

## **Lincoln University Digital Thesis**

### **Copyright Statement**

The digital copy of this thesis is protected by the Copyright Act 1994 (New Zealand).

This thesis may be consulted by you, provided you comply with the provisions of the Act and the following conditions of use:

- you will use the copy only for the purposes of research or private study
- you will recognise the author's right to be identified as the author of the thesis and due acknowledgement will be made to the author where appropriate
- you will obtain the author's permission before publishing any material from the thesis.

# **Services and Economic Growth in China**

---

A thesis  
submitted in partial fulfilment  
of the requirements for the Degree of  
Master of Commerce and Management

at  
Lincoln University  
by  
Xuedong Li

---

Lincoln University  
2014

Abstract of a thesis submitted in partial fulfilment of the  
requirements for the Degree of Master of Commerce and Management.

## Services and Economic Growth in China

by

Xuedong Li

The service sector is playing an ever-increasing role in China's economy (Li, 2012). Nevertheless, the service sector's share in gross domestic product (GDP) is still lagging behind the manufacturing sector. The purpose of this study is to investigate the contribution that an expansion in the service sector may make to per capita economic growth in China. In addition, the study examines the spillover effects of growth in the service sector on growth in the manufacturing sector and vice versa. The model specification is based on previous studies of per capita economic growth (Fischer, 1993; Gani & Clemes, 2010). The framework consists of a single structural growth equation and a structural equation to measure the spillover effects of growth in the service sector, on manufacturing. Multiple regression analysis is used to analyse panel data from 1994 to 2011. Finally, the study presents its findings and policy implications.

**Keywords:** The Service Sector, Economic Growth, Spillover Effects, China

## **Acknowledgements**

I would like to express my great appreciation to those who have helped me with my thesis. My deepest thanks go first and foremost to my main supervisor Mr. Michael D. Clemes, for his flexibility, invaluable guidance, insightful discussion and priceless suggestions throughout the research. I would also like to thank my associate supervisor, Dr Baiding Hu, for his patience and kindness and for his perspective on this research at important times. I am sincerely grateful of both for my supervisors showing their faith in my ability, and their exceptional support and encouragement throughout my studies.

Thanks also to my beloved parents for their endless love, support and encouragement. I certainly would never have made it to this point without the understanding and support of my mother and father. I would also like to thank all my relatives for their faith in my work.

Thanks also go to my postgraduate fellows and staff in the Commerce Faculty and my colleagues in the Printery Building who have given me help and support with my thesis throughout this long time, especially to Miss Nhung Nguyen. Thank you for your company throughout these months and for making the process as painless as possible.

Finally, I would also like to extend a big thank you to all the individuals and fellows in the Commerce Faculty, who have supported and encouraged me to complete my study.

# Table of Contents

<b>Abstract .....</b>	<b>i</b>
<b>Acknowledgements .....</b>	<b>ii</b>
<b>Table of Contents .....</b>	<b>iii</b>
<b>List of Tables .....</b>	<b>v</b>
<b>List of Figures .....</b>	<b>vi</b>
 <b>Chapter 1 Introduction .....</b>	 <b>1</b>
1.1 Research Problem Statement .....	1
1.1.1 The Service Sector in the World.....	2
1.1.2 The Service Sector in China .....	4
1.2 Research Gaps.....	6
1.3 Research Objectives.....	6
1.4 Research Contributions.....	7
1.5 Thesis Overview .....	7
 <b>Chapter 2 Literature Review.....</b>	 <b>8</b>
2.1 General Summary on the Service Sector .....	8
2.2 Main Factors in the Service Sector Expansion .....	11
2.2.1 Factors in Previous Studies .....	11
2.2.2 Main Factors and the Service Sector in China.....	13
2.3 The Contribution of the Service Sector to Per Capita GDP Growth.....	15
2.3.1 The Contribution of the Service Sector in the World.....	15
2.3.2 The Influential Factors in the Growth of Per Capita GDP .....	17
2.3.3 The Contribution of the Service Sector in China .....	18
2.4 The Spillover Effects between the Service Sector and the Manufacturing Sector .....	22
2.5 Research Methodology Discussion .....	24
2.5.1 Adjustments to Equation (1) .....	24
2.5.2 Adjustments to Equation (2) .....	25
2.5.3 Adjustments to Equation (3) .....	25
 <b>Chapter 3 Research Methodology .....</b>	 <b>27</b>
3.1 Hypotheses and Model .....	27
3.1.1 Hypotheses Development.....	27
3.1.2 Model Development .....	28
3.2 The Variables Used in This Study .....	30
3.3 Data and Econometric Modelling .....	33
3.3.1 Splicing Procedure.....	34
3.3.2 Cointegration .....	34
3.3.3 Multiple Regression Analysis .....	35
3.3.4 Coefficient of Determination .....	35
3.3.5 Test of Significance of the Regression Model .....	36
3.3.6 Simultaneous Equation Models .....	36
3.3.7 Two-Stage Least Squares Equation .....	37
3.3.8 Assumptions for Regression Analysis.....	38

<b>Chapter 4 Results and Discussion .....</b>	<b>42</b>
4.1 Assumptions for Regression Analysis.....	42
4.1.1 Outliers.....	42
4.1.2 Multiconllinearity.....	42
4.1.3 Linearity.....	43
4.1.4 Error Term Normality .....	43
4.1.5 Error Term Independence .....	43
4.1.6 Error Term Homoscedasticity .....	44
4.2 Results Pertaining to the Research Objectives .....	44
4.2.1 Results Pertaining to Hypothesis 1 .....	44
4.2.2 Results Pertaining to Hypothesis 2 .....	45
4.2.3 Results Pertaining to Hypothesis 3 .....	46
<b>Chapter 5 Conclusions and Implications .....</b>	<b>47</b>
5.1 Summary of This Study .....	47
5.2 Conclusions Regarding Research Objective 1 .....	48
5.2.1 Value-added in the Manufacturing Sector.....	48
5.2.2 Growth of Imports and Exports .....	50
5.2.3 Government Spending .....	51
5.3 Conclusions Regarding Research Objective 2 .....	51
5.3.1 Employment.....	51
5.3.2 Gross Domestic Investment .....	51
5.3.3 Primary School Enrolment .....	52
5.3.4 Trade .....	52
5.3.5 Inflation Rate.....	52
5.3.6 Government Spending .....	53
5.4 Conclusions Regarding Research Objective 3 .....	53
5.5 Contributions .....	54
5.5.1 Theoretical Implications.....	54
5.5.2 Politcal Implications .....	54
5.6 Limitations .....	55
5.7 Avenues for Future Research.....	55
<b>References .....</b>	<b>57</b>
<b>Appendices .....</b>	<b>63</b>
Appendix 1: Data Series .....	63
Appendix 2: Outliers.....	64
Appendix 3: Correlation Matrix.....	66
Appendix 4: Linearity .....	67
Appendix 5: Normality .....	69
Appendix 6: Independence .....	71
Appendix 7: Homoscedasticity .....	72
Appendix 8: Regression Results .....	74

## List of Tables

Table 2-1	Comparison on the Share of Service Sector to GDP (%) in the World and in China.....	19
Table 2-2	Annual Growth Rate of the Service Sector in China (%) .....	19
Table 2-3	Number of Employed People in the Three Sectors in China from 1981-2010 .....	21
Table 3-1	Critical Values for the Cointegration Test.....	35
Table 4-1	The Durbin-Watson Test Statistics .....	44
Table 4-2	Model 1: Multiple Regression Results Relating to Hypothesis 1 .....	44
Table 4-3	Model 2: Multiple Regression Results Relating to Hypothesis 2 .....	45
Table 4-4	Model 3: Simultaneous Equations Results Relating to Hypothesis 3 .....	46
Table 5-1	Comparison of Value-added in the Manufacturing Sector to GDP (%) in China and Selected Countries .....	49
Table 5-2	Value-added in the Service Sector; A Percentage GDP Comparison between China and the United States .....	50
Table 5-3	Exports of Goods and Exports of Services (Billion \$US).....	50

## List of Figures

Figure 1-1	GDP Growth in the United States and China between 2000 and 2011.....	1
Figure 1-2	The Value-added of the Three Sectors to the Global GDP .....	3
Figure 1-3	The Services Value-added in the World and China .....	4
Figure 1-4	China's Service Value-added Growth Rate between 2000 and 2012.....	5
Figure 2-1	The Service Sector as the "tertiary stage" .....	8
Figure 2-2	The Service Sector Accounts for Most of the Variation in Employment Rates Across OECD Countries in 2011, (as a percentage).....	11
Figure 2-3	The Comparison of GDP Growth in 2011 (Billions US\$) .....	13
Figure 2-4	The Structural Transformation of China's Exports in 2009 .....	14
Figure 2-5	The Share of Service Sector to GDP in China, Fiji, Papua New Guiana, Tonga and Vanuatu .....	15
Figure 2-6	Proportion of the Service Sector to GDP in Selected Asian Countries and Regions.....	16
Figure 2-7	Labour Force Annual Percentage Change in Growth in China .....	25
Figure 5-1	The Annual Changes in the Inflation Rate and GDP Growth Rate from 1995 to 2012.....	53

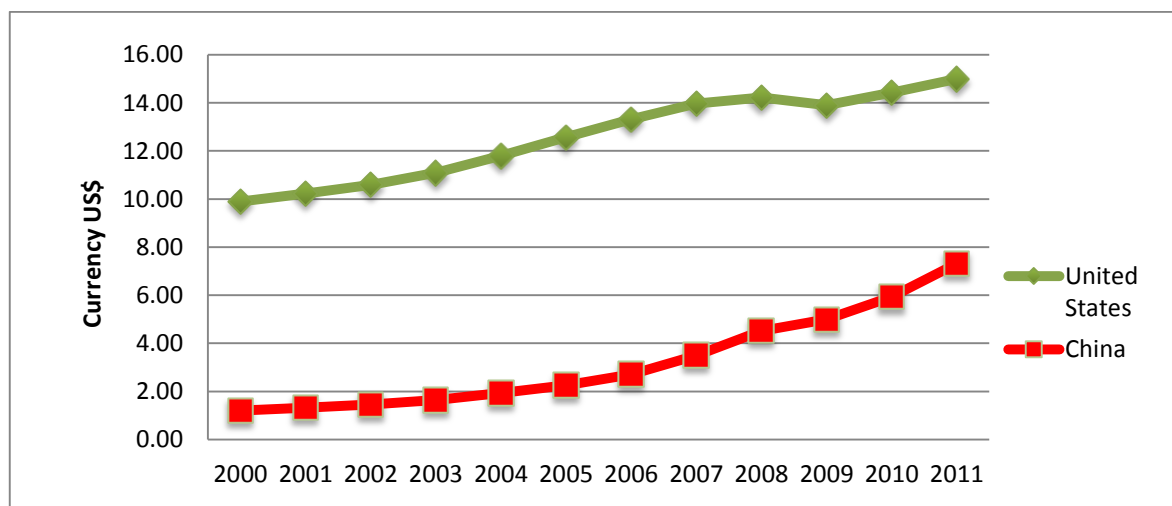


# Chapter 1

## Introduction

### 1.1 Research Problem Statement

China's economy has performed impressively since the Chinese government implemented the "reform and opening-up" policy in 1978 (Wong, 2013). A recent World Bank Report (2013) notes that the average annual growth rate of China's gross domestic product (GDP) has been approximately 10% over the last three decades. In 2011, China's total GDP reached US\$7.4 trillion (World Bank, 2013). China's GDP was approximately a 50% of the US level during the same period. However, China is now the world's second largest economy (Wong, 2013) (See Figure 1-1). China has a strong involvement in the global markets, through its exports and imports with other nations (Arora & Vamvakidis, 2011). The sustained growth in China also drives the economic development in its neighbouring countries (Rajah, Zhang, & Kong, 2012) .



**Figure 1-1 GDP Growth in the United States and China between 2000 and 2011**

The manufacturing sector plays a dominant role in China's productivity growth (Hussin & Yik, 2012) . After the "reform policy", China's government concentrated more on the manufacturing sector than the agricultural and service sectors (Hussin & Yik, 2012). The number of people employed in China's manufacturing sector is extremely large when compared to other countries (Banister, 2005). The manufacturing sector in China has attracted both domestic and international investors as it offers several comparative advantages, such as lower labour costs (Lu & Gao, 2011). The manufacturing sector has played an important part in China's exports and its exports account for a large share of total global exports (Rajah et al., 2012). Therefore, China is considered as a manufacturing powerhouse (Banister, 2005). In addition, the agricultural sector has been supported by a series of

government policies, although the agricultural sector has had weak growth in recent years (Waldron, Brown, & Longworth, 2006).

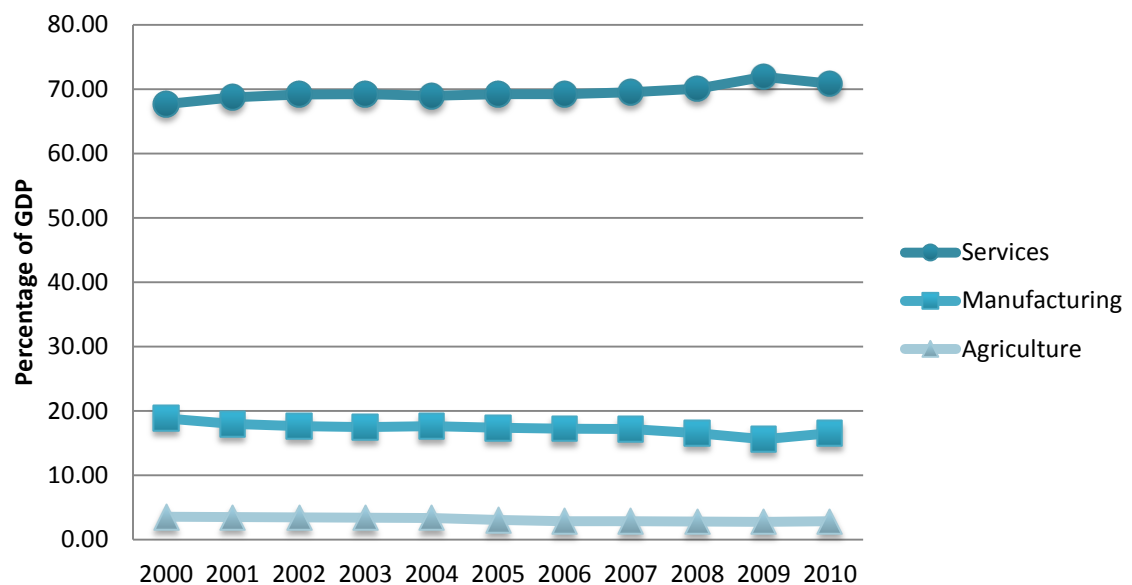
However, the service sector is underdeveloped in China (Zheng, Zhang, & Wang, 2011). The latest Asian Development Bank report (2013b) showed that the value-added in the service sector to GDP was only 44.6% in 2012, which is much lower than the world average level of 71% (ADB, 2013b). Additionally, as a traditional agricultural country, services are overlooked and underestimated in China (Yang, 2003). China's annual growth rate of the service sector was only 8.1 % in 2012 (ADB, 2013b).

Academically, research on the contribution of the service sector to per capita growth is scarce internationally; in particular, when it is compared to published research on the roles of the manufacturing and agricultural sectors and their effects on the economy (Gani & Clemes, 2010; Nissana, Galindob, & Méndezc, 2011). In China's case, published research on the service sector has concentrated more on particular service industries. For example, the contribution of the financial industry has been widely investigated, both domestically and with regard to international investments in China (Abdul & Najia, 2010; Presber, 2011; Worthington, 2005).

The following sections begin with a brief review of the global service sector, and a discussion of China's service sector. The research gaps and the purpose of the study are then stated. Finally, the contribution that this study will make to the economic literature is discussed.

### **1.1.1 The Service Sector in the World**

In the last decade, the service sector has been booming in the international economy (Nissana et al., 2011). World Bank data (2012) shows that global average service value-added into GDP reached 71% in 2011, which was much higher than the manufacturing sector and the agricultural sector, value-added individually in the same period (See Figure 1-2). In particular, developed countries contribute more service value-added to world GDP. A highly developed service sector has become an important symbol of a mature economy in many countries (Strom, 2005).



**Figure 1-2 The Value-added of the Three Sectors to the Global GDP**

The service sector has been a crucial contributor to accelerating economic growth and creating employment opportunities in both developed and developing countries (Mizuno, 2005). The contribution of the service sector to GDP is greater than the manufacturing sector in developed countries (Wirtz, 2000). For example, as the world's most powerful economy, value-added in the service sector in the USA accounts for 79% of GDP, which is much higher than the manufacturing sector's 20% value-added to GDP in 2011 (World Bank, 2013). Nissana et al (2011) note that sustained and diversified service industries are increasing their influence on economic activities. Fernandes (2009) reports that two thirds of economic activity in the Organization for Economic Co-operation and Development (OECD) countries is from the service sector .

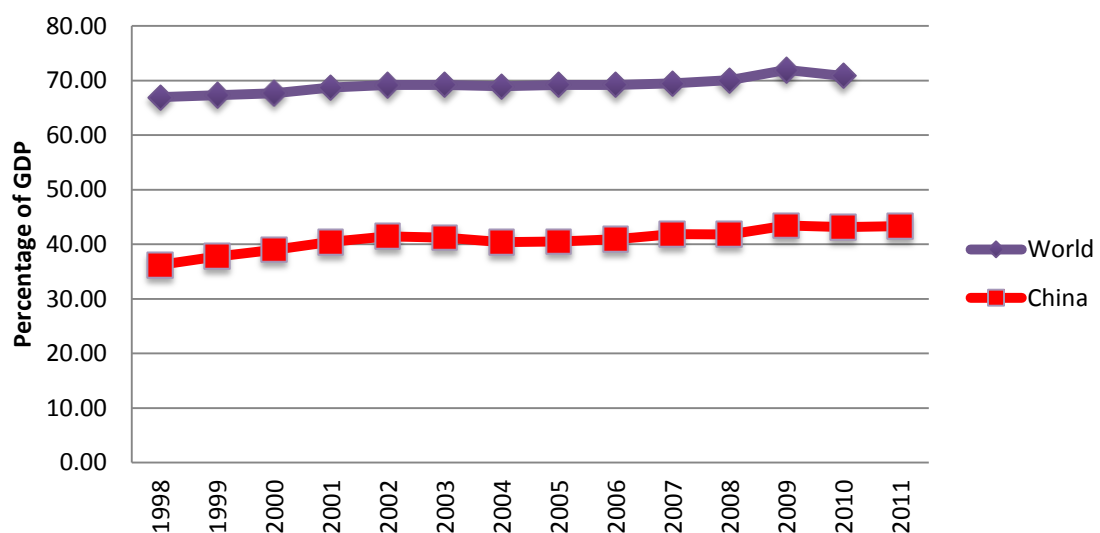
Additionally, the service sector is recognized as having as high capacity for employment (Wirtz, 2000). An OECD report (2005) shows that over 70% of job opportunities were created by the service sector in OECD economies. Developing countries such as India, also present a changed employment structure; that is, moving resources from the manufacturing and agricultural sectors to the service sector (Nayyar, 2012).

The dramatic development in the service sector primarily results in demand-side effects and technological progress (Mizuno, 2005). With the increase in income levels and living standards, customer demand for greater quality and quantity of services has become more specific (Mizuno, 2005). This has been leading numerous service sector related companies into the service market (Chadee, 2002). Technology is also regarded as the most influential factor in service innovation (Nissana et al., 2011; Pugno, 2006). Navarro and Camacho (2001) stated that technology progress supports the refining and distribution of information, which sits perfectly with innovation in the

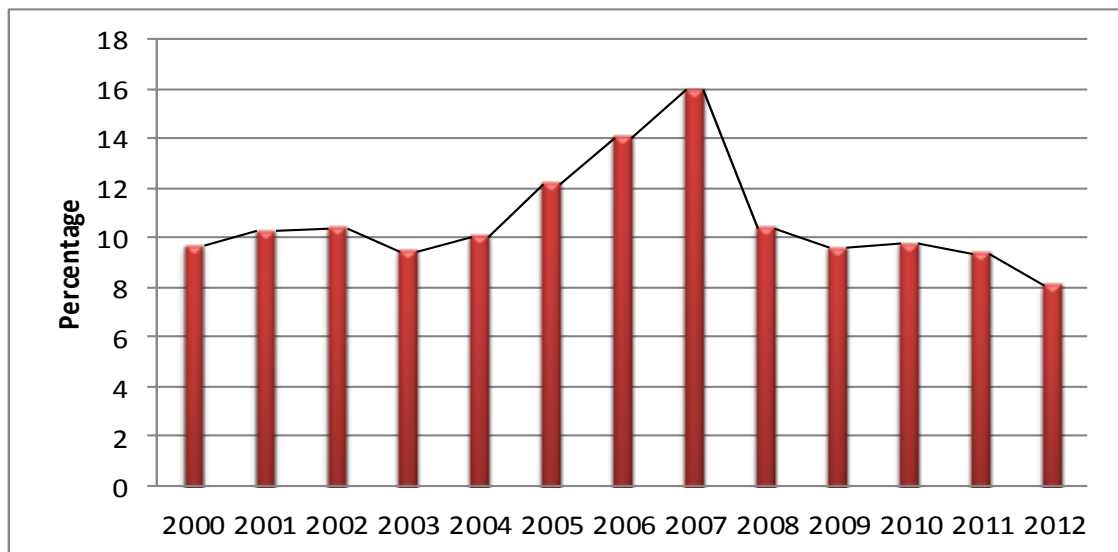
service sector. The progress in technology has acted like a catalyst in helping to promote growth in the service sector (Nissana et al., 2011).

### 1.1.2 The Service Sector in China

Growth in China's service sector is lagging behind the world average level, behind the most advanced countries, and even behind some developing countries (Chan & Zhao, 2012). In the last decade, the share of services to China's GDP edged up from 39.02% in 2000 to 43.37% in 2011, but was still relatively low compared to most developed countries (ADB, 2013b). Based on World Bank (2013) data, the value-added of the service sector to China's GDP is much lower than the world average level of 70% (See Figure 1-3). It is even lower than some developing countries: for example, India and Bangladesh achieved figures of 56.9% and 53.8 % respectively in the same period (ADB, 2013b). The annual growth rate of China's service sector has been progressing moderately. There was a decrease from 16% in 2007 to 10.4% in 2008 (See Figure 1-4), and the decrease has been continuing in the last five years (ADB, 2013b).



**Figure 1-3 The Services Value-added in the World and China**



**Figure 1-4 China's Service Value-added Growth Rate between 2000 and 2012**

Even though China's service sector starts from a low base, it is still considered to be a potential key resource for China's sustainable growth (Sun & Lawrence, 2010). Hussin and Yik (2012) examined the contribution of the three economic sectors in China and proved that the service sector has been an important contributor to China's economic growth. Global Finance (2012) notes that China has five organizations among the Global Top 500 companies, and four of them are in the service sector: Industrial & Commercial Bank of China, China Construction Bank, Agricultural Bank of China and Bank of China. Additionally, the employment trend in China has shifted from the agricultural and manufacturing sectors to the service sector (Li & Haynes, 2011). This new trend is leading a new economic structural transformation in China (Qin, 2006). However, the service sector is still regarded as a relatively young sector and it still requires government support (Li, 2012). Li (2012) also suggests that China's policy makers should treat the service sector equally to the manufacturing sector; strengthen its core competitiveness and protect the domestic service sector in global markets.

