

Recent Advances in Applied Economic Modelling and Forecasting for Policy Uses

Tran Van Hoa

- Centre for Strategic Economic Studies, and
- Director, Vietnam and ASEAN+3 Research Program
- Victoria University, Melbourne, Australia

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- Email: Jimmy.Tran@vu.edu.au
- Website: <http://www.staff.vu.edu.au/CSESBL/>

Motivation: Why Do It?

1. Contracted or Commissioned Brief
2. Thesis Topic (Self Selected)
3. Independent Research Project (Publish or Perish)
4. Research Assistance (Given Topics)

Research Strategies: How To Do It?

NO DATA

- » **Analytics**
(using Mathematical Economics chiefly Differential Calculus)
- » **Problems:**
 - Strong Untested Causal Assumptions
 - Too Stylised
 - No Realism
 - Real Issues Too Complex to handle

Research Strategies: How To Do It?

WITH DATA

- » **Graphical (Plots & Graphs)**
 - Fuzzy & Simplistic but Useful Sometimes (Finance)
- » **Descriptive (Mean, Variance, Var Coeff, Mode, Median)**
 - Causeless and No Causality Direction
- » **Quantitative Analysis**
 - Allows Testable Causality and Multiple Factors

Types of Applied Modelling

- **One-Equation Linear Models:**
 - **Simple or Univariate Regression**
 - 1 Eg, Health Exp= $a+b\text{Ageing}+u$
 - 2 Useful Sometimes but Unrealistic

Types of Applied Modelling

- **Multiple and Multivariate Linear Regression**
 1. **Time-Series**
 1. $C=a + b C(-1) + c C(-2)+u$
 2. **Unit Root Representation for LT or Cointegration**
 1. $DC=a + b T+ (r-1) C(-1)+ c DC(-1)+u$
 3. **Autoregressive Distributed Lag (Typical Topology)**
 1. $C=a + b C(-1) + c Y + d Y(-1)+u$
 4. **Econometric, eg, Growth Regressions:**
 1. $\log T=a + b \log GDP + c \log GDPP + d \log X+u$

Types of Applied Modelling

– Multiple-equation Models:

1 SUR:

eg, Stacked Regression (for say Demand Systems)

2 Multi-country Growth Regression (not used):

$$\log T(it) = a_i + b_i \log GDP(it) + c_i \log(GDP(jt)) + d_i \log X(it) + u(it)$$

3 Fixed-effect or WITHIN Multi-country Growth Regression (currently most popular):

$$\log T(it) = a_i + b \log GDP(it) + c \log(GDP(jt)) + d \log X(it) + u(it)$$

Types of Applied Modelling

4 Simultaneous-equation (circular causality, Marshall, Cowes Commission, Haavelmo):

or

when Errors-in-Variables (EV) exist

$$AY + BX = U \rightarrow A^{-1}AY + A^{-1}BX = A^{-1}U \rightarrow Y = PX + V$$

eg

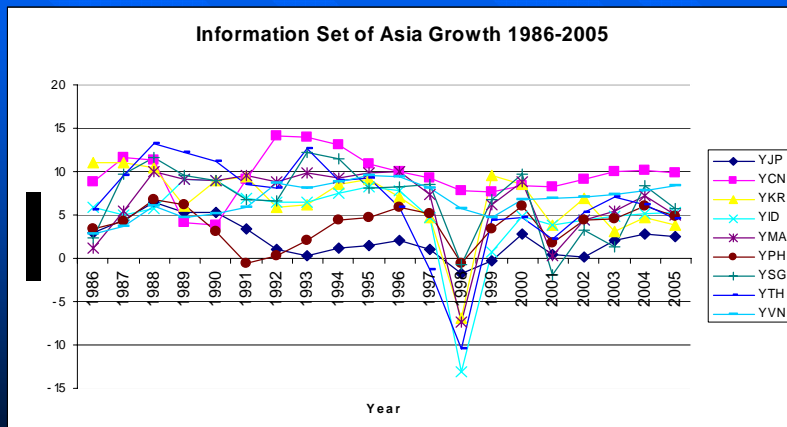
$$Y = a_1 + a_2 T + u_1$$

$$T = b_1 + b_2 Y + b_3 Y_2 + b_4 XR + b_5 MP + b_6 FP + b_7 IP + u_2$$

5 Other variations of SE models

eg, calibrated CGE/GTAP, Structural Equation Modelling

DATASET AND INFORMATIONAL CONTENT (eg, China & Other Asian Growths)



Two Questions from Dataset

- What is the Impact of China's Growth on Growth in Other Asian Economies?
- What is the Impact of Growth in Other Asian Economies on China's Growth?

