China's Displacement Effects on Asian Countries' Exports: A Closer Look with Disaggregate data

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ABSTRACT

This paper applies gravity model to disaggregate trade data to explore the differential impact of China's exports displacement on product categories, classified by technology intensity and stages of production, over the period 1992-2006. We examine variations over time, including post China's WTO accession, across markets and Asian exporters. Our results show that displacement due to China's export surge occurs more in medium- and high-tech sectors rather than low technology manufactures, initially perceived as the most vulnerable. Crowding-out is more noticeable in developed country markets and second half of the period. We find high income countries to be more adversely affected, but this effect disappears post 2001. From a stage of production perspective, we find displacement to occur in semi-finished goods and little discernable effect on capital and consumption goods. In a separate section, we identify product categories where China offers export growth opportunities to its neighbours. These occur mainly in parts and components, automotive products and high-tech sectors.

1. Introduction

China's rising prominence in the world economy has been one of the most striking economic developments in recent decades. Its expanding role in the global trading system has been particularly noteworthy, with its overall share in world trade rising from 1 % in 1979 to 8 % in 2006. China has emerged as a major player, ranking as the world's second largest exporter of goods in 2006, after Germany but ahead of USA. China's trade has not only been startling but has also undergone significant structural changes. From an exporter of mineral fuels in the 1980s, China quickly moved into labour-intensive exports in the early 1990s and made substantial gains in more sophisticated products by the end of the decade. It is equally making rapid progress in building capabilities in production of parts and components (Shafaeddin, 2004). The overall sophistication of China's exports bundle is said to resemble that of a country with per capita income three times higher (Rodrik, 2006). China's openness to foreign investment and the creation of special economic zones with good infrastructure along with preferential treatments given to foreign producers have played a pivotal role in its export success and upgrading (ibid).

China's rapid emergence and the proliferation of exports across a wide spectrum of products have sparked extensive debate among policy makers on the implications on countries' trade across the world in general, and neighbouring Asia in particular. One stream of thought reflects fears of head to head competition in third markets given the significant overlap of endowments and export structures between China and other Asian exporters at similar stages of development. Countries further up the development ladder also expressed concerns of hollowing out of their industries. Viewed from the 'flying geese' paradigm at the other extreme, China and its neighbours' exports are perceived to go hand-in hand as less developed Asian countries move into industries given up by China and the latter turn to industries relinquished by more advanced Asian countries (Ahearne et al, 2006). Either way, China could disturb other Asian countries' exports, the extent of which would rest on the ability of these countries to adjust their export structures.

Although being a potential threat to its neighbours, China offers vast trade and growth opportunities. A high proportion of China's exports to the world consist of products assembled from imported components, originating mainly from the region. The growing vertical integration in Asia has allowed countries to specialise according to their comparative advantage, with more advanced economies producing and exporting parts and components and lower income countries engaging in more labour-intensive assembly activities. China's rise can, therefore, also be seen as stimulus to intra-industry trade in Asia, boosting other Asian countries' exports to itself and offsetting any displacement of exports to third markets.

In our earlier work (Greenaway et.al, 2006), we explored whether and how growth of China's exports is affecting exports of other Asian countries in third markets over the period 1990-2003. Applying aggregate trade data to an augmented gravity model, we find that China (and Hong Kong) displaces neighbours' exports overall and more so in the second half of the period starting 1997. Such displacement tends to occur in developed markets rather than developing ones. Among the 13 Asian countries considered, the high income economies, namely Singapore, Korea and Japan, are most affected by China's exports surge but no evidence of crowding out emerges for low and middle income Asian countries. Displacement effects are stronger with the inclusion of Hong Kong. Moreover, using a more basic gravity specification, we explore how China's growth impacts on its imports from the 13 Asian countries, overall and individually. We find that higher growth in China leads to more imports from all the Asian countries considered, with the advanced economies of the region being major suppliers.

While the analysis using aggregate trade flows give a broad picture of any displacement effects that may exist, it nonetheless conceal other important aspects as various categories of products are lumped together. Where we do find a displacement effect, it would be interesting to explore the product categories where these are prevalent. Despite its size and presence across a wide range of exports, China is unlikely to be an efficient producer and exporter of all commodity categories. Hence we would expect displacement effects to be more observable in some sectors than others. Where we do not

find any effect, it may be possible that crowding out is taking place in specific product categories but may be too small to show up in the aggregate data. Alternatively, as suggested by the 'flying geese' paradigm, exports originating from China and other countries in the region could be growing in harmony in some sectors as less developed Asian countries move into industries given up by China and the latter turn to industries relinquished by more advanced Asian countries (Ahearne et al, 2006). Again such effects may be obscured when aggregating trade data.

This paper seeks to probe deeper into the displacement effects analysis using more disaggregate trade data. We specifically apply the gravity model used in Greenaway et al (2006) to explore the differential impact of China's exports displacement on various product categories, classified by technology intensity and stages of production. Taking advantage of the availability of more recent data, we extend the time coverage of the present analysis to 2006[1]. This allows us to particularly single out exports displacement effects following China's accession to the WTO, a move that generated significant fears in many countries. We also examine any variations over time, across developed and developing country markets and Asian exporters for each product category. In a separate section, we use a more basic gravity model to explore offsetting effects emanating from China's growth on its own imports from Asian countries in each product category for the whole period.

The remainder of the paper is organized as follows: Section 2 sets the scene by briefly describing the changing profile of China's trade. Section 3 gives an overview of previous research on China's competitive threat at the disaggregate level. The hypotheses we test and the model we employ are explained in Section 4. Data sources and outline of classifications used are discussed in Section 5. Section 6 looks into estimation issues and discussion of results. The penultimate section identifies sectors where China's growth provides opportunities and the final section concludes.

[1] We are, however, constrained to start the analysis from 1992, the earliest when SITC Revision 3 data for China is available.

2. The Changing Profile of China's Trade

The composition of China's trade has undergone considerable changes as China becomes more integrated into the global trading system. From an exporter of mineral fuels in the 1980s, China quickly moved into labour-intensive exports in the early 1990s and made substantial gains in more sophisticated products by the end of the decade. A breakdown of its exports by sector at SITC 1-digit level (Table 1) shows that manufactured goods (SITC 6), machinery and transport equipment (SITC 7) and miscellaneous manufactures (SITC 8) sectors accounted for the highest share since the beginning of the previous decade. The importance of miscellaneous manufactures has, however, consistently declined over time while the share of manufactured goods remained more or less stable. By contrast, the share of machinery and transport equipment sector surged considerably, moving from 15.5% in 1992 to 47.1% in 2006. Other sectors such as food and live animals, crude materials and mineral fuels, where China showed some export interests at the beginning are gradually losing weight in its export basket.

Table 1. China's Exports and Imports by Sector: 1992-2006
(% in total exports)

	Exports				**Imports**			
	1992	*1996*	*2000*	*2006*	*1992*	*1996*	*2000*	*2006*
0 Food and live animals	9.8	6.8	4.9	2.7	3.9	4.1	2.1	1.3
1 Beverages and tobacco	0.8	0.9	0.3	0.1	0.3	0.4	0.2	0.1
2 Crude materials	3.7	2.7	1.8	0.8	7.2	7.7	8.9	10.5
3 Mineral fuels	5.5	3.9	3.2	1.8	4.4	5.0	9.2	11.2
4 Animal and veg. oils and fats	0.2	0.2	0.0	0.0	0.7	1.2	0.4	0.5
5 Chemicals	5.1	5.9	4.9	4.6	13.9	13.0	13.4	11.0
6 Manufactured goods	19.0	18.9	17.1	18.0	23.9	22.6	18.6	11.0
7 Machinery and transport eq.	15.5	23.4	33.1	47.1	38.2	39.4	40.8	45.1
8 Miscellaneous manufactures	39.9	37.2	34.5	24.6	6.9	6.0	5.6	9.0

Source: UN COMTRADE, own calculations

Some sectors accounting for the highest share in China's export basket also rank among the most important in its imports. Machinery and transport equipment which accounted for about 38% of total imports in 1992 now represent slightly less than 50%. The importance of manufactured goods, which made up about 24% of exports in the early 1990s, on the other hand, has gradually fallen over the years. While China's import

demand for chemicals has remained fairly stable over time, it shows a growing appetite for crude materials (SITC 2) and mineral fuels (SITC3). Chemicals make up a fairly high proportion of imports but only a small part of exports, indicating that most imported chemicals are used in the production of goods.

