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Tran Van Hoa
University of Wollongong

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Evidence from ASEAN+3 based on Extended Helpman-Krugman Hypothesis and Flexible Modelling Approach

Tran Van Hoa

Department of Economics, University of Wollongong
Email: tvheco@uow.edu.au
Website: www.uow.edu.au/~tvheco/tvh.htm

ABSTRACT

In earlier cross-sectional gravity-theory reports (see for example Frankel and Romer, 1999), empirical modelling evidence lends support to the hypothesis of 'trade causes growth'. In our time-series study on trade-growth causation for a new Asian regionalism (namely ASEAN+3), the hypothesis was also confirmed (Tran Van Hoa, 2002c). A number of benchmark models have also been proposed to find out what causes trade (for a brief survey, see Baier and Bergstrand, 2001), but specific research on income convergence and Asian or more specifically ASEAN+3 trade is still scarce or even non-existent. The paper focuses on studying the growth of ASEAN+3 bilateral trade in the volatile period 1968-2000 and, using an extended Helpman-Krugman (1985) function-free model and World Bank national account and CHELEM trade data, tests the impact of convergence on this trade. Surprisingly, this convergence is found plausible but statistically insignificant and ASEAN output growth and crises are principal determinants of the trade flows between the East Asia 3 and the ASEAN.

Keywords*: New Asian Regionalism, Free Trade Agreement, ASEAN, ASEAN+3, Trade and Growth, Crises, Convergence Theory, Gravity Theory, Causality, Economic Modelling, Estimation Methods, Economic and Trade Policy.*

JEL*: C32, C51, C52, F02, F14, F15, F42, O11, O41, O53*

1 Introduction

The recent emergence of a new Asian regionalism ASEAN+3 (i.e., 10 ASEAN countries plus China, Korea and Japan) and other bilateral, multilateral and plurilateral free trade agreements (FTAs) requires not only debates on substance in policy and official statements at the ministerial level as is currently the case but, also and more importantly, research on empirical foundation (if any) to support such economic integration developments (see Tran Van Hoa, 2002a). While the adoption of the Tinbergen-inspired gravity theory derived from either the frictionless or general equilibrium model of international trade or an expenditure-based adding-up identity (see Baier and Bergstrand, 2001) has been useful to cross-sectional studies on the growth of trade, the idea of an income gap or similarity may also be an important determinant of trade in ASEAN+3 economies as elsewhere. Research on this convergence causation of trade, based on extended gravity theory framework and time-series data, for ASEAN+3 has not been carried out or reported (see ASEAN, 2002).

The paper adopts this new research approach and focus and constructs appropriate simultaneous-equation models of trade causation in flexible functional form (Tran Van Hoa, 1992a). It then uses 2002 World Bank World Tables national accounts and France's CHELEM international trade time-series data and recent improved estimation methodologies (Tran Van Hoa, 1985, 1986b, 1986c, 1997, and Tran Van Hoa and Chaturvedi, 1997) to fit these models to provide empirical evidence on income convergence on bilateral trade in the ASEAN+3. Trade expansion policy implications and prospects for the ASEAN and the East Asia 3 countries are also briefly discussed, and possible applications to other free trade agreements and economic integration suggested.

2 A Model on the Growth of Bilateral Trade

Consider, for convenience and without loss of generality, a simple model of 2 simultaneous implicit functions (extension to more functions is straightforward when more variables are considered and endogenised) comprising and extending the basics of gravity theory (see Helpman and Krugman, 1985, and Baier and Bergstrand, 2001) linking trade and growth between 2 trading countries. In this model, trade (named T) may be defined as exports or imports or openness (exports plus imports) and growth may be defined as GDP (with, for example, YA for ASEAN's GDP and YT for trading partner's GDP). The 2 countries may be comprehensively all possible pairs of the 13 ASEAN+3 members or, more specifically and within our focus, as pair-wise (bilateral) combinations of the ASEAN as a group and one of these 3 East Asian member countries separately. Thus

$$F1(a,T,YA,YT,G) = 0 \qquad (1)$$
$$F2(b,T,YA,YT,G,X,W) = 0 \qquad (2)$$

where F1 and F2 are 2 arbitrary functionals, a and b are parameter vectors, G, X and W denote, respectively, income gap or convergence (see Helpman and Krugman,