China's accession to the World Trade Organization (WTO), as an external influence, has had a profound impact on China's service sector. China's service sector has become more liberalized and globalized and therefore it is more open to international investors (Kanungo, 2005). Eliminating possible trade barriers encourages service sector to grow rapidly (El Khoury & Savvides, 2006). There has been a remarkable change in China's investment strategy. For example, the amount of foreign direct investment (FDI) in China's service sector exceeded the FDI in manufacturing in 2011, for the first time since China's economic reforms (United Nations Conference on Trade and Development, 2012). Nevertheless, the Chinese government still maintains strict control over the essential service

industries to prevent them from falling under the control of foreign companies (Hapsari & MacLaren, 2012).

The service sector is expected to continue to contribute more to the growth of China's GDP, and also to provide more basic services for the further development of the manufacturing sector (Gebauer & Fischer, 2009). However, rising costs and the appreciating exchange rate are having a negative influence on manufacturing companies and on future investment plans (Fang, Gunterberg, & Larsson, 2010; Fu & Lin, 2012). The authors also indicate that the rising costs and the appreciating exchange have affected not only the manufacturing sector, but also China's sustainable economic growth. Therefore, the service sector must be energetically improved, its productivity must be enhanced, it must deliver a positive influence on the manufacturing sector and it must assist in the acceleration of China's economic growth (Gebauer & Fischer, 2009).

## **1.2 Research Gaps**

The lack of published research on the contribution of the service sector to China's per capita GDP is the first research gap. Additionally, there has not been a comprehensive model produced to estimate the relationship that exists between the service sector and economic growth in China. Moreover, the majority of the empirical studies that have been conducted on China have focused on specific service industries such as: financial services (Presber, 2011), travel services (Qiu Zhang & Morrison, 2007), and health care services (Guo, Sun, Wang, Peng, & Yan, 2013).

The lack of published research that identifies the main variables that have a positive influence on the expansion of the service sector is the second research gap. It is important to identify the main variables in order to help guide the development of the service sector (Gani & Clemes, 2010).

The lack of published research investigating the spillover effects of growth in the service sector on growth in the manufacturing sector and vice versa, is the third research gap. It is important to investigate the relationship between the manufacturing sector as the largest current contributing sector to China's GDP and China's rising service sector in order to determine how they support and influence each other.

## **1.3 Research Objectives**

The purpose of this research is to assess how the expansion in the service sector can be a decisive factor affecting per capita economic growth in China. The study also examines the potential relationships among the service sector growth, the service sector value-added, GDP, the manufacturing sector growth, the manufacturing sector value-added, exports, imports, government expenditure, employment rate, gross domestic investment, primary school enrolment rate, per

capita GDP growth, inflation rate, and the trade share in GDP. In particular, the research adopts the method of two stage least squares to simultaneously estimate the spillover effects between the service sector and the manufacturing sector.

## **1.4 Research Contributions**

Satisfying the three research objectives will contribute to the economic literature theoretically and politically.

From the theoretical perspective, this study will contribute to the economic and marketing literature by providing an analysis of the variables that assess the relationship between the service sector and per capita economic growth in China and the spillover effects of the service sector to the manufacturing sector and vice versa. This is an important contribution as it helps to improve the understanding of the relationship at a macroeconomic level. This study is also the first research that focuses on the contribution of the service sector to economic growth in China. Moreover, only a few researchers have provided similar studies on other countries: Singapore, the Pacific Island Countries, the Association of Southeast Asian Nations (ASEAN) (not including China) and India (Anwar & Sam, 2008; Gani & Cledes, 2002, 2010; Singh, 2010)

From the political perspective, policymakers and service related organizations in China will benefit. The findings will improve the understanding of the Chinese government and public and private organizations on the importance of the service sector to China's economic growth. It may also assist service organizations to gain greater policy support in order to strengthen competitiveness in the global market.

## **1.5 Thesis Overview**

The study consists of five chapters. Chapter 2 reviews the service sector and economic growth literature, the empirical studies on the expansion of the service sector, and the literature on the spillover effects of the service sector. Chapter 3 presents the conceptual model, develops three testable hypotheses and details the methodology applied to test the formulated hypotheses. Chapter 4 presents the results of this study. Chapter 5 provides conclusions and implications.

## Chapter 2

### Literature Review

The literature review will address the four areas related to the research objectives stated in Chapter 1. First, it discusses the performance of the service sector and reviews the main factors affecting the expansion of services. Second, it discusses the research on the contribution of the service sector to the growth of GDP in developed countries and developing countries, particularly in China. The third section focuses on studies that have investigated the spillover effects of the service sector into the manufacturing sector and vice versa. Finally, it discusses the methodologies related to measuring the three research objectives formulated in Chapter 1.

#### 2.1 General Summary on the Service Sector

In general, the service sector in many developing countries is considered as the residual tertiary sector after the manufacturing and agricultural sectors (Gani & Clemes, 2010). Park and Chan (1989) demonstrated that the service sector arouses the attention of academics and policymakers only when the basic needs and demands of the first two sectors are satisfied.

Economists note that the service sector has been difficult to define, due to service activities being diverse (Lovelock, Patterson, & Wirtz, 2011; Riddle, 1986). Jansson (2006) points out that based on the production and distribution process, the service sector can be defined as the tertiary stage in a description of an economy. Figure 2-1 shows the division of the economy into three stages (Jansson, 2006).

Mining, agriculture, forestry, fishing				Primary production stage
Manufacturing and building industry				Secondary production stage
Wholesaling and retailing hotels and restaurants	Transport and communication	Banking, insurance and other business services	Health, education, child and elder care and other personal services	Tertiary production stage

**Figure 2-1 The Service Sector as the “tertiary stage”**

In order to analyse and evaluate the service sector, economists have classified service activities into several categories (Park & Chan, 1989). The classification system identified by Gershuny and Miles (1983) has been used conceptually and empirically for analysing the links between manufacturing



and services (Park & Chan, 1989). Gershuny and Miles (1983) originally categorised service activities into two major groups: marketed services (A) and non-marketed services (B). Sub-categories are as follows:

A. Marketed services include:

(1) Producer services

- i. Finance, banking, credit, insurance, real estate.
- ii. Professional services: engineering, architectural, legal.
- iii. Other services: cleaning, maintenance, security.

(2) Distributive services

- i. Transport and storage.
- ii. Communications.
- iii. Wholesale and retail trade.

(3) Personal services

- i. Domestic services.
- ii. Hotels, restaurants and catering.
- iii. Repairs.
- iv. Entertainment and recreation.

B. Non-marketed services include:

(1) Social services

- i. Health, medicine, hospitals
- ii. Education
- iii. Welfare
- iv. Public administration, legal, military services.

Based on Gershuny and Miles's (1983) classification, the features of services have been identified as intangible, untouchable, non-stored, and require production and consumption to be achieved at the same time (Gershuny & Miles, 1983).

Further, Clemes, Mollenkopf and Burn (2000) note that marketing management activities in the service sector have historically been distinguished from those in the manufacturing sector using at least five generic differences: intangibility, inseparability, heterogeneity, perishability, and lack of ownership. Intangibility is the most distinguishing characteristic of services, and Zeithaml, Bitner and Gremler (2009) note that the performance or actions of services are not possible to be seen, tasted, smelt or touched. Inseparability indicates that most services are purchased and consumed

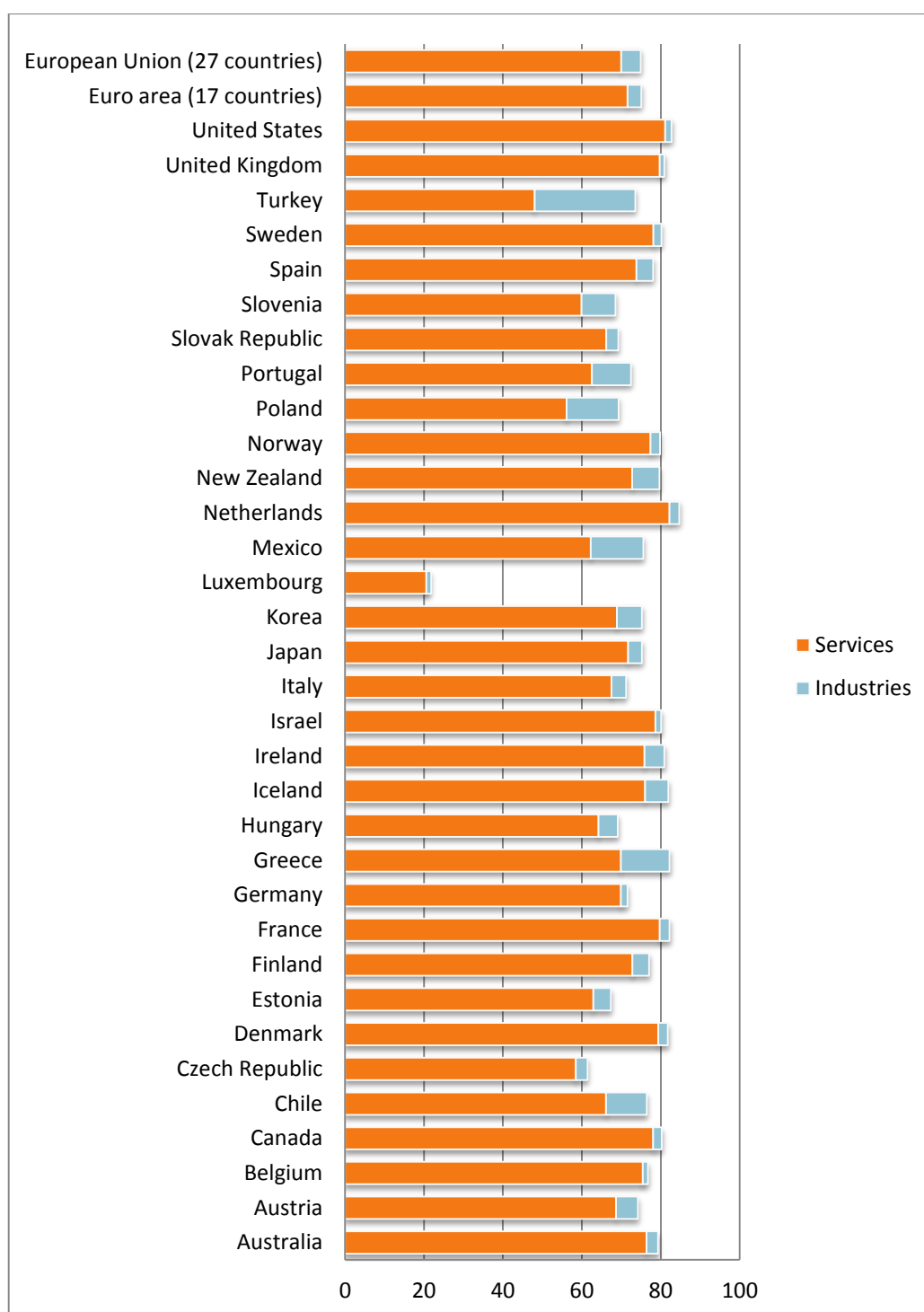
simultaneously (Clemes et al., 2000). Zeithaml, Bitner and Gremler (2009) note that services are heterogeneous due to the fact that the production processes of the two services will not be exactly the same. Perishability denotes that services cannot be re-sold after they are purchased and payment can often be only for access (Clemes et al., 2000).

In recent years, researchers have come to believe that the service sector plays an ever-growing role in the globalized economy (Buera & Kaboski, 2012). Mizuno (2005) indicates that income growth and technology innovation are two major factors explaining the development of the service sector. In terms of income growth, the increased consumer demand has expanded the diversity of services (Chadee, 2002). For example, consumer demand has produced more specific requirements for services (Mizuno, 2005). Moreover, in terms of the development of technology, service innovation is supported by the refining and distribution of information during the progress of technology (Nissana et al., 2011).

Previous studies have noted that the service sector generates more employment opportunities for the current generation (Buera & Kaboski, 2012; Wolfmayr, 2012). Employment has dramatically shifted from the manufacturing and agricultural sectors to the service sector in most developed countries in the last two decades (Li & Haynes, 2011). The service sector makes a large contribution to the employment figures in OECD countries in 2011 (OECD, 2013b) (See Figure 2-2).

McKee (2007) claims the role of services activities in the industrial process assists products moving to final consumers. However, due to the contribution of the service sector to the manufacturing sector being often invisible, it is therefore likely to be underestimated (McKee, 2007).

The following sections review the research related to the three research objectives in this study.



**Figure 2-2 The Service Sector Accounts for Most of the Variation in Employment Rates Across OECD Countries in 2011, (as a percentage)**

## 2.2 Main Factors in the Service Sector Expansion

### 2.2.1 Factors in Previous Studies

Wirtz (2000) proposes three main drivers in the expansion of the service sector in Asia. The three drivers are: first, an increasing specialisation of Asian economies; second, rapid deregulation of many markets; third, rapid advancement and leap frogging of many Asian economies in information

technology and telecommunications infrastructures (Wirtz, 2000). The three drivers promote the development of the service sector and increase the productivity of many service-based activities (Wirtz, 2000). However, Wirtz's study only uses the data to describe the changes in the service sector in the selected Asian countries. The author fails to examine the significances of the three drivers.

Gani and Clemes (2002) researched the service sector of the ASEAN economies. The authors included the following five factors: 1. the real output, 2. the manufacturing sector, 3. government spending, 4. exports, and 5. imports; as the five influential factors in the expansion of the service sector. The results show that real output, manufacturing, imports and government spending positively and strongly influence the expansion of the service sector.

Anwar and Sam (2008) used data from 1984 to 2004 to examine the influence of GDP on the real value-added in the service sector in Singapore. The empirical results show that the coefficient of GDP is as expected; it is positive on value-added in the service sector. Anwar and Sam (2008) also considered labour employment and human capacity as they affect the output of industry. These factors are also positive in the study.

Buera and Kaboski (2012) also measured the influence of per capita income of a country to the services share of value-added in the United States. The equation is formulated as follows:

$$\text{Services share of value-added}_{i,t} = \alpha_i + \beta \ln y_{i,t} + e_{i,t}$$

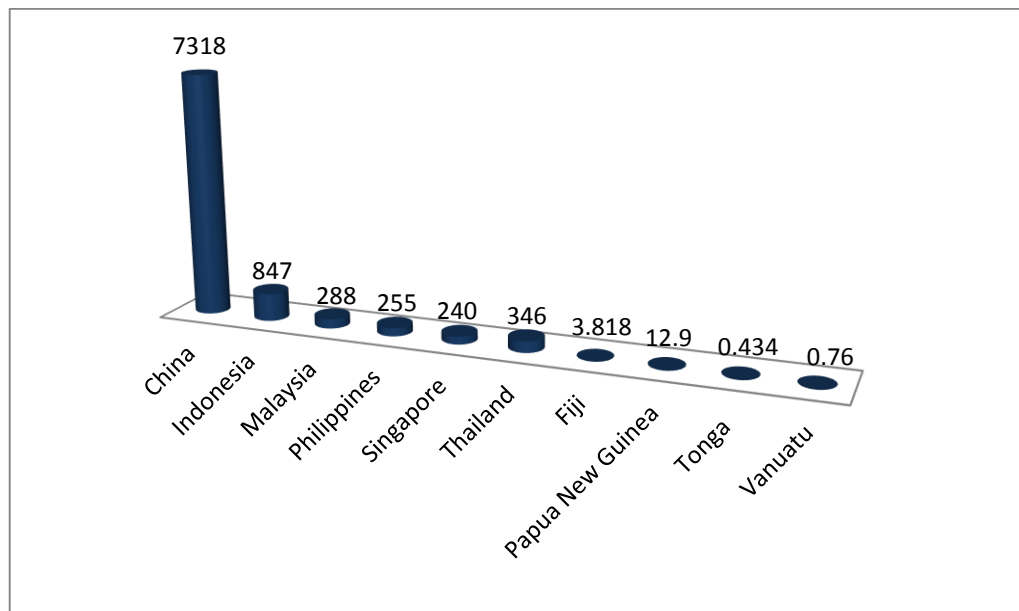
Where  $\ln y_{i,t}$  is log of per capita income of country  $i$  at time  $t$ , and  $\alpha_i$  is a country  $i$  fixed effect. The authors note that higher incomes accelerate the growth of services.

Gani and Clemes (2010) used the same five influential factors in their studies on Pacific Island countries and ASEAN countries. The authors examined the relationships between each factor and the service sector. The only difference discovered between the Pacific Island countries and ASEAN countries studies is that real output is positively and statistically significant in the service sector in both the Pacific Island countries and ASEAN countries (Gani & Clemes, 2010). Moreover, exports positively influence the service sector in the Pacific Island countries (Gani & Clemes, 2010). However, while the coefficients of manufacturing, imports and government spending are positive, they are statistically insignificant in the Pacific Island countries (Gani & Clemes, 2010).

Besides the five main factors used in Gani and Clemes' (2002, 2010) studies, technological innovation is also considered an important factor in the expansion of the service sector, and this is described in some studies (Nissana et al., 2011; Pugno, 2006). However, the quantities of the technological innovations are not easy to measure; therefore, the studies on the relationships between the technology and the service sector are mainly based on qualitative research.

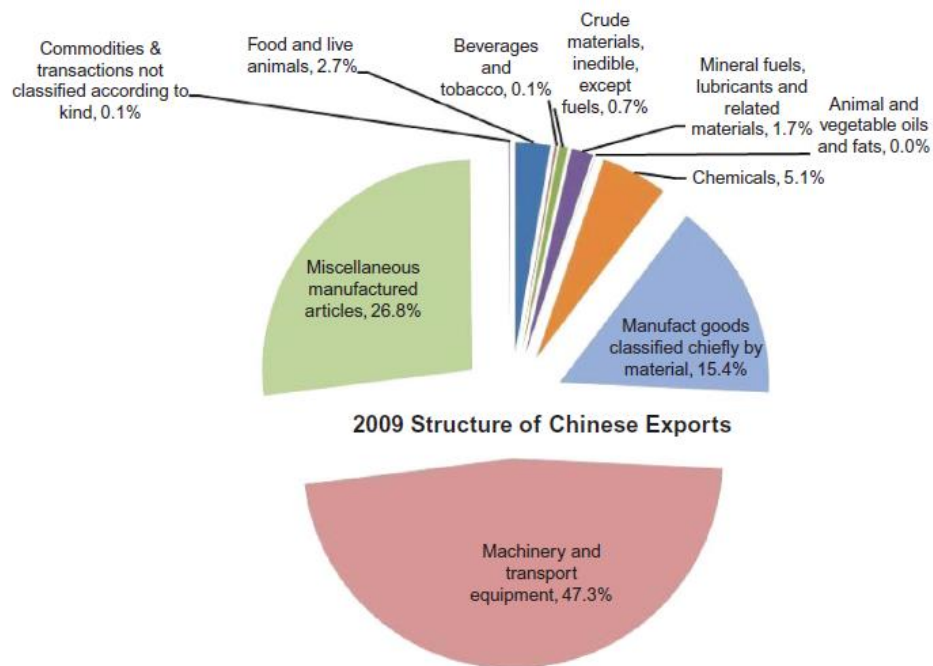
### 2.2.2 Main Factors and the Service Sector in China

China is considered as the largest developing country, and it plays an important role in the world economy (Wong, 2013). There are some obvious economic differences between China and other developing countries. First of all, the economies of the countries (Indonesia, Malaysia, Philippines, Singapore, Thailand, Fiji, Papua New Guinea, Tonga and Vanuatu) in Gani and Clemes' (2002, 2010) two studies are much smaller than China's economy. World Bank figures (2013) show that China's GDP reached \$7318 billion in 2011, which is approximately one thousand times larger than the other selected countries, as shown in Figure 2-3.



**Figure 2-3 The Comparison of GDP Growth in 2011 (Billions US\$)**

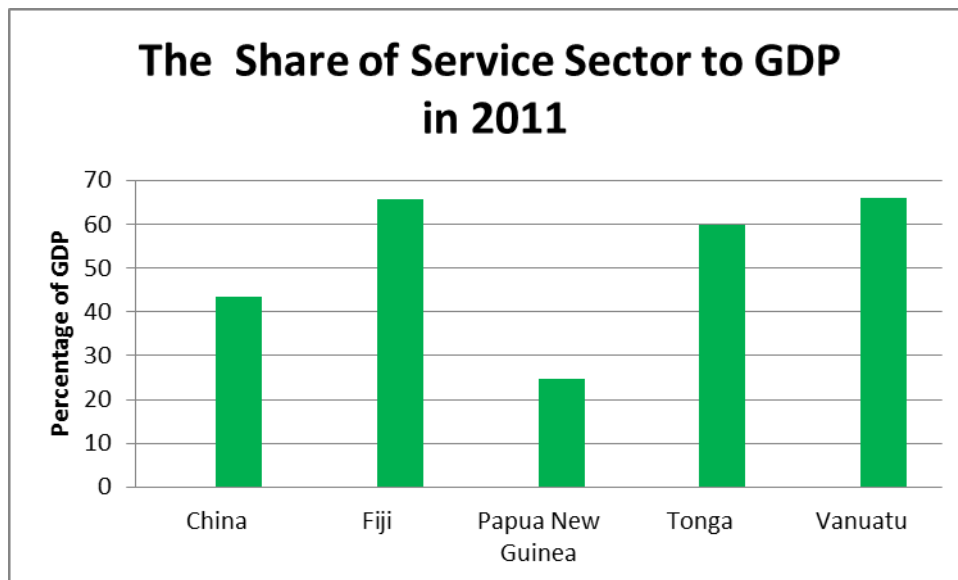
Moreover, Patten (2010) indicates that the manufacturing sector, especially the manufacturing of exports, has been the main contributor to China's economic growth. Figure 2-4 shows the structural transformation of China's exports in 2009 (Lin, 2011). Asian Development Bank figures (2013b) show the manufacturing sector was 19986 billion Yuan, in China's national accounts in 2012, which was three to seven times more than the other sectors. However, the countries that Gani and Clemes's (2002, 2010) studies are based on much less powerful manufacturing sectors. Further, the Asian Development Bank (2013b) reports that countries such as Singapore, Fiji and Tonga, generally have depended on the expansion of the service sector (See Figure 2-5).



**Figure 2-4 The Structural Transformation of China's Exports in 2009**

Zheng, Zhang and Wang (2011) provided a study on China's service sector in sixteen cities of Yangtze River Delta from 2001 to 2007. The authors proved that the level of economic activity promotes labour productivity in service sector. Further, the manufacturing sector also has positive influence on the service sector.

Therefore, GDP and the manufacturing sector may have a similar influence on the expansion of the service sector in China. Moreover, the influences in China's situation may be inconsistent with Gani and Clemes's (2010) research results.



