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Measuring the Impact of China's WTO Membership on its Trade and Growth: A New CGE-Keynesian Approach

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ABSTRACT

Measuring the impact of WTO memberships on trade and growth of a country is of paramount importance for its trade and economic policy, welfare improvement and international relations. Current econometric methodologies for measuring this impact using micro or macroeconomic multi-sectoral models are almost always based on a variety of the applied or CGE modelling approach or GTAP popularised initially by Johansen, among others. While the approach has been popular in many practical policy-oriented applications both with academic and institutional economists alike, it is deficient in many aspects. These include severely restrictive assumptions on the structure of the economy, inconsistency with empirical data, zero degree of freedom, non-dynamic characteristics, and its inability to accommodate sub- and add-factors in the sense of Johansen (1982) as well as other shocks (for example, the oil price hikes, the Gulf war, and the Asia crisis or 11 September 2001 attacks) or major policy change (for example, China's WTO membership in 2001).

The paper presents a new and general approach to modelling an open and multi-sectoral economy (or any multi-activity economy or industry or market) for impact studies. This approach combines the best aspects of the Johansen-type neo-classical models and the more realistic, flexible and data-consistent features of the Stone (1988) Keynesian framework. It also uses time-series data from the almost universally adopted SNA93 standards, more recently developed econometric estimation and forecasting theories with superior MSE properties in the sense of Wald (for example, the two-stage hierarchical information (2SHI) method (Tran Van Hoa, 1985, Tran Van Hoa and Chaturvedi, 1997)), and importantly assumes no a priori functional form for its economic relationships (a severe constraints on many econometric models).

Using this new modelling and impact study approach, the paper constructs, as an illustration, a new simple six-sector econometric model of China to study its major interrelationships and for use in WTO-membership impact analysis. The model is estimated by the OLS (or ML) and 2SHI methods using the most up-to-date (2002) time-series data from the World Bank World Tables. The estimates and forecasts from this model are then used in stochastic simulation to empirically study the impact of China's WTO membership on the country's major activities: investment and trade (international or with the Asian region) and growth, and in three convenient timeframes: short-, medium- and long-terms.

Contrary to the results of other CGE-GTAP-based impact studies of a similar kind, our results are shown to be able to provide more concrete transmission mechanism and econometric evidence to track period-by-period and activity-by-activity the detail and dynamics of this WTO-membership impact on the Chinese economy over the specified impact horizon, and even during the period of recent great crises (Tran Van Hoa, 2000 and 2002d). More detailed analysis of this impact and its transmission mechanism is finally carried out and recommendations for possible policy formulation and implementation by China's policy-makers made.

1 Introduction

Bilateral, plurilateral and multilateral economic integrations such as the WTO and other regional and international free trade agreements (for example, ASEAN+China, Korea and Japan, see Tran Van Hoa, 2002a) have one overriding objective: to enhance international trade and economic welfare of all their member countries. A by-product is cooperation and collaboration and other benefits of international economic relations and regional political stability. With its formal accession to the WTO in November 2001, China expects, as a result and in the medium and long term, enhanced trade, investment and economic development and growth in that sequential order. Conventional methodologies to study the impact of this or similar memberships have been based on the neo-classical CGE approach and its off-shoot, the GTAP. While useful as a convenient tool for this kind of analysis, this approach is by no means optimal in terms of the severe constraints it necessarily imposes on the structure of the model for study, and other various deficiencies in empirical implementation. These deficiencies or inadequacies include data inconsistency, a lack of statistical reliability, the inability to deal with sudden changes or shocks in national and world economies, and the inability to accommodate dynamics in an increasingly globalised economy and, with it, the requirement for growing international competitiveness.

The purpose of our paper is to contribute to the important nexus or causality study in trade, investment and growth by exploring empirically and over time the interdependence or simultaneity of the various 'engines of growth' and by using a new methodological approach. This approach integrates the static neo-classical CGE and dynamic multi-equation Keynesian theories maintaining the balances in Kuznets-type national accounts in the sense of Stone (1988) and satisfying the almost universal SNA93 framework.

To achieve our purpose in a novel way, the paper therefore departs from the applied econometric modelling approaches using conventional multiple regressions, Haavelmo's linear simultaneous equations, Zellner's SUR, or subjective or data-inconsistent CGE/GTAP, and makes use instead of a fairly simple and flexible economy-wide modelling approach based on the calculus of differential analysis in mathematical economics (Tran Van Hoa, 1992a, 1992d) to provide the fundamental equations in the reduced form for macroaggregates of interest. The success of this new approach is assessed via its modelling performance, analytic and empirical.

Finally, the paper is a contribution to applications of recent advances in the econometric theory of estimation, forecasting and impact studies to better formulate forward planning, impact policy and growth strategies either in economics, business or finance. These advances are IT-based and consist of our recent empirical Bayes or two-stage hierarchical information – 2SHI - (Tran Van Hoa, 1985, 1986a, 1993a, Tran Van Hoa and Chaturvedi, 1988, 1990, 1997) theories that have average MSE or Wald risk properties superior to other conventional methods including the OLS, the maximum likelihood, or the explicit (Baranchik, 1973) positive Stein-like (Anderson, 1984) methodologies.

