

学位論文及び審査結果の要旨

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論文の要旨

India gained its independence from the British in 1947. From 1947 for nearly four decades until 1991, it pursued inward oriented socialist style development policy with little reliance on external trade. However, the lacklustre growth in those decades combined with a balance of payment crisis in 1991, motivated India to initiate trade liberalization reforms from 1991. The new economic reforms were geared towards deregulating the industrial sector and integrating the Indian economy with the rest of the world. Following the economic reforms of 1991, Indian economy has enjoyed steady growth over the last two decades. From the infamous Hindu growth rate of 3% in the middle of 1980s, India grew at the rate of 7% to 8% in the first decade of the 21st Century. It now is one of the fastest growing economies in Asia.

Alongside the rise of India in Asia, there have been significant changes in the way in which many Asian countries engage in trade especially faced with the growth of global and regional value chains after the 1990s. In synch with these changes, India's external linkages may have changed. This thesis makes an attempt to examine these changes. The objective of this study is twofold. First, we examine the changes in external linkages of India using Input-Output (IO) Analysis. In particular, we use the following methodologies, Rasmussen (1957) index to look at the external backward linkages; the VAI_T (Value Added in Trade) method of Koopman (2010, 2012 and 2014) to measure value added in Indian imports disaggregated by country of origin; TIVA (Trade in Value Added) method of Johnson and Noguera (2012) to

measure the value added trade balance of India and its main trading partners. Second, we examine the responsiveness of trade to exchange rate changes. We use the Auto-regressive Distributed Lag Model (Pesaran et al 2001) to analyze the short-run and long-run response of bilateral trade balance to changes in bilateral exchange rate of India and its main trading partners.

The reasons why these objectives are pursued to understand the characteristics of India's external linkages and trade in this research are as follows.

1. Growing Importance of Value Chains in Asia: A value chain can be defined as the different stages in the production of a good which add value to the final product. Each of this stage can be called a part of the value chain. The term was popularized by Michael Porter (Porter, 1985). In recent decades, there has been an increase in shifting some stages of the value chain to locations abroad. This phenomenon has been addressed in various names. 'slicing up the value-added chain' (Krugman 1991); 'offshoring'; 'outsourcing'; 'fragmentation' (Jones and Kierkowski 1990 and 2001, Deardorff 2001); 'vertical specialization' (Balassa 1967 and Hummels et al 1998, 2001, Gonzalez 2012) and 'unbundling' (Baldwin 2006, 2012). It is surprising that there is barely any literature that examines how an emerging economy like India is linked to or benefits from these production networks. The first part of this thesis Chapter 2 to Chapter 4 begins by measuring the backward linkages of India in the global value chains for different industry classifications. It then makes a fresh attempt at quantifying the value added trade of India with its main trading partners. Quantifying value added trade is very important because it gives the true measure of the extent to which a country depends on other countries. For example, Indian imports from China could contain a high degree of foreign value added from other countries. The methodology developed in this thesis can quantify how much of third country value added is embodied in Indian imports from China. For this part of the thesis, we use Input-Output analysis as the research methodology. Use of Input-Output (IO) tables for analysis has an important advantage over the use of the trade statistics. While trade statistics only show direct interconnection among sectors, IO analysis shows direct and indirect interconnection of inputs from various sectors.

Therefore, the results from IO analysis can provide a better picture of the interconnections across different industries.

2. Response of Trade to Exchange Rate Changes: The second part of this thesis deals with another important topic for India, the effect of exchange rate changes on trade balance with main trading partners. India has had a persistent trade deficit with its main trading partners in spite of a depreciating rupee. Therefore, this creates an important research agenda of analyzing the responsiveness of its trade flows to exchange rate changes. In Chapter 5 examines the effect of exchange rate on trade balance by looking at India's bilateral trade with its main trading partners using Auto Regressive Distributed Lag model developed by Pesaran et al (2001). The advantage of this method over older versions of error correction models is that ARDL model can be used even when the variables include a mixture of $I(0)$ and $I(1)$ variables.

We now present a brief summary of the background and results of each chapter of this thesis which will be followed by the interpretation of those results.