**Figure 2-5 The Share of Service Sector to GDP in China, Fiji, Papua New Guiana, Tonga and Vanuatu**

## **2.3 The Contribution of the Service Sector to Per Capita GDP Growth**

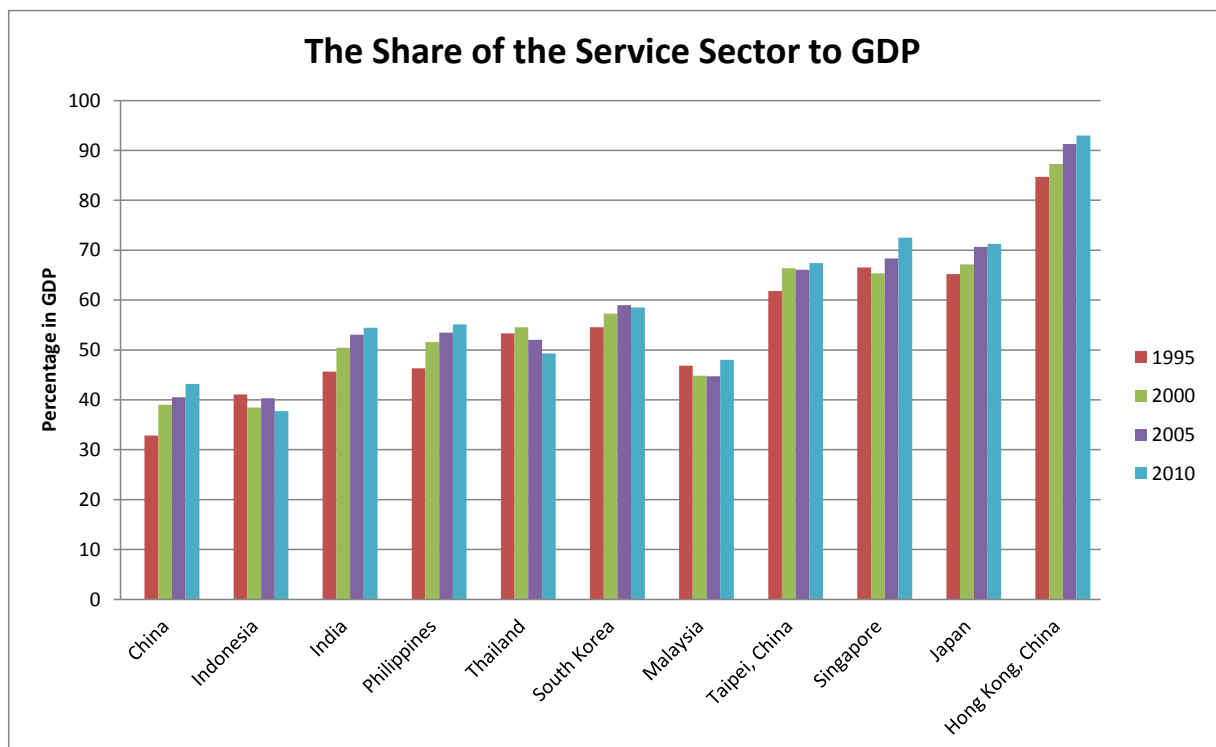
### **2.3.1 The Contribution of the Service Sector in the World**

The predominant role of the service sector in economic development has been widely recognized among developed countries and developing countries in recent years (Rajiv, Suvendu, & Sunita, 2007). Maroto-Sánchez (2012) notes that the service sector has made greater progress than the manufacturing sector in developed countries in the last three decades. For example, the World Bank (2013) reports that value-added in the service sector in the USA reached 79% in 2011. Moreover, developing countries have been awakened to the potential power of the service sector, since their manufacturing sectors have encountered barriers to further development (Noland, Park, & Estrada, 2012). For example, Shepherd and Pasadilla (2012) indicate that the increasing size of the service sector is believed to be the key for the future economic growth in the ACI countries (the Association of Southeast Asian Nations countries, the People's Republic of China and India). Further, the strong capacity of services to generate employment has been stressed in previous studies (Buera & Kaboski, 2012; Tregenna, 2011).

However, research on examining the relationships between the service sector and economic growth in a country is rare, even though the significance of the service sector has been widely accepted (Pugno, 2006). The following discussion reviews the studies on the service sector and economic growth in some countries, mainly in the last decade.

Wirtz (2000) found that the service sector has seen an impressive increase in Asia from 1975. The author selected 11 Asian countries and regions and compared the share of the service sector to GDP

in 1975, 1985 and 1996. The study confirms the rapid growth of the service sector in these selected Asian countries. Wirtz (2000) stresses that the proportion of employment in the service sector has also improved in these Asian countries. Moreover, the latest data from the Asian Development Bank (2013b) shows continuing service sector growth among the selected countries and regions. Hong Kong's service sector is the leading service sector among the selected countries (See figure 2-6). Wirtz (2000) emphasises that a large service sector reflects a more specialised economy. Therefore, the development of each Asian country's economy being reliant on the increasing size of their service sector is the trend for the future (Wirtz, 2000).



**Figure 2-6 Proportion of the Service Sector to GDP in Selected Asian Countries and Regions**

Strom (2005) compared the Japanese service industry with the service sector in OECD countries. The author notes that the service sector has made an important contribution to Japanese GDP growth and share of total employment (Strom, 2005). The study proves that the service sector had a net increase of employment in Japan between 1990 and 2002 (Strom, 2005). Despite this, the Japanese service sector lagged behind the other OECD countries during the same period. In addition, Strom (2005) considers that exports and imports are important factors in assessing the state of the service sector for international comparison. Japan's lower service sector export level indicates that it is less internationalized than the service sectors in the other the Group of Seven countries: the United States, the United Kingdom, France, Germany, Italy, Canada and Japan (Strom, 2005).



Mizuno's (2005) study also focuses on the service sector and economic development in Japan. The service sector is considered to have substantial and favourable effects on economic activity and employment creation in Japan (Mizuno, 2005). The author mainly focuses on the comparison between the productivity of the service sectors in Japan and the USA, implying that the Japanese service sector has ample room to improve its productivity. However, both Strom (2005) and Mizuno (2005) only describe the influence of the service sector in Japan.

Singh (2010) examines the long-run equilibrium and short-run dynamic relationship, between the service sector and GDP growth in India. The author uses the optimal single-equation and the Maximum-Likelihood (ML) system estimators, and finds that the service sector contributed significantly to Indian economic growth in the early 2000's. Moreover, Singh (2010) confirms the bidirectional causality between GDP and the service sector.

### **2.3.2 The Influential Factors in the Growth of Per Capita GDP**

Gani and Clemes' (2002) study on ASEAN countries noted that seven influential factors have an impact on the growth of per capita GDP. They are: 1. growth rate of the population, 2. gross domestic investment, 3. real per capita GDP, 4. primary school enrolment rate, 5. secondary school enrolment rate, 6. the growth of the service sector, and 7. the inflation rate. The equation is presented as follows:

$$gpcgdp = b_0 + b_1gpop + b_2inv/gdp + b_3pcgdp_{-s} + b_4pser_{-s} + b_5sser_{-s} + b_6ser + b_7ifn + b_8x$$

where gpcgdp is the growth rate in real per capita GDP; gpop is the growth rate of population; inv/gdp is the ratio of gross domestic investment; pcgdp is real per capita GDP at the start of the period, pser is the primary school enrolment rate; sser is the secondary school enrolment rate; ser is the growth rate of services; ifn is the rate of inflation, and x is the growth rate of exports.

The empirical results show the contribution of the service sector to the growth of real GDP per capita among ASEAN countries. The empirical results show that the expansion of the service sector contributes to the growth of per capita GDP. Although the growth of population is a positive and generally significant influence on the growth of per capita GDP, Gani and Clemes (2010) claim that the relationship between population and per capita GDP is generally negative in relatively poor countries and positive in relatively rich countries. Moreover, gross domestic investment is usually also found to be positive and statistically significant. In terms of human capital, primary and secondary school enrolments are positive and insignificant, and negative and significant, respectively. Gani and Clemes (2002) explain that the inconsistent outcomes may be because of measurement problems. Furthermore, the inflation rate is significant but negative, which implies high inflation rate is potentially disruptive to per capita GDP growth in ASEAN countries.

In addition, in the study of Pacific Island countries, Gani and Clemes (2010) investigated the relationships between the growth rate in real per capita GDP and eight factors: 1. the service sector growth, 2. labour force, 3. gross domestic investment, 4. real per capita GDP, 5. primary school enrolment rate, 6. the inflation rate, 7. trade share of GDP, 8. government spending. The authors found that the service sector is strongly positive and statistically significant on the growth of real GDP per capita between 1991 and 2006. Trade also has a positive and significant influence in Pacific Island countries. Moreover, the results of gross domestic investment and primary school enrolment show a positive but insignificant influence. However, labour force and per capita GDP are negative and statistically significant on per capita growth. The inflation rate was as expected, negative and significant in the study.

Pugno (2006) follows Baumol's (1967) model to examine the relationship between output and employment and output and the service sector, at a microeconomic level. The framework proposed is represented by the equations as follows:

$$(1) Q_{m,t} = aL_{m,t}h_t e^{rt} \text{ with } L_{m,t} \geq 0$$

$$(2) Q_{s,t} = bL_{s,t}h_t \text{ with } L_{s,t} \geq 0$$

Where  $Q_t$  and  $L_t$  are output and employment respectively at time  $t$ ; and  $s$  and  $m$  stand for services and manufacturing;  $h_t$  is labour's generic skill in production.

Pugno (2006) concludes that both the productivity and the quality of service production are significant for long-run economic performance, and that human capital accumulation impacts on service productivity.

### **2.3.3 The Contribution of the Service Sector in China**

Wang (2009) notes that the proportion of the service sector in China's economy is considerably lower than many countries. In the last decade, the share of service sector to GDP in China has increased only slightly. Data from the World Bank (2012) shows that value-added of the service sector to China's GDP was 39.02% to 43.37% from 2000 to 2011, which is much lower than the world average level of 66.67% to 71% (See Table 2-1). Moreover, the growth of China's service sector has been slow during the same period (World Bank, 2013). Table 2-2 shows annual growth of the service sector in China since 2000. From 2007, the trend of China's service sector growth rate is decreasing.

Wang (2009) explains the low share of services in China's economy in the following three ways. Firstly, the service sector started from an undersized and outdated level in China's planned economy (Wang, 2009). Also, Qin (2006) believes that China needs more time to achieve a real service

economy. Secondly, China's service sector has not been completely involved in the global economy. Soo (2012) notes that the share of exports and imports of the service sector to GDP in China is very low. The data from the Economic and Social Commission for Asia and the Pacific (ESCAP) (2012) shows that the exports and imports of services contributed 2.9% and 3.8% to China's GDP. The figures are much lower than the exports and imports of merchandise at 30.3% and 27.8% of China's GDP in 2011. Additionally, China's service sector has been protected from foreign ownership by the Chinese government (Wang, 2009). Kanungo (2005) notes that China's service sector has started late, in the context of liberalization and globalization. However, after China's accession to the WTO and agreement to open the service sector under its WTO obligations, the share of China's imports to GDP are trending more to the service sector (Chamberlin & Yueh, 2011). Thirdly, the importance of the service sector has been neglected in China (Wang, 2009). However, Chamberlin and Yueh (2011) point out that China's service sector has strong potential to increase in the future, due to its late start and low original level.

**Table 2-1 Comparison on the Share of Service Sector to GDP (%) in the World and in China**

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
World Average	66.67	67.71	68.23	68.28	67.94	68.15	68.16	68.48	69.06	70.91	68.00	71.00
China	39.02	40.46	41.47	41.23	40.38	40.51	40.94	41.89	41.82	43.43	43.19	43.37

Source: The World Bank Data, 2013

**Table 2-2 Annual Growth Rate of the Service Sector in China (%)**

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Service Sector Value-added Growth Rate	9.7	10.3	10.4	9.5	10.1	12.2	14.1	16	10.4	9.6	9.8	9.4	8.1

Source: The World Bank Data, 2013

Furthermore, from a comparative perspective, the number of people employed in the service sector has been lower than the number of people employed in the manufacturing sector in China since 1981 (See Table 2-3). However, the National Bureau of Statistics of China (NBS) (2012) indicates that China's service sector employment rate has increased gradually during the last three decades. Li and Haynes (2011) indicate that employment shifts from the agricultural sector to the manufacturing and service sectors and that this is the general trend in China's economy in the recent years.

The academic research on China's service sector and economic growth is sparse, and mainly concentrates on some particular service industries, such as financial services and health care services (Abdul & Najia, 2010; Cui & Shen, 2011; Meng et al., 2012). The following discussion reviews the studies closely related to the service sector and China's economic growth.

Yang (2003) focused on the development of the service sector in Guangzhou, China. The author notes that the contribution of the service sector to China's economy has been recognized in the large cities. The study investigated the growth of services in Guangzhou and the relationship between the growth of the service sector and China's metropolises. The reasons why the large cities have better developed service sectors are explained by the following factors: 1. supported policies; 2. increased income; 3. foreign investment; and 4. urban planning (Yang, 2003). Yang (2003) notes that the service sector has become a new and powerful source for the urban economies of China's metropolises.

Wang (2009) has studied the service sector in China's economy based on geography. It is a more comprehensive regional research study, due to the author including both developed and developing economies from among 31 provincial regions in China from 1979 to 2007. The study found that the share of the service sector to GDP in developed economic regions such as Beijing and Guangdong is higher than the national average. In contrast, small and underdeveloped economies of the regions have a lagging service sector.

Hussin and Yik (2012) compared the contribution of the economic sectors (agriculture, manufacturing and service sector) to economic growth in China and India. The study formulated the equation to examine the relationships between per capita real GDP and the three economic sectors as follows:

$$\ln gdp = \beta_0 + \beta_1 \ln agr + \beta_2 \ln manu + \beta_3 \ln serv + \mu$$

Where:  $\ln gdp$  is real GDP per capita;  $\ln agr$  is the share of the agricultural sector to real GDP per capita;  $\ln manu$  is the share of the manufacturing sector, to real GDP per capita;  $\ln serv$  is the share of the services sector to real GDP per capita.

The empirical results show that the service sector has an impact on real GDP per capita in China (Hussin & Yik, 2012). However, the manufacturing sector is still the highest contributor to real GDP per capita in China. The results also confirm that the service sector is the biggest contributor to real GDP per capita in India. Therefore, currently the relative importance of the contributions of the economic sectors to economic growth in China and India are different.

**Table 2-3 Number of Employed People in the Three Sectors in China from 1981-2010**

Number of Employed People at Year-end in the Three Sectors								
Year		Total				Composition in Percentage		
	Economically	Employed						
	Active	Persons	Primary	Secondary	Tertiary	Primary	Secondary	Tertiary
	Population	(10 000	Sector	Sector	Sector	Sector	Sector	Sector
	(10 000 people)	people)						
1981	44165	43725	29777	8003	5945	68.1	18.3	13.6
1982	45674	45295	30859	8346	6090	68.1	18.4	13.5
1983	46707	46436	31151	8679	6606	67.1	18.7	14.2
1984	48433	48197	30868	9590	7739	64.0	19.9	16.1
1985	50112	49873	31130	10384	8359	62.4	20.8	16.8
1986	51546	51282	31254	11216	8811	60.9	21.9	17.2
1987	53060	52783	31663	11726	9395	60.0	22.2	17.8
1988	54630	54334	32249	12152	9933	59.3	22.4	18.3
1989	55707	55329	33225	11976	10129	60.1	21.6	18.3
1990	65323	64749	38914	13856	11979	60.1	21.4	18.5
1991	66091	65491	39098	14015	12378	59.7	21.4	18.9
1992	66782	66152	38699	14355	13098	58.5	21.7	19.8
1993	67468	66808	37680	14965	14163	56.4	22.4	21.2
1994	68135	67455	36628	15312	15515	54.3	22.7	23.0
1995	68855	68065	35530	15655	16880	52.2	23.0	24.8
1996	69765	68950	34820	16203	17927	50.5	23.5	26.0
1997	70800	69820	34840	16547	18432	49.9	23.7	26.4
1998	72087	70637	35177	16600	18860	49.8	23.5	26.7
1999	72791	71394	35768	16421	19205	50.1	23.0	26.9
2000	73992	72085	36043	16219	19823	50.0	22.5	27.5
2001	73884	72797	36399	16234	20165	50.0	22.3	27.7
2002	74492	73280	36640	15682	20958	50.0	21.4	28.6
2003	74911	73736	36204	15927	21605	49.1	21.6	29.3
2004	75290	74264	34830	16709	22725	46.9	22.5	30.6
2005	76120	74647	33442	17766	23439	44.8	23.8	31.4
2006	76315	74978	31941	18894	24143	42.6	25.2	32.2
2007	76531	75321	30731	20186	24404	40.8	26.8	32.4
2008	77046	75564	29923	20553	25087	39.6	27.2	33.2
2009	77510	75828	28890	21080	25857	38.1	27.8	34.1
2010	78388	76105	27931	21842	26332	36.7	28.7	34.6

Source: China Statistic Year Book 2012

## 2.4 The Spillover Effects between the Service Sector and the Manufacturing Sector

Nissan, Galindo and Mendez (2011) stress that changes in one sector can influence other sectors, which is reflected in problems and opportunities in other economic activities. Regarding the problems, Nissan et al., (2011) consider that services may have some negative effects on several economic activities. For example, Combes (2000) found that the service sector always exhibit negative specialization effects. In terms of opportunity, Nissana et al., (2011) believe that the service sector stimulates the production of goods and services.

The following discussion reviews the studies on the relationships between the service sector and the manufacturing sector among some countries and China.

In the Indian economy, Dasgupta and Singh (2005) point out that the service sector grows faster than either the manufacturing or agricultural sectors. The authors consider that the manufacturing sector has spillover effects on the other two sectors through technical progress. The growth of the service sector is found to depend heavily on the growth of the manufacturing sector in India (Dasgupta & Singh, 2005). However, in certain services such as IT, the service sector becomes an important influential factor in the expansion of the manufacturing sector (Dasgupta & Singh, 2005).

However, Ray (2013) found that service sector growth in India has no influence on manufacturing sector growth in India. The study used the Unit Root Test and the Cointegration Test, which consist of the data on of the manufacturing sector, the service sector, and real GDP, from 1970 to 2010. According to the empirical results, the author concludes that the reforms undertaken in the manufacturing sector improved growth in the manufacturing sector.

Siddiqui and Saleem (2010) used the inductive approach to analyse the linkage between the Pakistan service sector and the agricultural and manufacturing sectors. The potential spillover effects for value-added in the three sectors are discussed, and the service sector's contribution to economic growth in Pakistan is investigated. In addition, the authors point out that the output of the service sector has a positive influence on the productivity of the manufacturing and agricultural sectors.

The interconnectivity between the service sector and the manufacturing sector was examined in EU15 (15 European countries) by Wolfmayr (2012) from 1995 to 2007. The equation was formulated as follows:

$$\text{Serv}_{jkt} = (y_{js}^{ti} / Y_j^{ti}) \text{ for } j \neq s$$

Where  $y_{js}^{ti}$  is a vector of purchases of intermediate service inputs of type  $s$  by sector  $j$  in country  $k$  at time  $t$ .  $Y_j^{ti}$  is a vector of total output of industry  $j$  at time  $t$  in country  $k$ . Wolfmayr (2012) found that

the evidence reveals the service sector has a positive and robust influence on a country's relative manufacturing export performance.

Gani and Clemes (2002) developed an equation to investigate the impact of the service sector on the manufacturing sector for five ASEAN countries. The manufacturing sector (man) is a function of GDP growth (gdp), the service sector (ser), the growth of exports (x) and imports (im) and government spending (gov), and is as follows:

$$\text{man} = c_0 + c_1\text{gdp} + c_2\text{ser} + c_3x + c_4\text{im} + c_5\text{gov}$$

The results of the study show a strong influence of the service sector on the manufacturing sector in the selected ASEAN countries (Gani & Clemes, 2002).

Additionally, in Gani and Clemes' (2010) study on the Pacific Island countries, they examined the spillover effects from the growth of the service sector to the growth of the manufacturing sector and vice versa. The equation to test the spillover effects is as follows:

$$\text{man}_{it} = \delta_0 + \delta_1\text{man}_{t-1} + \delta_2\text{gdp}_{it} + \delta_3\text{ser}_{it} + \delta_4x_{it} + \delta_5\text{im}_{it} + \delta_6\text{gov} + \mu_{it}$$

Unlike the ASEAN study, lagged manufacturing is included in the study. The authors found evidence that there is weak support for the influence of the services on the manufacturing sector among the Pacific Island countries.

The relationship between the service sector and the manufacturing sector in China is addressed in Li's (2012) study. The author notes that the interaction between the manufacturing sector and the service sector has become a trend during the last two decades. Services have been identified as penetrating into the production of both the manufacturing and agricultural sectors (Li, 2012). Li (2012) considers that the manufacturing process and producer services, promote the complementation of products and services.

However, there are some limitations in the studies. Firstly, the service sector is under-studied by academic researchers and is underestimated by politicians (Maroto-Sánchez, 2012). Also, the manufacturing sector has been the major objective in many academic studies that have included on studies on the service sector. Secondly, qualitative research is mainly used to analyse and compare the contributions and linkages of the service sector to economic growth and to other sectors. Therefore, empirical methods and results are urgently needed in future research. Third is the limited sample of countries have been investigated. With regard to the different national situations, the role of the service sector and other influential factors in a country's economy will show different performances.

## 2.5 Research Methodology Discussion

The structural equations used in Gani and Clemes' s (2010) research on the Pacific Island countries provides the foundation for this study to test the three research objectives stated in Chapter 1. The three structural equations are presented as follows:

$$(1) \text{ ser}_t = \alpha_0 + \alpha_1 \text{gdp}_{it} + \alpha_2 \text{mangth}_{it} + \alpha_3 \text{x}_{it} + \alpha_4 \text{im}_{it} + \alpha_5 \text{gov}_{it} + \mu_{it}$$

$$(2) \text{ gpcgdp}_t = \beta_0 + \beta_1 \text{sva}_{it} + \beta_2 \text{lab}_{it} + \beta_3 \text{inv/gdp}_{it} + \beta_4 \text{pcgdp}_{it} + \beta_5 \text{sch}_{it} + \beta_6 \text{ifn}_{it} + \beta_7 \text{trd}_{it} + \beta_8 \text{gov}_{it} + \mu_{it}$$

$$(3) \text{ man}_t = \delta_0 + \delta_1 \text{man}_{t-1} + \delta_2 \text{gdp}_{it} + \delta_3 \text{sva}_{it} + \delta_4 \text{x}_{it} + \delta_5 \text{im}_{it} + \delta_6 \text{gov}_{it} + \mu_{it}$$

Equation (1): the growth of the service sector (ser) is a function of the growth of real output (gdp); growth of the manufacturing sector (mangth); growth in exports (x); growth in imports (im); and the role of government spending (gov).

Equation (2): real GDP per capita (gpcgdp) is hypothesised to be influenced by the growth rate of services value-added (sva); total labour force (lab); gross domestic investment (inv/gdp); real per capita GDP (pcgdp); primary school enrolment; inflation rate (inf); trade (trd); and government spending (gov).

Equation (3): examines the spillover effects from the service sector to the manufacturing sector and vice versa. Value-added in the manufacturing sector is influenced by the lagged value-added in the manufacturing sector ( $\text{man}_{t-1}$ ); real output (gdp); exports (x) and imports (im); and government spending (gov).

However, there are two major differences between the Pacific Island countries and this current study. First, the different national situations: level of productivity, technology, professional labour, and resources. For example, China's population is over 600 times greater than the population in the Pacific Island countries. Moreover, China's economy has been heavily reliant on the development of the manufacturing sector. Secondly, there are differences between the equations used, estimation, and framework. Therefore, the following sections discuss the adjustments made to the equations used in this study.