1985), other economic (fiscal, monetary, trade and industry policy – see Sala-i-Martin, 1991, and Baier and Bergstrand, 2001) and non-economic (eg, distance, area, size, policy shifts and external shocks – see Johansen, 1982) variables relevant to a country or a group of countries' growth or development. Importantly, in addition to T and YA and YT, data for G, X and W must be available and consistent with published time-series data in a standard Kuznets-type accounting framework (eg, SNA93) or the recent 2002 World Bank World Tables.

Taking the total differentials of (1)-(2) and neglecting terms of second and higher–order (see for example Allen 1960 and Tran Van Hoa, 1992a), the model of 2 endogenous variables of interest, namely T and G, in (1)-(2) can be written in stochastic forms and in terms of the rates of change (YA%, YT%, T%, G%, X% and W%) of all the included exogenous and endogenous variables (YA, YT, T, G, X and W) as

$$T\% = a1 + a2YA\% + a3YT\% + a4G\% + u1 \qquad (3)$$
$$G\% = b1 + b2YA\% + b3YT\% + b4T\% + b5X\% + b6W\% + u2 \qquad (4)$$

(3) is the frictionless trade equation with income convergence as another determinant of trade (Helpman and Krugman, 1985) and (4) proxies a complicated process of production, consumption and trade between the 2 trading countries (see below). In their non-stochastic forms, these equations form the basis of applied or computable general equilibrium (CGE) models of the Johansen class in which all elasticities (necessary to model solutions) are usually assumed to be given or known a priori. For asymptotically consistent estimation by the OLS, (3) for study of ASEAN's growth of trade with the East Asia 3 can be extended and written more fully for empirical implementation as

$$T\% = a1 + a2 \quad A\% + a3 \quad T + a4 \quad \% + a5ST + v1 \qquad (5)$$

or, in reduced form

$$T\% = p1 + p2YA\% + p3YT\% + p4FT\% + p5MT\% + p6PT + p7ERT + p8IT + p9POT + p10ST + v2 \qquad (6)$$

where A, T and are reduced-formed estimates of YA, YT and G. The model (5) or (6) assumes that ASEAN's trade [traditionally defined as its exports (or imports, see Barro and Helpman, 1991)] is affected by the GDP in ASEAN and its trading partner (the frictionless gravity theory model – see Baier and Bergstrand, 2001), income convergence (defined below), other major economic activities, trade-related policies (see Coe and Helpman, 1993 for this approach) and external or internal shocks (ST) affecting its trading partner (due to the problem of aggregating over all 10 diverse ASEAN economies, impact of ASEAN's activities and policies on nits trade is subsumed in YA). These activities, policies and shocks include fiscal policy (FT), monetary policy (MT), inflation (PT) – see Romer (1993), trade policy and exchange rates (ERT) – see Rose (2000), industry structure (IT) – see Otto et. al. (2002), population (POT) as proxy to country size – see Frankel and Romer (1999), and national or international crises (ST) – see Johansen (1982), of its trading partner.

3 Alternative Estimates from Alternative Methods

Parameter estimates obtained by different methods for the equation in focus, namely (5), play an important part in growth-of-trade studies (see Helpman and Krugman, 1985, and Baier and Bargstrand, 2001) and those for (6) in trade-to-growth analysis (see Frankel and Romer, 1999). A new method to obtain estimates and forecasts of parameters in (5) or (6) with better properties than the OLS in terms of Wald risks has been proposed (see Tran Van Hoa, 1985, Tran Van Hoa and Chaturvedi, 1988, 1990, 1997). It is in a class of explicit improved Stein-rule or empirical Bayes (also known as the two-stage hierarchical information (or 2SHI) estimators for the linear regression models). This estimator includes the explicit Stein and the double k-class (Ullah and Ullah, 1978) estimators as subsets (Tran Van Hoa, 1993a). Other applications of the Stein, Stein-rule, and 2SHI estimators to linear regression models with non-spherical disturbances and to Zellner's seemingly unrelated regression model have also been made (see Tran Van Hoa et al, 1993, in the case of regressions with nonspherical disturbances, and Tran Van Hoa, 1992b, 1992c, and 1992d, in the case of seemingly unrelated regressions).