The implications from our paper are twofold. First, if the modelling success of our new mixed CGE/Keynesian approach is relatively superlative -- in terms of its empirical fit for troughs and peaks and turning point predictions of the variables in focus -- then its superiority in impact studies for China's WTO membership is confirmed, historically or in an *ex ante* sense (see Pindyck and Rubinfeld, 1998). Secondly, if, based on the same model and dataset, a substantial improvement in impact outcomes is achieved by our 2SHI methods in relation to other conventional procedures currently in use, then our findings will, in addition, point to a new direction of rigorous modelling and impact study methodology not only for China's WTO membership but also for other applications in economics, finance and by business analysts in their corporate and individual planning to investment, trade and growth.

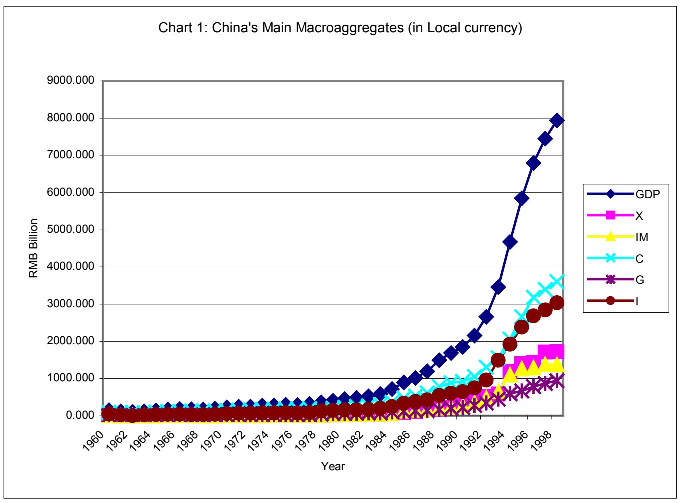
2 Trends in China's Main Economic Activities

As a major country in Asia and in world economy, China has achieved remarkable economic development, very high output growth, increased trade and investment inflows in the past 3 decades or so. It has also insulated itself well from the 1997 Asia crisis that has devastated other 'miracle' economies in the region and, to a lesser extent, to the former USSR and beyond. In 2002, the country seems poised to post a high growth rate in spite of the global economic slowdown. In addition, China's trade with the world is on the move with less and less reliance on Britain's former colony of Hong Kong and more and more on its own newly established exporting ports and centres on the eastern seaboard.

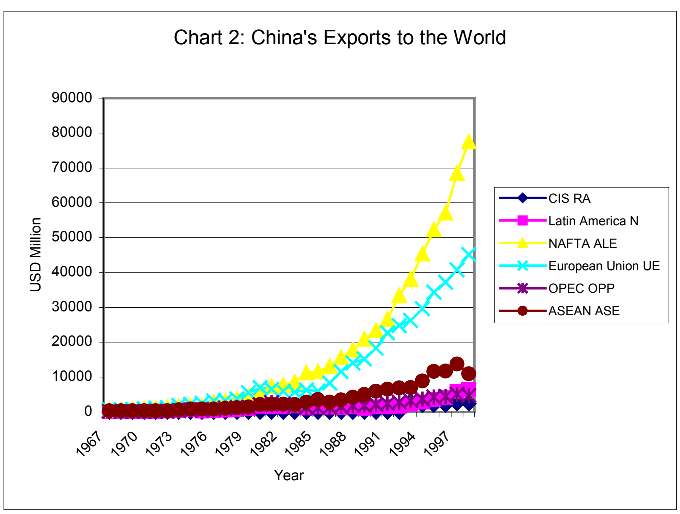
In the important area of investment, China has actively sought foreign direct investment (FDI) and technology to promote its modernization efforts and accelerate its export trade capabilities since its opening up in 1978. In particular, it also expects significantly increased inflows over the next five years following its WTO accession in November 2001. This accession would bring about the removal of a number of restrictions on FDI (OECD, 2001). Currently, China is on the threshold of crucial developments and policy decisions concerning FDI, and keen to increase the level, quality and source diversity of incoming FDI, particularly FDI from the OECD member countries. The Chinese government also continues its efforts to adjust its policy and institutional framework, as well as investment promotion policies, to the requirements of the changing international and domestic circumstances (OECD, 2001) such as globalisation and China's reforms even before its accession to the WTO.

