UNIVERSITI PUTRA MALAYSIA

MACROECONOMICS OF VERTICALLY GLOBALIZED PRODUCTION

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By

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Chairman: Professor Dr. Muzafar Shah Habibullah, Ph.D

Faculty: Economics and Management

This thesis investigates the macroeconomic implications of vertically fragmented production by shedding light on three long-standing issues in international macroeconomics: trade-comovement puzzle, China’s syndrome, and international monetary policy coordination. Chapter 3 revisits the trade-comovement puzzle. Existing models of international business cycle, ranging from two-country real business cycle model to simple vertical-specialization model, are known for the inability to reproduce the empirical regularities that economies linked with bilateral trade in intermediate inputs tend to comove more closely. Such modeling-empirics mismatch cast doubt on the role of international trade as transmission mechanism.

This thesis contributes to the literature by laying out a medium-scale two-country New Keynesian model with three processing stages fragmented across borders. Doing so allows us to capture the essence of vertical specialization in the form of
vertical and processing trade. The model is then estimated using Bayesian method on trade-weighted East and Southeast Asian time series. The estimated model has convincingly demonstrated its ability to replicate neatly the business cycle comovement over a large set of macroeconomic variables. As such, the thesis delivers a message that proper modeling of production fragmentation is a rewarding exercise for solving trade-comovement puzzle.

Turning our attention to contemporary issues, the anxiety with respect to the influence of rising China on Asian neighbors has been mounting. Whether China’s rise is benign or malign to Asian neighboring economies remains empirically indecisive. By taking the model into the data of China and East/Southeast Asia, Chapter 4 shows that vertical trade in intermediate inputs between China and East Asia has substantially arisen alongside processing trade in the aftermath of China’s WTO accession. East Asia, as the story goes, specializes at midstream production to produce intermediate goods traded vertically with China which specializes at downstream production for processing export.

Nonetheless, vertical trade between China and the developing Southeast Asia is trivial over the same time span. Both regions vertically specialize at downstream production, competing in processing trade against each other. Unsurprisingly then, the impulse response analysis indicates that China’s integration into regional production network has been benign to the advanced East Asian economies through vertical trade, but malign to the developing Southeast Asian economies that have to compete in processing trade. The thesis thus puts forward
an argument that macroeconomic interdependence is hugely influenced by the nature of production and trade linkage.

For open economies that are vertically and sequentially linked through production fragmentation and network-driven trade, an important question is if there is welfare gain from international monetary policy coordination. Drawn on the model estimated on China, East and Southeast Asia, Chapter 5 revisits this classic issue by proposing two novel views of optimal monetary policy coordination. Firstly, economies with strong trade link are not necessarily the natural candidates for policy coordination. The pattern of trade linkage does matter. Welfare gains from policy coordination can be sizeable only when the member economies vertically specialize at different chains of production and thus complement each other through vertical and processing trade.

Another equally if not more important contribution of this thesis is to develop a view of optimal monetary policy coordination as competing objectives of optimal input allocation due to production fragmentation and optimal consumption allocation with home bias. The former has disinflationary bias while the latter has expansionary bias. Were intratemporal elasticity of substitution between home and foreign final goods not equivalent to that between home and foreign intermediate goods, two biases are not counterbalanced. Either way will lead to currency misalignment, ending in inefficient price dispersion of identical goods across borders. Such effect occurs regardless of the genre of trade links. This has reinstated a strong case for international monetary policy coordination.
Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

