THE UNIVERSITY of ADELAIDE

Essays on Trade and Export Development

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Submitted to the University of Adelaide in partial fulfillment of the requirement for the degree of

Doctor of Philosophy

In

Economics

October 2017

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Acknowledgements

I would like to express my sincere gratitude for the constant support and supervision from my principal supervisor, **Professor Christopher Findlay**. He gave me the freedom to pursue projects I was interested in and provided constructive guidance over the dissertation. His patience, encouragement and broad knowledge led me in the right direction and set a good model for my career. Thanks for his understanding and persistent support during those important years. I have harvested much more than knowledge and a degree. I also owe sincere thanks to my co-supervisors, **Associate Professor Shandre Thangavelu** and **Dr Nicholas Sim**. Their insightful knowledge and experiences have helped to improve my studies and guide me during my Ph.D. studies. I am very fortunate to have been supervised by them.

Thanks to my wife, **Huijuan An**. Without her unconditional love and support, it would not have been possible to complete this dissertation. Thanks for her tireless cooking for a picky eater and for enduring boring years in a foreign city.

I would like to express my thanks to my desk mate and best friend, **Mr Dessie Ambaw**. He was always willing to help and advise me in my studies. We spent a great deal of time together and were able to discuss not only our problems and findings but also our views on life and support each other through arduous times.

Finally, thanks to every researcher in the School of Economics: **Professor Kym Anderson**, **Dr Stephanie McWhinnie**, **Dr Benedikt Heid**, and **Dr Raul Barreto** are just a few. I learnt

a lot from you at workshops, seminars and in every discussion. Your ideas and passion for research and teaching have had a great impact on me.

Abstract

The dynamics between industrial development and export activities have been the interest of research for the past two decades, especially those related to services activities and global value chain activities. This thesis contributes to the literature by examining the relationships between industrial upgrading, the similarity of countries' exports, and the economic development of countries. The thesis also explores the factors that promote export upgrading and policy barriers in services trade across different economies.

The thesis is organized as follows. Chapter 1 provides the motivation for the thesis. Chapter 2 highlights the literature on export activities (export similarity index and export quality index) foreign direct investment (FDI), and services activities in global economic development.

Chapter 3 investigates the links between export similarity and bilateral FDI of Japan and host countries, exploring in particular how multinational activities (FDI) could increase the export activities of domestic countries. The empirical analysis is conducted using a panel data of 70 countries based on SITC (Standard International Trade Classification) 4- and 5-digit products. The results suggest that: (1) outward FDI from Japan increases export similarity between host and source countries, however, inward FDI to Japan shows no evidence of promoting similarity; (2) bilateral FDI positively promotes similarity in the manufactured exports, but to a lesser

extent in primary sector exports; and (3) geographic distances and differences in per capita income have significant negative effects on export similarity.

In Chapter 4, the empirical framework is developed to study the impact of policy restrictions on services trade across countries. Recent studies highlight that services are essential for manufacturing productivity improvement and economic development. This chapter examines the relationship between policy restrictions (measured by the services trade restrictiveness index (STRI)) and services trade across countries using data from UN Comtrade. A log-linear gravity model is developed to explain variations in bilateral services-trade volumes. The main results show that: (1) a 1% percent increase in the overall STRI leads to a 0.3% decrease in bilateral services trade and around 0.04% decrease in services export; and (2) both goods-trade networks and merchandise exports similarity have statistically significant and positive influences on services trade.

In Chapter 5, the determinants of variations in export quality across countries are investigated. The study empirically examines the dynamic pattern of export upgrading and its main influencers based on a panel framework. The results imply that service imports, FDI inflows and the level of per capita income have positive effects on export quality growth. The last chapter, Chapter 6, provides the policy discussion and conclusion of the thesis, as well as discussing how the study could be extended as part of further research in this area.

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List of Abbreviations

FDI	Foreign direct investment
GDP	Gross domestic product
GVC	Global value chain
MNEs	Multinational enterprises
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary least squares
PCA	Principal components analysis
PPML	Poisson pseudo-maximum likelihood
RCA	Revealed comparative advantages
SITC	Standard International Trade Classification
STRD	Services Trade Restrictions Database
STRI	Services Trade Restrictiveness Index
UN Comtrade	United Nations Comtrade Database
WDI	World development indicators

Chapter 1 Introduction

1.1 Research Question

Industrial upgrading is important for economic development. It generally involves the transition to products that are more technology- and capital-intensive. This shift drives the growth in labour productivity, which in turns drives the incomes received by labour. The transition from producing low-quality to high-quality products is often viewed as an important indicator of economic development of the domestic economy (Amiti & Khandelwal 2013). Promoting and accelerating industrial upgrading is an important government objective in developing countries. The aim of this thesis is to understand more clearly some of the key drivers of the process of upgrading. A number of factors have been identified as contributing to upgrading, and this thesis will concentrate on two of these: foreign direct investment (FDI) activities and services trade. As will be explained in this chapter, both are linked with and interact with each other.

Foreign direct investment is an important source of private capital for emerging economies. It not only provides necessary capital to local firms, but also brings many positive externalities to the global economy – technology spillover, skilled worker training and networks to the global economy (Arnold & Javorcik 2009; Javorcik & Spatareanu 2011; Kodama, Javorcik & Abe 2016; Kwok & Tadesse 2006). These are important contributors to upgrading. However, we also observe governments are very cautious with regard to FDI activities and their impact on the domestic economy.

As noted, FDI helps drive global networking, including participation in global value chains (GVCs), which makes it easier for developing countries to enter manufacturing and then upgrade their products. A feature of GVCs is the access to intermediate inputs they offer. Imported intermediate inputs play an increasingly important role in quality upgrading and diversification of production varieties (Goldberg, Khandelwal & Pavcnik 2011; Goldberg et al. 2010). However, a key to success is the access to services inputs as well as intermediate goods. As new technologies make services becoming more tradable, services offshoring shows significant and positive effects on manufacturing productivity (Amiti & Wei 2009; Arnold, Javorcik & Mattoo 2011; Hoekman & Shepherd 2015). The liberalization of services is therefore also important, and is likely to be as significant we expect as that of trade in goods.

These are the sources of interest in FDI and services trade in this thesis. Clarity around the role of these factors will provide support for policy makers who are looking for actions that could provide the best opportunities for improving the levels of development and long-term growth by upgrading. For example, can countries grow faster by reducing policy barriers and allowing industrial upgrading in response to the forces of market and comparative advantages? The answer to this question would generally be expected to be positive, but what complementary actions are required for success?

In summary, the research question in this thesis is what is the contribution of FDI activities, liberalization policies especially for services for the process of upgrading.

This thesis is structured as follows. Chapter 2 provides an overview of the relevant literature, especially that on the nature of the upgrading process. In this thesis, the focus is on the interpretation of trade flows as an indicator of upgrading. The chapter introduces two indices useful for this purpose – the *export similarity index* and the *export quality index*. It also provides examples of some countries that have experienced upgrading.

In Chapter 3, we examine the link between export similarity and FDI. The method is to review bilateral FDI between Japan and various host countries and its impact on their export similarity with Japan, which can be viewed as upgrading. Chapter 4 examines the impact of services policies on services trade flows. Chapter 5 then makes the connections between the two factors by examining the relationship between upgrading, FDI activities and service imports across 76 main exporters. In the last chapter, Chapter 6 provides the concluding summary of the thesis and suggestions for future work. More details of the components of the three main research chapters are provided in the next section.

1.2 FDI and export similarity

The specialization of production reveals the comparative advantages of different countries. Institutional quality and factor endowments determine the production and export specialization pattern (Hausmann, Hwang & Rodrik 2007). The Heckscher–Ohlin theorem states that a country will export goods that intensively utilise its abundance factors. Countries with similar

export baskets could be considered as having similar industrial abilities.[1] Changes in endowments, in institutions and in access to technology shift comparative advantage and the industrial specialization and trade pattern (Bahar, Hausmann & Hidalgo 2014). The change in the degree of export similarity between countries can then be used to depict the trajectories of industrial development. For example, moving from light manufacturing production to greater emphasis on producing consumer electronics with higher value-added or resourced-based sectors.

Chapter 3 focuses on the relationship of bilateral FDI and export similarity between Japan and the host countries of Japan's FDI. Japan shows the advantages in high-technology and human-capital intensity products and strong outward FDI flows in recent years. Following Bahar et.al (2014), this chapter examines the proposition that export similarity is increased by foreign investment. This study considers the role of FDI from Japan and explores its impact in a two-way fixed-effects model using cross-country data for 70 countries from 2001 to 2007. The panel results show that Japanese FDI has a statistically significant role in the enhancement of similarity.

[1] H-O model is considered as one of the basic theories for international trade theory. But it still has limitation including the homogenous and identical counties assumption as well as the weak explanation power in trade pattern.

1.3 Policy restrictions and Services trade

Trade in services matters for upgrading as it is an important input for manufacturing. We expect that more trade in services (especially service imports) of economies will therefore be a force for upgrading.

However, trade in services faces a number of impediments from its natural characteristics and policy restrictions. A large number of services are non-storable and require direct interaction between suppliers and customers, which confines their transportation and tradability. Also, the possible uneven distribution of gains from trade leads to great concerns in business and political areas. Multiple restrictions are typically undertaken by governments in an effort to protect companies and workers from competition. These barriers to trade in services create deadweight losses to the society. Of special importance here is the consequence of policy choices for the quality of services. Quality could be reduced by lack of competition through trade in services, which could eventually influence the scope for industrial development through upgrading.

Chapter 4 is devoted to the analysis of factors that determine the patterns of services trade, including the effects of policy. Recent studies also indicate that there is more trade in services between countries with common merchandise trade partners and stronger bilateral merchandise trade flows (Egger, Francois & Nelson 2017). Bilateral physical trade is more intensive in countries with a similar income level (Caron, Fally & Markusen 2014). Therefore, it is

postulated in this thesis that countries with more similarity (e.g. similar income level or consumption habits) also tend to have stronger bilateral services trade flows. The models estimated and reported in Chapter 4 use measures of similarity and connectedness in goods trade between countries as independent variables. The results confirm that a more restrictive services trade policy inhibits services trade and as well as goods trade while greater similarity and connectedness have a positive effect.

1.4 Export quality, services trade and FDI

In chapters 3 and 4, the focus is on the similarity in patterns of exports, and changes in the degrees of similarity to high-income countries (e.g. economies moving towards the trade pattern of Japan) were interpreted as evidence of upgrading. In chapter 5, a different measure of upgrading is applied. The focus is on product quality. A shift towards exports of high-quality products can be viewed as upgrading. Quality in turn might be inferred from the skill or capital or technology intensity of the production process.

There is evidence that FDI activities, service imports and income levels of a country are all associated with the quality of production and of exports (Javorcik, Lo Turco & Maggioni 2017; Stojkoski, Utkovski & Kocarev 2016). A further application of model of these factors provides an opportunity to examine the contributions of both of the key contributors to upgrading which are the focus in this thesis, that is, FDI and services trade. Chapter 5 therefore applies these

variables to explain variations in export quality (in this case, using the export quality index proposed by (Pham & Riedel 2013) for a new panel data set of 76 countries from 2000 to 2014. Both FDI and services import have positive influences on export upgrading.

Chapter 2 Literature Review: Industrial Upgrading, Export Similarity and Export Quality

Economic and trade liberalization play an important role in growth and sustainable development for developing countries. The positive relationship between trade and GDP per capita has been investigated in many researches (Feyrer 2009; Irwin & Terviö 2002; Lin & Sim 2013). In fact, openness to trade allows individuals to benefit and improve their welfare from having more choices of products and services at lower prices. In addition, with trade, firms could also have access to wider range of intermediates and larger markets and improve both global production in terms of exports. Measuring the changes in trade is essential to understanding the development stage of the domestic economy. This chapter provides a literature review of the industrial upgrading and methods of measurements export changes.

2.1 Industrial upgrading and Openness of the Domestic Economy

Industrial upgrading is a dynamic process in which involves domestic industries to adopt new technologies and increase their human capital. It also involves improving domestic institutions by increasing their allocative efficiency in the economy – reallocating resources towards more productive sectors and improving the quality of products. In this case, industrial upgrading could be viewed as domestic firms adopting more capital- and skill-intensive activities with

high value-added production (Pavlínek, Domański & Guzik 2009). Gereffi and Tam (1998) highlights that industrial upgrading could also relate to improving organizational learning and the global network which enhance the efficiency of domestic firms in international markets.

Industrial upgrading can be driven by many factors, for example, higher quality inputs and managerial capabilities, linking to a global production network and competition from the domestic market (Esteves & Rua 2015). In a more globalized environment, the accumulation of more complex sets of capabilities and productivity growth will play a significant role in the development of domestic industries and exports (Borensztein & Ostry 1996; Hidalgo et al. 2007).

Directly measuring the degree of industrial upgrading is difficult because of the lack of proper data. Export performance could be a good proxy for the country and industrial ability to upgrade. Due to the global competition, the ability of domestic industries to improve their export competitiveness reflects the productive capability of domestic firms. Exports are also important for maintaining employment levels and increasing economies of scale in the economy. Nevertheless, the export quality of product reveals the industrial structure and its development trajectories, including moving to higher value-added production. In fact, many studies use export quality to analysis the economic and industrial performance of economies (Hallak 2006).

2.2 Product quality: Proxy for Competitive Industries

Quality is an important characteristic of product. The definition of quality can be identified from different dimensions. For example, the quality is normally defined from the preferences of the consumers as well as the manufacturer according to the production requirement (Garvin 1984). Leffler (1982) considers that prices do not measure all the economically important features of the good; thus, the quality can be understood as the unpriced attributes contained in each unit of the priced attributes (Leffler 1982). Quality could also be defined in terms of a product that includes services in the sales, which influences demand for the product (Dorfman & Steiner 1954). The quality of a product is also highly related to many characteristics: reliability, conformance, durability and so on. However, quantifying the quality of the product is rather difficult. Different methods of quality measurement tend to have a certain degree of bias. Heckscher-Ohlin factor endowment analyses and technological sophistication are widely adopted by economists in product quality analysis. They provide applicable and convenient way to measure and differentiate the product quality based on the sophistication of the production process. The main method used widely including technological classification of exports introduced by Lall (2000) who sort all products into five technological groups: high-technology, medium-technology, low-technology, primary products and resource-based products. The revealed factor intensity introduced by Shirotori, Tumurchudur and Cadot (2010) considers the human capital (proxied by education) and physical capital (proxied by a perpetual inventory method of capital stock estimation) and it also differentiates the product quality from different perspectives. This method allows us to differentiate products or sectors on a more

detail level, which is discussed in Chapter 5.

2.3 Country level export quality

Normally, a country will produce a wide range of products. To measure the overall quality or sophistication[2] of products at the country level provide more insights into their production position in the global markets even level of economic development. The most widely used indexes include export sophistication index (Hausmann, Hwang & Rodrik 2007), the export extensive margin index (Feenstra, R & Kee 2008), and export capital intensive index (Pham & Riedel 2013). The sophistication of exports (EXPY) developed by Hausmann, Hwang and Rodrik (2007) highlights the factor intensities of a country's export products using its factor endowments. If a product is mostly produced by wealthy countries, then it is considered to be a sophisticated product. However, certain primary products are also produced and exported from those rich countries. The export capital-intensive index measured by Pham and Riedel is used to proxy the export quality by the regression method[3].

The production of high-quality products reveals the industrial ability of a country. Change in export composition has attracted the attention of many researchers. For many developing countries, diversified exports can create greater stability in exports revenue, expand export

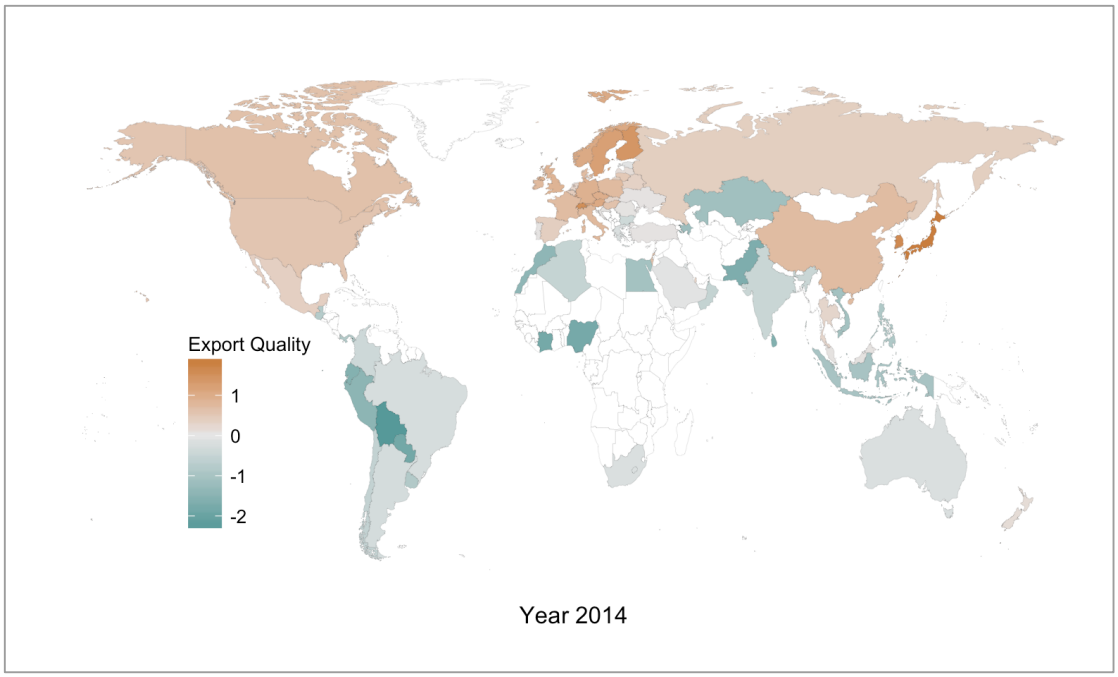
[2] More sophisticated products are treated as with higher quality in our study.

[3] This method is adopted in Chapter 5 and will be further introduced.

profit and upgrade value–adding. There is a strong consensus among researchers that diversified export sectors promote economic growth (Hausmann, Hwang & Rodrik 2007; Jarreau & Poncet 2012). The transition from producing low-quality to high-quality products is often viewed as export success as well as economic development (Amiti & Khandelwal 2013). Wealthier countries have a comparative advantage in exporting high-quality products in larger shares than poorer countries. Developing economies are usually believed to be large exporters of primary and natural resources products. Economies with a revealed comparative advantage in primary production and which export greater a share of natural resources are considered to be at a disadvantage. Moreover, unlike manufacturing or service industries, minerals and natural resources sectors do not generate high employment (McMillan & Rodrik 2011). Many researchers have shown that sub-Saharan African countries (SSAs) are at the lowest level of the export diversification index as well as having low per capita income (Bebczuk & Berrettoni 2006; Hesse 2009). The role of services trade, FDI as well as the dynamic effect in trade development are not fully examined by researchers. We estimate export quality introduced by Pham and Riedel (2013) and the estimation testing the role of FDI and inertia in trade. Further explanation will be presented in Chapter 5.

As shown in the map in Figure 2-1, the highest level of export quality countries are Japan and South Korea, which are about 1.8. Some European countries including Switzerland, Finland and Sweden also have relatively high export quality. Latin America, South Asia and Africa face lowest quality in export.

Figure 2-1. The Export Quality of Different Countries in 2014



Source: UN Comtrade and author's calculations

Note: White areas have no data.

2.4 Export similarity between countries

Export similarity measures the degree of similarity of exports of two respective countries (Finger & Kreinin 1979). The similarity index describes the export baskets of two countries and helps us to understand the export specialization pattern. Many propositions in trade theory can be examined by measuring the export similarity index of two countries. For example, the observation of the changes of export similarity over time between two economies (i.e. whether they become more similar or more divergent) helps to assess the degree of their economic structure (Finger & Kreinin 1979).

Finger and Kreinin (1979) defined exporting similarity between countries *j* and *i* as:

$$S(ab,c) = \{\sum_i Min[X_i(ac), X_i(bc)]\} * 100 \qquad \text{Eq. 2-1}$$

where *a* and *b* are countries; *c* is the market for comparison and *i* is the product. $X_i(ac)$ and $X_i(bc)$ are the shares of product *i* of countries *a* and *b* in market *c*. This formula measures the similarity of the export of countries *a* and *b* in the market *c*. The similarity index $S(ab,c)$ ranges from 0 if their exports are totally dissimilar, to 100 if they export identical products in the same shares (Finger & Kreinin 1979).

Glick and Rose (1999) provide another way to measure the export similarity, which they call a "trade link" between two countries:

$$S(ab,k) = \sum_k \{[\frac{X_k(a) + X_k(b)}{X(a) + X(b)}][1 - \frac{|X_k(a)/X(a) - X_k(bc)/X(b)|}{X_k(a)/X(a) + X_k(bc)/X(b)}]\} * 100 \qquad \text{Eq. 2-2}$$

where $X_k(a)$ denotes the aggregate bilateral exports from country a to market (or country) k and $X(a)$ denotes aggregate bilateral exports from country *a.* The index measures the weighted average importance of export in market *k* of countries *a* and *b* (Glick & Rose 1999).

In their recent study, Bahar, Hausmann and Hidalgo (2014) develop a new method combining revealed comparative advantages (RCA) and Pearson correlation to estimate the similarity

between countries. They firstly assign a small value (0.1) to the zeroes values of RCA, preventing the correlation from being driven up by products with little or no export at all.

$$r_{c,t} = ln\ (RCA_{c,t} + \epsilon) \qquad \text{Eq. 2-3}$$

Next, the export similarity index is measured by comparing the RCA of each products between two countries using the Pearson correlation method. The export similarity is defined as follows:

$$Export\_Similarity_{c,c\prime} = \frac{\sum_p (r_{c,p} - \bar{r}_c)(r_{c\prime} - \bar{r}_{c\prime})}{\sqrt{\sum_p (r_{c,p} - \bar{r}_c)^2 \sum_p (r_{c\prime,p} - \bar{r}_{c\prime})^2}} \qquad \text{Eq. 2-4}$$

where p and c' stand for product, and c and c' are the paired country.

