$r4$	0.00594	0.00011	0.00002	0.18984	0.00172
Japan	$r5$	0.00023	0.00021	0.00000	–0.00004	0.13426
On Import						
H.K.	$m1$	0.21757	0.00309	0.00077	–0.00897	0.00552
Taiwan	$m2$	0.02524	0.20689	0.00202	–0.00108	0.01978
Korea	$m3$	0.00386	0.00139	0.11898	–0.00036	0.00905

TABLE 5
CONTINUED

		H.K.	Taiwan	Korea	China	Japan
China	*m*4	0.03730	0.00066	0.00013	-0.06393	0.01083
Japan	*m*5	0.00251	0.00234	0.00003	-0.00044	0.17078
On GDP						
H.K.	*y*1	-0.42143	0.00129	0.00032	-0.00375	0.00231
Taiwan	*y*2	0.00643	-0.20506	0.00051	-0.00028	0.00504
Korea	*y*3	0.00349	0.00125	-0.20769	-0.00033	0.00818
China	*y*4	0.00887	0.00016	0.00003	-0.15265	0.00257
Japan	*y*5	0.00140	0.00131	0.00002	-0.00024	-0.30857
On Export						
H.K.	*e*1	0.00696	0.00380	0.00095	-0.01104	0.00679
Taiwan	*e*2	0.03064	0.00077	0.00245	-0.00131	0.02401
Korea	*e*3	0.01346	0.00484	0.00009	-0.00127	0.03158
China	*e*4	0.09465	0.00168	0.00034	-0.00395	0.02747
Japan	*e*5	0.01274	0.01188	0.00015	-0.00222	0.00167

TABLE 6
ABSOLUTE IMPACT OF WAGE GROWTH

US$Million

	H.K.	Taiwan	Korea	China	Japan
GDP					
Self	-221.29	-283.65	-382.26	-399.21	-923.36
Other 4	80.39	42.45	1.47	-10.25	29.98
Merchandise Exports					
Self	4.87	0.59	0.05	-0.97	5.83
Other 4	98.43	47.20	3.14	-17.17	47.70
Merchandise Imports					
Self	144.73	130.27	80.86	-12.47	528.94
Other 4	33.57	10.38	1.90	-8.25	24.39

other Northeast Asian economies (US$ 98 million) and larger imports by Hong Kong (US$ 33 million). This pattern holds for Taiwan, South Korea and Japan as well.

But for China, a one percent increase in wage rate adversely affects its own output as well as of the other Northeast Asian economies. It is also detrimental to its own and others' exports and imports. The adverse impact of wage rate increase in China may be because it is a growing source of inputs to the other Northeast Asian economies.

C. Impact of Growth in Money Supply

An increase in the growth of the money supply growth has the expected positive effect on the output growth of all economies in Northeast Asia (Table 7). However, the same cannot be said of the spillover effects, In general, Hong Kong and Taiwan have negative impact on the other economies for unilateral expansionary monetary policies. Expansionary monetary policies are often associated with inflationary tendencies. With respect to the NE Asian economies, only in China is there pressure for price to rise when money supply grows. In the other four NE Asian economies, the long run effect on the price is negative. This can be explained by the fact that money supply growth leads to greater output; the growth in labor demand is not as great as the growth in output resulting in productivity gain. The rise in productivity exerts a downward pressure on price.

Using 1990 as the base year, a one percent growth in money supply in Hong Kong will generate an increase in Hong Kong's GDP by US$ 0.375 millon but would depress the GDP of other Nor-theast Asian economies by US$0.08 million (see Table 8). Japan's GDP in 1990 will increase by US47.69 million if the money supply were to increase by one percent. Japanese expansionary monetary policies has very positive impact on the GDP of other Northeast Asian economies. In fact, China is one economy where expansionary monetary policy will exert the highest positive impact on GDP of other Northeast Asian economies. If this conclusion is correct, the recent contractionary monetary policy by China to cool its economy would have a negative impact on GDP of other Northeast Asian economies.