MAKROEKONOMI GLOBALISASI PENGE卢ARAN SECARA MENEGAK

Oleh

WONG CHIN YOONG

Disember 2012

Pengerusi: Professor Dr. Muzafar Shah Habibullah, Ph.D

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Tesis ini mengkaji implikasi makroekonomi bagi globalisasi pengeluaran secara menegak dengan memberikan tumpuan kepada tiga isu yang penting dalam makroekonomi antarabangsa, iaitu masalah ketidakselarasan antara perdagangan antarabangsa dan kitaran ekonomi, sindrom China, dan penyelarasan antarabangsa dasar monetari. Bab 3 mengkaji semula masalah ketidakselarasan antara perdagangan dan kitaran ekonomi. Sebagai masa yang diketahui, baik model dua negara kitaran ekonomi sebenar ataupun model pengkhususan menegak mudah, model-model kitaran ekonomi antarabangsa yang sedia ada ini tidak berkeupaya untuk menghasilkan semula kenyataan empirikal berikut: ekonomi bagi negara-negara yang dihubungkaitkan dengan perdagangan dua hala dalam barang perantaraan berkecenderungan untuk berkitar bersama dengan lebih rapat. Ketidaksepadanan antara model ekonomi dan bukti empirikal ini telah mencetuskan keraguan tentang peranan perdagangan antarabangsa sebagai mekanisme saluran kejutan.
Tesis ini menyumbang kepada karya yang sedia ada dengan membina model dua negara Keynesian Baru yang dilengkapi dengan tiga peringkat pemprosesan yang berpecah merentasi sempadan negara. Pemodelan sedemikian menyenangkan penghayatan intipati pengkhususan menegak dalam bentuk perdagangan menegak dan perdagangan pemprosesan. Model ini kemudiannya dianggarkan dengan kaedah Bayesian berdasarkan siri masa Asia Timur dan Asia Tenggara. Model tersebut telah menunjukkan keupayaan yang memberangsangkan dalam penghasilan semula kitaran ekonomi sebenar yang mengrakumi set pembolehubah makroekonomi yang luas. Oleh itu, tesis ini telah menyampaikan mesej yang penting bahawa pemodelan fragmentasi pengeluaran yang merentasi sempadan negara adalah satu usaha untuk menyelesaikan masalah ketidaksepadanan antara perdagangan dan kitaran ekonomi yang amat bernilai.

Apabila kita mengalihkan tumpuan kepada isu-isu semasa, kebimbangan terhadap pengaruh negara China yang semakin berkembang dalam negara-negara jiran di rantau Asia memang tidak dapat diabaikan. Walau bagaimanapun, bukti-bukti tentang sama ada kebangkitan negara China memanfaatkan atau menyusahkan negara jirandil rantau Asia masih dicari-cari. Apabila model tersebut dianggar dengan siri masa China dan Asia Timur/Tenggara, Bab 4 menunjukkan bahawa perdagangan menegak dalam barang pengantaran antara China dan Asia Timur telah berkembang pesat di samping perdagangan pemprosesan selepas penyertaan negara China dalam Organisasi Perdagangan Dunia (WTO). Khususnya, negara-negara Asia Timur mengkhusus pada pengeluaran aliran tengah untuk menghasilkan barang-barang pengantaraan yang
diperdagangkan secara menegak dengan China yang mengkhusus pada pengeluaran hiliran bagi tujuan eksport pemprosesan.

Sebaliknya, perdagangan menegak antara China dan Asia Tenggara tidak begitu ketara dalam jangka masa yang sama. Sebaliknya, kedua-dua rantau ini mengkhusus pada pengeluaran hiliran, and bersaing antara satu sama lain dalam perdagangan pemprosesan. Maka tidaklah hairan apabila analisis tindak balas impuls menunjukkan bahawa integrasi negara China dalam rangkaian pengeluaran serantau telah memanfaatkan ekonomi Asia Timur yang maju melalui perdagangan menegak. Sebaliknya, kebangkitan negara China merupakan cabaran hebat kepada ekonomi Asia Tenggara yang sedang membangun akibat daripada persaingan dalam perdagangan pemprosesan. Secara kesimpulannya, tesis ini telah mengemukakan hujah bahawa kesalingbergantungan ekonomi makro amat dipengaruhi oleh corak rangkaian pengeluaran dan perdagangan.

Bagi ekonomi-ekonomi terbuka yang dihubungkaitkan melalui pemecahan pengeluaran dan perdagangan menegak yang berurutan, satu persoalan yang penting sekali ialah sama ada penyelarasan antarabangsa dasar-dasar monetari membawa keuntungan kebajikan. Berdasarkan model yang dianggarkan pada China, Asia Timur dan Asia Tenggara, Bab 5 mengkaji semula isu klasik ini dengan mencadangkan dua pandangan yang asli berkenaan dengan penyelarasan antarabangsa dasar monetari yang optimum. Yang pertama, ekonomi-ekonomi dengan pautan perdagangan yang kukuh tidak semestinya sesuai untuk penyelarasan dasar monetari. Corak rantaian perdagangan yang menjadi penentu.
Keuntungan kebajikan daripada penyelarasan dasar monetari menonjol hanya apabila ekonomi-ekonomi anggota mengkhusus pada rantaian pengeluaran menegak yang berbeza dan saling melengkapi antara satu sama lain melalui perdagangan menegak dan pemprosesan.