The rising sophistication of China's trade can also be viewed in terms of technology content (Table 2). While the shares of primary products, resource based manufacturing as well as low-tech manufacturing all declined from their 1992 level, medium tech manufacturing exports command a continuously increasing share. Low tech manufactures, which accounted for the bulk of Chinese exports in the 1990s (about 50%), are now at par with high-tech manufacturing exports, contributing only a third to total exports. In particular, the fourfold rise of high-tech manufacturing share is quite remarkable. China appears to have gained some competitive advantage in exports of medium-and high-tech goods, reflecting some degree of technological upgrading.

Table 2. Technology Content of China's Exports and Imports, 1992, 1996, 2000, 2006
(Share of each category in total value, %)

	Exports				**Imports**			
	1992	***1996***	***2000***	***2006***	***1992***	***1996***	***2000***	***2006***
Primary products	14.9	9.4	7.1	4.2	10.9	12.1	15.3	15.9
Resource-based Manufacturing	10.4	11.3	8.9	8.0	12.2	12.7	13.9	14.4
Low-Tech Manufacturing	50.3	46.1	41.7	32.3	17.5	16.8	12.3	7.6
Medium-Tech Manufacturing	15.1	17.7	19.3	21.4	42.3	40.2	29.9	25.2
High-Tech Manufacturing	8.9	15.1	22.5	33.9	16.4	17.8	28.3	36.7

Source: Source: UN COMTRADE , own calculations using Lall (2000) technology classification

Closely related to this high-tech export surge is a simultaneous rise in share of high-tech imports, which in 2006 more than doubled from its 1992 level. Import demand for primary products and resource-based manufacturing has also been on the rise. Low- and medium-tech manufacturing imports have, by contrast, registered sizeable drop in their shares.

From a stage of production[2] perspective (Table 3), consumption goods accounted for over half of China's exports in the early 1990s, but its share gradually dropped to less than one-third in 2006. On the other hand, the share of exports of capital goods more than doubled from its 1992 level, representing about 20 % of exports in 2006. The gradual shift towards capital goods again suggests that China is upgrading its export capacities towards more technology-intensive products (Lemoine and Ünal-Kesenci, 2002). Semi-finished goods exports remained the second most important export sector over the years, despite a slight fall in its share. Parts and components exports, by contrast, have been rapidly gaining importance, with a fourfold increase registered by 2006.

Table 3. China's Imports and Exports by Stages of Production, 1992-2006
(Share of each category in total value, %)

	Exports				**Imports**			
	1992	***1996***	***2000***	***2006***	***1992***	***1996***	***2000***	***2006***
Primary Goods	4.7	3.8	2.5	1.2	3.3	3.3	4.7	4.4
Semi Finished goods	28.6	27.7	24.8	25.9	51.7	48.0	43.8	32.0
Parts & Components	5.2	8.3	13.9	19.8	15.7	17.4	28.5	38.5
Capital goods	8.4	11.6	14.8	22.2	24.7	27.2	18.6	21.2
Consumption goods	52.3	48.3	44.0	30.8	4.4	4.1	4.4	3.9

Source: Source: UN COMTRADE , own calculations

On the import side, semi-finished goods were the most important category in 1992, making up half of the total value. Although this category remained by far the most important import segment until 2000, its share slowly decreased and was surpassed by parts and components imports which claimed an overwhelming proportion of 38.5 % by 2006. Consumption goods have very little weight in China's import basket, given its comparative advantage in their production. Capital goods imports remained fairly steady, accounting for about one-fifth of total imports.

Together with the rapidly changing composition, there has been a noticeable shift in the direction of China's trade over time. China has made major inroads into developed countries' markets with exports share increasing from 36% in 1990 to 55 % in 2005[3]

[2] We follow the classification used by Gaulier et al. (2005), which is based on the United Nations' Broad Economic Categories (BEC) (Details follow in Section 5)
[3] UNCTAD Handbook of statistics, online

(Table 4). China's market penetration has been more marked in the American and European markets. The share of exports to developing economies, by contrast, fell to 42 % from the 1990 level of 60 %. Compared to Eastern and South-eastern Asia, developing countries in America and Africa account for a marginal market share. A major proportion of China's export, although lower than the 1992 level, has in fact been directed to countries in Asia and, in particular to the 1st-tier newly industrialised countries, comprising Hong Kong, Korea, Singapore and Taiwan.

While China's exports to the developed world increased remarkably, imports sourced from these countries dropped to 39 % in 2005 from 47 % in 1992. Imports from America decreased significantly, that from Europe fell slightly while China imported only marginally less from developed Asia. Imports from developing countries on the other hand, edged up, with a noticeable participation of African countries. Although imports from East and South-East Asia were lower in 2005, they accounted for more than a third of China's total imports, with a significant share originating from the 1st tier NIEs, mainly Japan and increasingly from 2nd tier NIEs.

Table 4. China's Exports and Imports by Main Regions: 1992, 2005 (%)

	Exports		**Imports**	
	1992	*2005*	*1992*	*2005*
Developed economies	35.4	55.2	46.8	38.5
America	10.8	23.0	13.2	8.6
Europe	10.0	19.3	14.5	11.9
Asia	13.7	11.3	16.8	15.4
Developing economies [Ψ]	60.4	42.0	46.0	49.9
Africa	1.5	2.4	0.6	3.2
America	1.2	3.0	2.3	4.0
Eastern and South-Eastern Asia [Ψ]	54.3	30.8	41.3	36.4
Newly industrialized economies: 1st tier	49.8	25.3	37.0	27.3
Newly industrialized economies: 2nd tier	2.6	4.1	3.6	8.4

Source: UNCTAD Handbook of Statistics

Note: [Ψ] excluding China. Country groupings, as per UNCTAD Handbook, are as follows: Developed America: Bermuda, Canada, Greenland, St. Pierre & Miquelon and USA(incl. Puerto Rico); Developed Europe: EU25, Andorra, Faeroe Is., Gibraltar, Holy See, Malta and San Marino; Developed Asia: Japan and Israel; NIE 1st-tier:Hong Kong, Korea, Taiwan, Singapore; NIE 2nd-tier: Indonesia, Malaysia, Philippines, Thailand.

The simultaneous imports and exports activities with other Asian partners is symbolical of growing intra industry trade and vertical specialisation: firms in high-wage

economies specialise in production of high value components and relocate their labour intensive assembly operations to China with a view to exploit differences in comparative advantage. The re-organisation of production processes has fostered strong production networks and triangular trade in the region, with China playing a key role. Intermediate goods flow into China for further assembly and processing while final goods flow to regions outside Asia through China, making it a pivotal export platform to the rest of the world (IMF, 2007). Processing activities, the bulk of which is undertaken by foreign affiliates, have in fact, been a major driving force in China's impressive trade performance. Exports after processing have increased progressively since 1992, accounting for more than half of total exports post-1995 (Lemoine and Ünal-Kesenci, 2002; Gaulier et al, 2006).

