China Economic Review 44 (2017) 30–47

Contents lists available at ScienceDirect

China Economic Review

Policy effect on structural change: A case of Chinese intermediate goods trade

Yanghua Huang [a], Nimesh Salike [b,*], Feiteng Zhong [c]

[a] Institute of Industrial Economics, The Chinese Academy of Social Sciences, No. 2 Yuetan Beixiaojie, Xicheng District, 100836 Beijing, China.
[b] International Business School Suzhou, Xi'an Jiaotong-Liverpool University, 111 Ren'ai Road, Dushu Lake Higher Education Town, Suzhou, China.
[c] National Institute of International Strategy, Chinese Academy of Social Sciences, No.3 Zhangzizhong Road, Beijing 100007, China

ARTICLE INFO

Article history:
Received 28 December 2015
Received in revised form 18 March 2017
Accepted 18 March 2017
Available online 21 March 2017

JEL classification:
F13
F14
L52

Keywords:
Institutional change
Intermediate goods trade
Intra industry trade (IIT)
Regional production network
Technological progress

ABSTRACT

We explain the dynamics of China's intra industry trade (IIT) development spanning over three decades from the perspective of institutional changes. We present two hypotheses after reviewing series of policy documents and related organizational adjustment descriptions. First, we argue that China's pro-liberal reform in trade and FDI institutions helped trade to take off. Second, China is ambitious in acquiring advanced technology and building up a sophisticated system to promote technological capability. An analysis of Grubel and Lloyd IIT index on intermediate goods trade belonging to SITC 7 and SITC 8- the key components of regional value chain in East Asia- suggests that the structural changes taking place in China's intermediate goods trade are in agreement with the stated hypotheses. China's institutional arrangements also help to explain the factor behind China's success in becoming a major player in the regional production network in East Asia.

1. Introduction

Trade in intermediate goods that gives rise to regional production networks has been a hallmark of East Asia's trade pattern. This regional value chain in East Asia began in the 1990s, which is largely credited to Japanese Foreign Direct Investment (FDI). Dependence on this form of value chain in East Asian economies is relatively larger than elsewhere in the world (Athukorala, 2009) and the trade relations are more stable (Obashi, 2010). This is in line with the general equilibrium model proposed by Kojima (1973) whereby trade and FDI work as complements rather than substitutes. It is to be noted that most of this trade in intermediate goods took place among the members of East Asia and eventually produced the final goods whose market is determined externally. The majority of these final goods were exported to the United States (US) and Europe. China played an important role in building this network by engaging in high levels of trade with all key members involved.

In this paper, we look into the various aspects of Chinese government policies and their corresponding effects on China's trade. Particular attention was given to the industrial upgrading policies that the Chinese government implemented for her manufacturing sector starting from the 1980s. This paper has two important aspects. Firstly, we examined the policy changes relating to manufacturing industries and trade and linked them to specific industries. Secondly, data work was conducted to see if the impact of these policies were reflected in China's intermediate goods trade with ten of her Asian counterparts.

* Corresponding author.
E-mail addresses: huangyh-gjs@cass.org.cn (Y. Huang), nimesh.salike@xjtlu.edu.cn (N. Salike), zhongft@cass.org.cn (F. Zhong).

http://dx.doi.org/10.1016/j.chieco.2017.03.005
1043-951X/

Many economic variables have been nominated and tested to be the causes of trade patterns between countries. They include the size of a country (Amiti, 1998), technology transfer (Lemoine & Ünal-Kesenci, 2004), commercial policy (Falvey, 1981), regional economic integration (Khalifah, 1996), production differentiation, labor intensity of production, economies of scale, FDI (Aturupane et al., 1997a, 1997b; Markusen & Venables, 1999) and intra-firm trade (Becuwe & Mathieu, 1992). In line with those literatures, studies explain China's trade in intermediate goods typically from those conventional perspectives, such as China's economic development, comparative advantage and market sizes, the role of FDI, the technological gap and income disparity between China and her trading partners, regional division of labor, economic freedom and business environment, as well as credit constraints (Amiti & Freund, 2010; Chirathivat, 2002; Dean et al., 2009; Fung, 1996; Hu & Ma, 1999; Manova & Yu, 2012; Prime & Park, 1997; Xing, 2007). Those factors are important in explaining China's Intra-Industry Trade (IIT) to a certain extent. However, the role of institutional factors has been largely ignored, which results in a partial explanation of those variables above or a misinterpretation of the way by which China's trade pattern is affected. We argue that most of the above economic determinants, both country and industry-specific, could be the consequences of China's continuous institutional changes. In other words, China's intermediate goods trade could largely be interpreted as the result of institutional changes.

We employed the Grubel-Lloyd index (Grubel & Lloyd, 1971) to measure China's IIT in various disaggregated levels. Our data work was based on SITC 5-digit level (basic heading) wherein we identified 347 basic headings for intermediary goods after a careful examination of previous studies (Athukorala, 2003; Kimura & Obashi, 2010; Sturgeon & Memedovic, 2011). This basic heading IIT index was then narrowed down to SITC 2-digit level (division code) for the purpose of general analysis. We found that the Chinese government had undertaken two major policy shifts that have resulted in structural changes in China's intermediate goods trade. Firstly, during 1991 to 2011, there was an emphasis on moving away from low-technology-intensive industries to medium-technology-intensive manufacturing industries. Secondly, with the onset of the Global Financial Crisis (GFC) during 2007 to 2009, the Chinese government tried to reduce the dependence on external demand by increasing domestic demand and by pushing further for the upgrading of industries from medium technology-intensive to high technology-intensive.

The rest of this paper is organized as follows. In Section 2, in contrast with previous studies, we explain China's intermediate goods trade by focusing on the importance of institutions. In particular, we concentrate on certain fundamental institutional changes made in the 1980s and in the beginning of the 1990s, when key policy adjustments were made to provide stable incentives for foreign investment and trade and which accelerated China's technological progress. China's response in the aftermath of the GFC and its effect on her intermediate good trade is also reviewed in the section. Section 3 portrays the evolution of China's intermediate goods trade with 10 of her Asian partners over the past two decades using data work generated from the IIT index. In particular, we look at SITC section 7 and section 8 as these sections fall under the manufacturing sector and contain most of the goods involved in China's intermediate goods trade. Section 4 concludes with some remarks on policy consideration for the future development of regional value chains.

2. Policy effects on China's intermediate goods trade: An analysis of the institutional framework

A consensus among economists and policymakers has been reached that China's economic miracle was delivered by over three decades of market-oriented reforms, which can be viewed as a process of effective institutional changes or as a shift in economic development strategy (Lin et al., 2003; Qian, 2003; Xu, 2011). Correspondingly, China's foreign trade regime also underwent a remarkable transformation during this period. To this front, it is important to comprehend two underlying facts related to this

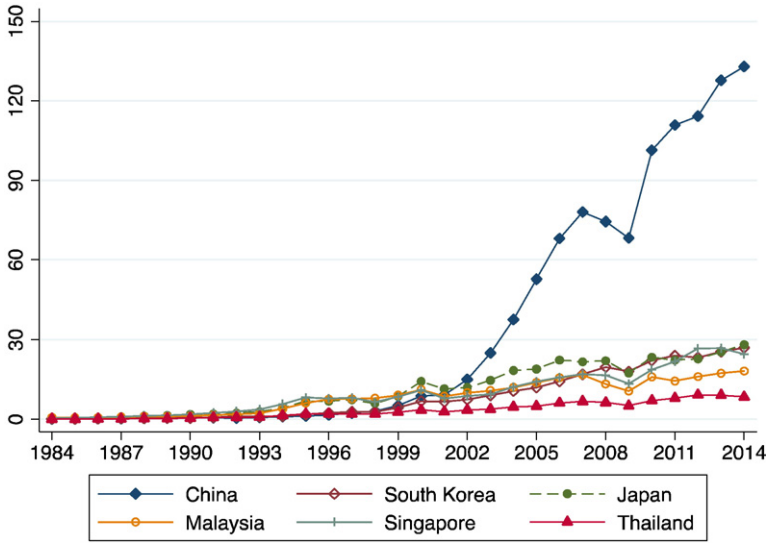

Fig. 1. Intermediate goods imports in Electronic and Automobile industries by selected East Asian economies from East Asia (USD billion). Source: CEPII-CHELEM Database.

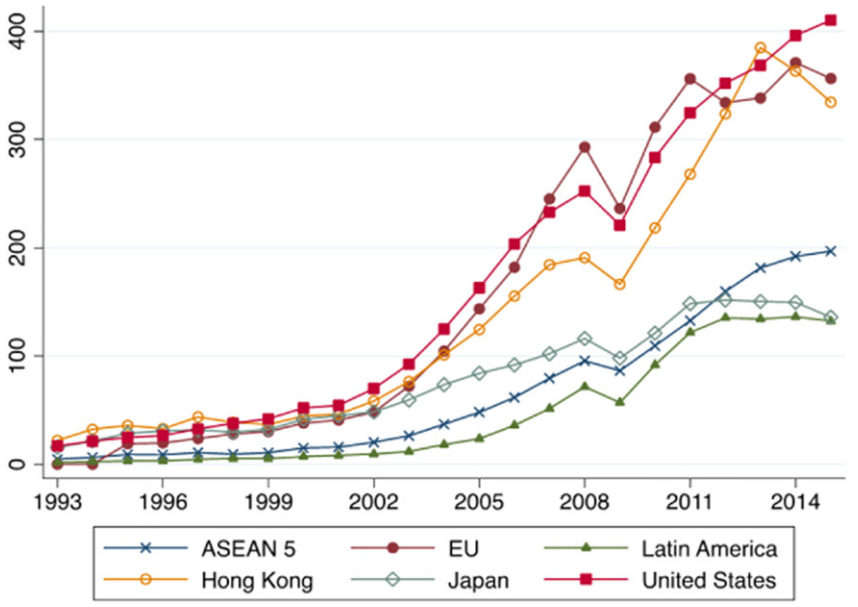

Fig. 2. China's exports by country and region (USD billion)
Source: CEIC Database.Note: ASEAN 5 includes Indonesia, Malaysia, Philippines, Singapore and Thailand.

development. Firstly, China's integration into the regional production network was particularly noticeable after its entry to WTO in 2001 as can be seen in Fig. 1. However, the policy changes carried out by the Chinese government before the WTO entry helped reap the benefits of WTO membership. Other East Asian economies, along with China, were involved in the regional production network by trading among themselves from the 1990s. China's performance has been particularly remarkable, with the share of Chinese imports of intermediate goods being much higher than other East Asian counterparts. For example, China's share in the electronic and automobile industries, the two most integrated industries, rose from 8.2% in 1990 to 21.7% in 2002 and 49.4% in 2014. This is much higher than the second best of 2014 of Japan with 10.4%, followed by South Korea with 10%.