Trade in intermediate inputs has been steadily growing facilitated by fragmentation of production; increase in importance of outsourcing; and foreign direct investment. Current trade pattern in Asia is best explained by a rise in interconnected vertical network trade in intermediate goods extending across various countries of East Asia. It can be seen as a conveyor belt which passes through many countries, with each country adding value to the good at various upstream or downstream stages of production. As a result, studies on intermediate goods and value chain are attracting more and more attention. Given this background, Chapter 2, "*The Importance of Vertical Production Networks and Intermediate Goods Trade in Asia: A Literature Review*" presents a literature review of production network trade for Asian region as a whole. It reviews the most cited literature on this field to highlight the importance of vertical production networks in Asia. Furthermore, it reviews and links the main empirical methodologies used to quantify the degree of vertical specialization by existing researches. As for the method used to quantify this vertical specialization, Hummels et al (2001) made the pioneer attempt at quantifying this phenomenon. However, his index of vertical specialization included restrictive assumptions like only one country exports intermediate goods which were not very applicable in the real world. His research was extended by more extensive researches like Johnson (2012), Koopman et al (2010, 2012, and 2014) and Stehrer (2012, 2013). All these methods included in their framework different

possibilities of exports and imports across countries. Johnson (2012) framework became the foundation for Trade in Value Added method (TIVA). Koopman et al (2010, 2012, and 2014) became the foundation for Value Added in Trade method (VAiT). Use of the above mentioned methodologies on international Input- Output tables by several researches showed that the degree of vertical specialization has increased considerable especially in Asia. Furthermore, many research findings underlined the importance of China as a downstream country where intermediate inputs from upstream countries like Japan and South Korea are processed for export to destinations like US and Western EU.

The next two chapters, Chapter 3 and Chapter 4, examine the changes in external linkages of India with the rise in production networks. There is a scarcity of literature that examines this issue. Few existing researches like UNENSCAP (2011), Yamashita (2012), Athukorala, P. (2008, 2012) analyse India's participation in production networks using trade data. However as we mentioned before, using only trade data has its limitations. To set the stage for research, Chapter 3 "*India's Intermediate Goods Trade in the Inter-regional Value Chain: An Examination Based on Trade Data and BRICS data*", uses both trade data and Input-Output analysis to examine India's sales and purchases from foreign countries and brings out the advantages of Input-Output tables by using the results of the research. For the Input-Output analysis, this chapter uses BRICs 2005 Input- Output table provided by Institute of Developing Economies (IDE). This IO table covers 25 industries for the following countries- Brazil, Russia, India, China, US, Japan, EU. The main results of this chapter are as follows:

- Based on RIEIT trade data the share of iron and steel in India's import basket was the highest but based on IO analysis it does not figure among top industries with backward linkages. This could be because the inputs of iron and steel industry are produced and consumed in the industry of origin and industry of import respectively. This result underlines the advantage of using input-output tables for our research.
- Overall backward linkages of the computer and electrical equipment and other machinery industries are the highest, in spite of the fact that the share of these industries is not so high in India's trade basket based on trade statistics.
- A country wise look at India's external backward linkages shows that EU takes the first place. That is followed by China at the second place. The industries that have the highest linkages with these countries are computer and electronic equipment, other electronic equipment industrial machinery, transport equipment, and chemicals, in

that order.

The BRICS 2005 IO table is only available for one year. Therefore, we were not able to see the transition in backward linkages of India overtime. The next chapter improved on Chapter 3 by using WIOD that provides International Input-Output tables from 1995 onwards.

In *Chapter 4*, we extended on Chapter 3 by using the World Input-Output tables. The World Input-Output Database provides the values of input-output transactions among 35 industries for 27 EU countries and 13 other major countries in the world for the period from 1995 to 2011. First, we calculated the external backward linkages of India between 1995 and 2011. This helped us to see a clear transition in the pattern of backward linkages of India with the growth of production networks. Next, we quantified the degree of vertical specialization in Indian imports using VAI_T (Value Added in Trade) method to identify the foreign and domestic value added in Indian imports from its main trading partners. The results show an increase in vertical specialization in Indian imports during the period under consideration. The degree of vertical specialization was especially high in Indian imports from China. Finally, we calculated the trade balance in value added terms of India with its main trading partners using TIVA (Trade in value added method) and compared the results with gross trade balance of India and those countries. The results from comparing the trade balance in value added terms with gross trade balance show that gross trade balance exaggerates the extent to India benefits from trade with its main trading partners. Some of important results of our analysis are as follows:

- **Result of External Backward Linkages:** The domestic backward linkages of India decreased in primary, secondary as well services industries. Conversely, external backward linkages in these industries increased. However, the increase in external backward linkages was most evident in secondary sector. The disaggregated result of external backward linkage analysis clearly indicates a rise in the position of China in India's supply chain. While in 1995, Japan and Germany took the second place after US in India's external backward linkages. By 2011, the second place was taken over by China. This was especially true in the case of secondary industries like Basic Metals and Fabricated Metal; Machinery, Nec; Electrical and Optical Equipment; Transport Equipment. Manufacturing, Nec & recycling. The external backward

linkages were highest in WIOD industry classification¹⁶ (Manufacturing, Nec & recycling).

- **Result of Value- Added in Indian Imports:** An examination of foreign value added (FVA) content in Indian imports from its two main partners China and US showed that FVA content in Indian imports from these countries increased in both countries. In the case of China, FVA in secondary industries was significantly higher than primary or service industries. Among the secondary industries, the FVA content was the highest in Electrical and Optical Equipment industries. A country disaggregation of Indian imports from US and China shows that in the case of US, the share of Chinese FVA in Indian imports from US increased. In the case of Indian imports from China, the share of US and rest of the world increased while the share of value added content of Japan, Korea and Taiwan decreased.
- **Result of Trade in Value Added:** We compared the gross and value added trade balance of India with China and US to find that for both countries the trade deficit in value added terms was much larger than gross trade balance. With US, India had a trade surplus in gross terms, however this turned into a huge trade deficit in value added terms. This trade deficit in value added terms was particularly significantly in the case of services industries. With China, India had a deficit in both value added terms and gross trade terms. However, the deficit in value added was much higher than the deficit in gross terms, the highest of which was in the secondary sector.

Our results from external backward linkage analysis showed that China's position in the value chain of India increased between 1995 and 2011. This result was expected given that China's position as supplier of manufacturing goods rose during that period. From our results of analysis on value-added in Indian imports, we could see that there was an increase in FVA in Indian imports from China. This confirms the results of previous literature like Dean et al (2008), Baldwin and Gonzalez (2013), Johnson (2014), Koopman et al (2008, 2010, 2012, 2014), Strehler (2012), Kuboniwa (2014) and Inomata (2013) who using international Input- Output tables have shown that Chinese exports contain high degree of imported components. With respect to foreign value added in Indian imports from China, our results pointed to one novel finding. Previous literature have underlined the importance of China as a downstream country where

intermediate inputs from upstream countries like Japan and the four dragons(Singapore, Hongkong, Taiwan, Korea) are processed for export to various destinations especially US and EU (Baldwin's Factory Asia argument)¹. Following from those results, we expected that the foreign value added in Indian imports from China will have high foreign value added of Asian countries like Japan and four dragons. However, our analysis showed that there is high value added content of the United States in Indian imports from China amounting to as much as 50% of total foreign value added in Indian imports from China. The pattern remains the same across primary, secondary and service industry classifications. This shows that China's procurement pattern for India is different from the usual pattern in Asia. This finding also points to the extent to which India is linked to the United States. Not only does India have direct linkages to United States (as seen from the results of External Backward Linkages) but it also has indirect linkages to the United States through China as almost half of the foreign value added in Indian imports from China comes from the United States(as seen from the results of Value- Added in Indian Imports).