Japan's exports are highly weighted to countries with high-technology manufactured products. The export similarity index of Japan with other countries can be calculated as:

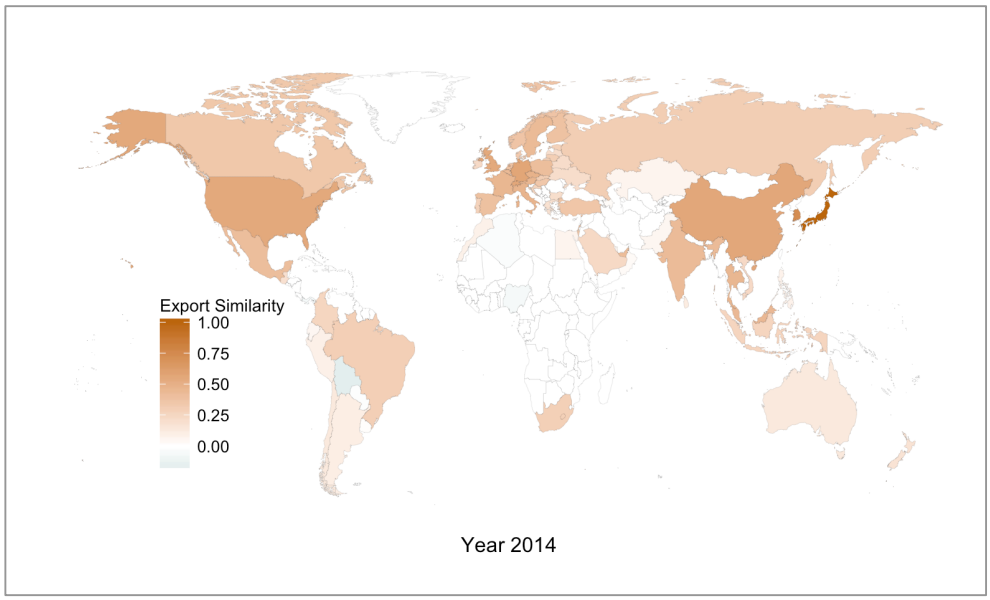
$$Export\_Similarity_{ij,t} = \frac{\sum_p (r_{i,p,t} - \bar{r}_{c,t})(r_{j,p,t} - \bar{r}_{j,t})}{\sqrt{\sum_p (r_{i,p,t} - \bar{r}_{i,t})^2 \sum_p (r_{j,p,t} - \bar{r}_{j,t})^2}} \qquad \text{Eq. 2-5}$$

where *p* stand for product, *i* is the country paired with Japan, *t* represents year, and *j* stands for Japan. In Chapter 3 we consider how the similarity change over time,

The index directly compares the variation in comparative advantages across different products in the export basket. The higher the value of similarity indices for two countries, the more similar the comparative advantages distribution. There are many advantages of using this measurement. It gives proper weight to all products by employing RCA and distinguishes

issues for non-export goods comparison between countries. More explanation of this index will be presented in Chapter 3.

Figure 2-2. World export similarity with Japan, 2014



Source: UN Comtrade and author's calculations
Note: White areas have no data.

Figure 2-2 presents the export similarity of different countries with Japan in 2014. The growth of export similarity over time shows the growth of intra-industry trade, but more importantly, it indicates the converging export structure among countries. An increase in export similarity between countries reveals greater competition in the market and less specialization in production (Finger & Kreinin 1979). Moreover, if the similarity pattern increases between developing and industrialized countries, it indicates the developing country export structure is improving as well as the gap between export quality and industrial ability is reducing (Pearson 1994; Xu & Song 2000). The study of export similarity patterns could reveal changes in production between countries, which has important implication for trade and investment in

terms of greater knowledge and technology diffusion (e.g. see Bahar, Hausmann & Hidalgo, 2014).

Export similarity and export quality are two important perspectives on countries' export situations. For developing economies, exports become more similar to those of an advanced and industrialized country, probably indicating export quality upgrading. China has achieved unprecedented success in economic growth, attracting great interests in recent years. The high-speed growth could be attributed to geographical and demographic advantages as well as success in economic structure transformation. China's export quality is growing and its export are becoming more similar to those of Japan.

2.5 Examples of export upgrading

2.5.1 Export similarity between countries

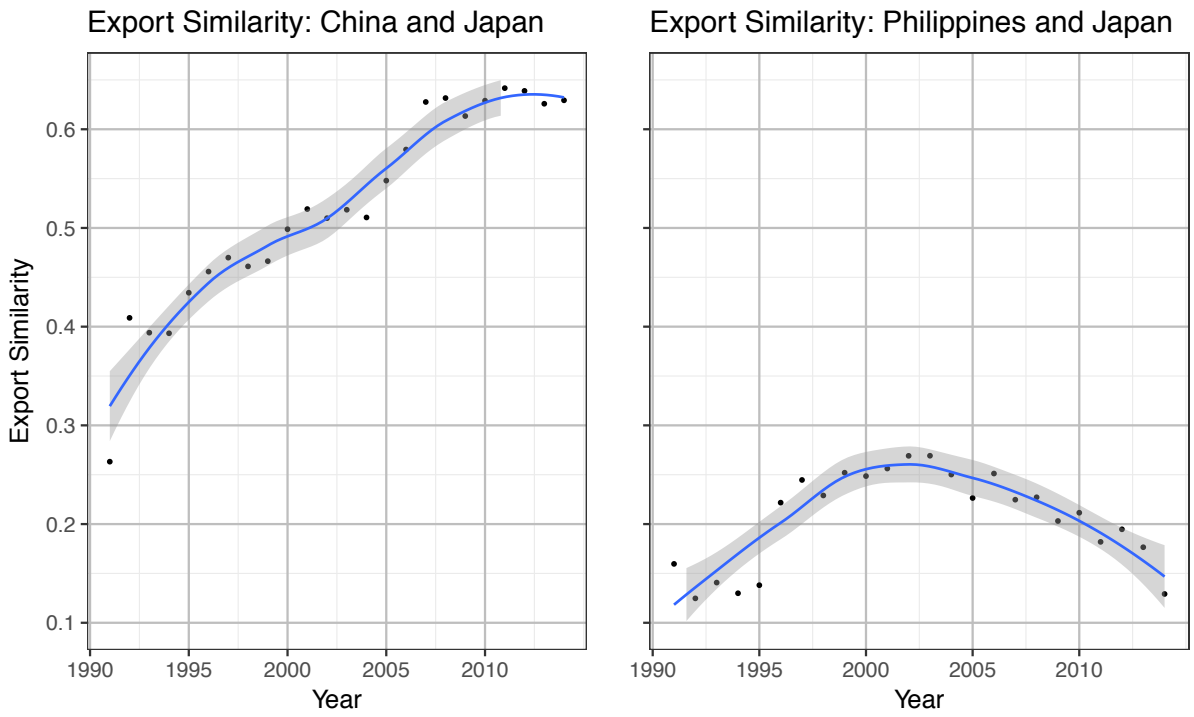
Export specialization depends on the key fundamentals of a country. Countries start to export new varieties and seize greater market share in high-quality products, usually indicating they become more productive (Bahar, Hausmann & Hidalgo 2014). Countries that specialize in producing higher quality products tend to perform better. The clear implication is that the gains from globalization depend on the ability of countries to position themselves appropriately along the export quality spectrum.

One important feature of the upgrading of export structure is that exports become more similar to those of an industrialized neighbor country, which usually indicates relatively higher capital to labor ratio, as well as higher shares of skilled labour force and efficient institutions.

2.5.1.1 Export similarity with between China, the Philippines and Japan

This section provides an example of the Export Similarity between countries. Japan is one of the largest industrial economies. Its farming population is less than 6% of the total population and agriculture accounted for only 1.2% of the GDP in the 2016 (Central Intelligence Agency, cited in Global finance 2017). Since the 1980s Japan has been an important exporter of high-technology products, including electrical and electronic appliances. It is one of the world's leading producers of machinery, ships, motor vehicles, and steel, with manufactured goods the majority of it exports (Dolan & Worden 1992). Where developing countries' exports becomes more similar to Japan's, they can be viewed as experiencing better exports and upgraded industrial ability. In Figure 2.3, Japan's exports are compared with those developing countries of China and the Philippines.

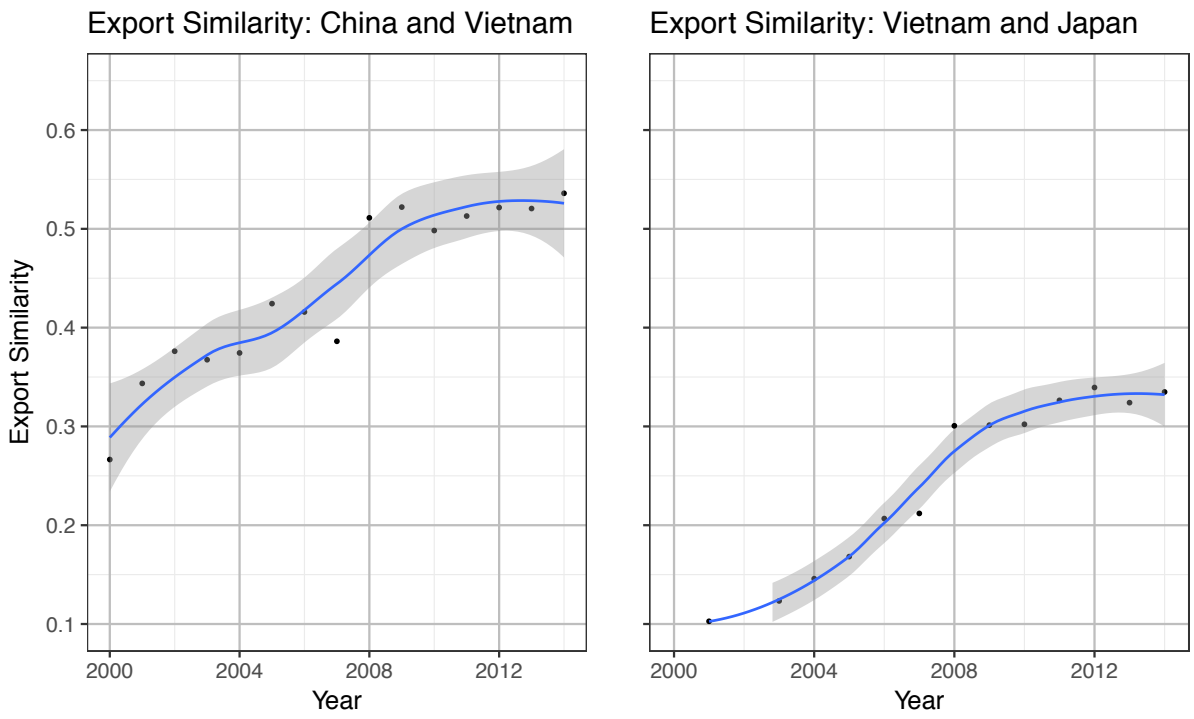
Figure 2-3. The export similarity of Japan with China and the Philippines (1990-2014)



Source: UN Comtrade and author's calculations

Figure 2-3 shows that China's exports are more similar to its high-income neighbor, Japan, which is with higher capital-labour ratio. The similarity index increases steadily from about 0.04 to approximately 0.57, showing that the structures and shares of China's export are much closer to Japan. The right graph shows that the export similarity between Philippines and Japan. The indices are mainly lower than 0.3 from 1990 to 2014. They increase swiftly from 0.17 in 1990 and peak at 0.27 in 2004, but then declines steadily to 0.13 in 2014, indicating that the export structure of Philippines is deviates from Japan's after 2003. Figure 2-4 compares the export similarity of China and Vietnam with Japan. China's export indices are much more similar to Japan than Vietnam, but both the indices are increase overtime.

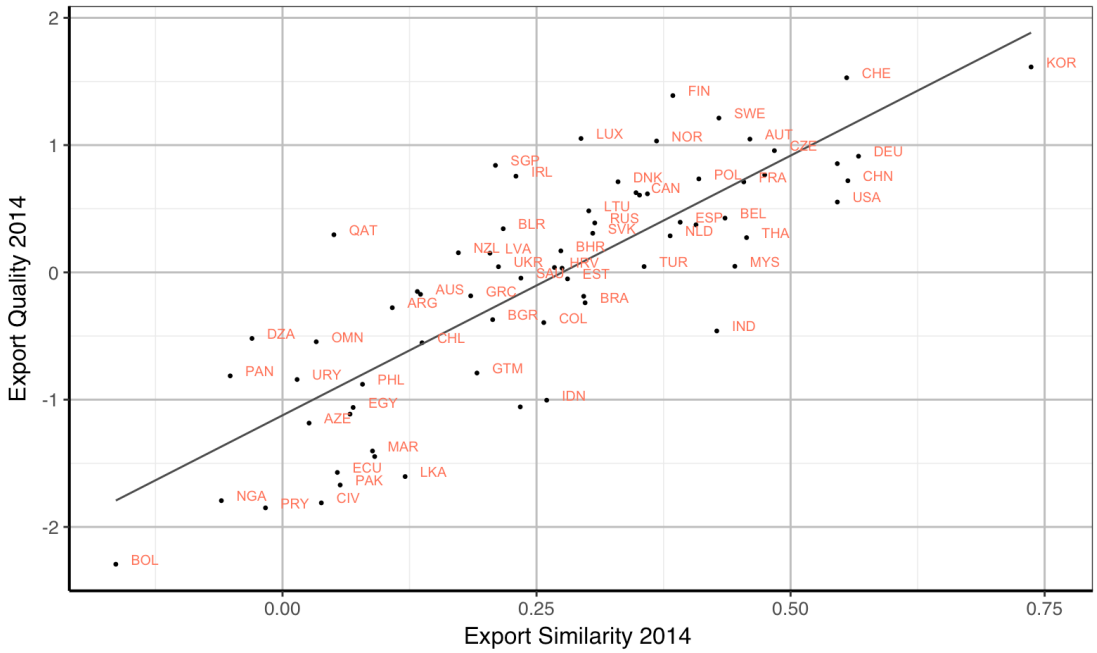
Figure 2-4. The export similarity of China and Vietnam with Japan (2000-2014)



Source: UN Comtrade and author's calculations

The Figure 2-5 is the export quality of different countries and their export similarity with Japan.

Figure 2-5. The Export Quality and Export Similarity (with Japan) in 2014



Source: UN Comtrade and author's calculations

Figure 2-5 presents the relationship between export quality and the export similarity[4] with Japan[5], showing that the correlation between export similarity and export quality is very high. Countries whose exports are more similar to Japan's appear to have better export quality.

2.6 Services trade, foreign direct investment and export upgrading

Intermediate inputs are essential for industrial productivity growth and play a central role in many trade models (Hulten 1978; Markusen 1989). Multinationals activities such as FDI are increasingly important in international trade and development.

[4] The calculation of export similarity and export quality can be seen in Chapter 3 and 4.

[5] Japan present the highest export quality all over the years from 1983 to 2014 based on calculation.

New growth theories suggest that transference of technology and knowledge through FDI could improve a country's economic performance of countries. As an important source of capital, FDI by multinational enterprises (MNE*s*) promotes trade and enhances local employment. As well, high-quality FDI could help low income countries to reduce the technology gap in production and promote the average quality and prices of manufacturing (Amighini & Sanfilippo 2014; Bajgar & Javorcik 2016; Glass & Saggi 1998; Sharma 2003). Firms will enter a foreign country only when it has certain compensating advantages, such as exclusive technologies, copyrights or location advantages (Markusen et al. 1995). The link between FDI and technology-spillover has gained wide attention among academics in both theoretical and empirical studies (Caron, Fally & Markusen 2014; Glass & Saggi 1998; Keller & Yeaple 2009; Liu 2008; Smarzynska Javorcik 2004). Studies on externalities of FDI address a wide variety of issues – ranging from technology spillover and welfare to culture and corruption problems (Arnold & Javorcik 2009; Javorcik & Spatareanu 2011; Kodama, Javorcik & Abe 2016; Kwok & Tadesse 2006). The literatures show that benefit of FDI can spillover across employees, sectors and economies unevenly according to firms' and economies' characteristics (Blalock & Gertler 2008; Blalock & Simon 2009; Havranek & Irsova 2011). However, the inflow of FDI can have multiple effects on countries, with both positive and negative influence, such as the Dutch Disease effect in some countries that have abundant natural resources. Many economies still welcome FDI cautiously or set various restrictions on it. One possible effect is that cross-border investment might bring changes in the host country's industrial growth pattern; another

deeper change is in culture and consumption. Export similarity can provide extra information about the distribution of industries or sectors between two countries, which is important and overlooked by some researchers. Chapter 3 addresses the question of how FDI impacts on export similarity, giving deeper insight into and explanation of this phenomenon.

Services, as an important input in manufacturing, could benefit firms and enterprises in many ways (OECD 2017b). The advancement of information and communication technology constantly reduces the physical barriers and promotes cross-border trade, with the result that the services trade has grown substantially over the past two decades. By 2014, the percentage of services in total export had increase from 17% in 1970 to more than 32% (Loungani et al. 2017). Recent studies highlight the importance of services trade and how the services trade restriction influences the trade flow (Mishra, Lundström & Anand 2011; Nordås & Rouzet 2015).

Like merchandise trade, services trade brings more choices for consumers and greater competition to local markets, which helps to increase firms' productivity and global integration. Firms benefit from necessary experiences and technologies transmitted from services. Education services and the mobility of professionals across borders, for example, are important channels and sources of knowledge transfer. The rising level of productivity is the main driving force for economic growth. Services could play an important role in the upgrading export

performance and productivity (OECD 2017b). Arnold, Javorcik & Mattoo (2011) studied study the relationship between service sector reform and manufacturing productivity. Based on firm-level data from the Czech Republic, they find that reform in service sectors, including reduction in monopolies and entry barriers, positively increases the performance of domestic manufacturing sectors (Arnold, Javorcik & Mattoo 2011). A latter study shows that Indian policy reforms in services exerts a powerful contribution on manufacturing productivity (Arnold et al. 2016). Similar results are found in a study by Beverelli, Fiorini and Hoekman (2017), which shows that service imports and institution quality play critical roles in increasing industrial productivity. Less services trade restriction and higher institutional quality can benefit the manufacturing sectors (Beverelli, Fiorini & Hoekman 2017).

High trade potentials could still be developed. Though the production of services occupies more than 60% of consumption, it accounts for only approximately 20% of world trade (Freund & Weinhold 2002). Trade in services faces a number of impediments from its natural characteristics and policy restrictions. A large number of services are non-storable and require direct interaction between supplier and customer, which confines their transportation and tradability. Also, uneven distribution of gains from trade leads to great concerns in business and political arenas. Local governments typical impose multiple restrictions in an effort to protect companies and workers from competition with foreign markets. Moreover, service sectors usually have potential market power and employ large numbers of workers in many countries. Offshoring refers to more competition and potential migration of jobs.

Discriminatory policies apply to foreign investors and eventually increase the cost of investment (Tideman & Hoekman 2010). Combined with latest studies and empirical method, chapter 4 considers main variables influencing the service trade and it further takes into accounts the influences of the trade network and export similarity between countries.

The fast growth of global trade and its effects on economic growth has gained vast attentions among academics, the rapid increase in trade coming mostly come from to the rise of the emerging market (OECD 2017a). Trade liberalization could help countries filter out firms with low efficiency and strengthen the advantageous sectors, which would eventually optimize industrial structure and improve export quality. The introduction of FDI and services trade liberalization (World Bank, WTO, OECD, IDE-JETRO, RCGVC 2017) could help countries grow faster and enhance their living standard. Chapters 3 to 5 will provide more insights into these problems and provides more empirical evidences.

Chapter 3 What is the role of foreign direct investment? Japanese FDI and export similarity

Abstract

This study investigates the relationship between export similarity and bilateral foreign direct investment (FDI) between Japan and host countries, in particular, how FDI influences domestic exports. The empirical analysis is conducted using a panel data set of 70 countries based on Standard International Trade Classification (SITC) 4- and 5-digit products. The results suggest, firstly, that outward FDI from Japan increases the export similarity between host and source countries, whereas inward FDI to Japan shows no evidence in improving export similarity. Secondly, bilateral FDI promotes similarity in manufactured exports, but to a lesser extent in primary sector exports. Thirdly, geographic distances, bilateral trade and differences in per capita income appear to have significant effects on the pattern of exports. (JEL F13, F14, F15)

Key words: Bilateral FDI, export similarity

3.1 Introduction

The expansion of FDI is a key driver of globalisation and it affects global production and trade. Of particular in interest in this thesis is that recent studies show that linkages between trade and FDI create the potential for countries to upgrade their exports and improve their value-adding ability in production (Amighini & Sanfilippo 2014; Harding & Javorcik 2012).

Compared to domestic companies, multinational enterprise (MNE) affiliates encounter numerous inherent disadvantages, including costs of communication and travelling, and barriers to communication in both language and culture. The MNEs will enter a foreign market only when they have certain compensating advantages, such as exclusive technologies, copyrights or location (Markusen et al. 1995). Foreign investment activities are therefore an important channel for transferring knowledge and technology to the domestic economy. This is one channel by which upgrading can occur.

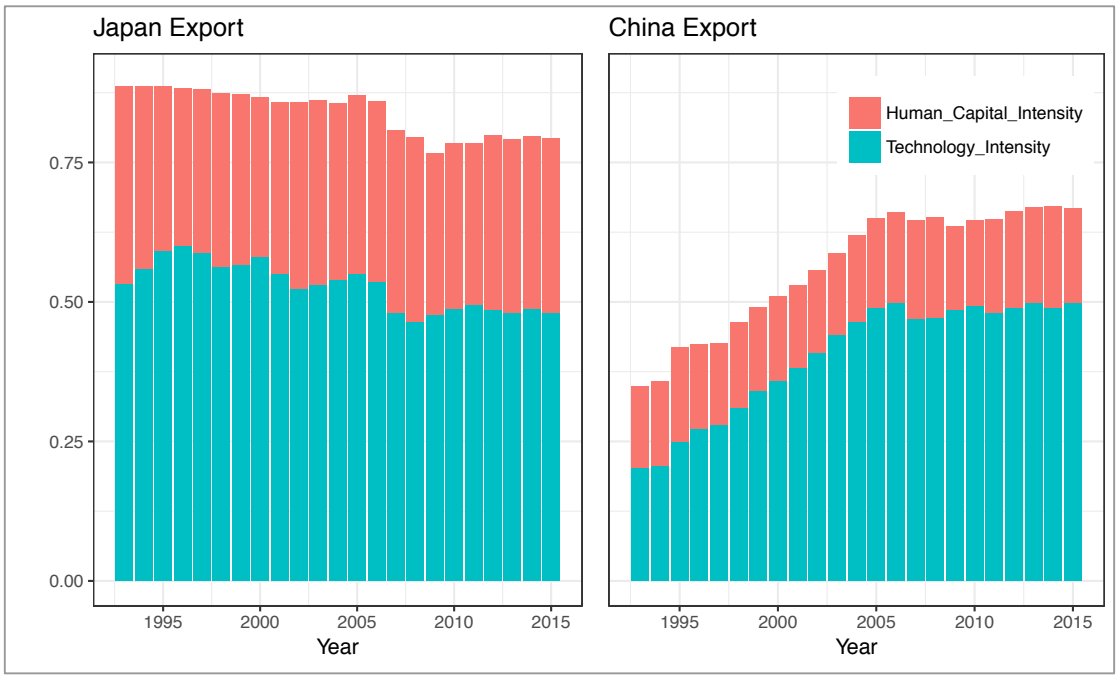
The potential link between FDI and technology spillover, and its contribution to upgrading, has gained wide attention among academics in both theoretical and empirical studies (Glass & Saggi 1998; Keller & Yeaple 2009; Liu 2008). There is a great potential for "learning-by-doing" in export activities as MNE activity is highly correlated with the growth in exports and the domestic economy (Keller 2004; Schneider 2005). Technology transfer through the expansion of FDI is also important for developing countries (Smarzynska Javorcik 2004). The

externalities of FDI tend to be key to a wide variety of issues — ranging from knowledge spillovers and welfare to firm culture and corruption problems (Arnold & Javorcik 2009; Javorcik & Spatareanu 2011; Kodama, Javorcik & Abe 2016; Kwok & Tadesse 2006). Studies have also shown that benefits of FDI can spill unevenly across employees, sectors and economies according to firms' and economies' characteristics (Blalock & Gertler 2008; Blalock & Simon 2009; Havranek & Irsova 2011).