Secondly, the demand for the final goods produced by East Asian economies was determined externally. This essentially means that East Asian economies trade the intermediate goods among themselves to produce the final products that are eventually exported to developed economies in North America and Europe (Baldwin & Okubo, 2012; Gaulier et al., 2007; Thorbecke & Salike, 2013). As can be seen in Fig. 2, the major destinations for China's exports are the US and Europe after discounting for Hong Kong, since most of these exports to Hong Kong are again trans-shipped to the rest of the world.

The above facts suggest that the external demand out of East Asia was an important driver of the development of the East Asian production network and then the growth of the intermediate goods trade. However, when comparing with other East Asian economies, China's phenomenal performance in both intermediate goods imports and final goods exports needs special explanation besides the general effect of external demand. We argue that the policy changes the Chinese government adopted in the wake of regional production networking and external demand played a significant role in China's exceptional performance. During this process, while development of the intermediate goods trade was not originally intended by Chinese policymakers, it was significantly affected by China's policies implemented over the years. To our knowledge, this paper is the first to explain China's intermediate goods trade from an institutional perspective.

2.1. Explanation of the framework

Soon after her founding in 1949, the People's Republic of China transplanted the planned foreign trade system. It was a highly monopolized state-run and managed system designed for trade control. A cohort of monopolist foreign trade corporations (FTCs) dominated foreign trade in specific sectors[1] and there were very few opportunities for new entrants. The quantity of trade and price were controlled by the monopolistic FTCs and limited room was left for the practice of conventional trade policy instruments, such as tariffs, quotas, licenses and duty exemption (Ianchovichina & Martin, 2001). With this system, China isolated herself from the world market, and regional economic ties between China and other East Asian economies were minimal.

China launched the Reform and Opening-up policy by the end of the 1970s, but after three decades of operating in a closed system it was incapable of forming global economic ties to serve China's new ambition of economic development. As the World Bank (1994) recorded, the promotion of foreign trade had been central to China's efforts to modernize her economy since the launching of the reform agenda. China's foreign trade system reform was generally pro-liberal (Lardy, 1995) and it

[1] Such as rice, sugar, tea, textile, cotton, silk, tobacco, etc.

transformed China into one of the world's most attractive foreign investment destinations, the 'world's factory' and the world's top exporter of hundreds of industrial products such as steel, cars, television sets, personal computers and cell phones.

In this paper, 'institution' refers to the stable mechanism that governs the incentives of agents that coordinate economic activities. In the case of China, institutional change often takes two forms. One is the top-down state policy that conveys the national priority and serves as the guideline for sub-national policy. The other is the bottom-up regional institutional experiment that mitigates the risk of reform and provides incentives for local entrepreneurship (Xu, 2011). Accordingly, there are two sources of economic policy initiatives. Firstly, state policies are often drafted and implemented by specialist central government departments. Secondly, based on the experience of the regional experiment, regional policies are then replicated nationwide.

Before the transition, China was a developing country with scarce capital, abundant labor and outdated technology in most of her industries. Following the theory of economic growth and development economics, the accumulation of capital and technological progress are two necessary conditions for economic growth. In a transition economy like China, some basic pre-requisites for a market economy, e.g., property rights protection, the rule of law and efficient price mechanism were absent, which resulted in the dysfunctional market system. Instead, the state played an active role in the early stage of transition.

Firstly, China's policies on foreign investment and trade played an important role in capital accumulation. Studies have found that China's trade was closely related to FDI (Lardy, 1995), which fueled China's growth in terms of the size of trade. Our concern is whether China's policies on foreign investment and trade could have affected her trade pattern besides the size of trade. Secondly, China's industrialization-driven growth model required continuous industrial efficiency improvement; technology policies were revised continuously during the whole process of China's economic development. As technological difference among countries is a key determinant to their position in the regional production network and then the pattern of trade, our second focus is whether China's technological policies affected her intermediate goods trade.

To sum up, our paper will concentrate on the effects of three forms of Chinese policies- foreign investment policies, foreign trade policies and technology enhancing policies, on her trade structure. Besides those domestic policies, the development of the East Asian production network was another institutional factor that potentially affected China's regional intermediate goods trade. Some authors showed that the East Asian regional production network was mainly achieved through regional FDI (Fukao et al., 2003; Kimura & Ando, 2005; Kimura et al., 2008; Thorbecke & Salike, 2011, 2013). Riding on these insights, we also assess the role of China's policies towards regional FDI and the regional production network.

By combining China's domestic policies and the regional production network, we propose that China's intermediate goods trade was primarily affected by China's domestic policies and the phenomenon of regional production network, which was influenced by China's foreign investment policy. To the basic level, all these policies were subject to administrative system adjustments and regional experimentation. We present our explanatory framework in Fig. 3.

Policy-induced structural change of China's intermediate goods trade was delivered by the changes of enterprises' behavior at the micro level. There were certain mechanisms by which enterprises responded to the policy changes according to different policy types.

Firstly, for the domestic policy, technology, trade and foreign investment policy could be further classified into two categories based on policy effects. One was the deregulation policy, which entitled enterprises to invest in desired businesses related to the intermediate goods trade. Among others, entrepreneurship and start-ups were encouraged. Consequently, joint ventures and foreign trade corporations surged under deregulation policies and resulted in the flourishing of processing trade. For example, the number of FTCs increased significantly from approximately 200 in 1979 to more than 2200 in 1987 and there was a dramatic upsurge in foreign investment from US$226 million in 1983 to US$11.55 billion in 1991. Also, foreign investment projects grew from 638 in 1983 to 12,978 in 1991 and processing trade increased from US$2.64 billion in 1981 to US$71.16 billion in 1992. The other was the selective policy towards certain activities, such as tax and tariff reduction, credit and foreign exchange access, etc. Certain enterprises or specific activities related to the intermediate goods trade were promoted, such as acquiring advanced technologies abroad, importing key components, and expanding the overseas market. For example, the average tariff on imports decreased by 10% since 1951 after the first revision of Regulation on Import and Export Duties in 1985. Similarly, tariff reduction on the imports of high-technological equipment was also significant. For instance, tariffs on the crystal cut materials used in the electronics industry and analog hybrid automatic data processing equipment decreased from 25% to 6% and 9%, respectively during the period. And, total tax rebates for exports increased from 4.4 billion *yuan* in 1985 to 125.9 billion *yuan* in 2002.

Secondly, for the foreign economic policy, China's policy facilitated the development of the regional production network and cross-border industrial and technological transfer, which offered opportunities for new business, including overseas market access and technology absorption, Original Equipment Manufacturers (OEM) partnership, regional supply chain participation and vertical division of labor. In 1984 alone, China experienced more than US$100 million of investment from Japanese companies, which was one of the key drivers of the East Asian production network and technology transfer.

Hence, China's policy was rooted in enterprises' behavioral adjustments by providing incentives, which restructured China's intermediate goods trade at macro level.

2.2. Policy matters

2.2.1. Administrative system adjustments and regional experimentation

In three decades of opening up, the Chinese government has had to make regular adjustments every 5 to 10 years in order to implement the state's updated blueprint for development. This routine makes it feasible to trace China's formal institutional changes by observing the adjustments of government departments at the national level. Regarding trade institution, two new

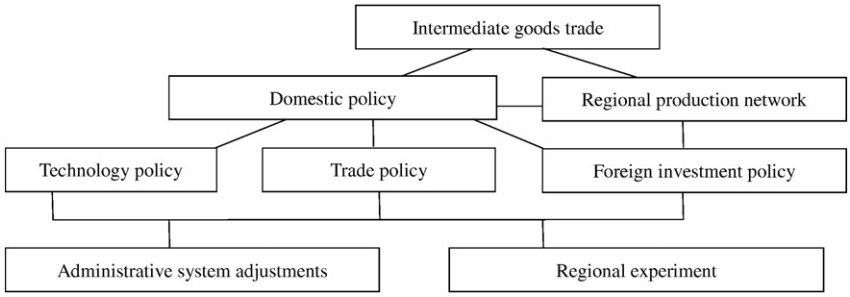

Fig. 3. Explanatory Framework of China's Intermediate Goods Trade.

administrative departments were established to promote foreign investment, trade and technological progress at the onset of Chinese economic transition. They were the Foreign Investment Administration Commission of China (FIACC) and the State Office for Import and Export of Machinery and Electronics Products (SOIEMEP). At the regional level, we focus on the experiment of special economic zones (SEZ), which define China's industrialization and subsequently, her trade pattern.

FIACC was established in 1979 as a super-ministerial department[2] and had another name to the public, the Foreign Trade Administration Commission of China (FTACC). This kind of organizational design had two obvious advantages. One is that its establishment reflected the government's strong ambition to gain access to the global economy. In the Chinese bureaucratic hierarchy, the higher the rank of a department, the more empowerment and higher administrative capacity it has in mobilizing resources. This also gives it greater bargaining power in inter-department coordination. The other advantage is that foreign investment and foreign trade could be facilitated within a coordinated policy process, which strengthened the 'foreign investment trade nexus' and allowed foreign investment to have a huge impact on trade. The mandate of FIACC was fulfilled by its technical subdepartments that were responsible in promoting foreign trade, introducing advanced technology and equipment, utilizing foreign capital, and promoting international cooperation; all of which were important in promoting economic growth. FIACC was reorganized several times in later years but its major responsibilities and functions remained and thus, served as a stabling incentive mechanism. Even though the mission of FIACC was to accumulate foreign trade surplus and facilitate technological progress rather than to promote intermediate goods trade, many of its policies affected China's trade patterns in the later years. This shall be further discussed subsequently.