D. Impact of Growth of Government Expenditure

In contrast to monetary policies, the sign of the impact of an expansionary fiscal policy is homogenous across all countries. All entries in Table 9 are positive with the exception of one row corresponding to the capital stock growth in Hong Kong. The positive output growth due to the increase in government expenditure will drive the rate of interest upward which would in turn discourages the growth in capital stock. Growth in capital stock in Hong Kong seems more sensitive to interest rate changes than to increase in income growth. Hence a net decline in the growth of capital stock results.

A one percent growth in government expenditure in Japan will

TABLE 7

ELASTICITIES WITH RESPECT TO MONEY SUPPLY GROWTH

		H.K.	Taiwan	Korea	China	Japan
On Employment						
H.K.	$n1$	–0.00339	–0.00000	0.00012	0.00535	0.00008
Taiwan	$n2$	–0.00012	–0.00157	0.00020	0.00043	0.00019
Korea	$n3$	–0.00005	–0.00000	–0.08412	0.00036	0.00022
China	$n4$	–0.00012	–0.00000	0.00001	–0.02845	0.00007
Japan	$n5$	–0.00002	–0.00000	0.00001	0.00029	–0.01272
On Price						
H.K.	$p1$	–0.01053	–0.00000	0.00005	0.00230	0.00004
Taiwan	$p2$	–0.00006	–0.00228	0.00010	0.00021	0.00009
Korea	$p3$	–0.00001	–0.00000	–0.15342	0.00009	0.00006
China	$p4$	–0.00004	–0.00000	0.00000	0.04815	0.00002
Japan	$p5$	–0.00001	–0.00000	0.00000	0.00009	–0.02866
On Rental Price of Capital						
H.K.	ρ_1	–0.02493	–0.00000	0.00012	0.00545	0.00008
Taiwan	ρ_2	–0.00012	–0.00474	0.00020	0.00043	0.00019
Korea	ρ_3	–0.00004	–0.00000	–0.59064	0.00035	0.00021
China	ρ_4	–0.00011	–0.00000	0.00001	–0.14606	0.00007
Japan	ρ_5	–0.00001	–0.00000	0.00000	0.00020	–0.06271
On Consumption						
H.K.	$c1$	0.00418	–0.00000	0.00001	0.00057	0.00001
Taiwan	$c2$	–0.00002	0.00062	0.00003	0.00007	0.00003
Korea	$c3$	–0.00001	–0.00000	0.04212	0.00010	0.00006
China	$c4$	–0.00005	–0.00000	0.00000	0.02274	0.00003
Japan	$c5$	–0.00000	–0.00000	0.00000	0.00002	0.01663
On Capital Stock						
H.K.	$k1$	0.02154	0.00000	–0.00000	–0.00010	–0.00000
Taiwan	$k2$	–0.00000	0.00317	0.00000	0.00000	0.00000
Korea	$k3$	–0.00000	–0.00000	0.50653	0.00001	0.00001
China	$k4$	–0.00001	–0.00000	0.00000	0.11761	0.00001
Japan	$k5$	–0.00001	–0.00000	0.00000	0.00009	0.04999
On Interest Rate						
H.K.	$r1$	–0.14011	–0.00000	0.00002	0.00099	0.00002
Taiwan	$r2$	–0.00001	–0.03266	0.00001	0.00002	0.00001
Korea	$r3$	–0.00002	–0.00000	–0.98425	0.00015	0.00010
China	$r4$	–0.00006	–0.00000	0.00000	–0.27890	0.00003
Japan	$r5$	–0.00000	–0.00000	0.00000	0.00003	–0.18143
On Import						
H.K.	$m1$	–0.00213	–0.00000	0.00016	0.00729	0.00011
Taiwan	$m2$	–0.00025	–0.00018	0.00041	0.00088	0.00040
Korea	$m3$	–0.00004	–0.00000	0.02428	0.00030	0.00018