While all the estimators given above can be applied to the model such as (5) or (6) for structural and forecasting analysis, their relative performance in terms of historical, *ex-post* or *ex-ante* (Pindyck and Rubinfeld, 1998) forecasting MSE can differ. Denote by $\hat{\beta}$, $\hat{\beta}$s, $\hat{\beta}$h, $\hat{\beta}$+s and $\hat{\beta}$+h for OLS, Stein, 2SHI, positive Stein and positive 2SHI estimators respectively. Thus, it is well-known that, in MSE and for $k \geq 3$ and $T \geq k + 2$, $\hat{\beta}$s dominates (that is, it performs better in forecasting MSE) $\hat{\beta}$, and $\hat{\beta}$s is dominated by $\hat{\beta}$+s. However, it has also been demonstrated (Tran Van Hoa, 1985, Tran Van Hoa and Chaturvedi, 1988) that, in MSE, $\hat{\beta}$h dominates both $\hat{\beta}$ and $\hat{\beta}$s, and more importantly, $\hat{\beta}$+h dominates $\hat{\beta}$+s (Tran Van Hoa, 1986a).

Some relevant remarks about appropriate estimation of (5) or (6) should be made here. First, an important result of the 2SHI theory has recently been proved (see Tran Van Hoa and Chaturvedi, 1997): *the dominance of the 2SHI over the OLS and Stein exists anywhere in the range $0 < c < 2(k-1)/(T-k)$*. Second, since one of the best known IV estimators, namely the 2SLS, has been demonstrated to be dominated in MSE by the 2SHI in identified structural equations of simultaneous-equation models (see Tran Van Hoa, 1986b and 1986c) such as Equation (3), the so-called IV (see Frankel and Romer, 1999) impact of for example income convergence on ASEAN trade can be directly studied via the application of the 2SHI to (3). Third, the 2SHI estimators are finite-sample estimators (which converge to the OLS or 2SLS when T ->) with optimal MSE properties (see above). Since all data used here are necessarily annual and have, as usual, a small sample size, the study outcomes are therefore finite-sample optimal. Finally, the 2SHI dominates other conventional estimators when measurement errors exist (Tran Van Hoa, 1986b). Since the poor quality of economic data from the Asian countries and other less developed countries economies is well known, one by-product of our study is that the findings are also optimal in errors-in-variables cases.

The results of our experimental study on the forecasting performance evaluated in terms of the Wald risk criterion of the standard gravity theory using ASEAN+3 data

(see the specification in (7) below) are given in Table 2. The results are based on stochastic Monte Carlo simulation with finite-sample data (1968-1999) and obtained for 3 different ex-post forecasting timeframe horizons: short (2-years ahead)-, medium (5-years ahead)- and long (10-years ahead)-terms, and for 3 possible cases of measurement errors (that is, σ^2) on ASEAN+3 trade data: actual estimated value of σ^2, 10 times more (low data quality) and 100 times more (very low data quality). The evidence reported in Table 2 shows that ASEAN+3 trade ex-post forecasts based on the 2SHI dominate substantially the other ex-post forecasts based on the OLS and positive Stein estimation theories in all 9 models of trade for the ASEAN+China, ASEAN+Korea and ASEAN+Japan free trade agreements, and for all 3 scenarios of measurement errors on trade data and also for all 3 forecasting timeframes under study.

4 Empirical Evidence on Growth of Trade in ASEAN+3

A number of models based on the 2-equation model in (1)-(2) or its empirical implementation versions in (5) and (6) as given in Section 2 have been estimated and reported below. For plausibility analysis and efficiency comparison with previous findings in similar studies, the 3 estimation methods used are the OLS, 2SLS and 2SHI. A brief discussion on the data and variable definitions used is given below.