The other noticeable institutional change at the national level was targeted at technological upgrading. In order to promote high-tech production trade, the Chinese government set up a brand new department, SOIEMEP in 1993.[3] SOIEMEP was established to take charge of the coordination, administration, inspection and supervision of the import of machinery and electronics products, and to guide regional and departmental administration of machinery and electronics products. According to the state's standard, these products are marked as technology-intensive products. Hence, the establishment of SOIEMEP could be interpreted as China's effort to promote technological sophistication of foreign trade. Following the installation of SOIEMEP, many ministries and state-owned enterprises (SOEs) under the State Council set up parallel offices to encourage the trade of high-tech products.[4]

Besides FIACC and SOIEMEP, an array of supporting institutions was created to facilitate foreign trade and investment in technologically intensive products. Firstly, the state policy bank, the Export-Import Bank of China (EIBC), was founded under the State Council of China in 1994 in order to improve the efficiency of the state's industrial, investment and trade policies. One of its main mandates was to finance the export and import of mechanical and electronic products as well as complete sets of equipment and new and high-tech products. Moreover, a nationwide semi-administrative organization, the China Chamber of Commerce for Import & Export of Machinery & Electronics Products (CCCME), was set up in 1988 to promote the foreign trade of machinery and electronics products. CCCME provided import and export-related services (e.g., consulting, information, marketing, legal services, training and international cooperation promotion services) to its member enterprises. Under the guidelines and coordination of CCCME, more than 20 industry-wise branches were responsible for promoting foreign trade and investment in areas such as automobiles, rail transport equipment, electrical elements, metalworking equipment and electric power equipment.[5]

Besides the above national-level institutional efforts, there were also institutional changes made to provide incentives for intermediate goods trade at the regional level. Following China's gradualist approach for economic transition, many institutional changes were first trialed in a pilot region before being implemented nationwide. Among others, the SEZ experiment was an innovative policy practice. China's SEZ experiment underwent a significant expansion since 1980. The first group of SEZ was five

[2] This Commission was first presided by the Deputy Premier of the State Council.

[3] SOIEMEP is now the Department of Mechanics, Electronics and Hi-tech Industries under the Ministry of Commerce. In China, statistics for machinery and electronics products cover a wide range of products including metal products, machinery and equipment, electrical appliances and electronic products, transportation equipment, apparatus and instruments and other miscellaneous products.

[4] These ministries include the Ministry of Electronics, Ministry of Post and Telecommunication, Ministry of Mechanics, Ministry of Chemical Industry, Ministry of Electricity, Ministry of Metallurgical Industry, Ministry of Textile Industry. Along with these central ministries, some central-level SOEs set up offices of this kind. In China, some central SOEs function like ministries, and even were directly transformed from government bodies. Central SOEs often serve as a direct policy tool for state industrial policy.

[5] Again, most of these industries are from SITC section 7.

coastal cities: Shenzhen (1980), Zhuhai (1980), Xiamen (1980), Shantou (1981) and Hainan (1988). The second group incorporated 14 coastal open-up cities approved in 1984, including Shanghai, Tianjin, Dalian, Qingdao, Guangzhou, Ningbo, Wenzhou, and other coastal and economically developed cities. Afterwards, SEZ were expanded to inland provinces. Since 1992, the SEZ model prevailed across China and transformed into different forms, such as state-level economic and technological development zones, hi-tech and new industrial development zones, free trade zones, national bonded areas as well as border trade and cooperation regions. SEZ functioned like a free port that provided incentives for foreign investment and trade by decentralizing the administrative authority, deregulating economic planning and facilitating the market process, and by providing a favorable supply of production factors. Since its initiative in 1980, exports and FDI in SEZ increased tremendously; more than 90% of Chinese exports and FDI were contributed by SEZ in 2005 (Xu, 2011).

China's SEZ experiment was a pillar to the development of the East Asian regional production network. Firstly, the East Asian regional production network had been supported by regional capital flows, of which the top two sources of foreign investment to China were Hong Kong and Japan. SEZ provided a relatively relaxed investment environment for inward foreign investment to China and they also became a spatial location of regional production networks. Secondly, thousands of FTCs that were set up after deregulation in SEZ improved transaction efficiency and contributed to China's participation in regional production networks. More importantly, foreign investment rushed in and sizeable foreign joint venture enterprises were set up within SEZ. Those enterprises were mainly export-oriented firms that collaborated with FTCs. Consequently, the main economic activity in SEZ was processing imported intermediate goods, which had limited local content and were export-oriented.

The development of the processing activity model in SEZ was vital to China's intermediate goods trade. On the one hand, the processing activity model of SEZ was replicated nationwide due to the 'demonstration effect'. Since its launch in the 1980s, the SEZ experiment and preferential policy specific to SEZ were gradually replicated from a few selected coastal regions to the whole country under the central government's initiative. Furthermore, after the fiscal decentralization reform in 1994, the increasing fiscal expenditure responsibility drove Chinese sub-national governments to compete for FDI by offering cheap land, financial resources, preferential tax reductions and weak environmental regulations. As such, the processing model prevailed in China with FDI, which fueled China's intermediate goods trade as a whole. On the other hand, state policies for stimulating processing activity took effect. As will be explained later, the pattern of China's trade development echoes the processing activity evolution and is a reflection of the FDI-driven East Asian regional production network.

2.2.2. Persistent policy efforts in promoting trade-FDI nexus

We reviewed various Chinese policy documents to identify the effects of policy changes.[6] We found that there were persistent policy efforts to encourage foreign investment and trade as well as the promotion of technological capability until the occurrence of the GFC. Usually, regional polices were implemented by taking reference from state policies, and thus we concentrate on the state policies here. As there were numerous policy documents, we focus on some of the fundamental state policies that affected China's intermediate goods trade.

In 1979, the *Law on Chinese-Foreign Equity Joint Ventures* (hereafter the *1979 Law*) was promulgated, which permitted foreign agents to establish joint-equity ventures together with Chinese partners 'with a view to expand international economic cooperation and technological exchange'. Thereafter, foreign investment was initially allowed in China after decades of prohibition. More fundamentally, China's 1982 *Constitution* welcomed foreign entities to invest and to carry out various forms of economic cooperation with Chinese economic organizations. Although due to ideological and political reasons, there were no *de jure* private property right protections until the 2004 Constitution amendment, the interests of foreign investments were *de facto* protected. The *Provisions on the Encouragement of Foreign Investment* in 1986 (hereafter the *1986 Provisions*) provided systematic preferential policies for FDI and exporting enterprises with the standards of SOEs, such as, priority of access to public utilities, loans and credits, income tax exemption or reduction,[7] tax refund for reinvestment, free duties for intermediate goods and final products exports, etc. With these preferential offerings, foreign investment and exporting enterprises enjoyed favorable treatment from the government.

The *1979 Law* and *1986 Provisions* served as a stable incentive that marked the turning point for foreign investment in China. Barriers to entry for foreign capital were gradually eliminated. Supplementary to these laws, departments under the State Council implemented a basket of policies to encourage foreign investments (see Table 1). These policies are assigned into different policy categories such as policy of deregulating barriers to investment and trade, policy of encouraging foreign investment by offering factors of production, various tax discount policies, policy of tariff exemption and duty reduction, policy for easier credit and loan accesses, and policy of deregulation of capital account control. Simply put, a series of well-designed polices were offered for foreign investment. In this process, the FIACC/FTACC played a prominent role in coordinating state departments and policy implementation. The policies of various sub-national governments, which were drafted with reference to state policies, further reinforced the attraction to draw foreign investors.

In addition to attracting FDI, there were two other policy priority aspects. One was to increase processing activities through tariff reductions or rebates for imported materials and parts that were processed in China and then re-exported. This fervent support could be demonstrated by the total tax rebates for exports which increased from 4.4 billion *yuan* when it was firstly practiced in 1985 to 125.9 billion *yuan* in 2002. For example, the 1985 *Provision for the Collection and Refund of Product Tax and Value Added*

[6] Policy documentation in China takes various forms that include laws, local legislation, judicial interpretations, administrative regulations, local government rules, and industry regulations.

[7] Tax rate for foreign invested enterprises was 1/3 ~ 1/2 of that for SOEs.

Table 1
Selected favorable policies for foreign investment.

Category	Title/department, year	Policy description
Deregulation and encouragement of foreign investment	Law on Chinese-foreign equity joint ventures/standing committee of the National People's Congress (NPC), 1979	Approval of foreign agents to invest in China, protection of basic rights under the law; trade promotion to technologically advanced foreign investors
	Provisions on the encouragement of foreign investment/ the State Council (SC), 1986	Favorable treatment for exporting firms and technologically advanced firms
	Implementation measures on enterprises with foreign investment Applying for import and export Licenses/Ministry of Foreign Trade and Economic Cooperation (MOFTEC), 1987	Deregulation of foreign trade administration
	Circular concerning the extension of the limits of power vested with the IPs, ARs, MSLSP and the departments concerned under the State Council in examining and approving foreign investment absorption/the SC circular No. 42, 1988	Barriers to investment were lifted
	Implementation concerning the confirmation and assessment of export enterprises and technologically advanced enterprises with foreign investment/MOFTEC, 1987	Promotion of foreign capital investments in areas such as goods exports, foreign trade, introduction of advanced technology
	Some rules concerning speeding-up and deepening the reform of the foreign trade system/the SC circular No. 12, 1988 (updated in 1990)	Local government foreign trade and currency responsibility; trade surplus sharing system between central-local governments; deregulation of Foreign Trade Companies to local governments
	Some supplementary provisions of the state council on the coastal areas of the development of export-oriented economy/the SC circular No. 22, 1988	Deregulation of FDI and foreign trade
	Trial measures for control of the inspection of imported/exported commodities of foreign investment enterprises & ventures involving processing &assembly with supplied materials & parts or compensation trade/State administration of entry-exit inspection and quarantine, 1988	Promotion of processing activity
	Interim measures for import administration of machinery and electronics products/the SC circular No. 135, 1993	
Tax	Regulations concerning the collection and remission of industrial and commercial taxes on import and export commodities/SC, 1980	
	Announcement on taxation of joint ventures and cooperative operations with Chinese and foreign investment/SC, 1982	
	Circular concerning taxation of industrial and commercial consolidated tax and enterprise income tax on land development and compensatory land use right transfer undertaken by enterprises with foreign investment/Ministry of Finance (MOF), General Administration of Custom (GAC), 1995	
	Interim provisions concerning reduction and exemption of enterprise income tax and consolidated industrial and commercial tax for the encouragement of foreign investment in china's open coastal economic areas/MOF, 1988	Preferential tax rate of 15% if FDI is technology-intensive or knowledge-intensive enterprises; enterprise income tax at a 20% discount for investment in certain materials and parts
	Income tax law for enterprises with foreign investment and foreign enterprises/NPC, 1991	Overall tax reduction for foreign enterprises, which led sub-national governments to compete for foreign investment by offering favorable tax rates
Tariff	Provisions for the collection and refund of product tax and value added tax on import and export products/SC, 1985	95% tax exemption on imported parts for machinery and electrical products and 12 other intermediate goods; 85% tax reduction for materials and components; duty reduction in the trading of parts
	Regulations on import and export duties/SC, 1987	Tariff exemption for intermediate goods processing, tariff exemption or reduction for SEZ and foreign-involved enterprises
	Foreign trade system reform for 1988/SC, 1987	Comprehensive tax reimbursement, tariff refund for exported goods
	Measures for bonded warehouse factory engaged in processing trade/GAC, 1988	Tariff exemption for exported goods
Credit & loan	Regulations on provision of loans to enterprises with foreign investment/Bank of China, 1987[a]	
	Provisional measures concerning mortgage by enterprises with foreign investment of foreign exchange for renminbi loans/People's Bank of China, 1986	
Foreign exchange	Administrative regulations governing the use of foreign currency by foreign investment enterprises when computing prices and settling accounts within china/State Administration of Foreign Exchange (SAFE), 1989	
	Provisions on the purchase and export of domestic products by enterprises with foreign investment to balance foreign exchange accounts/MOFTEC, 1987	

Table 1 *(continued)*

Category	Title/department, year	Policy description
	Foreign trade system reform for 1988/SC, 1987	Increase foreign currency surplus retention ratio
	Provisions for the control of bank accounts opened abroad by foreign-funded enterprises/SAFE, 1989	

Source: Collected by authors.
[a] Bank of China (BOC) was franchised by the State Council to manage China's foreign currency business.