TABLE 7
CONTINUED

		H.K.	Taiwan	Korea	China	Japan
China	*m*4	–0.00037	–0.00000	0.00003	0.05192	0.00022
Japan	*m*5	–0.00002	–0.00000	0.00001	0.00036	0.00344
On GDP						
H.K.	*y*1	0.00714	–0.00000	0.00007	0.00305	0.00005
Taiwan	*y*2	–0.00006	0.00071	0.00010	0.00022	0.00010
Korea	*y*3	–0.00003	–0.00000	0.06930	0.00027	0.00016
China	*y*4	–0.00009	–0.00000	0.00001	0.01970	0.00005
Japan	*y*5	–0.00001	–0.00000	0.00000	0.00020	0.01594
On Export						
H.K.	*e*1	–0.00007	–0.00000	0.00019	0.00897	0.00014
Taiwan	*e*2	–0.00030	–0.00000	0.00050	0.00107	0.00048
Korea	*e*3	–0.00013	–0.00000	0.00002	0.00103	0.00064
China	*e*4	–0.00093	–0.00000	0.00007	0.00321	0.00055
Japan	*e*5	–0.00012	–0.00001	0.00003	0.00180	0.00003

TABLE 8
ABSOLUTE IMPACT OF MONEY SUPPLY GROWTH

US$Million

	H.K. ms1	Taiwan ms2	Korea ms3	China ms4	Japan ms5
GDP					
Self	0.375	0.098	12.755	5.152	47.691
Other 4	–0.079	–0.004	0.030	0.832	0.060
Merchandise Exports					
Self	–0.005	–0.000	0.001	0.078	0.012
Other 4	–0.096	–0.004	0.064	1.394	0.096
Merchandise Imports					
Self	–0.142	–0.011	1.650	1.013	1.066
Other 4	–0.033	–0.001	0.039	0.670	0.049

increase the GDP by US$2.4 billion (using 1990 as the base year as in Table 10). However, the spillover effect of Japanese expansionary fiscal policy is small (US$25 million) relative to that of Taiwan and China. In particular, Taiwan's GDP will expand by only US$87 million a result of one percent growth in government expenditure, whereas, the spillover impact is US$51 million increase in GDP for other Northeast Asian GDPs.

TABLE 9
ELASTICITIES WITH RESPECT TO FISCAL POLICIES

		H.K.	Taiwan	Korea	China	Japan
On Employment						
H.K.	*n*1	0.02928	0.00272	0.00042	0.04011	0.00341
Taiwan	*n*2	0.00226	0.12125	0.00074	0.00322	0.00813
Korea	*n*3	0.00085	0.00201	0.10804	0.00268	0.00921
China	*n*4	0.00232	0.00027	0.00003	0.13201	0.00309
Japan	*n*5	0.00037	0.00229	0.00002	0.00216	0.11686
On Price						
H.K.	*p*1	0.01260	0.00117	0.00018	0.01726	0.00147
Taiwan	*p*2	0.00108	0.05798	0.00035	0.00154	0.00389
Korean	*p*3	0.00022	0.00051	0.02720	0.00068	0.00232
China	*p*4	0.00069	0.00008	0.00001	0.03946	0.00092
Japan	*p*5	0.00012	0.00072	0.00001	0.00068	0.03679
On Rental Price of Capital						
H.K.	*r*1	0.02982	0.00277	0.00043	0.04084	0.00347
Taiwan	*r*2	0.00225	0.12074	0.00074	0.00320	0.00810
Korea	*r*3	0.00083	0.00195	0.10473	0.00260	0.00893
China	*r*4	0.00210	0.00024	0.00003	0.11970	0.00280
Japan	*r*5	0.00026	0.00157	0.00001	0.00149	0.08049
On Consumption						
H.K.	*c*1	0.00313	0.00029	0.00005	0.00428	0.00036
Taiwan	*c*2	0.00037	0.01967	0.00012	0.00052	0.00132
Korea	*c*3	0.00023	0.00054	0.02910	0.00072	0.00248
China	*c*4	0.00100	0.00012	0.00001	0.05720	0.00134
Japan	*c*5	0.00003	0.00018	0.00000	0.00017	0.00910
On Capital Stock						
H.K.	*k*1	–0.00053	–0.00005	–0.00001	–0.00073	–0.00006
Taiwan	*k*2	0.00001	0.00051	0.00000	0.00001	0.00003
Korea	*k*3	0.00003	0.00006	0.00331	0.00008	0.00028
China	*k*4	0.00022	0.00003	0.00000	0.01231	0.00029
Japan	*k*5	0.00012	0.00071	0.00001	0.00067	0.03637
On Interest Rate						
H.K.	*r*1	0.00543	0.00050	0.00008	0.00744	0.00063
Taiwan	*r*2	0.00010	0.00540	0.00003	0.00014	0.00036
Korea	*r*3	0.00037	0.00087	0.04671	0.00116	0.00398
China	*r*4	0.00109	0.00013	0.00002	0.06200	0.00145
Japan	*r*5	0.00004	0.00025	0.00000	0.00024	0.01291
On Import						
H.K.	*m*1	0.03989	0.00370	0.00058	0.05464	0.00465
Taiwan	*m*2	0.00463	0.24822	0.00152	0.00659	0.01665
Korea	*m*3	0.00071	0.00166	0.08941	0.00222	0.00762