Data – Due to availability limitation of the required data in our studies, all original data are obtained only as annual and then transformed to their ratios (when appropriate). Income convergence or similarity is defined as the gap of per capita incomes between 2 trading partners. A smaller gap implies more income convergence or similarity and this seems a plausible approximation to incentive to trade. The ratio variables include trade (exports and imports), government budget, and money supply (M2) - all divided by GDP, and labour force divided by population. Other non-ratio variables include exchange rates, population and binary variables representing the occurrence of the economic, financial and other major crises over the period 1961 to 2001. All non-binary variables are then converted to their percentages. This percentage measurement is a main feature of our modelling approach and avoids the problem of specific *a priori* functional forms for estimation (see above) and also of logarithmic transformations for negative data. For small changes, log difference is approximately rate of change. For most economic time-series data, rate of change is usually integrated of degree 0 (stationary) for most countries and I(1) for transition economies such as Vietnam.

The data for national (eg, China, Japan and Korea) and regional (eg, ASEAN) trade (exports (X) and imports (IM) respectively), GDP, and estimated mean population (named POP) are retrieved from 2001 France's CHELEM international trade databases. Per capital income is GDP/POP. Income convergence between ASEAN and Japan for example is defined as the difference between ASEAN and Japan per capita incomes. Openness between 2 trading countries is defined as T=(X+IM)/GDP. All economic data are at current prices. Fiscal, monetary, trade and industry policy data for ASEAN or each of the East Asia 3 are obtained from the 2002 World Bank World Tables and proxied, respectively, by government budget/GDP (BUR), M2/GDP (M2R), exchange rates per US dollar (ER), and employment rate

(employment/POP or UR). POP approximates size in the context of standard gravity theory (see Frankel and Romer, 1999).

In addition to the usual demographic and economic components in our model, we also identified 4 major world crises that had affected the ASEAN+3 economies (and other economies) during our sampling period and included them as 4 dummy variables with persistent effects after their occurrence (the one-off effect was postulated but discarded as implausible in our experimental studies). These are the first oil crisis of 1975 (named C75), the stock market crash of 1987 (C87), the Gulf War of 1991 (C91), and the Asia crisis of 1997 (C97). For China whose data can go back only to 1978, we substitute the country's crisis of 1989 (the Tiananmen Square event) for C75 and call this C89. Various modelling experiments in our study also show that these crises all have a permanent effect on trade and growth in ASEAN. Due to very limited data on government budget for some ASEAN+3 countries, fiscal policy variable BUR has been omitted from the estimation altogether.

The Estimated Models - The estimation of the various bilateral models for growth of trade in the ASEAN vis-a-vis each of the East Asia 3 is based on these data. The growth-of-trade model from the 2-simultaneous equation trade-growth model for ASEAN and Japan in our studies for example [that is, based on (3)] can be written fully for estimation and analysis below as

$$\begin{aligned} TJP2A\% = \hat{a}_1 &+ \hat{a}_2 YA\% + \hat{a}_3 YJP\% + \hat{a}_4 GAPAJP\% + \hat{a}_5 M2R\% \\ &+ \hat{a}_6 IPD\% + \hat{a}_7 ER\% + \hat{a}_8 UR\% + \hat{a}_9 POPA\% + \hat{a}_{10} C75 \\ &+ \hat{a}_{11} C87 + \hat{a}_{12} C91 + \hat{a}_{13} C97 + v3 \qquad (7) \end{aligned}$$

where, in percentages, TJP2A= Japan's total trade (exports+imports or openness) with ASEAN, YA=ASEAN's GDP, YJP=Japan's GDP, and GAPAJP=income convergence (gap) between ASEAN and Japan. The variables M2R, IPD, ER, UR and POPA denote respectively monetary, inflation, trade, industry policy in Japan and population in the ASEAN. v3 is the disturbances representing other unknown factors (Frankel and Romer, 1999) on TJP2A. The growth-of-trade models for ASEAN+Korea and ASEAN+China can be similarly constructed.