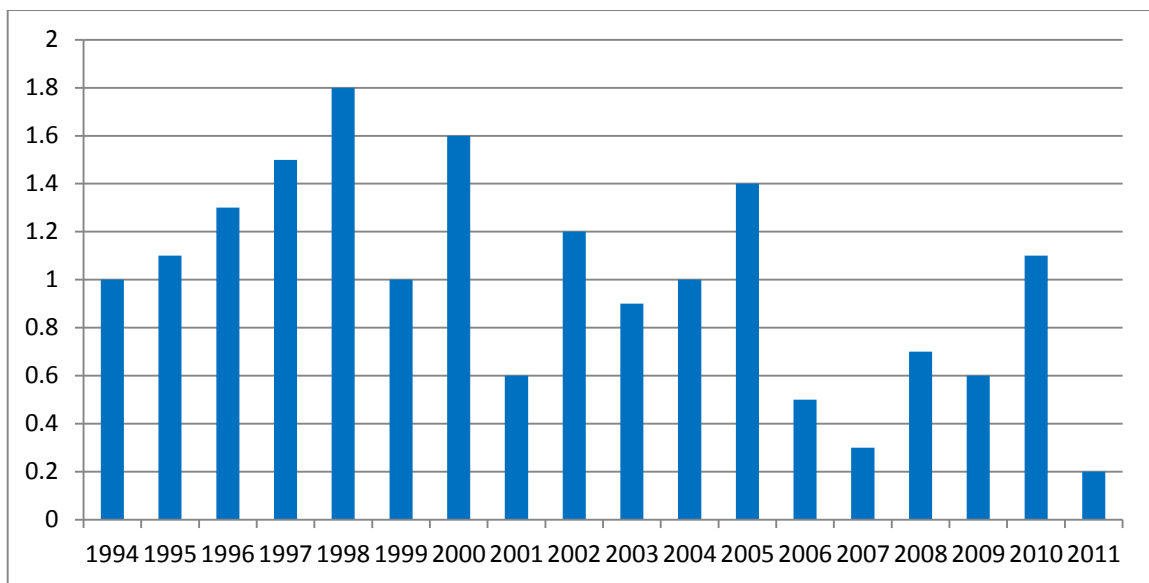
### 2.5.1 Adjustments to Equation (1)

Many researchers stress that China's GDP growth has strongly relied on the growth of the manufacturing sector (Lin, 2011; Patten, 2010; Rajah et al., 2012). Considering the close relationship between the manufacturing sector and GDP in China, the results may be impacted by the double estimation of these two variables. Therefore, the variables of GDP and manufacturing sector need to be adjusted in Equation (1) for China's situation.



### 2.5.2 Adjustments to Equation (2)

Two variables need to be adjusted in equation (2): growth rate of the labour force and per capita GDP. The Asian Development Bank (2013b) figures show China's labour force has a weak percentage change in growth from 1994 to 2011 (See Figure 2-7). However, Zhang, Guo and Zheng (2012) note that productive employment has a significant positive influence on China's economic development. Cai, Wang and Zhang (2010) also note that because China has a huge population base, real employment participation has an impact on the long-term real per capita GDP growth in China. Previous studies on China and India used employment participation as the human capital variable to examine per capita GDP growth (Hicks, Basu, & Sappey, 2010). Therefore, employment participation rate can replace the total of labour force in Equation (2).



**Figure 2-7 Labour Force Annual Percentage Change in Growth in China**

Per capita GDP measures economic activity and reflects average living standards. The per capita GDP variable may have a high correlation with other variables in the estimation, such as primary school enrolment rate and inflation rate. Additionally, previous studies on OECD countries and China mainly measure per capita GDP and per capita GDP growth as two dependent variables (Marattin & Salotti, 2011; Narayan, 2008). Hence, the per capita GDP variable must be adjusted in Equation (2).

### 2.5.3 Adjustments to Equation (3)

The spillover effects from the service sector to the manufacturing sector and vice versa are expected to exist simultaneously. Hill, Griffiths and Lim (2011b) note that simultaneous equations can examine a two-way influence at the same time. Thus, the manufacturing sector and the service sector can be jointly examined. Hence, the study uses the simultaneous equations to estimate the spillover effects between the two sectors in China.

The simultaneous equation approach has been used in previous studies to investigate the relationships in the manufacturing sector (Delorme Jr, Klein, Kamerschen, & Voeks, 2003; Resende, 2007). However, there is a lack of research on spillover effects using simultaneous equations. Therefore, the development of the simultaneous equations also relies on Equation (3) as stated in Gan and Clemes's (2010) study.

## **Chapter 3**

### **Research Methodology**

This chapter has four purposes. First, it presents the three research hypotheses. Secondly, it outlines the research model used to examine the hypotheses. Then, it provides justification for the variables used in this study. Finally, it discusses the data collection and data analysis techniques.

### **3.1 Hypotheses and Model**

#### **3.1.1 Hypotheses Development**

Gani and Clemen (2010) identified several variables that potentially influence the expansion of the service sector in their study on the four Pacific Island countries (Fiji, Papua New Guinea, Tonga and Vanuatu). GDP growth, the manufacturing sector, exports and imports growth, and government spending are hypothesised to have significant positive relationships with the growth of the service sector. Although Asian Development Bank data (2013b) shows that China's service sector value-added has increased in the last 15 years, the potential influential factors have not been identified nor assessed. Hence, Hypothesis 1 is formulated:

H1: There are several variables that have a positive influence on the growth of the service sector in China.

Fischer (1993), Gani and Clemen (2010) used mainly conventional factors to examine the potential contribution of the factors on per capita GDP growth. Gani and Clemen (2010) presented per capita growth as mainly influenced by the following variables: service value-added, employment ratio, gross domestic investment, primary school enrolment rate, inflation rate, trade share and government spending. This current study focuses on the contribution of the service sector to China's per capita GDP growth. Therefore, Hypothesis 2 is formulated:

H2: There is a significant and positive relationship between the service sector and China's economic growth.

Gani and Clemen (2002, 2010) identified an important linkage between the growth of the service sector and growth of the manufacturing sector. The authors assessed the spillover effects from the service sector to the manufacturing sector and vice versa in the ASEAN countries and the Pacific Island countries. However, a spillover effect between China's service sector and China's manufacturing sector has not been clearly identified. Therefore, Hypothesis 3 is formulated:

H3: There is a significant and positive spillover effect of the service sector to the manufacturing sector and vice versa in China's economic growth.

### 3.1.2 Model Development

The model in this study is based on Gani and Clemes's (2002, 2010) studies. The authors' used empirical methods to analyse the contribution of the service sector to economic growth and the spillover effects of the service sector on the growth of the manufacturing sector, in the four Pacific Island countries and the selected ASEAN countries respectively. The model is designed to estimate three issues: 1. factors affecting the expansion of the service sector; 2. the contribution of the service sector on per capita growth; 3. spillover effects of the service sector on the manufacturing sector and vice versa. The structural equations are as follows:

$$\begin{aligned}
 (1) \text{ ser}_t &= \alpha_0 + \alpha_1 \text{gdp}_t + \alpha_2 \text{mangth}_t + \alpha_3 x_t + \alpha_4 \text{im}_t + \alpha_5 \text{gov}_t + \mu_{1t} \\
 (2) \text{ gpcgdp}_t &= \beta_0 + \beta_1 \text{sva}_t + \beta_2 \text{lab}_t + \beta_3 \text{inv/gdp}_t + \beta_4 \text{pcgdp}_t + \beta_5 \text{sch}_t + \beta_6 \text{ifn}_t + \beta_7 \text{trd}_t + \beta_8 \text{gov}_t + \mu_{2t} \\
 (3) \text{ man}_t &= \delta_0 + \delta_1 \text{man}_{t-1} + \delta_2 \text{gdp}_t + \delta_3 \text{sva}_t + \delta_4 x_{it} + \delta_5 \text{gov}_t + \mu_{3t}
 \end{aligned}$$

These variables are:

- |       |         |   |  |
|-------|---------|---|--|
| I.    | ser     | = | growth of the services sector                  |
| II.   | gdp     | = | growth of real output                          |
| III.  | mangth  | = | growth of the manufacturing sector             |
| IV.   | x       | = | growth in exports                              |
| V.    | im      | = | growth in imports                              |
| VI.   | gov     | = | government spending as a percentage of GDP     |
| VII.  | gpcgdp  | = | growth rate in per capita GDP                  |
| VIII. | sva     | = | growth rate of services value-added to GDP     |
| IX.   | lab     | = | growth rate of the total labour force          |
| X.    | inv/gdp | = | ratio of gross domestic investment             |
| XI.   | pcgdp   | = | real per capita GDP at the start of the period |
| XII.  | sch     | = | primary school enrolment rate                  |
| XIII. | ifn     | = | rate of inflation                              |
| XIV.  | trd     | = | trade share in GDP                             |
| XV.   | man     | = | growth rate in the value of manufacturing      |

In order to improve the model's appropriateness for China's economic situation, this study adjusts some variables in each equation. The model in Gani and Clemes's (2010) study is the only core foundation for this research, as studies on the service sector and its contribution to economic growth are sparse. In addition, China's national conditions have distinct differences from the Pacific Island

countries. For example, the population of China is more than 600 times the population of the Pacific Island countries (ADB, 2013a). Also, the manufacturing sector is the primary contributor to China's economic growth. Therefore, the adjustments in the model are based on technical calculations in order to apply the analysis to China's economic conditions. The adjustments are as follows:

In the first equation, the growth rate of services value-added to GDP (sva) and the growth rate of manufacturing value-added to GDP (man) are substitutes for the growth of the service sector and the growth of the manufacturing sector respectively. In addition, variable gdp is dropped from the model, avoiding the double count. Further, China's economic growth depends heavily on the expansion of the manufacturing sector (Hussin & Yik, 2012). Therefore, the adjusted model is:

$$sva_t = \alpha_0 + \alpha_1 man_t + \alpha_2 x_t + \alpha_3 im_t + \alpha_4 gov_t + \mu_{1t}$$

In the second equation, variable pcgdp is dropped from the model. China's national data (NBS, 2012) shows China's per capita GDP has grown dramatically during the last two decades, reaching approximately 35,197 Yuan in 2011. However, there is a big gap in China's per capita growth between the advanced areas and the underdeveloped areas. For example, per capita GDP in Beijing and Shanghai was 81,658 Yuan and 82,560 Yuan respectively. Tibet was only 20,077 Yuan (NBS, 2012). Moreover, real per capita GDP has a very high correlation with the growth of service value-added, gross domestic investment, primary school enrolment, trade share and government spending. When pcgdp is dropped, the model's t-statistic improves. Additionally, this study uses employment to population ratio as a substitute for the total labour force growth rate. The employment to population ratio is the proportion of a country's population, age 15 and older, who are employed (World Bank, 2012). It reflects the labour force productivity for the whole population. Therefore, the adjusted model is:

$$gpcgdp_t = \beta_0 + \beta_1 sva_t + \beta_2 emp_t + \beta_3 inv/gdp_t + \beta_4 sch_t + \beta_5 trd_t + \beta_6 ifn_t + \beta_7 gov_t + \mu_{2t}$$

This study adopts simultaneous equations models to estimate the spillover effects of the service sector to the manufacturing sector and vice versa. Simultaneous models include two or more dependent variables and consist of set equations (Hill., Griffiths., & Lim, 2011a). This study examines the two-way influence between the service sector and the manufacturing sector at the same time. The service sector and the manufacturing sector are both endogenous and exogenous variables in simultaneous equations models. The spillover effects between the two sectors are expected to exist simultaneously. Therefore, the adjusted models are:

$$mangth_t = \delta_0 + \delta_1 mangth_{t-1} + \delta_2 ser_t + \delta_3 gdp_t + \delta_4 gov_t + \mu_{3t}$$

$$ser_t = \eta_0 + \eta_1 ser_{t-1} + \eta_2 mangth_t + \eta_3 x_t + \eta_4 im_t + \eta_5 gov_t + \mu_{4t}$$

## **3.2 The Variables Used in This Study**

### **Value-added in the Service Sector**

There are two purposes for including value-added in the service sector. First of all, the growth of the service sector is influenced by multiple factors. Gani and Clemes (2010) note that the growth and development of a country's economy and real output factors increase the service sector's diversity and improve its productivity. In recent years, incomes and consumption patterns in China have undergone big changes, which require improving services to suit diverse consumer demand (Yang, 2003). Asian Development Bank data (2013b) indicates that value-added in the service sector has increased in China's GDP during the last decade; however, the essential factors in the service sector development have not been verified. Examining the relationships between the service sector and selected variables may improve the understanding of the service sector growth in China.

In addition, the growth rate in value-added of the service sector is expected to be a contributor to per capita growth in China. Fernandes (2009) emphasised that the expansion of the service sector increases aggregate productivity. The manufactured product improves the product's tangible quality, and the service sector improves the productivity and the competitive advantage of the product from a customer perspective (Wolfmayr, 2012). Gani and Clemes (2010) point out that improved producer services, enhanced distribution services and improved consumer services increase the efficiency of resource allocation and the factor of productivity. Therefore, value-added in the service sector is included and tested for possible impact on the per capita growth in China.

### **The Growth of the Service Sector**

The growth of the service sector has endogenous and exogenous variables in the simultaneous equations models, in order to examine the spillover effects from the service sector to the manufacturing sector and vice versa. As the endogenous variable, the service sector growth is presumed to be determined by the growth of the manufacturing sector. As the exogenous variable, the service sector combines with the variables of GDP and government spending in order to examine its impact on the manufacturing sector.

### **Value-added in the Manufacturing Sector**

The growth in value-added of the manufacturing sector is included to test its influence on the growth in value-added of the service sector. Gani and Clemes (2002) note that the improvement in efficiency in the manufacturing sector may promote expansion of the service sector. In addition, the linkage between the service sector and the manufacturing sector is important in terms of improving the diversity of the products in the service sector (Biege, Jaeger, & Buschak, 2012; Zheng et al., 2011).

## **The Growth of the Manufacturing Sector**

Gani and Clemes (2002) note that the growth in the manufacturing sector has connected with the growth in the service sector in ASEAN economies. Most commercial products are not produced in one specific sector (Tao & Wong, 2002). Yoon and Choi (2002) found that in Korea, the effect of the joint effort between the manufacturing sector and the service sector has improved the diversity of products and strengthened their international competitiveness.

However, the manufacturing sector remains a significant contributor to China's economic growth (Liu & Li, 2012). Zheng, Zhang and Wang (2011) note that efficiency in the manufacturing sector is expected to boost the growth of the service sector in China. Additionally, Wolfmayr (2012) points out that further development of the manufacturing sector needs coordination with the service sector. Therefore, the growth of the manufacturing sector is included in this current study to examine the spillover effect from the manufacturing sector to the service sector and vice versa.

## **Per Capita GDP Growth**

Gani and Clemes (2010) demonstrate that the level of per capita GDP growth represents the efficiency of resource allocation and factor productivity. The authors also indicate that the service process has more elasticity of demand in aggregate compared to a manufactured good, and this factor impacts on economic growth.

## **Exports and Imports**

Exports and imports provide a connection between the domestic economy and the global economy (Gani & Clemes, 2010). Growth of the service sector is promoted through the interaction of economic activities (Nissana et al., 2011). Exporting and importing introduces and spreads the latest technological developments, which are considered to be the core of the service sector development (Nissana et al., 2011). Exporting and importing increase the level of investment and urge domestic organisations to enhance product and services competitiveness (Gani & Clemes, 2010).

Although the majority of China's exports are from the manufacturing sector, increased quantities of services products and increased customer demand has given China's service related organisations more opportunities to access the global markets (Kanungo, 2005). Soo (2012) found that in international trade, China was the fifth largest exporter and the fourth largest importer of services in 2009. Since China's accession to the World Trade Organization (WTO) in 2001, its service market has become more open to international investors (Kanungo, 2005). Thus, exporting and importing are expected to have a positive influence on the growth of the service sector in China.

## **Government Spending**

Government spending has a beneficial influence on the sectors' growth, which is mainly reflected in public infrastructure development (Temple, 1999). For example, Ding (2012) analysed the relationships between transport development and economic growth in China, finding that an improved transport system positively affects the economic output.

Additionally, government spending is also included to model the effect on per capita growth. Butkiewicz and Yanikkaya (2011) indicate that the impact of government spending on growth is different in developed and developing countries.

## **Employment**

The employment rate reflects labour force productivity in economic growth (Gani & Clemes, 2010). Empirical evidence shows that the growth of employment affects the portion of real per capita growth (Lim & Lee, 2002). In terms of the huge population in China, employment related issues, such as the growing aging problem (Zhang et al., 2012), strengthen the importance of labour productivity in China's long term per capita GDP growth (Cai et al., 2010).

## **Gross Domestic Investment**

Gross domestic investment is included in the model of estimation per capita growth due to its accounting for the growth in stock of physical capital (Gani & Clemes, 2010). Lean and Tan (2011) note that gross domestic investment has the capacity to increase aggregate demand and expand a country's stock of productive assets.

Additionally, previous studies have compared the influence of gross domestic investment and foreign direct investment (FDI) on economic growth in different areas (Choe, 2003; Samuel, 2009; Tang, Selvanathan, & Selvanathan, 2008). Although the amount of foreign direct investment (FDI) in China accounts for the largest FDI among the developing countries, Tang et al., (2008) found that gross domestic investment has made a greater contribution to China's economic development during the time period covered in this current study.

## **Primary School Enrolment**

Primary school enrolment is considered to be human capital (Gani & Clemes, 2010). Keller (2006) notes that the primary school enrolment rate encourages investment and improves the further education enrolment rate. Moreover, educated workers improve productivity, which has a favourable effect on economic growth (Keller, 2006). Compared to the strict tertiary entrance examination, China's nine-year compulsory education system ensures that more young children have



access to primary education (Sun, 2010). Therefore, the primary school enrolment is considered as an influential factor on per capita growth in China.

### **Trade**

Gani and Clemes (2010) indicate that trade reflects the level of openness in a country's economy. Trade may improve resource allocation, leading to a faster per capita growth. Edmonds, La Croix and Li (2008) found that China's trade performance has been more powerful after China's accession to the WTO, which particularly reflects on the improvement in the quantity and quality of China's exports and imports. Trade is an important factor in China's economic growth (Edmonds et al., 2008).

### **Inflation Rate**

Empirical studies show that the inflation rate has three relationships with per capita growth: positive, negative and none, in different economies (Jayathilleke & Rathnayake, 2013). Moreover, Iqbal and Nawaz (2009) argue that the inflation rate may affect economic growth in the medium-term and long-term. Also, Narayan and Smyth (2009) note that the inflation rate has uncertain effects on China's economic growth. Therefore, this study tests the impact of the inflation rate on China's per capita growth.

## **3.3 Data and Econometric Modelling**

The research sample was based on data from the People's Republic of China. Hong Kong, Macao and Chinese Taipei were excluded from the analysis as the service sector is highly developed in these three areas. The World Bank (2013) and the Asian Development Bank (2013b) reported the service value-added to GDP in Hong Kong, Macao and Chinese Taipei was approximately 93%, 93% and 68% respectively, compared to China's which was approximately 43% in 2011. Therefore, the data for Hong Kong, Macao and Chinese Taipei would bias the results for the service sector.

The secondary data used in this study was collected mainly from the Asian Development Bank. These variables are: service sector growth, manufacturing sector growth, service value-added to GDP, manufacturing value-added to GDP, government expenditure, inflation rate, growth of exports and imports and the primary school enrolment rate. The variables: gross domestic investment of GDP, trade share, the ratio of employment to the population, and the growth of per capita GDP were collected from the World Bank in order to use a complete data set in the statistical analysis.

The sample years were from 1994 to 2011. The Asian Development Bank notes that China's traditional statistical reporting system did not include the growth of the service industries, pre 1994. Before 1994, China's national accounting system focused on merchandise rather than value-added

data (Pant, 2008) .The services sector statistics were more defined by the Asian Development Bank and the Chinese government after 1994 (Pant, 2008).

The data collected was analysed using Eviews7.2 software. Multiple regression analysis and simultaneous equations analysis were the two statistical techniques applied to satisfy the three research objectives. Multiple regression analysis was used first to identify the potential factors in the expansion of the service sector, and second, to examine the contributions of the service sector to per capita growth in China. Simultaneous equations analysis was used to test the spillover effects from the service sector on to the manufacturing sector and vice versa.

### **3.3.1 Splicing Procedure**

The splicing procedure is used in deriving shorter economic data series (Fuentea, 2013). Splicing improves and extends the number of observations (Hill & Fox, 1997). In terms of a better data series, the results of the measurements become more accurate (Hill & Fox, 1997). A solution for the splicing procedure is as follows:

$$Y_t = (Y_{t+1}/Y_{t+1}') * Y_t'$$

Where: Y is re-scaled benchmark level;

Y' is reference benchmark level;

t is year.

The data for government spending for 1994 and 1995 is not available from the Asian Development Bank database (ADB, 2013b). Therefore, this study uses the splicing procedure to calculate the two years data, in order to achieve a complete data series.

### **3.3.2 Cointegration**

Cointegration estimates an equilibrium relationship among a set of nonstationary time series variables (Hill. et al., 2011b). When a linear combination in the nonstationary variables is stationary, these variables are cointegrated (Wooldridge, 2013). Cointegration indicates the non-stationary variables share similar stochastic trends (Hill. et al., 2011b). Critical values of the cointegration test have been provided as the benchmarks (Hill. et al., 2011b) (see the Table 3-1).

**Table 3-1 Critical Values for the Cointegration Test**

Regression Model	1%	5%	10%
1. $y_t = \beta x_t + e_t$	-3.39	-2.76	-2.45
2. $y_t = \beta_1 + \beta_2 x_t + e_t$	-3.96	-3.37	-3.07
3. $y_t = \beta_1 + \delta_t + \beta_2 x_t + e_t$	-3.98	-3.42	-3.13

### 3.3.3 Multiple Regression Analysis

Multiple regression analysis is applied to test the relationships between a single dependent variable and a number of explanatory variables (Hill. et al., 2011a). The value of the explanatory variables is assumed to have effects on the value of the dependent variables (Tabachnick & Fidell, 2007). The effect could be positive or negative (Hill. et al., 2011a). The form of the multiple regression equation is as follows:

$$y = \beta_1 + \beta_2 x_2 + \beta_3 x_3 + \dots + \beta_k x_k + e$$

Where:  $y$  is the dependent variable;

$X$  s are independent variables;

$\beta$  s are the coefficient of  $X$  terms;

$e$  is the error term.

The  $\beta$  coefficient measures the effect of a change in the dependent variable, for one unit of change in the independent variable (Hill. et al., 2011a). The error term  $e$  represents residuals between observed values and predicted values of the dependent variable (Hill. et al., 2011a).

This study tests the direct relationships between the two dependent variables and the selected explanatory variables in the first and second models, respectively. In addition, in the first model, the relative importance of the selected variables is compared, based on the standardised beta coefficients. Moreover, the contribution of the service sector to China's per capita growth is also identified based on the standardised beta coefficient.

### 3.3.4 Coefficient of Determination

The coefficient of determination ( $R^2$ ) measures the predictive accuracy of the overall regression model (Hair, Black, Babin, & Anderson, 2010).  $R^2$  represents the proportion of the variance in the

dependent variable that is explained by all independent variables (Wooldridge, 2013). When  $R^2$  equals to 1, the regression line perfectly fits the sample data. When  $R^2$  equals to 0, the regression model has weak predictions. Consequently,  $R^2$  is considered as a measure of "goodness-of-fit" (Hill. et al., 2011b). The calculation of  $R^2$  is:

$$R^2 = \frac{SSR}{SST}$$

Where: SSR is the sum of squares regression;

SST is the total sum of squares.

### 3.3.5 Test of Significance of the Regression Model

F test is used to test the overall significance of the regression model (Hill. et al., 2011b). F test determines whether  $R^2$  is significantly higher than 0 (Hair et al., 2010). The F test is calculated as follows:

$$F = \frac{(SST - SSE)/(k-1)}{SSE/(N-K)}$$

Where: SST is the total sum of squares;

SSE is the sum of squared least squares residuals;

K is the number of coefficients in the unrestricted model;

N is the number of observations.

The null hypothesis is tested when all the model parameters are equal to zero (Hill. et al., 2011b). An acceptance of the null hypothesis is when a regression model has no significant predictability for the dependent variable (Hill. et al., 2011b). In contrast, a rejection of the null hypothesis is when at least one of the independent variables has significant predictability on the dependent variable in a regression model (Hill. et al., 2011b). The F-value is automatically reported by computer software.