TABLE 9
CONTINUED

		H.K.	Taiwan	Korea	China	Japan
China	*m*4	0.00684	0.00079	0.00010	0.38934	0.00912
Japan	*m*5	0.00046	0.00281	0.00002	0.00266	0.14379
On GDP						
H.K.	*y*1	0.01668	0.00155	0.00024	0.02285	0.00194
Taiwan	*y*2	0.00118	0.06327	0.00039	0.00168	0.00424
Korea	*y*3	0.00064	0.00150	0.08083	0.00201	0.00689
China	*y*4	0.00163	0.00019	0.00002	0.09256	0.00217
Japan	*y*5	0.00026	0.00157	0.00001	0.00148	0.08007
On Export						
H.K.	*e*1	0.00128	0.00456	0.00071	0.06726	0.00572
Taiwan	*e*2	0.00562	0.00093	0.00184	0.00800	0.02021
Korea	*e*3	0.00247	0.00580	0.00007	0.00775	0.02659
China	*e*4	0.01736	0.00202	0.00025	0.02407	0.02313
Japan	*e*5	0.00234	0.01425	0.00012	0.01350	0.00141

TABLE 10
ABSOLUTE IMPACT OF FISCAL POLICY IN US$ MILLION

	H.K.	Taiwan	Korea	China	Japan
GDP					
Self	8.76	87.51	148.78	242.05	2396.04
Other 4	14.74	50.93	1.11	62.40	25.24
Merchandise Exports					
Self	0.89	0.70	0.04	5.88	4.91
Other 4	18.05	56.63	2.36	104.56	40.16
Merchandise Imports					
Self	26.54	156.29	60.76	75.92	445.34
Other 4	6.16	12.46	1.43	50.25	20.53

E. Impact of Export Growth in Other Parts of the World

The qualitative impact of the increase in export growth outside the Northeast Asia region is similar to that of fiscal policies initiated in each of the countries (Table 11).

In absolute terms, using 1990 as a reference year, a one percent increase in the growth of export to North America will yield US$1,688 million of GDP in the Northeast Asian economies (Table 12). For a simi-

