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Modelling the Impact of China's WTO Membership on Its Investment and Growth: A New Flexible Keynesian Approach

Van Hoa Tran
University of Wollongong, tvheco@uow.edu.au

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Abstract

The standard theories of economics, international finance, transnational corporations, and within the accounting framework of the United Nations System of National Accounts (SNA93) or earlier stipulate that investment plays a crucial role in influencing microeconomic activity, national output growth and economic development.

Keywords

Modelling, Impact, China, WTO, Membership, Its, Investment, Growth, Flexible, Keynesian, Approach

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However, consider the United States' main origins of imports as reported in The Economist's World in Figures, 2002:

- Canada:	19.3 % of total
- EU15:	19.1 % of total
- Japan:	12.8 % of total
- Mexico:	10.7 % of total
- China:	8.0 % of total

Would anyone seriously suggest that the above ranking would correspond the way the United States would line up the above countries on its scale of importance. Surely, Canada is not bigger in the eyes of its neighbour to the South than the EU15. Neither is Mexico bigger than China.

Without getting into a hair-splitting exercise, it seems important to define who is small and who is large. There is no obvious way of settling this discussion but a large country will not bash a small country every time the latter commits a trade infringement. And the bigger the difference in their sizes, the more can a small country get away with. And if you reduce the cost of dispute settlements you will in general encourage more trade infringements and in particular infringements by small courtiers.

To my mind, the basic asymmetry comes possibly from different national welfare functions applied by large countries vis-à-vis those who punch in the same weight category and the ones who are much weaker opponents. To put it in an extreme way: A truly big country cannot afford to lose a fight with a strong opponent. At the same time, it may not "afford" to win, or even start, a fight with a truly small country. I would very much encourage Earl Grinols and Roberto Perrelli to pursue this line of investigation.

There is another aspect of the paper which could be greatly extended, even though it would certainly not be easy. As it stands, the model assumes that infringement opportunities arrive on a random basis. Would it mean that commercial policies become random with case-by-case response to some external shocks? If this indeed were claimed, I would find such a proposition hard to swallow.

If it is a game, trade policy is not a one-shot event; it is a repeated game. I know, it is easy to say it but much more difficult to come up with a tractable model. Luckily, not everything is lost. The very rich literature of the 1980s on wage indexation, government-trade union bargaining and the credible conduct of monetary policy produced results such as "tit-for-tat strategy", or "overlook a first infringement but hit hard when a second violation happens".

I applaud the approach taken by Earl Grinols and Roberto Perrelli. Perhaps my suggestions can encourage them to go further in their research.

Modelling the Impact of China's WTO Membership on Its Investment and Growth: A New Flexible Keynesian Approach

Tran Van Hoa

Department of Economics, University of Wollongong, Australia

1 Introduction

The standard theories of economics, international finance, transnational corporations, and within the accounting framework of the United Nations System of National Accounts (SNA93) or earlier stipulate that investment plays a crucial role in influencing microeconomic decisions and macroeconomic activity, national output growth and economic development. Investment also helps to shape fiscal and monetary policy (Dornbusch and Fischer 1990) and economic reforms in many developed, newly industrialized and especially developing countries (World Bank 1991). Corporate and private strategies for business development and expansion in a home or host economy depend on this crucial role in a Wiener-Granger causal sense. As a result, a rigorous study and discussions of the movements or trends of these economic aggregates and their empirical relationships either in a historical context or in future predictions are amply justified.

With its formal accession to the WTO in November 2001, China expects, as a result in the medium and long term, enhanced trade, investment and economic growth in that sequential order. The purpose of our paper is therefore to contribute to this important nexus study by exploring empirically the interdependence of the various 'engines of growth' and by using a new modelling approach integrating the static CGE and dynamic multi-equation Keynesian theories and the SNA93 framework.

To achieve our purpose in a novel way, the paper departs from the applied econometric modelling approaches using conventional multiple regressions, Haavelmo's 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 economics (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 forecasting and impact studies to better formulate forward planning/impact policy and strategies either in finance, economics or business

These advances consist of our new empirical Bayes or two-stage hierarchical information – 2SHI – (Van Hoa 1985, 1986a, 1993b, 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 approach is relatively superlative – in terms of its empirical fit and turning point predictions – then its superiority in impact studies for say China's WTO membership is confirmed, historically or in an *ex ante* sense. 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 finance, economics, and business analysts in their corporate and individual planning to investment and growth.

2 Trends in China's Main Economic Activities (1960-1999)

In the investment area, 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. The total amount of incoming FDI rose from almost zero in that year to a high of about \$110 billion in 1993 and \$320 billion in 1999. Thus, China has become the world's third (second until 1998) largest recipient of FDI, and the largest recipient among developing countries. The FDI volume has hovered around \$40-50 billion in each of the past several years. China 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 foreign investment (OECD 2001).

At present, 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 globalization and China's reforms.