EXISTING TOOLS & THEIR SUITABILITY

General Tools (Methodologies)

- 1 Talkfest (ministerial and senior official meetings)
- 2 Graphical and Descriptive Analysis (WTO, ADB, WB)
- 3 Quantitative Approaches (CGE, Macro, Micro)
- 4 Policy-Compliant Research (commissioned)
- 5 Research-Based Policy Analysis (independent)
- 6 **Core Need:** Historical Realism and Valid Projections (Kydland Criterion)

EXISTING QUANTITATIVE APPROACHES: MAJOR FEATURES & LIMITATIONS

- Time Series (No Economic Theory – Unit Roots, Cointegration)
- Regression Models (Spurious, lacks ST/LT Causality, and Simultaneity)
- Econometric Models (Mainly Linear)
- CGE/GTAP Models (Highly Calibrated)

EXISTING QUANTITATIVE APPROACHES: MAJOR FEATURES & LIMITATIONS

- Gravity Theory (Frankel & Romer 1999): **mainly Cross Section**
- Panel Regression (Dollar & Kraay 2004, Eichengreen et al 2007): **uses Cross-Section and Time-Series data, No Simultaneity, Country Heterogeneity Problem**

EXISTING QUANTITATIVE APPROACHES: Serious Omissions

- Marshall/Haavelmo proposition in Economics: **Circular Causality (Simultaneity) for all Activities**
- Linear/Loglinear/Nonlinear: **Do We Know the Exact Functional Form for the Data-Generating Process for Implementing?**
- Structural Change: **Role of Crises, Disasters and Reforms on Economy**

AN ADVANCE IN MODELLING

A New Quantitative Approach: The Generalised Gravity Theory

A GGT TRADE-GROWTH MODEL 1

■ Testable Function-Free Simultaneous-Equation Specification

- $Y = Y(T,X)$ **Implicit Arbitrary Function**
- $T = T(Y,X,S,Z)$ **Implicit Arbitrary Function**

where Y =GDP
 T =Trade in goods, services, FDI
 X =Other economic factors
 Z =Gravity & non-economic factors
 S =Shocks, policy reforms etc

GGT MODELLING FEATURES

- 1 Allowing **Testable Circular Causality** in Economy or Sector-wide Economic Activities
- 2 Specifying No Specific Functional Form (**Baier & Bergstrand 2008**)
- 3 Macro & Micro (Disaggregated) Mixture
- 4 **Data-Consistent** & Non-Calibrated
- 5 Incorporates Shocks/Change (**Johansen 1982, Edwards 2007**)
- 5 Including Gravity Factors (**Transaction Costs**)
- 6 **Stochastic** Structural & Policy Equations
- 7 Time Varying Domain

A GGT TRADE-GROWTH MODEL: Mathematical Derivation

- **Using Planar Taylor Series Expansion**
- $dY = (\partial Y/\partial T) dT + (\partial Y/\partial X) dX + \text{higher order}$
- $dY/Y = T (\partial Y/\partial T) (dT/T) / Y + X (\partial Y/\partial X) (dX/X) / Y$
- $= [(\partial Y/Y) / (\partial T/T)] (dT/T) + [(\partial Y/Y) / (\partial X/X)] (dX/X)$
- $= E1 (dT/T) + E2 (dX/X), \text{ or}$
- $Y\% = E1 T\% + E2 X\% + U (\text{stochastic}).$

$E1$ =Elasticity of Y on T, etc. And, similarly for Function of T.