3. Previous Studies

China's competitive threat at the disaggregated level has been the focal point of a growing number of studies. Various methodologies such as analysis of trends in the data, computation of Revealed Comparative Advantage (RCA) measures, market shares approach and to a lesser extent econometric analysis, have been applied to diverse classifications such as by sector, technology, stages of production and factor intensity.

Lall and Albaladejo, (2004) compare relative market shares of China and its neighbours in 1990 and 2000 and find that China has the strongest presence in the low-technology category, which includes products such as textiles, clothing, footwear, toys and sports goods in the global market in both years. But it is equally relatively strong and gains substantial market share in medium-tech category, mainly process industries and engineering. Its share in high-tech categories is low but rising over time and by 2000, it was the fourth largest high-tech exporter in the region. NIEs are found to suffer most from Chinese competition in low-tech categories.

Applying a variant of the conventional constant market share approach to 2-digit SITC data, Roland-Holst and Weiss (2004) find the main ASEAN economies (Singapore, Malaysia, Thailand, Indonesia and the Philippines) lost market share to China during

1995-2000 in US and Japanese markets mostly in sectors such as Office and Automatic data processing machines (SITC 75), Telecommunications (SITC 76), Electrical machinery (SITC 77), Furniture (SITC 82), Miscellaneous (SITC 89). Applying Lall (2000) classification, Roland-Holst and Weiss (2004) find evidence of increased competition between China and ASEAN at both labour-intensive and high technology ends of the product scale in US and Japan. Loss of competitiveness in electronics and electricals, engineering, resource-based manufactures and textile and garments are observed.

Similarly, evidence from industry level data in Ahearne et al (2006) shows that China gained market share in US markets in almost every industry while share of other Asian economies declined. They find that ASEAN-4 also experienced gains in market shares in many industries at expense of Asian NIEs, implying that both China and ASEAN-4 move into product space vacated by NIEs, an indication of 'flying geese' hypothesis. Likewise, the dynamic share shift analysis applied by the Monetary Authority of Singapore (MAS, 2005) reveals that NIE-3 economies experience the largest negative net shifts in consumer goods due to higher wages. China also emerged as a competitor in low and mid-range capital and intermediate goods, mainly electrical and electronics related products such as automatic data processing machines, mostly personal computers, peripherals and servers; office machinery and parts; telecom equipment and machinery; electrical machinery and apparatus, especially since 2002. Such crowding out is experienced by lower-income economies such as Indonesia as well as middle income Asian economies

Departing from earlier studies, Eichengreen et al (2004) use stages of production classification to group products into capital, intermediate and consumer and estimate a gravity model for the period 1990-2002. Their findings suggest that displacement effect occurs only in consumer goods, which are produced by less advanced Asian countries and not in capital and intermediate products of more advanced Asian countries. In a follow-up study, Eichengreen and Tong (2005) disaggregate consumer goods into textiles and apparel and other products, intermediates into energy, non-energy raw materials and other products, and capital goods into components and equipment. They reiterate their

previous results that China competes with Asian countries in consumer goods, particularly textiles and apparel. In contrast, it complements Asian exports of intermediates. China's own exports stimulate other Asian countries' exports of components (mainly electronic components and auto parts), while having no significant impact on their exports of equipment.

Finally, Shafaeddin (2004) classifies main export products according to factor intensity (labour intensive, capital and technology intensive and natural resource base and compares 'revealed *competitive* advantage' (R) measures in 1992-93 and 1997-98. He finds that countries relying on the production and exports of labour intensive products and assembly operations are more subject to competitive effects. By the end of the previous decade, China was already showing signs of rapid gain in market share in capital/technology intensive products such as office machinery, switch gears, transistors and data processing equipment

Most studies apply market share analysis or its variant in assessing China's changing exports patterns on other countries' exports. While Roland-Holst and Weiss (2004) use regression analysis, only Eichengreen et al (2004, 2005) apply gravity modelling in their work. Gravity model is well-known in trade literature not only for its high empirical success in explaining impacts on bilateral flows in various contexts such as currency unions, regional trade agreements, national borders and accession to WTO, but also for its strong theoretical foundations. As proved by various studies, it can be derived from a number of standard theories of trade eg Anderson (1979), Bergstrand (1985), Deardoff (1995), Eaton and Kortum (2002), Evenett and Keller (2002)

4. The Gravity Model

Our present study, despite being along same line as Eichengreen et al (2004), demarcates itself in a number of ways. First, we consider a longer time period which enables us to better gauge displacement impacts, with particular focus on the period

following China's WTO accession[4]. As a WTO member, China agrees to further open and liberalise its trade and investment regimes by reducing tariffs, abolishing quotas and export subsidies on goods trade, providing non-discriminatory treatment to all WTO members with respect to right to trade and strengthening protection of intellectual property rights. As China opens up its markets to trade and investment, it equally benefits from increased overseas market access. Second, we use technology classification to broadly capture technological upgrading of Chinese exports and investigate any associated displacement. As Eichengreen et al, we look at effects on goods categories at different stages of production, but in addition to consumption and capital goods, we consider semi-finished goods and parts & components, an increasing share in Chinese trade.

We use the following gravity specification as in Greenaway et al (2006) for our displacement analysis:

$$\ln M_{ijt} = a_0 + a_1 \ln ChX_{it} + a_2 \ln GDPM_{it} + a_3 \ln CAPM_{it} + a_4 \ln GDPX_{jt} + a_5 \ln CAPX_{jt} + a_6 \ln Dist_{ij} + a_7 \ln Areap_{ij} + a_8 Landl_{ij} + a_9 Island_{ij} + a_{10} Border_{ij} + a_{11} ComLang_{ij} + a_{12} ComCol_{ij} + a_{13} Colony_{ij} + a_{14} ImpCor_{it} + \varepsilon_t \quad (4)$$

M_{ijt}	Real imports of country i from country j;
CHX_{it}	China's real exports to country i;
$GDPM_{it}$	Real GDP of importing country;
$CAPM_{jt}$	Real GDP per capita of importing country;
$GDPX_{jt}$	Real GDP of exporting country;
$CAPX_{jt}$	Real GDP per capita of exporting country;
$Dist_{ij}$	Distance between i and j;
$Areap_{ij}$	Product of areas of country i and j in km²;
$Landl_{ij}$	Number of landlocked countries in country pair, taking values of zero, one or two;
$Island_{ij}$	Number of island nations in country-pair, taking value of zero, one or two;
$Border_{ij}$	Dummy which is unity if i and j share a common land border, and zero otherwise;
$ComLang_{ij}$	Dummy variable taking a value of one if i and j share common language, and zero otherwise;
$ComCol_{ij}$	Dummy variable which is unity if i and j were ever colonies post 1945 with same colonizer, and zero otherwise;
$Colony_{ij}$	Dummy which is unity if i ever colonized j and vice-versa, and zero otherwise;

[4] China became a member of the WTO on 11th December 2001, after 15 years of negotiations

$\boldsymbol{Iicor_{it}}$ Importer's corruption index
ε_t Other omitted effects on imports

Traditional Chinese exports such as apparel, clothing and footwear, most of which are consumer goods, remain quantitatively significant in China's exports basket, albeit a sluggish growth. These are the sectors where China has a long standing presence, for example, as Ravenhill (2006) documents, China was already a significant source of imports in these sectors than other Asian countries in the Japanese and US markets by 1995. These are, therefore, the sectors where other exporter countries are expected to be most adversely affected. China's changing export profile, as portrayed by the data analysis in earlier sections, however implies a move towards more sophisticated high-tech exports such as office machines, telecommunications and sound recoding equipment, electrical machinery and parts, whose share grew more rapidly than the traditional sectors. Although comprising a high proportion of labour-intensive assembly activities, the high-tech sector requires advanced technologies and technical skills. Would displacement effects be observed in categories where China has long established market niches and expertise or in a rather new and dynamic high-tech sector? Or would it be in the capital and intermediate products, often classed as medium-tech products whose share in total exports has edged up slightly over time? In the aggregate analysis, we find an overall export displacement effect. Which product category is more vulnerable to Chinese competition is another empirical issue which we explore further.