FDI can affect trade patterns directly, through exports from FDI projects and from the imports of intermediate products for those projects. The technology spillover process can also affect the composition of trade. The change in export composition reflects the industrial evolution pattern. Economies specialising in different production spaces can gain differently from the world market; the quality of institution and factor endowments determines the production and export specialisation pattern of respective countries (Hausmann, Hwang & Rodrik 2007). The Heckscher-Ohlin theorem states that a country will export goods that intensively utilise its abundant resources. The flow of products between countries is largely determined, therefore, by comparative advantage — the difference in productivity, factor intensity or factor abundance (Bernard et al. 2007). The export basket changes according to the comparative advantages. These also evolve as access to technology changes, and through that channel FDI can influence export patterns (Bahar, Hausmann & Hidalgo 2014).

This paper examines the relationship between bilateral FDI from Japan and the similarity of the export pattern between Japan and the host economies. Revealed comparative advantage data show that Japan is more specialized in knowledge- and skill-intensive production with higher value-added. In this paper, products are grouped using factor intensities suggested by Shirotori, Tumurchudur and Cadot (2010), which divides products into five factor intensity categories as presented in Appendix Table 3-9. As shows in the Figure 3-1, Japanese exports are heavily weighted (about 80%) towards technology- and human capital–intensive commodities. Compared to Japan, for example, China tends to be more competitive in lower value-added and more labour-intensive commodities. The relatively stable mix of Japanese exports provides the basis for the comparative work in this thesis.

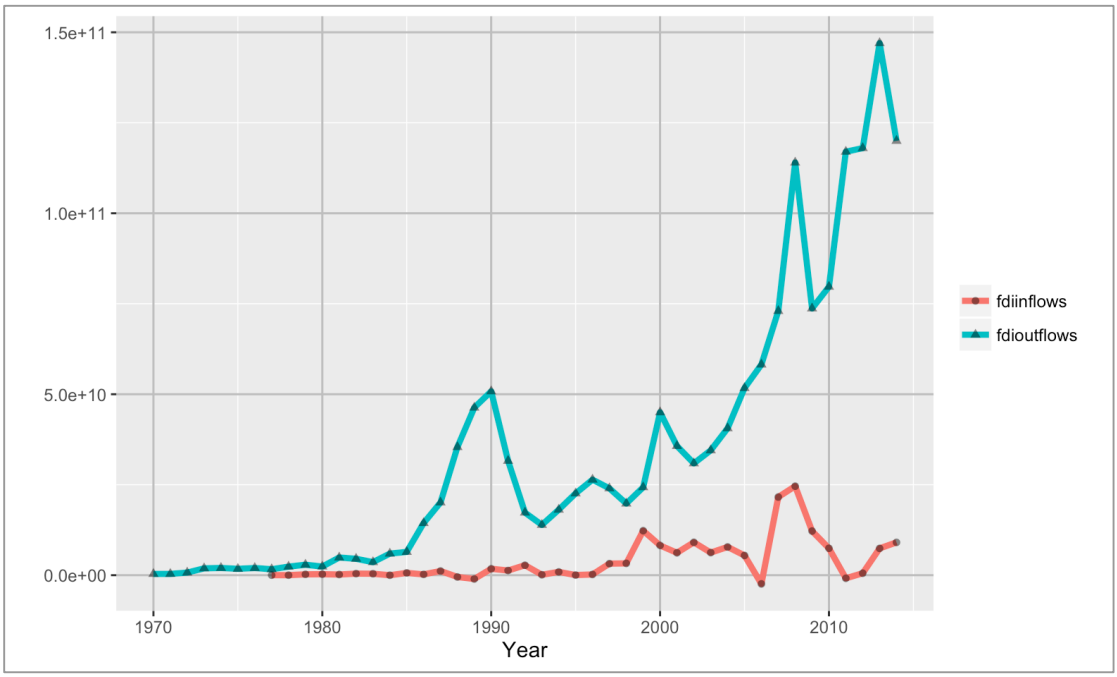
Figure 3-1. The export proportion of different factor intensity sectors (1993-2015)



Source: UN Comtrade and author's calculations

Several factors affect the outward FDI activities of Japanese firms. Figure 3-2 depicts the aggregate FDI of Japan from 1970 to 2014. The FDI outflow notably outweighs its inflow. This phenomenon is caused by economic and political forces. Firstly, before the mid-1990s, official restrictions were in place to control inward FDI for fear that foreign investment may cause unneeded complications and threats to infant Japanese industries. As well, there are many economic obstacles in Japan including the high cost of rent and labour, oligopoly in the markets and the social cost costs (i.e. cultural differences) discouraging foreign investors and impeding FDI inflow (Thorbecke & Salike 2013). Therefore, FDI inflow grew slowly even after 2000. Outward FDI shows a different trend. The Japanese yen appreciated significantly after the Plaza Accord in 1985. To cut production costs, Japanese MNEs had been investing intensively overseas and promoting FDI. The outflow of FDI shows a striking upward trend over this period, peaking in 1990, 2000 and 2007, respectively. Japanese MNEs greatly expanded their economic influence through FDI. By contrast, the insignificant inflow of FDI shows less impact on Japanese domestic production.

Figure 3-2. Japanse FDI inflow and outflow from 1970 to 2014 (BoP, current USD millions)



Source: Word Development Index

3.1.1 Does FDI influence the variation in production between the host and source countries?

The flying geese theory states that the production of mature goods will move continually from advanced economies to undeveloped ones seeking lower costs.[6] Less advanced nations are able to improve or upgrade their industries as production is transferred to them (Akamatsu 1962; Vernon 1966). In order to compete with the domestic advantages of local firms, MNEs need to focus on their own fundamentals, which include new trademarks or superior technologies. Firstly, FDI can replace some exports from the home country. FDI in new facilities and

[6] The flying geese theory is based on the Asian experiences in 19th century. Some scholars also emphasis it is limited for cross-border transfer due to the stability of industries.

products will promote local production and replace or reduce direct imports from those investors (in this case, Japan). Helpman and colleagues (2003) believe transport costs and tariffs have significant negative influences on export sales relative to FDI (Helpman, Melitz & Yeaple 2003). Secondly, inward FDI increases the exports of domestic firms and brings the potential to compete internationally. Moreover, the global network of MNEs could assist local firms to gain entry to foreign markets (Zhang & Song 2002). Therefore, FDI enriches the variety of the export basket and increases export similarity between investor and recipient countries.

The global economy is becoming more diversified and integrated and countries more interdependent. Developing countries that enjoy "comparative advantages" such as cheaper labour wages or natural resources have become increasingly more involved in the global value chains (GVCs), which affect developing countries along multiple dimensions. Global production networks are led by MNEs who are also important sources of FDI in those networks and the investment strengthens interactions between countries. The expansion of the GVC connects countries at different levels of development, from the poorest countries to the most advanced ones. It enhances their abilities to access each other's markets and promotes intra-industrial trade, which further increases the degree of export similarity.

This chapter studies the role of Japanese FDI in changing the pattern of exports of destination countries. Postulating that industrial evolution patterns can be influenced by foreign investment, this study incorporates FDI into a model derived from recent studies on export similarity. The study explores empirical evidence in a two-way fixed-effects model using cross-country data for 70 countries from 2001 to 2007. The export similarity index on country-level data of exports is based on SITC 4- and 5-digit product classification. Compared with other studies focusing on the links of FDI flow and trade (i.e. Alfaro et al. (2004), Makki and Somwaru (2004)), this study provides more insight into the changing in the similarity pattern in exports through bilateral investment flow.

3.1.2 Does FDI bring the export comparative advantages of investors to host countries?

Taking the investigation further, this paper discusses the role of FDI in the transformation of industries and the "country of origin effect". It is possible that FDI plays a more interesting role than mediation of technology and knowledge diffusion. Recipient companies or countries might accept the investment as well as the production comparative advantages from the parent companies. In addition to exports becoming more similar, might cross-border FDI also enhance the similarity of production and influence the industrial growth trajectory?

The results suggest that the greater inflow of FDI increases the similarity between Japan and host countries even after controlling for income level, culture, geographic features and factor endowments. The necessary production advantages brought by FDI help countries to incorporate new products and promotes their comparative development advantages in the world market. The export similarity is not only dependent on natural resource endowments and distance, which approximate the barriers of knowledge diffusion, but it is also driven by the inflow of investment. Bilateral trade and geographic distance also exert a significant effect on the explained variables. The rest of the chapter is structured as follows. Section 3.2 presents the data and measurement. Section 3.3 provides empirical methodology and models. Section 3.4 provides the conclusion and implications for further study.

3.2 Data and measurement

3.2.1 Data

The main data set on bilateral and aggregate trade was collected from the UN Commodity Trade Statistics Database. Two classifications of data were used: the final products in SITC Rev 1 (with a total of 1183 products, including both 4- and 5-digit subheadings)[7] and all 4-digit products from SITC Rev 3 (1066 products). For data integrity, we cover the top 75 countries ranked for aggregate export value in 2012 as well as those with bilateral FDI with Japan. Table

[7] In SITC Rev 1.0 there are 1034 5-digit products. Including 4-digit final products, the total number is 1336. Consistent with Shirotori's paper, 1183 main types of export products were chosen to reduce missing data in each country.

3-7 in the appendix lists the sample countries under study. For reasons of data availability, the number of countries was reduced to 70 for the years 2001 to 2007.

Table 3-6 in the appendix presents the summary statistics for product comparisons between the two categories of samples in this study. SITC Rev 3 is a systematic extension of SITC Rev 1. For a more detailed comparison, the model is separately estimated from two groups of similarity indices based on Rev 3 and Rev 1, producing similar estimation results for the two different product categories.

The bilateral FDI data in this study extend from 2001 to 2014, with the unit of measurement of FDI in trillions of US dollars. Physical capital and human capital per capita reflect the essential production factor endowments intensity of the countries. The variables controlling structural economic factors of production are from UNCTAD, ranging from 1983 to 2007. Time-invariant variables such as distance between different countries, common continent or region, territorial contiguity, common coloniser and coloniser–colony relationship are taken from CEPII's GeoDist dataset (Mayer & Zignago 2011). The key source of the population and per capita GDP data is the World Development Indicators.

3.2.2 Export similarity index and summary statistics

The following is the derivation of the export similarity index used here. The revealed comparative advantage (RCA) is calculated to investigate the specialisation pattern of a product/sector of a country across time. The RCA index of this study is computed as:

$$RCA_{p,c} = \frac{X_{p,c}/\sum_p X_{p,c}}{\sum_c X_{p,c}/\sum_c \sum_p X_{p,c}} \quad \text{Eq.3-1}$$

where, p stands for product and c for the country.

The RCA of a product is the ratio between the proportion of the product in the country's export basket and its corresponding share in world market.[8] However, the calculation of RCA can often be over-represented when its value is greater than 1. The value can be very high when the specific product is exported from only a very few countries. A logarithm form can reduce the correlation from being driven by a few products with a very high RCA[9]. In their study, Bahar and colleagues (2014) assign a small value (0.1) to the zeros, preventing the correlation from being influenced by similarities of products that countries export very little or not at all. That is:

$$r_{c,t} = ln\ (RCA_{c,t} + \epsilon) \quad \text{Eq.3-2}$$

[8] RCA can not distinguish the sector specific factors which indicating the source of comparative advantage.

[9] The Reveal Symmetric Comparative Advantage (RSCA) also provide a possible way to eliminate the asymmetric problem.

The main results calculated in this study include 5-digit subheadings. To avoid exaggerating the zero exports of certain products, instead ϵ is added to every RCA index and ϵ is adjusted from *0.1* to *0.001*. Different data adjustments do not influence the results significantly and the results are compared in Table 3-5.

The export similarity index is measured by comparing the RCA of each product between two countries using the Pearson correlation method. It directly compares the variation of comparative advantages across different products in the export basket. The definition of the export similarity index is as follows:

$$Export\_Similarity_{c,c\prime} = \frac{\sum_p (r_{c,p} - \bar{r}_c)(r_{c\prime} - \bar{r}_{c\prime})}{\sqrt{\sum_p (r_{c,p} - \bar{r}_c)^2 \sum_p (r_{c\prime,p} - \bar{r}_{c\prime})^2}} \qquad \text{Eq.3-3}$$

There are positive and negative indices in the Pearson correlation. This calculation involves a difference in the RCA mean and focuses on the variation process. When the similarity index is larger than zero, the paired countries tend to enjoy a similar export basket with similar intensities. When it is negative, there is more difference in the export intensity distribution over the two countries. The greater the value of similarity indices of two countries, the more similar are the comparative advantages. The FDI of MNCs could take advantages of the lower production cost in recipient countries. The transferring of production would eventually improve the local production, add new product to the export basket and promote export similarity. Bahar and colleagues (2014) believe their measurements give equal weights to all products by employing RCA and distinguish issues for non-export goods comparison between countries.

To consider the time dimension, the paper directly compares countries with Japan over years. The export similarity index of Japan and other countries is calculated as:

$$Export\_Similarity_{ij,t} = \frac{\sum_p (r_{i,p,t} - \bar{r}_{c,t})(r_{j,p,t} - \bar{r}_{j,t})}{\sqrt{\sum_p (r_{i,p,t} - \bar{r}_{i,t})^2 \sum_p (r_{j,p,t} - \bar{r}_{j,t})^2}} \qquad \text{Eq. 3-4}$$

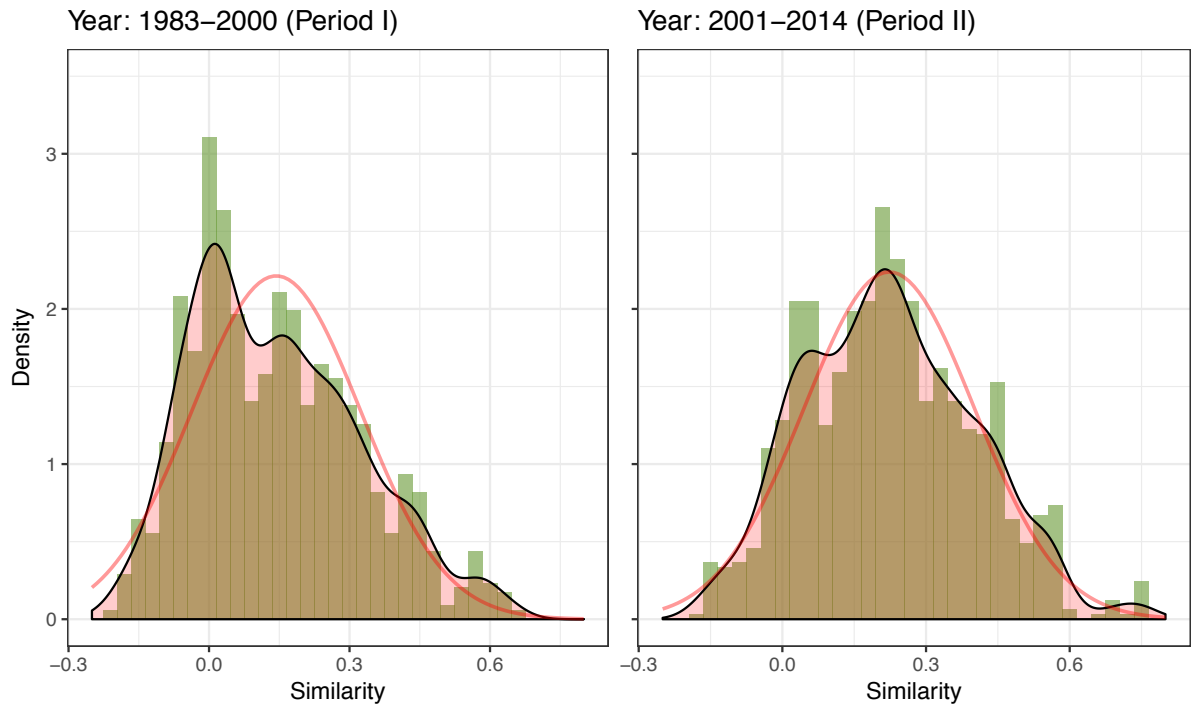
where *p* stands for product, *i* is the country paired with Japan, *t* represents year, and *j* stands for Japan.

Table 3-1. Summary statistics of main variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Similarity Index (ALL)	2229	0.182	0.184	-0.247	0.762
Similarity Index(Manufactures)	858	0.199	0.172	-0.124	0.686
Similarity Index(Primaries)	858	0.233	0.131	-0.113	0.711
Bilateral $FDI_{j\rightarrow i}$ (From JPN)	862	0.809	2.724	-2.644	43.167
Bilateral $FDI_{i\rightarrow j}$ (To JPN)	862	0.089	0.946	-7.562	13.483
Log Bilateral Trade(EX+IM)	2207	21.290	1.987	11.734	26.561
Colonial Relationship	2251	0.014	0.118	0.000	1.000
Log Distant	2251	9.102	0.473	7.053	9.830
Log abs. Dif. GDP per capita	2200	9.636	1.171	1.980	10.833
Log abs. Dif. Population	1971	18.369	0.673	13.166	20.904
Log abs. Dif. Human Capital per worker	1630	0.763	1.072	-5.218	2.093
Log abs. Dif. Physical Capital per worker	1630	11.353	0.988	4.360	12.364

Table 3-1 summarises the statistics of key variables employed in the estimation. Similarity Index is the similarity indices calculated from different categorisations of products. Similarity Index(ALL) stands for all the final products based on SITC Rev 1 final products. Its value ranges from -0.247 to 0.762 from 1983 to 2014. The similarity indices of primary and manufactured products are measured only from 2001 to 2014. Bilateral FDI (to Japan) is the quantity of FDI invested by Japan in the recipient countries, ranging from 43.167 trillion to -2.644 trillion dollars[10]. Bilateral FDI (to Japan) is the amount of FDI flow into Japan from other countries. The bilateral trade, distances and the gaps in capital and human capital variables are given as logarithm forms.

Figure 3-3. The transition of export similarity of Japan and paired countries (1983-2014)



[10] Negative values in FDI inflows indicate that the value of divestment from foreign investors outweighs the value invested in that year. Negative outflows show that the investment of domestic investors is less than the amount of disinvested direct investment in the recipient economy.

In order to see the dynamic effect of export similarity, the time period is split into two – period I (1983–2000) and period II (2001–2014). Figure 3-3 shows the changes in export similarity between Japan and the recipient countries for the two periods. The mean and maximum values increase in period II, compared to period I. During 1984 and 2000, the mean of the similarity index is about 0.14. The lowest and highest values are -0.25 and 0.65, respectively. There is slight increase in period II. The mean value in the second period rises to 0.2, while the maximum and minimum are -0.19 and 0.76 respectively. It shows that the similarity of exports between Japan and recipient countries moves to a higher level over these two periods.

3.3 Methodology

3.3.1 The effect of Japanese FDI on export similarity

Foreign direct investment has long been viewed as an important source of technology and physical capital for many countries. For each exporting country *i*, it is assumed that the variation in export similarity index is explained by the inflow of FDI from Japan. To examine this hypothesis, first the following fixed-effects regression model is set:

$$Export\_Similarity_{i,t} = \beta \cdot FDI_{inflow_{i,t}} + u_i + \varepsilon_{i,t} \qquad \text{Eq.3-5}$$

where *i* denotes export partners with Japan, and *t* is year, $FDI_{inflwo_{i,t}}$ represents Japan's FDI flow into country *i* in year *t*, u_i is country-paired fixed effect, $\varepsilon_{i,t}$ represents a stochastic error term.

As well as bilateral FDI, cultures, geographical features and differences in factor endowments between two countries are essential in explaining the pattern of export similarity. Based on Bahar and colleagues' (2014) regression specification, the model is augmented with more controls under a gravity framework. The final estimated regression model is:

$$
\begin{aligned}
&Export\_Similarity_{i,t} \\
&\quad = FDI_{inflow_{i,t}} * \beta_0 + FDI_{outflow_{i,t}} * \beta_1 + \ln(dist_i) * \beta_2 \\
&\quad + Colony_i * \beta_3 + \ln\left(Bilateral\_trade_{i,t}\right) * \beta_4 + \ln\left(X_{i,t}\right) * \beta_5 \\
&\quad + u_i + y_t + \varphi_i t + \varepsilon_{i,t}
\end{aligned}
\qquad \text{Eq. 3-6}
$$

The variable of interest is $FDI_{inflow_{i,t}}$, which is the direct investment from Japan in countries *i* of year *t.* Model also controls the corresponding outflow *FDI* from country *i* to Japan $FDI_{outflow_t}$. X_i is a group of variables: GDP per capita, population, physical capital per worker and human capita per worker.[11] They are all differences between Japan and country *i*. The model also includes fixed year dummies y_t and countries dummy u_i. For robustness, we also control for country specific linear time trend $\varphi_i t$ to capture possible unobservable time-variant factors.

[11] For robustness, the variables aggregate FDI inflow and outflow of the recipient countries are also considered in all estimations. However, it does not influence the results.

3.3.2 Regression method

The gravity model soundly describes the trade patterns widely adopted in the empirical literature (Feenstra, RC 2015). Based on this framework, the model first adopts the two-way fixed-effects approach for estimation. In Eq. 3-6, country and year fixed effect are used to control for country-specific features and common time shocks. Also, as the possible presence of heteroscedasticity in error term could lead to invalid statistics, heteroscedasticity-robust standard errors are adopted in all regressions.

Silva and Tenreyro (2006) demonstrate that the OLS-based estimator gives inconsistent results and biases the estimated coefficients when there are heteroscedasticity issues. Because the zero values could lead to biased estimation and inconsistent results in a log-linearity model, a PPML method is adopted, which is more robust with heteroscedasticity and naturally deals with too many zeros in the data (Silva & Tenreyro 2006). PPML requires the dependent values to be positive and thus 1 is added to the dependent variable to make it positive.

Therefore, the study estimates Eq. 3-6 with both two-way fixed effects and PPML techniques, the hypothesis relying on the coefficient signs for $FDI_{inflow_{i,t}}$ in the estimation. A positive and statistically significant coefficient implies that an increase in the FDI from Japan has a positive impact on export similarity.