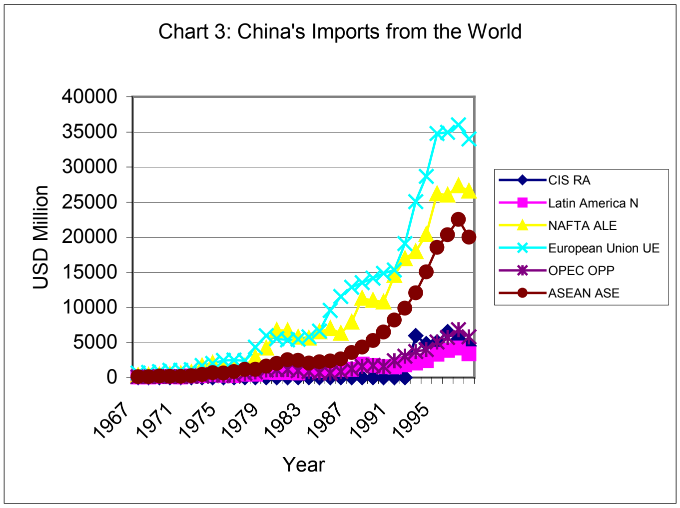
Our study below supplements these trade, investment, development and growth efforts of China from a methodological perspective and would have important implications for more effective impact and policy studies of China's WTO membership consistent with historical data over three decades.

Chart 1 summarises the annual (1961-1998) movements of China's six main SNA macroaggregates: GDP, private consumption, gross fixed investment, government expenditure, exports, and imports (all at current prices). All these aggregates show an exponential growth path from 1961 to 1998 recording the well-known fast pace of China's recent development. The largest component of GDP is private consumption, followed by investment, exports and then imports (generally with a trade surplus especially in recent years). Despite the generally perceived role played by the government in the economy, its share in SNA is the lowest as seen in Chart 1. Significantly, there is a slight sign of the Asia crisis' impact only in so far as exports and imports are concerned. Also, there seems to be a correlation between the trends of these macroaggregates. Charts 2 and 3 report trade between China and the world's 6 major trading blocs (USSR, NAFTA, Latin America, OPEC, the European Union and the ASEAN). We note from these charts that, during 1960-1998, China's largest exports were to the NAFTA, followed by the European Union (EU), and then the ASEAN, but China's largest imports were from the EU, followed by the NAFTA and then the ASEAN. From these observations, it is clear that China's trade after its WTO membership will continue the trend towards North America and the EU, and much less towards the ASEAN. This trend will pose an obstacle to the new Asian regionalism that proposes a free trade agreement between ASEAN and China (ASEAN, 2002). In view of this, our study below will focus on China's total trade in general at this stage and not with any specific region or country or with any specific commodity or group of commodities.



Source: 2002 World Bank World Tables





Source: Data for Charts 2-3 are from 2001 CHELEM International Trade Databanks

While the impact of China's WTO membership can be studied directly via an perceived increase in exports and imports (trade) alone, the apparent correlation between trade and the rest of the economy's activities in a Marshallian context and SNA93 framework makes the task of study more complicated. More specifically, to decompose this correlation into a more precise form for a study of the impact of increased trade, investment and growth from China's WTO membership (or for other planning or policy analysis), we have a number of options. These options may involve (a) a descriptive analysis of the graphs of these macroaggregates, their means, standard deviations and cross-correlations, or their shifts (instability) over time. We can also look at (b) the econometric interaction between trade, investment and growth and other relevant causal economic activities in the economy. We adopt the second Haavelmo-type simultaneity approach because of the inherent Marshallian nature of economic activities in which all in an economy are interrelated or interdependent.

3 Modelling China's Economy: A Multi-sectoral Flexible CGE-Keynesian Approach

Modelling an economy can take many approaches and forms with varying degrees of success from both a theoretical and empirical context. In an economy with interdependent sectors and activities, any of our six macroaggregates in-focus for China in Chart 1 above could be argued to be dependent on many varied internal and external, economic and non-economic factors and in a linear, nonlinear, or mixed functional form. Consider for illustration in this paper a simple well-known generic five-equation Keynesian macroeconomic model satisfying an SNA93 framework of an open economy in an arbitrary functional form as

$$C = C(Y, C\text{-}1) \quad (1')$$
$$I = I(Y, Y\text{-}1, R, R\text{-}1) \quad (2')$$
$$X = X(Y, YW, PCN, PUS) \quad (3')$$
$$IM = IM(Y, YW, PCN, PUS) \quad (4')$$
$$Y = Y(C, I, G, X, IM) \quad (5')$$

or in its usual linear form

$$C_t = \alpha 11 + \alpha 12Y_t + \alpha 13C_{t-1} + u1_t \quad (1)$$
$$I_t = \alpha 21 + \alpha 22Y_t + \alpha 23Y_{t-1} + \alpha 24R_t + \alpha 25R_{t-1} + u2_t \quad (2)$$
$$X_t = \alpha 31 + \alpha 32Y_t + \alpha 33YW_t + \alpha 34PCN + \alpha 35PUS_t + u3_t \quad (3)$$
$$IM_t = \alpha 41 + \alpha 42Y_t + \alpha 43YW_t + \alpha 44PCN + \alpha 45PUS_t + u4_t \quad (4)$$
$$Y_t = C_t + I_t + G_t + X_t - IM_t \quad (5)$$

where C = private final consumption expenditure, Y = gross domestic product or GDP, I = private gross fixed investment, G = government expenditure, X = exports of goods and services, IM = imports of goods and services, YW = US income (as a proxy for world income), PCN = general price deflator in China, PUS = general price deflator in the US (as a proxy for world prices), and R = US prime rate (as a proxy for world interest rate). The α's denote the structural parameters, and the u's the error terms. All value variables are expressed in terms of their constant 1995 prices.