Our aggregate analysis in Greenaway et al (2006) also indicated that Asian countries' exports are crowded out mainly in industrial markets. This is not surprising given that China's exports are increasingly being directed to developed countries (as shown in Table 4, Section 2 above). Developing countries, nonetheless, remain important destinations altogether representing about 42 % of China's export destination in 2005. We therefore investigate in which product categories competitive pressure arises in developed markets and also unravel any crowding out that may occur in developing country markets but which are hidden in the aggregate picture.

We find evidence of China's displacement solely of high income Asian countries' exports in our aggregate analysis. This may be a result of relocation of production bases to China. One would expect such hollowing out to occur in labour-intensive, low value added industries, particularly in consumer goods, given that more advanced economies are disadvantaged due to their higher wages. We test this hypothesis across various product categories for the whole period. As before, we classify Asian exporting countries into three income groups[5]: High Income (Korea, Singapore, Japan), Middle Income (Indonesia, Malaysia, Philippines, Sri Lanka, Thailand) and Low Income (Bangladesh, Cambodia, India, Pakistan, Vietnam).

Not only is it interesting to examine China's impact across various cross-sections, temporal effects are also revealing. In line with the previous chapter's analysis, we look at the impacts in pre- and post 1997 periods. Does the displacement impact still hold in the second half, and if so, in which product categories?

In addition we also look at the situation post China's WTO accession. One implication of China's entry into the WTO is that it automatically gained most favoured nation[6] (MFN) status in virtually all markets (Martin et al 2004). This not only frees China from review procedures but also instilled confidence in investors of the continuing access to foreign markets (ibid). Increased and sustained access to third markets inevitably mean heightened competitive pressures with other countries' exports. One would expect countries whose comparative advantage and export structure overlap with China to be at greater stake. Many countries, particularly in south east Asia compete with China in world markets for manufactures, especially labour intensive products and increasingly higher-end technology products (Ianchovichina and Wamsley, 2005). As China lowers tariffs further and eliminate other non-tariff barriers, cost of production and hence export prices of its exportable would also fall, making it even more competitive in the world markets. Moreover, it is argued that due to China's vast supply of cheap labour, including underemployed agricultural workers, China is likely to maintain its cost

[5] Based on World Bank Classification as in footnote 6.
[6] Under this principle, the best market access given to one member is extended to all other members (Martin 2004)

competitiveness for quite a long time. It is already has a much lower unit labour cost compared to may developing countries. Finally, the abolition of quotas under the Agreement of Textile and Clothing in 2005 is likely to provide significant opportunities for China to expand its exports of textile and clothing in markets that were previously restricted. These effects may however be tempered if trading partners choose to enforce the special textile and clothing safeguards under the Product-specific Transitional Safeguard Provisions, a feature of China's accession agreement. This effect may not be fully apparent in our analysis given the time period under consideration.

The emergence of China as the 'world factory' has dramatically changed the patterns and composition of trade within Asia. Most of China's exports to the world consist of products assembled from imported components. Processing trade (where goods are imported, assembled or transformed and re-exported with imported intermediate imports and finished goods barred from entering China's domestic market) have been a major driving force in China's impressive trade performance. Exports after processing made up 46% of China's exports in 1992 and have increased progressively since, accounting for more than half of total exports post-1995 (Lemoine and Ünal-Kesenci, 2002). Most of China's imports of parts and components are sourced from other Asian countries. These are produced in relatively high wage countries eg Singapore, Korea and Japan, who capitalize on China's relatively low wage costs for product assembly. China has also been increasingly importing electronic products and machinery and equipment from other Asian countries. Intra-industry trade has gained a significant boost since China and other Asian countries increasingly source from each other, giving rise to strong production networks within the region. The rise of China is, therefore, a source of dynamism for regional trade growth. Ignoring this channel of effect would amount to exaggerating China's adverse impacts. Does our gravity model provide support for such offsetting effects? In which product category are offsetting effects more obvious? We investigate this issue using a more basic formulation of the gravity model in a separate section.

5. Data Sources and Classification

We use Standard International Trade Classification, Revision 3 data for imports and Chinese exports, which we extracted from United Nations' COMTRADE database using WITS software. Since Chinese trade data based on SITC Rev 3 is available only from 1992, we are constrained to start the analysis therefrom. Our sample includes more than 150 importing countries and 13 Asian countries with gaps in years for country-pairs when trade in a particular commodity did not occur.

Merchandise imports and exports series, recorded in thousand US dollars, are deflated by the US CPI for all urban consumers (1982–1984=100) obtained from http://www.bls.gov/home.htm. Real GDP and GDP per capita (in constant 2000 US dollars) are extracted from the World Development Indicators online. All country specific variables are from Rose (2002). Corruption indices are from the International Country Risk Guide-ICRG and range between 0 (high corruption) and 6 (low corruption). We note, at this point, that we have interpolated data for years 2004 and 2005 by taking the average of corruption indices for years 2003 and 2006, the most recent years for which we hold data.

Classification

A rigorous export competition analysis demands that one considers individual export items of China and its competitors as in so doing one would avoid putting together different/differentiated products or those with varying levels of technological complexity in same product category. This approach is however highly data-intensive and more suited for analysis involving a handful of countries. Given the large number of countries and wide time coverage in our sample, we consider product categories at the general level instead. We adopt the most common classifications used in the literature, namely categorisation by technology and skill intensity involved in the production of commodities as well as by stages.

Technology Classification

We adopt Lall (2000)[7] classification which is based on 3-digit SITC, Revision 2[8] data, to categorise products into primary (PP), and sub groups of resource-based, low technology , medium technology and high technology (See details of classification in Table A1 in Appendix). Although some goods in the resource-based category are simple and labour intensive such as simple food or leather processing (RB1), there are a number of other goods that require capital- scale- and skill-intensive technologies (RB2) eg, petroleum refining. Resource-based manufactures therefore comprise two main groups.

Low technology (LT) products have 'stable and well-diffused' technologies, which are embodied in capital equipment, with the low-end range needing simple skills. Price competitiveness and labour costs are crucial for many products which are generally undifferentiated. The low-technology category also includes some high-end products where brand names, skills, design and technological sophistication are important but are not high enough to be grouped in higher technology groups. This category has been broadly segmented into Textile and fashion clusters (LT1) and other (LT2).

Most capital and intermediate products fall in the Medium-technology (MT) category, which epitomizes the bulk of skill-and scale-intensive technologies and industrial activities in more mature economies. Technologies involved are complex, research and development (R&D) levels fairly high and skills needs and learning periods more intensive. Automotive (MT1), process (MT2) and engineering (MT3) industries are the three components within this group.

High-technology (HT) products are associated with advanced and rapidly evolving technologies, high R&D investments, specialized technical skills and product

[7] In addition to the author's judgement, Lall (2000) classification combines and extends earlier work of Pavitt (1984) and OECD (1994) to take on board product groups relevant to developing countries. Pavitt (1984) essentially distinguishes between resource-based, labour-intensive, scale intensive, differentiated and science-based manufactures while OECD (1994) presents a more detailed classification based on technological activity within each category.