3.4 Results

3.4.1 Foreign direct investment and export similarity in all industries

First the similarity index is calculated with all final products from SITC Rev 1.0. To detect the possible misspecification problem, a heteroscedasticity-robust regression test (RESET) is adopted for adequacy in model specification (Ramsey 1969). To explain the dependent variable the test adds a non-linear combination of independent variables into the equation; for example, $(X^T \mathrm{b})^2$, where b is a vector of coefficients. The p-value is reported in the notes to Table 3-2.

The regression results in Table 3-2 show that the FDI from Japan performs a significant role in increasing export similarity. Columns (1), (2) and (5) of Table 3-2 show the two-way fixed-effects regression results. The PPML estimates are reported in columns (3), (4) and (6). A country-specific trend is added to models (5) and (6) as a robustness check.

The variable of interest, FDI from Japan, is statistically significant and displays the expected sign in regressions. Columns (1) and (2) suggest that holding other variables constant, an increase of one trillion (USD) in investment from Japan can lead to about 0.004-unit growth in export similarity, which means that the investment variation is small but does have a significant impact in the empirical estimations.

Table 3-2. Main regression results: the influence of Japan's FDI on export similarity

	(1) OLS	(2) OLS	(3) PPML	(4) PPML	(5) OLS	(6) PPML
$FDI_{j\to i_t}$	0.004***	0.004***	0.002**	0.002***	0.002*	0.001*
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
$FDI_{i\to j_t}$		-0.001		-0.001	0.001	0
		[0.001]		[0.000]	[0.001]	[0.000]
Log distance			-	-0.114***		-
			[0.022]	[0.022]		[0.148]
Log Dif. $GDP_{per\ capita}$	-0.010***	-0.010***	-	-0.009***	-0.007**	-0.005*
	[0.002]	[0.002]	[0.002]	[0.002]	[0.003]	[0.003]
Log Dif. POP	0.007	0.007	0.011	0.011	-0.042	-0.059
	[0.036]	[0.036]	[0.034]	[0.034]	[0.088]	[0.080]
Log bilateral trade	0.019*	0.019*	0.019**	0.019**	0.019*	0.019**
	[0.010]	[0.010]	[0.009]	[0.009]	[0.011]	[0.010]
Log Dif. physical Capital per worker	-0.025***	-0.025***	-0.017**	-0.017**	-0.024	-0.015
	[0.009]	[0.009]	[0.007]	[0.007]	[0.020]	[0.013]
Log Dif. human capital per worker	-0.001	-0.001	-0.001	-0.001	-0.002	-0.002
	[0.003]	[0.003]	[0.002]	[0.002]	[0.002]	[0.002]
Constant	0.064	0.063	0.944	0.941	0.886	4.059
	[0.707]	[0.708]	[0.736]	[0.737]	[1.639]	[2.488]
Colony relationship	YES	YES	YES	YES	YES	YES
Year fixed effect	YES	YES	YES	YES	YES	YES
Country fixed effect	YES	YES	YES	YES	YES	YES
Country-specific	No	No	No	No	YES	YES
N	478	478	478	478	478	478
adj. R-sq	0.362	0.361	0.975	0.975	0.583	0.986
RESET test	0.893	0.825	0.398	0.419	0.016	0.902

Notes: Robust standard errors are shown in brackets. * p < 0.1, ** p < 0.05, *** p < 0.01

Bilateral trade is expected to play an essential role in promoting similarity. Imported intermediates incorporating technologies can raise productivity in recipient countries (Amiti & Konings 2007; Coe, Helpman & Hoffmaister 2009; Goldberg et al. 2010). Also, trade could reduce uneven endowment distribution between countries. For example, Japan can alleviate the problem of natural resource scarcity by importing from resource-abundant countries. The coefficients for bilateral trade are positive and statistically significant, which indicates that a 1% increase in bilateral trade increases the similarity by 0.019 unit.

The PPML estimator provides more information with several important time-invariant variables. In columns (3) and (4), the geographic distance, usually a proxy for culture differences and transport or transaction costs, has clear and expected negative effects on the dependent variable, in line with the results of other research studies (Bahar, Hausmann & Hidalgo 2014). Expanding bilateral trade positively promotes the growth of similarity between two countries, suggesting that more intra-industry trade promote export similarity. Overall, the results are remarkably similar between fixed-effects and Poisson pseudo-maximum likelihood (PPML) estimators. As well, including a country-specific trend does not influence the FDI activities in this model. The RESET test shows no evidence of misspecification of the gravity equations estimated using the PPML.

Variables such as differences of per capita income and physical capital per worker show significant effects on export similarity, with expected signs. Greater differences among those variables leads to less export similarity. Due to slight multicollinearity issues, other controlled variables do not present significant relationships with the explained variable.

3.4.2 Industry effects: FDI and the similarity index

How do the bilateral FDI flows influence export similarity over different industries? The products are further split into two groups – primary and manufactured – to analyse the effect of FDI on each group of industries.

Table 3-3 shows the classification of primary and manufactured products based on the SITC Rev 1. The primary products include cultivated or extracted raw materials without a manufacturing process. Typical primary sectors include agriculture, fishing, mining and forestry. The manufactured industries, however, involve steps that transform raw materials into final products with higher value-added.

Table 3-3. SITC Rev 1.0 1-digit products

SITC 1-Digit Code	Products groups or compositions
0	Food and live animals
1	Beverages and tobacco
2	Crude materials, inedible, except fuels
3	Mineral fuels, lubricants and related materials
4	Animal and vegetable oils and fats
5	Chemicals
6	Manufactured goods classified chiefly by material
7	Machinery and transport equipment
8	Miscellaneous manufactured articles
9	Commodities. & transacts. Not class. Accord. To kind

Note: The first five rows (SITC 0–4) are basically primary products, whereas the rest (SITC 5–9) are mainly manufactured products.

The provision of primary products depends on domestic natural endowments not easily transferred across borders, whereas the expansion of manufactured industries, which requires capital and technologies, could be accelerated by technologies and capital. The specific factors model describes this imperfect mobility of inputs between industries. It is expected that FDI will have different impacts on different sectors, for example, the capital used for electronics is much different from that used in agriculture. The development of agricultural products is constrained by cropping areas (area planted or harvested), cropping intensity and natural conditions. Knowledge capital, such as trademarks or blue prints, is relatively easier to transfer across borders. Therefore, it is expected that the comparative advantages of primary industries will not be significantly influenced by the inflow of FDI, but the higher export similarity of

manufactured products will enjoy positive and significant promotion by foreign investment, because of factor influences.

Table 3-4. Japan FDI and Different Industries

	(1) Primary FE	(2) Manufactured FE	(3) Primary PPML	(4) Manufactured PPML
$FDI_{j\to i_t}$	0.000	0.004**	0.000	0.002**
	[0.001]	[0.002]	[0.001]	[0.001]
$FDI_{i\to j_t}$	-0.001*		-0.001**	-0.001
	[0.001]		[0.001]	[0.001]
Log distant			-0.120***	-0.116***
			[0.010]	[0.017]
Log Dif. $GDP_{per\ capita}$	-0.009***	-0.001	-0.007***	-0.001
	[0.001]	[0.002]	[0.001]	[0.002]
Log Dif. POP	0.066	-0.002	0.061	0.007
	[0.058]	[0.026]	[0.050]	[0.025]
Log bilateral trade	0.019***	0.004	0.018***	0.006
	[0.004]	[0.008]	[0.004]	[0.007]
Log Dif. physical capital per worker	-0.015**	-0.031***	-0.012**	-0.021***
	[0.007]	[0.007]	[0.005]	[0.005]
Log Dif. human capital per worker	-0.009**	-0.001	-0.007**	-0.002
	[0.004]	[0.004]	[0.003]	[0.003]
Constant	-1.15	0.465	-0.006	1.218**
	[1.085]	[0.520]	[0.940]	[0.575]
Colony relationship	YES	YES	YES	YES
Year fixed effect	YES	YES	YES	YES
Country fixed effect	YES	YES	YES	YES
N	478	478	478	478
adj. R-sq	0.219	0.495	0.941	0.966
RESET test	0.539	0.131	0.375	0.49

Note: Robust standard errors in brackets. * p < 0.1, ** p < 0.05, *** p < 0.01

The empirical models study the similarity of different groups of products between Japan and partner countries. The results presented in Table 3-4 show that there are statistically significant coefficients in the difference of physical capital per worker for all models, indicating smaller gaps in physical capital endowment promote greater export similarity over time. The PPML estimation reports negative and statistically significant coefficients on distance in both groups. It is also worth highlighting that the absolute values of coefficients in manufactured products are all slightly larger than in primary products in those variables, showing that Japanese FDI has greater effects in export similarity of manufactured products.

There is no statistically significant evidence that Japanese FDI would help to promote export similarity in primary products in the recipient countries; however, it is an essential impetus for promoting manufacturing activities. This is consistent with the previous assumption. Other variables are also important for increasing export similarity. For primary products, FDI flow into Japan from the paired countries tend to make the two countries dissimilar. Gaps in GDP per capita and human capital per worker shows a negative relationship with similarity. Bilateral trade shows positive and statistically significant coefficients in the primary goods model, indicating that the quantity of bilateral trade improves the similarity in primary but not in manufacturing industries.

3.4.3 Sensitivity check

For robustness, it is further tested whether the results are sensitive to the selection of data with different adjustments. The dependent variables, similarity indices, are calculated based on two classifications of trade data, with Rev. 1 final products and Rev. 3 4-digit products. Two types of adjustments are made: (1) select ϵ to be 0.1 and 0.001, and (2) add ϵ to all RCAs or only plus to zeros. The first five columns in Table 3-5 are based on Rev. 1 and they are all final products. Columns 6 to 10 are calculated using Rev. 3 4-digit products, also all final products.

Table 3-5. Sensitivity test on different adjustments

	SITC Rev 1 Final products					SITC Rev 3 4-digit				
	(1) + 0.001 to all	(2) +0.001 to 0s	(3) + 0.1 to all	(4) + 0.1 to 0s	(5) +0.1	(6) +0.001 to all	(7) + 0.001 to 0s	(8) + 0.1 to all	(9) + 0.1 to 0s	(10) +0.1
$FDI_{j \to i_t}$	0.004***	0.003***	0.003**	0.003**	0.002*	0.004***	0.003**	0.004**	0.002	0.003**
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.002]	[0.001]	[0.001]
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.063	-0.285	0.316	-1.026**	0.384	-0.284	-0.599	0.017	-0.806	1.025*
	[0.708]	[0.709]	[0.573]	[0.423]	[0.450]	[0.656]	[0.662]	[0.554]	[0.567]	[0.566]
N	478	478	478	478	474	482	482	482	482	482
adj. R-sq	0.361	0.285	0.227	0.081	0 .977	0.109	0.114	0.156	0.125	0.99

Note: Columns (1), (2), (6) and (7) are all RCA plus ϵ. Columns (1), (2), (6) and (7) are processed with ϵ 0.001, and the rest with 0.1. Columns (4) and (9) specifically add zeros to all, which is consistent with the treatment given by Bahar et al. (2014) in their study. Columns (5) and (9) adopt the PPML method.

Robust standard errors are presented in brackets. * p < 0.1, ** p < 0.05, *** p < 0.01

The dependent variables of Table 3-5 are based on different data treatment. Columns (1) to (5) use selected 4- and 5-digit samples from SITC Rev 1, and columns (6) to (10) repeat the exercise, changing the data to 4-digit products of SITC Rev 3. The results of Table 3-5 are similar to those presented in Table 3-4. There is no significant difference between both the coefficients and significance except in column (9), where 0.1 is added only to zeros. In general, adding 0.001 to all selected data performs better with controlled variables.

3.5 Conclusion

A shift in export to become more similar to those of an advanced country, such as Japan, can be viewed as progress, especially for developing economies. It is widely believed that FDI is an important vehicle for knowledge transmission, providing benefits to host countries. However, in order to protect infant industries and avoid uncertainties, many countries still cautiously welcome or even restrict the inflow of FDI. Understanding the effects of FDI is important for policy design.

One possible effect is that cross-border investment might change the host country. Many studies show that FDI can bring technologies and improve or make the economy wealthier. The study reported here examines whether that FDI also makes the country's exports more similar. It addressed the question of how FDI changes the production and export structure of the domestic economy, which could have important policy implications.

The panel results show that countries' exports do become more similar to Japan's as they accept more FDI from Japan. Although the effect is marginal, the results indicate a significant impact.

A number of other factors are also found to be important. The development of GVCs can promote intermediate and intra-industry trade. Importing intermediates incorporating new technologies leads to the upgrading of exports. Therefore, bilateral trade flows can also foster technological inflow and increase export similarity. A 1% increase in bilateral trade will lead to an increase of approximately 0.019 in the similarity of exports. Other variables, including colony relationship and the difference of physical capital per worker, are significant influencers for the change of export pattern. Most of the controlled variables are showing the expected signs in the result, but the span of years was reduced to seven due to data availability of certain variables. The multi-collinearity problems might become obvious. Some variables become insignificant due to collinearity.

In summary, export patterns of host countries do became more similar to those of the developed country of the FDI inflow, in this case, of Japan. This is an indication of the presence of export upgrading, which it is argued here also contributes to economic development.

An implication of the results here is that developing countries could encourage investment from high-income countries and embrace trade to enhance their economic development. Investment climate is important for attracting investment. Economies should expand openness to foreign investment, increase investor protections and reduce trade barriers. More olicy implications of the work of the thesis are discussed in more detail in the final chapter. Neighbouring countries may also benefit more from this "knowledge diffusion" as there are fewer barrier in culture and

distance. China and ASEAN countries should take their natural advantages into account and encourage investment from high-income neighbours such as Japan and Korea.

Chapter 4 Services liberalisation, export similarity and trade in services

Abstract

Studies show that service activities are essential for promoting manufacturing productivity and economic development. This raises an important question of how to promote services trade and whether policy liberalisation contributes to its development. The study examines the impact of policies on trade in services across countries using export data from UN Comtrade, where restrictions on trade as a result of policy are measured by the Services Trade Restrictiveness Index (STRI). The estimations are in the form of a log-linear gravity model analyzing the effect of STRI on bilateral services trade and one-sided service exports. Our results show that a one per cent increase in the overall STRI brings about a 0.25%–0.29% decrease in bilateral services trade and a 0.04% decrease in service exports. In addition, goods trade networks and export similarity show significant and positive impacts on services trade. (JEL F13, F14, F15)

Key words: trade in service, Services Trade Restriction Index, export similarity

4.1 Introduction

Trade in services which has become an important component of regional and global trade over the past two decades is mainly driven by the advancement in new technologies, declining trade costs and increasing levels of economic liberalisation in global and regional economies. In 2017, service industries account for about two-thirds of global GDP and 75% of FDI related in the developed countries. The share of services is rising in the global GDP while the shares of primary and manufacturing sectors are decreasing. The percentage of manufacturing in global GDP decreased from 20% in 1997 to 15% to 2015. It was the decline in relative prices of manufactured products and increased demand in services led to this change (OECD 2017b). The World Bank (2007) highlighted that approximately 70% of global value-added trade in 2007 was generated from the service sectors; however, existing entry barriers and transportation costs still hamper the development of the trade, especially services trade. A recent paper by Borchert, Gootiiz and Mattoo (2013) highlights that changes in service policy are essential for services development and economic growth.

The connection between services trade and merchandise trade has received attention in previous studies (e.g. Egger, Francois and Nelson (2017)). Export similarity in merchandise trade reflects similar technological and production ability. The international linkages built through good trade can further promote the services exchanges among countries. The study will as well test the role of merchandise export similarity and trade network in the services trade development.

4.1.1 Benefits of services trade

Compared with goods production, service products cannot be traded separately from their production (OECD 2008). Free international trade brings mutual advantages to trading countries under certain circumstances. Both theoretical and empirical studies show that trade between countries can improve both countries' social welfare (Markusen et al. 1995). Trade is an important vehicle through which firms can access cheaper and higher quality services and other intermediates. Similar to commodity trade, trade in services exploits countries' comparative advantages and accelerates technology exchange. For consumers, trade brings more competition to local markets, helping to reduce prices through lower costs and increased productivity. Individuals benefit from imported services by having more choices and lower prices. The main driving force of economic growth is the rising level of productivity. Service activities also play an important role in upgrading manufacturing productivity and export performance (OECD 2017b). Firms and enterprises gain experiences and technologies transmitted from foreign services; for example, education services such as Internet e-learning and the mobility of professionals (e.g. accountants, engineers, lawyers) across borders are important channels and sources for knowledge transfer.

Compared to merchandise goods, demand for services is more stable and less cyclical. During the Global Financial Crisis in 2008, service exports were observed to be less volatile and more resilient than the goods trade (Borchert & Mattoo 2010). Services are important inputs for manufactured production. Arnold and colleagues (2011) empirically studied the linkage between service sectors reform and manufacturing productivity. Based on firm-level data from the Czech Republic, they show that reform in services sectors, including the elimination of monopolies and barriers to entry, will contribute positively to the performance of domestic

manufacturing sectors (Arnold, Javorcik & Mattoo 2011). Also, Indian policy reforms in service could exert a positive impact on manufacturing productivity (Arnold et al. 2016). Beverelli, Fiorini and Hoekman (2017) find that service imports and the quality of domestic institutions play critical roles in increasing manufacturing productivity. Lower services trade barriers and higher institutional quality benefit the manufacturing sectors in those countries.

The price and quality of services have major impacts on all sectors in an economy. High-tech services are heavily utilised by modern manufacturers and their competitiveness relies on access to suppliers (OECD 2017b). An open services market brings more competition and ensures firms have access to higher quality inputs, essential technologies and necessary funding supports. International trade and investment provide better opportunity for wider choices and better quality products. Services also play an essential part in linking value-added activities. For example, transport services move components and parts for assembly and carry final products to the consumers; insurance and banking services provide firms with funding and insurance support; and information and technology services monitor the tastes and demand of consumers and supply that information to relevant producers. Professional and abundant intermediate services help local producers to reduce costs, improve product quality and stimulate exports. High-quality service suppliers usually employ an abundance of skilled labour. In developed countries, the most service-intensive firms are generally in high-technology sectors, because they require a relatively higher share of skilled labour (OECD 2017b). The presence of high-quality service sectors in a country often indicates a move up in the ladder of global value chains.

4.1.2 Barriers in services trade

Services trade could be an important source of various positive externalities. However, it generally faces a large number of impediments, both from its own natural limitations and various policy restrictions. A large number of services are innate in nature and require interaction between the service supplier and customer. Also, trade could induce wage inequality (Verhoogen 2007). Uneven distribution of gains from trade (Mehta & Hasan 2012) attracts much concern in business and political arenas. Political requirements in many countries can impose multiple restrictions on the trade of services in an effort to protect local companies and workers from competition from foreign providers.

Further, service sectors with potential market power can drive a wedge between producer costs and customer prices. For example, a successful digital platform such as Facebook or Twitter, which employ a large number of workers in many countries, can dominate the industry in which it operates and exhibit characteristics of a monopoly. Discriminatory policies, including limits on shares in equity ownership or direct prohibition of entry to protect local services producers, may apply to foreign investors. Those regulations eventually increase investors' costs and are usually more significant in services trade than in manufactured trade (Tideman & Hoekman 2010).

Domestic regulations and barriers often impede international services trade and create deadweight losses to society. Lack of competition could result in low service quality, which eventually influences the development of local industries. By weighting the STRI into different industries, Beverelli and colleagues (2017) show that services trade liberalisation is important for manufacturing. A reduction in service barriers has positive impacts on manufacturing

industries (Beverelli, Fiorini & Hoekman 2017). The development of technologies such as the Internet makes services cheaper and easier to trade across borders. Freund and Weinhold (2002) show that there is a correlation between the development of the Internet and the services trade, especially in business, professional and technical services. Adopting the top-level domain as a measure of Internet penetration, they find that services are promoted by Internet development (Freund & Weinhold 2002).

The services trade restrictiveness index (STRI), which measures the prevailing services trade policies, has gained wide attention in academic studies. Nordas and Rouzet (Nordås & Rouzet 2015) conducted an analysis on the negative impact of STRI on cross-border trade in services. (Marel & Shepherd 2013) find that policy restrictions have a strong and negative association with total services. Recent studies also focus on the link between the matured physical goods and services trades and find positive relationships between them. This study further adds trade network and export similarity indices into the model. It extends the empirical study of the STRI effect on both bilateral services trade and unilateral services export, with more countries from the UN Comtrade Service Trade database. Recent studies indicate that countries with common trade partners have stronger bilateral merchandise trade (Egger, Francois & Nelson 2017). This study includes both the export similarity index and goods trade network index of physical goods trade between countries as independent variables to test the relationship between merchandise trade and services trade.

This chapter is organised as follows. Section 4.2 summarises the data using basic analysis. Sections 4.3 and 4.4 present the results of the empirical analysis and relevant results. Section 4.5 reports the conclusions and makes policy suggestions.

4.2 Data analysis

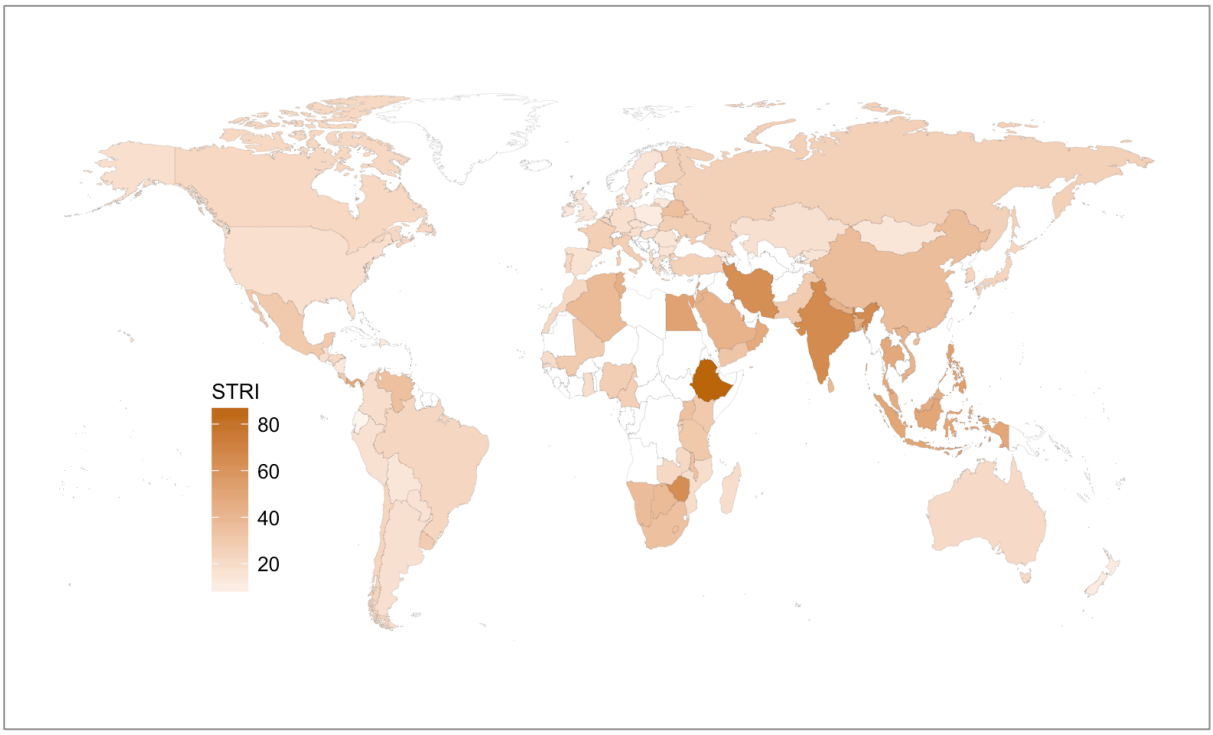
4.2.1 Data source

The study adopts bilateral services trade data for 190 countries, from 2000 to 2015, from the UN Comtrade database[12]. We also use the STRI from the World Bank Services Trade Restrictions Database for comprehensive data on barriers to services.[13] The time-invariant variables are derived from CEPII's GeoDist database: geographic distance, common continent or region, common coloniser and coloniser–colony relationship between countries (Mayer & Zignago 2011). Population and per capita GDP data are derived from world development indicators.