The last chapter of this thesis, Chapter 5 "*Examining the effect of Exchange Rate on Bilateral Trade Balance*" examines the effect of changes in exchange rate on trade balance

¹ For details see Chapter 3 Section 1.

for the case of India. India's trade balance has persistently been in deficit in spite of a depreciating rupee. This raises concerns over the responsiveness of its trade flows to exchange rate changes. Often in the literature on this field, aggregate trade balance is used to see the responsiveness of trade to exchange rate. We argue that aggregate trade balance may not be good representation to ascertain the effect of exchange rate changes. This is because aggregate trade balance does not account for the bilateral differences in exports and imports across trading partners. Using monthly time series for the period 1991 to 2014, we examine the ability of exchange rate to affect bilateral trade balance of India with its six main trading partners, United States, China, United Kingdom, Germany, Japan and South Korea using Bonds testing method and the Auto Regressive Distributed Lag Model (ARDL) developed by Pesaran et al(2001). Our results find that in the short run, except in the case of South Korea, the bilateral real exchange rate does not have a statistically significant effect on India's trade

partners, United States, China, United Kingdom, Germany, Japan and South Korea using Bonds testing method and the Auto Regressive Distributed Lag Model (ARDL) developed by Pesaran et al(2001). Our results find that in the short run, except in the case of South Korea, the bilateral real exchange rate does not have a statistically significant effect on India's trade balance with any of its main partners. Furthermore, our results found no evidence to support the J curve hypothesis in any of the six countries. In the long run, currency depreciation can lead to improvement of trade balance only in the case of US and South Korea. In the case of Germany, currency depreciation worsens the trade balance even in the long run. In the case of all other countries including China, there is no statistically significant effect of real exchange rate on trade balance in the long run.

In a nutshell, in this thesis we tried to examine India's external linkages and trade through an analysis of value chains and the effect of exchange rate. One main conclusion that emerges from all the above chapters is that India's position in the Asian production networks is more of a buyer than of a supplier. The result of external linkages based on Input-Output Analysis show that India's external backward linkages have increased, especially in secondary industries. In the long run, this can be a disadvantage for a country with a growing population like India. This is because the secondary sector is one of the strongest employment creating sectors of any developing economy.

In this thesis, we also found that even though in gross trade terms India has a large surplus with United States, in value added terms India has a big deficit with United States. An industry wise break-up of this trade deficit in value added terms shows that it is the highest in the services industries. This can raise concerns as to what extent does India really benefit from its services trade with the US. Moreover, often there are claims that Indian services industry adversely affects employment in United States. However, our result of India's value added trade deficit in services sector with United States shows that United States gets considerable amount of value added from its trade with India.

Finally, about the responsiveness of trade flows to exchange rate, it was apparent that response of trade flows to exchange rate varies across trading partners. We found that real exchange rate fails to play a significant role on trade balance in the long run in three out of six countries and in the short run in five out of six countries. There can be many reasons for this. One possible reason could be that firms either in the foreign country or in India have a pricing behaviour in the market such that they do not change their prices in response to

relative price changes, making supply relatively inelastic even in the long run. Second possible reason could be due to the nature of the commodities which are traded. Some type of goods may be less sensitive to exchange rate changes than others. For instance, the effect of exchange rate changes could be different on intermediate goods and final goods. Intermediate goods have relatively less substitutability, and this makes demand for them less responsive to exchange rate changes. For instance, the effect of exchange rate changes could be different on intermediate goods and final goods. Intermediate goods have relatively less substitutability, and this makes demand for them less responsive to exchange rate changes. India trades with China mostly in intermediate goods; this could be one reason why the effect of real exchange rate is not statistically significant in determining trade flows.

One limitation of this study is that we could not see the linkages between India and the ASEAN countries because of limitation of data. It would be interesting to examine this when data is available. Another promising way in which this research can be extended is by analysing the factor content of trade in the external linkages of India. The SEA (Socio Economic Accounts) database of WIOD that provides details on labour used to produce a unit of output will be very helpful for this study. Another avenue for future research is to examine the differential effect of changes in exchange rate on intermediate goods and final goods can also be an interesting area for future research.

審査結果の要旨

1990年代以降、アジア経済全体にわたってグローバル・バリューチェーンと中間財貿易の急速な発展がみられ、これにともなって、インドの対外的な国際産業連関にも大きな変化が生じている。このような変化を念頭におきつつ、本論文は、インド経済の対外的連関と貿易の変化を、特に中間財貿易と付加価値貿易の観点から分析するとともに、それをふまえて実質為替レートの変化がインドの貿易収支にどのような効果をもっているか分析することを課題としている。