[8] In his classification, Lall (2000) uses SITC Revision 2 data at 3-digit level to group products. We assign a technology category to any additional SITC that appear in the third revision using SITC Rev2-Rev3 concordance table. As for stages of production categorisation, we first concord 5-digit SITC to broad economic categories (BEC), which are subsequently grouped according to as per Gaulier et al (2005)

design. Some products such as electronics, however, have high labour-intensive final assembly, making them ideal to be located in low-wage countries and are gaining increasing importance in production networks activities generated by MNCs located in such economies. The HT group consist of Electronics and Electricals (HT1) and other, mainly pharmaceuticals (HT2).

Stages of Production Classification

We also capture the composition of trade by stage of production using the United Nations' Broad Economic Categories (BEC) which reclassifies SITC, Rev 3 headings according to main end-use. We follow previous CEPII studies (eg Gaulier et. al., 2005) to distinguish between five categories of products, namely (1) Primary products, (2) Semi-Finished goods, (3) Parts and Components, (4) Capital goods, (5) Consumption goods (see Appendix Table A2 for details)

6. Estimation and Results

The model is estimated by instrumental variable technique as it is possible that our main variable of interest, Chinese exports to third markets (CHX), is influenced by the same factors (encapsulated in error term) that affect third markets' imports from Asian countries. Correlation between a regressor and the error term, if not properly dealt with, result in biased coefficient estimates. We formally test for the endogeneity of Chinese exports using the endogeneity test for regressor. The highly significant test statistic confirms that the variable is endogenous and instrumental variable is the proper estimation technique. As before, we instrument Chinese exports by Chinese GDP and distance between China and importing countries.

A suitable instrument must satisfy two conditions: it must be *relevant*, i.e. correlated with the endogenous regressor and *valid* i.e. uncorrelated with the error term. We check for the relevance of our instruments through the underidentification test statistic. A rejection of the null indicates that instrument is relevant. In our case, the test statistics are highly significant, suggesting that instrument irrelevance is not an issue. Instrument validity is gauged through the test of overidentifying restrictions, in particular the Hansen-J statistic. A rejection of the null casts doubt on instrument validity. The null

of instrument validity is accepted in many, but not all, of the equations estimated for the various sub-samples despite the use of same instruments across the board. It may be possible that instruments behave differently in different samples. When discussing results, we will therefore focus on cases where instrument validity is confirmed.

We additionally test for weak instruments. This occurs when instruments are relevant (ie correlated with endogenous regressor) but only weakly. Some estimators (such as IV and two-step GMM) are less robust to weak instruments and can perform poorly. In presence of weak instruments, alternative estimators such as the Limited-information maximum likelihood (LIML) and Continuously-updated GMM estimator (CUE), are preferred due to their greater robustness (Baum et al, forthcoming). The weak identification test statistic in the presence of heteroskedasticity is the Kleibergen-Paap rk Wald F statistic. Since critical values for this statistic are those compiled by Stock and Yogo (2005) for i.i.d case, Baum et al (2007) suggest it should be applied with caution when using rk statistic. One can otherwise refer to the Staiger and Stock (1997) rule of thumb that if the F statistic is greater or equal to 10, weak identification is not a problem (Baum et al, pp23). Our reported F-statistic largely exceeds 10, implying weak instruments is not a problem.

Finally, we chose GMM estimator over the standard IV/2SLS estimator as the latter assumes independent and homoskedastic disturbances. Since our dataset includes a large number of countries, we expect error terms to be heteroskedastic. This is formally tested by the Pagan and Hall's (1983) test of heteroskedasticity for instrumental variables estimation. The highly significant test statistic indeed rejects the null of homoskedastic errors.

Results

We estimate our gravity specification separately for each product category, markets, and Asian exporters. Due to a fairly large number of regressions and estimates, we only report coefficients on Chinese exports for each regression[9] for brevity. We limit

[9] Detailed results provided on request.

our discussion to those results where instrument validity holds in the regression (these appear as shaded in the tables). Gravity-type variables (not reported) have the expected signs across all specifications. Imports tend to rise with GDP of importing and exporting countries and decrease with distance. GDP per capita on the other hand have mixed impacts, possible depending on countries' threshold of development. Landlocked and island countries trade less, common language, present and previous colonial relationship between trading partners all have a positive impact on trade. While the product of land areas is inversely related to bilateral trade flows, in general, it has no impact. In many instances, border and product of land areas do not have any impact on trade.

Technology Classification

Table 5 below summarizes our findings for the Technology Classification. There is no discernable displacement effect in Asian countries' exports of primary products from an increase in China's exports; if anything, China's exports in this category tend to have a positive effect.

Similarly no clear displacement evidence emerges for agro/forest based manufacturing exports, although middle income Asian exporters seem to be affected. This effect however quickly disappears in more recent years. Results for other resource based products are more forthcoming: competition from China is evident for the whole period 1992-2006 and particularly second half as well as more recent years. Crowding out occurs in both industrial and developing markets. This does not come at the expense of low income countries however.

In the textile/fashion cluster category, contrary to oft-heard observations, we find no evidence of competitive pressure for the period as a whole and across markets. Viewed from exporter's angle, however, high income countries is the only group adversely affected, but this quickly disappears post 2001. This could be an indication of relocation of businesses from more advanced Asia to China to capitalise on low labour costs. The virtual absence of any crowding out of low and middle income countries confirms to some extent flying geese hypothesis. Over the period 1992 to 2006, the share of textile/fashion cluster in China's exports almost halved, falling from 35 % to 17%.

Asian countries with similar factor endowments may have moved into industries vacated by China. Moreover, despite a significant overlap in factor endowments with China, these Asian exporters may not specialise and export the same product category for within each category, there are various types of items, which are additionally differentiated by quality and brand (Shafaeddin, 2004). Alternatively, in face of China's strength in textile/apparel exports, countries most vulnerable to Chinese competition in these sectors may have transferred resources to other industries which would instead meet China's growing import demand.

Within other light manufactures, by contrast, we find strong displacement effects, mostly in industrialised markets and in second half of the period. Unlike textile/fashion cluster, the share of other light manufacture in total exports remained fairly stable at 15%. Once more, high income Asian exporters are adversely affected, but this is reversed post 2001, where we find low income Asian exporters being more vulnerable.

In the medium tech category, results for automotive products show co-movements between high and low income Asian countries and China in post WTO entry period. China's automotive industry is still at a very early stage and therefore is unlikely to compete with other more established producers. In fact, the heavy protection granted to China's auto industry has encouraged inefficient production and most plants operate at below global standards of efficient production (Martin et al, 2004).

We unambiguously find competitive pressures in process industries (MT2) for the whole period, in particular the second half and industrialised markets. This comes at the expense of low-income countries mainly, who are even more affected following China's WTO accession. Likewise, crowding-out occurs in engineering industries (MT3) over the whole period and in particular the second half and in both markets. Although high income exporters are hurt but any negative impact disappears in the latest period. Instead, the adverse impact on low income exports becomes more obvious. Low income Asian exporters seem unable to compete with China in attracting processing and assembly activities.

Finally, in the high tech's electronics and electrical sector, any displacement occur at the expense at high and middle Asian countries, with the effect reversing for high income countries in more recent years. For other high tech sectors, we find some evidence of competition in industrial markets, mostly at the expense of high income Asian exporters for the whole period. Again, this effect reverses in more recent years. Low income Asian exporters' exports appear to be more complementary for the whole period as well post 2002.

To sum up, we find that China competes with its neighbours in more sophisticated product range, mainly processing and engineering, rather that textile/clothing which has initially been a mainstay in its export basket. Competitive pressure is mainly felt in industrial markets and second half of the period. In a number of instances, we find high income countries to be more vulnerable. However in the post WTO accession period, their exports seem to be more complementary. This may suggest that more advanced countries in the region have to a large extent specialised in production of higher end products that would eventually be exported to China for assembly and processing. Low income Asian exporters are particularly hurt following China's WTO accession, especially in medium tech sectors. It is possible that due to their relatively higher labour cost and inability to attract sufficiently high FDI, they lose out exports to China.

