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# The Location Substitution Effect: Does it Apply for China?

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## Abstract

The notion that China is the factory of the world is now changing. Factories in China are shifting their production base to neighbouring Asia, primarily because of higher input costs in China, a volatile Chinese exchange rate and protectionist measures targeted against Chinese exports. In this article, we examine the location substitution effect for China: Chinese firms are exporting primary, intermediate and machinery items, meant for producing final output in the Greater Mekong Subregion (GMS), which include Laos, Thailand, Vietnam, Cambodia and Myanmar. Results suggest that GMS countries are exporting finished items to China, that are increasingly getting manufactured using primary and intermediate inputs imported from China.

## Keywords

Trade, location substitution effect, China, GMS

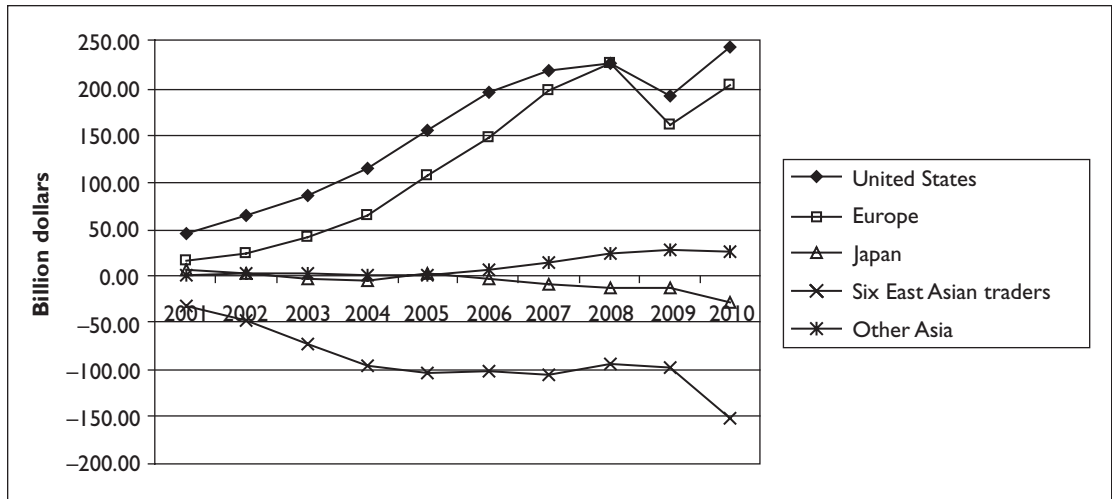
## Introduction

China is the second largest economy in the world after the United States (US). Trade account for around 70 per cent of China's gross domestic product (GDP), making it an important component of national income. The reason for success, especially in trade, has to do with the fact that China imports primary and intermediate goods from neighbouring Asia, assembles them in the factories of coastal provinces, such as Guangdong and transport these assembled products through its port at Hong Kong and Shenzhen, to destinations such as in Europe and the USA. This is quite evident from a number of studies (see Athukorala, 2008, 2012; Gaulier et al., 2007). Athukorala (2008) observes that China has emerged as an important trading partner for ASEAN within regional production networks. Network-related trade in parts and components has certainly strengthened economic interdependence between ASEAN, China and other major economies in East Asia, but this has not lessened the dependence of growth dynamism of these countries on the global economy (Athukorala, 2008; Gaulier et al., 2007). Furthermore, global production sharing has become a unique feature of the region's economic landscape, with China playing a pivotal complementary role as the premier assembly centre within regional production networks (Athukorala, 2012). Most of these intermediate inputs are manufactured in ASEAN including in Thailand, Myanmar and Vietnam, which are finally used for producing Chinese made electronic items. China's

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**Figure 1.** China's Merchandise Trade Surplus (in billion US \$)

**Source:** Statistical Communiqué of the PRC, 2011.

trade pattern, which is, maintaining trade surplus with the EU and the US, whereas, maintaining trade deficits with Japan, Taiwan, South Korea and the ASEAN—supports the proposition that China is ‘factory of the world’ (see Figure 1). In fact, studies have shown there is an increase in foreign content for Chinese exports. Assembling, and processing of imported inputs meant for re-exports account for about half of China’s foreign trade (Hummels et al., 2001; Koopman et al., 2008). Higher foreign content of its exports is due to vertical intra-industry trade<sup>1</sup> which has grown manifold in China, and possibly may have been responsible for its diverse exports base, from electronics and machinery to textile and apparel (Ando, 2006; Fukao et al., 2003; Gaulier et al., 2007).