The model (1)-(5) is a dynamic macroeconomic model (Pindyck and Rubinfeld, 1998) for an open economy and takes into account (a) a partial adjustment process in consumption behaviour encompassing the hypotheses of relative and permanent income, liquid assets, wealth, and life cycles in the sense of Duesenberry, Friedman, and Modigliani, (b) a flexible accelerator investment behaviour, augmented by foreign capital borrowings (see for further detail Tran Van Hoa and Harvie, 1998) and user’s costs, (c) trade openness through exports and imports regulated by foreign and domestic demand conditions and price relativities and (d) relevance of the government sector expenditure or intervention especially in transition economies.

In this model, the WTO membership impact is assumed to be transmitted through increased trade (exports and imports) and enhanced investment, and this itself will be transmitted to increased growth and private consumption (which is a component of growth according to the income identity in the SNA93). In the model, consumption, investment, exports, imports and GDP are endogenous, and there are 9 exogenous and predetermined variables. For usual trade-to-growth studies based on gravity theory (see Frankel and Romer, 1999), trade is usually defined as openness (i.e., exports+imports) and country size is taken into account. In our model for empirical implementation below, a side equation is in fact T=(X+IM)/Y where T is the trade variable.

It can be verified that, using the order condition for identifiability or mathematical consistency in the theory of econometrics, all equations in the model are over-identified. As a result, the endogenous variable equations for say investment, trade and growth specified in (1’)-(5’) can be written, instead of their linear form given traditionally in (1)-(5), in their complete differential or function-free form (see Allen, 1960) in the reduced form as (see Tran Van Hoa, 1992a and 1992d, Harvie and Tran Van Hoa, 1993)

$$I\%_t \cup T\%_t \cup Y\%_t = ai1 + ai2\ C\%_{t-1} + ai3Y\%_{t-1} + ai4R\%_t + ai5R\%_{t-1} + ai6YW\%_t + ai7PCN\% + ai8PUS\% + ai9G\%_t + ei_t \quad (6a/b/c)$$

where I%, T%, C%, Y%, R%, YW%, PCN%, PUS%, and G% indicate the rate of change of I, T, C, Y, R, YW, PCN, PUS and G respectively, a's indicate the reduced-form parameters, and e's are the new error terms with i referring to the I, T or Y equation.

The 3 equations in (6) characterize the investment, trade and growth relationships from the illustrative five-equation macroeconomic model given in Eqts (1')-(5'). In contrast to the conventional single-equation unidirectional analysis, the impact of enhanced trade due to China's WTO membership on investment, trade and growth in our model can be only seen indirectly through the exogenous and predetermined variables. By conventional definition, the impact parameters from these equations are in fact either static (or dynamic) elasticities associated with either current (or lagged) variables included in it.

The derivation of (6) by means of total differentiation of an arbitrarily functional relationship is simple and, more importantly, consistent with the procedure usually adopted for the neoclassical macroeconomic models of the applied or CGE kind. In these neo-classical models, the endogenous and exogenous variables in the economy are linked by a (usually first-order) approximate transmission mechanism in terms of the elasticities. There are however at least five important differences between our equations given in (6) above and the specifications from applied or CGE Johansen-class models.

First, in our case, the important linking elasticities have to be estimated for the model as a whole using economic time-series data and possibly other extraneous (prior) information such as policy switches or external non-economic factors. Our equations given in (6) thus are completely data-based, although clearly we do not preclude the use of prior or extraneous information (in the form of an oil crisis, a major war, the 1997 Asia turmoil and the 11 September 2001 attacks for example) in the equations in other theoretical or judgemental contexts.

Secondly, in view of the above arguments, our model is capable of accommodating sub- and add-factors as well as structural change and other institutional considerations (for a discussion supporting the use of these factors in macroeconomic policy models, see Johansen, 1982).

Thirdly, our equations must be mathematically consistent as required by the identifiability conditions for complete systems of structural simultaneous equations in the theory of econometrics.

Fourthly, by its construct, our modelling approach encompasses a wide class of linear and nonlinear multi-equation econometric models in which the exact functional form of each of the individual structural equations is, as usual, unknown or needs not be specified.

Finally, for an important group of economic variables whose first differences in logs are approximately equivalent to their rates of change, our equations by their construct include as the special cases (and with autoregressive terms) the Granger-Wiener short-term causality if these rates of changes are I(0) and the co-integration or long-term Durbin-Watson regression equations of the Engle-Granger (1987) class (see Tran Van

Hoa, 1993b, and Harvie and Tran Van Hoa, 1993, for further detail) if the rates of change are I(1).

To evaluate the performance of the equations of interest in (6) in our macroeconomic model (1')-(5') and our new impact study methodology using real-life data from China in recent years, we have fitted the I%, T% and Y% equations in (6) to data for the period 1961 to 1998. This will optimally produce the necessary elasticity estimates. These estimates can then be used in a comparative study which is based on stochastic simulation to measure the relative historical forecasting MSE performance or operational accuracy of our modelling equations. These equations can finally be used for a study of the impact of China's WTO membership under different and plausible scenarios of shocks or policy regimes.