### 3.3.6 Simultaneous Equation Models

Simultaneous equations models are where one or more of the explanatory variables are jointly determined by the dependent variables, which consist of at least two equations (Wooldridge, 2013). In the simultaneous equations models, there is the two-way influence or feedback (Hill. et al., 2011b). A simple two equations set of the simultaneous equations models are as follow:

$$Y_1 = \alpha_0 + \alpha_1 Y_2 + \alpha_2 X_1 + \epsilon_1$$

$$y_2 = \gamma_0 + \gamma_1 y_1 + \varepsilon_2$$

Where:  $y_1$  and  $y_2$  are endogenous variables;

$x$  is exogenous variables;

$\varepsilon_1$  and  $\varepsilon_2$  are structural errors.

The value of the endogenous variables,  $y_1$  and  $y_2$ , are determined within the system at the same time (Hill. et al., 2011a). However,  $x$  as the exogenous variable is determined outside of the system.

In this study, the spillover effects from the service sector to the manufacturing sector and vice versa were examined using the simultaneous equations models. The potential and significant spillover effects were identified based on the standardised beta coefficients.

### 3.3.7 Two-Stage Least Squares Equation

Two-stage least squares (2SLS) are used to estimate the parameters in an identified structural equation within simultaneous equations models (Hill. et al., 2011a). Compared to the ordinary least squares (OLS), 2SLS can measure multiple endogenous explanatory variables (Wooldridge, 2013).

The 2SLS estimation procedure within a simultaneous equations system is described by Hill, Griffiths and Lim (2011a) pages from 453 to 454, showing as follows:

" $y_1, y_2, \dots, y_m$  are the endogenous variables;  $x_1, x_2, \dots, x_k$  are the exogenous variables;  $K$  is the number of the exogenous variables;  $\alpha, \beta, \pi$  and  $\hat{\pi}$  are the parameters in each equation.

$$(1) \quad y_1 = \alpha_2 y_2 + \alpha_3 y_3 + \beta_1 x_1 + \beta_2 x_2 + e_1$$

Suppose the structural equation (1) is identified, the parameters are estimated in two stages:

First, estimate the parameters of the reduced-form equations

(2)

$$y_2 = \pi_{12} x_1 + \pi_{22} x_2 + \dots + \pi_{k2} x_k + v_2$$

$$y_3 = \pi_{13} x_1 + \pi_{23} x_2 + \dots + \pi_{k3} x_k + v_3$$

by least squares and obtain the predicted values

(3)

$$\hat{Y}_2 = \hat{\pi}_{12}X_1 + \hat{\pi}_{22}X_2 + \dots + \hat{\pi}_{k2}X_k + v_2$$

$$\hat{Y}_3 = \hat{\pi}_{13}X_1 + \hat{\pi}_{23}X_2 + \dots + \hat{\pi}_{k3}X_k + v_3$$

Second, replace the endogenous variables,  $y_2$  and  $y_3$ , on the right-hand side of the structure (1) by their predicted values from (3)

(4)

$$y_1 = \alpha_2\hat{y}_2 + \alpha_3\hat{y}_3 + \beta_1x_1 + \beta_2x_2 + e^*_1$$

Estimate the parameters of this equation (4) by least squares.”

2SLS was used in this study to identify the spillover effects from the service sector to the manufacturing sector and vice versa and measure in the simultaneous equations models.

### 3.3.8 Assumptions for Regression Analysis

#### Outliers

An outlier is an observation that is distinctly distant from the rest of the observations (Studenmund, 2001). Outliers can be used to check data entry or transcription errors through judging a larger or smaller value on a variable (Studenmund, 2001). However, problematic outliers can misrepresent the statistical tests (Hair, Black, Barry, Anderson, & Tatham, 2006). The standardised residuals are useful in identifying outliers (Hair, Anderson, Tatham, & Black, 1998). Hair et al., (1998) suggest that an outlier is defined as a standard residual of 2.5 or greater for 80 or fewer observations.

#### Multicollinearity

Multicollinearity denotes the correlation between two or more independent variables (Wooldridge, 2013). Hair et al (2006) note that multicollinearity impacts on both estimation and explanation of the model. The effect of multicollinearity on estimation is reflected in two aspects. First of all, increased multicollinearity can lower the predictive ability of the regression model (Anderson, Sweeney, & Williams, 2011). Secondly, a high degree of multicollinearity leads to incorrect estimations of the regression coefficients (Dorak, 2007). In terms of explanation, multicollinearity causes difficulty in understanding the effects of the independent variables (Maddala, 2001).

The method of detecting multicollinearity is to test the correlation matrix for independent variables (Asteriou. & Hall, 2007). A collinearity problem is defined as being when the result of correlation is equal to or greater than 0.90 (Asteriou. & Hall, 2007). Additionally, a large value of  $R^2$  and a statistically significant F test with insignificant t-tests of coefficients, indicates substantive effects of multicollinearity in the regression model (Asteriou. & Hall, 2007).

## Linearity

A linear relationship is examined between each pair of variables and the correlation coefficient represents this relationship (Hair et al., 2006). Linearity requires the mean value of the outcome variable for each increment of the predictive variables to lie along a straight line (Field, 2009). Hair et al (2010) stress that a non-linearity relationship in a model can limit the generalizability of the results. Therefore, the assumption of linearity is considered as an essential issue in regression analysis (Tabachnick & Fidell, 1989).

The general method of detecting linearity is to examine the residuals (Tabachnick & Fidell, 1989). Residual plots in the graph should be randomly dispersed around the horizontal axis (Anderson et al., 2011). Any curves that are presented in the graph indicate the potential violation of the linearity assumption (Hair et al., 2006).

## Error Term Normality

Normality refers to the pattern of the sample data distribution and its correspondence to the normal distribution (Hair et al., 2010). Field (2009) suggests that the differences between the regression model and the observed data are generally zero or very close to zero.

Histogram and the Jarque-Bera (JB) test are used to check the normality of residuals (Asteriou. & Hall, 2007; Maddala, 2001). In terms of the histogram, the distribution of observed data values is compared with the normal distribution (Hair et al., 2006). In terms of the Jarque-Bera test, skewness and kurtosis are two measurements for normality (Hill. et al., 2011b). The calculation of the Jarque-Bera statistic (Hill. et al., 2011b) is as follows:

$$JB = \frac{N}{6} \left( S^2 + \frac{(K-3)^2}{4} \right)$$

Where: N is the sample size;

S is skewness;

K is kurtosis.

Hill et al (2011b) demonstrate that when the sample size is sufficiently large, the JB test has a chi-square distribution with two degrees of freedom. If the value of JB test is larger and equals to the critical value 5.99, the null hypothesis is rejected (Hill. et al., 2011b).

## Error Term Independence

Independence means one observation should not be influenced by the other observations (Field, 2009). Serial correlation can cause no bias in the coefficient estimators, but overestimate the F and t statistics (Studenmund, 2001). Moreover, the regression results are severely affected by serial correlation (Field, 2009). Therefore, the statistical validity of the regression analysis relies on the independence assumption of the observations (Hair et al., 2006).

The Durbin-Watson test is the method for testing the serial correlations between errors (Asteriou. & Hall, 2007). The Durbin-Watson test procedure is as follows:

$$d = \frac{\sum_{t=2}^T (e_t - e_{t-1})^2}{\sum_{t=1}^T e_t^2},$$

Where:  $e_t$  is the least squares residual.

Nieuwenhuis (2009) highlights five principles for understanding the Durbin-Watson test:

1. D statistic values can only be from 0 to 4.
2. When the D statistic closes to 0, first-order autocorrelation is positive.
3. When the D statistic closes to 4, first-order autocorrelation is negative.
4. If D statistic is closer to 0, the positive first-order autocorrelation is stronger. If D statistic is closer to 4, the negative first-order autocorrelation is stronger.
5. When D statistic is closer to 2, this supports the validity of no first-order autocorrelation.

The Durbin-Watson bounds test, which is also known as the decision rules. The decision rules can be expressed as follows (Hill. et al., 2011b):

1. If  $d < d_L$ , reject the null hypothesis.
2. If  $d > d_U$ , do not reject the null hypothesis.
3. If  $d_L < d < d_U$ , the test is inclusive.

## Error Term Homoscedasticity

Homoscedasticity assumes that the variance of the error terms is constant for the range of predictor variables (Hair et al., 2006). Studenmund (2001) demonstrates that if the variances are unequal in the predictor variables heteroscedasticity is present. Heteroscedasticity leads to two consequences: first, unbiased but inefficient least squares estimators; second, biased estimates of the variances (Nieuwenhuis, 2009).



Two general methods apply for detecting heteroskedasticity. Asteriou and Hall (2007) present that the first method is the informal way, which inspects the scatter plot between two variables. If the scatter plots form a triangle-shaped pattern or a diamond-shaped pattern, then there is heteroskedasticity in the data (Asteriou. & Hall, 2007). The second method is to use appropriate tests, including the Breusch-Pagan LM test, the Glesjer LM test, the Harvey-Godfrey LM test, the Park LM test, the Goldfeld-Quandt test and White's test (Asteriou. & Hall, 2007). Asterious and Hall (2007) indicate that the null hypothesis is rejected if the p-value of the Chi-Square statistic in tests is less than the level of significance  $\alpha$  (usually  $\alpha = 0.05$ ).

## **Chapter 4**

### **Results and Discussion**

This chapter presents the results of the data analysis and discusses the research findings. The statistical assumptions of the multiple regression and simultaneous equations are examined. The three hypotheses are tested. The results are discussed that have satisfied the three research objectives.

#### **4.1 Assumptions for Regression Analysis**

##### **4.1.1 Outliers**

Outliers may bias the estimated regression parameters (Draper & Smith, 1998). For small samples (80 or less), Hair (2006) suggests that outliers are present when the standardised residuals are 2.5 or greater. Outliers with standardised residuals 2.5 or greater were omitted before conducting the regression analysis (Maddala, 2001).

##### **4.1.2 Multicollinearity**

Three models were evaluated for the level of multicollinearity. In the first model, the correlation between any pair of independent variables, except Export and Import, was less than 0.65. The correlation was 0.95 between Export and Import. The  $R^2$  – value of the model was 98%. Moreover, the value of the F-statistic was significant at the 1% level. The t-values of all independent variables were statistically significant at 1%.

In the second model, the correlation between any pair of independent variables, except Value-added in the Service Sector and Government Spending, was less than 0.80. The correlation was 0.94 between Value-added in the Service Sector and Government Spending. In addition, the value of  $R^2$  was 90.7% and the F- value was significant at the 1% level. The t-values for the independent variables: Value-added in the Service Sector, Employment Rate, Gross Domestic Investment, Primary School Enrolment Rate and Trade were significant at the 1%. Inflation Rate and Government Spending were insignificant.

In the simultaneous equations model, the correlation between any pair of independent variables was under 0.90 except the correlation between Export and Import. The values of  $R^2$  were 97.7% and 69.0% respectively. Furthermore, the independent variables: Service Sector Growth, GDP, Government Spending and Export were highly significant at the 1% level.

### **4.1.3 Linearity**

The residuals were assessed using a visual examination of the graphs in the three regression models to detect any systematic pattern. The scatter plots of the residuals were randomly distributed around the horizontal line. Therefore, the pattern for the three regression models indicates that there were no nonlinear relationships present (Hair et al., 2006).

### **4.1.4 Error Term Normality**

The Histogram and the Jarque-Bera (JB) test were applied to test the assumption of normality. The histogram graphs show the shape of the residuals in the first and the second regression models and they are distributed close to the normal distribution pattern. In addition, the values of the Jarque-Bera statistic were 11.38, 0.46 and 2.19 for the three regression models, respectively. Moreover, the probabilities of the models were 0.003, 0.796 and 0.700. The JB values of the second and third models were less than the critical value 5.99 and the p-values were larger than 0.05. Therefore, the assumption of normality in the two models was met (Hill. et al., 2011b).

The JB value in the first model was smaller than 0.05, Thadewald and Buning (2007) point out that the JB test is more powerful and the approximation is more precise with a sufficiently large sample size. Since the sample size of 18 in this study is considerably smaller, the power of the JB test for the first model is unknown.

### **4.1.5 Error Term Independence**

The assumption of independent errors was determined by the Durbin-Watson test in this study. The statistics results for the three regression models are presented in Table 4-1. The results of the Durbin – Watson test for the first and third models were greater than  $D_U$ , which indicates no autocorrelation in the residuals. The assumption of independent errors was satisfied in there two models (Nieuwenhuis, 2009). However, the Durbin – Watson test result of the second model were between  $D_L$  and  $D_U$  at both the 5% level and 1% level, Nieuwenhuis (2009) indicates that the test is said to be inconclusive. The result of the F statistic is 13.99 and significant at the 1% level for the second model. Therefore, this study accepts the second model.

**Table 4-1 The Durbin-Watson Test Statistics**

Model	Dependent Variable	Durbin-Watson Statistic	Critical Value (at 5% level)		Critical Value (at 1% level)	
			DL	DU	DL	DU
1	Value-added in the Service Sector	1.904387	0.82	1.87	0.61	1.6
2	Per Capita GDP Growth	1.524781	0.71	2.06	0.52	1.8
3	Growth of the Manufacturing/ Service Sector	2.011709	0.67	2.1	0.48	1.85

#### 4.1.6 Error Term Homoscedasticity

The Breusch-Pagan LM test was used to test the assumption of homoscedasticity error for the first and second simple linear regression models. The probability values of chi-square were 0.5206 and 0.8516 for the first and second equations respectively. The values are much larger than the critical value of 0.05, therefore, the assumption of homoscedasticity was satisfied (Asteriou. & Hall, 2007).

The following sections report the results of statistical analysis for the three regression models. In addition, a discussion of the results is provided.

## 4.2 Results Pertaining to the Research Objectives

### 4.2.1 Results Pertaining to Hypothesis 1

Hypothesis 1 was formulated to satisfy Research Objective 1. The results of the regression analysis are presented in this section.

The regression model used the Value-added in the Service Sector as the dependent variable. The independent variables are: Value-added in Manufacturing Sector, Exports, Imports and Government Spending. The results of the analysis are presented in Table 4-2.

**Table 4-2 Model 1: Multiple Regression Results Relating to Hypothesis 1**

Variable	Coefficient	Std. Error	t-Statistic
<b>MAN</b>	-1.602537***	0.219198	-7.310911
<b>X</b>	0.469118***	0.088513	5.299997
<b>IM</b>	-0.328453***	0.105266	-3.120214
<b>GOV</b>	0.770229***	0.060207	12.79299

Note: Significant at: \*\*\*1%, \*\*5% and \*10% respectively; Adjusted  $R^2$  is 0.974519;  $F=163.5432$ \*\*\*

The regression model results show the F statistic is 163.5432 and significant at the 1% level. Hence, the model can be used for examining the relationships between the Value-added in the Service Sector and the selected four independent variables. The adjusted coefficient of determination ( $R^2$ )

indicates that the regression model explains 97.4519% of the variation in Value-added in the Service Sector. In addition, the t statistics of Value-added in the Manufacturing Sector, Exports, Imports and Government Spending are significant at the 1% level. Therefore, these results support Hypothesis 1.

### Discussion Regarding Hypothesis 1

The regression analysis results show that the four independent variables are statistically significant. The beta coefficients suggest that an increase in Exports and Government Spending will positively affect Value-added in the Service Sector. However, Value-added in the Manufacturing Sector and Imports have a negative influence on Value-added in the Service Sector.

### 4.2.2 Results Pertaining to Hypothesis 2

Hypothesis 2 tests the contribution of service sector growth to per capita GDP growth in China. The statistics results are presented in Table 4-3.

**Table 4-3 Model 2: Multiple Regression Results Relating to Hypothesis 2**

Variable	Coefficient	Std. Error	t-Statistic
<b>SVA</b>	1.466877**	0.498402	2.943162
<b>EMP</b>	4.632973***	1.166528	3.971592
<b>INV/GDP</b>	0.604170***	0.188844	3.199305
<b>SCH</b>	3.541137**	1.144893	3.092984
<b>TRD</b>	0.150132***	0.032453	4.626087
<b>IFN</b>	0.026028	0.064128	0.405879
<b>GOV</b>	-0.801448	0.479683	-1.670787

Note: Significant at: \*\*\*1%, \*\*5% and \*10% respectively; Adjusted R<sup>2</sup> is 0.842498; F=13.99072\*\*\*

The result of the F statistic is 13.99072, significant at the 1% level. Therefore, the regression model is useful in predicting the relationship between Per Capita GDP Growth and Value-added in the Service Sector. The adjusted coefficient of determination shows that the regression model explains 84.2498% of the variation in Per Capita GDP Growth. Additionally, three independent variables for Model 2 are significant at the 1% level of significance; two independent variables are significant at the 5% level of significance. The t statistics of Value-added in the Service Sector is significant at the 5% level. Therefore, Hypothesis 2 is supported.

### Discussion Regarding Hypothesis 2

There are five significant independent variables and two insignificant independent variables observed when examining the growth of per capita GDP in China. The five significant independent variables are: Value-added in the Service Sector, Employment Rate, Gross Domestic Investment, Primary School Enrolment Rate, and Trade. The beta coefficients indicate that the variables have a

positive influence on the Growth of Per Capita GDP. However, the effect of Inflation Rate and Government Spending on the Growth of Per Capita GDP is insignificant.

### 4.2.3 Results Pertaining to Hypothesis 3

Hypothesis 3 tests the spillover effects from the service sector on the manufacturing sector and vice versa. The estimation results of the simultaneous equations are in Table 4-4.

Table 4-4 Model 3: Simultaneous Equations Results Relating to Hypothesis 3

Variable	Coefficient	Std. Error	t-Statistic
<b>MANGTH(-1)</b>	-0.087980	0.061485	-1.430907
<b>SER</b>	-0.650411***	0.175162	-3.713207
<b>GDP</b>	1.837234***	0.221434	8.296981
<b>GOV</b>	-0.137305***	0.034876	-3.936982
<b>SER(-1)</b>	-0.168837	0.286919	-0.588446
<b>MANGTH</b>	-0.096492	0.428287	-0.225297
<b>X</b>	0.663910**	0.243090	2.731127
<b>IM</b>	-0.465939	0.306097	-1.522195
<b>GOV</b>	-0.243970	0.171647	-1.421346

Note: Significant at: \*\*\*1%, \*\*5% and \*10% respectively; Adjusted R<sup>2</sup> are 0.969946 and 0.549443.

The adjusted R<sup>2</sup> explains 96.99% and 54.94% of the variation in Manufacturing Sector Growth and Service Sector Growth respectively. The regression analysis shows that the Service Sector, GDP and Government Spending are statistically significant at the 1% level. Moreover, Export is statistically significant at the 5% level. In addition, the regression results suggest that Manufacturing Sector Growth is insignificant to Service Sector Growth. Also, the spillover effects from the service sector to the manufacturing sector and vice versa are not supported in the model. Therefore, Hypothesis 3 is not supported.

### Discussion Regarding Hypothesis 3

The results of simultaneous equations show that Service Sector Growth, GDP, Government Spending and Exports are statistically significant. The beta coefficients suggest that an increase in Real Output will positively affect Manufacturing Sector Growth. Moreover, the variable of Exports has a positive effect on Manufacturing Sector Growth. However, Service Sector Growth and Government Spending did not positively affect the Manufacturing Sector Growth.

## **Chapter 5**

### **Conclusions and Implications**

First, this chapter provides a summary of the current study. Secondly, the findings are discussed. Next, the theoretical and managerial implications are explained. Finally, the limitations and avenues for future research are discussed.

#### **5.1 Summary of This Study**

The literature review presented in Chapter Two suggests that the research on estimating the relationship between the service sector and economic growth is scarce. Therefore, Gani and Clemes's (2010) study on the service sector in the Pacific Island countries is the foundation for this study, including three equations in the authors' research. Gani and Clemes (2010) proposed that first, the service sector is measured by the growth of the manufacturing sector, real output (GDP), growth of exports and imports, and government spending. Second, the growth of per capita GDP is measured by the value-added in the service sector, labour force growth rate, gross domestic investment, per capita GDP, primary school enrolment, rate of inflation, trade share and government spending. Third, the manufacturing sector is measured by lagged manufacturing sector, GDP, growth of the service sector, growth of exports and imports, and government spending. However, the literature review also suggests that China and the Pacific Island countries have many differences. The required adjustments are made according to China's national situation.

In order to achieve a better understanding of China's service sector; that is, the relationships between the service sector and economic growth in China, and the spillover effects between the service sector and the manufacturing sector in China, three research objectives were stated:

1. To determine the main factors contributing to the expansion of the service sector in China.
2. To investigate the contribution of the service sector to China's economic growth.
3. To discover the spillover effects from the service sector to the manufacturing sector and vice versa.

The three research objectives were addressed by testing three hypotheses, developed in Chapter Three. The following sections discuss the results with regard to the three research objectives.

## **5.2 Conclusions Regarding Research Objective 1**

Identifying the positive contributors to the expansion of services in China was the focus of Research Objective 1. This goal was accomplished; as exports and government spending have been identified as positively affecting the growth of services in China. The findings are supported by Gani and Clemes's (2010) study on the Pacific Island countries, where exports and government spending were identified as positively influencing growth of services. Further, that Governments positively and significantly affect the growth of services is also supported by Gani and Clemes's (2002) study in the ASEAN countries.

However, due to several differences between China and the Pacific Island countries in Gani and Clemes's (2010) studies, the current study has several new findings. The following sections discuss the results of each variable related to Research Objective 1.

### **5.2.1 Value-added in the Manufacturing Sector**

In this study, value-added in the manufacturing sector has been identified as negatively affecting value-added in the service sector. This result is not supported by the findings in Gani and Clemes's (2010) study on the Pacific Island countries, where value-added in the manufacturing sector was positive but statistically insignificant. This result indicates that the expansion of the service sector does not heavily rely on the manufacturing sector in the selected Pacific Island countries (Gani & Clemes, 2010). The differences between the two converse results can be explained by the uniqueness of China's economic structure. China's government has concentrated on developing and promoting diversity in the manufacturing sector since the "reform and opening-up" policy in 1978 (Liu & Li, 2012). The author also point out with China's economic policy support, the manufacturing sector accounts for the highest value-added among the three sectors during the last three decades. Felipe and Estrada (2008) point out that the share of the manufacturing sector to GDP is close to 50% in China, which is much higher than many countries in the Asia Pacific region (See Table 5-1).



**Table 5-1 Comparison of Value-added in the Manufacturing Sector to GDP (%) in China and Selected Countries**

Country Name	1995	2000	2005	2010	2012
China	47.2	45.9	47.4	46.7	N/A
Fiji	22.8	21.6	19.2	21.2	N/A
Papua New Guinea	33.3	40.7	44.3	45.1	44.2
Tonga	21.6	20.7	19	20	21.1
Vanuatu	11.5	12.2	8.5	13.3	N/A
India	27.7	26.2	28.1	27.6	25.8
Singapore	33.3	34.5	31.6	27.5	26.7
Philippines	32.1	34.5	33.8	32.6	31.1
Japan	33	31.1	28.1	27.5	N/A

Source: Asian Development Bank, Key Indicators for Asia and the Pacific 2013.

The development of China's service sector started relatively late and the pace of development is lower than the world average level (Zheng et al., 2011). China's GDP in 2011 shows that after the United States, the Chinese economy is the second largest in the world. However, the World Bank data (2012) shows that in recent years, the share of the service sector to China's GDP is much lower, when compared to the share of the service sector to GDP in the United States (See Table 5-2). China's economic policy has focused heavily on the development of the manufacturing sector. Therefore, China's economic policy has led to the development gap between the rapid growth of the manufacturing sector and the slower growth of the service sector (Jefferson, Hu, & Jian, 2006).