However, recently this notion about China being factory of the world is changing. Factories in China are shifting their production base to neighbouring Asia, primarily because of higher input costs in China, a volatile Chinese exchange rate, Chinese exports being increasingly targeted by its major trading partners and a fall in price-competitiveness in producing goods in mainland China. Pushed by these domestic disadvantages and external restrictions, and helped by change in government policy to circumvent such problems, there has been industrial restructuring in the form of diversification of production base of some of the products to cheaper overseas destinations. This has been part of ‘going global’ strategy that has led to offshore equity investments and acquisitions. Such an effect relating to the shift in production location from home country to cheaper overseas locations (also known as location substitution effect), is possible for firms in China because their method of production—particularly the low- and medium-technology products that can be easily replicated in other developing countries. If China were to shift its factories outside China, we would expect that China is exporting primary, intermediate and machinery items to neighbouring Asia, and importing finished manufactured items from them.

In this article, we examine this hypothesis, that is, location substitution effect with respect to Chinese investment in the Greater Mekong Subregion (GMS).<sup>2</sup> Although Chinese companies are investing in countries around the globe, GMS is a natural choice given their geographical proximity to China and free

trade agreements that prevail between countries in the GMS and China.<sup>3</sup> This hypothesis can also be examined using the concept of extended neighbourhood with respect to China and the GMS countries being her neighbour (Banik and Bhaumik, 2006).

Results suggest that China is exporting primary and intermediate inputs (including machinery items), and in turn expanding manufacturing base in the GMS. For the location substitution effect hypothesis to be valid, we would expect a greater level of association between imports of primary and intermediate items from China with the exports of finished manufactured items to China, both with reference to the GMS. Our result supports this hypothesis about the existence of location substitution effect. We find, intermediate inputs from China are used for producing final manufactured items such as telephones, computers, air conditioners, refrigerators and televisions, in Vietnam and Thailand; whereas primary items comprising of textile and woven fabrics are used in garments manufacturing units in Cambodia, Laos and Myanmar.

This aspect about examining location substitution effect has not been considered before, and this study fills this gap. Through this study we expect to complement an important aspect of new trade theory, which suggests, a way to explain vertical intra-industry trade is to look at the extent of firm-level heterogeneity. Extent of heterogeneity within any given industry affects outsourcing decision—with high productivity firms sourcing intermediate inputs in international markets, and multinational firms with heterogeneous productivity self-select into different host countries (Castellani et al., 2010; Chen and Moore, 2010; Helpman, 2006). Therefore, this study will also help to understand changing nature of international trade and investment linkages. The rest of the article is organized as follows: the following section documents reasons for China to relocate its production base; the next section deals with the methodology, and data used for this study; followed by results and the final section provide conclusion.

## China's Competitive Dynamics

Traditional trade theory has much to offer in explaining shifts in trade and investment patterns and reorganization of production across national borders. However, it goes only part way towards explaining geographical reallocation of production by multinational firms, and fragmentation of production within the firm (Helpman, 2006). The modified theory has incorporated firm and industry specific characteristics with a view to explain the international reorganization of production through foreign direct investment (see Helpman et al., 2004; Helpman, 2006; Melitz, 2003). In these theories, the degree of heterogeneity within industries, such as productivity differences across firms, play a central role in explaining outward investment by multinational firms. There are empirical evidences on such theories in the context of advanced countries (Chen and Moore, 2010; Castellani et al., 2010).

However, explaining shift in trade and investment across national borders involves complex interplay of multiple factors besides those specific to the firm and industry. These include country specific factors, institutional and policy environment in the home and host countries, and regional economic integration, among others. Although our objective is not to test any specific theory *per se*, we expect to complement the new trade theory in which the intra-regional trade and investment could be driven by fragmentation of the production process across national borders.

Thus, before empirically examining the applicability of location substitution effect we discuss the factors that are motivating the Chinese firms to relocate their production base outside mainland China.

## Economic Crisis and the Chinese Exports

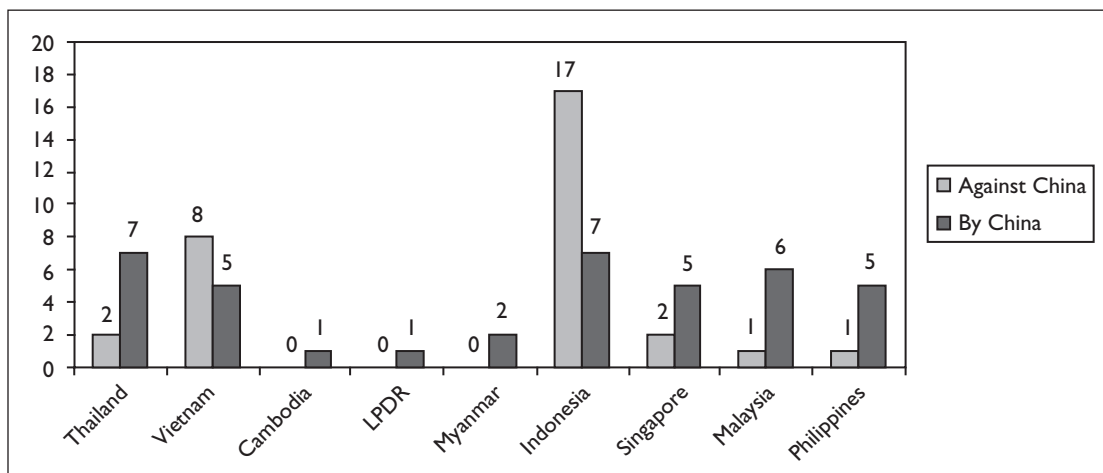
The financial crisis since 2007 has seriously affected world trade, with some governments resorting to protectionist measures, such as antidumping and countervailing measures to protect their domestic industries. It is no surprising to see that such protectionist measures is hurting China the most, especially because during 2008 and 2009, Chinese exports value ranked highest in the world. During 2008, Chinese exports to the European Union (EU), and the United States (US) fell by 19.4 per cent, and 12.5 per cent, respectively. China's trade surplus fell from US\$ 298.1 billion in 2008 to US\$ 195.8 billion in 2009.