[12] The World Bank Trade in Services Database provides cross-section and annual bilateral services trade information in Mode 1 (cross-border trade) and Mode 2 (consumption abroad) for 248 countries across a multitude of sectors and years spanning 1985 and 2011 (Francois & Pindyuk 2013). However, the STRI is collected after 2011.

[13] OECD also provide detailed data over 18 service sectors, but for 44 countries.

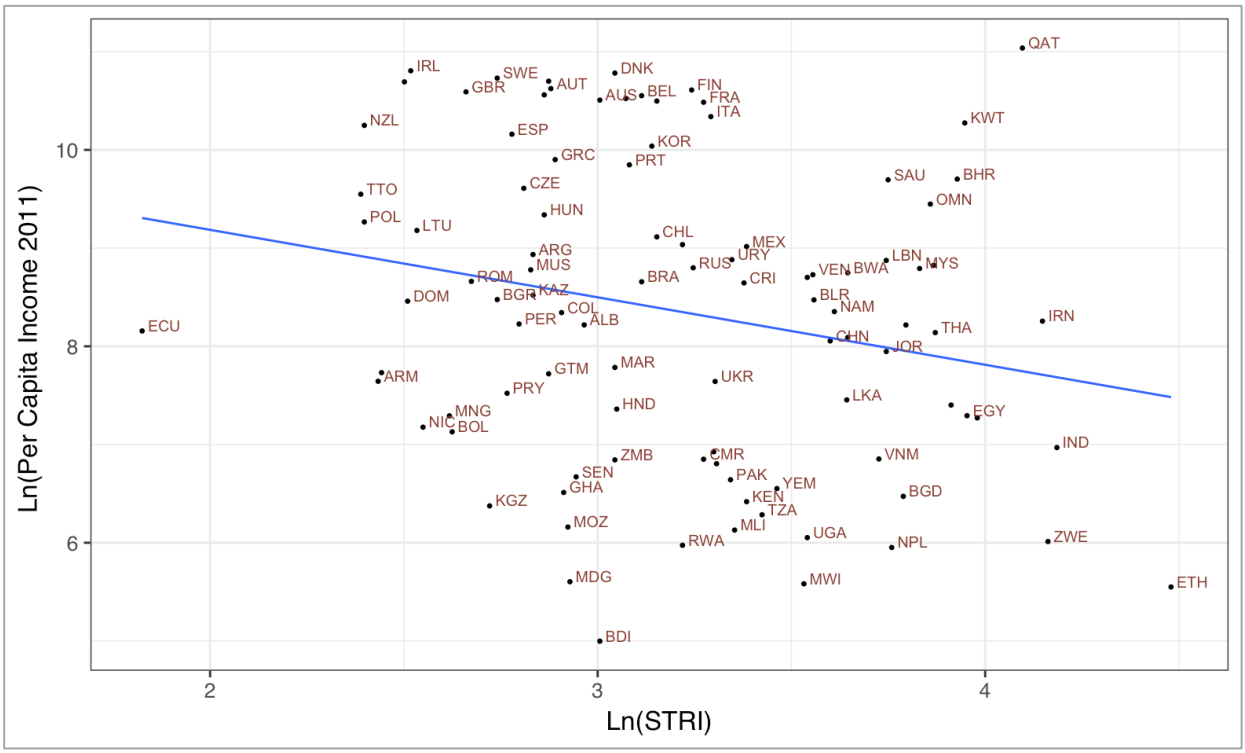
Figure 4-1. The overall STRI of 99 countries



Source: Services Trade Restrictions Database, World Bank Group

Figure 4-1 shows the overall distribution of policy restriction on foreign services in 99 countries. The darker the colour, the higher the level on the STRI. The highest level of STRI is in Ethiopia, whose overall STRI reaches 88.2. The lowest is 6.2 in Ecuador, an upper-income country in Latin America. From the graph, it would seem that countries in Africa, the Middle East and South Asia face stricter barriers and more regulations on services trade.

Figure 4-2. Per capita income and STRI across countries in 2011



Source: World Bank Services Trade Restrictions Database.

Note: some country labels are dropped as they overlap

In testing to determine what types of countries have higher barriers to services trade and whether that is correlated with the level of development, the first step is based on the following simple model:

$$Ln(Per\_Captia\_income_i) = \beta_1 + \beta_2 Ln(STRI_i) + \varepsilon_i$$

Table 4-1. Per capita income and STRI

	Pool OLS	Year 2011	Year 2012	Year 2013	Year 2014
Ln(STRI)	-0.681***	-0.687**	-0.681**	-0.684**	-0.670**
	[0.140]	[0.286]	[0.283]	[0.279]	[0.277]
Constant	10.573***	10.560***	10.560***	10.590***	10.582***
	[0.455]	[0.932]	[0.921]	[0.909]	[0.903]
N	395	99	99	99	98
adj. R-sq	0.049	0.041	0.041	0.042	0.041

Notes: Robust standard errors are shown in brackets. * p < 0.1, ** p < 0.05, *** p < 0.01

Table 4-1 shows that the effect of the STRI on per capita income is negative and significant. High-income nations show less trade restriction. A 10% increase in the STRI is associated with about a 6.8% reduction in per capita income across countries. However, it is important to note that our results imply that there is a correlation between restrictiveness and per capita income, but not a causal relationship. The model builds on the assumption that STRI is exogenous and independent. However, causality probably runs in both directions: economies are able to reduce barriers and restrictions to trade when they are wealthier, whereas a greater level of STRI might hamper a country's development. Overall, lower income countries on average experience higher restrictions and more inconvenience in services trade activities.

4.3 Empirical strategies and results

The study adopts the gravity model, which originates from Newton's universal law of gravitation, as one of the empirical workhorses in trade analysis. Tinbergen (1962) was the first to adopt the gravity equation for econometric international trade study, claiming that trade volume is proportional to the economic scale of two countries and correlates inversely to

physical distance. Anderson (1979) was the first to develop the economic theory of gravity model. He argued that trade volume between two countries decreases as the relative trade barriers increase, when compared with other partners after controlling for size. In most applied studies, researchers apply the gravity model for testing a variety of variables, including trade policies, culture, common language and common boarders, and colonial relationships.

Here, the interest is in how STRI influences the services trade. We adopt new data from UN Comtrade from 2011 to 2014. The general empirical specification is set as follows:

$$Trade_{ij} = \beta_0 (GDP_i)^{\beta_1} \left(GDP_j\right)^{\beta_2} \left(DIST_{ij}\right)^{\beta_3} e^{\beta_4 (LANG_{ij})} e^{\beta_5 (COLONY_{ij})} e^{\beta_5 (STRI_{ij})} \varepsilon_{ij} \quad \text{Eq. 4-1}$$

where $Trade_{ij}$ is the value of services trade flow between country *i* and country *j*; GDP_i and GDP_j are GDPs for a specific year in countries *i* and *j*, respectively; and $DIST_{ij}$ is the distance between countries *i* and *j*.

4.3.1 Bilateral trade volume

The STRI is a constant index across years and an importer-specific value. In order to measure bilateral services trade and consider the bilateral barriers at the same time, we first add the total bilateral export and import between two countries:

$$Service_{ij} = Sevice\_export_{i \to j} + Service\_import_{i \to j} \quad \text{Eq. 4-2}$$

where $Sevice\_export_{i \to j}$ is the export from country *i* to country *j* and $Service\_import_{i \to j}$ is the import services value of country *i* from country *j*.

Also, the bilateral STRI index[14] is derived by following method:

$$Ln(STRI_{bilateral}) = Ln(STRI_i + STRI_j) \quad \text{Eq. 4-3}$$

Following economic theory, services trade is supposed to be negatively influenced by the level of policy restriction on services – $Ln(STRI_{bilateral})$ and should be positively influenced by the GDP of both countries. Geographic distance is a proxy for transport cost and is assumed to have a negative effect on trade. The gravity model is generally estimated by taking a log on both sides to make the model linear. Following the standard gravity model in the literature, Eq. 4-4 is specified to investigate the influence of geographic distance, colonial relationship and GDP.

First, a typical cross-section gravity equation for multiple years is estimated:

$$\begin{aligned} Ln(Service_{ij}) = {} & \beta_0 + Ln(Dist_{ij}) * \beta_1 + Colony_{ij} * \beta_2 + Ln(Language_{ij}) * \beta_3 \\ & + Ln(STRI_{ij}) * \beta_4 + Ln(Pop_i) * \beta_5 + Ln(Pop_j) * \beta_6 + Ln(GDP_i) \\ & * \beta_7 + Ln(GDP_j) * \beta_8 + \varepsilon_{ij} \end{aligned} \quad \text{Eq. 4-4}$$

where $Service_{ij}$ is the bilateral services trade between *i* and *j*.

One key aspect of the log-linearity gravity model is the heteroscedasticity issues and the problem of zero values in trade data. Silva and Tenreyro (2006) point out that the ordinary least squares (OLS) regression (i.e. of Eq. 4-4) would give inconsistent results and bias the estimated coefficients when there are heteroscedasticity issues. Also, the prevalence of zero values in trade data produces an unsatisfactory estimation in log-linearity model. Therefore, they

[14] In testing how bilateral policy restriction influence the bilateral trade, it is observed that country *j* exports to country *i* are influenced by $STRI_i$ and country *j* imports from country *i* are influenced by $STRI_j$. Therefore, this study sums the STRIs before taking the logarithm.

recommend performing a Poisson pseudo-maximum likelihood (PPML), which is more robust with heteroscedasticity and deals naturally with too many zeros in the data (Silva & Tenreyro 2006). Consequently, a typical cross-section gravity equation is estimated with different years, using the PPML method. The STRI is a comprehensive measure of policy regulations that hamper the entry and operations of foreign service suppliers, based on each sector. A negative relationship is expected. Table 4-2 provides cross-section coefficient estimates for the mean value of services between 2011 and 2014 for different modes of supply measured by STRI.

Table 4-2. Typical cross-section gravity equation estimates

	Mean (2011–2014)	Mean (2011–2010)	Mean (2011–2014)	Mean (2011–2014)
$\text{Ln(STRI\_overall}_{\text{bilateral}}\text{)}$	-0.151***			
	[0.031]			
$\text{Ln(STRI\_mode1}_{\text{bilateral}}\text{)}$		-0.117***		
		[0.017]		
$\text{Ln(STRI\_mode3}_{\text{bilateral}}\text{)}$			-0.084***	
			[0.027]	
$\text{Ln(STRI\_mode4}_{\text{bilateral}}\text{)}$				-0.023
				[0.056]
Ln(Distance)	-0.065***	-0.073***	-0.069***	-0.073***
	[0.008]	[0.008]	[0.008]	[0.008]
Colonial relationship	0.052**	0.066**	0.048**	0.057**
	[0.025]	[0.027]	[0.024]	[0.026]
Common language	0.071***	0.050**	0.081***	0.075***
	[0.021]	[0.021]	[0.021]	[0.021]
Ln (importer population)	-0.025***	-0.026***	-0.031***	-0.038***
	[0.008]	[0.007]	[0.008]	[0.007]
Ln (exporter population)	0.036***	0.029***	0.031***	0.023***
	[0.007]	[0.006]	[0.007]	[0.007]
Ln (importer GDP)	0.000***	0.000***	0.000***	0.000***
	[0.000]	[0.000]	[0.000]	[0.000]
Ln (exporter GDP)	0.085***	0.084***	0.091***	0.093***
	[0.006]	[0.006]	[0.006]	[0.006]
Common coloniser	-0.048	-0.038	-0.06	-0.079**
	[0.043]	[0.040]	[0.042]	[0.039]
Contiguous	0.018	0.003	0.01	0.015
	[0.023]	[0.025]	[0.024]	[0.027]
Constant	1.507***	1.589***	1.309***	1.325***
	[0.198]	[0.198]	[0.206]	[0.293]
N	451	451	451	451
adj. R-sq	0.576	0.587	0.559	0.5461

Notes: The dependent variable is the average bilateral services trade value between 2011 and 2014. Robust statistic errors are in parentheses. ***, **, and * refer to statistical significance at the 1%, 5%, and 10% levels respectively.

Table 4-2 presents the results of estimating Eq. 4-4 using robust standard errors for possible heterogeneity issues. The bilateral services trade is regressed on bilateral STRI, geographic distance, common language, colonial relationship, GDP and population with PPML estimation. The services trade are found to be negatively associated with different modes of STRI, which are also statistically significant, except in STRI mode 4. It suggests the restrictiveness on person mobility have negative but no significance effect on service trade. The coefficient suggests that a 10% increase in the restrictiveness of services trade policies is associated with a 1% decrease in bilateral services trade in manufactured goods. The results show that for each country pair, distance has a negative effect on bilateral services trade. As expected in gravity model studies, the reasoning behind this result is that more distant markets face greater trade costs, which reduces the amount of trade itself. In addition to the effects of market size and distance, it is seen that countries that have common official languages and colonial relationships have greater services trade intensity, which is similar to goods trade.

4.3.1.1 Multiple price resistances

Anderson and Van Wincoop (2003) illustrate that omitted variables bias may arise by ignoring prices in the cross-section gravity equation. The trade between two countries is also dependent on the relative price of products with other trade partners, which is not captured by distance. By assuming symmetric trade cost, their framework suggests theoretically that the gravity model should be estimated as:

$$Ln\left({Trade_{ij}}/{GDP_i GDP_j}\right) = \beta_0 + Ln(Dist_{ij}) * \beta_1 + Colony_{ij} * \beta_2 + Ln(LANG_{ij}) * \beta_3 + Ln(STRI_{ij}) * \beta_4 + Ln(Pop_i) * \beta_5 + Ln(Pop_j) * \beta_6 - Ln\, P_i^{1-\sigma} - Ln\, P_j^{1-\sigma} + \varepsilon_{ij} \quad \text{Eq. 4-5}$$

subject to *N* market- equilibrium conditions of price index:

$$P_1^{1-\sigma} = \sum_{i=1}^{N} P_i^{1-\sigma} \left(\frac{GDP_i}{GDP_w}\right) e^{\beta_4(LANG_{ij})} e^{\beta_5(COLONY_{ij})} e^{\beta_5(STRI_{ij})} \quad \text{Eq. 4-6}$$

$$P_N^{1-\sigma} = \sum_{i=1}^{N} P_i^{1-\sigma} \left(\frac{GDP_i}{GDP_w}\right) e^{\beta_4(LANG_{ij})} e^{\beta_5(COLONY_{ij})} e^{\beta_5(STRI_{ij})}$$

where GDP_w stands for world GDP and $P_j^{1-\sigma}$ and $P_i^{1-\sigma}$ are "multilateral price resistance terms". The unbiased coefficient can be estimated by a customised nonlinear least-squares program that utilises information on the full structure of the model. According to Anderson and Wincoop (2003), an alternative, simpler way is to replace the multilateral resistance terms with country fixed-effect dummies, though the importer and exporter fixed effects are less efficient the nonlinear least-squares method (Anderson & Van Wincoop 2003; Baier & Bergstrand 2007).

We consider the following model:

$$LnService_{ij} = Ln(Dist_{ij}) * \beta_1 + Colony_{ij} * \beta_2 + Ln(LANG_{ij}) * \beta_3 + Ln(STRI_{ij}) * \beta_4 + Ln(Pop_i) * \beta_5 + Ln(Pop_j) * \beta_6 + LnGDP_i * \beta_7 + LnGDP_j * \beta_8 + Ln(Export\_similarity_{ij}) * \beta_9 + \sum \delta_i * D_i + \sum \delta_j * D_j + \varepsilon_{ij} \quad \text{Eq. 4-7}$$

Following Anderson and Van Wincoop (2003), we control country fixed effects to account for the multilateral price terms. Table 4-3 presents the results of OLS regression with importer and exporter fixed-effect estimation.

The estimates in Table 4-3 reveal that the coefficient of STRI is statistically significant and negative except for 2014. Similar results are observed with the earlier estimation in Eq. 4-5 on geographic distance, common languages and coloniser relationship, revealing the expected signs. The results indicate that a 1% reduction in overall STRI could lead to about a 0.3% increase in bilateral trade in our sample of countries. Common official language and colonial relationship also tend to increase services trade, in line with the existing literature. In addition to the effects of overall STRI, Table 4-4 provides similar estimation with the different modes of STRI effect on bilateral services trade.

Table 4-3. Gravity model estimation with Anderson and Van-Wincoop (2003) gravity specifications

	2011	2012	2013	2014
$\text{Ln(STRI\_overall}_{\text{bilateral}}\text{)}$	-0.254***	-0.299***	-0.277***	-0.043
	[0.079]	[0.089]	[0.095]	[0.150]
Ln(distance)	-0.065***	-0.050***	-0.068***	-0.065***
	[0.004]	[0.005]	[0.006]	[0.008]
Colonial relationship	0.031**	0.023**	0.028*	0.055**
	[0.012]	[0.010]	[0.015]	[0.024]
Common language	0.032***	0.040***	0.050***	0.041**
	[0.009]	[0.009]	[0.014]	[0.018]
Ln (importer GDP)	0.002	0.063***	-0.015*	0.037**
	[0.004]	[0.011]	[0.009]	[0.016]
Ln (exporter GDP)	0.003	0.059***	-0.014	0.044***
	[0.004]	[0.011]	[0.010]	[0.015]
Ln (exporter population)	-0.000*	0	0.000**	0
	[0.000]	[0.000]	[0.000]	[0.000]
Ln (importer population)	-0.013**	-0.007	0.008	0.002
	[0.006]	[0.008]	[0.006]	[0.010]
Common coloniser	0.133***			0.098***
	[0.045]			[0.033]
Contiguous	0.014	0.018	0.014	0.044
	[0.013]	[0.020]	[0.019]	[0.029]
Constant	4.494***	2.662***	4.658***	2.107***
	[0.368]	[0.101]	[0.228]	[0.366]
N	528	262	312	451
R-sq	0.889	0.872	0.9131	0.866

Notes: The dependent variable is the average bilateral service value from 2011 to 2014, weighted by GDP. Robust statistic errors are in parentheses. ***, **, and * refer to statistical significance at the 1%, 5%, and 10% levels respectively.

Table 4-4. Gravity model estimations with Anderson and Van-Wincoop (2003) gravity specifications: country fixed effects and different modes

	Mean (2011–2014)	Mean (2011–2014)	Mean (2011–2014)	Mean (2011–2014)
$\text{Ln(STRI\_overall}_{\text{bilateral}}\text{)}$	-0.273***			
	[0.073]			
$\text{Ln(STRI\_mode1}_{\text{bilateral}}\text{)}$		0.014		
		[0.031]		
$\text{Ln(STRI\_mode3}_{\text{bilateral}}\text{)}$			-0.244***	
			[0.061]	
$\text{Ln(STRI\_mode4}_{\text{bilateral}}\text{)}$				-0.567**
				[0.263]
Ln(distance)	-0.066***	-0.068***	-0.067***	-0.068***
	[0.004]	[0.004]	[0.004]	[0.004]
Colonial relationship	0.030**	0.032***	0.031**	0.031**
	[0.012]	[0.012]	[0.012]	[0.012]
Common language	0.034***	0.032***	0.034***	0.031***
	[0.009]	[0.009]	[0.009]	[0.009]
Common coloniser	0.124***	0.114***	0.122***	0.115***
	[0.045]	[0.044]	[0.044]	[0.044]
Contiguous	0.014	0.013	0.013	0.013
	[0.013]	[0.013]	[0.013]	[0.013]
Ln (exporter population)	0.019***	0.024***	-0.033***	0.024*
	[0.004]	[0.004]	[0.007]	[0.015]
Ln (importer population)	0.018***	0.025***	-0.033***	0.025*
	[0.004]	[0.004]	[0.006]	[0.015]
Ln (importer GDP)	0.000	-0.000*	0.000	-0.000*
	[0.000]	[0.000]	[0.000]	[0.000]
Ln (exporter GDP)	-0.013**	-0.012**	-0.013**	-0.013**
	[0.006]	[0.006]	[0.006]	[0.006]
Constant	4.119***	2.782***	5.697***	5.546***
	[0.341]	[0.195]	[0.460]	[0.809]
N	528	528	528	528
R-sq	0.896	0.893	0.896	0.895

Notes: The dependent variable is the average bilateral service value between 2011 and 2014 weighted by GDP. Robust statistic errors are in parentheses. ***, **, and * refer to statistical significance at the 1%, 5%, and 10% level respectively.

4.4 Unilateral service exports

Adding the imports and exports of paired countries and treating them symmetrically in both trade and the STRI reduces some essential country-specific information as well as the size of samples. If we consider only one-sided service exports, however, including fixed effects to control for multilateral resistance will be impossible because the STRI is an importer-specific variable. Baier and Bergstrand (2009) apply a first-order log-linear Taylor series expansion to the price system to control for multilateral resistance without including fixed effects, to generate a reduced-form gravity equation. They show that the revised method produces a similar estimation and this method is adopted in recent studies (Baier & Bergstrand 2009; Hoekman & Shepherd 2015).

The trade of goods between countries can build important bilateral channels and strengthen trust between countries, which in turn could impact significantly on the services trade. Recent studies focus on the relationship between the goods and services trades. The expanding global value chain and production network will not only source intermediate goods globally, but also require more service support (e.g. insurance, finance, transportation and eduation) from relevant countries. As the cost of trade declines, the trade of services could be further accelerated by using the existing goods trade network (Egger, Francois & Nelson 2017). Export similarity between countries might indicate similar industrial production and ability. Based on the emprical setting in line with Baier and Bergstrand (2009) and Hoekman and Shepherd

(2015), this study further tests whether the goods trade network and export similarity could influence the services trade.