Table 5 : Coefficient on Chinese Exports- Technology Classification

PERIOD	1992-2006						1992-1996	1997-2006	2002-2006			
	All Markets	Industrial Markets	Developing Markets	Asian Exporters to All Markets High	Middle	Low	All Markets		All Markets	Asian Exporters to All Markets High	Middle	Low
Primary Products(PP)	-0.152** (-2.32)	-0.243 (-1.57)	-0.002 (-0.02)	-0.116 (-1.62)	-0.382** (-2.17)	-0.093 (-0.44)	0.426** (1.99)	-0.041 (-0.78)	0.166*** (3.39)	0.203*** (3.45)	0.038 (0.38)	0.146 (0.67)
Agro/Forest-Based (RB1)	-0.105** (-2.57)	-0.374*** (-3.32)	-0.026 (-0.61)	-0.061 (-1.34)	-0.131** (-2.21)	0.210 (1.59)	-0.008 (-0.11)	-0.017 (-0.46)	0.038 (0.90)	0.175*** (3.61)	-0.060 (-0.97)	-0.052 (-0.27)
Other Products (RB2)	-0.221*** (-4.62)	-0.188** (-2.33)	-0.296*** (-4.33)	-0.213*** (-2.86)	-0.079 (-1.08)	0.213** (2.46)	-0.237 (-1.63)	-0.243*** (-5.23)	-0.157*** (-2.81)	0.058 (0.75)	-0.345*** (-3.18)	-0.099 (-0.59)
Textile/Fashion Cluster(LT1)	-0.016 (-0.49)	-0.094 (-1.28)	-0.017 (-0.47)	-0.291*** (-4.12)	-0.025 (-0.42)	-0.005 (-0.07)	-0.032 (-0.45)	0.001 (0.04)	-0.090* (-1.76)	-0.109 (-1.21)	-0.361** (-2.44)	-0.194 (-1.43)
Other (LT2)	-0.069** (-2.17)	-0.226*** (-3.21)	-0.013 (-0.37)	-0.326*** (-4.86)	-0.063 (-1.43)	-0.182*** (-2.61)	-0.013 (-0.26)	-0.058* (-1.70)	0.019 (0.52)	0.139*** (2.70)	-0.073 (-1.19)	-1.302*** (-4.73)
Automotive Products (MT1)	-0.084** (-2.20)	0.079 (1.34)	-0.140*** (-2.72)	0.003 (0.06)	0.148*** (2.68)	0.555*** (5.64)	0.248** (2.06)	-0.090** (-2.49)	0.055 (1.19)	0.357*** (5.72)	0.068 (1.01)	0.504** (2.06)
Process Industries (MT2)	-0.162*** (-3.36)	-0.170*** (-2.61)	0.002 (0.03)	-0.005 (-0.08)	-0.234*** (-2.65)	-1.055*** (-3.44)	-0.121 (-0.91)	-0.133*** (-2.79)	-0.039 (-0.72)	0.232*** (3.59)	-0.567*** (-4.54)	-2.890** (-2.25)
Engineering Industries (MT3)	-0.120*** (-4.00)	-0.096** (-2.00)	-0.083** (-2.15)	-0.223*** (-4.85)	-0.123** (-2.38)	-0.073 (-1.24)	-0.038 (-0.62)	-0.097*** (-3.21)	-0.004 (-0.09)	0.202*** (4.19)	-0.333*** (-3.28)	-0.709*** (-2.90)
Electron & Electrical (HT1)	-0.031 (-1.22)	-0.083* (-1.67)	0.053* (1.65)	-0.105*** (-2.79)	-0.143*** (-3.26)	0.329*** (6.44)	-0.057 (-0.90)	-0.065** (-2.28)	-0.014 (-0.36)	0.169*** (3.48)	-0.418*** (-5.63)	-0.083 (-0.52)
Other (HT2)	-0.172*** (-2.91)	-0.190* (-1.91)	-0.188** (-2.25)	-0.179** (-2.21)	-0.583*** (-3.99)	0.855*** (5.43)	-0.100 (-0.92)	-0.183*** (-2.82)	-0.093 (-1.35)	0.239*** (2.75)	-0.615*** (-3.75)	0.978*** (3.97)

Pooled GMM estimates. Table shows coefficient on Chinese exports, each obtained from separate regressions. For any estimate from instrumental variable estimation to be meaningful, instruments used should pass the validity test (J statistic) . Although we use the same instruments in all the regressions, their validity through sub-samples. Coefficients with valid instruments are shaded in the above table. Significance level: *** 1% ** 5% * 10% (t-ratio in parentheses). Test statistics and coefficient estimates are robust to arbitrary heteroskedasticity and inter-group correlation.

Stages of Production

Results for the stages of production classification are reported in Table 6. This classification is less refined than the one used above as it brings together a large number of products into a single heading. The positive relationship in exports of primary products over time found earlier is echoed in Table 6. The exports of semi-finished goods, on the other hand, are displaced over the whole period and in particular the second half. This occurs in industrial markets mainly, at the expense of middle and low income countries. In more recent years, all Asian exporters are affected to different extent. This group consist mainly of processed items, many of which are part of the processing industries (MT2) in the technology classification, where we found displacement evidence.

Regarding parts and components, China only displaces high income Asian exports, which seems plausible when one considers the fact that most high income Asian countries specialise in production and exports of parts and components to China instead of rest of world for further assembly. Not surprisingly, we find no significant evidence of displacement for capital and goods as China is more of an importer of such goods. Our results for consumption goods at odds with common perceptions given that China is more of an exporter of finished consumer products in that we do not find any adverse effects on other Asian exports. Instead, some complementary evidence emerges in relation to low income exporters, in particular in most recent years. This reiterates the possible operation of the 'flying geese' phenomenon or adjustments of these countries to China's emergence.

Table 6 : Coefficient on Chinese Exports- Stages of Production

PERIOD	1992-2006						1992-1996	1997-2006	2002-2006			
	All Markets	Industrial Markets	Developing Markets	Asian Exporters to All Markets			All Markets		All Markets	Asian Exporters to All Markets		
				High	Middle	Low				High	Middle	Low
Primary Products	0.493**	0.613	0.600**	-2.804*	-0.120	0.443	1.156*	0.051	0.378**	-0.607*	0.011	0.396
	(2.09)	(0.90)	(2.25)	(-1.69)	(-0.24)	(1.61)	(1.65)	(0.26)	(2.46)	(-1.66)	(0.02)	(1.57)
Semi-finished	-0.140***	-0.228***	-0.046	-0.070	-0.173***	-0.911***	-0.265***	-0.081***	0.030	-0.110*	-0.276***	-0.911***
	(-4.09)	(-3.50)	(-1.20)	(-1.35)	(-3.16)	(-5.28)	(-3.05)	(-2.63)	(0.87)	(-1.89)	(-4.48)	(-5.50)
Parts & Comp.	-0.039	-0.033	0.016	-0.110***	0.127***	0.232***	0.119**	-0.082***	-0.014	-0.103**	0.088**	0.228***
	(-1.50)	(-0.71)	(0.47)	(-2.80)	(3.78)	(3.83)	(2.16)	(-2.79)	(-0.34)	(-2.55)	(2.33)	(3.82)
Capital Goods	0.010	-0.001	0.067**	-0.085**	0.019	-0.074	-0.035	0.010	0.060**	-0.047	-0.041	-0.070
	(0.44)	(-0.02)	(2.30)	(-2.35)	(0.51)	(-1.28)	(-0.55)	(0.42)	(1.98)	(-1.29)	(-0.92)	(-1.23)
Consumer Goods	0.025	-0.157***	0.059*	-0.163***	0.030	0.186***	0.096*	0.064**	0.196***	-0.034	0.056	0.226***
	(0.87)	(-2.63)	(1.94)	(-2.89)	(0.59)	(2.84)	(1.73)	(2.16)	(5.61)	(-0.65)	(1.08)	(3.62)

Pooled GMM estimates. Table shows coefficient on Chinese exports, each obtained from separate regressions. For any estimate from instrumental variable estimation to be meaningful, instruments used should pass the overidentification test for all instruments as shown by an insignificant Hansen-J statistic. Although we use the same instruments in all the regressions, their validity through sub-samples. Coefficients with valid instruments are shaded in the above table. Significance level: *** 1% ** 5% * 10% (t-ratio in parentheses). Test statistics and coefficient estimates are robust to arbitrary heteroskedasticity and inter-group correlation.