Applications:

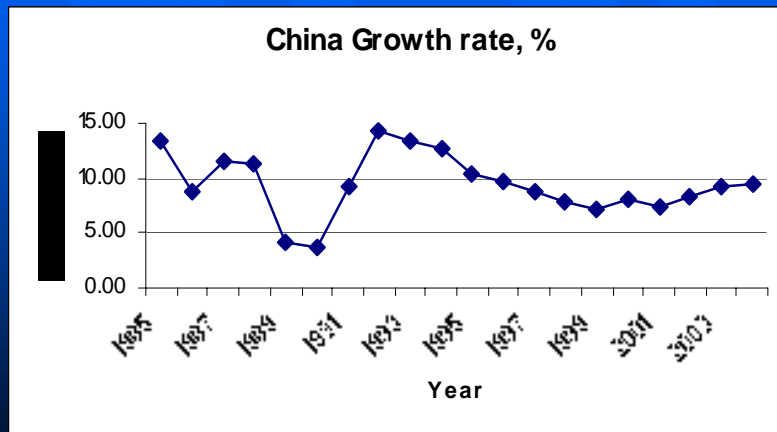
China-World and Australia-China FTA Issues

- China & WTO Membership (since 2001)
- China Economic Performance (since 1980s)
- China & Its Trading Partners
- Causes & Impact of China Growth
- Causes & Impact of China Trade
- Impact of Reform & Global Shocks on China
- Australia-China FTA: *Prospects and Challenges*

ECONOMIC AND TRADE DATA SETS

- FRANCE CEPII CHELEM
- UNCTAD
- OECD
- WORLD BANK WORLD TABLES
- ICSEAD
- AUSSTATS
- DFAT

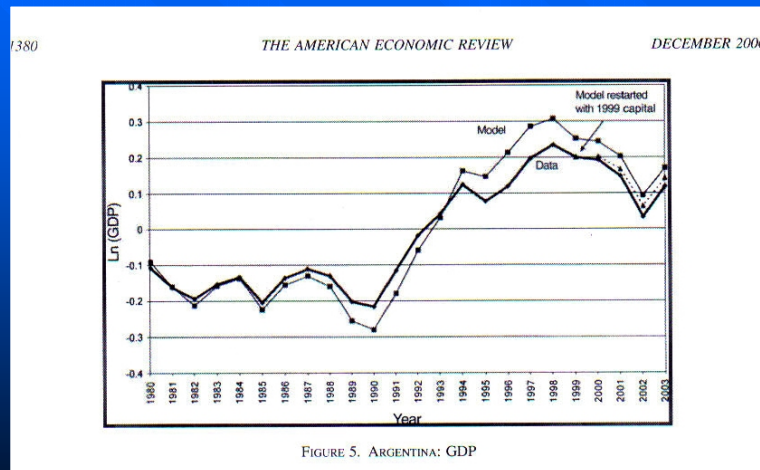
FACTS AND FIGURES 2



FACTS AND FIGURES 3



Friedman-Kydland Data-Model Consistency Criterion



CAUSALITY ISSUES FROM FACTS AND FIGURES

- 1 Does Trade Cause Development and Growth?
- 2 What Causes Trade?
- 3 What Are Major Trade Components?
- 4 Endogenous and Exogenous Causality of Trade
 - WTO and FTA Scope
 - Any Credible Empirical Support for ACFTA?

SUBSTANTIVE GGT FINDINGS FOR

- **China and Its Major Trading Blocs: ASEAN, Japan, US and EU**
 - Impact of Trade, Services, FDI, Policy Change and Global Shocks **on China Growth**

- **China and Australia (ACFTA Outcomes)**
 - Impact of Trade, Services, FDI, Policy Change and Global Shocks **on China/Australia Growth**