Yang kedua, buat pertama kali dalam karya-karya berkenaan tesis ini mengusulkan konsep penyelarasan dasar monetari yang optimum dari segi objektif-objectif yang bertentangan akibat peruntukan input optimum yang disebabkan oleh pemecahan pengeluaran dan peruntukan penggunaan optimum yang disebabkan oleh keutamaan terhadap barang tempatan. Objektif ter dahulu bersifat menguncup manakala objektif yang kemudian bersifar mengembang. Sekiranya keanjalan penggantian antara barang akhir tempatan dan asing tidak bersamaan dengan keanjalan penggantian antara barang tempatan dan asing, kedua-dua objektif yang bertentangan ini tidak dapat diimbangi. Hasilnya, ketidakselerasan dalam kadar pertukaran mata wang akan berlaku. Ia akan mengakibatkan dispersi harga barang akhir yang tidak effisien merentasi sempadan negara. Kesalan ini akan terjadi tanpa mengira corak hubungan perdagangan. Oleh hal yang demikian, faktor ini telah menguahkan seruan bagi penyelarasan antarabangsa dasar monetari.
ACKNOWLEDGEMENTS

This thesis is the culmination of many years of thoughts and efforts, and along the way I have accumulated a great deal of practical support and intellectual debt. My greatest debt goes to Prof. Dr. Muzafar Shah Habibullah for his relentless trust and tolerance on my work. His willingness to accept me as his supervisee is deeply appreciated till date. Sincere gratitude also goes to Associate Professor Dr. Law Siong Hook for his invaluable assistance throughout the studies. Their humbleness and academic enthusiasm, despite the outstanding academic achievements, has always been a role model for me.

I would like to express my gratefulness to three individuals who have indirectly influenced my attitude as an academic economist. I first met Jomo K.S during a public talk in Melaka in 1997 when currency and financial crises started landing on Malaysia. Since then I never miss his lectures during my undergraduate and master studies. His academic integrity and uncompromising concern about the relevance of economics for understanding the economic world, till date, has constantly reminded me not to give up practical relevance simply for the sake of analytical rigor in my intellectual pursuit.

My first article related to this topic has been published in a special issue on Phillips curve in the North American Journal of Economics and Finance. And the guest editor is Kenneth Kuttner. I can still remember his advice that “you have to bridge your work to existing literature, not just cite them, to show appreciation on others’ work on the one hand and to demonstrate your novelty on
the other hand”. This has been the principle of writing ever since then that I attempt to hold every time I have my ink poured, although more often than not I fail miserably.

I always have great enthusiasm on theoretical modeling. Revealing the mechanism underlying an economic phenomenon through the lens of self-constructed economic model is intellectually fascinating. But in an academic environment which I stay that weighs heavily on empirical not theoretical analysis, the learning process becomes extremely taxing and demotivating. I nearly lost my enthusiasm until I attended ZEW summer workshop for young economist last year in Mainheim, Germany and met Fabio Ghironi. His enthusiastic presentation on the integration of firm heterogeneity into macroeconomic model has been especially inspiring. I regain the long lost interest and confidence when my work has been invited and accepted for publication in *International Review of Economics and Finance*.

Lastly and most importantly, I owe my deepest gratitude to Yoke Kee, my frequent coauthor and life companion. It is indeed an understatement to claim that without her this thesis can never be completed. She appeared when I was in the trough of my life; she brought me to my current supervising committee who treats me as researcher not student when I found dead end with the previous one; she shares my thoughts and opinions when no one cares; she keeps the confidence and trust on me when I myself have lost. She fixes me. I thus dedicate this thesis to her.
I certify that a Thesis Examination Committee has met on 6 December 2012 to conduct the final examination of Wong Chin Yoong on his thesis entitled "Macroeconomics of Vertically Globalized Production" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the degree of Doctor of Philosophy.

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Date: 26 February 2013
DECLARATION

I declare that the thesis is my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously, and is no summated for any other degree at Universiti Putra Malaysia or other institution.