Global Trade Alert database (a database tracking number of protectionist measures imposed around the world) has indicated that as many as 659 measures have been initiated against the Chinese exports in 2009. Most of these measures (numbers of measures initiated are indicated in parenthesis) have originated from—Russia (31), Germany (18), France (16), United Kingdom (17), Spain (16), Italy (15), Netherlands (15), Sweden (13), Austria (13), Belgium (13), Finland (13), in Europe and USA (9).

Chinese firms are looking for an alternate production base to evade such protectionist measures, in addition to rising domestic cost, as discussed below. Given their geographical proximity, the GMS member countries become a natural choice. Figure 2 shows when it comes to imposition of protectionist measures, the ASEAN member countries are much less hostile towards Chinese exports in comparison to the EU and the US.

### Higher Input Cost

The China growth story is still intact making it a favourable destination among the foreign fund managers. In 2009, China has received more foreign fund—much higher than any of other four emerging economies in the BRICS group, comprising of Brazil, Russia, India and South Africa. The expectation about future



**Figure 2.** Number of Measures Against (and by) China

**Source:** Global Trade Alert, November 2010.

appreciation of Chinese renminbi also has been responsible for enhancing inflow of foreign funds. Chinese central bank has been frantically trying to keep renminbi from appreciating further by actively intervening in the foreign exchange market. Active intervention in the foreign exchange market has resulted in inflation (Zhang, 2009). In addition, wages of migrant workers, land, property rents, and power prices, have all registered an increase.<sup>4</sup> Measured on a year-over-year basis, as of November 2010, labour costs have gone up by 21 per cent, and the home prices across 70 cities in China have gone up by 7.7 per cent. 2010 estimates suggest minimum annual wage rates for Cambodia, Laos and Vietnam are US\$ 600, US\$ 434, and between US\$ 1200–1500, respectively. If one were to add the mandatory welfare allowances to the minimum annual wage rates, then the Chinese labour costs are at least double compared to labourers in other regions in south-east Asia (Devonshire-Ellis, 2011).

Li and He (2007) provide evidence about foreign fund entering into the real estate sector. What is worrisome is that property prices are rising despite the government having ownership right for land—indicating possible real estate bubble. China has also imposed stricter pollution control norms on its industries, raising the marginal cost of producing goods in China, further. Hence, Chinese firms stand to gain by shifting production base to the neighbouring south-east Asia, with a lower production cost. Also, as Chinese currency has been appreciating since 2005, and with an expectation that it will appreciate further, there is a likelihood of Chinese exports becoming costlier. Chinese firms can gain by importing raw material (as imports become cheaper when currency appreciate), and use this imported raw material to produce finished goods outside China.

### *Access to a Bigger Market*

Trade and investment measures undertaken in the south-east Asian region are non-discriminatory and complementary in nature. These nations are increasingly driving down differences among each other by reducing tariffs, and other border costs. Most of the items are traded at zero tariffs among the member countries. Thailand, Laos, Cambodia, Vietnam and Myanmar are all part of ASEAN. As on 1 January 2010, duties on 99.65 per cent of all tariff lines under the Common Effective Preferential Tariff Scheme for the ASEAN Free Trade Area have been eliminated. For the newer ASEAN Member States—Cambodia, Laos, Myanmar and Vietnam—98.96 per cent of total tariff lines are within the tariff of 0 to 5 per cent range. Since October 2003, China and Thailand have taken lead in implementing zero tariffs on agricultural products, covering 200 types of fruits and vegetables. China has also granted zero tariffs treatment to Cambodia (83 products), Laos (91 products) and Myanmar (87 products). Free market access for Chinese exports into this region means a larger market share for their manufacturers.