Previous efforts by the OECD and China's Ministry of Foreign Economic Cooperation and Trade (MOFTEC) resulted in a conference in Xiamen, Fujian, in September 2000 to discuss the driving forces and economic effects of FDI on China's development, to exchange information and experiences on best FDI promotion practices, and to elaborate China's future FDI plans and policies. Our study below supplements these efforts from a methodological perspective and having

important implications for more effective impact studies of China's WTO membership consistent with historical data over three decades.

Figure 1 summarizes the annual (1960-1998) 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 1960 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 imports (generally with a trade surplus). Despite the role played by the government in the economy, its share in SNA is the lowest as seen in Figure 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 link between the trends of these macroaggregates.

While the impact of China's WTO membership can be studied via increased exports and imports alone, the apparent link between them and the rest of the economy's activities in an SNA93 context makes the task of study more complicated.

More specifically, to decompose this link into a more precise form for say a study of the impact of increased trade and investment from China's WTO membership or for other policy analysis, we have a number of options. These options can 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 and investment and other relevant causal economic activities in the economy. We adopt the second approach because of the inherent Marshallian nature of economic activities in which all are interrelated or interdependent.

Figure 1. China's Main Macroaggregates (in local currency)
Source: World Bank World Tables (2001)

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 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 of an open economy in an arbitrary functional form as

$$C = C(Y, C-1) \quad (1')$$

$$I = I(Y, Y-1, R, R-1) \quad (2')$$

$$X = X(Y, YW, PCN, PUS) \quad (3')$$

$$IM = IM(Y, YW, PCN, PUS) \quad (4')$$

$$Y = Y(C, I, G, X, IM) \quad (5')$$

or its usual linear form

$$C_t = \alpha_1 I + \alpha_2 Y_t + \alpha_3 C_{t-1} + u_1 t \quad (1)$$

$$I_t = \alpha_4 I + \alpha_5 Y_t + \alpha_6 Y_{t-1} + \alpha_7 R_t + \alpha_8 R_{t-1} + u_2 t \quad (2)$$

$$X_t = \alpha_9 I + \alpha_{10} Y_t + \alpha_{11} YW_t + \alpha_{12} PCN + \alpha_{13} PUS_t + u_3 t \quad (3)$$

$$IM_t = \alpha_{14} I + \alpha_{15} Y_t + \alpha_{16} YW_t + \alpha_{17} PCN + \alpha_{18} PUS_t + u_4 t \quad (4)$$

$$Y_t = C_t + I_t + G_t + X_t - IM_t \quad (5)$$

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 1991) 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, Fried-

man, and Modigliani, (b) a flexible accelerator investment behaviour, augmented by foreign capital borrowings (see for further detail 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 elasticities and (d) relevance of the government sector expenditure especially in transition economies.

In this model, the WTO membership impact is assumed to be transmitted through increased trade and investment, and this itself will be transmitted to increased growth and private consumption. In the model, consumption, investment, exports, imports and GDP are endogenous, and there are 9 exogenous and predetermined variables.

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, consumption and growth can be written, instead of their linear form given traditionally in (1)-(5), in their complete differential form (see Allen 1960) in the reduced form as (see Van Hoa 1992a and 1992d, Harvie and Van Hoa 1993)

$$\begin{aligned} I/Y_t \quad U \quad C/Y_t \quad Y/Y_t &= a_{11} + a_{12} C/Y_{t-1} + a_{13} Y/Y_{t-1} + a_{14} R/Y_t + a_{15} R/Y_{t-1} \\ &+ a_{16} YW/Y_t + a_{17} PCN/Y_t + a_{18} PUS/Y_t + a_{19} G/Y_t + e_i \end{aligned} \quad (6a/b/c)$$

where U is a union symbol, I/Y , C/Y , Y/Y , R/Y , YW/Y , PCN/Y , PUS/Y , and G/Y indicate the rate of change of I , 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 the I , C or Y equation.

The three equations in (6) characterize the investment, consumption and growth relationships from the illustrative five-equation macroeconomic model given in Eqs (1)-(5). In contrast to the conventional unidirectional analysis, the impact of enhanced trade due to China's WTO membership on investment, consumption and growth 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 or a

major war 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 the rates of change, our equations by their construct include as the special cases the Granger-Wiener short-term causality if these rates of changes are $I(0)$ and the co-integration or long-term equations of the Engle-Granger (1987) class (see Van Hoa 1993c, and Harvie and 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 $I\%$, $C\%$ and $Y\%$ equations (6) to data for the period 1966 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 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

$$\begin{matrix} y & = & Z & \beta & + & u \\ (Tx1) & & (Txk) & (kx1) & & (Tx1) \end{matrix} \quad (7)$$

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

We now define our evaluation criterion (Wald risks) for an arbitrary estimator $\hat{\beta}$ for β in (7) as Wald risk $\equiv \text{MSE}(\hat{\beta}) = (\hat{\beta} - \beta)'W(\hat{\beta} - \beta)$ where W is positive definite.