Tax on Import and Export Products stipulated a rate of 95% exemption on imported parts for machinery and electrical products and another 12 specific intermediate goods, 85% for materials and components and duty reduction in the trading of machinery parts.

The other major concern of China's policymakers was the introduction of advanced technology, equipment, and new products to accelerate industrial upgrading. When a foreign enterprise was approved as a technologically advanced firm, it had access to favorable tax rebates and easy access to financial resources. For example, the 1979 *Law* stipulated that the type of technology and equipment contributed by a foreign joint venture as its investment in kind must be advanced technology and equipment that suited China's needs. An equity joint venture equipped with advanced technology by international standards could apply for a reduction from income tax for the first two to three years of profit-making. A regular policy of this type was the *Catalogue of Industries for Guiding Foreign Investment* (hereafter the *Catalogue*), which listed the types of foreign industrial investments that were encouraged or prohibited. The first version of the *Catalogue* was implemented in 1995 and then subsequently amended every two to four years in accordance with China's dynamic industrial demands for advanced technologies and equipment. The *Catalogue* encouraged foreign investments in machinery and transportation equipment manufacturing, which resulted in an increase in the industrial demand for foreign parts and components and boosted China's intermediate goods trade in these sectors.

As a response to China's preferential policies for foreign investment and advanced technology, China's foreign investment and trade pattern underwent an enormous structural change. In real terms, foreign investment increased from US$226 million in 1983 to US$11.55 billion in 1991. There was a significant increase in foreign investment after the implementation of the *1986 Provisions*, and most FDI was concentrated in SEZ where processing activity thrived. Regarding trade, China's export underwent a structural change from 1986, the year after which manufactured products dominated primary products and became the prime driving force of China's impressive export expansion (Fig. 4). Similarly, imports of manufactured products were highly correlated to China's total imports. This would be the cause of the overall robust development of China's IIT.

Looking further into the import structure, it is evident from Fig. 5 that China's import of machinery and transportation equipment (SITC 7) expanded since the mid-1980s. By 1991, it accounted for 35.9% of total imports. The performance of China's intra-industry trade of machinery and electronics products could be partly explained by the aforementioned policies. In addition, there were some specific industrial policies implemented with regards to machinery and electronics products. As early as 1985, the State Council approved the *Report to Expand the Export of Machinery and Electronics Products* (hereafter the 1985 *Report*). Since then, machinery and electronics products were classified as major exporting items and policies were implemented to 'support as a pivot'. The *Report* set targets for growth and for the ratio of export of machinery and electronics products to total export for 1990, 1995 and 2000. To achieve these goals, systemic 'basic works' were deployed, which included enhancing industrial

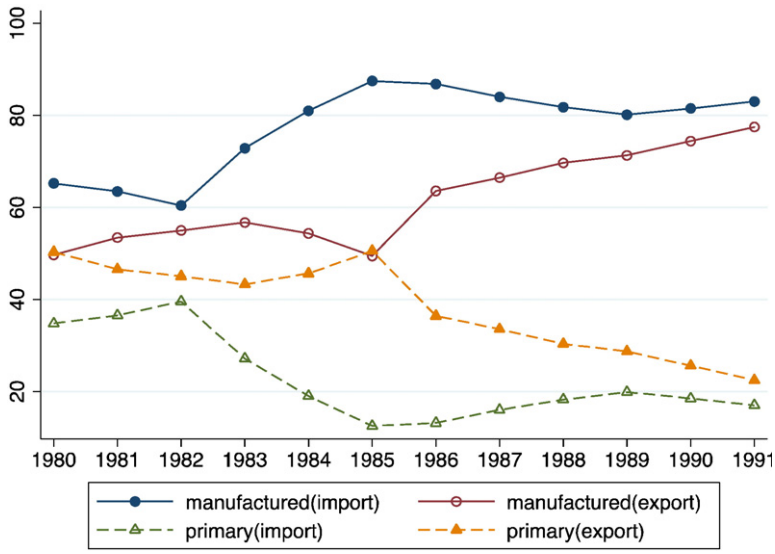

Fig. 4. Trade structure of China by SITC standard (1980–1991)
Source: China Customs Statistics.

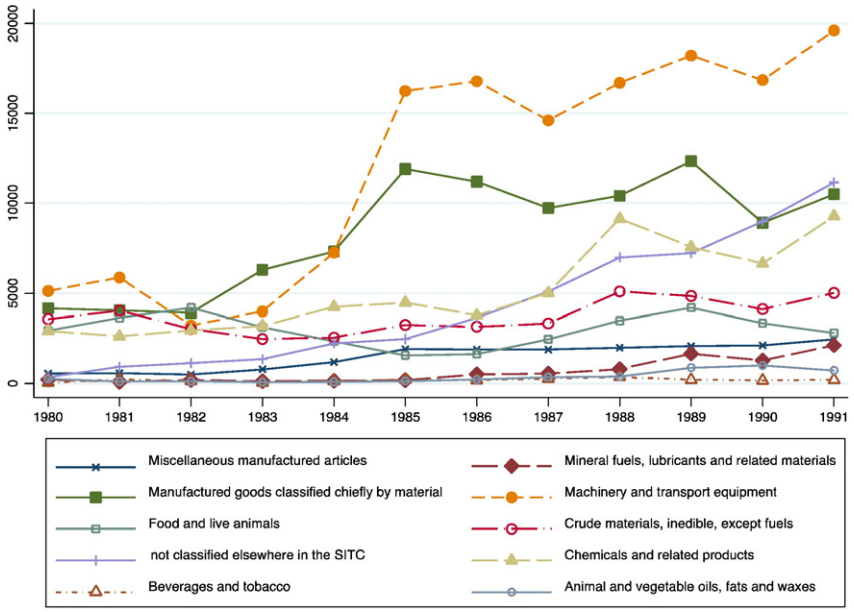

Fig. 5. Import of China by SITC classification (1980–1991)
Source: China Customs Statistics.

technology and management, building up the export and production system of machinery and electronics products and employing professionals in international marketing and sales networking. Production and exporting firms of machinery and electronics products were categorized into three categories. About 100–200 advanced firms were approved as an 'exporting basis enterprise', which were encouraged to enter the world market; about 500 key state enterprises were listed as a 'foreign trade authority', which were encouraged to increase export; and the last category was 'general enterprises', which were planned for export by product quality improvement. Favorable policies were drafted for exporting firms (especially for 'exporting basis enterprises'). These included fiscal subsidies to deal with the risk arising from foreign exchange, tax exemption and rebates in order for them to compete with joint venture enterprises, retention of foreign exchange, which enterprises earned from exports so as to increase exports, bonuses for the employees of such exporting firms, supplier credit, and export credit issuance. Discounts on export bills were given to encourage research and development (R&D). Besides, firms that exported machinery and electronics products were given priority access to raw materials, parts and components, fuels, energy, packing stuffs and transportation. Correspondingly, sub-national governments allocated resources to increase the export of machinery and electronics products under the state policy. In 1991, another state policy, initiated by the SOIEMEP, was implemented to further increase the export of machinery and electronics products. Most of the policies listed in the 1985 *Report* were prolonged, of which some policies such as various financial support for the technological upgrading and R&D of exporting firms were updated, mid- to long-term export credits were strengthened. This policy was amended and extended in 1994, 1999, 2001 and 2006 in almost every national Five-Year-Plan.[8] The latest effective version was updated in 2011. These efforts resulted in China's trade development in machinery and electronics products.

Although it is difficult to identify the exact policy effects on trade for specific industries, we can see evidence in certain strategic industries such as the automobile industry. China implemented the first national industrial policy for automobiles in 1994. It encouraged domestic automobile enterprises to utilize foreign capital in the form of joint-venture enterprises. According to the Japanese Automobile Manufacturers Association (JAMA), major Japanese automobile firms started to establish manufacturing facilities in China from 1993 to 1998, thus benefitting from this policy (JAMA, 2014).[9] However, for some time, China lagged behind in the production technology for automobiles and relied heavily on imported technology-intensive components (such as piston engines, transmissions)[10] while exporting low technological and non-environmentally friendly products (such as tires, brake linings). This contributed to China's intermediate goods trade on the one hand and mirrored the formation of regional production networks on the other.

2.2.3. East Asian production network

As discussed above, China's SEZ experiment was an important institutional pillar to the East Asian regional production network. In light of previous studies on the East Asian regional production network, the role of Japanese FDI is often deemed as

[8] These policy documents are the State Council Circular No. 58 (1994), the General Office of State Council Circular No. 27 (1999), the State Council Circular No. 84 (2001), the General Office of State Council Circular No. 42 (2006), and 2011.

[9] Including Suzuki, Toyota, Nissan, Honda, Mazda, Mitsubishi, Yamaha, Kawasaki, Subaru and UD Trucks.

[10] In 2011, Japan was the largest source of China's automobile parts and components of engines, steering systems, braking systems, vehicle systems, transmission systems and accessories and the second largest source of automobile electrical and electronic components.

one of the driving forces. Ando and Kimura (2009) argued that Japanese multinational firms played an important role in the development of East Asian production and distribution networks by expanding the fragmentation of Japanese production overseas. As a consequence, the East Asian intermediate goods trade, which was greatly shaped by Japanese FDI, surged after the Plaza Accord in 1985 (Kimura & Ando, 2005; Kimura et al., 2008; Thorbecke & Salike, 2011, 2013). Driven by her policy of trade openness, China became the largest recipient of regional Japanese FDI, and the regional production network quickly spread throughout China. Once again, we can see that China's policy towards Japanese FDI was an essential catalyst for the expansion of the East Asian production network.