本論文の内容は、次のような点で意義のある研究成果であると評価される。第1に、本論文は国際生産リンクージと中間財貿易に関する既存研究を包括的に整理しており、これに基づいてインドと中国・他のアジア諸国・アメリカなどとの国際産業連関と国際貿易を対象とし、国際産業連関表（BRICS 国際産業連関表及び World Input-Output Database(WIOD)）を利用して達成された先駆的研究の成果である。第2に、近年の付加価値貿易に関する理論的及び実証的研究の発展をふまえ、その分析手法である Value Added in Trade (VAiT)及び Trade in Value Added (TiVA)とを詳細に検討している。前者は、最終財及び中間財の輸出に含まれる自国及び外国の付加価値の構成を分析するもので、この方法は UNCTAD-EORA GVC Database によって使用されている。後者は、最終財の需要によって誘発される自国及び外国の付加価値が国際貿易によってどのように各国間で移転されるかを分析するもので、この方法は WTO-OECD TiVA Database によって使用されている。さらに、本論文は Value Added in Trade (VAiT)の枠組みを、特定貿易相手国からの輸入財が含まれている付加価値の構成を分析できる枠組みへと独自に発展させている。第3に、国際産業連関分析とこのような付加価値貿易分析の枠組みを、具体的にインドの国際貿易の構造変化の分析に応用している。この分析によって、インドの中国からの中間財輸入の増加とインドの中国に対する後方連関の強まり、インドの中国からの輸入にしめるアメリカ合衆国で生み出された付加価値の比率の高さ、そしてインドの輸出を牽引するサービス業が粗貿易額では黒

字であっても付加価値貿易額でみると赤字であるという構造的脆弱性を持っている点などを解明している。インド経済の国際関係に対するこのような国際産業連関分析による分析結果は、本論文の実証的研究におけるオリジナルな成果である。第4に、自己回帰分布ラグモデルを用いて、実質為替レートの変動がインドの貿易収支に与える効果を分析し、中国やアメリカ合衆国などの主要貿易相手国との間で、短期的には韓国を除いて実質為替レートの貿易収支に与える効果がみられず、長期的にもアメリカ合衆国・韓国との間で効果があるものの、中国との間では効果がみられないことを確認した点である。これは、先行研究に対して最新のデータによる分析を付け加えたものであって、インドの貿易パターンの近年の特徴を析出したものとして、今後の研究にとって重要な情報となっている。

ただし、本論文は次のような発展すべき点をもっている。第1に、インド経済が付加価値貿易において、中国だけでなくアメリカ合衆国に強い依存性を有する点が検証されたが、それが貿易される中間財のいかなる特徴と多国籍企業のいかなる行動の結果として生じているのか、詳細な貿易データや国際産業連関表を用いた検証が必要である。第2に、インドと中国などの主要貿易相手国との間で、実質為替レートの貿易収支に与える効果が十分にみられない点を、さらに産業レベルや商品レベルにまで立ち入って分析することが必要であろう。また、この点は貿易理論において中間財貿易に対する為替レートの効果をどのように理論化するかという理論問題と関連しており、今後の研究の発展が期待される。第3に、本論文を全体としてみた場合、インド経済の国際産業連関と貿易パターンがその国内経済構造の特質や経済発展といかに関わっているのか十分に考察されていない。特に、インドのサービス業のアメリカ合衆国に対する貿易収支が、粗貿易額では黒字であるのに対して、付加価値額では赤字である点は、サービス業に牽引されたインドの成長パターンの構造的問題を示しているが、この問題について経済発展論の観点からの考察も必要となっている。しかしながら、以上の点は、本論文における研究のさらなる発展を希望するためのものであって、本論文の持つ高い学問的価値を損なうものではない。

本論文の Chapter 2、Chapter 3、及び Chapter 5 は、それぞれ『国際社会科学研究所』に発表された3本の論文をもとにしている。また、Chapter 4 の一部は、The 23rd International Input-Output Conference, Mexico City, June 2015 において発表されている。

以上のことから、本論文審査委員一同は、本研究科の博士号審査基準③に照らして、Simi Thambi の学位請求論文 *India's External Linkages and Trade: An Analysis of Value Chains and the Effect of Exchange Rate* が博士（経済学）の学位を授与するに値するものとして判断する。

注 論文及び審査結果の要旨欄に不足が生じる場合には、同欄の様式に準じ裏面又は別紙によること。