TABLE 11

ELASTICITIES WRT EXPORT GROWTH IN OTHER PARTS OF THE WORLD

		Xasean	Xnamer	Xrow
On Employment				
H.K.	$n1$	0.03336	0.09831	0.37258
Taiwan	$n2$	0.04734	0.16441	0.12287
Korea	$n3$	0.03053	0.12330	0.13099
China	$n4$	0.01430	0.04733	0.03791
Japan	$n5$	0.02247	0.06259	0.06702
On Price				
H.K.	$p1$	0.01435	0.04230	0.16030
Taiwan	$p2$	0.02264	0.07862	0.05876
Korea	$p3$	0.00769	0.03105	0.03298
China	$p4$	0.00427	0.01415	0.01133
Japan	$p5$	0.00707	0.01970	0.02110
On Rental Price of Capital				
H.K.	ρ_1	0.03396	0.10010	0.37937
Taiwan	ρ_2	0.04714	0.16371	0.12235
Korea	ρ_3	0.02960	0.11952	0.12698
China	ρ_4	0.01297	0.04291	0.03437
Japan	ρ_5	0.01548	0.04311	0.04616
On Consumption				
H.K.	$c1$	0.00356	0.01049	0.03976
Taiwan	$c2$	0.00768	0.02667	0.01993
Korea	$c3$	0.00822	0.03321	0.03529
China	$c4$	0.00620	0.02051	0.01643
Japan	$c5$	0.00175	0.00487	0.00522
On Capital Stock				
H.K.	$k1$	–0.00061	–0.00179	–0.00680
Taiwan	$k2$	0.00020	0.00069	0.00052
Korea	$k3$	0.00093	0.00378	0.00401
China	$k4$	0.00133	0.00441	0.00354
Japan	$k5$	0.00699	0.01948	0.02086
On Interest Rate				
H.K.	$r1$	0.00619	0.01824	0.06913
Taiwan	$r2$	0.00211	0.00732	0.00547
Korea	$r3$	0.01320	0.05331	0.05664
China	$r4$	0.00672	0.02223	0.01780
Japan	$r5$	0.00248	0.00691	0.00740
On Import				
H.K.	$m1$	0.04544	0.13394	0.50759
Taiwan	$m2$	0.09692	0.33658	0.25155
Korea	$m3$	0.02527	0.10204	0.10841

TABLE 11
CONTINUED

		Xasean	Xnamer	Xrow
China	*m*4	0.04217	0.13957	0.11180
Japan	*m*5	0.02765	0.07701	0.08247
On GDP				
H.K.	*y*1	0.01900	0.05601	0.21227
Taiwan	*y*2	0.02470	0.08579	0.06411
Korea	*y*3	0.02284	0.09225	0.09801
China	*y*4	0.01003	0.03318	0.02658
Japan	*y*5	0.01539	0.04288	0.04593
On Export				
H.K.	*e*1	0.05594	0.16487	0.62481
Taiwan	*e*2	0.11767	0.40864	0.30540
Korea	*e*3	0.08815	0.35599	0.37821
China	*e*4	0.10703	0.35421	0.28373
Japan	*e*5	0.14009	0.39024	0.41791

TABLE 12
ABSOLUTE IMPACT OF EXPORT GROWTH IN OTHER PARTS OF THE WORLD IN US$MILLION

	ASEAN	N. America	Rest of the World
GDP	573.09	1687.90	1824.30
Exports	692.96	2074.74	2409.98
Imports	202.27	636.10	846.94

lar one percent growth in export to the ASEAN economies, the contribution to GDP of the five Northeast Asian economies will US$573 million, which is about a third of that for the export growth to North America.

F. A Possible Northeast Asian Free Trade Area

Before we consider the impact of a hypothetical Northeast Asian Free Trade Agreement, similar to the North American Free Trade Agreement (NAFTA), it is useful to know the existing trade relations between them as a bloc vis-a-vis the other major regions in the world. Table 13 shows the trade flows between Northeast Asia and the other regions. The relative importance of each region to one another are indicated by the computed export and import shares. Table 14 shows the individual Northeast Asian economies' GDP, exports and imports in 1990.

TABLE 13
TRADE RELATIONS BETWEEN MAJOR REGIONS, 1990

	NE Asia	ASEAN	N. Amer	ROW	Total
Trade Flows in US$b					
NE Asia	146.3	58.0	176.1	175.6	555.9
ASEAN	46.1	24.7	30.0	38.2	139.0
N. Amer	105.7	25.4	168.9	206.7	506.8
ROW	193.6	52.2	258.2	1618.4	2122.4
Tot imp	491.7	160.3	633.2	2038.8	3324.0
Imports: Percentage Distribution					
NE Asia	29.7	36.2	27.8	8.6	16.7
ASEAN	9.4	15.4	4.7	1.9	4.2
N. Amer	21.5	15.9	26.7	10.1	15.2
ROW	39.4	32.6	40.8	79.4	63.8
Tot imp	100.0	100.0	100.0	100.0	100.0
Exports: Percentage Distribution					
NE Asia	26.3	10.4	31.7	31.6	100.0
ASEAN	33.2	17.8	21.6	27.5	100.0
N. Amer	20.9	5.0	33.3	40.8	100.0
ROW	9.1	2.5	12.2	76.3	100.0
Tot exp	14.8	4.8	19.0	61.3	100.0