Japanese companies began to establish branches or make green-field investments in China's SEZ in the 1980s. According to the Japanese Ministry of Finance, Japanese FDI in China experienced a great rise in 1984, from nearly US$3 million in 1983 to over US$114 million in 1984. It can be said that Japanese FDI in manufacturing propelled China into the East Asian production network. Japanese FDI flow into China's manufacturing had outpaced non-manufacturing since 1988 with a widening gap over the consequent years. This structural change could be largely explained by that year's milestone policy, when China signed a bilateral investment treaty (BIT) with Japan. This was the first BIT that China gave national treatment to a foreign country. The China-Japan BIT improved China's credibility and commitment in attracting FDI. During the late 1980s and the early 1990s, Japanese FDI continued to grow. When Japan started industrial upgrading in the 1990s, China became a major overseas destination for Japan to outsource her manufacturing processes, as demonstrated earlier in the case of the automobile industry.

The largest Japanese FDI recipient industry was electric machinery, followed by industries of fiber, machinery, and transportation equipment. Most of them are categorized in the SITC section 7 at the 2-digit level. Taking machinery, electric machinery and transportation equipment together, which are treated as medium and high-tech manufacturing, we can draw a clear picture of the role of Japanese FDI in China's industrial structure and its related trade pattern. Japanese FDI in medium and high-tech manufacturing accounted for about 70% of Japanese FDI in manufacturing sectors (Fig. 6) and the highest record of 78.6% took place in 2000.This level was maintained until 2004. After that, this share decreased gradually to nearly 50%. The export of intermediate products in section 7 experienced a great increase from the early 1990s to the late 2000s. Whereas Japanese FDI played an important role in establishing the production network in East Asia, China's efforts on liberalizing trade in the region also had positive impact on trade. For example, Yang and Martinez-Zarzoso (2014) found that ASEAN–China Free Trade Agreement (ACFTA) had significant trade creation effects in the region with positive relationship between exports and ACFTA in machinery and transport sectors, among others, which were key drivers of East Asian production network.

2.2.4. China's anti-global financial Crisis policy adjustments and the post-global financial Crisis structural changes

After the 2008 GFC when the international market melted down and foreign investment became sluggish, China's policy concerns for foreign investment and trade started to change. To ensure sustained economic growth, China's macroeconomic policy towards demand changed from being outward looking to inward looking. A series of policies were implemented to serve two purposes.

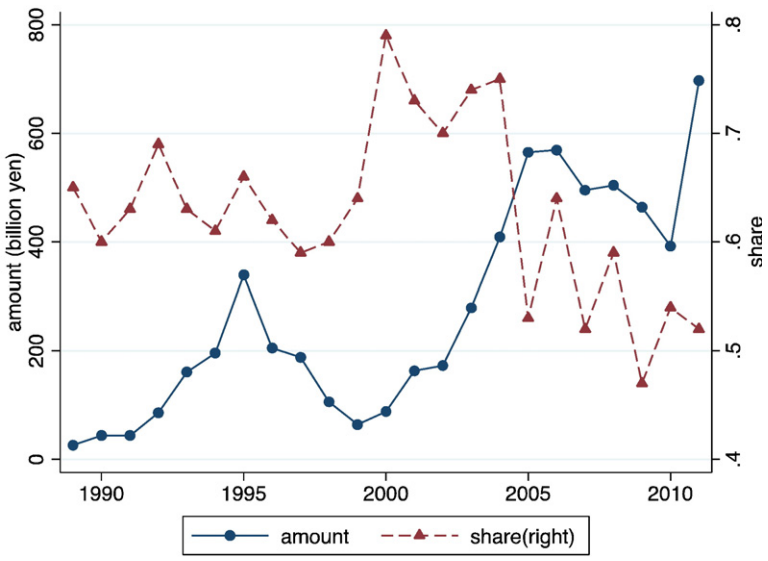

Fig. 6. Japanese FDI in medium and high-technology industries in China (1989–2011) (billion Japanese Yen)
Source: Ministry of Finance, Japan.

One was to increase domestic demand to counter the shrinking external demand. To this end, the Chinese government introduced a massive fiscal stimulus amounting to RMB 4 trillion (US$586 billion) in 2008, which was 12.5% of the 2008 Chinese GDP (Fardoust et al., 2012). China's fiscal stimulation package covered public expenditure in infrastructure construction (e.g., railway, road and airports, rural public service), social services development (e.g., public housing, health, education and culture) and environmental projects (e.g., energy-saving, industrial pollution treatment, ecological recovery). Those policies on encouraging infrastructure construction and real estate were likely to accelerate the growth of their related intermediate goods trade.

The other policy objective was to promote industrial development by encouraging industrial innovation and the development of technology-intensive industries. At the beginning of 2009, the Chinese government selected ten key industries for 'restructuring and revitalization', including steel, automobile, shipbuilding, equipment, ICT, and non-ferrous metals, etc. Most of these industries produce products that are categorized in SITC 7 and 8. The motivation behind this was to promote technological upgrading and indigenous innovation so as to substitute imported products, parts, and components with local suppliers. This policy adjustment would lead to the structural change of China's IIT index in SITC 7 and 8.

In this section, we illustrated China's institutionalized efforts to promote the FDI-trade nexus that accelerated the East Asian regional production network and the accumulation of technological capability. These efforts could be traced through the regular specialized administrative organizational adjustment and major policy documents. While these efforts were not deliberately designed to boost China's intermediate goods trade with her regional neighboring economies, we predict that two structural changes would be made based on these observations. Firstly, China's intermediate goods trade would be enhanced along the expansion of the regional production network in general. Secondly, China's push for technological upgrading will be reflected in her intermediate goods trade. In the next section, we will further analyze the effects of China's institutionalized efforts on its intermediate goods trade.

3. Data work

In this section, we endorse the arguments made in Section 2 with some data work and propose the following two hypotheses.

Hypothesis 1. China's macroeconomic policy, which favored FDI and technological upgrading after the opening up of the economy, shifted China's structure of intermediate goods trade from primary products (low technology-intensive) towards manufacturing products (medium technology-intensive).

Hypothesis 2. China's anti-Global Financial Crisis policy, which was achieved by stimulating domestic demand and shifting towards an innovation-driven growth model, is likely to bring about a structural change in the intermediate goods trade through the increase of domestic demand and the drive to develop the high-technology-intensive sectors.

The basic framework to test these hypotheses is by observing the changes in the structure of China's IIT index in intermediate goods. Given the vital role that China plays in the East Asian regional production network, the shifts in index in specific product would indicate how the focus of Chinese manufacturing changed over the time. For e.g., if China's IIT for one specific range of product increases and sustained for a certain period of time, then it would indicate that China is specializing its manufacturing in that particular product range.

3.1. Data description

The Grubel-Lloyd index for IIT is used as a measure to assess how China was being integrated in the intermediate goods trade in Asia. This IIT index takes the following form:

$$IIT_{s,t} = 1 - \frac{|X_{s,t} - M_{s,t}|}{X_{s,t} + M_{s,t}}$$

where $IIT_{s,t}$ is the IIT index of China for SITC basic heading "s" in time "t". $X_{s,t}$ is Chinese exports of "s" to 10 partner economies at "t". $M_{s,t}$ is Chinese imports of "s" from 10 partner economies at "t".The IIT index lies between 0 and 1. 0 represents complete inter-industry trade while 1 represents complete IIT. Therefore, from the perspective of integration, a higher number would imply that China is better integrated in the region.

The database used for this study is the UN Comtrade - SITC Revision 3 (UN, 1991) and includes bilateral trade data of China with her 10 Asian partners,[11] which spans from 1991 to 2011. In particular, we looked into two section codes - SITC section 7 (Machinery and transport equipment) and section 8 (Miscellaneous manufactured articles). The reason for focusing on these two sections is that these are primarily manufacturing products and the majority of intermediate goods trade took place in these two sections. Several studies have been carried out to highlight the intermediate goods trade based on these sections (Athukorala & Yamashita, 2006; Kimura & Obashi, 2010; Sturgeon & Memedovic, 2011). The data was collected up to its finest level of code, i.e. 5-digit level (basic heading).

[11] They are Hong Kong, Indonesia, Japan, Korea, Malaysia, Philippines, Singapore, Taiwan, Thailand and Vietnam.

Section 7 consisted of 653 basic headings whereas section 8 consisted of 442 basic headings. Since we are interested only in the intermediate goods trade, our task was to build a comprehensive list of basic headings belonging solely to intermediate goods and this was an arduous undertaking. With the help of Athukorala (2003), Kimura and Obashi (2010) and Sturgeon and Memedovic (2011), we first pulled all the basic headings belonging to sections 7 and 8 and then tallied them with those included in the three studies.[12] There were circumstances when the categorization was not clear and easy. Hence, we consulted with the experts in the relevant fields to clarify them. By doing so, we identified 347 basic headings belonging to intermediate goods with 277 in section 7 and 70 in section 8.[13] Therefore, our main analysis falls within these 347 basic headings.[14]

We calculated the IIT index for all 347 basic headings from 1991 to 2011. In order to smooth out the short-term fluctuations and clearly identify the long-term structural changes, we took the moving average of three years. The IIT index calculated for these 347 basic headings were then narrowed down to the 2-digit level (division code) by taking the average of all the basic headings that belonged to those specific division codes. Since the trade volume of each basic heading within the division codes was different, the division code IIT index was calculated using the weighted average with weights being the proportion of the trade volume of each basic heading to the trade volume of division code. This would leave us with nine section 7 division codes and seven section 8 division codes.[15] It is notable that division codes 71, 72, 74 and 77 constituted broad basic headings, which imply that these division codes comprised more intermediate goods in trade compared to others.

3.2. Data analysis: 2-digit level (division code) observations

As mentioned above, there are altogether 16 division codes (nine from section 7 and seven from section 8), which belong to the intermediate goods listed in SITC Revision 3. Tables 2 and 3 show China's three-year moving average IIT index from 1991 to 2011 for product categories listed in Sections 7 and 8, respectively. It is evident that, compared to 1991, the IIT index of these intermediate goods shows a significant rise in trade in almost all division codes. This is particularly distinct for the division codes: 71, 72, 73, 74 and 78; although there has been a decline in some product categories such as 76 and 79. Another noticeable occurrence is that almost all the division codes saw a decline in indices in the more recent years of 2009 to 2011. In the case of section 8, most of the IIT indices declined over the years. Although there was a big jump from 1991 to 1996, thereafter, however, there has been a consistent drop in China's intermediate goods trade to Asia and this is particularly true for division codes 81, 84 and 85.[16] Another interesting observation for this section is that in the recent years of 2009 to 2011, there has been a rise in the indices for division codes 81, and 82 and 87.

Moreover, for the latest period of 2009 to 2011, China is highly integrated with Asia in six out of nine section 7 division codes with a score of more than 0.5; and three out of seven section 8 division codes. The tables clearly show that in the past two decades, China has been highly integrated in her intermediate goods trade with other Asian economies. Figs. 7 and 8 reflect the above data for two separate sections.