CHINA: IMPACT OF TRADE ON GROWTH

Variables	China-ASEAN			China-Japan			China-US		
	OLS	2SLS	2SHE	OLS	2SLS	2SHE	OLS	2SLS	2SHE
■ Constant	10.71**	10.34**	8.78**	11.02**	10.97**	9.17**	10.87**	10.93**	9.71**
■ Openness/GDP	0.02	0.02	0.02	0.01	0.03	0.03	0.02	0.03	0.02
■ Services/GDP	0.001	0.003	0.002	0.001	0.003*	0.003*	0.002	0.001	0.001
■ FDI/GDP	0.03**	0.04**	0.03**	0.03**	0.03**	0.03**	0.03**	0.03**	0.03**
■ China Turmoil 89	-6.87**	-6.56**	-5.67**	-6.97**	-6.74**	-5.64**	-7.09**	-7.19**	-6.38**
■ Gulf War 91	6.05**	5.90**	5.00**	5.79**	5.29**	4.43**	6.06**	6.15**	5.46**
■ China Reform 93	-0.03	-0.62	-0.53	0.02	-0.58	-0.49	0.07	0.05	0.04
■ Asia Crisis 97	-1.39	-0.61	-0.52	-1.28	-0.30**	-0.25	-1.32	-1.53	-1.36
■ WTO Membership	0.81	0.69	0.59	0.81	0.64	0.53	0.81	0.81	0.72
■ R2	0.92	0.89	0.94#	0.92	0.88	0.94#	0.92	0.2	0.86
■ F	12.60**	4.25**	9.16**	12.24**	4.41**	8.41**	12.74**	8.58**	12.45**
■ DW	2.71	2.65	0.63&	2.72	2.57	0.58&	2.78	2.78	0.87&

CHINA: IMPACT OF TRADE ON GROWTH

Variables	China-EU			China-Australia			Australia-China		
	OLS	2SLS	2SRI	OLS	2SLS	2SRI	OLS	2SLS	2SRI
Constant	11.11**	11.29**	10.01**	11.16**	11.07**	9.78**	7.43**	4.91**	4.07**
Openness/GDP	0.02	0.03	0.03	0.02	0.03	0.03	0.11**	0.22**	0.18***
Services/GDP	0.001	0.001	0.001	0.002*	0.003@	0.003@	-0.03	-0.01*	-0.01*
FDI/GDP	0.03**	0.03**	0.03**	0.04**	0.04**	0.04**	0.001*	0.001**	0.001**
Stock Market Crash 87							8.45**	13.45**	11.14**
China Turmoil 89	-7.22**	-7.43**	-6.59**	-7.45**	-7.47**	-6.59**	-7.11**	-10.04**	-8.31**
Gulf War 91	6.09**	6.27**	5.56**	6.04**	5.81**	5.13**	-7.57**	-8.44**	-6.99**
China Reform 93	-0.10	0.01	0.01	-0.25	-0.70	-0.62	3.89**	4.56**	3.79**
Asia Crisis 97	-1.43	-1.77	-1.57	-0.97	-0.15	-0.14	-1.10	-3.14@	-2.60@
WTO Membership	0.77	0.75	0.67	0.72	0.62	0.55			
R ²	0.92	0.92	0.96#	0.92	0.91	0.96#	0.90	0.87	0.94
F	12.81**	6.22**	12.27**	13.62**	6.98**	11.89**	11.07**	7.88**	13.29**
DW	2.75	2.72	0.84&	2.71	2.65	0.81&	2.21	2.40	0.99&

CHINA AND THE WORLD QUESTIONS and SUBSTANTIVE ANSWERS

- 1 More Trade -> Higher Growth?
 - Yes (but weak) for all trading blocs
 - Best Gains from Developed Countries (Japan, US, EU and Australia. Not from ASEAN)
- 2 More Services -> Higher Growth?
 - Yes (mild from Japan and Australia)
- 3 More FDI -> Higher Growth?
 - Yes (strong) for all trading blocs

CHINA AND THE WORLD

QUESTIONS and SUBSTANTIVE ANSWERS (contd)

4 Good Policy Reform 1991 -> Higher Growth?

Yes (strong) all trading blocs

5 Internal Shocks -> Lower Growth?

Yes (strong) all trading blocs

6 Regional Crises 1997 -> Lower Growth?

Yes (strong) all trading blocs

7 WTO Membership -> Higher Growth?

Yes (but weak) all trading blocs

AUSTRALIA-CHINA FTA

1 **Who Gains More in an ACFTA?**

1 Australia more from China's Trade

2 China more from Services & FDI

2 **Who Loses More in an ACFTA?**

Australia more from

1 China Internal Turmoil

2 Reforms

3 Regional Crises

3 **Are Our Findings/Policy Recommendations Reliable?**

Outcomes Reliability: A Graphical Evaluation Analysis

Reliability of Our Findings on

- Trade Modelling
- Growth Modelling
- Policy Recommendations
- Regional Strategic Studies