Empirical Findings – A total of 9 sets of empirical findings for the model (7) are given in Table 1. These include 3 models of growth-of-trade for ASEAN and Japan, ASEAN and Korea, and ASEAN and China. Three sets of estimates are obtained for each model. The first set is for the convergence-on-trade model based on a simple frictionless gravity theory (Helpman and Krugman, 1985, and Baier and Bergstrand, 2001) with convergence (income gap) assumed exogenous (necessitating the OLS). The second set is for this model as estimated by the 2SHI. Our experiments with the 2SLS for (5) indicated that endogenising convergence whose reduced form contains all exogenous variables assumed in (6) or (7) would produce either implausibly signed or statistically insignificant results. Convergence that may be regarded as expressing a complex and diverse process of production, consumption and trade between 2 trading economies, should not be endogenised in this context. The results are therefore not reported. The third is the OLS applied to (7).

TABLE 1
ASEAN Growth of Trade with China, Japan and Korea
Extended Helpman-Krugman Hypothesis in Flexible Functional Form
1968 to 1999

	ASEAN-Japan			ASEAN-Korea			ASEAN-Extended China		
Variables	OLS	2SHI	OLS	OLS	2SHI	OLS	OLS	2SLS	OLS
Constant	45.39	40.77	95.34	-79.46	-44.91	-227.6	73.13	47.03	-44.69
ASEAN GDP	1.36**	1.22**	1.47**	0.83	0.47	1.60**	1.53**	0.99**	1.08*
Partner GDP	0.09	0.08	-0.63	1.06	0.60	2.56*	0.03	0.02	0.35
Convergence	-0.14	-0.13	-1.64	-0.67	-0.37	-1.74	-0.06	-0.04	-0.01
Inflation			0.42			-2.92*			0.56
Money M2			-1.15			0.43			0.51
Exchange rate			-2.53*			0.19			0.44
Employment rate			-1.88			-5.22			2.15
Population	-15.50	-13.92	-24.61	38.79	21.93	112.1	-33.09	-21.28	15.27
Oil Crisis 75	-15.96**	-14.33**	-30.00**	-6.06	-3.43	8.67			
Stock Crash 87	6.01	5.40	4.17	17.04	9.69	5.75	-0.26	-0.17	10.11
China Crisis 89							-6.88	-4.42	-7.79
Gulf War 91	-11.95*	-10.73*	-25.86**	-2.86	-1.61	10.35	-6.13	-3.94	-3.66
Asia Crisis 97	6.44	5.78	21.02*	1.89	1.12	20.55	-0.11	-0.07	27.82**
R^2	0.84	0.92#	0.91	0.54	0.73#	0.61	0.59	0.77#	0.84
F	15.42**	33.06**	15.08**	3.34**	7.77**	4.94**	4.14**	9.23**	3.51**
DW	2.08	1.96	2.34	2.52	1.96	2.18	2.06	1.52	2.29

Sources of data: 2002 World Bank World Tables, 2001 CHELEM International Trade Data.
*Notes: ** significant at 5% level, * significant at 10% level. # correlation coefficient between ASEAN's trade and its estimate by the 2SHI. Tests on 2SHI estimates are based on their asymptotic properties as T -> .*

From the results in Table 1, we note 5 important findings.

First, while high success in modelling growth-of-trade has been difficult to achieve (that is, having an R^2 > 30 per cent, see further detail for example in Baier and Bergstrand, 2001), all 9 estimated models of ASEAN's trade with each of its major trading partners in Asia (the East Asia 3) have statistically significant and higher modelling performance. More specifically, our R^2 reaches up to 91 per cent, or 3 times higher than other growth-of-trade causality models as reported in previous studies. A graph of the observed and estimated growth-of-trade fluctuations in the ASEAN for all 9 models for the period under study also indicates that the peaks, troughs and turning points of this growth are accurately predicted in almost all periods in the sample. All 9 estimated models also appear free from autocorrelation-induced inefficiency problems.

Second, ASEAN's trade is significantly affected by ASEAN's GDP, as expected. This income effect is strong as all statistically significant impact has an elasticity more than unity. However, the GDP of ASEAN's 3 trading partners has generally no significant impact on their trade with the ASEAN.