Sheng and Kuo (2012) indicate that the trend in recent years for the service industries is from labour-intensive to technology-intensive, this transition requires a large number of professional solid, high-quality technical and management personnel. However, Pan and Lv (2013) indicate that labour-intensive activities are the major comparative advantage for China's service sector, which is also true for the manufacturing sector. The authors also point out that the manufacturing sector finds it easier to attract a labour force due to its having lower requirements for knowledge and high quality technical skills. Zheng et al., (2011) emphasise that buoyancy in the manufacturing sector may also cause wages in the service industries to increase due to a scarcity of skilled service employees , leading to increased costs in the service sector. The resulting higher labour costs in the people based service sector leads to increases in service sector prices, a possible reduction in service sector quality and a deterioration of financial status (Zheng et al., 2011).

**Table 5-2 Value-added in the Service Sector; A Percentage GDP Comparison between China and the United States**

Country Name	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
China	<b>39.02</b>	<b>40.46</b>	<b>41.47</b>	<b>41.23</b>	<b>40.38</b>	<b>40.51</b>	<b>40.94</b>	<b>41.89</b>	<b>41.82</b>	<b>43.43</b>	<b>43.19</b>	<b>43.37</b>
United States	<b>75.37</b>	<b>76.52</b>	<b>77.19</b>	<b>77.23</b>	<b>76.62</b>	<b>76.60</b>	<b>76.72</b>	<b>76.88</b>	<b>77.65</b>	<b>79.30</b>	<b>79.02</b>	<b>78.60</b>

Source: The World Bank, 2013

## 5.2.2 Growth of Imports and Exports

The results of this study show that the import variable has a negative influence on the expansion of services in China. However, this finding is not supported by Gani and Clemes's (2010) study on the Pacific Island countries, where imports positively affect services in the selected four countries. Compared to the Pacific Island countries, China is an export-orientated country, particularly in the exporting of manufactured products (Patten, 2010). The quantity of manufactured goods exported is almost ten times the quantity of services exported from China from 2005 to 2012 (Davies, 2013) (See Table 5-3). In addition, China's government has very strict regulations on foreign investment into China's markets (Hapsari & MacLaren, 2012). After China's accession to the WTO in December 2001, China's government committed to the General Agreement in Trade in Services (GATS), which encouraged services liberalization in China (Kanungo, 2005). Since 2001, the government has implemented a series of measures to streamline and decentralise foreign direct investment administration and to strengthen enforcement (Davies, 2013). However, the development of China's service sector has not been proceeding faultlessly; importing numerous foreign based services inhibits the expansion of domestic service sector.

**Table 5-3 Exports of Goods and Exports of Services (Billion \$US)**

	2005	2006	2007	2008	2009	2010	2011	2012
Exports of Goods	<b>762</b>	<b>968.9</b>	<b>1 220.1</b>	<b>1 430.7</b>	<b>1 201.6</b>	<b>1 577.8</b>	<b>1 898.4</b>	<b>NA</b>
Exports of Services	<b>74.4</b>	<b>92</b>	<b>122.2</b>	<b>147.1</b>	<b>129.5</b>	<b>162.2</b>	<b>186.1</b>	<b>191.5</b>

Source: OECD, Country Statistical Profile: China, 2013

The positive relationship between Exports and Value-added in the Service Sector was confirmed in this study. Gani and Clemes's (2010) study also supports this finding. The result suggests that exports are attracted into a higher productive service sector. OECD data (2013a) shows that the amount of exports of services in China has been increasing, reaching US\$191.5 billion in 2012. Additionally, increased exports may positively influence value-added growth in the service sector and may reflect less distortionary policies (Gani & Clemes, 2010). Ianchovichina and Walmsley (2005) believe that WTO accession has provided greater opportunities for exporters of services in China. Soo (2012)

indicates that the service sector liberalisation policy is a prime driver of China's services export growth.

### **5.2.3 Government Spending**

Government spending is identified as positively affecting the growth of value-added in the service sector in China, which is supported by Gani and Clemes's (2002, 2010) studies on the ASEAN countries and the Pacific Island countries. The role of government has been considered as a powerful element to in the expansion of the service sector and the result confirms that government spending positively contributes to service sector development in China. Rolf and Audun's (2006) study on Norway also supports the finding that role of government has an important effect on the expansion of the service sector. In particular, the effect of government is reflected in financial services in China. For example, Chen and Steve (2002) point out that financial services have had an important influence on China's post-1978 economic reforms. China's four major state-owned commercial banks: Industrial & Commercial Bank of China, China Construction Bank, Agricultural Bank of China, and Bank of China, were the only service-related organizations among the Global Top 50 companies in 2012 (Global Finance, 2012).

## **5.3 Conclusions Regarding Research Objective 2**

Research Objective Two was satisfied. The positive relationship between value-added in the service sector and per capita GDP was identified. Value-added in the Service Sector explains 84.2% of the variation in Per Capita GDP Growth (See Section 4.2.2), supporting the claim that the growth of the service sector contributes to the growth of per capita GDP. The finding is supported by studies on many developed and developing countries (Buera & Kaboski, 2012; Maroto-Sánchez, 2012; Rajiv et al., 2007; Shepherd & Pasadilla, 2012).

### **5.3.1 Employment**

Employment was found in this study to have a positive influence on Per Capita GDP Growth. The finding is supported by Cai, Wang and Zhang's (2010) study on China where employment has a positive influence on aggregate growth. The result suggests that an increase in the number of people employed can strengthen production and promote China's economic growth.

### **5.3.2 Gross Domestic Investment**

The result for Gross Domestic Investment indicates that gross domestic investment positively contributes to per capita GDP growth in China. This finding suggests that increased gross domestic investment has a favourable effect on per capita GDP. This is supported by Gani and Clemes's (2010) study which shows that gross domestic investment is an important factor for per capita GDP growth.

In an earlier study, Gani and Clemes (2002) also identified that gross domestic investment is usually found to be positive and statistically significant and contributes to per capita GDP.

### **5.3.3 Primary School Enrolment**

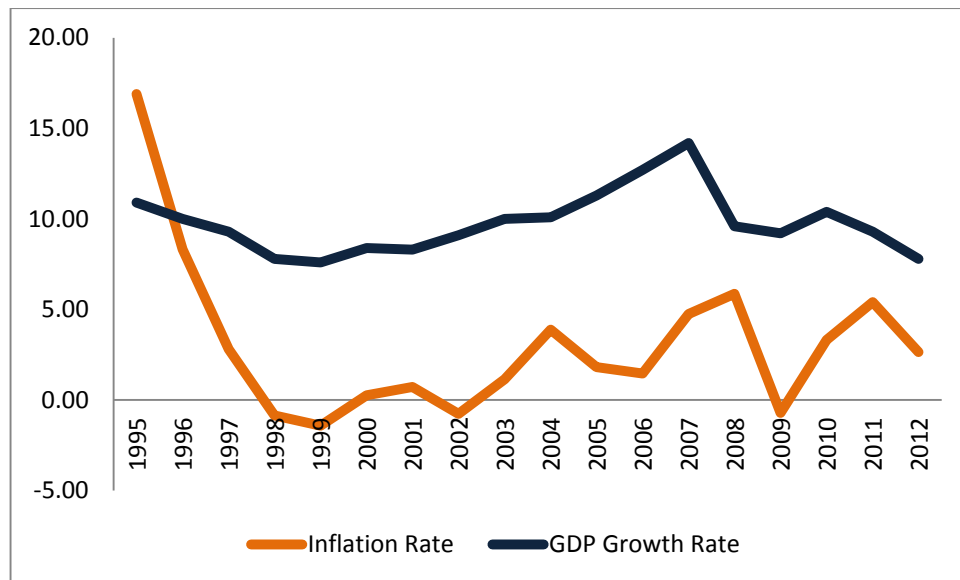
Primary School Enrolment was identified in this study as being statistically significant and positive on Per Capita GDP Growth. The result indicates that a higher primary education enrolment rate increases China's per capita GDP. However, Gani and Clemes's (2002, 2010) studies on the ASEAN and Pacific Island countries suggest that the primary school enrolment rate was positive but insignificant in the studied countries. China's government has implemented a nine-year compulsory education system reform in 1978: six years of primary education and three years of junior high school (Sun, 2010). Sun's (2010) study on China's education system points out that in terms of the huge population in China, primary school education has a significant influence on economic development. Additionally, Song's (2012) results illustrate that the popularization of primary education has significantly impacted on poverty reduction in China.

### **5.3.4 Trade**

This study found that the trade share also positively and significantly affects per capita GDP growth in China. This result is supported by Gani and Clemes's (2010) study which found that the trade share has a positive and significant impact on economic growth in the Pacific Island countries. In general, a large share of trade positively influences GDP growth.

### **5.3.5 Inflation Rate**

The study found that Inflation Rate has a positive but insignificant influence on Per Capita GDP Growth. This result is not consistent with Gani and Clemes's (2002, 2010) studies which found that the inflation rate significantly and negatively affected both the ASEAN countries and the Pacific Island countries. The result in this study indicates that the low inflation rate does not impact on China's per capita GDP growth. Hussain and Malik (2011) findings support this result, in that the inflation rate is positively related to economic growth in Pakistan, which is also a developing country. Hwang and Wu's (2011) study on China supports the finding that a low inflation rate can be helpful for economic development. World Bank data (2012) shows that the inflation rate has been lower than the GDP growth rate in China during the last decade (See Figure 5-1).



**Figure 5-1 The Annual Changes in the Inflation Rate and GDP Growth Rate from 1995 to 2012**

### 5.3.6 Government Spending

Government Spending was identified as having a negative but insignificant influence on Per Capita GDP Growth. The result is supported by the recent studies on the relationship between the government spending and economic growth in Pakistan (Nabila, Parvez, & Hafeez, 2011) and in Kenya (Muthui, George, James, & Thuku, 2013). Butkiewicz and Yanikkaya (2011) indicate that developing countries should limit their government spending in order to stimulate economic growth.

## 5.4 Conclusions Regarding Research Objective 3

Research Objective Three was satisfied. The results of the simultaneous equations reveal a negative and statistically significant effect of Service Sector Growth on Manufacturing Sector Growth, but a negative and insignificant effect of Manufacturing Sector Growth on Service Sector Growth. The findings indicate that positive spillover effects are not found from Service Sector Growth to Manufacturing Sector Growth and vice versa in China. Gani and Clemes's (2002) study confirmed a one-way influence where the service sector had a positive and statistically significant effect on the manufacturing sector in the ASEAN countries. Further, Gani and Clemes's (2010) study confirmed a positive but statistically insignificant spillover effect between the service sector and the manufacturing sector in the Pacific Island countries. However, Ray (2013) found that there is no positive influence from the growth in the service sector to the growth in the manufacturing sector in India. The author concludes that the rapid growth of the manufacturing sector can be primarily attributed to the reforms targeted at the manufacturing sector.

Kuusisto, Kuusisto and Yli-Viitala (2012) argue that the development of the service sector needs more time and other resources to be achieved. Moreover, inefficient management systems may cause

over-production in the manufacturing sector leading to under-production in the service sector in China (Wang, 2009). Currently, the service sector competes for resources with the manufacturing sector, such as skilled labour and financial support (Pan & Lv, 2013). Therefore, spillover effects may occur from the service sector to the manufacturing sector and vice versa in the future when China's service sector attracts more skilled labour and becomes more fully developed.

## **5.5 Contributions**

Satisfying the research objectives and examining the spillover effects between the service sector and the manufacturing sector and vice versa in this study makes several contributions to the economic literature on the service sector both theoretically and politically.

### **5.5.1 Theoretical Implications**

This study empirically tests and adjusts Gani and Clemes's (2010) three equations for measuring the relationships between the Chinese service sector and: economic growth, the spillover effects from the service sector to the manufacturing sector, and vice versa.

The results of this study confirm that Growth of Exports and Government Spending are two significant factors that make a major contribution to Value-added in the Service Sector in China. Moreover, the Growth of Value-added in the Service Sector has a significant and favourable effect on China's economic growth. Lastly, no positive spillover effects were found between Growth of the Service Sector and Growth of the Manufacturing Sector and vice versa during the selected data period.

Further, this study used simultaneous equations to measure the spillover effects of a two-way influence between the service sector and the manufacturing sector. To date, this is the first study conducted on China that has used simultaneous equations to measure these effects and it provides a theoretical framework for future research.

### **5.5.2 Political Implications**

In relation to Research Objective 1, the results indicate that Growth of Exports and Government Spending positively and significantly influence Value-added in the Service Sector. The findings suggest that China's government should give greater support to developing the service sector, such as investment incentives and government financial support. However, Value-added in the Manufacturing Sector and Growth of Imports negatively affect Value-added in the Service Sector. This finding suggests that China's government should rationalise allocation of resources to facilitate the equitable development in both the service sector and the manufacturing sector. Moreover, China's government should also promote technological innovation to improve efficiency and

productivity of domestic services, which will enhance the competitiveness of China's services among the international service-based organizations.

In relation to Research Objective 2, the results identified that Value-added in the Service Sector contributes to China's economic growth positively and significantly. The finding suggests that the service sector should be considered as equally important as the manufacturing sector in China's economic development. Additionally, this study also confirms the positive relationships between Growth of Per Capita GDP; and Employment, Gross Domestic Investment, Primary School Enrolment, and Trade. China's government could strengthen the advantages of these contributors. For example, the labour force needs to be trained so they acquire the relevant skills required in order to increase productivity.

In relation to Research Objective 3, positive spillover effects were not found from the service sector to the manufacturing sector and vice versa. These findings indicate that the existing inter-connection between the service sector and the manufacturing sector should be investigated further by the government. The government should recognize the key part the service sector plays in the manufacture of physical goods. Manufacturing-related companies should also recognise and exploit the importance of the service sector in manufacturing physical goods.

The government may also want to encourage China's service sector to be more engaged in the global service market. Exporting more services normally results in an increase in demand for labour and this had acted to lower the unemployment rates in many countries.

## **5.6 Limitations**

Although this study contributes to the theoretical and political areas, there are two main limitations of the study that should be considered.

First, this study used secondary data from two databases: World Bank and Asian Development Bank. Generally, there are some factors to cause errors in the secondary data, such as different statistical methods.

Second, this exploratory study is the first one that has empirically examined the relationships between the service sector and the main factors: the service sector and China's economic growth; and the service sector and the manufacturing sector in China. However, other potential important factors such as the growth of FDI were not included in the econometric analysis.

## **5.7 Avenues for Future Research**

A number of avenues for future research are presented as follows:

First, future research may explore the other factors that were not included in this study but may also influence the growth of the service sector and value-added growth in the service sector in China.

Second, future research may examine the relationship between service sector growth and agricultural growth in China.

Third, future research may use the simultaneous equations developed in this study to examine the spillover effects from the service sector to the manufacturing sector and vice versa in other developing or developed countries.



## References

- Abdul, W., & Najia, Y. (2010). Effects of Financial Sector's Development and Financial Sector's Efficiency on Economic Growth: Empirical Evidence from Developing and Developed Countries. *International Journal of Economic Perspectives*, 4(2), 449-458.
- ADB, A. D. B. (2013a). Basic Statistics 2013. from Asian Development Bank <http://www.adb.org/sites/default/files/pub/2013/basic-statistics-2013.pdf>
- ADB, A. D. B. (2013b). *Key Indicators for Asia and the Pacific 2013: Asia's Economic Transformation: Where to, How, and How Fast?* Retrieved from [http://www.adb.org/sites/default/files/pub/2013/ki2013\\_0.pdf](http://www.adb.org/sites/default/files/pub/2013/ki2013_0.pdf)
- Anderson, D. R., Sweeney, D. J., & Williams, T. A. (2011). *Statistics for business and economics* (11th ed.): South-Western Cengage Learning.
- Anwar, S., & Sam, C. Y. (2008). Services Sector Growth in Singapore. *Singapore Management Review*, 30(2), 19-33.
- Arora, V., & Vamvakidis, A. (2011). China's Economic Growth: International Spillovers. *China & World Economy*, 19(5), 31-46. doi:10.1111/j.1749-124X.2011.01257.x
- Asteriou., D., & Hall, S. G. (2007). *Applied Econometrics A Modern Approach* New York: Palgrave Macmillan.
- Banister, J. (2005). Manufacturing employment in China. *Monthly Labor Review*, 128(7), 11-29.
- Baumol, W. J. (1967). Macroeconomics of Unbalanced Growth: The Anatomy of Urban Crisis. *The American Economic Review*, 57(3), 415-426. doi:10.2307/1812111
- Biege, S., Jaeger, A., & Buschak, D. (2012). New Service Development in Manufacturing Companies- Insights from the German Manufacturing Sector. *Journal of Applied Management and Entrepreneurship*, 17(3), 4-19.
- Buera, F. J., & Kaboski, J. P. (2012). The Rise of the Service Economy. *The American Economic Review*, 102(6), 2540-2569.
- Butkiewicz, J. L., & Yanikkaya, H. (2011). Institutions and The Impact of Government Spending on Growth. *Journal of Applied Economics*, 14(2), 319-341.
- Cai, F., Wang, D., & Zhang, H. (2010). Employment Effectiveness of China's Economic Stimulus Package. *China & World Economy*, 18(1), 33-46. doi:10.1111/j.1749-124X.2010.01179.x
- Chadee, D. D. (2002). Foreign ownership structure of service equity joint ventures in China. *International Journal of Service Industry Management*, 13(2), 181-201.
- Chamberlin, G., & Yueh, L. (2011). China and the UK. *Economic & Labour Market Review*, 5(5), 26-45.
- Chan, T.-w. G., & Zhao, S. X. B. (2012). Advanced producer services industries in Hong Kong and Shenzhen: Struggles towards integration *Asia Pacific Viewpoint*, 53(1), 70-85. doi:10.1111/j.1467-8373.2012.01476.x
- Chen, J., & Steve, T. (2002). WTO and China's Financial Services Sector [Article]. *Journal of Contemporary China*, 11(33), 673-682. doi:10.1080/1067056022000008869
- Choe, J. I. (2003). Do Foreign Direct Investment and Gross Domestic Investment Promote Economic Growth? [Article]. *Review of Development Economics*, 7(1), 44-57.
- Clemes, M., Mollenkopf, D., & Burn, D. (2000). An investigation of marketing problems across service typologies. *The Journal of Services Marketing*, 14(7), 573-594.
- Combes, P.-P. (2000). Economic Structure and Local Growth: France, 1984-1993. *Journal of Urban Economics*, 47(3), 329-355.
- Cui, Y., & Shen, F. (2011). Relationship of International Trade in Financial Services and Economic Growth: The Case of China. *Asian Social Science*, 7(9), 220-225.
- Dasgupta, S., & Singh, A. (2005). Will Services be the New Engine of Indian Economic Growth? *Development and Change*, 36(6), 1035-1057. doi:10.1111/j.0012-155X.2005.00449.x
- Davies, K. (2013). China Investment Policy: An Update. *OECD Working Papers on International Investment*.
- Delorme Jr, C. D., Klein, P. G., Kamerschen, D. R., & Voeks, L. F. (2003). Structure, conduct and performance: a simultaneous equations approach [Article]. *Applied Economics*, 35(1), 13. doi:10.1080/00036840210147149

- Ding, C. (2012). Transport Development, Regional Concentration and Economic Growth. *Urban Studies*, 50(2), 312-328. doi:10.1177/0042098012450479
- Dorak, M. T. (2007). *Common Concepts in Statistics*. Retrieved from <http://www.dorak.info/mtd/glosstat.html>
- Draper, N. R., & Smith, H. (1998). *Applied Regression Analysis* (3rd ed.). New York, the United States: John Wiley & Sons, Inc.
- Economic and Social Commission for Asia and the Pacific, E. (2012). Statistical Yearbook for Asia and the Pacific 2012. from United Nations Publication <http://www.unescap.org/stat/data/syb2012/index.asp>
- Edmonds, C., La Croix, S., & Li, Y. (2008). China trade: Busting gravity's bounds. *Journal of Asian Economics*, 19(5-6), 455-466.
- El Khoury, A. C., & Savvides, A. (2006). Openness in services trade and economic growth. *Economics Letters*, 92(2), 277-283.
- Fang, T., Gunterberg, C., & Larsson, E. (2010). Sourcing in an Increasingly Expensive China: Four Swedish Cases. *Journal of Business Ethics*, 97(1), 119-138.
- Felipe, J., & Estrada, G. (2008). Benchmarking developing Asia's manufacturing sector. *International Journal of Development Issues*, 7(2), 97-119.
- Fernandes, A. M. (2009). Structure and performance of the service sector in transition economies. *Economics of Transition*, 17(3), 467-501. doi:10.1111/j.1468-0351.2009.00355.x
- Field, A. P. (2009). *Discovering statistics using SPSS : and sex and drugs and rock 'n' roll* (3rd ed.). Los Angeles ; London SAGE Publication Ltd.
- Fischer, S. (1993). The Role of Macroeconomic Factors in Growth. *Journal of Monetary Economics*, 32(3), 485-512.
- Fu, T.-W., & Lin, M. (2012). Interest rate, unemployment rate and China's exchange rate regime. *International Journal of Emerging Markets*, 7(2), 177-190.
- Fuentea, A. d. I. (2013). *A Mixed Splicing Procedure for Economic Time Series*. Retrieved 01/08/2013, 2013, from [http://serviciodeestudios.bbva.com/KETD/ketd/bin/ing/publi/global/novedades/detalle/Nov e348\\_220989.jsp?id=tcm:348-183651-64](http://serviciodeestudios.bbva.com/KETD/ketd/bin/ing/publi/global/novedades/detalle/Nov e348_220989.jsp?id=tcm:348-183651-64)
- Gani, A., & Clemes, M. D. (2002). Services and economic growth in ASEAN economies. *ASEAN Economic Bulletin*, 19(2), 155-169.
- Gani, A., & Clemes, M. D. (2010). Services and economic growth in Pacific Island countries. *International Journal of Development Issues*, 9(2), 113-130.
- Gebauer, H., & Fischer, T. (2009). Exploring service needs in the Chinese manufacturing industry. *Chinese Management Studies*, 3(2), 143-154.
- Gershuny, J., & Miles, I. (1983). *The New Service Economy*. London: Frances Pinter.
- Global Finance. (2012). World's Largest Companies. <http://www.gfmag.com/tools/global-database/economic-data/11935-largest-companies.html#axzz2ddBQPvdR>
- Guo, X., Sun, Y., Wang, N., Peng, Z., & Yan, Z. (2013). The dark side of elderly acceptance of preventive mobile health services in China. *Electronic Markets*, 23(1), 49-61.
- Hair, J., Anderson, R. E., Tatham, R. L., & Black, W. C. (1998). *Multivariate Data Analysis* (5th ed.). Upper Saddle River, New Jersey, the United States
- Hair, J., Black, W. C., Barry, J. B., Anderson, R. E., & Tatham, R. L. (2006). *Multivariate Data Analysis* (6th ed.). Upper Saddle River, New Jersey, the United States: Pearson Education, Inc.,.
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis: A global perspective* (7th ed ed.). New Jersey: Upper Saddle River.
- Hapsari, I. M., & MacLaren, D. (2012). The Growth Effects of Services Trade Liberalization in ASEAN. *ASEAN Economic Bulletin*, 29(2), 85-100.
- Hicks, J., Basu, P. K., & Sappey, R. B. (2010). Ageing, Labour Force Participation and Education: Comparing the Implications for Economic Growth in China and India. *Economic Papers: A journal of applied economics and policy*, 29(3), 333-341. doi:10.1111/j.1759-3441.2010.00073.x
- Hill, R. J., & Fox, K. J. (1997). Splicing Index Numbers. *Journal of Business & Economic Statistics*, 15(3), 387-389. doi:10.2307/1392342