### *Inflation, Exchange Rate Appreciation and External Price Competitiveness*

Rapid economic growth in China over the last two decades has been accompanied by a surge in foreign capital inflows both in current and capital accounts (the ‘twin surpluses’), causing a massive accumulation of foreign exchange reserve (US\$ 2.65 trillion by September 2010).<sup>5</sup> Accumulation of foreign exchange reserve has its own risks, including the cost of holding in low yielding financial assets of foreign governments. Before the global economic crisis started, China has invested a major portion of their trade surplus in US dollars and euro-denominated assets. Values of these assets are now falling because of

Federal Reserve in the US, and European Central Bank in the EU, are printing too much money. In fact, USA is investing in assets in China, and other emerging economies in Asia through Foreign Direct Investment (FDI) route, thereby exporting inflation (Banik, 2011). The EU and the US still remain the largest investors in China. Such investment is leading to accumulation of foreign currencies, making it difficult for the Chinese monetary authority to prevent growth of ‘excess liquidity’. A part of this excess liquidity is finding its way into the Chinese stock market, further accelerating inflation (Li and He, 2007). In fact, for the period between 1980 and 2002, pass-through effect of exchange rate translating into higher domestic price was much less in comparison to the period after 2002 (Yu, 2007).

The People Bank’s of China want to curb this inflation by formulating contractionary monetary policy, raising the interest rates. The rise in interest rates in China relative to the US in recent years has accentuated the inflow of capital. The appreciation of Chinese renminbi alongside with an increase in inflation has hurt Chinese external competitiveness. Following goods market approach of determining the value of exchange rate, we define external competitiveness of any country as the difference between domestic inflation and movement in its exchange rates. As is evident from Table 1, China’s external competitiveness has fared reasonably well against many of the GMS countries until 2006 but has started to fall thereafter, especially, since 2007. For example, in 2007, Vietnam and Cambodia have shown better external price competitiveness. In particular, in 2009, Thailand and Cambodia have done better, relative to China in terms of price competitiveness. Starting 2006, price competitiveness has declined at a much faster rate for China in comparison to the other GMS countries. This is going to hurt price elastic low technology intensive Chinese exports, such as leather, foot ware, and apparel. In fact, share of these items has fallen in total exports (Amiti and Freund, 2008). The fall in price competitiveness has also motivated Chinese firms to relocate their production base outside China.

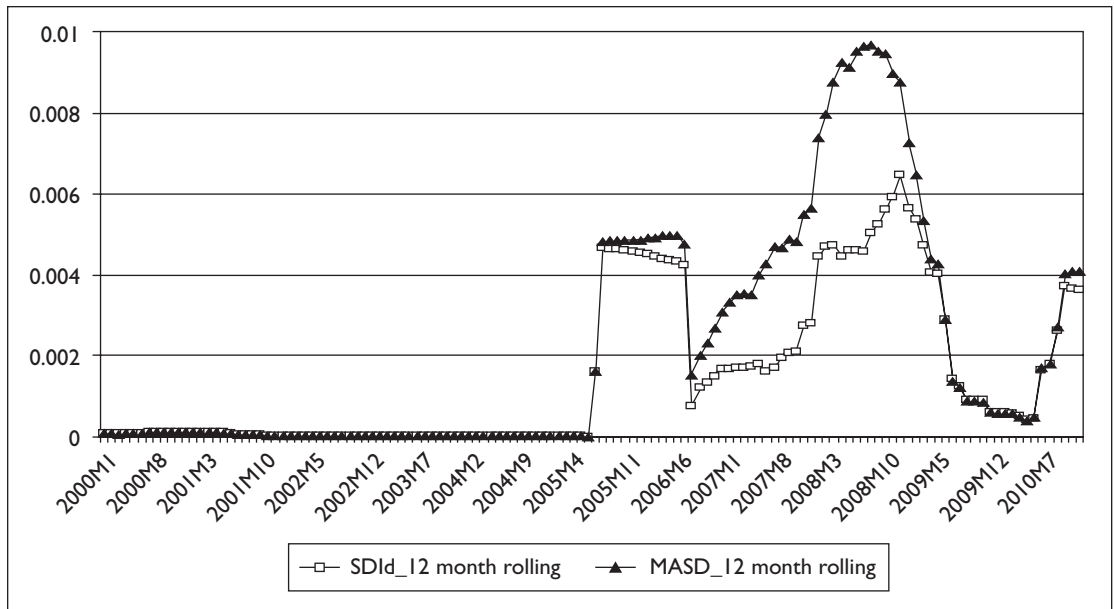
In addition to, higher inflation rates and interest rates, the Chinese renminbi has also become more volatile. Once the longstanding peg to the US dollar was abandoned in July 2005, the renminbi-dollar exchange rate has shot up, appreciating by about 20 per cent (Figure 3).

**Table 1.** External Competitiveness (change in price–change in nominal exchange rate)

Year	China	Thailand	Vietnam	Cambodia	Laos
2000	0.25	-4.49	-3.32	-1.66	14.02
2001	0.74	-9.14	-4.37	-2.57	-5.71
2002	-0.76	4.01	0.07	3.33	-1.67
2003	1.15	5.24	1.71	-0.36	10.39
2004	3.89	5.80	6.23	2.84	10.31
2005	2.82	4.55	7.56	4.45	6.51
2006	4.16	10.45	6.53	5.88	11.45
2007	9.34	11.16	7.61	8.82	10.00
2008	14.53	8.89	21.89	25.05	16.57
2009	0.98	-3.77	2.38	-2.76	2.64
2010	4.22	10.89	-0.21	2.91	9.02

**Source:** Calculated from International Financial Statistics, International Monetary Fund.

**Note:** Higher values indicate fall in competitiveness.



**Figure 3.** Volatility of RMB-dollar Exchange Rate

**Source:** Calculated from International Financial Statistics, International Monetary Fund.

**Note:** Volatility is calculated using (a) the standard deviation of the first difference of the log of monthly exchange rate, and (b) the moving average standard deviation of the log of (monthly) exchange rate. Such measures have been used for studying the impact of exchange rate volatility on exports (See, Tenreyro, 2007; Chit et al., 2010).