Third, judged from the OLS and 2SHI estimates, income convergence as defined has a plausible (that is, negative) impact on ASEAN's trade. The finding is confirmed uniformly in all 9 estimated models. This impact is however statistically insignificant at the conventional critical level in all cases. The implication is that, while a narrower gap between income per head in 2 trading countries is conducive to their bilateral

trade improvement, the evidence is not strong enough to support its presence with available data or for the models used.

Fourth, a main factor of the standard gravity theory, namely the size (proxied by population, see Frankel and Romer, 1999) of the trading countries, does not seem statistically significant in all our models. In addition, while all estimated effects of ASEAN population on its trade are large but they are mixed with positive or negative signs in the estimated models.

Finally, the impact of the oil crisis of 1975, the stock market crash of 1987, the Gulf War in 1991 and the 1997 Asia turmoil all has a mixed effect on ASEAN trade with its East Asia 3 partners. More specifically, while the impact of the 1975 and 1991 crises on ASEAN+Japan trade is statistically significant and plausibly signed, other crises' effect is either negligible or wrongly signed. We stipulate in this case as in our previous studies (Tran Van Hoa, 2002c) that, over the period under study 1968-1999, ASEAN+Japan trade is a more dominant activity both in volume and value than ASEAN trade with both Korea and China. This position of less trade would limit the information available to study the relationship between ASEAN trade with these 2 countries.

5 Convergence and Growth of Trade in ASEAN+3: Policy Implications

Does convergence in ASEAN+3 cause its trade? This is an important topic in economics that has attracted some of the best minds in the field over the last 10 years or so (see for example Baier and Bergstrand, 2001, for some survey), and the conclusions have not been finalised for all cases. Our results above show that in the specific case of ASEAN+3 free trade agreement, ASEAN's trade, when defined as its relative size of openness and for the available data at our disposal (1968-1999), a convergence-to-growth-of-trade causation is found for all of our estimated models but the evidence indicates mainly an inelasticity and, in addition, is not strong enough to confirm its presence. As a result, convergence is not a prime factor for enhancing ASEAN+3 trade in analysis of trade policy formulation and implementation.

Does growth affect ASEAN's trade with its trading partners? Within the context of the SNA93 or similar national accounting framework, trade is a component of output and hence its growth. Our findings above indicate that growth also affects trade and, therefore, trade and growth have a circular causation, necessitating a Haavelmo or simultaneous-equation specification in econometric modelling. More specifically, the findings also reveal that it is ASEAN growth that affects its trade and not the growth of its trading partners. This empirical finding on ASEAN's trade and growth benefits would give strong support the 10 ASEAN leaders' efforts in setting up and promoting an ASEAN+3 free trade agreement.

Do crises affect ASEAN+3 growth of trade? When openness is used as a proxy for trade between ASEAN and the East Asia 3, crises in our models do appear to affect ASEAN's trade. Different crises impact ASEAN's trade differently and they also impact different trading partners differently. It is also interesting to note from our findings that ASEAN's trade with high-trade countries such as Japan seems to be

affected by more crises than less high-trade country partners like Korea and especially China. In spite of this conclusion, it is important to note that, due to the sheer size of the estimated impact of crises on ASEAN's trade in our models, a contemporary growth-of-trade model for ASEAN+3 (or even for other regions or countries) studies without the inclusion of these recent shock factors (as implied by Frankel and Romer, 1999, or stipulated by Johansen for policy analysis, 1982) may have serious and biased results on the causation being investigated and also for appropriate trade formulation and promotion policy studies.

Do we have empirical support for better understanding of ASEAN+3 trade and benefits of ASEAN+3 free trade agreement? As we have mentioned earlier, the objectives of setting up an ASEAN+3 free trade agreement are, in addition to better regional cooperation and stability, to enhance trade between its 13 members and to improve their welfare. These objectives necessarily require that trade does in fact directly and positively affect growth. Some empirical results supporting this causation has been reported in Tran Van Hoa (2002c). In the present study, we have investigated further the significance of the convergence hypothesis and its transmission mechanism in an extended gravity theory in ASEAN trade determination. We have also studied what are other fiscal, monetary, trade and industry determinants of trade and how they have affected ASEAN's trade through the interaction of the various activities in the trading country partners. Our findings reported above lend ample support to the hypothesis that growth and crises have impacted ASEAN+3 trade and, importantly, that income convergence or similarity between ASEAN and its East Asia trading partners does help to increase bilateral trade but this impact is negligible in size and in statistical inference.