3.3. Discussion

Looking at the findings of China's IIT index at the division code level, we argue that the structural change in the behavior of the intermediate goods trade of China in Asia took place in two stages.

3.3.1. Stage 1: 1991–2008

During this stage, the IIT index for China increased for most of the section 7 division codes. The most significant rise could be attributed to division codes: 71, 72, 73, 74, whereas 76 and 79 registered a drop. Division code 71 refers to power-generating machinery and equipment; 72 refers to machinery specialized for particular industries; 73 refers to metalworking machinery; and 74 refers to general industrial machinery and equipment. Division code 76 refers to telecommunications and sound-recording items, while 79 refers to other transport equipment. For section 8, major drops were seen in the IIT index for China, in particular: 81, 84 and 85. Division code 81 refers to prefabricated buildings, sanitary, plumbing, heating and lighting fixtures and fitting; 84 refers to apparel and clothing accessories; and 85 refers to footwear. Others division codes remained more or less consistent over the years. It is notable that all the division codes that saw a decline in the IIT index were from low-technology, high-labor-intensive industries.

We argue that these trends suggest a possible shift in the direction of China's government policy towards prioritizing specific industries as discussed in Section 2. The decline in the indices for section 8 indicates that there was a clear shift from these industries to some other industries. This could be attributed to the product categories of section 7 particularly 71, 72, 73, which are relatively technology-intensive (Lall, 2000). Therefore, our premise is that the policy changes have brought upon the change in the composition of these division codes, both in production as well as in the trade of intermediate goods. Clearly, for

[12] Both Athukorala (2003) and Sturgeon and Memedovic (2011) used SITC codes in their studies, whereas Kimura and Obashi (2010) used the HS classification. The HS classification has been tallied with SITC Revision 4 and then with Revision 3 using Comtrade's correspondence tables.

[13] 224 came from Athukorala (2003); 111 came from Kimura and Obashi (2010) and 12 came from Sturgeon and Memedovic (2011).

[14] The full description of these basic headings is available upon request.

[15] The 347 basic headings within the division codes are as follows: 31 from SITC level 71; 31 from SITC level 72; 9 from SITC level 73; 82 from SITC level 74; 5 from SITC level 75; 4 from SITC level 76; 95 from SITC level 77; 14 from SITC level 78; 6 from SITC level 79; 6 from SITC level 81; 3 from SITC level 82; 2 from SITC level 84; 1 from SITC level 85; 21 from SITC level 87; 22 from SITC level 88; 15 from SITC level 89.

[16] Note however that division codes 84 and 85 contained only 2 and 1 basic heading, respectively. Therefore, caution is needed in making meaningful conclusions.

Table 2
Three-year moving average IIT index for China with her Asian counterparts (Section 7).

	S3-71	S3-72	S3-73	S3-74	S3-75	S3-76	S3-77	S3-78	S3-79
1991–1993	0.12	0.16	0.26	0.30	0.53	0.41	0.28	0.20	0.20
1992–1994	0.20	0.26	0.39	0.40	0.76	0.63	0.42	0.40	0.29
1993–1995	0.24	0.26	0.39	0.45	0.72	0.66	0.43	0.52	0.32
1994–1996	0.25	0.29	0.40	0.51	0.71	0.76	0.48	0.62	0.41
1995–1997	0.26	0.31	0.41	0.55	0.69	0.85	0.54	0.59	0.45
1996–1998	0.24	0.32	0.42	0.56	0.67	0.90	0.58	0.61	0.47
1997–1999	0.25	0.34	0.44	0.57	0.74	0.90	0.60	0.61	0.34
1998–2000	0.27	0.35	0.48	0.57	0.86	0.88	0.59	0.61	0.30
1999–2001	0.31	0.40	0.56	0.60	0.91	0.85	0.57	0.58	0.23
2000–2002	0.33	0.42	0.60	0.61	0.89	0.85	0.53	0.58	0.20
2001–2003	0.43	0.44	0.59	0.63	0.81	0.83	0.50	0.54	0.22
2002–2004	0.31	0.46	0.53	0.62	0.76	0.81	0.50	0.50	0.28
2003–2005	0.31	0.53	0.51	0.64	0.73	0.78	0.52	0.49	0.29
2004–2006	0.33	0.61	0.52	0.64	0.73	0.74	0.54	0.55	0.25
2005–2007	0.36	0.66	0.58	0.65	0.71	0.72	0.51	0.60	0.19
2006–2008	0.39	0.66	0.63	0.64	0.68	0.70	0.47	0.62	0.18
2007–2009	0.41	0.64	0.63	0.64	0.63	0.68	0.43	0.63	0.17
2008–2010	0.39	0.62	0.61	0.65	0.68	0.68	0.44	0.64	0.19
2009–2011	0.37	0.61	0.60	0.59	0.70	0.67	0.44	0.65	0.26

Source: Authors' calculation based on UN Comtrade database.

intermediate goods, there has been a distinct shift from low technology industries towards higher technology-intensive (medium tech) industries. This supports our first hypothesis that there has been a structural change in the intermediate goods trade from primary and/or low technology industries towards medium technology industries. This could be recognized as the change in China's policies on export orientation and the regional production network for which China has been actively reforming since the 1980s. Also, China's accession to WTO (December 2001) was another factor that helped to achieve the policy changes undertaken by the Chinese government. We would further argue that these changes in the components of the intermediate goods trade was brought about mainly by foreign investment (particularly from Japan), as these investments have been key to the industrial upgrading of China.

3.3.2. Stage 2: 2008–2011

The most notable feature of this stage is that there has been a drop in China's IIT index for both sections 7 and section 8 (the exception being division codes 81, and 82 and 87) including division codes 71, 72 and 73. The main reason for this could be attributed to the GFC of 2007 to 2009, which had a lagged effect on Asia. While America and Europe were affected largely through the financial sector, the effects of which were rather immediate, Asia was particularly affected through the trade channel. Although most of the IIT that China conducted was with other Asian economies, the final demand for the finished product was in the US and Europe. After the drop in global GDP growth and purchasing power, the consumer demand in these external markets for Asian products was drastically weakened after 2008. This is clearly visible in our data work as well.

Table 3
Three-year moving average IIT index for China with her Asian counterparts (Section 8).

	S3-81	S3-82	S3-84	S3-85	S3-87	S3-88	S3-89
1991–1993	0.49	0.59	0.55	0.38	0.32	0.36	0.27
1992–1994	0.74	0.82	0.84	0.70	0.49	0.52	0.44
1993–1995	0.72	0.72	0.81	0.86	0.52	0.52	0.48
1994–1996	0.75	0.63	0.82	0.97	0.51	0.58	0.50
1995–1997	0.73	0.60	0.85	0.98	0.54	0.59	0.51
1996–1998	0.69	0.64	0.93	0.96	0.61	0.55	0.50
1997–1999	0.59	0.67	0.96	0.94	0.65	0.53	0.53
1998–2000	0.53	0.70	0.89	0.90	0.71	0.54	0.53
1999–2001	0.47	0.64	0.74	0.87	0.70	0.54	0.54
2000–2002	0.43	0.60	0.58	0.82	0.58	0.52	0.53
2001–2003	0.41	0.57	0.48	0.80	0.46	0.52	0.51
2002–2004	0.42	0.60	0.47	0.77	0.41	0.56	0.50
2003–2005	0.41	0.61	0.50	0.76	0.48	0.58	0.49
2004–2006	0.34	0.60	0.54	0.70	0.53	0.60	0.48
2005–2007	0.27	0.55	0.58	0.62	0.57	0.60	0.48
2006–2008	0.33	0.48	0.57	0.52	0.57	0.61	0.48
2007–2009	0.45	0.48	0.56	0.42	0.60	0.58	0.47
2008–2010	0.49	0.52	0.46	0.37	0.58	0.56	0.46
2009–2011	0.44	0.58	0.37	0.33	0.60	0.56	0.46

Source: Authors' calculation based on UN Comtrade database.

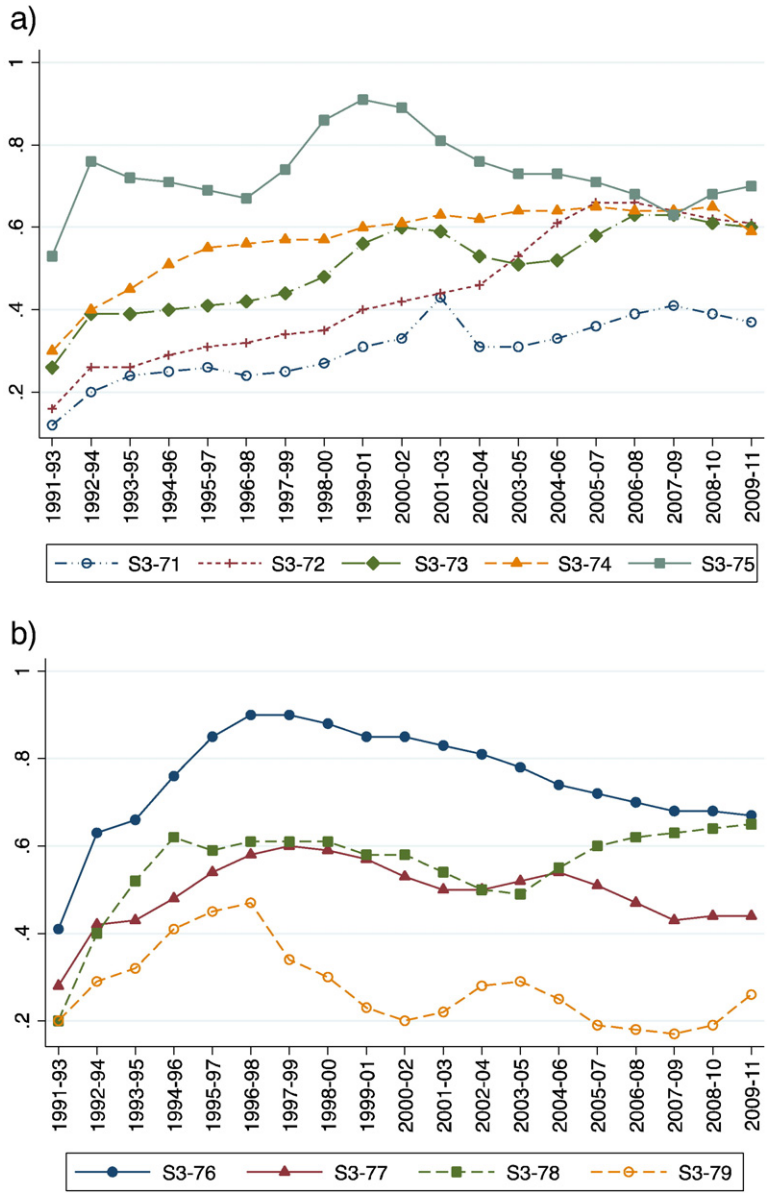

Fig. 7. a,b Three-year moving average IIT index for China for section 7.
Source: Authors' calculation based on UN Comtrade database.