7. Opportunities from China's Growth

These displacement effects may be offset in part by increased potential for exports to China for Asian countries in each product category. To gauge how Chinese growth has impacted on its imports from each Asian countries, we estimate a more basic formulation of the gravity model which relates China's imports to exporter's GDP, distance and China's GDP interacted Asian exporter dummy.

$$\ln M_{itj} = \alpha_1 + \alpha_2 \ln CHGDP_{it} . D + \alpha_3 \ln GDPX_{jt} + \alpha_4 \ln CAPX_{jt} + \alpha_5 \ln Dist_{ij} + \varepsilon_{ijt}$$

where

M_{ijt}	: Imports of China from Asian country j
$CHGDP_{it}$	: Real GDP of China
D	: Dummy variable for Asian countries
$GDPX_{jt}$	: Real GDP of exporting Asian country
$CAPX_{jt}$	: Real GDP per capita of exporting Asian country
$Dist_{ij}$	: Distance between China and exporting Asian country

The model is estimated by pooled OLS for the period 1992-2006. Results for the technology classification and stages of productions are reported in Tables 7 and 8 respectively. Except for the low-tech categories, China's growth is associated with higher imports from its neighbours, but this effect varies by product groups and across exporters. China relies primarily on low and middle income neighbours such as Indonesia, Philippines, Malaysia, Pakistan, India and so on, for its supply of primary and resource based. In the low-tech category, China's growth has a negative impact on some high income and most middle income Asian exporters in the textile/fashion cluster (LT1) and no discernable impact in other low tech manufactures (LT2), owing to its comparative advantage in production in these sectors.

There is a large reliance on imports of automotive products (MT1) from other Asian countries, with Japan being the most important source. This reflects to some extent the infancy stage of China's automobile industry and need for imports of parts and components for further assembly in this sector. The other medium-tech sectors, where China was found to displace its neighbours exports, namely MT2 (process) and MT3

(engineering) provide little opportunities for exports to China for Asian countries. On the other hand, China sources much of its high-tech products, both electronics & electricals and other from rest of Asia. Displacement of high income countries exports in these categories are therefore offset to some extent. There may be an indication of vertical integration in this sector, as the more advanced countries in the region engage in production of parts and components of more technologically advanced goods and export them to China for further assembly. The final products are subsequently sold to the world.

China's high dependence on imports of parts and components is also reflected by the remarkably high coefficients of the sector in the stages of production (Table 8). It also sources its supply of primary products and capital goods from its neighbours, but comparatively very little consumption goods.

Table 7. China's Imports from Asia -Technology Classification, 1992-2006

	PP	*RB1*	*RB2*	*LT1*	*LT2*	*MT1*	*MT2*	*MT3*	*HT1*	*HT2*
	b/t	b/t	b/t	b/t	b/t	b/t	b/t	b/t	b/t	b/t
lchgdpjap	0.706**	0.812	1.966***	-1.429***	0.032	3.019***	0.815	0.581	3.009***	3.382***
	(2.231)	(1.518)	(3.139)	(-3.203)	(0.062)	(2.870)	(1.289)	(0.854)	(4.733)	(4.967)
lchgdpkor	0.896***	0.788	1.337**	-0.945**	0.804	2.748**	0.371	1.509**	2.400***	3.579***
	(2.637)	(1.357)	(1.991)	(-1.987)	(1.487)	(2.398)	(0.562)	(2.102)	(3.633)	(4.980)
lchgdpsin	0.218	0.357	1.579***	-1.005***	0.319	2.297***	1.184**	0.063	3.500***	3.470***
	(0.863)	(0.831)	(3.151)	(-2.827)	(0.781)	(2.731)	(2.372)	(0.117)	(6.935)	(6.386)
lchgdpindo	0.981***	1.356**	3.063***	-0.792	-0.427	2.643**	1.693**	-0.014	4.090***	2.992***
	(2.874)	(2.323)	(4.578)	(-1.651)	(-0.771)	(2.236)	(2.496)	(-0.019)	(6.012)	(3.958)
lchgdpmal	0.641**	0.864**	2.057***	-0.825**	0.155	2.427***	1.270**	0.314	3.614***	3.315***
	(2.517)	(1.999)	(4.095)	(-2.301)	(0.373)	(2.852)	(2.507)	(0.578)	(7.083)	(6.012)
lchgdpphi	0.998***	1.027**	2.144***	-0.725*	0.273	2.457***	0.937*	0.907	3.278***	3.284***
	(3.820)	(2.323)	(4.167)	(-1.972)	(0.644)	(2.871)	(1.808)	(1.632)	(6.330)	(5.932)
lchgdpthai	1.047***	0.992*	1.660***	-0.727*	0.658	2.585***	0.586	1.420**	2.717***	3.430***
	(3.537)	(1.970)	(2.839)	(-1.751)	(1.390)	(2.630)	(1.012)	(2.269)	(4.704)	(5.513)
lchgdpslan	0.565**	0.769*	2.137***	-0.598*	0.035	2.068**	1.267***	0.133	3.660***	3.056***
	(2.314)	(1.846)	(4.448)	(-1.742)	(0.090)	(2.523)	(2.619)	(0.255)	(7.531)	(5.777)
lchgdpban	1.207***	1.132**	1.440**	-0.474	0.699	2.196**	0.185	1.866***	2.169***	3.184***
	(3.676)	(2.019)	(2.226)	(-1.031)	(1.346)	(2.019)	(0.291)	(2.708)	(3.437)	(4.636)
lchgdpcam	0.841***	0.893**	1.345***	-0.310	0.699*	1.907**	0.481	1.180**	2.631***	3.187***
	(3.639)	(2.270)	(2.943)	(-0.957)	(1.899)	(2.460)	(1.069)	(2.419)	(5.833)	(6.557)
lchgdppak	1.032***	1.046**	2.425***	-0.546	-0.021	2.335**	1.079**	0.613	3.200***	3.058***
	(3.766)	(2.253)	(4.509)	(-1.418)	(-0.046)	(2.584)	(1.979)	(1.049)	(5.880)	(5.220)
lchgdpviet	1.300***	1.109**	1.733***	-0.472	0.767	2.395**	0.444	1.682***	2.570***	3.313***
	(4.413)	(2.209)	(2.986)	(-1.144)	(1.638)	(2.453)	(0.774)	(2.715)	(4.516)	(5.390)
lchgdpind	1.330***	1.426**	2.992***	-0.799*	-0.142	2.841**	1.098	0.868	3.328***	3.099***
	(3.970)	(2.516)	(4.561)	(-1.697)	(-0.260)	(2.575)	(1.646)	(1.216)	(5.012)	(4.335)
lgdpx	-2.818**	-3.566*	-6.079***	3.787**	5.111***	-4.158	0.608	-0.101	0.581	2.187
	(-2.495)	(-1.865)	(-2.767)	(2.394)	(2.822)	(-1.102)	(0.273)	(-0.042)	(0.263)	(0.915)
lcapx	6.044***	6.680***	9.295***	2.598	-2.305	2.774	1.660	4.289	2.320	-1.684
	(4.445)	(2.864)	(3.509)	(1.372)	(-1.087)	(0.620)	(0.637)	(1.538)	(0.898)	(-0.597)
ldist	12.414	-2.176	-39.981*	4.013	35.425**	1.677	-40.808*	58.399**	-52.450**	10.994
	(1.077)	(-0.108)	(-1.768)	(0.250)	(1.980)	(0.040)	(-1.854)	(2.397)	(-2.382)	(0.430)
_cons	-80.850	40.372	339.884*	-114.410	-377.298***	9.545	263.682	-481.833**	285.304	-208.812
	(-0.884)	(0.253)	(1.894)	(-0.898)	(-2.647)	(0.028)	(1.503)	(-2.474)	(1.622)	(-1.018)
r2	0.960	0.885	0.914	0.926	0.950	0.872	0.920	0.924	0.951	0.929
N	193.000	192.000	185.000	191.000	188.000	166.000	186.000	184.000	177.000	163.000