- Hill, R. C., Griffiths., W. E., & Lim, G. C., &. (2011a). *Chapter 11 Simultaneous Equations Models* [Principles of Econometrics ]. New Jersey, the United States of America: John Wiley & Sons.
- Hill, R. C., Griffiths., W. E., & Lim, G. C. (2011b). *Principles of Econometrics* New Jersey, the United States of America: John Wiley & Sons.
- Hussain, S., & Malik, S. (2011). Inflation and Economic Growth: Evidence from Pakistan. *International Journal of Economics and Finance*, 3(5), 262-276.
- Hussin, F., & Yik, S. Y. (2012). The Contribution of Economic Sectors to Economic Growth: The Cases of China and India. *Research in Applied Economics*, 4(4), 38-53.
- Hwang, J.-T., & Wu, M.-J. (2011). Inflation and Economic Growth in China: An Empirical Analysis. *China & World Economy*, 19(5), 67-84. doi:10.1111/j.1749-124X.2011.01259.x
- Ianchovichina, E., & Walmsley, T. (2005). Impact of China's WTO Accession on East Asia. *Contemporary Economic Policy*, 23(2), 261-277.
- Iqbal, N., & Nawaz, S. (2009). Investment, inflation and economic growth nexus [Report]. *Pakistan Development Review*, 48, 863+.
- Jansson, J. O. (2006). *The Economics of Services Development and Policy*. Cheltenham: Edward Elgar Publishing Limited.
- Jayathileke, P. M. B., & Rathnayake, R. M. K. T. (2013). Testing the Link between Inflation and Economic Growth: Evidence from Asia. *Modern Economy*, 4(2), 87-92.
- Jefferson, G. H., Hu, A. G. Z., & Jian, S. (2006). The Sources and Sustainability of China's Economic Growth [Article]. *Brookings Papers on Economic Activity*(2), 1-47.
- Kanungo, A. K. (2005). Service Sector in China After its Accession to the WTO. *International Studies* 42(3-4), 229-345. doi:10.1177/002088170504200309
- Keller, K. R. I. (2006). Investment in Primary, Secondary, and Higher Education and the Effects on Economic Growth. *Contemporary Economic Policy*, 24(1), 18-34.
- Kuusisto, J., Kuusisto, A., & Yli-Viitala, P. (2012). Service development tools in action. *The Service Industries Journal*, 33(3-4), 352-365. doi:10.1080/02642069.2013.747520
- Lean, H. H., & Tan, B. W. (2011). Linkages between Foreign Direct Investment, Domestic Investment and Economic Growth in Malaysia. *Journal of Economic Cooperation & Development*, 32(4), 75-95.
- Li, H., & Haynes, K. E. (2011). Economic Structure and Regional Disparity in China: Beyond the Kuznets Transition. *International Regional Science Review*, 34(2), 157-190. doi:10.1177/0160017610386480
- Li, J. H. (2012). Service innovation research in China: past, present and future. *Journal of Science and Technology Policy in China*, 3(1), 68-91.
- Lim, C., & Lee, C. (2002). An Examination of Labor Productivity Growth and Structural Changes in the Singapore Labor Force [Article]. *Asian Economic Journal*, 16(3), 267-283.
- Lin, J. Y. (2011). China and the global economy 1. *China Economic Journal*, 4(1), 1-14. doi:10.1080/17538963.2011.609612
- Liu, T., & Li, K.-W. (2012). Analyzing China's productivity growth: Evidence from manufacturing industries. *Economic Systems*, 36(4), 531-551.
- Lovelock, C. H., Patterson, P. G., & Wirtz, J. (2011). *Services Marketing: An Asia-Pacific and Australian Perspective* (5th ed.). Frenchs Forest: Person Australia.
- Lu, M., & Gao, H. (2011). Labour market transition, income inequality and economic growth in China. *International Labour Review*, 150(1/2), 101-126.
- Maddala, G. S. (2001). *Introduction to Econometrics* (3rd ed.). West Sussex, England: John Wiley & Sons Ltd.
- Marattin, L., & Salotti, S. (2011). Productivity and per capita GDP growth: The role of the forgotten factors. *Economic Modelling*, 28(3), 1219-1225.
- Maroto-Sánchez, A. (2012). Productivity in the services sector: conventional and current explanations [Article]. *Service Industries Journal*, 32(5), 719-746. doi:10.1080/02642069.2010.531266
- McKee, D. L. (2007). Services, growth poles and advanced economies. *Service Business*, 8. doi:10.1007/s11628-007-0026-y

- Meng, Q., Xu, L., Zhang, Y., Qian, J., Cai, M., Xin, Y., . . . Barber, S. L. (2012). Trends in access to health services and financial protection in China between 2003 and 2011: a cross-sectional study. *The Lancet*, 379(9818), 805-814.
- Mizuno, M. (2005). Development of the Service Sector in Japan and Its Implications for the Economy. *Pacific Economic Review*, 10(4), 485-492.
- Muthui, J. N., George, K., James, M., & Thuku, G. K. (2013). The Impact of Public Expenditure Components on Economic Growth in Kenya 1964-2011. *International Journal of Business and Social Science*, 4(4).
- Nabila, A., Parvez, A., & Hafeez, R. (2011). Impact of Government Spending in Social Sectors on Economic Growth: A Case Study of Pakistan [Case Study]. *Journal of Business & Economics*, 3, 214-234.
- Narayan, P. (2008). Is Asian per capita GDP Panel Stationary? *Empirical Economics*, 34(3), 439-449. doi:10.1007/s00181-007-0129-2
- Narayan, P. K., Narayan, S., & Smyth, R. (2009). Understanding the inflation–output nexus for China. *China Economic Review*, 20(1), 82-90.
- Navarro, J. L., & Camacho, J. A. (2001). Productivity of the Service Sector: A Regional Perspective. *The Service Industries Journal*, 21(1), 123-148.
- Nayyar, G. (2012). Inside the black box of services: evidence from India. *Cambridge Journal of Economics*, 37(1), 143-170. doi:10.1093/cje/bes039
- NBS, N. B. o. S. o. C. (2012). *China Statistical Yearbook 2012*. Beijing, China: China Statistics Press. Retrieved from <http://www.stats.gov.cn/tjsj/ndsj/2012/indexeh.htm>
- Nieuwenhuis, G. (2009). *Statistical Methods for Business and Economics*. Berkshire, UK: McGraw-Hill Education.
- Nissana, E., Galindob, M.-A., & Méndezc, M. T. (2011). The future of services in a globalized economy. *The Service Industries Journal* 31(1), 59-78. doi:10.1080/02642069.2010.485195
- Noland, M., Park, D., & Estrada, G. B. (2012). Developing the Services Sector as Engine of Growth for Asia: An Overview. *Working Paper*, 12(18).
- OECD. (2005). *Growth in Services - Fostering Employment, Productivity and Innovation*: OECD. Retrieved from [http://www.oecd-ilibrary.org/economics/growth-in-services\\_9789264064577-en](http://www.oecd-ilibrary.org/economics/growth-in-services_9789264064577-en)
- OECD. (2013a). Country statistical profile: China (Publication no. 10.1787/20752288). Retrieved from [http://www.oecd-ilibrary.org/economics/country-statistical-profile-china\\_csp-chn-table-en](http://www.oecd-ilibrary.org/economics/country-statistical-profile-china_csp-chn-table-en)
- OECD. (2013b). Online OECD Employment database from OECD <http://www.oecd.org/employment/emp/onlineoecdemploymentdatabase.htm#box>
- Pan, C., & Lv, J. (2013). The Development of China's Service Trade in Recent Years. *Journal of Service Science and Management*, 6(2), 191-195. doi:10.4236/jssm.2013.62020
- Pant, B. D. (2008). *Improving Services Sector Statistics*: Asian Development Bank. Retrieved from <http://www.adb.org/sites/default/files/projdocs/2008/37005-PRC-TCR.pdf>
- Park, S.-H., & Chan, K. S. (1989). A cross-country input-output analysis of intersectoral relationships between manufacturing and services and their employment implications. *World Development*, 17(2), 199-212.
- Patten, C. (2010). The Rise of China. *The RUSI Journal*, 155(3), 54-57. doi:10.1080/03071847.2010.499626
- Presber, J. J. H. (2011). The Chinese Financial System and Its Impact on Economic Growth in China. *The ISM Journal of International Business*, 1(2), 35.
- Pugno, M. (2006). The service paradox and endogenous economic growth. *Structural Change and Economic Dynamics*, 17(1), 99-115.
- Qin, D. (2006). Is China's Growing Service Sector Leading to Cost Disease? *Structural Change and Economic Dynamics*, 17(3), 267-287.
- Qiu Zhang, H., & Morrison, A. (2007). How can the small to medium sized travel agents stay competitive in China's travel service sector? *International Journal of Contemporary Hospitality Management*, 19(4), 275-285.
- Rajah, R., Zhang, M., & Kong, X. X. (2012). Can China's Miraculous Economic Growth Continue? *Journal of Contemporary Asia*, 43(2), 295-313. doi:10.1080/00472336.2012.740940

- Rajiv, S., Suvendu, H., & Sunita, C. (2007). Measurement of GDP of Services Sector in the New Series of National Accounts Statistics. *Economic and Political Weekly*, 42(37), 3727-3731. doi:10.2307/40276388
- Ray, S. (2013). Does Service Sector Growth Explain Manufacturing Growth in India? *IUP Journal of Applied Economics*, 12(1), 68-76.
- Resende, M. (2007). Structure, conduct and performance: a simultaneous equations investigation for the Brazilian manufacturing industry [Article]. *Applied Economics*, 39(7), 937-942. doi:10.1080/00036840500461949
- Riddle, D. I. (1986). *Service-Led Growth The Role of the Service Sector in World Development*. New York: Praeger Publishers.
- Rolf, A., & Audun, L. (2006). Measuring the Benefits from Public Services: the Effects of Local Government Spending on the Distribution of Income in Norway. *Review of Income and Wealth*, 52(1), 61-83. doi:10.1111/j.1475-4991.2006.00176.x
- Samuel, A. (2009). Foreign Direct investment, domestic investment, and economic growth in Sub-Saharan Africa. *Journal of Policy Modeling*, 31(6), 939-949.
- Sheng, Z., & Kuo, W. (2012). Research on the Problems and Countermeasures of China's Service Trade in the New Era [Article]. *International Journal of Financial Research*, 3(4), 98-101. doi:10.5430/ijfr.v3n4p98
- Shepherd, B., & Pasadilla, G. (2012). *Services as a New Engine of Growth for ASEAN, the People's Republic of China, and India*. Tokyo: Asian Development Bank Institute. Retrieved from <http://www.adbi.org/files/2012.03.06.wp349.services.new.engine.growth.asean.prc.india.pdf>
- Siddiqui, S. H., & Saleem, H. M. N. (2010). Services-led industrial policy for inclusive growth and competitiveness. *Competitiveness Review*, 20(2), 166-181.
- Singh, T. (2010). Services sector and economic growth in India. *Applied Economics* 42(30), 3925-3941. doi:10.1080/00036840802360229
- Song, Y. (2012). Poverty Reduction in China: The Contribution of Popularizing Primary Education. *China & World Economy*, 20(1), 105-122. doi:10.1111/j.1749-124X.2012.01275.x
- Soo, K. T. (2012). Services Trade in China and India. *International Journal of China Studies*, 3(1), 25-42.
- Strom, P. (2005). The Japanese Service Industry: An International Comparison. *Social Science Japan Journal*, 8(2), 253-266.
- Studenmund, A. H. (2001). *Using Econometrics A practical Guide* (Vol. 4th ed). The United States: Addison Wesley Longman, Inc.
- Sun, M. (2010). Education system reform in China after 1978: some practical implications. *The International Journal of Educational Management*, 24(4), 314-329.
- Sun, W., & Lawrence, W. J. (2010). Service Programs-New Chances for the US-China's Economies. *International Journal of Business and Management*, 5(3), 101-108.
- Tabachnick, B. G., & Fidell, L. S. (1989). *Using Multivariate Statistics* (2nd ed.). New York: HarperCollins Publishers, Inc.
- Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* Boston, the United States: Pearson/Allyn & Bacon.
- Tang, S., Selvanathan, E. A., & Selvanathan, S. (2008). Foreign Direct Investment, Domestic Investment and Economic Growth in China: A Time Series Analysis. *World Economy*, 31(10), 1292-1309.
- Tao, Z., & Wong, Y. C. R. (2002). Hong Kong: From an Industrialised City to a Centre of Manufacturing-Related Services. *Urban Studies*, 39(12), 2345-2358.
- Temple, J. (1999). The New Growth Evidence. *Journal of Economic Literature*, 37(1), 112-156. doi:10.2307/2564727
- Thadewald, T., & Büning, H. (2007). Jarque-Bera Test and its Competitors for Testing Normality – A Power Comparison [Article]. *Journal of Applied Statistics*, 34(1/2), 87-105. doi:10.1080/02664760600994539
- Tregenna, F. (2011). What Does the 'Services Sector' Mean in Marxian Terms? *Review of Political Economy*, 23(2), 281-298.



- Waldron, S., Brown, C., & Longworth, J. (2006). State Sector Reform and Agriculture in China. *The China Quarterly*(186), 277-294.
- Wang, E. (2009). The Service Sector in the Chinese Economy: A Geographic Appraisal. *Eurasian Geography and Economics*, 50(3), 275.
- Wirtz, J. (2000). Growth of the services sector in Asia. *Singapore Management Review*, 22(2), 37-54.
- Wolfmayr, Y. (2012). Export Performance and Increased Services Content in Manufacturing. *National Institute Economic Review*(220), 36-52. doi:10.1177/002795011222000115
- Wong, J. (2013). A China-Centric Economic Order in East Asia. *Asia Pacific Business Review*, 19(2), 286-296.
- Wooldridge, J. M. (2013). *Introductory Econometrics: A Modern Approach*. Mason, the United State of America South-Western Cengage Learning.
- World Bank. (2012). World Development Indicators. from The World Bank  
<http://databank.worldbank.org/data/views/reports/tableview.aspx?isshared=true&ispopular=country&pid=1>
- World Bank. (2013). *The little data book 2013*. Retrieved from  
<https://openknowledge.worldbank.org/handle/10986/13205>
- Worthington, S. (2005). Entering the market for financial services in transitional economies: A case study of credit cards in China. *The International Journal of Bank Marketing*, 23(4/5), 381-396.
- Yang, F. F. (2003). Services and metropolitan development in China: the case of Guangzhou. *Progress in Planning*, 61(3), 181-209.
- Yoon, S.-J., & Choi, Y.-G. (2002). Comparison of Marketing Performance Between Manufacturing and Service sector Firms in Korea. *Journal of Asia Pacific Marketing*, 1(2), 63-87.
- Zeithaml, V. A., Bitner, M. J., & Gremler, D. D. (2009). *Services marketing : integrating customer focus across the firm* (5th ed ed.). New York: McGraw-Hill/Irwin.
- Zhang, N. J., Guo, M., & Zheng, X. (2012). China: Awakening Giant Developing Solutions to Population Aging. *The Gerontologist*, 52(5), 589-596. doi:10.1093/geront/gns105
- Zheng, J., Zhang, L., & Wang, Y. (2011). The underdevelopment of service industry in China: An empirical study of cities in Yangtze River Delta. *Frontiers of Economics in China*, 6(3), 413-446.

## Appendices

### Appendix 1: Data Series

Table A.1 Variables (%)

Year	SER Growth	MANGTH Growth	SVA	MAN	GDP Growth	INV/GDP	GOV	IFN	X	IM	SCH	TRD	EMP	GPCGDP
1994	11.1	18.4	33.6	46.6	13.1	42.2	13.9	24.24	21.3	20	98.4	41.22	75.30	11.83
1995	9.8	13.9	32.9	47.2	10.9	41.9	12.5	16.90	20.2	18.6	98.5	38.81	74.90	9.7
1996	9.4	12.1	32.8	47.5	10	40.44	12.2	8.32	20.1	18	98.8	38.06	74.70	8.85
1997	10.7	10.5	34.2	47.5	9.3	37.95	12.9	2.81	21.8	17.3	98.9	39.01	74.40	8.19
1998	8.4	8.9	36.2	46.2	7.8	37.1	14.1	-0.84	20.3	16	98.9	36.39	73.90	6.77
1999	9.3	8.1	37.8	45.8	7.6	36.74	15.7	-1.41	20.4	17.6	99.1	37.69	73.70	6.67
2000	9.7	9.4	39	45.9	8.4	35.12	16.3	0.26	23.3	20.9	99.1	44.24	73.50	7.55
2001	10.3	8.4	40.5	45.2	8.3	36.27	17.5	0.72	22.6	20.5	99.1	43.08	73.10	7.52
2002	10.4	9.8	41.5	44.8	9.1	37.87	18.3	-0.77	25.1	22.6	98.6	47.70	72.90	8.37
2003	9.5	12.7	41.2	46	10	41.2	18.1	1.16	29.6	27.4	98.7	56.91	72.60	9.32
2004	10.1	11.1	40.4	46.2	10.1	43.26	17.8	3.88	34	31.4	98.9	65.35	72.30	9.45
2005	12.2	12.1	40.5	47.4	11.3	42.1	18.3	1.82	37.1	31.5	99.2	68.63	72.20	10.65
2006	14.1	13.4	40.9	47.9	12.7	42.97	18.7	1.46	39.1	31.4	99.3	70.57	72.10	12.07
2007	16	15.1	41.9	47.3	14.2	41.74	18.7	4.75	38.4	29.6	99.5	68.03	72.10	13.61
2008	10.4	9.9	41.8	47.5	9.6	44.05	19.9	5.86	35	27.3	99.5	62.24	71.30	9.04
2009	9.6	9.9	43.4	46.3	9.2	48.24	22.4	-0.70	26.7	22.3	99.4	49.02	71.10	8.66
2010	9.8	12.3	43.2	46.7	10.4	48.22	22.4	3.31	29.4	25.6	99.7	57.31	71.10	9.87
2011	8.9	10.6	43.1	46.8	9.2	48.45	23.4	5.41	28.6	26	99.8	58.68	70.90	8.78

Appendix 2: Outliers

Figure A.1 Value-added in the Service Sector

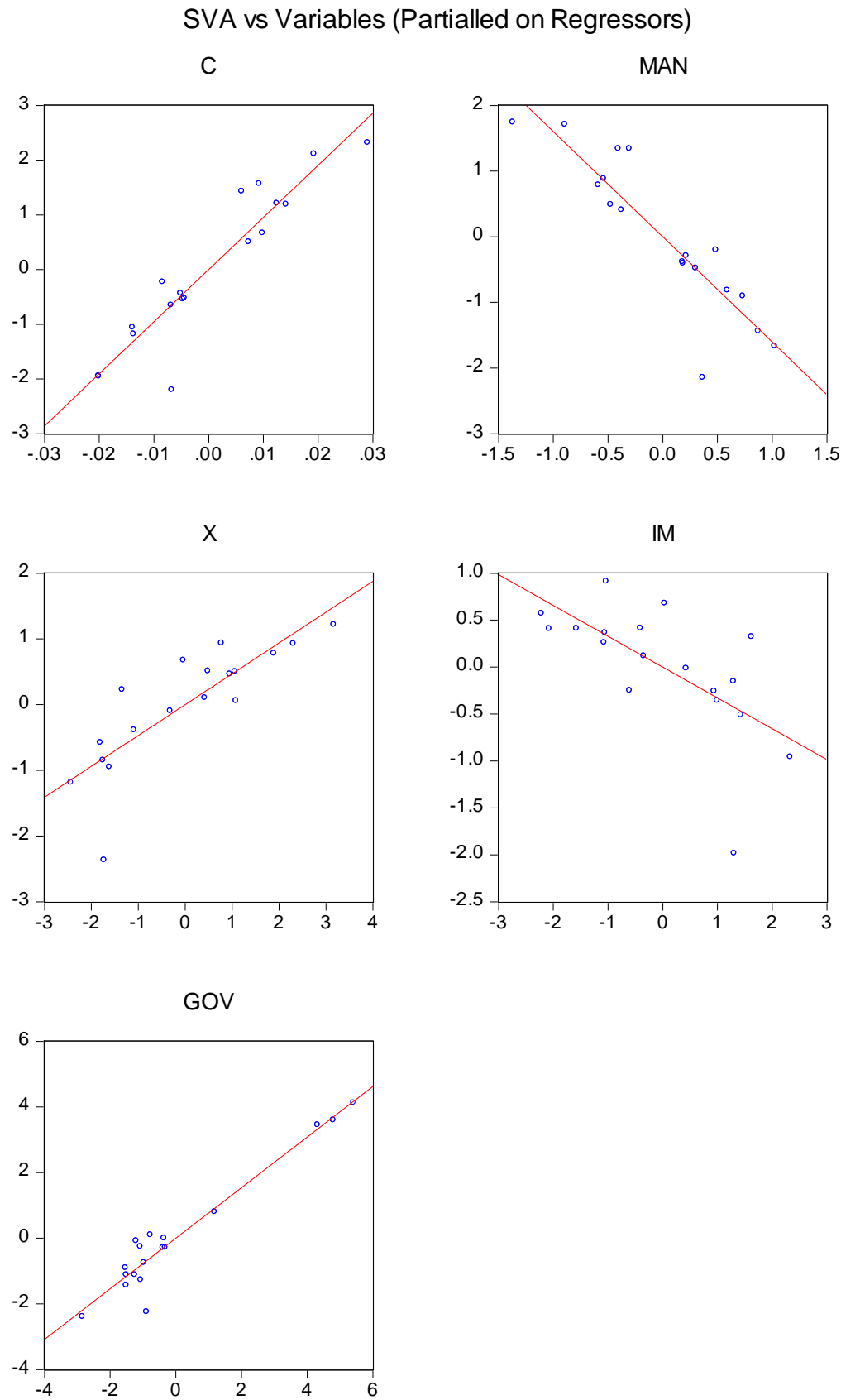
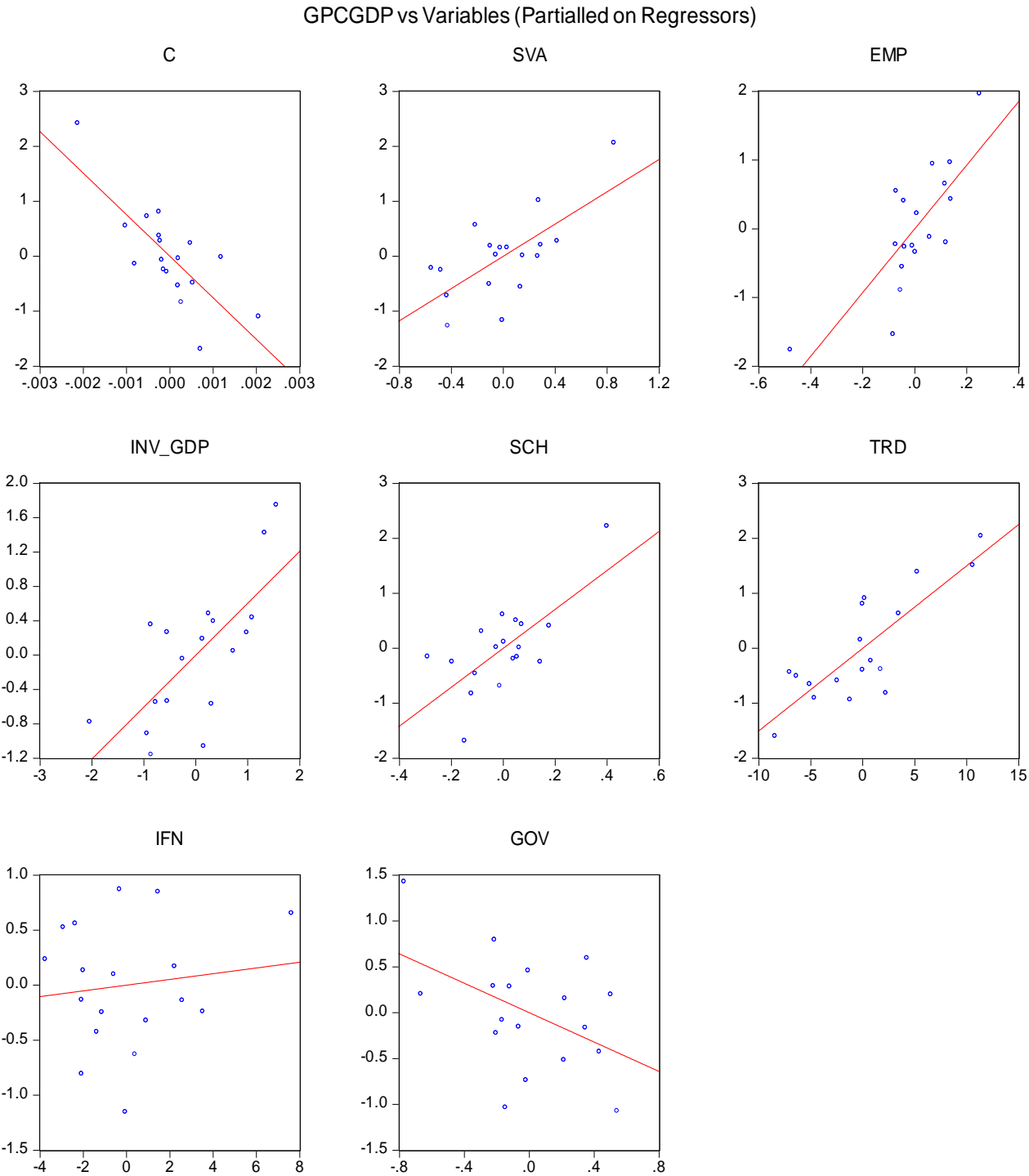