4 Impact and Forecasting Study: Alternative Methodologies

The equations in differential and reduced form as given in (6) can be written more generally with a sampling size T and k independent variables (possible causes) in matrix notation as

$$\underset{(T\text{x}1)}{y} = \underset{(T\text{x}k)}{Z} \underset{(k\text{x}1)}{ß} + \underset{(T\text{x}1)}{u} \tag{7}$$

where y=I%, T% or Y%, Z=the rate of changes of the exogenous and predetermined variables (both static and dynamic), ß =the parameters, and u the disturbance satisfying all standard statistical assumptions.

We now define our evaluation criterion (Wald risks) for an arbitrary estimator βa for β in (7) as Wald risk ≡ MSE(βa) = (βa-β)'W(βa-β) where W is positive definite.

Under Wald risks, we can estimate (7) which is essentially a general linear model for structural or behavioral analysis or for direct forecasting and policy studies (see Pindyck and Rubinfeld, 1998) by using the OLS or, at a more efficient level, any of the explicit (Baranchik, 1973) Stein or Stein-rule methods as described below.

More specifically, using (7), the basic and most well-known method to produce estimates and forecasts of y (or I%, T% and Y%) is the OLS estimator of ß (denoted by b) and written as

$$b = (Z'Z)^{-1}Z'y \tag{8}$$

A more sophisticated and efficient method is the explicit Stein estimator of ß (Baranchik, 1973) and given by

$$\begin{aligned} ßs &= [1 - c(y-Zb)'(y-Zb)/b'Z'Zb]\, b \\ &= [1 - c(1-R^2)/R^2]\, b \end{aligned} \tag{9}$$

where c is a characterizing scalar and defined in the range $0 < c < 2(k-2)/(T-k+2)$, and R^2 is the square of the sample multiple correlation coefficient.

A still more efficient method is the explicit positive-part Stein estimator of ß (Anderson, 1984) defined as

$$ß{+}s = [1 - \min\{1 , c(y-Zb)'(y-Zb)/b'Z'Zb\}]\ b$$
$$= [1 - \min\{1 , c(1-R^2)/R^2\}]\ b \qquad (10)$$

A new method to obtain estimates and forecasts of ß in (7) with better properties 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 two-stage hierarchical-information (2SHI)] estimators for 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 SUR 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, and 1992d, in the case of seemingly unrelated regressions).

The explicit 2SHI estimator is a *bona fide* or fully operational estimator and defined as

$$ßh = [1 - c(1-R^2)/R^2\} - c(1-R^2)/\{R^2(1+c(1-R^2)/R^2)\}]\ b \qquad (11)$$

and its positive-part counterpart (Tran Van Hoa, 1986a) is given by

$$ß{+}h = [1 - \min\{1 , c(1-R^2)/R^2\} - \{1/((R^2/c(1-R^2)) + 1)\}]\ b \qquad (12)$$

While all the estimators given above can be applied to the general linear model (7) 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. Thus, it is well-known that, in MSE and for $k \geq 3$ and $T \geq k + 2$, ßs dominates (that is, it performs better in forecasting MSE) b, and ßs is dominated by ß+s (Baranchik, 1973, Anderson, 1984). However, it has also been demonstrated (Tran Van Hoa, 1985, Tran Van Hoa and Chaturvedi, 1988) that, in MSE, ßh dominates both b and ßs, and more importantly, ß+h dominates ß+s (Tran Van Hoa, 1986a).

A further 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 $0 < c < 2(k-1)/(T-k)$*. This indicates that the 2SHI method produces better (in terms of smaller Walk risks or closer generalized Pitman nearness) estimates and forecasts even if the estimating and forecasting equation has only one independent variable in it. *The condition for the optimal Stein dominance in the linear equation up to now requires that $0 < c < 2(k-2)/(T-k+2)$* [see Anderson, 1984].

While some application of these forecasting methodologies to predictions of economic activities in some developed countries such as Australia (see Tran Van Hoa, 1992d) has been made, the extent of the significance of the MSE dominance, or equivalently, the informational gain or relative forecasting success between the alternative estimators above has not been investigated explicitly within an open trade and multi-sectoral theoretical framework and an empirical context using more recent economic data for the major economies in East Asia. This issue is taken up in the study below for one of the fastest growth economies in the world in recent years but with highly fluctuating investment and being very sensitive to foreign trade and capital flows in the region (see Tran Van Hoa and Harvie, 1998).

Another interesting feature of our study is that, since all data are annual and have, as usual, a small sample size, our study is therefore designed to look at the finite sample performance of alternative impact study methods, an area neglected in numerous studies of this kind. Finally, 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 we in fact investigate the performance of the alternative forecasts in the case of serious measurement errors on the variables of the macromodel of an economy however it is defined.

The substantive findings reported below are based on the five-equation macroeconomic model described earlier in (1')-(5'), and the appropriate estimating equations (6) to produce elasticity parameters or the equations to study the impact of China's WTO membership on its investment, trade and growth as given in (6). In addition, a number of well-known methods is used to compare their relative performance for better decision analysis.