Under Wald risks, we can estimate (7) which is essentially a general linear model (7) for structural or behavioral analysis or for direct forecasting and policy studies (see Pindyck and Rubinfeld 1991) 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 $I\%$, $C\%$ and $Y\%$) is the OLS estimator of β (denoted by b) and written as

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

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

$$\hat{\beta}s = [1 - c(y-Zb)'(y-Zb)/b'Z'b] b = [1 - c(1-R^2)/R^2] b \quad (9)$$

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 β (Anderson 1984) defined as

$$\begin{aligned} \hat{\beta} + s &= [1 - \min\{1, c(y-Zb)'(y-Zb)/b'Z'b\}] b \\ &= [1 - \min\{1, c(1-R^2)/R^2\}] b \end{aligned} \quad (10)$$

A new method to obtain estimates and forecasts of β in (7) with better properties has been proposed (see Van Hoa 1985, 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 some linear regression models. This estimator includes the explicit Stein and the double k -class (Ullah and Ullah 1981) estimators as subsets (Van Hoa 1993b). 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 Van Hoa et al. 1993a, in the case of regressions with non-spherical disturbances, and 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

$$\hat{\beta}h = [1 - c(1-R^2)/R^2] - c(1-R^2)/\{R^2(1+c(1-R^2)/R^2)\}] b \quad (11)$$

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

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

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 1991) forecasting MSE can differ. 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) *b*, and $\hat{\beta}$ *s* is dominated by $\hat{\beta}$ + *s* (Baranchik 1973, Anderson 1984). However, it has also been demonstrated (Van Hoa 1985, Van Hoa and Chaturvedi 1988) that, in MSE, $\hat{\beta}$ *h* dominates both *b* and $\hat{\beta}$ *s*, and more importantly, $\hat{\beta}$ + *h* dominates $\hat{\beta}$ + *s* (Van Hoa 1986a).

A further important path-breaking result of the 2SHI theory has recently been proved (see 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 risk or 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 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 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 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 (LDC) 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 macro-economic 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, consumption 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, consumption and growth) in differential and reduced form (6a-6c) of the model (1)-(5) to annual data from China. The original dataset is from 1961 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 study, only the OLS or ML, the positive-part Stein, and the positive-part 2SHI forecasts of investment 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 2000 World Bank World Tables Industrial 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 turning point predictions and improved forecasting MSE.

The possible effects of structural instability (economic dynamism) and uncertainty (due to financial or economic crises) on China's investment, consumption 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 simulation results from this study (not shown here) support the analytical results discussed in Section 3 in all scenarios (see also other evidence in Appendix). More specifically, our methodologies indicate that they are specially suited to study the impact of the factors affecting China's trade, investment, consumption and growth especially in the long term.

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

6.1 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. 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 are econometrically efficient and emulate well its actual fluctuations (peaks and troughs) during the period under study, 1962-98 (see Figure 2). While there are some underestimations 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 four 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.

Figure 2. Modelling China's Investment for WTO Membership Impact Study

6.2 Possible Impact on China's Private Consumption

Modelling China's private consumption (6b) for impact study and based on our illustrative Keynesian model (1)-(5) has not been as successful in accurately predicting the peaks and troughs as in the case of investment (see Figure 3). This may be understandable in the sense that this underestimation of consumption occurred during the period of great constitutional changes. These changes include the opening up of China to the world in 1972, the internal turmoil of 1989, and the Gulf War of the early 1990s. In addition, expected conspicuous consumption (due to great anticipations of the country's reform) in China has been fairly high in the decades of high growth (1980s and early 1990s), and political stability in the country.

The consumption explanation needs further clarification. In fact, it is our observation that in economies of fairly sustained high growth rates, sometimes over-

hyped expectations of better things seem to override unrealistically other considerations (see also Hewitt 2001). It is within this context of consumer's behaviour that our model which is based on the Keynesian-Friedman-Modigliani theory should be amended to take this observation into account in future modelling and impact studies.

Figure 3. Modelling China's Private Consumption for WTO Membership Impact Study

6.3 Possible Impact on Growth

In contrast to the performance of the private consumption equation (6b) discussed above, our estimated equation (6c) for China's growth over the period of nearly four decades (1962-98) appears to fare very well (see Figure 4). These findings thus indicate that the equation is particularly suitable 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 and the consumer's hype may have affected our estimated private consumption, they are 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 still could mimic almost all fluctuations (including the peaks and troughs) of China's spectacular and widely fluctuating output growth 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 wel-

fare. The impact is transmitted significantly through the variables specified for the model and given in the reduced form equation (6c).

It should be noted that, there is no reason why other relevant variables or the sub- and add-factors in the sense of Jorgensen (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.

Figure 4. Modelling China's Growth for WTO Membership Impact Study

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 1991).

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 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 Figure 5.

The outcomes: In Figure 5 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 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 challenges of restructuring in policy and over-hyped community perception in the country. But six years after the change, China's growth was 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. In addition, 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 are taken into account in modelling and in policy analysis.

Figure 5. Impact of China's WTO Membership on Growth

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