From the viewpoint of China's policy shift, there has been two major policy shifts during this period: firstly, an inclination towards boosting domestic demand; and secondly, undertaking an upgrading of the industries. While the first policy shift could be directly linked with the GFC, for the latter, the Chinese government has been trying to upgrade its industry from medium tech to relatively higher tech from the mid-2000s. In response to the threat of the GFC, the Chinese government speeded up its pace for industrial upgrading.

We argue that the policy shift by the Chinese government in preference of higher-end technological intermediate goods may also be the reason for the drop in some of these division codes. Furthermore, we can see that although division codes 71, 72, 73 and 74 registered a decline, the drop was not substantial for division codes 73 and 74. Hence, this may hint that the structural changes happened only for division codes 71 and 72.

The increase in division codes 81, 82 and 87 could be explained by China's policy of boosting domestic demand. Division code 81 refers to prefabricated buildings, sanitary, plumbing, heating and lighting fixtures and fittings; division code 82 refers to furniture, bedding, mattress, mattress supports, cushions and similar stuffed furnishings; and division code 87 refers to professional, scientific and controlling instruments and apparatus. One of the most effective ways in China to boost the domestic demand has been through investment in the real estate sector. Both division codes 81 and 82 are related to the real estate sector whereas division code 87 is for relatively high-end equipment products.

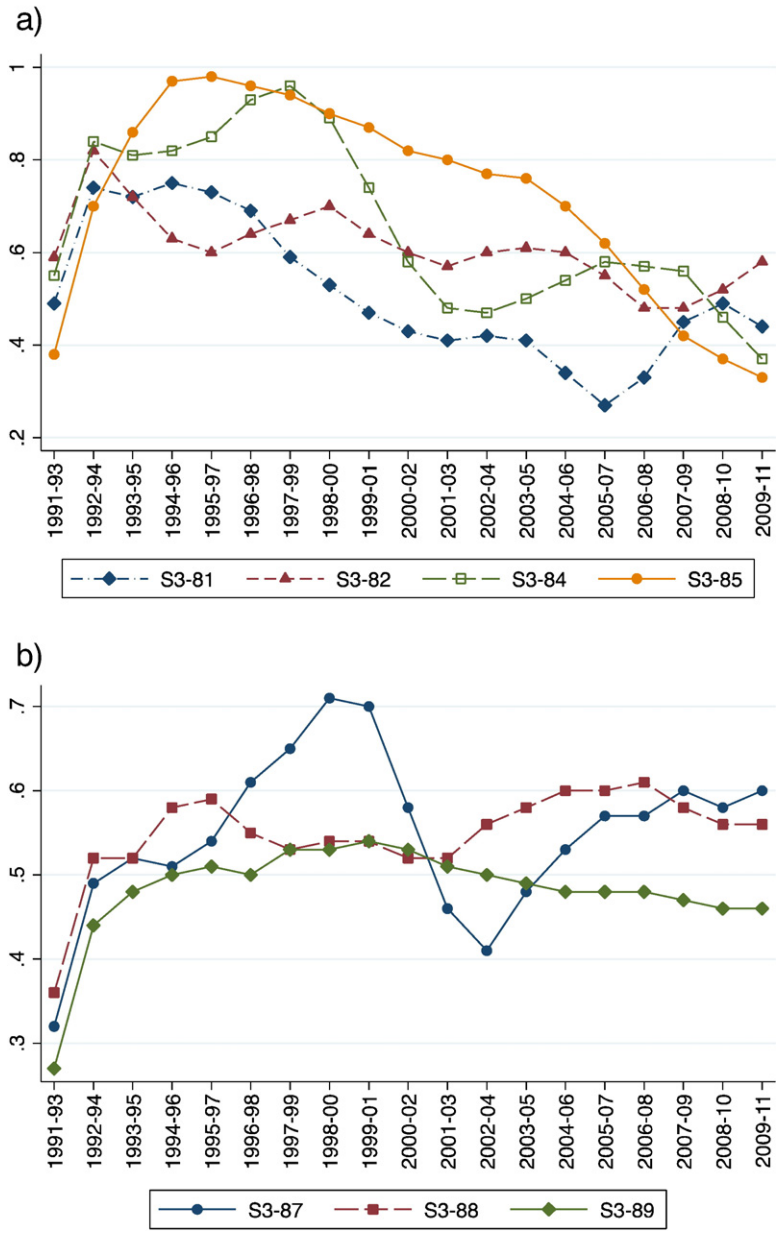

Fig. 8. a,b Three-year moving average IIT index for China for section 8.
Source: Authors' calculation based on UN Comtrade database.

The policy adjustments adopted after the GFC resulted in the structural change of China's IIT index in SITC 7 and SITC 8. The three-year average ITT index (2009–2011) for China with her Asian counterparts in most product categories of SITC 7 and SITC 8 started to decline after years of persistent growth since the 1990s and suggests that China's demand for foreign medium and high-tech products was decreasing. This is a result of the Chinese government's preference to invest in R&D in the area of science and technology due to her drive to build an innovative country, a strategy which began in 2006. Following this reasoning, the rise of the IIT index for S3-87 is logical. These findings are in line with our second hypothesis that China is trying to upgrade its industries towards high-technology industries in the aftermath of the GFC.

3.4. Data analysis and Discussion: 5-digit level (basic heading) observations

As discussed in the earlier sub-section, we believe that the major structural changes for the intermediate goods trade for China occurred in two stages: division codes: 71, 72, 73, 74 and 81, 84, 85 during the first stage and division codes: 71, 72 and 81, 82

during the second stage. Therefore, we would concentrate our analysis of the 5-digit level (basic heading) on these specific division codes only. One of the key challenges in dealing with the basic heading level is the mix of technological content.

3.4.1. Stage 1: 1991–2008

There are 31 basic headings in division code 71. Almost all the basic headings saw a big increase of the IIT index since 1991. Among these, the basic headings that had high levels of intermediate goods trade in year 2008 (with IIT index of more than 0.5) were 71,219, 71,322, 71,332, 71,381, 71,391, 71,392, 71,690, 71,811, 71,819, 71,892 and 71,899. The first six headings belong to parts and components related to transportation equipment while the latter five belong to the electrical machinery. According to Lall (2000), these are relatively medium and high-level technology-intensive products that are used in engineering and the electronics & electrical industry.

Division code 72 also consisted of 31 basic headings, of which those that had a higher IIT index in 2008 were: 72,129, 72,392, 72,399, 72,439, 72,449, 72,467, 72,468, 72,488, 72,492, 72,591, 72,599, 72,689, 72,699, 72,819, 72,852 and 72,855. All these headings are for specialized machinery products in industries like agriculture, tractors, textile and leather, paper mill and pulp mill, printing and bookbinding, food processing and other machineries. These products are mostly medium technology engineering products (Lall, 2000).

Among the nine basic headings from division code 73, a high IIT index could be observed for 73,591, 73,595, 73,719, 73,729, 73,739 and 73,749. These products are intermediate goods for machine tools for metal machineries. Division code 74 has one of the highest numbers of basic headings, which total up to eighty-two. Among these, 46 had an IIT index of more than 0.5. The majority of these belong to machinery and equipment relating to industries such as those for heating and cooling equipment, pumps, mechanical handling equipment, etc., which could be seen as relatively medium technology products.

For division code 81, all six basic headings except 81,219 registered a major drop in the IIT index. According to Lall (2000), almost all the products under these basic headings are classified as low skill and low technology-intensive manufacturers. Interestingly, however, 81,219 could be for medium technology-intensive goods.

Division code 84 has two basic headings while division code 85 has only one. These division codes refer to products associated with apparel/clothing and footwear, which are low skill and low technology-intensive. All these three basic headings (84,669, 84,848, and 85,190) maintained an IIT index of about 0.5 in 2008, a figure which has declined over the years. For example, the ITT index for these basic headings was 0.9 in1994. This shows that during the early 1990s, China placed heavy emphasis on these industries. Although the government is currently trying to move away from these industries, they still register a relatively high IIT index due to the huge initial investment.

This analysis of the basic heading level in stage 1 clearly supports our argument made in the earlier section that the policy implementation undertaken by the Chinese government to shift from low technology-intensive to relatively high-technology-intensive industries has resulted in structural changes in the behavior of the intermediate goods trade.

3.4.2. Stage 2: 2008–2011

During the second stage, both division codes 71 and 72 saw a drop in the intermediate goods trade, which is evidence of the structural changes in trade that were taking place. For the 5-digit (basic heading) level, major drops were seen for all the items that were doing particularly well up until 2008 except 71,280, 71,392, 71,499 and 72,119. As discussed earlier, the major reason for this drop may be due to the GFC. However, we also suspect that the Chinese government's policy shift from medium-tech industries to high-tech industries could have also contributed to the decline.

For division codes 81 and 82, which registered increases in the IIT index, major increases were seen for 81,211, 81,399, 82,112 and 82,119. The first heading belongs to the household commodity of boilers and radiators for central heating whereas the second item is related to another household commodity, that of lighting fixtures and fittings. The last two headings belong to furniture items related to bedding, mattresses, etc. The increase of trade of these items, which are complementary goods for housing, can be seen as directly related to the expansion of the real estate business that the Chinese government sought to develop so as to boost domestic demand.

Although the above are plausible explanations for structural changes in the intermediate good trade in the second stage, one needs to be careful in making any conclusions, as this time frame is very short (only four years) and no considerable effects could have been seen yet given that policy adjustments usually take time.

4. Conclusion and recommendations

China is an important player in the East Asian production network and is heavily involved in the trade of intermediate goods with other countries in the region. Most of the final goods thus produced are eventually exported to the external markets primarily in North America and Europe. We argue that the successful involvement of China in these events is the result of a series of policy changes and adjustments that the Chinese government had undertaken over the years since her opening up in the 1980s. In this paper, we looked into these changes from two aspects. Firstly, we reviewed the Chinese government policies from an intuitionalist point of view, focusing on industrial upgrading policies that led China to become one of the world's major manufacturing hubs. Looking into various policy documents related to China's inward foreign investment policies, trade policies and technology policies, we present two hypotheses: i) the policy amendments and adjustments were critical in successfully transforming China from a country that was previously primary product-based to one that is now largely manufacturing-based -. this was the first structural change that had happened since her opening up; and ii) in the aftermath of the Global

Financial Crisis (GFC), China is trying to climb further up the technology ladder by targeting high-technology industries - this is the second structural change that is currently underway.