5 Modelling China's Economy: Performance of Alternative Methodologies

In our study, we have fitted the three equations (investment, trade and growth) in differential and reduced form (6a-6c) of the model (1')-(5') to China's annual data. The original dataset is from 1960 to 1998, but the effective sample period is 1962 to 1998, giving, when the dynamic (lag) structure is taken into account, a sample size of up to 37 observations for each variable. In our comparative experimental study, only the OLS or ML, the positive-part Stein, and the positive-part 2SHI forecasts of investment, trade and growth are used to produce elasticities for impact study.

The data for our study are in real terms at the constant 1995 prices and obtained from the 2002 World Bank World Tables OECD Countries and East Asia databases, using Australia's data express (DX) extracting procedure. The performance of our reduced-form equations is determined solely from their good fit, correct predictions of peaks, troughs and turning points, and improved forecasting MSE.

The possible effects of structural instability (economic dynamism) and uncertainty (due to financial or economic crises or global economic slow-down) on China's investment, trade and growth have also been taken into account. This is achieved by modelling these macroaggregates in the short (one year), medium (two years) and long-terms (3 or more years), and also subjecting our impact to wide fluctuations (measurement errors) over the study period.

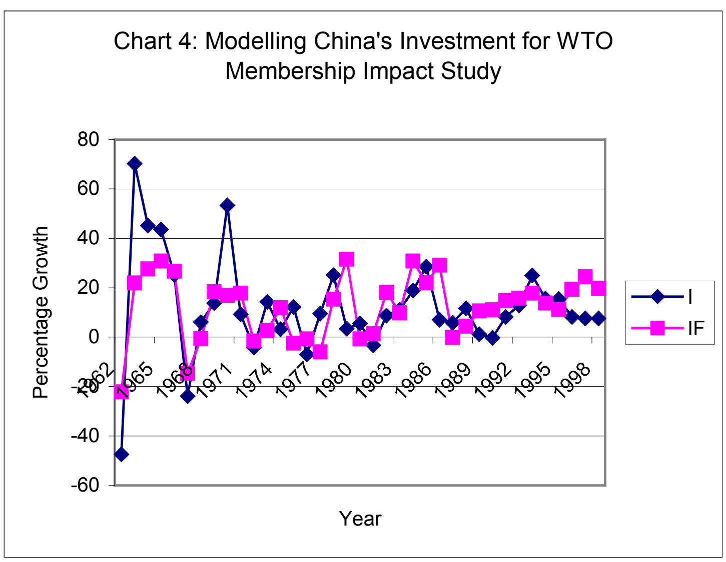
The stochastic simulation results from this study (not shown here) support the analytical results discussed in Section 3 in all scenarios described above. More specifically, our methodologies indicate that the findings are superior in terms of Wald risks for all 3 timeframes: short-, medium- and especially long-terms and under all conditions of measurement errors. They are therefore specially suited to be used to study the impact of the factors affecting China's investment, trade and growth especially in the long term. For comparison purposes with other previous studies on investment, trade and growth, the following section is based only on the results from the OLS or ML estimation methods.

6 Measuring the Impact of China's WTO Membership on Investment, Trade and Growth

Possible Impact on China's Investment

In order to study the impact of China's WTO membership on the country's investment, it is necessary to study the determinants (whether WTO-induced or not) as focused in our specified model that have directly or indirectly affected this investment in an historical context and used in *ex ante* predictions. The relevant determinants of investment based on our simple model (1')-(5') are given in Equation (6a). The impact of the WTO membership on China's investment is transmitted directly via enhanced trade (exports and imports) but indirectly through these determinants at the end of the transmission mechanism. A good equation in this case would then be able to provide better outcomes for future impact or *ex ante* studies on investment.

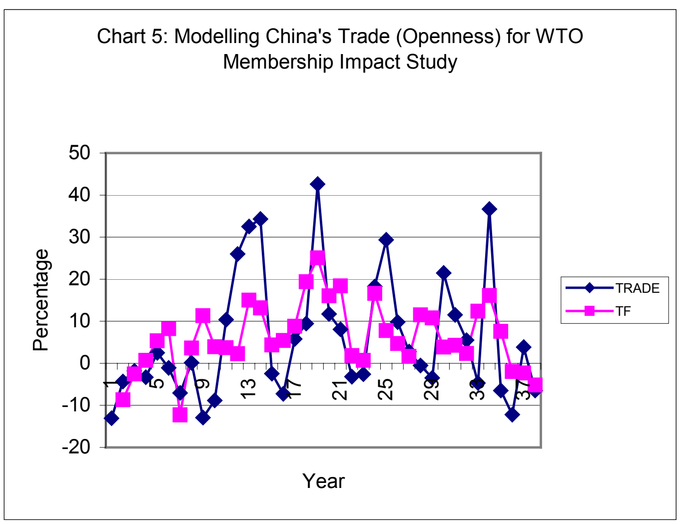
The historical forecast movements of China's investment (named IF) are econometrically efficient and emulate well its actual fluctuations (I) including peaks and troughs) during the period under study, 1962-98 (see Chart 4). While there are some underestimation of the actual peaked investment in the early 1960s, there is also some indication of more minor overestimation in the recent years due possibly to other relevant but omitted (internal or external) factors from our model. Of special interest to us is however the ability of our estimated model to mimic not only the trends but also the turning points of the observed investment data over nearly 4 decades, even though we conceded earlier that our model is simply an illustration of the performance of our new modelling methodologies for impact study. On this evaluation criterion, our forecasts and impact findings would be regarded as reliable.