Perhaps, this result is due to limited sampling data over a rather volatile period of high economic achievements and also serious financial turmoil and downturn with damaging contagion in the ASEAN+3 development and growth (see Tran Van Hoa, 2000 and 2002d). Or it may be due to the basic postulates of the models and the underlying theory we have used. These issues need further study.

TABLE 2

Performance in Ex-Post Forecasts of ASEAN+3 Trade
Based on Standard Gravity Theory and the OLS, Positive STEIN and 2SHI
Results of Stochastic Monte Carlo Simulation
1968-1999

Estimation period									
	1968 to 1978			1968 to 1978			1968 to 1988		
Forecasting period									
	1979 to 1981			1979 to 1984			1989 to 1999		
	σ^2	$10\sigma^2$	$100\sigma^2$	σ^2	$10\sigma^2$	$100\sigma^2$	σ^2	$10\sigma^2$	$100\sigma^2$
Relative Ex-Post Forecasting MSE: Informational Gain (%)									
1. ASEAN+JAPAN BILATERAL TRADE									
R(ml/s)	1.53	7.73	5.81	1.75	8.41	8.12	1.74	3.92	7.04
R(ml/h)	3.05	14.60	10.68	3.48	15.11	15.74	3.49	7.12	11.86
R(s/h)	1.50	6.38	4.61	1.71	6.18	7.04	1.72	3.08	4.51
2. ASEAN+KOREA BILATERAL TRADE									
R(ml/s)	4.12	9.92	5.26	6.82	14.80	9.93	6.61	8.17	7.81
R(ml/h)	8.19	19.34	10.27	12.22	23.95	19.58	12.97	15.52	15.25
R(s/h)	3.91	8.57	4.76	5.05	7.96	8.77	5.96	6.79	6.90
3. ASEAN+CHINA BILATERAL TRADE									
R(ml/s)	3.54	31.98	51.16	3.82	31.49	51.12	3.23	29.56	49.13
R(ml/h)	7.13	60.46	105.16	7.64	63.17	100.38	6.52	60.35	92.57
R(s/h)	3.46	21.57	35.72	3.68	24.09	32.60	3.19	23.77	29.12

NOTES. *$\hat{\beta}$ = OLS, $\hat{\beta}$ s = positive-part Stein (STEIN), $\hat{\beta}$ h = positive-part 2SHI. R(ml/s)=R($\hat{\beta}$ /$\hat{\beta}$ s)= 100[MSE($\hat{\beta}$)/MSE($\hat{\beta}$ s)-1], where MSE($\hat{\beta}$) = E($\hat{\beta}$ -ß)'($\hat{\beta}$ -ß) with ß calculated from the OLS estimates of each equation using 500 repetitions (with the error terms only random from trial to trial), and used as the true parameter vector. Similarly for $\hat{\beta}$ h and $\hat{\beta}$ s, i.e., R(ml/h)=R($\hat{\beta}$ /$\hat{\beta}$ h) and R(s/h)=R($\hat{\beta}$ s/$\hat{\beta}$ h). Relative efficiency in ex-post forecasting MSE of say $\hat{\beta}$ h over $\hat{\beta}$ s exists whenever R(s/h) = R($\hat{\beta}$ s/$\hat{\beta}$ h) ³ 0. s² = OLS-based disturbance variance. In our stochastic simulation study, all results are based on 100 statistical trials and c is optimally set as c = (k-2) /(T-k+2) (see Baranchik, 1973, and Anderson, 1984). All data are from the 2002 World Bank World Tables DX databases and 2001 CHELEM trade databases. For the derivation of the ASEAN+3 standard gravity theory trade equation used, see (7) in text. The 'benchmark' parameter estimates of this equation are obtained as the mean parameters from 500-iteration stochastic simulations with the equation variances equal the actual residual variance s².*

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