Figure A.2 Per Capita GDP Growth



### Appendix 3: Correlation Matrix

**Table A.2 Correlation Matrix (Value-added in the Service Sector)**

	MAN	X	IM	GOV
MAN	1.000000	0.403049	0.272929	-0.105003
X	0.403049	1.000000	0.958921	0.583297
IM	0.272929	0.958921	1.000000	0.613447
GOV	-0.105003	0.583297	0.613447	1.000000

**Table A.3 Correlation Matrix (Per Capita GDP Growth)**

	SVA	EMP	INV/GDP	SCH	TRD	IFN	GOV
SVA	1	-0.94905	0.469094	0.721282	0.697419	-0.55857	0.939025
EMP	-0.94905	1	-0.64786	-0.831	-0.74455	0.489378	-0.95282
INV/GDP	0.469094	-0.64786	1	0.534693	0.524302	0.213281	0.700111
SCH	0.721282	-0.831	0.534693	1	0.544047	-0.41551	0.781062
TRD	0.697419	-0.74455	0.524302	0.544047	1	-0.17955	0.647637
IFN	-0.55857	0.489378	0.213281	-0.41551	-0.17955	1	-0.35516
GOV	0.939025	-0.95282	0.700111	0.781062	0.647637	-0.35516	1

**Table A.4 Correlation Matrix (Manufacturing Sector Growth)**

	MANGTH(-1)	SER	GDP	GOV
MANGTH(-1)	1.000000	0.179344	0.467715	-0.271385
SER	0.179344	1.000000	0.853674	0.083769
GDP	0.467715	0.853674	1.000000	0.160129
GOV	-0.271385	0.083769	0.160129	1.000000

**Table A.5 Correlation Matrix (Service Sector Growth)**

	SER(-1)	MANGTH	X	IM	GOV
SER(-1)	1.000000	0.376130	0.567884	0.398733	0.190582
MANGTH	0.376130	1.000000	0.515868	0.499534	0.002025
X	0.567884	0.515868	1.000000	0.959003	0.560810
IM	0.398733	0.499534	0.959003	1.000000	0.599337
GOV	0.190582	0.002025	0.560810	0.599337	1.000000

## Appendix 4: Linearity

Figure A.3 Linearity (Value-added in the Service Sector)

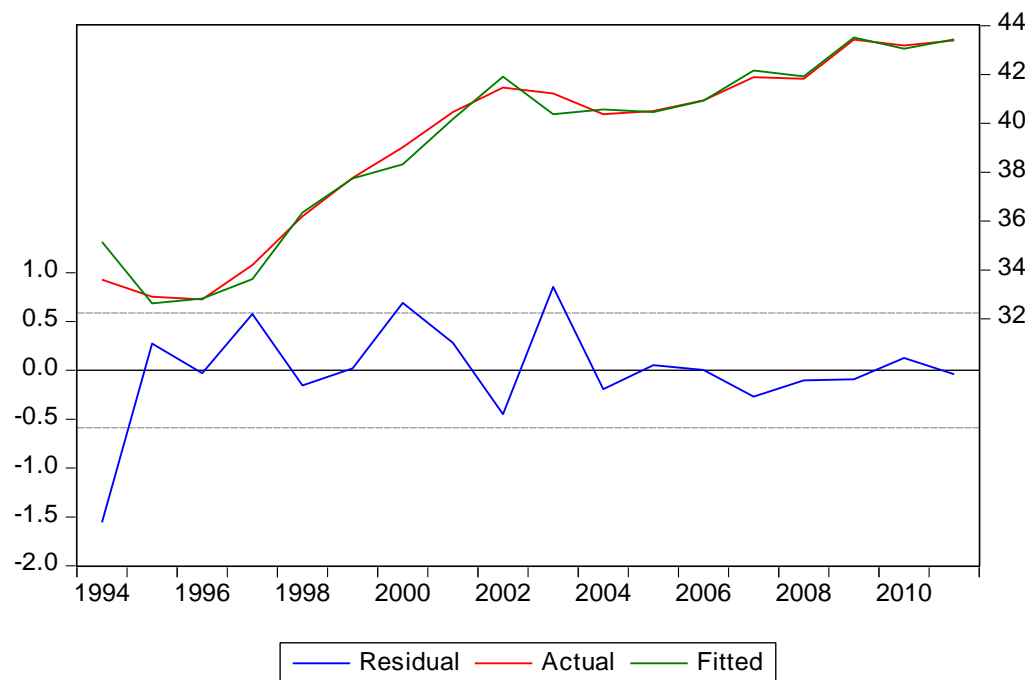


Figure A.4 Linearity (Per Capita GDP Growth)

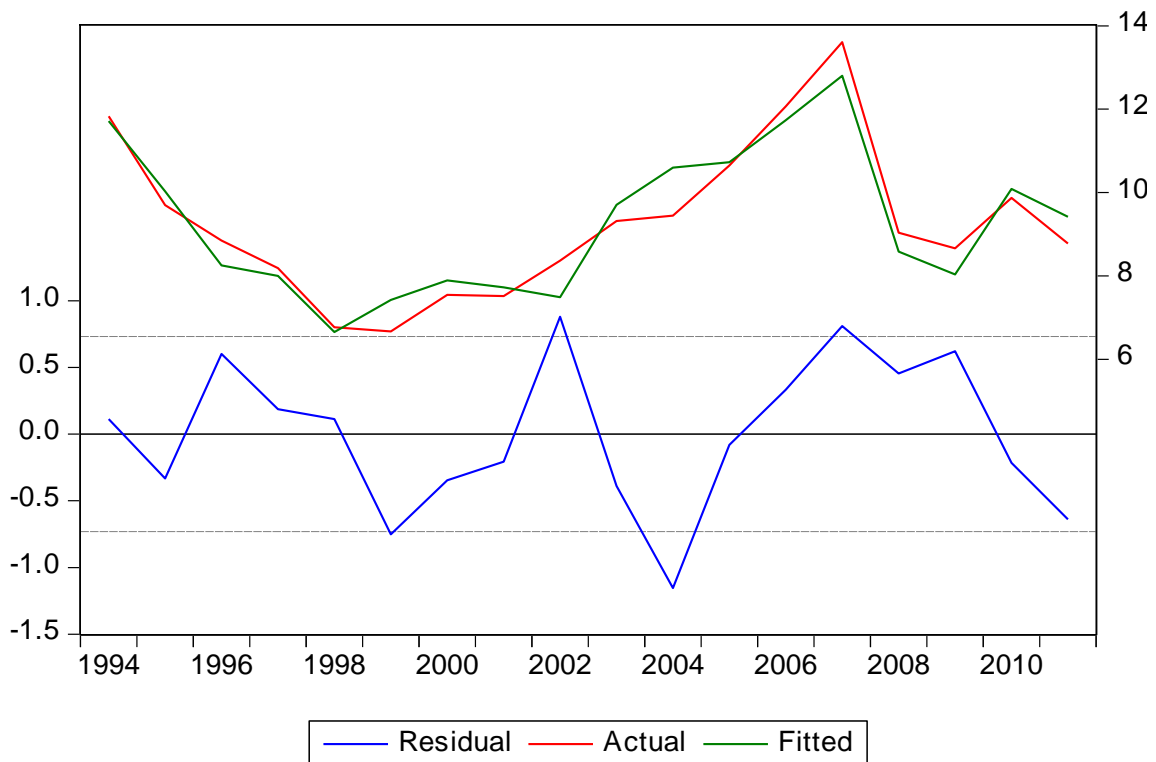
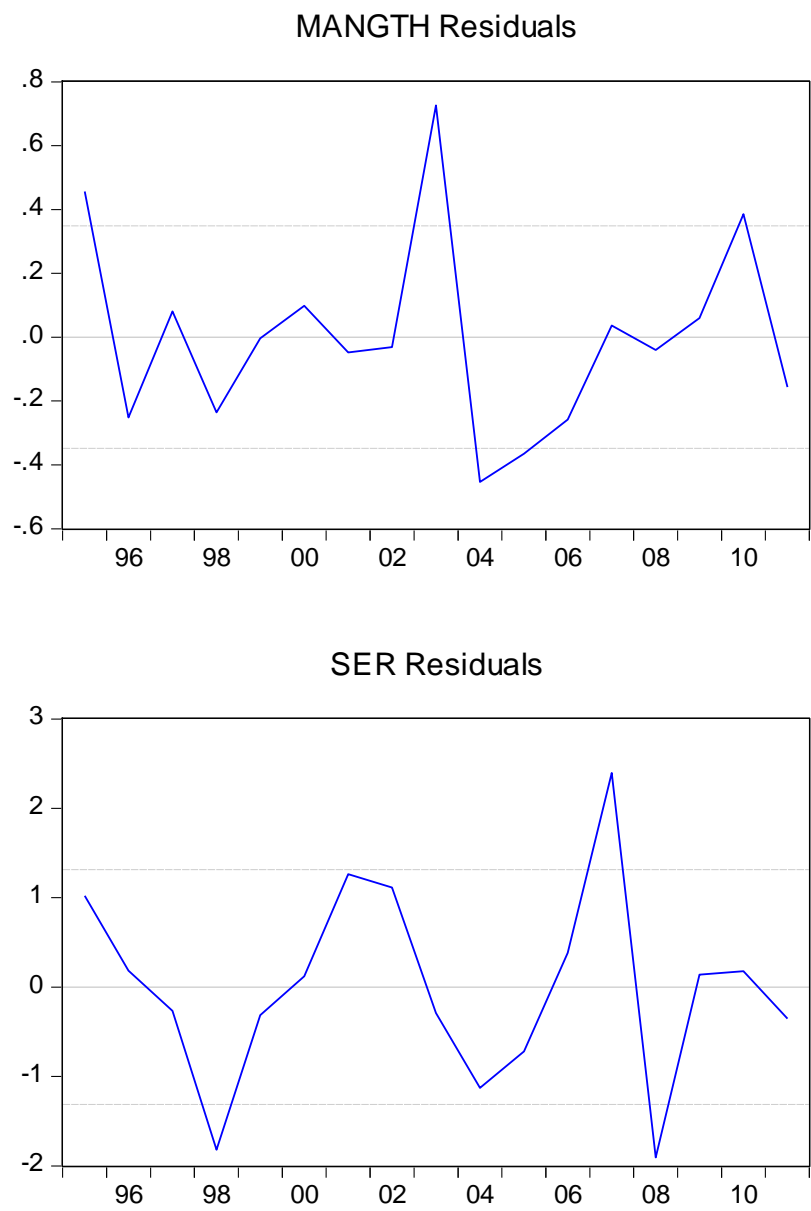
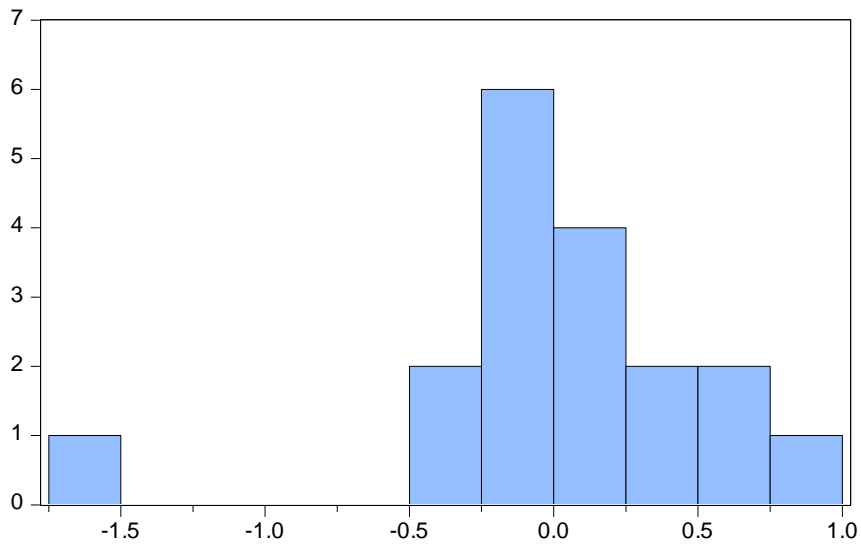


Figure A.5 Linearity (Manufacturing Sector Growth and Service Sector Growth)



## Appendix 5: Normality

Figure A.6 Normality (Value-added in the Service Sector)

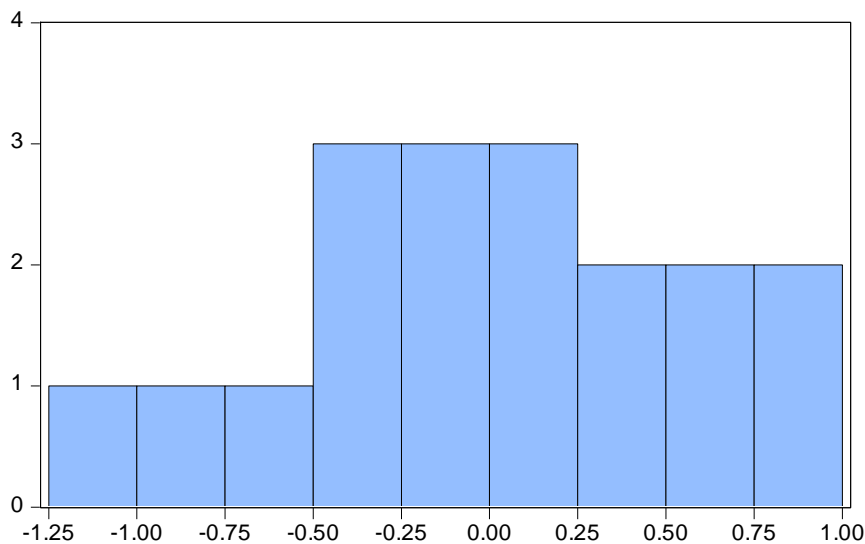


Series: Residuals  
Sample 1994 2011  
Observations 18

Mean	-3.03e-14
Median	-0.011448
Maximum	0.855069
Minimum	-1.556552
Std. Dev.	0.514145
Skewness	-1.202968
Kurtosis	6.064039

Jarque-Bera	11.38265
Probability	0.003375

Figure A.7 Normality (Per Capita GDP Growth)



Series: Residuals  
Sample 1994 2011  
Observations 18

Mean	-6.87e-14
Median	0.016112
Maximum	0.880054
Minimum	-1.152686
Std. Dev.	0.560096
Skewness	-0.194048
Kurtosis	2.322953

Jarque-Bera	0.456758
Probability	0.795823

**Table A.6 Normality (Manufacturing Sector Growth and Service Sector Growth)**

System Residual Normality Tests

Orthogonalization: Cholesky (Lutkepohl)

Null Hypothesis: residuals are multivariate normal

Sample: 1995 - 2011

Observations included: 17

Component	Skewness	Chi-sq	df	Prob.
1	0.806167	1.841398	1	0.1748
2	0.309302	0.271059	1	0.6026
Joint		2.112456	2	0.3478

Component	Kurtosis	Chi-sq	df	Prob.
1	3.320562	0.072788	1	0.7873
2	3.113964	0.009200	1	0.9236
Joint		0.081988	2	0.9598

Component	Jarque-Bera	df	Prob.
1	1.914186	2	0.3840
2	0.280258	2	0.8692
Joint	2.194444	4	0.7000

## Appendix 6: Independence

**Table A.7 The Durbin-Watson Statistic**

Model	Dependent Variable	Durbin-Watson Statistic	Critical Value (at 5% level)		Critical Value (at 1% level)	
			DL	DU	DL	DU
1	Value-added in the Service Sector	1.904387	0.82	1.87	0.61	1.6
2	Per Capita GDP Growth	1.524781	0.71	2.06	0.52	1.8
3	Growth of the Manufacturing/Service Sector	2.011709	0.67	2.1	0.48	1.85

## Appendix 7: Homoscedasticity

**Table A.8 Homoscedasticity (Value-added in the Service Sector)**

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.709892	Prob. F(4,13)	0.5995
Obs*R-squared	3.226869	Prob. Chi-Square(4)	0.5206
Scaled explained SS	4.261770	Prob. Chi-Square(4)	0.3717

Test Equation:

Dependent Variable: RESID^2

Method: Least Squares

Sample: 1994 2011

Observations Included: 18

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.914134	10.48520	-0.087183	0.9319
MAN	0.040673	0.223285	0.182160	0.8583
X	-0.103987	0.090163	-1.153316	0.2695
IM	0.122902	0.107229	1.146168	0.2724
GOV	-0.044540	0.061330	-0.726245	0.4806
R-squared	0.179270	Mean dependent var		0.249659
Adjusted R-squared	-0.073262	S.D. dependent var		0.578107
S.E. of regression	0.598909	Akaike info criterion		2.042720
Sum squared resid	4.663001	Schwarz criterion		2.290046
Log likelihood	-13.38448	Hannan-Quinn criter.		2.076823
F-statistic	0.709892	Durbin-Watson stat		1.579194
Prob(F-statistic)	0.599529			



**Table A.9 Homoscedasticity (Per Capita GDP Growth)**

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.325847	Prob. F(7,10)	0.9250
Obs*R-squared	3.343130	Prob. Chi-Square(7)	0.8516
Scaled explained SS	0.682531	Prob. Chi-Square(7)	0.9985

Test Equation:

Dependent Variable: RESID^2

Method: Least Squares

Sample: 1994 2011

Included observations: 18

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	36.92249	112.3004	0.328783	0.7491
SVA	0.078002	0.281570	0.277026	0.7874
EMP	-0.044808	0.659026	-0.067991	0.9471
INV/GDP	0.028393	0.106687	0.266136	0.7955
SCH	-0.366067	0.646804	-0.565963	0.5839
TRD	0.002174	0.018334	0.118576	0.9080
IFN	-0.007103	0.036229	-0.196055	0.8485
GOV	-0.080328	0.270995	-0.296419	0.7730
R-squared	0.185729	Mean dependent var		0.296280
Adjusted R-squared	-0.384260	S.D. dependent var		0.350660
S.E. of regression	0.412567	Akaike info criterion		1.368266
Sum squared resid	1.702115	Schwarz criterion		1.763987
Log likelihood	-4.314395	Hannan-Quinn criter.		1.422831
F-statistic	0.325847	Durbin-Watson stat		3.144423
Prob(F-statistic)	0.924954			

## Appendix 8: Regression Results

**Table A.10 Regression Results (Value-added in the Service Sector)**

Dependent Variable: SVA

Method: Least Squares

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	95.26422	10.29329	9.254980	0.0000
MAN	-1.602537	0.219198	-7.310911	0.0000
X	0.469118	0.088513	5.299997	0.0001
IM	-0.328453	0.105266	-3.120214	0.0081
GOV	0.770229	0.060207	12.79299	0.0000
R-squared	0.980515	Mean dependent var	39.17833	
Adjusted R-squared	0.974519	S.D. dependent var	3.683268	
S.E. of regression	0.587948	Akaike info criterion	2.005775	
Sum squared resid	4.493870	Schwarz criterion	2.253101	
Log likelihood	-13.05198	Hannan-Quinn criter.	2.039878	
F-statistic	163.5432	Durbin-Watson stat	1.904387	
Prob(F-statistic)	0.000000			

**Table A.11 Regression Results (Per Capita GDP Growth)**

Dependent Variable: GPCGDP

Method: Least Squares

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-755.5954	198.7805	-3.801154	0.0035
SVA	1.466877	0.498402	2.943162	0.0147
EMP	4.632973	1.166528	3.971592	0.0026
INV/GDP	0.604170	0.188844	3.199305	0.0095
SCH	3.541137	1.144893	3.092984	0.0114
TRD	0.150132	0.032453	4.626087	0.0009
IFN	0.026028	0.064128	0.405879	0.6934
GOV	-0.801448	0.479683	-1.670787	0.1257
R-squared	0.907352	Mean dependent var	9.272222	
Adjusted R-squared	0.842498	S.D. dependent var	1.840110	
S.E. of regression	0.730276	Akaike info criterion	2.510314	
Sum squared resid	5.333032	Schwarz criterion	2.906035	
Log likelihood	-14.59283	Hannan-Quinn criter.	2.564879	
F-statistic	13.99072	Durbin-Watson stat	1.524781	
Prob(F-statistic)	0.000197			

**Table A.12 Regression Results (Manufacturing Sector Growth and Service Sector Growth)**

Estimation Method: Two-Stage Least Squares

Total system (balanced) observations 34

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	3.128229	0.947888	3.300209	0.0031
C(2)	-0.087980	0.061485	-1.430907	0.1659
C(3)	-0.650411	0.175162	-3.713207	0.0011
C(4)	1.837234	0.221434	8.296981	0.0000
C(5)	-0.137305	0.034876	-3.936982	0.0007
C(6)	10.30223	4.303003	2.394197	0.0252
C(7)	-0.168837	0.286919	-0.588446	0.5620
C(8)	-0.096492	0.428287	-0.225297	0.8237
C(9)	0.663910	0.243090	2.731127	0.0119
C(10)	-0.465939	0.306097	-1.522195	0.1416
C(11)	-0.243970	0.171647	-1.421346	0.1686
Determinant residual covariance		0.087887		

Equation:  $MANGTH = C(1) + C(2)*MANGTH(-1) + C(3)*SER + C(4)*GDP + C(5)*GOV$

Instruments:  $MANGTH(-1) SER(-1) GDP GOV C$

Observations: 17

R-squared	0.977459	Mean dependent var	11.05294
Adjusted R-squared	0.969946	S.D. dependent var	2.010633
S.E. of regression	0.348565	Sum squared resid	1.457972
Durbin-Watson stat	2.250957		

Equation:  $SER = C(6) + C(7)*SER(-1) + C(8)*MANGTH + C(9)*X + C(10)*IM + C(11)*GOV$

Instruments:  $SER(-1) MANGTH(-1) X IM GOV C$

Observations: 17

R-squared	0.690242	Mean dependent var	10.47647
Adjusted R-squared	0.549443	S.D. dependent var	1.956569
S.E. of regression	1.313318	Sum squared resid	18.97284
Durbin-Watson stat	2.011709		