Possible Impact on China's Trade (Openness/GDP)

Empirical modelling of trade has always been a difficult task for econometricians world-wide, and resulted invariably in only modest or even low modelling success. These findings are based on the gravity theory or its extension and cross-section data (see Baier and Bergstrand, 2001). However better success – with R^2 being close to 80 per cent – has been achieved and reported by Tran Van Hoa (2002b and 2002c) using extended gravity theory and time-series data. The low success obtained may be due to numerous factors but, in our view, the most likely determinants are perhaps the characteristics of openness and its inherent international competitiveness (therefore much unpredictability and uncertainty) of the trading economies. External shocks are other plausible explanations (see below).

In our case, modelling China's trade (openness/GDP) equation (6b) for impact study and based on our illustrative Keynesian model (1')-(5') has been fairly successful. The success is seen through the statistical efficiency (i.e., being free of serial correlation problems) and in the accurate predictions (TF) of the great majority of the peaks and troughs and the turning points of trade fluctuations (TRADE) over the period 1962 to 1998 (see Chart 5). The chart also shows up the effect of the country's great constitutional changes and internal turmoil in the late 1960s and the 1980s on its trade, resulting in some underestimation in our predictions of trade for these periods. Surprisingly, the four major crises of 1975, 1989, 1991 and 1997 which had had serious impact on major economies in the world were found to have only a negligible effect on China's trade.

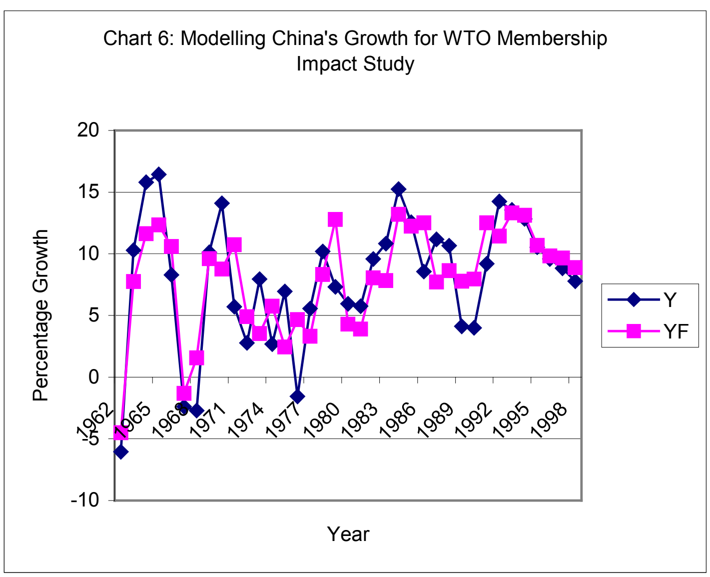


Possible Impact on China's Growth

In contrast to the performance of the estimated trade equation (6b) discussed above, our estimated equation (6c) for China's growth over the period of nearly 4 decades (1962-98) appears to fare very well (see Chart 6). While a successful modelling of growth has also been regarded as notoriously hard to achieve (in any country but especially for transition and developing economies that have achieved very high growth rates in recent years such as China), our findings here could be seen as good if not excellent (with an R^2 of over 64 per cent). These findings alone thus indicate that the equation is particularly suitable - in relation to other similar studies - for WTO membership impact study. It should be noted that the sampling period is a period of great upheavals in the country that also was subject to big changes or shocks outside it. Some of these shocks are well-known such as the opening up of China to the outside world, the two great oil crises of 1974 and 1981, the crash of the stock market in the US in 1987, the Gulf War in 1991, China's internal turmoil in 1989, and the Asia crisis of 1997. While these shocks may be important in influencing China's process of development and growth, they seem to have been capably and fully accommodated in our estimated growth equation.

Thus, in spite of these so-called perceived outliers in the data, our estimated growth equation (generating YF) still could mimic almost all fluctuations (including the peaks and troughs) of China's spectacular and widely fluctuating output growth (Y) during 1962-98. On the basis of these findings, our model as given in (1')-(5') should be capable of calculating fairly accurately the impact of China's WTO membership on the country's principal economic objective: its increasing standard of living or welfare. The impact is transmitted significantly through the variables specified for the model and given in the reduced form equation (6c).

It should also be noted that, there is no reason why other relevant variables or the sub- and add-factors in the sense of Johansen (1982) cannot be integrated into the model (1')-(5') for a better study of the impact of the WTO membership on China's growth or standard of living in the future.