Pooled OLS estimates

Table 8. Stages of Production: Pooled OLS-1992-2006

	PP	*SFG*	*PC*	*CAP*	*CON*
	b/t	b/t	b/t	b/t	b/t
lchgdpjap	1.535***	0.593	3.276***	1.953***	0.434
	(4.469)	(1.457)	(5.428)	(2.829)	(1.344)
lchgdpkor	1.308***	1.068**	2.963***	1.764**	0.368
	(3.524)	(2.431)	(4.727)	(2.417)	(1.069)
lchgdpsin	0.566**	0.614*	3.778***	1.861***	0.807***
	(2.051)	(1.882)	(7.942)	(3.421)	(3.140)
lchgdpindo	2.193***	0.282	3.575***	2.504***	0.789**
	(5.935)	(0.644)	(5.508)	(3.343)	(2.262)
lchgdpmal	1.356***	0.586*	3.615***	2.115***	0.747***
	(4.910)	(1.792)	(7.471)	(3.822)	(2.877)
lchgdpphi	1.738***	0.686**	3.255***	2.170***	0.617**
	(6.127)	(2.044)	(6.615)	(3.847)	(2.316)
lchgdpthai	1.655***	0.958**	3.014***	1.947***	0.500*
	(5.123)	(2.505)	(5.493)	(3.063)	(1.665)
lchgdpslan	1.298***	0.388	3.482***	2.093***	0.753***
	(4.897)	(1.236)	(7.546)	(3.955)	(3.023)
lchgdpban	1.896***	1.007**	2.431***	1.710**	0.300
	(5.284)	(2.369)	(4.046)	(2.442)	(0.903)
lchgdpcam	1.301***	0.941***	2.815***	1.714***	0.600**
	(5.152)	(3.149)	(6.587)	(3.458)	(2.564)
lchgdppak	1.975***	0.588*	3.057***	2.097***	0.588**
	(6.655)	(1.674)	(5.899)	(3.534)	(2.103)
lchgdpviet	1.913***	0.993***	2.783***	1.951***	0.505*
	(5.947)	(2.607)	(5.140)	(3.100)	(1.691)
lchgdpind	2.643***	0.496	2.997***	2.375***	0.482
	(7.293)	(1.157)	(4.733)	(3.273)	(1.408)
lgdpx	-7.575***	2.164	2.703	-1.556	2.422**
	(-6.197)	(1.495)	(1.287)	(-0.642)	(2.098)
lcapx	10.960***	-0.618	-2.208	4.678	-0.405
	(7.388)	(-0.352)	(-0.904)	(1.651)	(-0.294)
ldist	-2.577	24.685	-28.142	-16.250	-14.446
	(-0.204)	(1.653)	(-1.337)	(-0.649)	(-1.238)
_cons	95.215	-242.720**	80.968	79.917	44.291
	(0.953)	(-2.052)	(0.481)	(0.399)	(0.478)
r2	0.930	0.935	0.951	0.934	0.948
N_clust					
N	194.000	194.000	180.000	182.000	192.000

Pooled OLS estimates

8. Conclusions

Our gravity model applied to disaggregate data over the period 1992-2006 points to some evidence of exports displacement caused by surge of China's exports in many product categories. These effects, however, differ over time, markets and Asian exporters. Most crowding-out tends to occur in second half of the period and in industrial markets. It is mainly felt in medium to higher-end technology products and less in low-

skill manufactures, where China's fear was initially expected. There are indications that countries sharing the same factor endowments have somehow adjusted their production and export structures or moved into products relinquished by China. Overall, high income Asian countries are the most adversely affected, but the effects are largely reversed in more recent years. Although there was little competition with low income countries products for the whole period, there are signs of intensification is a few product categories after China's WTO accession.

China does, however, offer high export growth opportunities for its neighbours due to its high imports, particularly in parts and components, automotive products and high-tech sectors. Although displacement occurs in sectors other than the ones just mentioned, there are signs of some offsetting effects. More importantly, the results give an insight into the ongoing production fragmentation and vertical integration prevalent in Asia, where parts and components, originating from more advanced Asia are exported to China for further processing and assembly.

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Appendix

Table A1. Lall (2000) Technology Classification of Products

Classification	Examples
Primary products:	Fresh fruit, meal, rice, cocoa, tea, coffee, wood, coal, crude petroleum, gas
Manufactured products	
Resource-based manufactures(RB)	
Agro/forest-based products (RB1)	Prepared meats/fruits, beverages, wood products, vegetable oils
Other resource-based products (RB2)	Ore concentrates, petroleum/rubber products, cement, cut gems, glass
Low-technology manufactures (LT)	
Textile/fashion cluster (LT1)	Textile fabrics, clothing, headgear, footwear, leather manufactures, travel goods
Other low technology (LT2)	Pottery, simple metal parts/structures, furniture, jewellery, toys, plastic products
Medium technology manufactures(MT)	
Automotive products (MT1)	Passenger vehicles and parts, commercial vehicles, motorcycles and parts
Medium technology process industries (MT2)	Synthetic fibres, chemicals and paints, fertilizers, plastics, iron, pipes/tubes
Medium technology engineering industries (MT3)	Engines, motors, industrial machinery, pumps, switchgear, ships, watches
High-technology manufactures	
Electronics and electrical products (HT1)	Office/data processing/telecommunications equip, TVs, transistors, turbines, power-generating equipment
Other high technology (HT2)	Pharmaceuticals, aerospace, optical/measuring instruments, cameras
Other transactions	Electricity, cinema . lm, printed matter, “special” transactions, gold, art, coins, pets

Source: Lall (2000)

Table A2. Stages of Production Classification –BEC

3 Stages	*5 Stages*	*BEC Code*	*BEC Title*
Primary Goods		111	Food and Beverages , primary mainly for industry
		21	Industrial supplies, n.e.s, primary
		31	Fuels and lubricants, primary
Intermediate Goods	Semi-finished goods	121	Food and beverages, processed, mainly for industry
		22	Industrial supplies, n.e.s., processed
		322	Fuels and lubricants, processed
	Parts & Components	42	Of capital goods, except transport equipment
		53	Parts and accessories of transport equipment
Final goods	Capital goods	41	Capital goods, except transport equipment
		521	Other industrial transport equipment
	Consumption goods	112	Food and Beverages, primary mainly for household consumption
		122	Food and Beverages, processed, mainly for household consumption
		51	Passenger motor cars
		522	Other non-industrial transport equipment
		61	Durable consumer goods n.e.s
		62	Semi-durable consumer goods n.e.s
		63	Non-durable consumer goods n.e.s

Source : Gaulier et al (2005)