4.4.1 Goods trade network index

Based on data from the United Nations' Comtrade database in 2010, the goods trade network index developed by Egger, Francois and Nelson (2017)represents the physical goods trade network overlap of two countries. For example, for countries *i* and *j*, the partners of each country is measured by $G_{i,-j}$and $G_{j,-i}$, which denotes the whole set of trading partners except each other. The network overlap index is specified by the log of the number of the overlapping set of countries .

$$Net_{ij}^{G} = Ln(G_{i,-j} \cap G_{j,-i}) \qquad \text{Eq. 4-8}$$

4.4.2 Export similarity index

The export similarity index is measured by comparing the revealed comparative advantages of each physical product for two countries using the Pearson correlation method. It directly compares the variation of comparative advantages across different products in the export basket (Bahar, Hausmann & Hidalgo 2014). The export similarity index is defined as follows:

$$Export\_Similarity_{c,c\prime} = \frac{\sum_p (r_{c,p} - \bar{r}_c)(r_{c\prime} - \bar{r}_{c\prime})}{\sqrt{\sum_p (r_{c,p} - \bar{r}_c)^2 \sum_p (r_{c\prime,p} - \bar{r}_{c\prime})^2}} \qquad \text{Eq. 4-9}$$

4.4.3 Empirical model

The estimation model is as following:

$$\begin{aligned} Ln(Trade_{ij}) = {} & b_0 + b_1\, Ln\, STRI_i{}^* + b_2\, Ln\, DIST_{ij}^* + b_3 Colony_{ij}^* \\ & + b_3 Contiguous_{ij}^* + b_4 Common\_language_{ij}^* \\ & + b_5 Net_{ij}^G + b_6 Export\_simlarity_{ij}^G + b_7 LnGDP_j + b_8 LnGDP_i + e_{ij} \end{aligned} \quad \text{Eq. 4-10}$$

where $Trade_{ij}$ indicates the export from country *j*, to the relevant importer country *i; STRI* is the World Bank STRI of the importer; *Distance* is the distance between the exporter and the importer; *Contiguous* is a dummy equal to 1 if the countries share a common land border; *Colony* is a dummy equal to 1 if one of the countries in the pair was once a colony of the other; *Common coloniser* is a dummy equal to 1 if the countries in the pair were once colonised by the same country; *Common language* is a dummy equal to 1 if the countries in the pair share a common language (ethnographic basis); *Smtrcy* is the binary variable where it takes 1 if country *j* and *i* were ever the same country and 0 otherwise; Net_{ij}^G and $Export\_simlarity_{ij}^G$ are the trade network index and export similarity index for countries *i* and *j* in 2010, which are calculated from Eq. 4-9 and Eq. 4-10; and GDP_i *and* GDP_j are the GDP of the importer and the exporter, respectively. In order to reduce the possible endogeneity issue, both the export similarity index and the goods trade network index are calculated based on data for the year 2010.

Baier and Bergstrand (2009) suggest that each trade cost variable in the model should be adjusted for multiple resistance. The controlled variables marked with a star are transformed to control for multilateral resistance. The transformation process is as follows:

$$v_{ij}{}^{*} = v_{ij} - \sum_{j=1}^{N} \frac{GDP_j}{GDP_w} v_{ij} - \sum_{i=1}^{N} \frac{GDP_j}{GDP_w} v_{ij} + \sum_{j=1}^{N} \sum_{i=1}^{N} \frac{GDP_i}{GDP_w} \frac{GDP_j}{GDP_w} v_{ij} \qquad \text{Eq. 4-11}$$

The $\sum_{j=1}^{N} \frac{GDP_j}{GDP_w} v_{ij}$ is a GDP-share-weighted average of the gross trade costs (v_{ij}) facing exporter *i* across all importer *j*. The higher this value is, the greater the overall multilateral resistance for country *i*. In addition, the last components in the formula for the multilateral resistance term are constant across all country pairs and therefore can be included naturally in the constant. Estimation using the PPML method and the dependent variable is the mean of trade from 2011 to 2014. The resuslts are shown in Table 4-5.

Table 4-5. Export similarity index and goods trade network index

	Export (2011-2014)	Export (2011-2014)	Export (2011-2014)	Export (2011-2014)
$Ln(STRI\_overall_{importer})$	-0.070***	-0.050***	-0.012	-0.016**
	[0.008]	[0.008]	[0.008]	[0.008]
Net_{2010}^{G}		0.351***		0.300***
		[0.053]		[0.055]
$Export\_similarity_{2010}^{G}$			0.194***	0.108***
			[0.024]	[0.030]
Ln(distance)	-0.069***	-0.065***	-0.050***	-0.053***
	[0.004]	[0.004]	[0.004]	[0.004]
Colonial relationship	0.024**	0.054***	0.033***	0.044***
	[0.012]	[0.012]	[0.010]	[0.010]
Common language	0.012	0.014	-0.012	-0.004
	[0.012]	[0.012]	[0.010]	[0.010]
Common coloniser	0.042*	0.04	0.006	0.037
	[0.024]	[0.030]	[0.016]	[0.028]
Contiguous	0.041***	0.008	0.039***	0.027***
	[0.011]	[0.011]	[0.009]	[0.009]
Ln (importer GDP)	0.000***	0.000***	0.000***	0.000***
	[0.000]	[0.000]	[0.000]	[0.000]
Ln (exporter GDP)	0.054***	0.044***	0.049***	0.043***
	[0.002]	[0.003]	[0.002]	[0.003]
Constant	1.027***	-0.541**	1.100***	-0.297
	[0.085]	[0.249]	[0.086]	[0.278]
Observations	1458	1210	1065	987
R^2	0.421	0.542	0.511	0.549

Note: (i) Robust standard errors clustered by country pair are in parentheses below the parameter estimates.

(ii) All trade cost proxies are transformed as per Baier and Bergstrand (2009). (iii) Statistical significance is indicated by * (10%) and *** (1%).

The estimates shown in Table 4-5 highlight that there is generally a negative correlation between services trade restrictiveness and the dependent variable. Placing greater restrictive regulations on services trade can significantly hamper trade from foreign countries. The estimation implies that a 10% reduction in the STRI of importing countries will increase the export of services by 1.6% on average. Our estimations also highlight that having a common trade network as well as similarity in exports of physical goods positively promotes trade in services. We also observe that a 1% increase in export similarity will enhance trade by about 0.1%. The results support the hypothesis that the channels linking the physical goods trade network and export similarity play a role in service exports. The effects of market size (GDP) and distance as well as colonial relationship and sharing a land border have significant explanatory power for unilateral services trade.

Table 4-6 adopts a similar regression strategy but with different modes of STRI. As previously discussed, different modes of STRI can influence services trade differently. The provision of services is affected by mode 3 (i.e. foreign investment), mode 1 (i.e. cross-border trade) and mode 4 (i.e. movement of people). It is seen that different modes of the importing country's STRI also show negative relationships with service exports.

Table 4-6. Services trade regress with different modes, export similarity and trade network indices

	Mean (2010–2014)	Mean (2010–2014)	Mean (2010–2014)	Mean (2010–2014)
$\text{Ln(STRI\_overall}_{\text{importer}})$	-0.041***			
	[0.016]			
$\text{Ln(STRI\_mode1}_{\text{importer}})$		-0.020**		
		[0.009]		
$\text{Ln(STRI\_mode3}_{\text{importer}})$			-0.028*	
			[0.015]	
$\text{Ln(STRI\_mode4}_{\text{importer}})$				-0.040*
				[0.023]
Ln(distance)	-0.044***	-0.044***	-0.044***	-0.045***
	[0.008]	[0.008]	[0.008]	[0.008]
$\text{Export similarity}_{2010}$	0.190***	0.214***	0.207***	0.219***
	[0.048]	[0.045]	[0.047]	[0.045]
$\text{Net}_{2010}{}^{G}$	0.375***	0.368***	0.387***	0.385***
	[0.093]	[0.093]	[0.094]	[0.093]
Colonial_relationship	0.085***	0.081***	0.086***	0.083***
	[0.020]	[0.020]	[0.020]	[0.020]
Common language	0.016	0.013	0.014	0.016
	[0.022]	[0.022]	[0.022]	[0.022]
Common coloniser	0.066*	0.057*	0.064*	0.052
	[0.034]	[0.034]	[0.034]	[0.034]
Contiguous	0.019	0.025	0.015	0.025
	[0.022]	[0.022]	[0.022]	[0.022]
Same_country_before	-0.033	-0.043	-0.031	-0.041
	[0.090]	[0.093]	[0.093]	[0.098]
Ln (importer GDP)	0.000***	0.000***	0.000***	0.000***
	[0.000]	[0.000]	[0.000]	[0.000]
Ln (exporter GDP)	0.067***	0.069***	0.069***	0.067***
	[0.006]	[0.006]	[0.006]	[0.006]
Constant	-1.274***	-1.362***	-1.439***	-1.321***
	[0.480]	[0.490]	[0.481]	[0.479]
N	694	694	693	694
R-sq	0.515	0.552	0.551	0.552

Note: (i) Robust standard errors clustered by country pairs are shown in parentheses below the parameter estimates. (ii) All trade cost proxies are transformed as per Baier and Bergstrand (2009). (iii) Statistical significance is indicated by * (10%) and *** (1%).

Heterogeneity across service sectors is important (Tideman & Hoekman 2010). Policies have distributional effects across many sectors. This suggests that policies in certain areas and sectors may also have effects and linkage with other service sectors. To investigate this hypothesis, we use aggregate STRIs and regress with different sectors respectively.

Table 4-7 shows a negative relationship between services trade restrictiveness and parts of the service sectors. It is apparent that application of policy restrictions (measured by STRI) generates a statistically significant coefficient in most of the sectors. The coefficients imply that a 10% reduction in aggregate STRI of importing countries can increase services trade by 1% in the insurance sector. In the travel service sector, recreational services and government services, a similar decrease in STRI can promote the services trade by 0.2%, 0.6% and 0.7%, respectively. This finding provides some evidence that overall restrictions might have greater effects on the insurance and government service sectors, but the aggregate STRI does not show obvious influences on other sectors, such as construction and royalties and licence fees. Similarity in goods trade brings more opportunity and cooperation between paired countries. Having a common trade partner, as well as export similarity of goods between countries promotes service exports in most sectors. However, some other variables are not statistically significant due to data quality or collinearity problems. Results might be improved if considering more specific modes of STRI or more relevant policy restrictiveness.

Table 4-7. Gravity model regression results by different sectors

	Travel	Insurance services	Royalties and licence fees	Construction services	Personal, cultural & recreational services	Government services
$Ln(STRI\_overall_{importer})$	-0.026**	-0.100***	-0.012	0.036	-0.058**	-0.070***
	[0.011]	[0.022]	[0.020]	[0.032]	[0.025]	[0.018]
Ln(distance)	-0.056***	-0.054***	-0.043***	-0.037***	-0.063***	-0.017**
	[0.005]	[0.013]	[0.012]	[0.013]	[0.013]	[0.008]
Export $similarity_{2010}$	-0.04	0.168*	0.337***	0.354***	0.177**	0.023
	[0.038]	[0.086]	[0.087]	[0.085]	[0.081]	[0.068]
Net_{2010}^{G}	0.558***	0.633***	0.377***	0.166	0.780***	0.488***
	[0.072]	[0.149]	[0.126]	[0.130]	[0.155]	[0.123]
Common language	0.016	-0.083**	-0.076*	-0.027	-0.03	-0.073***
	[0.013]	[0.039]	[0.041]	[0.035]	[0.040]	[0.028]
Common coloniser	0.064**	-0.032	-0.07	-0.001	0.067	-0.062
	[0.030]	[0.102]	[0.064]	[0.070]	[0.082]	[0.059]
Contiguous	0.023	-0.002	0.02	0.041	0.02	0.042
	[0.015]	[0.032]	[0.025]	[0.029]	[0.031]	[0.029]
Same_country_before	0.067***	0.029	-0.147***	-0.123***	-0.055	-0.001
	[0.026]	[0.059]	[0.043]	[0.043]	[0.038]	[0.050]
Colonial relationship	0.050***	0.070**	0.067**	0.058*	0.097***	0.079***
	[0.014]	[0.034]	[0.031]	[0.032]	[0.033]	[0.029]
Ln (importer GDP)	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Ln (exporter GDP)	0.043***	0.048***	0.050***	0.035***	0.051***	0.042***
	[0.003]	[0.008]	[0.007]	[0.008]	[0.008]	[0.005]
Constant	-1.651***	-2.249***	-1.198**	0.313	-3.366***	-1.009*
	[0.353]	[0.749]	[0.592]	[0.837]	[0.771]	[0.592]
N	706	559	428	340	450	396
R-sq	0.516	0.356	0.409	0.23	0.404	0.482

Note: (i) Robust standard errors clustered by country pair are in parentheses below the parameter estimates.
(ii) All trade cost proxies are transformed as per Baier and Bergstrand (2009).
(iii) Statistical significance is indicated by * (10%) and *** (1%).

4.5 Conclusion

Services are essential inputs for many sectors. Trade helps shift resource allocation to more productive areas and increases welfare. Analyzing the relevant policies and important factors promoting services trade are essential for production and export upgrading among countries, which eventually influence the improvement of social welfare. The objective of this study is to explain how services policy, as indicated by the STRI, influences the bilateral volume of services trade at the paired-country level. We also test the impact of having a similar goods trade partner and export similarity on services trade. Using data from UN Comtrade, we include the largest possible number of countries in our analysis. The estimations take a log-linear gravity model based a theoretical model derived from Anderson and Van Wincoop (2003) with country fixed effects. Following Baier and Bergstrand (2009) and Hoekman's specification (2015) allows consideration of unilateral exports as well as importers' STRI. In the purpose of connecting to physical goods trade, two indices (goods trade network index and export similarity index) between paired countries were also taken into account as factors that could potentially stimulate bilateral services trade. The results show that policy restrictions are hampering both service imports and exports. A 1% increase in the overall STRI brings about a 0.25%–0.29% decrease in bilateral service exchange. A 10% increase in the overall STRI leads to about a 0.7%–0.2% decrease in unilateral services trade.

We evaluate the major determinants of services trade between different countries for the period 2011–2014. The results verify that STRI and geographical distance negatively affect services and commodities trade, and export structure and economic scales positively affect services trade. Having a common border and having colonial links tend to exert positive and statistically significant influences on services trade. Conditional on those factors, goods trade networks and

export similarity appear to play a role in stimulating services trade. Similarity in goods trade also exerts significant influence on services trade, which in turn implies that two countries with greater similarity tend to enjoy greater trade volume, that is, having a common language and having a colonial relationship).

The negative relationship between STRI indices and services trade volume confirms that the STRI effectively captures the impact of regulations and barriers between countries. The findings suggest that it is possible that trade openness and policy liberalisation would promote service sectors, which would eventually bring more opportunities to enhance industrial abilities and firms' learning and innovation.

Chapter 5 FDI, Service imports and Export development

Abstract

The ability of an economy to export high-quality products is a function of its key fundamentals, such as capital, technologies and its institutions. This chapter examines the relationship between export quality, FDI activities and level of service imports across different countries. The study develops a panel framework to empirically examine the dynamic pattern of export upgrading and factors directly affecting countries' export performance. We find that services importing, FDI activities and level of per capita income positively affect export upgrading. (JEL F13, F14, F15)

Key words: export quality, industrial structure, FDI, services trade

5.1 Introduction

The competitiveness of a country depends on the quality and competitiveness of domestic fundamentals, such as institutions, capital and level of domestic technologies. However, most developing economies do not have the necessary resources to build the fundamentals of the economy and hence must rely on foreign investment to support their activities. FDI activities develop externalities such as learning-by-doing effects and can promote industrial upgrading. Other factors also directly affect value-added activities and quality of exports, for example service imports. Services are used throughout the manufacturing process. They are an important part of the value chain and essential for both manufacturers and consumers. The relationship between trade and FDI has been widely studied by many researchers (Frankel & Romer 1999; Rodrik, Subramanian & Trebbi 2004; Slaughter 2001), however, the role of import services tends to be neglected in the literature. Further, there is a need to study the dynamic patterns of exports and the role of inputs factors, including FDI, in the production process. This study focuses on how export quality is influenced by service imports and FDI inflow.

Industrial upgrading involves outputs moving from low value-added products to higher value goods production. Upgrading industries in terms of technologies and capital investment could also create more competitive industries and thus generate higher revenue, increase employment and income through more efficient production. The export of more and higher quality goods reflects a country's economic performance (Hallak 2006; Hausmann, Hwang & Rodrik 2007). Transitioning from exporting low-quality to high-quality products[15] is often viewed as export

[15] Quality is measured by considering the market share and price at the same time.

success and economic development (Amiti & Khandelwal 2013). Gereffi and Tam (1998) argue that industrial upgrading involves organisational learning to enhance the status of firms or nations in international markets. Upgrading is dependent on various conditions, including higher quality inputs (e.g. capital and skilled workers), managerial capacities, government policy support, integration in the global production network and so on. A large number of studies show that FDI and services trade are important factors in export upgrading. In addition, growth of productivity and quality require accumulation of capital, skilled labour and experience. The accumulation of more complex sets of capabilities and productivity growth play an important role in export development (Borensztein & Ostry 1996; Hidalgo et al. 2007).

The presence of foreign affiliates improves the export performance of domestic economies (Javorcik, Lo Turco & Maggioni 2017). The literature highlights that the flow of FDI is one of the main sources of knowledge and technology transfer for developing countries. In fact, many studies have shown that FDI inflow is important for export upgrading for both host and recipient countries (Harding & Javorcik 2012; Javorcik, Lo Turco & Maggioni 2017). High-quality FDI could help low-income countries reduce the production technology gap and improve their competitiveness (Glass & Saggi 1998). FDI accelerates structural transformation and raises average export quality as well as prices of manufacturing exports in low-income economies (Amighini & Sanfilippo 2014; Bajgar & Javorcik 2016).

Production fragmentation and the outsourcing of intermediates can create opportunities for firms to shift to their core and higher value-added activities. Many studies have shown that imported intermediate inputs can lead to increased productivity and support the development of new products, leading to economic growth (Goldberg, Khandelwal & Pavcnik 2011; Rivera-

Batiz & Romer 1991). In fact, intermediates incorporated with the necessary technology hold an important role in facilitating and improving product quality.

Several studies highlight the importance of services trade and how it promotes manufacturing and exports (Mishra, Lundström & Anand 2011). As important inputs in production, services imports have long been overlooked in countries' production processes. Increasingly, firms become more 'servicified', using as well as producing and selling more services than before. Services are incorporated into manufacturing products (e.g. engineering, design and software services) and create higher value-adding (Cernat & Kutlina-Dimitrova 2014). Economies are also becoming more services-driven and services production accounts for a greater share of GDP. Services also play a role in upgrading export performance and manufacturing productivity (OECD 2017b).

Rapid technology advancement increases the importance of services provision and also make services more tradable. Services are utilised throughout the whole value chain of production and help producers to lower costs, enhance efficiency and upgrade product quality. Firms and enterprises can benefit from advanced managerial skills and technologies transmitted by the services trade. Education services and professional movement (e.g. accountants, engineers, lawyers) across borders can bring necessary technologies and management methods to recipient countries. In agriculture production, for example, services link the different stages of the value chains, which includes equipment rental and weather information services, as well as packaging, transportation and marketing (OECD 2014). The intensity of services adopted by firms affects their export performance and competitiveness in the market (Lodefalk 2014) and shapes manufacturing sector competitiveness (Wolfmayr 2008).

The main purpose of this study is to examine export patterns across countries and identify the sources utilised in upgrading exports. Section 5.2 introduces a panel data set for 76 countries from 2000 to 2014 and builds a dynamic model to analyse export changes across countries. Section 5.3 reports the estimates of the model. Section 5.4 contains the conclusion and future study.

5.2 The Development of Export Quality: Data and Methodology

5.2.1 Data Source and Analysis method

The data for this study are drawn mainly from the UN Commodity Trade Statistics Database (UN Comtrade) from 2000 to 2014. Seventy-six of the main exporters in the world are ranked by their total export value of 2012. Data are taken for SITC final commodities, including 4- and 5-digit final products/sectors and the total service imports for each country from 2000. The analysis also includes country information: the level of real income (GDP per worker) and total GDP (to calculate trade openness). World development indicators provide information about the per capita income and aggregate FDI of each country. In addition, we adopt several proxies for bilateral trade costs from the CEPII Gravity Dataset. The following sections outline the calculation of the index of revealed comparative advantage and of the revealed capital intensity index. This is followed by a discussion of a measure of export quality, which is based on these two indices.

5.2.1.1 Revealed comparative advantage index

The traditional measure of comparative advantage is based on the Balassa index, which compares the export proportions of each product in a country with the "average" world percentages.[16] In other words, it reveals the "comparative export percentage" of a product in a specific country, revealing the specialisation pattern.[17] This export index eliminates the scale effect and facilitates computation (Balassa 1965). If country *j* exports product *i* to world markets, the RCA index is given as follows:

$$RCA_{ij} = \frac{X_{ji}/\sum_i X_{ij}}{\sum_j X_{ij}/\sum_i \sum_j X_{ij}} \qquad \text{Eq. 5-1}$$

where X_{ij} are exports of sector *i* from country *j*. The numerator gives the percentage share of country *j's* exports of sector *i* in country *j's* total exports. The denominator gives the percentage share of world exports of sector *i* in world total exports.

5.2.1.2 Revealed capital intensity index

The revealed capital intensity of final products at the 4- and 5-digit level is based on the SITC standard (Shirotori, Tumurchudur & Cadot 2010). A product's capital intensity (i.e. its capital to labour ratio) is revealed by the weighted average of the ratio of capital to labour endowment of the country that exports the product. In other words, a product is revealed to be relatively

[16] Eaton and Kortum (2002)develops a theoretical model which incorporate the distance into the general equilibrium. Their model includes parameter of absolute advantage, comparative advantage and the cost of distances, which is closer to real bilateral trade. French (2017) extends Eaton's model with imperfect competition and firm selection, which allows differences across products, intra-industrial trade and links to product-level gravity model. Based on the theoretical work, he compares different ways of estimating comparative advantage and their properties, which are important for future empirical analysis.

[17] Based on theoretical work, they study the different way of evaluating the RCA for different purpose. (French 2017)

capital-intensive if it is exported disproportionately more from relatively capital-abundant countries. Specifically, the revealed capital intensity of good *i* is computed as:

$$k_i = \sum_j \omega_{i,j} \frac{K_j}{L_j}, \omega_{i,j} = \frac{X_{j,i}/\sum_j X_{i,j}}{\sum_j \left(X_{j,i}/\sum_j X_{i,j}\right)} \quad \text{Eq. 5-2}$$

where $\omega_{i,j}$ is the weight of country *j* for product *i* ($\sum_i \omega_{i,j} = 1$), K_j and L_j are the capital and labour endowments of country *j*, and $\omega_{i,j}$ is a variant of the RCA. Using the capital intensity in different commodities, we can show the trend of capital deepening across countries.