_________________________________
WONG CHIN YOONG
Date: 6 December 2012
## LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Share of intermediate goods in total exports and imports, 2004</td>
<td>3</td>
</tr>
<tr>
<td>1.2</td>
<td>Geographic profile of world trade in parts and components</td>
<td>4</td>
</tr>
<tr>
<td>1.3</td>
<td>Share of value added component in total gross exports, 2004</td>
<td>5</td>
</tr>
<tr>
<td>3.1</td>
<td>Prior and posterior distributions for international real business cycle model</td>
<td>48</td>
</tr>
<tr>
<td>3.2</td>
<td>International real business cycle model and simple vertical-specialization model: cross-region correlations</td>
<td>50</td>
</tr>
<tr>
<td>3.3</td>
<td>Prior and posterior distributions for simple vertical-Specialization model</td>
<td>52</td>
</tr>
<tr>
<td>3.4</td>
<td>Prior and posterior distributions for New Keynesian model with vertical and processing trade</td>
<td>72</td>
</tr>
<tr>
<td>3.5</td>
<td>Measuring vertical specialization of total export</td>
<td>77</td>
</tr>
<tr>
<td>3.6</td>
<td>NKVPT model: contemporaneous cross-region correlations</td>
<td>79</td>
</tr>
<tr>
<td>4.1</td>
<td>Calibrated steady states, 1987Q1-2008Q4</td>
<td>113</td>
</tr>
<tr>
<td>4.2</td>
<td>Priors and posteriors for full sample 1987Q1 – 2008Q4</td>
<td>115</td>
</tr>
<tr>
<td>4.3</td>
<td>Vertical specialization index</td>
<td>121</td>
</tr>
<tr>
<td>4.4</td>
<td>Priors and posteriors for subsample 2001Q1 – 2008Q4</td>
<td>126</td>
</tr>
<tr>
<td>4.5</td>
<td>Forecast error variance decomposition in post Chinese WTO accession</td>
<td>141</td>
</tr>
<tr>
<td>5.1</td>
<td>Parameters and shocks, 1987Q1-2008Q4</td>
<td>161</td>
</tr>
<tr>
<td>5.2</td>
<td>Some stylized facts, 1987Q1-2008Q4</td>
<td>162</td>
</tr>
<tr>
<td>5.3</td>
<td>Measure of vertical specialization in total export</td>
<td>164</td>
</tr>
<tr>
<td>5.4</td>
<td>Definition of parameters in the unconditional welfare measure</td>
<td>166</td>
</tr>
<tr>
<td>5.5</td>
<td>Unconditional welfare cost of policy noncoordination</td>
<td>174</td>
</tr>
</tbody>
</table>
### LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Taxonomy of vertical specializations</td>
<td>2</td>
</tr>
<tr>
<td>3.1</td>
<td>Trade-weighted macroeconomic data of advanced East Asian and developing Southeast Asian economies</td>
<td>69</td>
</tr>
<tr>
<td>3.2</td>
<td>Cross correlations</td>
<td>80</td>
</tr>
<tr>
<td>3.3</td>
<td>Autocorrelations for developing Southeast Asia</td>
<td>81</td>
</tr>
<tr>
<td>3.4</td>
<td>Effects of EA5 total factor productivity shock</td>
<td>87</td>
</tr>
<tr>
<td>3.5</td>
<td>Effects of EA5 investment-specific technology shock</td>
<td>88</td>
</tr>
<tr>
<td>3.6</td>
<td>Effects of EA5 monetary policy shock</td>
<td>89</td>
</tr>
<tr>
<td>4.1</td>
<td>Rising trade of Asia with China alongside falling trade with the United States</td>
<td>94</td>
</tr>
<tr>
<td>4.2</td>
<td>Forecast error variance decomposition, GDP: (a) China; (b) East Asia</td>
<td>132</td>
</tr>
<tr>
<td>4.3</td>
<td>Forecast error variance decomposition, PPI inflation: (a) China; (b) East Asia</td>
<td>133</td>
</tr>
<tr>
<td>4.4</td>
<td>Forecast error variance decomposition, CPI inflation: (a) China; (b) East Asia</td>
<td>134</td>
</tr>
<tr>
<td>4.5</td>
<td>Forecast error variance decomposition, interest rate: (a) China; (b) East Asia</td>
<td>135</td>
</tr>
<tr>
<td>4.6</td>
<td>Forecast error variance decomposition, GDP: (a) China; (b) Southeast Asia</td>
<td>136</td>
</tr>
<tr>
<td>4.7</td>
<td>Forecast error variance decomposition, PPI inflation: (a) China; (b) Southeast Asia</td>
<td>137</td>
</tr>
<tr>
<td>4.8</td>
<td>Forecast error variance decomposition, CPI inflation: (a) China; (b) Southeast Asia</td>
<td>138</td>
</tr>
<tr>
<td>4.9</td>
<td>Forecast error variance decomposition, interest rate: (a) China; (b) Southeast Asia</td>
<td>139</td>
</tr>
<tr>
<td>4.10</td>
<td>Dynamic responses of East and Southeast Asia to Chinese TFP shock</td>
<td>145</td>
</tr>
<tr>
<td>4.11</td>
<td>Dynamic responses of East and Southeast Asia to Chinese TFP shock</td>
<td></td>
</tr>
<tr>
<td>Section</td>
<td>Title</td>
<td>Page</td>
</tr>
<tr>
<td>---------</td>
<td>----------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>5.1</td>
<td>Welfare cost of noncoordination under vertical-processing trade structure</td>
<td>179</td>
</tr>
<tr>
<td>5.2</td>
<td>Welfare cost of noncoordination under vertical-vertical trade structure</td>
<td>180</td>
</tr>
<tr>
<td>5.3</td>
<td>Welfare cost of noncoordination under processing-processing trade structure</td>
<td>181</td>
</tr>
<tr>
<td>5.4</td>
<td>Welfare cost of noncoordination and home bias</td>
<td>186</td>
</tr>
<tr>
<td>5.5</td>
<td>Welfare cost of noncoordination and correlation of productivity</td>
<td>187</td>
</tr>
</tbody>
</table>
LIST OF ABBREVIATIONS