Exchange rate volatility can have negative effect on international trade, directly through uncertainty and adjustment cost, and indirectly through its effect on allocation of resources (see Côte, 1994; McKenzie, 1999 for a review).

## Methodology and Data

Trade flow is usually explained using the gravity model. The original application of the Newtonian law of gravity in the field of economics goes back to the work of Tinbergen (1962), Poyhonen (1963) and Linnemann (1966), suggesting that bilateral trade between two nations is positively related to their national income, and inversely related to the distance between them.<sup>6</sup> For this study, to examine, location substitution effect for China, we use a variant of the gravity model using two-stage least squares technique (2SLS). We use 2SLS framework to control for endogeneity, and also to capture simultaneity of two-way trade between China and the GMS. Following, Leamer and Stern (1970) and Magee (1975), we specify the exports and imports demand functions. For the purpose of our analysis, we categorize the commodities into two groups, namely, primary and intermediate exports including machinery, and final manufactured goods (See, the Appendix). For this classification, we use Standard International Trade Classification (SITC) Revision 3 at a two-digit level.



*Data Source:* Data on trade (both exports and imports) between China and individual countries within GMS are obtained from the United Nations COMTRADE database. Trade figures are reported in constant US dollars for each country. The data are available annually and involve trade values of 4 GMS countries, namely, Thailand, Vietnam, Cambodia and Laos, with China.<sup>7</sup> The time period is between 2000 and 2009. In total, we have 40 observations, involving four countries and 10 years data. We choose this time period because GMS initiative was undertaken starting early 2000, and there were considerable trade integration happening in this region (through tariffs reduction) during this period.

For commodity classification into primary, intermediate, and final manufactured items, we have followed the classification put forward by Lall (1998, 2000). Primary exports contain items falling under SITC headings 0 to 4. Intermediate and machinery items fall under SITC headings 5, 6, 7 and 8, whereas, the final manufactured items falls under SITC headings 6 and 8.<sup>8</sup> To arrive at overall primary, intermediate and machinery exports, and final manufactured exports, we aggregate trade values for all commodities falling under respective categories.

### Estimation

We estimate the following equations:

$$FX_{ic}^t = \alpha_1 + \beta_1 PIM_{ic}^t + \beta_2 GDP_c^t + \varepsilon_i^t \quad (1)$$

$$PIM_{ic}^t = \alpha_2 + \gamma_1 FX_{ic}^t + \gamma_2 PIM_{ic}^{t-1} + \gamma_3 GDP_i^t + \varepsilon_i^t \quad (2)$$

where,  $FX_{ic}^t$  is the total value of final manufactured exports at time period  $t$  from country  $i$  to China ( $i$  = Thailand, Vietnam, Cambodia and Laos);

$PIM_{ic}^t$  refers to primary, intermediate and machinery imports of country  $i$  from China;

$GDP_c^t$  is China's GDP, and  $GDP_i^t$  is  $i$ th country's GDP.

$FX_{ic}^t$  and  $PIM_{ic}^t$  are the endogenous variables, whereas,  $GDP_c^t$ ,  $GDP_i^t$  and  $PIM_{ic}^{t-1}$  are the exogenous variables. As equation (1) is over-identified, we use 2SLS to derive efficient estimates. For comparison, and to capture the individual country effect, we also consider the least square dummy variable (LSDV) model;  $\varepsilon_i^t$  is the disturbance term. In LSDV,  $\varepsilon_i^t$  captures both country specific (cross sectional) and temporal effects.<sup>9</sup> We use country specific dummies to capture individual country characteristics. As we are not randomly selecting countries within GMS, there is no necessity to undertake random effect modeling (where it is assumed we are randomly selecting sample countries from the population).<sup>10</sup> Also, since cross sectional element in our case is small (comprising of five different countries, including China), the dynamic panel approach of generalized method of moments (GMM) estimation techniques, which are expected to yield more consistent estimates in presence of large cross section, are not considered.<sup>11</sup> In a dynamic panel there can be an element of cointegration among exports, imports and GDP—as all of these variables tend to move in the same direction. However, Levin et al. (2002) test confirms absence of non-stationarity, and hence cointegration in this dynamic panel framework. For each one of these variables superscript  $t$  stands for time and subscript  $c$  implies China. All the variables, except for the dummies (as in the case with LSDV), are reported in log.