TABLE 14
GDP, EXPORTS AND IMPORTS IN NORTHEAST ASIA, 1990

US$ BILLION

	HK	Taiwan	S. Korea	China	Japan	NE Asia
GDP	52.5	138.3	184.1	261.5	2992.4	3628.8
Exports	82.2	67.1	65.0	61.3	280.4	555.9
Imports	82.5	54.3	69.8	53.3	231.7	491.7

Intra regional trade is of a much larger magnitude in Northeast Asia than in ASEAN. In 1990, intra regional trade in Northeast Asia amounted to US$146 billion which is more than 6 times the intra regional trade (US$24 billion) among ASEAN countries. In terms of export, intra regional exports constitutes 26.3% of total Northeast Asia's exports, while intra regional exports only constitute 17.8% of total ASEAN's exports. About one third of ASEAN's export goes to Northeast Asia. However, only about 10% of Northeast Asia's exports go to ASEAN. For ASEAN, 36% of its imports come from Northeast Asia, but for Northeast Asia, only 9% of its imports come from ASEAN. While both regions are heavily dependent on North America, the dependency

TABLE 15
BILATERAL AVERAGE TARIFF RATE (Percent)
(Excluding agricultural products)

	China	S. Korea	Taiwan	Japan	USA	EU	ROW	AVG
China	-	10.9	10.9	13.4	8.5	17.8	10.1	12.2
S. Korea	35.4	-	23.0	11.2	24.3	10.0	11.4	14.5
Taiwan	28.2	19.2	-	10.3	19.3	8.0	9.1	11.5
Japan	12.0	9.2	9.0	-	14.6	13.3	7.2	12.5

Note: Hong Kong is excluded from the table as it is basically a free port. EU denotes Europe, ROW for Rest of the World and AVG is the overall average tariff rate.
Source: Adapted from the GTAP database, University of Purdue.

TABLE 16
REDUCTION OF BILATERAL IMPORT PRICES BY 10%

	H.K.	Taiwan	S. Korea	China	Japan	Total	% of total
GDP US$m							
Created	384.9	275.8	352.8	1327.9	4073.6	6415.1	0.16
%	6.0	4.3	5.5	20.7	63.5	100.0	
Exports US$m							
Created	965.1	850.0	613.5	1942.9	2019.6	6391.1	1.20
%	15.1	13.3	9.6	30.4	31.6	100.0	
Imports US$m							
Created	1919.8	859.4	488.5	1138.2	1985.2	6391.1	1.30
%	30.0	13.4	7.6	17.8	31.1	100.0	

is higher for the Northeast Asia bloc. Apparently, there is further scope to liberalize trade in the Northeast Asian region as indicated by the average bilateral tariff rate for non-agricultural goods in Table 15. We hope the removal of tariff barriers will be a precursor for the removal of tariff barrier on agricultural products and non-tariff barriers which are perhaps of greater significance in the Northeast asian region.

On a possible free trade area (FTA) among Northeast Asian countries, we use the model to investigate the impact of say, a 10% reduction in tariff among them. But the tariff remains unchanged for the other non-member economies. Table 16 shows the results for changes in GDP, exports and imports of the member countries in the FTA.

The last column indicates the total impact on GDP, exports and imports as percentages of their respective totals as a group. Thus, GDP generated as a result of the tariff reduction constitutes 0.16% of the

TABLE 17
10% DECREASE IN THE BILATERAL IMPORT PRICES WRT ASEAN

	H.K.	Taiwan	S. Korea	China	Japan	Total	% of total
GDP US$							
Created	-137.2	-128.6	-29.9	8.1	-2169.7	-2457.4	-0.068
%	5.6	5.2	1.2	-0.3	88.3	100.0	
Exports US$m							
Created	66.0	95.7	101.9	145.3	124.2	533.7	0.096
%	12.5	17.9	19.1	27.2	23.3	100.0	
Imports US$m							
Created	251.6	204.4	130.2	167.9	1657.3	2411.4	0.490
%	10.4	8.5	5.4	7.0	68.7	100.0	

combined GDP of Northeast Asia in 1990. The tariff reduction has the desired effect on trade flows, namely, exports increase by US$6.4 billion (1.20% of total Northeast Asia exports in 1990).