Introduction

This notation guide and symbol glossary provides a brief summary of the chapters’ basic notation conventions. Symbol usage is generally covered by the self-contained discussion within each chapter. For the sake of convenience, a listing of symbol conventions is included here.

Label conventions

(i) Parameters

\( \mu \) : Share of consumption in non-separable utility  
\( \alpha \) : Constant relative risk aversion  
\( \kappa_M \) : Reciprocal of interest elasticity of money demand  
\( \alpha_k \) : Share of capital in Cobb-Douglass production function  
\( \delta \) : Depreciation rate  
\( \omega \) : Share of imported intermediate inputs in production (two-production stage model)  
\( \theta \) : Intratemporal elasticity of substitution between home and imported intermediate inputs  
\( \varphi \) : Intratemporal elasticity of substitution between home and imported final goods  
\( \varepsilon \) : Elasticity of substitution between varieties  
\( \gamma \) : Home bias  
\( \lambda \) : Indicator for habit formation  
\( \kappa_2 \) : Share of imported intermediates in midstream production  
\( \kappa_3 \) : Share of imported intermediates in downstream production  
\( \theta_p \) : Probability that firm \( j \) is not able to re-optimize price  
\( \theta_w \) : Probability that worker \( t \) is not able to re-optimize nominal wage  
\( \psi \) : The degree of exchange rate pass-through into imported consumer price  
\( \rho_a \) : Persistence in AR(1) total factor productivity shock  
\( \rho_1 \) : Persistence in AR(1) investment-specific technology shock  
\( \rho_R \) : Persistence in interest rate  
\( V_\pi \) : Central bank’s responsiveness toward variability in CPI inflation  
\( V_Y \) : Central bank’s responsiveness toward aggregate demand variability  
\( V_{\Delta E} \) : Central bank’s responsiveness toward rate of change in nominal exchange rates between home currency and U.S. dollar

(ii) Variables
(iii) Abbreviations

ASEAN : Association of Southeast Asian Nations
CEE : Central and East Europe
CPI : Consumer Price Index
C.I.F : Cost, insurance and freight
DP : U.S dollar pricing
DSGE : Dynamic stochastic general equilibrium
EA : East Asia
EIU : Economist Intelligence Unit
F.O.B : Free on board
GDP : Gross Domestic Product
IDE-JETRO : Institute of Developing Economies-Japan External Trade Organization
IRBC : International Real Business Cycle
IST : Investment-specific Technology
LCP : Local currency pricing
MCMC : Markov Chan Monte Carlo
NAWM : New Area-Wide Model
NKVPT : New Keynesian model with vertical and processing trade
NOEM : New open economy macroeconomics
PCP : Producer currency pricing
PPI : Producer Price Index
SEA : South East Asia
TFP : Total Factor productivity
TOT : Terms of Trade
UIPC : uncovered interest parity condition
VP : Vertical Processing
VS : Vertical Specialization
WTO : World Trade Organization
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>ABSTRACT</th>
<th>i</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSTRAK</td>
<td>iv</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>viii</td>
</tr>
<tr>
<td>APPROVAL</td>
<td>x</td>
</tr>
<tr>
<td>DECLARATION</td>
<td>xi</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>xii</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>xiii</td>
</tr>
<tr>
<td>LIST OF ABBREVIATIONS</td>
<td>xv</td>
</tr>
</tbody>
</table>