## Results

The estimation results of equations (1) and (2) are reported in Table 2. The models fit the data well.<sup>12</sup> Table 2 indicates that imports of primary, intermediate and machinery items from China are related to the exports of finished manufactured items to China, both with reference to the GMS. A positive and significant  $\beta_1$ ,  $\gamma_1$  and  $\gamma_2$ , support the location substitution effect hypothesis. A large adjusted R<sup>2</sup> reveals a higher degree of association between intermediate inputs and final output. The 2SLS and the LSDV estimates suggest that final exports of GMS countries going to China are increasingly getting manufactured using primary, intermediate and machinery items imported from China. This result is validated by high correlation coefficient of 0.81 between primary, intermediate and machinery imports from China with final manufactured exports to China. Statistically, insignificant Chinese GDP may indicate Chinese imports from GMS is not driven by China's income but because of other factors such as procuring goods from cheaper overseas destination. In LSDV, the significant country dummies indicate the importance of GMS in China's trade.

The location substitution effect is substantiated by growing importance of GMS in China's total trade.<sup>13</sup> Banik (2011) indicates that China is exporting primary and intermediate inputs (including

**Table 2.** Results of the Estimated Model for 4 GMS Countries

Variable	$FX'_{ic}$ (LSDV)	$FX'_{ic}$ (2SLS)	$PIM'_{ic}$ (LSDV)	$PIM'_{ic}$ (2SLS)
Constant	-0.1231 (0.2182)	-0.0240 (0.2254)	0.2793 (0.2456)	-0.1681 (0.1186)
$PIM'_{ic}$	0.6713*** (0.1355)	0.7822*** (0.1455)	-	-
$FX'_{ic}$	-	-	0.8572** (0.3598)	-0.0751 (0.2186)
$GDP'_c$	0.0773 (0.1154)	0.0260 (0.1191)	-	-
$GDP'_i$	-	-	1.3835** (0.5895)	0.1621 (0.1818)
$PIM'^{-1}_{ic}$	-	-	1.0100*** (0.1143)	1.0088*** (0.1238)
Dummy Thailand	0.9933*** (0.2824)	-	-1.2308* (0.6494)	-
Dummy Vietnam	-0.4777* (0.2714)	-	-0.2010 (0.2314)	-
Dummy Cambodia	-0.0587 (0.1820)	-	-0.0519 (0.0888)	-
Adjusted R <sup>2</sup>	0.8629	0.8589	0.9695	0.9644
F Test	19.36***	19.24***	80.52***	73.78***
Hausman Test		5.56***		0.00

**Source:** Authors' analysis.

**Notes:** \*\*\*significant at 1 per cent, \*\*significant at 5 per cent, \*significant at 10 per cent  
Figures in the parenthesis are standard errors.

machinery items), and in turn expanding manufacturing base in the GMS. Much of the GMS final produce are manufactured using Chinese primary and intermediate inputs, which again get sold back to China. In fact, most of the trade between China–Thailand and China–Vietnam include trade in the capital goods sector. Chinese imports are used for producing final manufactured items such as office machines, electric machines, road vehicles and white goods, such as, mobile phones, air conditioners, computers and televisions. A good number of the office machines and electrical machineries that Thailand exports, and most of the motorcycles that Vietnam sells are made with Chinese machinery inputs. Similarly, most of the garment manufacturing units in Myanmar, Laos and Cambodia, use Chinese textile and woven fabrics.

## Conclusion

Our results provide evidence in support of location substitution effect hypothesis. This may be because of an increase in vertical intra-industry trade between China and the GMS countries, involving back-and-forth transaction in vertically fragmented cross-border production process. Instances, such as in the case of white goods, and garments suggest that GMS countries are exporting finished items to China, that are increasingly getting manufactured using primary and intermediate inputs imported from China. As a result of higher cost of producing in mainland China (resulting from higher labour, land and energy prices), and Chinese exports getting increasingly targeted by its major trading partners, Chinese firms are expanding their production base outside China. By shifting to cheaper overseas destination such as in GMS countries, Chinese firms are circumventing protectionist measures targeted against its exports. The integration with GMS comes naturally, because of closer proximity to mainland China, better policy coordination among the governments of the GMS countries, and availability of similar technology to replicate medium technology products outside mainland China.

Our results have implication for trade facilitation and infrastructure development in the GMS as emergence of successful regional production network requires lower trade costs. Further, GMS countries could make effort towards greater collaboration with China to increase investments, and spillover benefits from such investments. Emphasis also needs to be given on technological capacity building especially in less developed GMS countries, which could help them move up the value chain, and ease their supply-side constraints.

One limitation of our analysis is that we have worked with aggregated data. This we have done because of scarcity in getting disaggregated firm-level trade and investment data. However, classification of commodities into intermediate and final at higher level of desegregation could provide better insights. In addition, the extent of production shifting across the GMS could be different across industries identified by level of technology. Future research could be directed towards addressing these gaps.