Shihotori et al. (2010) provide the data for the study from 1993 to 2007. The capital intensity can vary according to the change of export and capital labour ration across countries. This study uses the mean of capital intensity for the 15 years. The k_i gives orders to each commodity based on their production features, which provides a useful "sequence or orders" for export structure analysis. For convenience, products with higher capital intensity are defined as having higher quality[18]. Based on this assumption, a country that exports more capital-intense goods is considered to exporting higher quality goods.

5.2.1.3 Export quality indicators

The RCA indices indicate the degree of production specialisation in the world. Following the empirical setting of Pham and Riedel, we first derive the relationship between RCA and capital intensity k_i, by estimating the following simple linear regression for each country *j* in each year *t*. In Pham and Riedel's study capital intensity is measured in millions. However, a

[18] Amiti and Kandalwal's (2013) method of measuring products quality is based on the price and market shares of the relevant market.

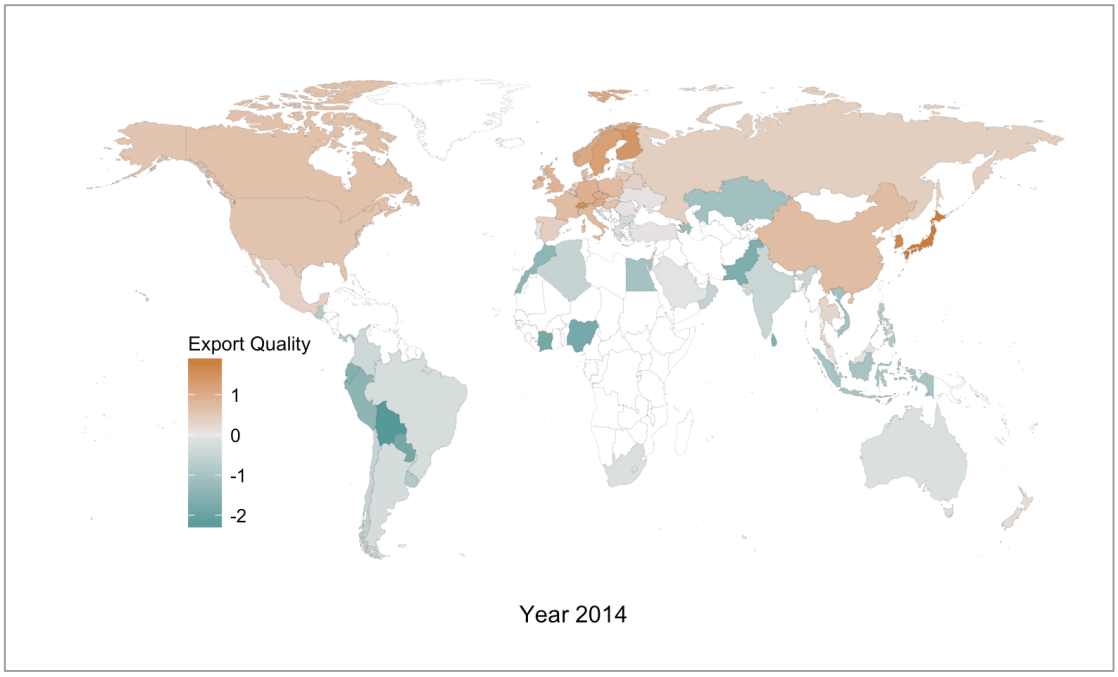
country's exports will be over-represented if its RCA is greater than 1. A log form can reduce the bias, especially when the RCA value is small:

$$lnRCA_{j,i,t} = \alpha_{j,t} + \beta_{j,t}\, ln(k_i) + \varepsilon_{j,i,t} \qquad \text{Eq. 5-3}$$

The coefficient of interest in this regression is $\beta_{j,t}$ in the model.[19] By regressing RCA on capital intensity k_i, we can derive $\beta_{j,t}$ to indicate how much the country export basket has larger shares of capital-intensive products. For example, when $\beta_{j,t}$ is positive, the respective country is likely to specialise in more capital-intensive or higher quality industries. If it is negative, the country is specialising in the more labour-intensive sector. In this study, export quality is defined differently from product quality, by the relative percentage of various capital-intensive products in the export basket of a country. For example, if a country exports larger shares of agricultural products, the export quality index will be low. Figure 5-2 shows the export quality of different countries in 2014. It can be seen that the countries with the highest level of export quality are Japan and South Korea, at about 1.8. Some European countries, including Switzerland, Finland and Sweden, also export products of relatively higher quality. Latin America, South Asia and Africa have the lowest export quality. Pairwise correlations shown in Table 5-1 give the first overview of the relationship between variables.

[19] RCA can be viewed as the comparative proportion of a country with the world. Product *i* in country *j* have relatively larger proportions if the RCA_{ij} is bigger. Capital intensity – k_i – gives a product quality/orders based on capital intensity. Combined with the capital intensity of different products, the coefficient $\beta_{j,t}$ will show whether the country is moving to specialise in more capital-intensive products. In other words, it is an indicator of export quality. The greater the $\beta_{j,t}$, the more high-capital intensive products, or greater proportion of high-quality products, are exported by economy *j*. This indicates that country *j* is exporting more and better quality goods. The higher the value of $\beta_{j,t}$, the greater the share of capital-intensive products is exported from country *j* at year *t*.

Figure 5-1. The Export Quality of Different Countries in 2014



Source: UN Comtrade and author's calculations

Note: White areas have no data.

Table 5-1. export similarity, export quality, per capita income, services trade: pairwise Correlations

	Export Quality	Export Similarity	Ln (Per Capita Income)	Ln (Service Import)
Export Quality	1			
Export Similarity	0.802	1		
Ln (Per Capita Income)	0.8056	0.5399	1	
Ln (Service Import)	0.6657	0.7023	0.5602	1

5.2.1.3 Model of the determinants of export quality

As discussed in the previous section, countries' exports should positively associate with FDI

inflow, service imports and per capita income. Combine with the export quality index from section 5.2.2, The chapter presents a model to test the dynamic pattern of export structure improvement and accounting for variables including FDI, services import. We further include a lag term of dependent variable on the right-hand side:

$$\begin{aligned} Export\_quality_{i,t} \\ &= \beta_0 + Export\_quality_{i,t-1} * \beta_1 + Ln(Service\ import_{i,t}) * \beta_2 \\ &+ Ln(FDI_{i,t}) * \beta_3 + Ln(Per\ Captia\ Income_{i,t}) * \beta_4 \\ &+ Trade\_Openness_{i,t} * \beta_5 + \mu_i + \mu_t + \varepsilon_{ij,t} \end{aligned} \quad \text{Eq. 5-4}$$

$Export\_quality_{i,t}$ is the export quality of country i in year t. $Export\_quality_{i,t-1}$ is a lag term of the dependent variable, $Ln(Service\ import_{i,t})$ is the value of service imports, $Ln(FDI_{i,t})$ and $Ln(Per\ Captia\ Income_{i,t})$ are the logarithm forms of the FDI inflow and income level of country i in year t, $Trade\_Openness_{i,t}$ is the trade openness of country i's total trade divided by the country's gross domestic product, and μ_i and μ_t are country dummies capturing country characteristic and time dummy for common time shock across countries, respectively

The model corresponds to the estimation Eq. 5-4 in a dynamic panel autoregressive (AR) model with country-specific fixed effects and year dummy. This model captures the heterogeneity among the countries via country fixed effects, which represents the countries' specific characteristics, which are not directly observable. The model also considers the year fixed effects for considering common time shock and trend. Historical factors such as cultures and beliefs often influence the current export status. Also, exports usually show 'inertia'. To produce new and better products, producers require time for adjustment or upgrading. Exports

are highly affected by the previous period's exports because of the influence of trade policy and long-term contracts. A lag term is a necessary factor to explain the dynamic changes of exports.

5.3 Results and discussion

Table 5-2 shows the ordinary least squares and two-way fixed estimations of Eq. 5-4. The results show that the previous period's export quality is highly related to the present period's.

Table 5-2. OLS and Fixed-effects Analysis

	(1) OLS	Fixed effect	Fixed effect	Fixed effect	Fixed effect	Fixed effect	Fixed effect
Y_{t-1}	0.905***	0.534***	0.431***	0.530***	0.433***	0.430***	0.547***
	[0.021]	[0.046]	[0.069]	[0.047]	[0.081]	[0.069]	[0.051]
Ln Service Import	0.010**		0.009		0.011*	0.009	
	[0.005]		[0.006]		[0.006]	[0.006]	
Ln FDI Inflow	0.001		0.01	0.005	0.014**	0.009	0.010**
	[0.004]		[0.006]	[0.005]	[0.007]	[0.007]	[0.005]
Ln Per Capita Income	0.041**	0.160**		0.162**		0.06	
	[0.013]	[0.068]		[0.074]		[0.08]	
Trade Openness	0.013*	0.080**	0.177***	0.076**		0.165**	0.101**
	[0.007]	[0.037]	[0.049]	[0.037]		[0.051]	[0.036]
Constant	-0.461***	-1.548**	-0.418**	-1.662**	-0.470**	-0.897	-0.389***
	[0.131]	[0.585]	[0.146]	[0.605]	[0.154]	[0.67]	[0.10]
Country Dummy	No	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummy	No	Yes	Yes	Yes	Yes	Yes	Yes
N	1179	1678	1179	1626	1214	1179	1626
adj. R-sq	0.961	0.51	0.44	0.512	0.412	0.44	0.506

Robust Standard errors in parentheses

* p<0.1, ** p<0.05, *** p<0.01

Some variables (e.g. service imports, FDI and per capita income level) show positive effects on improvement in export quality. The last period export quality presents a statistically significant influence on export quality. A 1% increase in service import bring around 0.01 unit increase in the export quality. Trade openness, per capita income and FDI inflow are also positively promoting the export quality. However, due to possible multi-collinearity and endogeneity issues, all variables do not perform significantly in all settings although, based on the standard errors provided, we can find that most of them are quite close to significance at the 10% level.

5.3.1. Dealing with endogeneity issues

Better export quality will also bring countries greater trade profits, which enforces per capita income increase, causing a possible endogeneity problem in the previous estimation and leading to biased results. Therefore, it is assumed that the lagged term, per capita income and service import are endogenous with the dependent variable.

The study further uses both difference generalized method of moments (GMM) and Arellano and Bover (1995) system GMM estimator with a heteroscedasticity-consistent error correction in line with Windmeijer (2005), whose finite-sample correction for the two-step covariance matrix reduces the downward bias of standard error in small samples when the instrument count is high.

In both difference and system GMM, the first difference is taken to eliminate the fixed effect, which is a potential source of omitted variable bias. By using the dynamic GMM method, the

lagged period terms are used as instrument variables to mitigate the endogeneity problem. For comparison, this study adopts four different estimators: simple OLS, difference GMM, system GMM and fixed-effects methods. According to Roodman (2009), in the OLS regression, the lagged dependent variable is endogenous and positively correlated with the error term. The coefficient often biases upwards. In the fixed-effects regression, however, the coefficient tends to bias downward due to collinearity between the fixed effect and lag terms. Therefore, the coefficient of lagged dependent variable in GMM would be bounded between the OLS and the fixed-effects model, or at least close to them (Roodman 2009).

The Sargan (1958) test and Hansen (1982) J-test of over-identifying restrictions is used to test the validity of instruments. The null hypotheses for the tests assumes that all instruments are valid and uncorrelated with the error term. Rejection indicates that at least one of the instruments is not valid. For the difference GMM estimation to be consistent, serially uncorrelated errors are required. The Arellano–Bond test is used for zero autocorrelation in first-differenced errors (or second-order serial correlation).

Both difference and system GMM provide a rich set of instrument variables for selection. The number of instrument variables is "quartic-in-T[20] ". However, research also suggests that too many IVs could bias and outfit the results (Roodman 2009; Windmeijer 2005). Bai and Ng (2009) and Kapetanios and Marcellino (2006) propose the principal components analysis (PCA) method to select a smaller instrument set that is maximally representative of the many weak variables. The PCA method uses the features of the data itself and provides a less arbitrary way

[20] The number IV is quadratic growth with respect to T.

to select a smaller instrument set. Monte Carlo simulations show it has a lower bias and root-mean-square error as well as greater robustness in the over-identification test (Bai & Ng 2010; Kapetanios & Marcellino 2010; Mehrhoff 2009). In this study, the estimation also adopts a one-step robust variance estimator for heteroscedasticity and autocorrelation within panels.

5.3.1.1 Discussion of the results

System GMM exploits both first differences and levels of the regressors as instruments. The Arellano–Bond p-values reported in this study are the second-order p-values. All the setting of GMM and System GMM pass the tests. The test of system GMM in setting (7) indicates that there is not significant AR (2) correlation in 5% level (Prob > z = 0.218). The Sargan/Hausman J tests indicate the validity of the instrument choice. The Sargan test (Prob > chi2 = 0.145) reject the over-identification in the instruments.

Roodman (2009) also emphasis that if the panel is long (large T), dynamic panel bias becomes less significant, and the fixed-effects estimator shows a close result. He emphasises that the cluster-robust standard errors and the Arellano–Bond autocorrelation test might be unreliable if N is small (number of section) (Roodman 2009). We use the PCA method embedded in STATA to select the instruments by the data. In column (7) system GMM estimation extracts total 70 instruments and the portion of variance explained by the components is 0.857. The Kaiser-Meyer-Olkin measure of sampling adequacy is 0.678. Both of them shows that selected instrument can largely explained the instruments variance in a very high level.

Our study presents the case where services import and per capita income are assumed to be endogenous. The Sargan test, Hansen test of joint validity of instruments and the Arellano–Bond tests for *AR (2)* in differences are passed in different specifications. The estimates suggest that the upgrading in export is both influenced by many factors, including the last period export, per capita income and FDI flow into this country. The lag term performs fairly robustly in all regressions.

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Table 5-3. Dynamic GMM estimation

	(1) Dif. GMM	(2) Dif. GMM	(3) Dif. GMM	(4) Dif. GMM	(5) System GMM	(6) System GMM	(7) System GMM
Y_{t-1}	0.309***	0.514***	0.591***	0.553***	0.522**	0.523**	0.571**
	[0.079]	[0.069]	[0.049]	[0.053]	[0.168]	[0.167]	[0.192]
Ln Service Import		0.010**		0.010**		0.014*	0.013*
		[0.003]		[0.003]		[0.008]	[0.007]
Ln FDI Inflow	0.059**	0.012	0.053***	0.004	0.061**	0.026	0.007
	[0.017]	[0.008]	[0.011]	[0.01]	[0.028]	[0.025]	[0.027]
Ln Per Capita Income	0.019	0.088	-0.192	0.212	0.056	0.312*	0.460*
	[0.122]	[0.097]	[0.12]	[0.141]	[0.21]	[0.158]	[0.264]
Trade Openness			0.049	-0.078			-0.119
			[0.045]	[0.063]			[0.117]
Constant					-1.885	-3.402**	-4.345*
					[1.815]	[1.416]	[2.341]
Arellano–Bond p-values	0.594	0.137	0.082	0.138	0.435	0.160	0.218
Sargen p-values	0.052	0.292	0.333	0.173	0.284	0.345	0.145
Hansen p-values	0.178	0.213	0.059	0.052	0.289	0.218	0.056
Portion of variance explained by the	0.924	0.914	0.974	0.915	0.881	0.857	0.857
Kaiser-Meyer-Olkin measure of sampling	0.799	0.661	0.8	0.663	0.797	0.67	0.678
Country Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1775	1113	1506	1078	1903	1214	1190

Robust Standard errors are in parentheses

* p<0.1, ** p<0.05, *** p<0.01

Note: Instruments are selected by PCA method and the number of IVs is controlled under panel numbers

5.4 Conclusion

Productivity and industrial upgrading are the key source of development progress. Trade and cooperation across countries have become increasingly intensive and complex. Comparative advantage and industrial productivity changes are still the key drivers in the dynamics of international trade. Foreign direct investment brings developing countries important production resources, including essential services, and creates opportunities for learning-by-doing. Many countries improve their export quality and transform their economic landscape as a result.

The export of high-quality commodities directly reflects countries' economic performance and industrial growth patterns. Several studies have focused on service exports as evidence of economic performance and development; however, import services are also important for export promotion. Both FDI and imported services can therefore play an important role in export upgrading.

In this chapter, an export quality index is measured by combining products capital intensity and export composition of each country in each year. A dynamic model was proposed that examines whether or not the current export quality depends on the country's exports in previous years. The model accounts for the process of export adjustment, heterogeneity of countries, and the effects of FDI, service imports and per capita income growth. Data from 2000 to 2014 were adopted for 76 countries and the PCA method used to select the instrument sets. The study estimates a panel AR model using the difference and system GMM, which makes it possible to deal with endogeneity of the explanatory variables.

It was found that service imports, FDI inflows and per capita income growth do positively influence the development of exports. The implication is that countries that reduce services trade barriers to promote the growth of imports of services and that encourage FDI inflow could enhance their production ability and promote export upgrading.

Chapter 6 Concluding remarks and Future study

6.1 Conclusion

Having a good understanding of the factors that influence industrial upgrading can help policy makers design better strategies for long-term inclusive development. A number of factors influence industrial upgrading. The question of this thesis concerns on the contribution of FDI activities, liberalization policies and services on the process of upgrading.

The extent of industrial upgrading is assessed here by using trade data, in particular, changes in the patterns of exports. Upgrading is indicated in this perspective by a rise in export quality. Although there are large number of studies on the determinants of export quality, which were reviewed in Chapter 2, there is value in more empirical work on the effects of FDI and services liberalization on export patterns. This thesis is expected to contribute to filling this gap in the literature.

Studies show FDI could promote knowledge transmission and exert many benefits to developing countries in terms of their ability to upgrade their industrial structure. The change in the export basket is an important reflection of industrial upgrading. Countries with similar export baskets share similar comparative advantages and industrial abilities. Chapter 3 identifies the determinants of changes in the export similarity index between Japan and recipient countries. It is found that Japanese FDI plays a significant role in raising the similarity of the exports of the host countries to that of Japan, although the effects are relatively small.

Bilateral relationships also apparently improve export similarity and therefore greater bilateral trade with Japan will also lead to higher similarity in export. We find that other variables including colonial links and the relative levels of physical capital per capita have significant influences on the degree of export similarity.

International trade in services is another potential driver of upgrading. It could increase allocation efficiency and reduce the cost of production for firms. Reducing barriers to services trade could therefore also help to promote export upgrading. We test the influence of services trade on upgrading later in Chapter 5 in the thesis. But as a first step it is useful to examine the determinants of services trade flows themselves. In Chapter 4, we examine the relationship between policy restriction (STRI) and other factors influence services trade with data from *UN Comtrade*. Our estimates show a more restrictive policy is one of the significant factors influencing services trade. The degree of restrictiveness is measured by the Services Trade Restrictiveness Index. Overall, a one percent increase in the *STRI* causes a decrease in bilateral services exchanges about 0.3%. Geographical distances are also found to negatively influence the levels of services trade. Merchandise commodities trade networks and export similarity also have positive impact on services trade volumes. In other words, countries with more common trading partners as well as similar production also tend to have stronger bilateral services trade flows.

Trade theory emphasizes that comparative advantage – determined by the structure of factor endowment – is one of the driving forces of international trade. The provision of high-quality goods reflects countries' industrial abilities. The hypothesis of this thesis is that key drivers of these abilities are FDI flows and access to imported services, and that as industrial abilities are

increased, in other words, as upgrading occurs, then export patterns will also change. Chapter 3 examined the direct effect on export patterns of FDI, where exports of host countries were compared to those of Japan. Chapter 4 looked at the determinants of services trade flows, including the role of policy. These factors are brought together in Chapter 5 which empirically investigates the evidence of export upgrading measured by the changes in composition of exports. It is confirmed that service imports and FDI are key drivers of upgrading measured in this manner.

6.2 Policy implications

The results of this thesis lead to very strong messages to policy makers with an interest in industrial upgrading. Deepening services liberalization and reducing services trade barriers would also increase the competitiveness of export and eventually benefit the domestic economy. Removing barriers to service imports will help local firms to enhance productivity. Expanding the trade network and increasing trade openness between countries could foster technology and skill transfer, increased productivity and motivate economic growth and development. Low income countries tend to have more services trade restriction (as shown in Chapter 4). Greater growth potential could be expected as more supporting polices are put in place.

Another contribution is to improve the investment climate and attract high-quality foreign resources for local industrial development. Local infrastructure and supporting faculties like roads, electricity are important for foreign investment. Legislative supports, investment policy and protection and other support are essential for attracting FDI. Developing countries could amend FDI policy to remove impediments to inflows for this purpose. Expanding market

opportunities by linking FDI with the local business for more sustainable development. As we shown in Chapter 3, FDI will bring many positive externalities and promote export similarity. Investment from high income countries could influence not only the export volume but also the industrial and production pattern of a country.

6.3 Future Study

The results here suggest a number of areas for further work. Industrial and export upgrading pattern are influenced by numerous factors. Even though a lagged dependent variable in the model (in Chapter 5) can account for certain unobserved and missing variables, considering possible effects from other variables would be a useful extension of the work here. Other calculations of export quality (e.g. an export sophistication index) could also be considered.

Similarity in merchandise exports is apparently a significant influence on trade in services. There is further interesting work to undertake on the drivers of the degrees of similarity in patterns of services trade and how these change over time.

Finally, recent studies have found linkages between FDI inflows and service imports, especially in communications, financial and business services (e.g. Fillat Castejon, Francois and Wörz (2008)). Does FDI replace existing imports or create additional imports? In addition, better data on policy measures could be used to produce more powerful analysis of the pattern of trade in services and country characteristics.

References

Akamatsu, K 1962, 'A historical pattern of economic growth in developing countries', *The Developing Economies*, vol. 1, no. s1, pp. 3-25.

Alfaro, L, Chanda, A, Kalemli-Ozcan, S & Sayek, S 2004, 'FDI and economic growth: the role of local financial markets', *Journal of international economics*, vol. 64, no. 1, pp. 89-112.

Amighini, A & Sanfilippo, M 2014, 'Impact of South–South FDI and trade on the export upgrading of African economies', *World Development*, vol. 64, pp. 1-17.

Amiti, M & Khandelwal, AK 2013, 'Import competition and quality upgrading', *Review of Economics and Statistics*, vol. 95, no. 2, pp. 476-490.

Amiti, M & Konings, J 2007, 'Trade liberalization, intermediate inputs, and productivity: Evidence from Indonesia', *The American Economic Review*, vol. 97, no. 5, pp. 1611-1638.

Amiti, M & Wei, SJ 2009, 'Service offshoring and productivity: Evidence from the US', *The World Economy*, vol. 32, no. 2, pp. 203-220.

Anderson, JE 1979, 'A theoretical foundation for the gravity equation', *The American Economic Review*, vol. 69, no. 1, pp. 106-116.