# CHAPTER

1 **INTRODUCTION**

1.1 Motivation of study 1
1.2 Problem statements 5
1.3 Objectives of study 7
  1.3.1 General objective of the study 7
  1.3.2 Specific objectives of the study 8
1.4 Overview of the study 9
1.5 Significance of the study 11

2 **THE MACROECONOMICS IMPLICATIONS OF VERTICALLY PRODUCTION AND TRADE: WHAT’S OLD AND WHAT’S NEW?**

2.1 International business cycle comovement 13
  2.1.1 What’s old in modeling strategy? 15
  2.1.2 What’s new? 17
2.2 The China’s syndrome 19
  2.2.1 What’s old in the empirical literature? 20
  2.2.2 What’s new? 21
2.3 Gain from international monetary policy coordination 22
  2.3.1 What’s old? 23
  2.3.2 What’s new? 29

3 **INTERNATIONAL BUSINESS CYCLE COMOVEMENT AND VERTICAL SPECIALIZATION RECONSIDERED IN A MULTISTAGE BAYESIAN-DSGE MODEL**

3.1 Introduction 31
3.2 A Brief tour on two-country IRBC and VS model 35
  3.2.1 International Real Business Cycle (IRBC) Model 35
  3.2.2 A simple form of vertical-specialization (VS) model 37
3.3 Bayesian estimation 42
3.4 Estimating two-country IRBC and VS model 45
  3.4.1 Data and priors for IRBC model 45
  3.4.2 Quantitative performance of IRBC model 46
3.4.3 Data and priors for VS model 51
3.4.4 Quantitative performance of VS model 54
3.5 A two-country, three-processing stage New Keynesian Model 56
3.5.1 Upstream firms 57
3.5.2 Midstream firms 58
3.5.3 Downstream firms 60
3.5.4 Optimal pricing decision with U.S dollar pricing in export 61
3.5.5 Household 63
3.5.6 Trade balance, value added and monetary policy 65
3.5.7 Modeling trade cost 66
3.6 Evaluating New Keynesian Model with vertical and processing trade 66
3.6.1 Data, prior and posterior distribution for NKVPT model 67
3.6.2 Quantitative performance of NKVPT model 77
3.6.3 What can we learn from sensitivity analysis? 82
3.6.4 Inspecting the mechanism 84
3.7 Concluding Remark 90

4 RISING CHINA, ANXIOUS ASIA? AN ASSESSMENT IN BAYESIAN-DSGE MODEL WITH VERTICAL AND PROCESSING TRADE
4.1 Introduction 92
4.2 A macroeconomic model of vertical and processing Trade 97
4.2.1 Firm’s cost minimization problem 98
4.2.2 First order and market clearing conditions 101
4.2.3 Optimal symmetric pricing decision with U.S. dollar denominated trade 103
4.2.4 Household 106
4.3 Parameter Estimates 109
4.3.1 Data and calibration 110
4.3.2 Prior and posterior distribution 113
4.3.3 What can we learn from subsample estimates? 121
4.4 Evaluating macroeconomic interdependence between China and Asia 129
4.4.1 Source of shocks 129
4.4.2 A Reassessment when vertical trade arises 140
4.4.3 Shocks propagation 143
4.5 Concluding remarks 147

5 OPTIMAL MONETARY POLICY COORDINATION FOR OPEN ECONOMIES WITH PRODUCTION FRAGMENTATION AND TRADE
5.1 Introduction 149
5.2 The linearized model of production fragmentation and trade 153
5.2.1 Value added 154
5.2.2 Chains of production 155
5.2.3 Time-dependent U.S dollar pricing 157
5.3 Bayesian estimation and some stylized facts 159
5.4 Characterizing the welfare criterion 164
5.5 Optimal Nash and coordinated monetary policy 171
5.6 Is monetary policy coordination always (sub)optimal? 176
  5.6.1 The role of intertemporal and intratemporal elasticity of substitution 177
  5.6.2 Disinflationary versus inflationary bias: recipe for currency misalignment 182
  5.6.3 The role of home bias in consumption 185
  5.6.4 Do the symmetries of shock matter? Yes and no 186
5.7 Conclusion 188

6 CONCLUSION
  6.1 What we already did? 190
  6.2 What we need to do? 193

REFERENCES 195
APPENDIX 3.1 202
APPENDIX 4.1 220
APPENDIX 4.2 222
APPENDIX 4.3 224
APPENDIX 5.1 238
BIODATA OF STUDENT 246
LIST OF PUBLICATIONS 248