A CASE STUDY

WTO Membership Impact (via 10% Price Reduction and 10% Government Spending Boost) on China's Growth

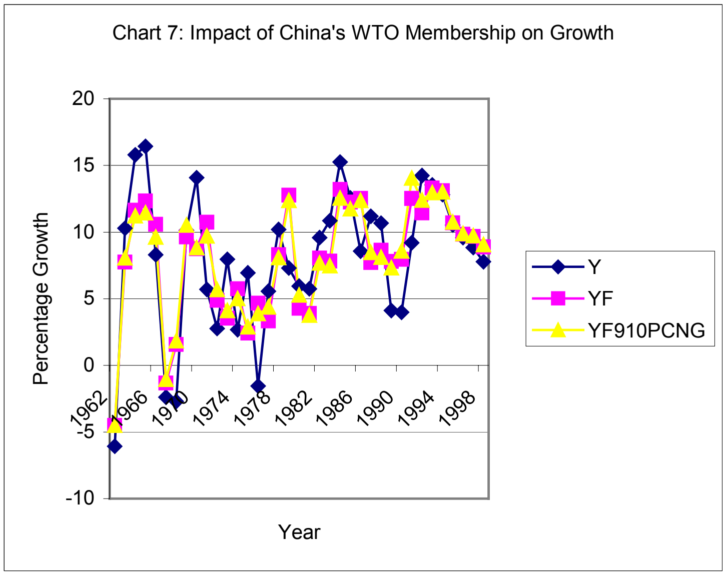
The impact model: Below we have used our estimated reduced-form equation (6c) for China's growth to study the perceived impact of the country's 2001 WTO membership on its standard of living or growth rates over a number of years. The analysis is historical but its translation to impact studies for the post-WTO accession period is straightforward. The methodological justification for this argument is that good historical or *ex post* outcomes will produce good *ex ante* results (Pyndyck and Rubinfeld, 1998).

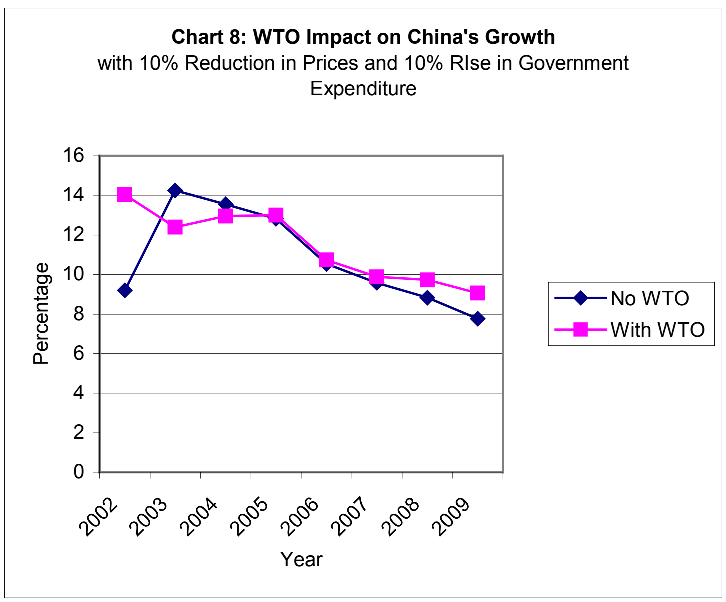
The scenario*:* As a result of the WTO membership, it is assumed that opening up the Chinese market to the outside world and accompanying reform (and change of culture) will reduce the general price level (the CPI) in China by 10 per cent. This will boost domestic spending due to reduced commodity and service prices and increase government revenue and subsequent increased government spending. Assume that the spending boost is also 10 per cent. Assume also that the impact started in 1991 for historical studies (or equivalently in 2002 for *ex ante* studies). The estimated impact of the WTO membership on China's growth rate under this scenario is depicted in Chart 7 and with more year-to-year detail of this impact given in Chart 8.

The outcomes*:* In Charts 7 and 8, we have plotted the WTO-membership-induced impact of a 10 per cent reduction in China's CPI and a 10 per cent increase in the government expenditure. This impact seems to have a mixed effect initially on China's growth rate. The effect becomes clearer and more uniform or clear-cut after a few years.

For example, in the first two years after the change (that is, the WTO membership), there would be a slow-down (that is, lower but still very much positive rates) in China's growth. This may be due to unmet challenges of restructuring in policy and unfulfilled over-hyped community perception in the country. But six years after the change, China's growth will be seen to attain an increase of 10.1 per cent higher than that in the no-change (no WTO membership) state. And seven years after the change, China's growth will be 16.5 per cent higher than that in the no-change state.

The effects of China's WTO membership are, from our study, beneficial and of a long-term nature. Sudden change and benefit are not of a short-term nature in this case. In addition, our modelling and impact study approach's substantiated evidence can be used to infer that the effects would continue to grow over time, especially when the compound flow-throughs of other economic, financial or administrative reforms introduced as a result of China's WTO membership or of increasing globalisation are taken into account in econometric modelling and in practical policy analysis or formulation by government and corporate policy-makers in the country.





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