Of the total of US$6.4 billion of GDP generated with the tariff reduction, the largest proportion (US$4.1 billion) is accrued to Japan. The smallest gain in GDP is for Taiwan (US$276 million or 4.3%).

Japan also enjoys the largest increase in export (US$2,020 million or 31.6%). The second largest increase in export is for China (US$1943 million, 30.4%) followed by Hong Kong, (US$965 million, 15.2%). In fact the combined exports generated for Hong Kong and China exceed that of Japan.

These results reaffirm the synergy in greater China comprising China, Hong Kong and Taiwan. South Korea does not seem to benefit as much should an Northeast Asia free trade area be formed.

Two further simulations were conducted to investigate the impact of a bilateral reduction in import prices (10%) between the Northeast Asian countries and ASEAN (as a bloc) and between the Northeast Asian countries and North America (as a bloc). These results are shown in Tables 17 and 18.

As a result of a concurrent decrease in import prices of 10% by the Northeast Asian economies vis-a-vis ASEAN, the combined GDP of the Northeast Asian economies declines by US$2.5 billion which is only about 0.07% of the combined GDP in 1990(Table 17). China is the only economy that will experience an increase in GDP. On the other hand, both exports and imports are given positive boosts. Total Northeast Asian exports increase by US$534 million, while imports increase by US$2,411 million.

TABLE 18
10% DECREASE IN THE BILATERAL IMPORT PRICES WRT NORTH AMERICA

	H.K.	Taiwan	S. Korea	China	Japan	Total	% of total
GDP US$m							
Created	−137.1	−486.9	−241.4	−0.2	−4740.1	−5605.8	−0.154
%	2.4	8.7	4.3	0.0	84.6	100.0	
Exports US$m							
Created	137.9	187.2	216.1	246.8	272.2	1060.1	0.191
%	13.0	17.7	20.4	23.3	25.7	100.0	
Imports US$m							
Created	329.8	594.4	444.2	317.9	3621.6	5308.0	1.080
%	6.2	11.2	8.4	6.0	68.2	100.0	

Repeating the simulation for Northeast Asia vis-a-vis North American region. Table 18 show the results.

The overall impact with respect to GDP, imports and exports are much larger compared to the previous simulation with ASEAN. This reflects the greater reliance of the Northeast Asian economies on North America, particularly the US than on the ASEAN economies. As a result of the 10% drop in import prices, US$1,060 million of exports and US$5,308 million of imports from the Northeast Asian economies were stimulated. These were about twice that observed in Table 15 for ASEAN.

VI. Conclusion and Policy Implications

The Asia Pacific interlinked model constructed in this study is essentially a Johansen-type model. It is explicit in the structural relationship and offers scope for further improvement, such as the inclusion of capital and labor flows, exchange rate policies and feedback of trade related production on innovation and technical change.

From the impact studies conducted, we draw the following conclusions in Table 19.

The policy implications arising are:

A. Cross Country Effects

As the spillover effects arising from policy changes on one country are as expected in other Northeast Asian economies, this implies that policy coordination may be important. This is especially so in the

TABLE 19
SUMMARY OF IMPACT STUDIES

Stimulus	Impact on GDP		
	Self	Others	Remarks
Rise in technical progress	Positive	negative	Except China's impact on others is positive
Rise in wage rate	Negative	Positive	Except Hong Kong and Taiwan which affect others adversely
Expansionary monetary	Positive	Mixed	China, Strong positive impact on other countries
Policy Expansionary fiscal	Positive	Positive	
Free trade area	Positive	Positive	
Bilateral tariff reduction with ASEAN	Negative	–	
Bilateral tariff reduction with North America	Negative	–	Impact much reduction with N. America stronger than that with ASEAN

future with increasing factor flows as in capital and labor and trade flows, harmonization or convergence of investment policies growth strategies and the common experience of Northeast Asian economies as matured economies.