Anderson, JE & Van Wincoop, E 2003, 'Gravity with gravitas: a solution to the border puzzle', *The American Economic Review*, vol. 93, no. 1, pp. 170-192.

Arnold, JM & Javorcik, BS 2009, 'Gifted kids or pushy parents? Foreign direct investment and plant productivity in Indonesia', *Journal of international economics*, vol. 79, no. 1, pp. 42-53.

Arnold, JM, Javorcik, BS, Lipscomb, M & Mattoo, A 2016, 'Services reform and manufacturing performance: Evidence from India', *The Economic Journal*, vol. 126, no. 590, pp. 1-39.

Arnold, JM, Javorcik, BS & Mattoo, A 2011, 'Does services liberalization benefit manufacturing firms?: Evidence from the Czech Republic', *Journal of international economics*, vol. 85, no. 1, pp. 136-146.

Bahar, D, Hausmann, R & Hidalgo, CA 2014, 'Neighbors and the evolution of the comparative advantage of nations: Evidence of international knowledge diffusion?', *Journal of international economics*, vol. 92, no. 1, pp. 111-123.

Bai, J & Ng, S 2010, 'Instrumental variable estimation in a data rich environment', *Econometric Theory*, vol. 26, no. 06, pp. 1577-1606.

Baier, SL & Bergstrand, JH 2007, 'Do free trade agreements actually increase members' international trade?', *Journal of international economics*, vol. 71, no. 1, pp. 72-95.

Baier, SL & Bergstrand, JH 2009, 'Bonus vetus OLS: A simple method for approximating international trade-cost effects using the gravity equation', *Journal of international economics*, vol. 77, no. 1, pp. 77-85.

Bajgar, M & Javorcik, BS 2016, 'Climbing rungs of the quality ladder: FDI and domestic exporters in Romania', in Mimeo. http://www.nottingham.ac.uk/gep/documents/conferences/2013-14/13th-post-graduate-conference/papers/bajgarm.pdf. Accessed 24 April.

Balassa, B 1965, 'Trade liberalisation and "revealed" comparative advantage1', *The Manchester School*, vol. 33, no. 2, pp. 99-123.

Bebczuk, RN & Berrettoni, D 2006, 'Explaining export diversification: an empirical analysis', *Documentos de Trabajo*, no. 65, p. 26.

Bernard, AB, Jensen, JB, Redding, SJ & Schott, PK 2007, 'Firms in international trade', *The journal of economic perspectives*, vol. 21, no. 3, pp. 105-130.

Beverelli, C, Fiorini, M & Hoekman, B 2017, 'Services trade policy and manufacturing productivity: The role of institutions', *Journal of international economics*, vol. 104, pp. 166-182.

Blalock, G & Gertler, PJ 2008, 'Welfare gains from foreign direct investment through technology transfer to local suppliers', *Journal of international economics*, vol. 74, no. 2, pp. 402-421.

Blalock, G & Simon, DH 2009, 'Do all firms benefit equally from downstream FDI? The moderating effect of local suppliers' capabilities on productivity gains', *Journal of International Business Studies*, vol. 40, no. 7, pp. 1095-1112.

Borchert, I, Gootiiz, B & Mattoo, A 2013, 'Policy barriers to international trade in services: evidence from a new database', *the world bank economic review*, vol. 28, no. 1, pp. 162-188.

Borchert, I & Mattoo, A 2010, 'The crisis-resilience of services trade', *The Service Industries Journal*, vol. 30, no. 13, pp. 2115-2136.

Borensztein, E & Ostry, JD 1996, 'Accounting for China's growth performance', *The American Economic Review*, vol. 86, no. 2, pp. 224-228.

Caron, J, Fally, T & Markusen, JR 2014, 'International Trade Puzzles: A Solution Linking Production and Preferences*', *The quarterly journal of economics*, vol. 129, no. 3, pp. 1501-1552.

Cernat, L & Kutlina-Dimitrova, Z 2014, 'Thinking in a box: A 'mode 5'approach to service trade', *Journal of World Trade*, vol. 48, no. 6, pp. 1109-1126.

Coe, DT, Helpman, E & Hoffmaister, AW 2009, 'International R&D spillovers and institutions', *European Economic Review*, vol. 53, no. 7, pp. 723-741.

Dolan, RE & Worden, RL 1992, *Japan, a country study*, Headquarters, Dept. of the Army.

Dorfman, R & Steiner, PO 1954, 'Optimal advertising and optimal quality', *The American Economic Review*, vol. 44, no. 5, pp. 826-836.

Eaton, J & Kortum, S 2002, 'Technology, Geography, and Trade', *Econometrica*, vol. 70, no. 5, pp. 1741-1779.

Egger, PH, Francois, J & Nelson, DR 2017, 'The Role of Goods-Trade Networks for Services-Trade Volume', *The World Economy*, vol. 40, no. 3, pp. 532-543.

Esteves, PS & Rua, A 2015, 'Is there a role for domestic demand pressure on export performance?', *Empirical economics*, vol. 49, no. 4, pp. 1173-1189.

Feenstra, R & Kee, HL 2008, 'Export variety and country productivity: Estimating the monopolistic competition model with endogenous productivity', *Journal of international economics*, vol. 74, no. 2, pp. 500-518.

Feenstra, RC 2015, *Advanced international trade: theory and evidence*, Princeton university press.

Feyrer, J 2009, *Distance, trade, and income-the 1967 to 1975 closing of the suez canal as a natural experiment*, National Bureau of Economic Research.

Fillat Castejon, C, Francois, JF & Wörz, J 2008, 'Cross-border trade and FDI in services'.

Finger, JM & Kreinin, ME 1979, 'A Measure ofExport Similarity'and Its Possible Uses', *The Economic Journal*, vol. 89, no. 356, pp. 905-912.

Francois, J & Pindyuk, O 2013, *Consolidated data on international trade in services*, IIDE discussion paper, Institue for International and Development Economics.

Frankel, JA & Romer, D 1999, 'Does trade cause growth?', *American Economic Review*, vol. 89, no. 3, pp. 379-399.

French, S 2017, 'Revealed comparative advantage: What is it good for?', *Journal of international economics*, vol. 106, pp. 83-103.

Freund, C & Weinhold, D 2002, 'The Internet and International Trade in Services', *The American Economic Review*, vol. 92, no. 2, pp. 236-240.

Garvin, DA 1984, 'What Does “product Quality” Really Mean?', *MIT Sloan Management Review*, vol. 26, no. 1, fall 1984, p. 25.

Gereffi, G & Tam, T 1998, 'Industrial upgrading through organizational chains: Dynamics of rent, learning, and mobility in the global economy', in *93rd Annual Meeting of the American Sociological Association, San Francisco, CA, August,* pp. 21-25.

Glass, AJ & Saggi, K 1998, 'International technology transfer and the technology gap', *Journal of Development Economics*, vol. 55, no. 2, pp. 369-398.

Glick, R & Rose, AK 1999, 'Contagion and trade: Why are currency crises regional?', *Journal of international money and Finance*, vol. 18, no. 4, pp. 603-617.

Global Finance 2016, viewed 20 AUG 2017, <https://www.gfmag.com/global-data/country-data/japan-gdp-country-report>.

Goldberg, PK, Khandelwal, AK & Pavcnik, N 2011, 'Variety In, Variety Out: Imported Input and Product Scope Expansion in India'.

Goldberg, PK, Khandelwal, AK, Pavcnik, N & Topalova, P 2010, 'Imported intermediate inputs and domestic product growth: Evidence from India', *The quarterly journal of economics*, vol. 125, no. 4, pp. 1727-1767.

Hallak, JC 2006, 'Product quality and the direction of trade', *Journal of international economics*, vol. 68, no. 1, pp. 238-265.

Harding, T & Javorcik, BS 2012, 'Foreign direct investment and export upgrading', *Review of Economics and Statistics*, vol. 94, no. 4, pp. 964-980.

Hausmann, R, Hwang, J & Rodrik, D 2007, 'What you export matters', *Journal of economic growth*, vol. 12, no. 1, pp. 1-25.

Havranek, T & Irsova, Z 2011, 'Estimating vertical spillovers from FDI: Why results vary and what the true effect is', *Journal of international economics*, vol. 85, no. 2, pp. 234-244.

Helpman, E, Melitz, MJ & Yeaple, SR 2003, *Export versus FDI*, National Bureau of Economic Research.

Hesse, H 2009, *Export diversification and economic growth*, Breaking into new markets: emerging lessons for export diversification.

Hidalgo, CA, Klinger, B, Barabási, A-L & Hausmann, R 2007, 'The product space conditions the development of nations', *Science*, vol. 317, no. 5837, pp. 482-487.

Hoekman, B & Shepherd, B 2015, 'Services productivity, trade policy and manufacturing exports', *The World Economy*.

Hulten, CR 1978, 'Growth accounting with intermediate inputs', *The Review of Economic Studies*, vol. 45, no. 3, pp. 511-518.

Irwin, DA & Terviö, M 2002, 'Does trade raise income?: Evidence from the twentieth century', *Journal of international economics*, vol. 58, no. 1, pp. 1-18.

Jarreau, J & Poncet, S 2012, 'Export sophistication and economic growth: Evidence from China', *Journal of Development Economics*, vol. 97, no. 2, pp. 281-292.

Javorcik, BS, Lo Turco, A & Maggioni, D 2017, 'New and Improved: Does FDI Boost Production Complexity in Host Countries?', *The Economic Journal*.

Javorcik, BS & Spatareanu, M 2011, 'Does it matter where you come from? Vertical spillovers from foreign direct investment and the origin of investors', *Journal of Development Economics*, vol. 96, no. 1, pp. 126-138.

Kapetanios, G & Marcellino, M 2010, 'Factor-GMM estimation with large sets of possibly weak instruments', *Computational Statistics & Data Analysis*, vol. 54, no. 11, pp. 2655-2675.

Keller, W 2004, 'International technology diffusion', *Journal of economic literature*, vol. 42, no. 3, pp. 752-782.

Keller, W & Yeaple, SR 2009, 'Multinational enterprises, international trade, and productivity growth: firm-level evidence from the United States', *The Review of Economics and statistics*, vol. 91, no. 4, pp. 821-831.

Kodama, N, Javorcik, BS & Abe, Y 2016, *Transplanting Corporate Culture across International Borders: FDI and female employment in Japan*, Research Institute of Economy, Trade and Industry (RIETI).

Kwok, CC & Tadesse, S 2006, 'The MNC as an agent of change for host-country institutions: FDI and corruption', *Journal of International Business Studies*, vol. 37, no. 6, pp. 767-785.

Lall, S 2000, 'The Technological structure and performance of developing country manufactured exports, 1985-98', *Oxford development studies*, vol. 28, no. 3, pp. 337-369.

Leffler, KB 1982, 'Ambiguous changes in product quality', *The American Economic Review*, vol. 72, no. 5, pp. 956-967.

Lin, F & Sim, NC 2013, 'Trade, income and the baltic dry index', *European Economic Review*, vol. 59, pp. 1-18.

Liu, Z 2008, 'Foreign direct investment and technology spillovers: Theory and evidence', *Journal of Development Economics*, vol. 85, no. 1, pp. 176-193.

Lodefalk, M 2014, 'The role of services for manufacturing firm exports', *Review of World Economics*, vol. 150, no. 1, pp. 59-82.

Loungani, P, Mishra, S, Papageorgiou, C & Wang, K 2017, 'World Trade in Services: Evidence from A New Dataset'.

Makki, SS & Somwaru, A 2004, 'Impact of foreign direct investment and trade on economic growth: Evidence from developing countries', *American Journal of Agricultural Economics*, vol. 86, no. 3, pp. 795-801.

Marel, E & Shepherd, B 2013, 'Services trade, regulation and regional integration: evidence from sectoral data', *The World Economy*, vol. 36, no. 11, pp. 1393-1405.

Markusen, JR 1989, 'Trade in producer services and in other specialized intermediate inputs', *The American Economic Review*, pp. 85-95.

Markusen, JR, Melvin, JR, Maskus, KE & Kaempfer, W 1995, *International trade: Theory and evidence*, University Library of Munich, Germany.

Mayer, T & Zignago, S 2011, 'Notes on CEPII's distances measures: The GeoDist database'.

McMillan, MS & Rodrik, D 2011, *Globalization, structural change and productivity growth*, National Bureau of Economic Research.

Mehrhoff, J 2009, *A solution to the problem of too many instruments in dynamic panel data GMM*, Discussion Paper Series 1: Economic Studies.

Mehta, A & Hasan, R 2012, 'The effects of trade and services liberalization on wage inequality in India', *International Review of Economics & Finance*, vol. 23, pp. 75-90.

Mishra, S, Lundström, S & Anand, R 2011, 'Service export sophistication and economic growth', no. WPS 5606, World Bank,, <https://openknowledge.worldbank.org/handle/10986/3372 >.

Nordås, H & Rouzet, D 2015, *The Impact of Services Trade Restrictiveness on Trade Flows*, OECD Publishing.

OECD 2008, 'OECD glossary of statistical terms', OECD, Paris, <http://site.ebrary.com/id/10251720>.

OECD 2014, 'GLOBAL VALUE CHAINS: CHALLENGES, OPPORTUNITIES, AND IMPLICATIONS FOR POLICY', in *Report prepared for submission to the G20 Trade Ministers Meeting Sydney, Australia,* Sydney, vol. 19.

OECD 2017a, *OECD Economic Outlook*, vol. 2017 Issue 1, OECD Publishing, Paris.

OECD 2017b, *Services Trade Policies and the Global Economy*, OECD Publishing, Paris.

Pavlínek, P, Domański, B & Guzik, R 2009, 'Industrial upgrading through foreign direct investment in Central European automotive manufacturing', *European Urban and Regional Studies*, vol. 16, no. 1, pp. 43-63.

Pearson, CS 1994, 'The Asian export ladder', *Manufactured Exports of Asian Industrializing Economies: Possible Regional Cooperation, New York: ME Sharpe*, pp. 35-52.

Pham, T & Riedel, J 2013, 'An Empirical Analysis of Comparative Advantage Dynamics', *Forum for Research in International Trade Working Paper No. 633*, vol. accessed 12 September 2017.

Ramsey, JB 1969, 'Tests for specification errors in classical linear least-squares regression analysis', *Journal of the Royal Statistical Society. Series B (Methodological)*, pp. 350-371.

Rivera-Batiz, LA & Romer, PM 1991, 'International trade with endogenous technological change', *European Economic Review*, vol. 35, no. 4, pp. 971-1001.

Rodrik, D, Subramanian, A & Trebbi, F 2004, 'Institutions rule: the primacy of institutions over geography and integration in economic development', *Journal of economic growth*, vol. 9, no. 2, pp. 131-165.

Roodman, D 2009, 'A note on the theme of too many instruments*', *Oxford Bulletin of Economics and statistics*, vol. 71, no. 1, pp. 135-158.

Schneider, PH 2005, 'International trade, economic growth and intellectual property rights: A panel data study of developed and developing countries', *Journal of Development Economics*, vol. 78, no. 2, pp. 529-547.

Sharma, K 2003, 'Factors determining India's export performance', *Journal of Asian Economics*, vol. 14, no. 3, pp. 435-446.

Shirotori, M, Tumurchudur, B & Cadot, O 2010, 'Revealed Factor Intensities at the Product Level', *Policy issues in international trade and commodity studies*, vol. 44, UNITED NATIONS PUBLICATION, New York and Geneva.

Silva, JS & Tenreyro, S 2006, 'The log of gravity', *The Review of Economics and statistics*, vol. 88, no. 4, pp. 641-658.

Slaughter, MJ 2001, 'Trade liberalization and per capita income convergence: a difference-in-differences analysis', *Journal of international economics*, vol. 55, no. 1, pp. 203-228.

Smarzynska Javorcik, B 2004, 'Does foreign direct investment increase the productivity of domestic firms? In search of spillovers through backward linkages', *The American Economic Review*, vol. 94, no. 3, pp. 605-627.

Stojkoski, V, Utkovski, Z & Kocarev, L 2016, 'The impact of services on economic complexity: Service sophistication as route for economic growth', *PloS one*, vol. 11, no. 8, p. e0161633.

Thorbecke, W & Salike, N 2013, 'Foreign direct investment in East Asia', paper presented at http://www.rieti.go.jp/jp/publications/pdp/13p003.pdf.

Tideman, S & Hoekman, B 2010, 'Services trade and policy', *Journal of economic literature*, vol. 48, no. 3, pp. 642-692.

Tinbergen, J 1962, 'Shaping the world economy; suggestions for an international economic policy', *Books (Jan Tinbergen)*.

Van Marrewijk, C & Van Marrewijk, C 2002, *International trade and the world economy*, vol. 6, Oxford University Press Oxford.

Verhoogen, EA 2007, 'Trade, quality upgrading and wage inequality in the Mexican manufacturing sector', *Vol*.

Vernon, R 1966, 'International Investment and International Trade in the Product Cycle', *The quarterly journal of economics*, vol. 80, no. 2, pp. 190-207.

Windmeijer, F 2005, 'A finite sample correction for the variance of linear efficient two-step GMM estimators', *Journal of econometrics*, vol. 126, no. 1, pp. 25-51.

Wolfmayr, Y 2008, *Producer services and competitiveness of manufacturing exports*, FIW Research Reports.

World Bank 2007, 'World Bank national accounts data, and OECD National Accounts data files.', World BanK, OECD, <http://databank.worldbank.org/>.

World Bank 2016, 'World Development Indicators', World Bank Publications, <https://data.worldbank.org/data-catalog/world-development-indicators>.

World Bank, WTO, OECD, IDE-JETRO, RCGVC 2017, *Measuring and Analyzing the Impact of GVCs on Economic Development*, World Bank Publications, Washington DC.

Xu, X & Song, L 2000, 'Export similarity and the pattern of East Asian development', *China in the Global Economy. First edition, Cheltenham*, pp. 145-164.

Zhang, KH & Song, S 2002, 'Promoting exports: the role of inward FDI in China', *China Economic Review*, vol. 11, no. 4, pp. 385-396.

Appendixes

Appendix A: Supplementary material for Chapter 2

Table 2-1: Five product groups

Product group A Primary products	**Product group B** Natural resource–intensive	**Product group C** Unskilled	**Product group D** Technology-intensive	**Product group E** Human capital–intensive
Meat	Leather	Various textiles	Various chemicals	Synthetic colors
Cereals	Cork	Clothing	Plastics	Perfumes
Fruit	Wood	Glass	Generators	Cosmetics
Coffee	Precious stones	Pottery	Machines	Rubber and tires
Sand	Copper	Ships	Pumps	Various types of steel and iron
Minerals	Lead	Furniture	Telecommunications	
Natural gas		Footwear	Optical equipment	Televisions
Iron ore		Office supplies	Aircraft	Cars
Copper ore				Watches
				Jewelry

Appendix B: Supplementary material for Chapter 3

Table 3-6. Summary Statistics for Exports Data

	SITC REV 1	SITC REV 3
	4 and 5-digit Final Products	4-digit Products
Total Number of Products	1336	1033
Products Covered	1183	1033

Source: UN Comtrade and Author's calculations

Table 3-7. List of countries

United Arab Emirates	Argentina	Australia	Austria	Belgium	Bangladesh
Bulgaria	Bahrain	Bolivia	Brazil	Brunei	Canada
Switzerland	Chile	China	Cote d'Ivoire	Colombia	Costa Rica
Czech Republic	Germany	Denmark	Algeria	Ecuador	Egypt, Arab Rep.
Spain	Finland	France	United Kingdom	Ghana	Greece
Guatemala	Hungary	Indonesia	India	Ireland	Iran, Islamic Rep.
Israel	Italy	Kazakhstan	Korea, Rep.	Kuwait	Libya
Sri Lanka	Luxembourg	Morocco	Mexico	Malaysia	Nigeria
Netherlands	Norway	New Zealand	Oman	Pakistan	Panama
Peru	Philippines	Poland	Portugal	Paraguay	Qatar
Russian Federation	Saudi Arabia	Singapore	Slovak Republic	Sweden	Thailand
Trinidad and Tobago	Tunisia	Turkey	Ukraine	Uruguay	United States
Venezuela	Vietnam	South Africa			

Note: The selection of countries is based on the rank of export value of year 2012 and order in their name.

Table 3-8. Categorizes base on factor intensities

Product group A	Primary products (Primary), such as meat, cereals, fruit, coffee, sand, minerals, natural gas, iron ore, and copper ore.
Product group B	Natural-resource intensive products (Natural-resource), such as leather, cork, wood, precious stones, copper, and lead.
Product group C	Unskilled-labor intensive products (Unskilled), such as various textiles, clothing, glass, pottery, ships, furniture, footwear, and office supplies.
Product group D	Technology intensive products (Tech), such as various chemicals, plastics, generators, machines, pumps, telecommunications, optical equipment, and aircraft.
Product group E	Human-capital intensive products (Human-capital), such as synthetic colors, perfumes, cosmetics, rubber and tires, various types of steel and iron, televisions, cars, watches, and jewellery

Note: The categorizations are based on the factor intensity from Van Marrewijk and Van Marrewijk's paper. (Van Marrewijk & Van Marrewijk 2002).

Table 3-9. Lists of Variables

Variable	Description of the variable
Export_Similarity	The export similarity index between Japan and paired countries
Bilateral FDI_{in} (From JPN)	The Bilateral FDI into paried countries from Japan
Bilateral FDI_{out} (To JPN)	The Bilateral FDI flow Japan into from paired countries
Log Bilateral Trade(EX+IM)	The total amount of import and export
Colonial Relationship	If a country has a colonial relationship with Japan
Log Distant	The geographic distance between two countries
Log abs.Dif. $GDP_{per\ capita}$	The absolute different of the GDP per capita of the two countries in the logarithm form
Log abs.Dif. Population	The absolute different of the population of the two countries in the logarithm form
Log abs.Dif. Human Capital per worker	The absolute different of the human capita intensity of the two countries in the logarithm form
Log abs.Dif. Physical Capital per worker	The absolute different of the physical capita intensity of the two countries in the logarithm form

Appendix C: Supplementary material for Chapter 4

The process of obtaining a country STRI score involves three steps.

The first step is to select the policy measures that go into building the *STRI*s for each subsector-mode combination.

The second step is to determine the level of restrictiveness imposed by a particular measure in place; that is, a decision whether a limit on number of licenses deserves a restrictiveness score of 25 or 50. To determine the level of restrictiveness of certain measures, they consulted private sector representatives.

The third step is to aggregate subsector–mode scores to model and sector scores using a set of weights. Formally, the sectoral scores are given by:

$$STRI_{cj} = \sum_{m} w_m^{(j)} s_{jmc}$$

Sectoral scores are then aggregated across all sectors $j \in J$ using weights w_j that reflect the relative importance of constituent service sectors in domestic value added. Sector weights w_j are based on service sectors' standardized share in total services output for an 'average' industrialized country. Overall country-level scores are obtained as

$$STRI_c = \sum_{j} w_m^{(j)} s_{cj}$$