Ex-Post and Ex-Ante Simulations

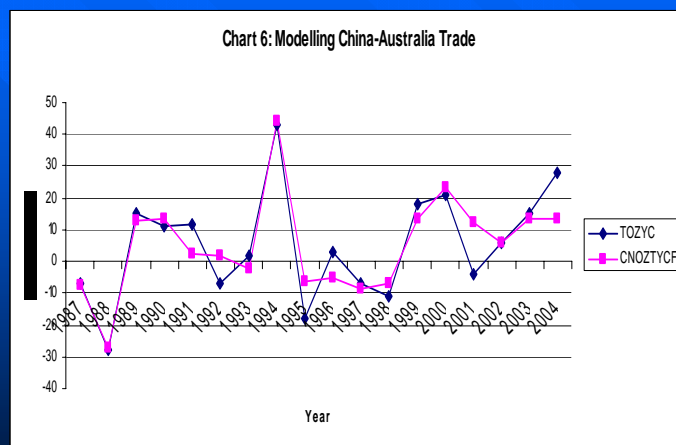


Chart 7: Modelling Australia-China Trade

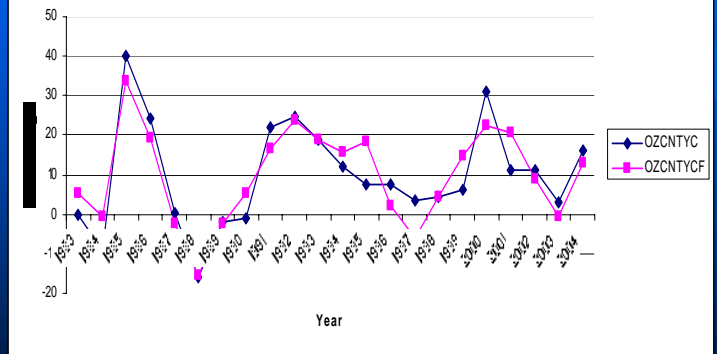


Chart 8: Modelling Australia Trade-to-China Growth

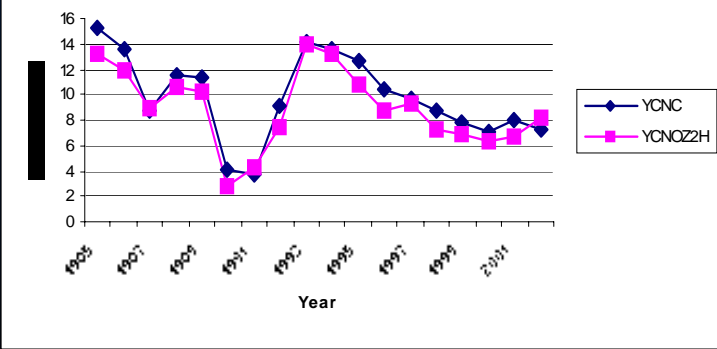
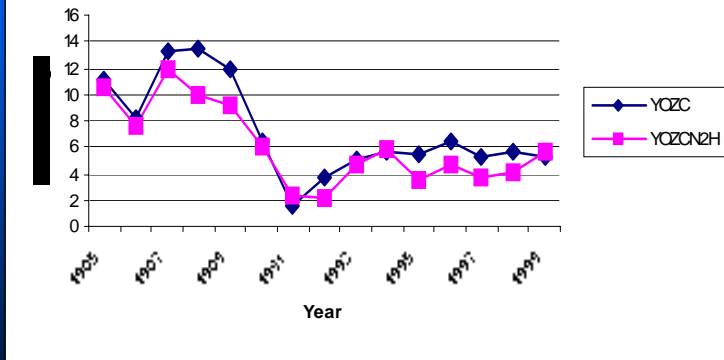


Chart 9: Modelling China Trade-to-Australia Growth



**ACFTA: CURRENT STATE OF PLAY
CHINA IMPORTS INTO AUSTRALIA**