B. Scope for FTA

This is positive as expected, indicating the potential for such a movement is possible if a free trade area is all desirable and the political and operational difficulties can be overcome. While such a development may be considered if the West grows more protectionistic with threats from the NAFTA and Single European Market (SEM), whether retaliation is the best policy may be seriously weighed. The globalization of production has given greater prominence to the role of foreign direct investments (FDI). With little disagreement among researchers, FDI has been observed to foster trade, especially intra-industry trade. An FTA is increasingly looked upon not only for promoting flows of goods and services but also factors of production, labor and capital, as well as technological know-how.

C. Linkages with ASEAN and North America

From a 10% reduction in import prices with both ASEAN and North America, the stronger linkages of the Northeast Asian economies with North America is reaffirmed. The policy implication would be that the health of the American economy in particular is still of vital interest not only in Northeast Asia but the Asia Pacific region as a whole.

Nonetheless, whether a free trade area is formalized or not, the external world already tends to view the Northeast Asian economies as a bloc, such as the greater China concept. While this perception is a threat from the perspective of the rest of the world, it unconsciously make the Northeast Asian economies also look at themselves with renewed synergy to enhance their complementarity rather than competitive stances.

Appendix

ESTIMATED VALUES OF PARAMETERS, NORTHEAST ASIA.

		H.K.	Taiwan	S. Korea	China	Japan
Production Function	β_1	0.577	0.520	0.740	0.670	0.543
	s.e.	0.059	0.031	0.056	0.121	0.093
	t stat	9.859	16.512	13.187	5.549	5.836
	β_2	0.423	0.480	0.260	0.330	0.457
	s.e.	0.059	0.031	0.056	0.121	0.093
	t stat	7.215	15.255	4.627	2.729	4.913
Consumption Function	γ_1	0.322	0.437	0.393	0.698	0.303
	s.e.	0.060	0.289	0.238	0.408	0.179
	t stat	5.386	1.513	1.650	1.710	1.692
	γ_2	0.278	0.178	0.116	0.200	0.420
	s.e.	0.106	0.095	0.055	0.125	0.164
	t stat	2.611	1.872	2.105	1.592	2.561
Price of Consumption Goods	α_1	0.643	0.775	0.838	0.936	0.981
	s.e.*	0.121	0.188	0.158	0.160	0.106
	t stat**	5.329	4.130	5.311	5.847	9.256
	α_2	0.357	0.225	0.162	0.064	0.019
	s.e.*	0.230	0.202	0.036	0.053	0.011
	t stat**	1.548	1.115	4.538	1.206	1.665

CONTINUED

		H.K.	Taiwan	S. Korea	China	Japan
Capital Formation	μ_1	0.018	0.016	0.325	0.397	0.492
	s.e.*	0.011	0.008	0.100	0.189	0.188
	t stat**	1.638	2.100	3.260	2.096	2.609
	μ_2	0.153	0.097	0.492	0.394	0.232
	s.e.*	0.035	0.057	0.126	0.208	0.188
	t stat**	4.320	1.700	3.894	1.897	1.237
Interest Rate	λ_1	0.140	0.033	0.870	0.276	0.178
	s.e.*	0.078	0.018	0.082	0.082	0.061
	t stat**	1.802	1.815	10.559	3.354	2.910
	λ_2	0.220	0.055	0.285	0.552	0.080
	s.e.*	0.112	0.044	0.144	0.291	0.052
	t stat**	1.970	1.248	1.981	1.900	1.537
Imports	ϕ_1	1.480	2.999	1.006	3.973	1.474
	s.e.*	0.821	0.897	0.546	1.925	1.200
	t stat**	1.803	3.344	1.844	2.064	1.228
	ϕ_2	1.206	1.008	0.296	0.547	0.700
	s.e.*	0.577	0.708	0.214	0.508	0.343
	t stat**	2.092	1.424	1.387	1.076	2.038

Notes: * : standard error of estimated parameter.
**: the student *t* statistic.

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