## APPENDIX

### Commodity Classification

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#### A. Primary and Resource-Based

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- 00 Live animals other than animals of division 03
- 01 Meat and meat preparations
- 02 Dairy products and birds' eggs
- 03 Fish (not marine mammals), crustaceans, molluscs and aquatic invertebrates and preparations thereof
- 04 Cereals and cereal preparations
- 05 Vegetables and fruit
- 06 Sugars, sugar preparations and honey
- 07 Coffee, tea, cocoa, spices and manufactures thereof
- 08 Feeding stuff for animals (not including milled cereals)
- 09 Miscellaneous edible products and preparations
- 11 Beverages
- 12 Tobacco and tobacco manufactures
- 21 Hides, skins and fur skins, raw
- 22 Oil-seeds and oleaginous fruits
- 23 Crude rubber (including synthetic and reclaimed)
- 24 Cork and wood
- 25 Pulp and waste paper
- 26 Textile fibres (other than wool tops and other combed wool) and their wastes (not manufactured into yarn or fabric)
- 27 Crude fertilizers, other than those of division 56, and crude minerals (excluding coal, petroleum and precious stones)
- 28 Metalliferous ores and metal scrap
- 29 Crude animal and vegetable materials, n.e.s.
- 32 Coal, coke and briquettes
- 33 Petroleum, petroleum products and related materials
- 34 Gas, natural and manufactured
- 35 Electric current
- 41 Animal oils and fats
- 42 Fixed vegetable fats and oils, crude, refined or fractionated
- 43 Animal or vegetable fats and oils, processed; waxes of animal or vegetable origin; inedible mixtures or preparations of animal or vegetable fats or oils, n.e.s.

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#### B. (Industrial) Intermediate and Machinery

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- 51 Organic chemicals
- 52 Inorganic chemicals
- 53 Dyeing, tanning and colouring materials
- 54 Medicinal and pharmaceutical products
- 55 Essential oils and resinoids and perfume materials; toilet, polishing and cleansing preparations
- 56 Fertilizers (other than those of group 272)
- 57 Plastics in primary forms
- 58 Plastics in non-primary forms
- 59 Chemical materials and products, n.e.s.
- 64 Paper, paperboard and articles of paper pulp, of paper or of paperboard
- 65 Textile yarn, fabrics, made-up articles, n.e.s., and related products

*(Appendix continued)*

(Appendix continued)

67	Iron and steel
69	Manufactures of metals, n.e.s.
71	Power-generating machinery and equipment
72	Machinery specialized for particular industries
73	Metalworking machinery
74	General industrial machinery and equipment, n.e.s. and machine parts, n.e.s.
75	Office machines and automatic data-processing machines
76	Telecommunications and sound-recording and reproducing apparatus and equipment
77	Electrical machinery, apparatus and appliances, n.e.s. and electrical parts thereof (including non-electrical counterparts, n.e.s., of electrical household-type equipment)
78	Road vehicles (including air-cushion vehicles)
79	Other transport equipment
81	Prefabricated buildings; sanitary, plumbing, heating and lighting fixtures and fittings, n.e.s.
87	Professional, scientific and controlling instruments and apparatus, n.e.s.
89	Miscellaneous manufactured articles, n.e.s.

### C. Final Manufactured Goods

61	Leather, leather manufactures, n.e.s., and dressed furskins
62	Rubber manufactures, n.e.s.
63	Cork and wood manufactures (excluding furniture)
66	Non-metallic mineral manufactures, n.e.s.
68	Non-ferrous metals
82	Furniture, and parts thereof; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings
83	Travel goods, handbags and similar containers
84	Articles of apparel and clothing accessories
85	Footwear
88	Photographic apparatus, equipment and supplies and optical goods, n.e.s.; watches and clocks

**Source:** All SITC codes except 91, 93, 96 and 97 are included in the analysis.

SITC is provided by United Nations Statistics Division, and is available at: <http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=14>

### Export Data of GMS Countries from China (US \$)

	Year	Primary	Intermediate and Machinery	Final
Laos	2000	6328186	2608	89876
	2001	7322958	113602	21489
	2002	9441171	8305	199885
	2003	11022891	27300	151656
	2004	12413597	64107	176399
	2005	17870506	89126	7053824
	2006	43429944	806755	5410056
	2007	64186448	2751629	18980901
	2008	107171726	2787091	24299944
	2009	325771084	3685068	37863031