Our second aspect was a focus on the supporting data work, which was based on the calculation of the intra-industry trade (IIT) index proposed by Grubel and Lloyd. The IIT index analysis was conducted for both the 2-digit (division code) level and 5-digit (basic heading) level. We showed though our data work that there were two specific structural changes in the behavior of the intermediate goods trade of China that was a result of the policy changes undertaken by the Chinese government. Firstly, during the period of 1991 to 2008, the successful efforts by the Chinese government to shift from low technology-intensive industries to medium technology-intensive industries could be observed through the big increase in the IIT index of the latter (related to division codes 71, 72, 73, 74) and a drop in the former (such as those related to division codes 81, 84, 85). Secondly, in the aftermath of the GFC, we argue that, in the more recent years of 2009 to 2011, the Chinese government had taken two major policy shifts: i) a reallocation of demand from external demand to domestic demand; and ii) a further push to move from medium technology-intensive industries to high-technology-intensive industries.

Fundamental institutional underpinnings were crucial on China's stand-out performance on this front in comparison to her other regional counterparts who have also adopted similar policies. As we have presented, structural change in China's intermediate goods trade was rooted in her long-term, persistent and systemic policy efforts with sophisticated policy tools, which was achieved by changing the behavior of enterprises. Furthermore, those policies were embedded in China's national development strategy, which secured the sustainability of policies on the one hand, and updated the goals of policies on the other.

We observed that the Chinese government had been successful in upgrading her industry since the 1990s. As China had already achieved success in most medium technology-intensive industries, which were vital towards China's exceptional economic growth since her opening up, it is recommended for China to strive for further industrial upgrading. This would also be crucial in moving away from the concept of “Made in China” to “Created in China”. We therefore recommend further policy changes that would bring structural changes to industrial upgrading.

China's recent industrial plan and policies are advancing in this direction. For example, The *Made in China 2025* Plan, the first ten-year-plan of manufacturing rather than the traditional five-year-plans released in May 2015, sets strengthening ‘manufacturing basic capabilities’ as one of the major tasks of the manufacturing upgrading. Under this plan, China will support the development of industries of key materials, high-end basic components/part at home to alleviate import dependence. Meanwhile, China's policy is shifting from encouraging inward FDI to overseas investment of Chinese enterprises. As shown in this paper, China's policy has brought structural change in the trade pattern of intermediate goods; we expect further structural changes along with updates in China's policies.

Acknowledgement

The authors acknowledge the support of XJTLU Research Development Fund (RDF-11-03-08) and National Science Fund (No.71373283 and No. 71503261). The authors would like to thank Uthpala Ekanayake and Yilin Jolene Tan for their able research assistance and Shafeena Taylor-Cross for proof reading. Appreciations also to the constructive comments and feedback from the participants of 2nd International Seminar on Asia and Pacific Economies held in Xi'an Jiaotong-Liverpool University (XJTLU), Suzhou, China, 9th-10th May 2014. Last but not the least, the authors would like to thank Prof. Belton M. Fleisher, Prof. Cheryl Long and the anonymous referees of China Economic Review for their valuable and insightful comments, which improved the quality of the paper.

References

Amiti, M. (1998). Inter-industry trade in manufactures: Does country size matter? *Journal of International Economics*, *44*, 231–255.
Amiti, M., & Freund, C. (2010). The anatomy of China's export growth. In R. C. Feenstra, & S. -J. Wei (Eds.), *China's growing role in world trade*. University of Chicago Press.
Ando, M., & Kimura, F. (2009). Fragmentation in East Asia: Further evidence. *ERIA Discussion Paper Series. 20*.
Aturupane, C., Djankov, S., & Hoekman, B. M. (1997a). Determinants of intra-industry trade between East and West Europe. *Policy research working paper*. Washington, DC: World Bank, Development Research Group.
Athukorala, P. C. (2003). *Product fragmentation and trade patterns in East Asia.* working paper no. 2003/21 Research School of Pacific and Asian Studies: Australian National University.
Athukorala, P. C. (2009). *Production networks and trade patterns: East Asia in a global context.* ANU College of Asia and the Pacific (Working Paper No. 2009/15).
Athukorala, P. C., & Yamashita, N. (2006). Production fragmentation and trade integration: East Asia in a global context. *The North American Journal of Economics and Finance*, *17*, 233–256.
Aturupane, C., Djankov, S., & Hoekman, B. (1997b). Determinants of intra-industry trade between East and West Europe. *World bank policy research working paper 1850*.
Baldwin, R., & Okubo, T. (2012). Networked FDI: Sales and sourcing patterns of Japanese foreign affiliates. *NBER working paper no. 18083*.
Becuwe, S., & Mathieu, C. (1992). The determinants of intra-industry trade: The case of the automobile industry. *Weltwirtschaftliches Archiv*, *128*(1), 34–51 (http://doi.org/10.2307/40440082).
Chirathivat, S. (2002). ASEAN-China free trade area: Background, implications and future development. *Journal of Asian Economics*, *13*(5), 671–686.
Dean, J. M., Lovely, M. E., & Mora, J. (2009). Decomposing China–Japan–U.S. trade: Vertical specialization, ownership, and organizational form. *Journal of Asian Economics*, *20*, 596–610 (http://doi.org/10.1016/j.asieco.2009.08.003).
Falvey, R. (1981). Commercial policy and intra-industry trade. *Journal of International Economics*, *11*(4), 495–511.
Fardoust, S. F., Lin, J. Y., & Luo, X. (2012). Demystifying China's fiscal stimulus. *Policy research working paper 6221*. The World Bank.
Fukao, K., Ishido, H., & Ito, K. (2003). Vertical intra-industry trade and foreign direct investment in East Asia. *Journal of the Japanese and International Economies*, *17*(4), 468–506 (http://doi.org/http://dx.doi.org/10.1016/j.jjie.2003.09.004).

Fung, K. C. (1996). Accounting for Chinese trade: Some national and regional considerations. *National Bureau of economic research working paper series* No. 5595. Retrieved from:. (http://www.nber.org/papers/w5595).
Gaulier, G., Lemoine, F., & Ünal-Kesenci, D. (2007). China's integration in East Asia: Production sharing, FDI & high-tech trade. *Economic Change and Restructuring*, *40*(1), 27–63.
Grubel, H. G., & Lloyd, P. J. (1971). The empirical measurement of intra-industry trade. *Economic Record*, *47*(4), 494–517.
Hu, X., & Ma, Y. (1999). International intra-industry trade of China. *Weltwirtschaftliches Archiv*, *135*(1), 82–101.
Ianchovichina, E., & Martin, W. (2001). Trade liberalization in China's accession to WTO. *Journal of Economic Integration*, *16*(4), 421–445 (http://doi.org/10.2307/23000767).
JAMA (2014). *Overview of Japanese automobile manufactures' operation in China.* via http://www.jama-english.jp/publications/Operations_in_China.pdf JAMA publications.
Khalifah, N. A. (1996). AFTA and intra-industry trade. *ASEAN Economic Bulletin*, *12*(3), 351–368 (http://doi.org/10.2307/25770607).
Kimura, F., & Ando, M. (2005). Two-dimensional fragmentation in East Asia: Conceptual framework and empirics. *International Review of Economics & Finance*, *14*(3), 317–348 (http://doi.org/http://dx.doi.org/10.1016/j.iref.2004.12.005).
Kimura, F., Hayakawa, K., & Ji, Z. (2008). Does international fragmentation occur in sectors other than machinery? *Asian Economic Journal*, *22*(4), 343–358 (http://doi.org/10.1111/j.1467-8381.2008.00281.x).
Kimura, F., & Obashi, A. (2010). International production networks in machinery industries: Structure and its evolution. *ERIA Discussion Paper Series 2010–09*.
Kojima, K. (1973). A macroeconomic approach to foreign direct investment. *Hitotsubashi Journal of Economics*, *14*(1), 1–21.
Lall, S. (2000). The technological structure and performance of developing country manufactured exports, 1985-98. *Oxford Development Studies*, *28*(3), 337–369.
Lardy, N. R. (1995). The role of foreign trade and investment in China's economic transformation. *The China Quarterly*, *144*, 1065–1082 (http://doi.org/10.2307/655292).
Lemoine, F., & Ünal-Kesenci, D. (2004). Assembly trade and technology transfer: The case of China. *World Development*, *32*(5), 829–850 (http://doi.org/http://dx.doi.org/10.1016/j.worlddev.2004.01.001).
Lin, J. Y., Cai, F., & Li, Z. (2003). *The China miracle: Development strategy and economic reform.* Chinese University Press.
Manova, K., & Yu, Z. (2012). Firms and credit constraints along the global value chain: Processing trade in China. *National Bureau of economic research working paper series* No. 18561. Retrieved from:. (http://www.nber.org/papers/w18561).
Markusen, J. R., & Venables, A. J. (1999). Foreign direct investment as a catalyst for industrial development. *European Economic Review*, *43*, 335–356.
Obashi, A. (2010). Stability of production networks in East Asia: Duration and survival of trade. *Japan and the World Economy*, *22*, 21–30.
Prime, P. B., & Park, J. H. (1997). China's foreign trade and investment strategies: Implications for the business environment. *Business Economics*, *32*(4), 29–35 (http://doi.org/10.2307/23487545).
Qian, Y. (2003). How reform worked in China. In D. Rodrik (Ed.), *In: Search of Prosperity: Analytic Narratives on Economic Growth*. Princeton University Press.
Sturgeon, T. J., & Memedovic, O. (2011). Mapping global value chains: Intermediate goods trade and structural change in the world economy. *UNIDO working paper 05/2011*.
Thorbecke, W., & Salike, N. (2011). Understanding foreign direct Investment in East Asia. *ADBI Working Paper Series, 290*.
Thorbecke, W., & Salike, N. (2013). Foreign direct Investment in East Asia. RIETI Policy Discussion Paper Series 13-P-003. Retrieved from: (http://www.rieti.go.jp/jp/publications/pdp/13p003.pdf.)
World Bank (1994). *China: Foreign trade reform.* (World Bank).
Xing, Y. (2007). Foreign direct investment and China's bilateral intra-industry trade with Japan and the US. *Journal of Asian Economics*, *18*(4), 685–700 (http://doi.org/10.1016/j.asieco.2007.03.011).
Xu, C. (2011). The fundamental institutions of China's reforms and development. *Journal of Economic Literature*, *49*(4), 1076–1151.
Yang, S., & Martinez-Zarzoso, I. (2014). A panel data analysis of trade creation and trade diversion effects: The case of ASEAN–China free trade area. *China Economic Review*, *29*, 138–151.