	Year	Primary	Intermediate and Machinery	Final
Thailand	2000	1267996345	2881146751	231642811
	2001	1368762379	3081650725	263435038
	2002	1388832285	3855563323	355201163
	2003	2140223842	6152668228	533909831
	2004	2695086328	8154402121	690932524
	2005	2865736624	10419457594	706410949
	2006	3880020610	13023224983	1059182417
	2007	4615189283	16727859059	1322676370
	2008	5683699058	18533337702	1439674840
2009	4830062756	18434634724	1632231888	
Vietnam	2000	859671663	57587810	11887665
	2001	925203473	67918798	17663392
	2002	991060697	95112706	29718341
	2003	1192930428	162207431	101570235
	2004	2079289800	228972130	173726732
	2005	2095601899	274355999	182880047
	2006	1802726365	409517128	273832807
	2007	2238755919	641227901	346297005
	2008	2811130823	1037605487	487581160
2009	2939542377	1329399799	477797616	
Cambodia	2000	8329709	7036	51153972
	2001	9431431	552863	24820014
	2002	10168139	213782	14167814
	2003	13615118	3530483	8855821
	2004	14195736	9529994	6206167
	2005	13048254	9317709	4938957
	2006	24149729	7737862	3203764
	2007	38783465	7388224	4894190
	2008	26766400	926452	11135331
2009	24081166	937191	11873794	

**Source:** Calculation from UN COMTRADE.

#### Import Data of GMS Countries to China (US \$)

	Year	Primary	Intermediate and Machinery	Final
Laos	2000	2264072	28930770	3082047
	2001	1845695	49183025	3381201
	2002	2054476	49899954	1867004
	2003	1885674	93390053	2708801
	2004	1459658	78652927	7045876
	2005	2300694	95776211	5299563
	2006	3397736	156392409	8348457

(Appendix continued)

(Appendix continued)

	Year	Primary	Intermediate and Machinery	Final
	2007	3521943	153548325	7047860
	2008	5484168	253665026	8014945
	2009	10919649	321276221	40804119
	2000	339881961	1756864960	142003535
	2001	165170107	2001603107	166154717
	2002	226236266	2521923693	203194792
Thailand	2003	322946311	3171932014	319551479
	2004	370331243	4843170149	572135103
	2005	393149296	6684806769	690810626
	2006	441283633	8321635182	958618355
	2007	720243146	10000209787	1310078333
	2008	1010320267	12958740595	1666648074
	2009	1091610523	10820357490	1394024427
	2000	304302733	1131914218	101017166
	2001	352267603	1332217898	113289698
	2002	598643143	1346751995	202985317
	2003	1048893875	1812868842	320793044
Vietnam	2004	899782686	2944437283	415655446
	2005	1257026675	3904406595	482435737
	2006	1188581927	5670434711	595892001
	2007	1315172040	9706309037	870797267
	2008	1780851256	12088022000	1244849464
	2009	2652244307	11788629915	1835508138
	2000	9384766	132655884	22023623
	2001	12126996	168755729	23061780
	2002	8644767	215052528	27432217
	2003	7222388	255037406	32354419
Cambodia	2004	29142002	383500205	39101077
	2005	29102707	449301064	57340420
	2006	23520721	597670182	76318354
	2007	23908628	772881504	86428202
	2008	40187393	930674927	121997850
	2009	28149428	793198866	85415825

Source: Calculation from UN COMTRADE.

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## Notes

1. Vertical integration happens when a firm controls several steps in the production and distribution process, such as a firm having its own supply and distribution facilities. According to Ando (2006) the explosive increase in vertical intra-industry trade in East Asia is largely due to the expansion of back-and-forth transaction in vertically fragmented cross-border production process.
2. GMS comprises of Yunnan and Guangxi province of Peoples Republic of China (PRC), Thailand and CLMV (Cambodia, Lao People's Democratic Republic, Myanmar and Vietnam) countries. The GMS is a natural economic area held together by the Mekong River.
3. There has been no noticeable decline in total GMS trade despite global economic crisis indicating the strength of regional economic integration (Banik, 2011). This is in contrast to other comparable free trade areas. For example, in the case of Economic Community of West African States (ECOWAS) trade between member countries and their major trading partners in Asia and Africa has fallen because of global economic crisis (Banik and Yoonus, 2012).
4. See Xiaobo et al. (2011), Cai and Du (2011) and Li et al. (2012) for study-based evidence of rise in labour cost in China.
5. China's entry into WTO in 2001 has made it easy for many multinational firms to invest in China, an attractive investment destination (He and Lyles, 2008).
6. For more discussion about the theory of the gravity model, see Anderson and van Wincoop (2004).
7. Trade statistics for Myanmar are not available. Accordingly, we have to exclude Myanmar from our analysis.
8. For a detail classification, see the Appendix. SITC headings 7 and 8, contains both final manufactured items, and intermediate and machinery items. For our analysis, machinery items are treated as an intermediate item.
9. We use j-1 dummies to avoid dummy variable trap. For this analysis, Laos is treated as the base country.
10. In fact, fixed effect and random effect are going to yield similar results when all samples in the population are used for regression.
11. For more on the application of GMM techniques in the context of gravity equation see Arellano and Bond (1991) and Blundell and Bond (1998). This is a widely acknowledged that use of GMM techniques in the presence of small number of cross section element will increase the finite sample bias.
12. Hausman test indicated the appropriateness of 2SLS over LSDV for equation (1) and LSDV for equation (2).
13. For a detail analysis about direction of China-GMS trade flow see Banik (2011).

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