MNCs, FDI and Production Networks

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Abstract

Offshore sourcing and cross-border production networks have contributed to the rapid rise in recent years of trade in parts, components, and intermediate products. The trade patterns associated with production networks conform with standard considerations of comparative advantage. Full exploitation of the benefits of specialization at intra-product levels, however, requires transfers of FDI and technology from advanced to emerging economies. Unlike traditional horizontal FDI, these vertical FDI flows also conform with the laws of comparative advantage. This paper outlines the key determinants of vertical specialization and reviews the stylized facts pertaining to electronics trade between China and the U.S., Japan, and Singapore. It provides evidence on the activities of Japanese and American multinationals in East Asia and Latin America in the machinery sector. The findings are relevant to the current policy debate on the bilateral trade balance between the U.S. and China.

1. Introduction

Offshore sourcing and cross-border production networks have grown rapidly since the early nineties. They have been especially important in manufacturing, but have recently spread into services trade, where innovations in communications technologies have transformed many formerly non-tradable services into tradable ones.

In the context of production sharing, the dominant form of trade and integration tends to be vertical in nature. Production sharing and production networks bring together developing and developed countries in accordance with basic principles of comparative advantage, but multinational companies (MNCs) play a key role in facilitation and coordination by providing investment in capacity, technology transfer and managerial expertise.

This vertical form of intra-industry trade differs from the more traditional type in that products at various stages of completion move back and forth among participating countries in place of the cross-hauling of differentiated finished products in horizontal intra-industry trade. An excellent example is the pendulum flow of trade in the automobile industry between Detroit and Windsor, Canada. Unlike their horizontal cousins, vertical trade and investment flows may to a significant extent be explained with reference to traditional trade theories, including the Ricardian and Heckscher-Ohlin theories.

While these theories do not deal explicitly with foreign direct investment (FDI), it turns out that their basic predictions have significant explanatory power. The standard theories do not, of course, provide a totally comprehensive explanation, particularly with respect to implications of imperfect competition and scale economies, and the role of multinationals. Here, insights from the gravity model and from more recent explicit treatments of imperfect competition and multinational companies enrich our understanding of trade and investment patterns.

This paper provides an assessment of the current state of knowledge. Section 2 examines the contribution of the factor-proportions model to explaining patterns of vertical trade and investment flows. Section 3 considers the effects of production networks on the domestic economies of participating countries. Section 4 assesses the effects of production networks on the trade balance and the sensitivity of the trade balance to exchange-rate changes. Section 5 concludes with some brief policy-relevant considerations.

2. *Vertical Intra-Industry Trade and FDI*

The Heckscher-Ohlin model has been criticized for its inability to explain horizontal intra-industry trade. Analogous criticisms apply to the Ricardian model. Their focus on differences in factor-endowments and in technological knowledge, respectively, made it difficult to explain trade in differentiated products among highly similar advanced economies. This failure provided a major impetus for development of the "new" trade theories of Krugman (), Helpman and Krugman () and others.

Vertical intra-industry trade is a different story, entirely. It occurs in the context of cross-border production fragmentation and production sharing. Instead of producing finished products in their entirety, each country undertakes production of one or more phases of a good. The resulting trade patterns see parts and components as well as end products belonging to the same industry moving back and forth across borders. Well-known examples include production sharing in the auto industry, where U.S.-made parts flow to Northern Mexico to be assembled into passenger vehicles for shipment to the United States. Another example are the increasingly complex multi-country production networks in the electronics sector in East and South-East Asia.

As noted, an important feature of production networks is that instead of producing entire products, countries divide the various tasks among themselves. Determining how tasks are allocated among the participating economies is then a key question and the H-O model is actually very helpful in answering it. The answer turns heavily on factor endowment differences among countries and factor-intensity differences among the constituent activities of a production process. The Ricardian model, in which differences across countries in technical know-how matter, is also relevant. But in the context of production networks, technology transfers via FDI and multinational companies tend to reduce if not eliminate differences in technical know-how.

The essence of the argument is easily stated. If the various phases of production of a good can be characterized in terms of their factor intensities and if those factor intensities vary across activities and if countries differ in their factor endowments, then comparative advantage considerations based on Heckscher-Ohlin suggest that countries will tend to specialize in activities which make intensive use of their relatively abundant factors. Thus, labor-abundant countries will produce labor-intensive parts and components and undertake labor-intensive assembly, while capital- and skill-abundant countries will produce capital- and skill-intensive parts and components and undertake capital- and skill-intensive assembly. One reason production sharing works especially well between advanced and emerging economies is that there are larger endowment differences to be exploited.[1]

Unlike the basic Heckcher-Ohlin model, which assumes that countries initially produce every product and then exploit the opening of trade by specializing in accordance with the dictates of comparative advantage, in emerging economies “comparative advantage” is often more latent than real. An emerging economy may have a large pool of low-cost labor, but the infrastructure and production capacity needed to participate in a network do not exist. Before the

country can exploit its abundant and relatively cheap labor force and produce labor-intensive components and undertake labor-intensive assembly productive capacity must be created. This process is often accompanied by technology transfer from advanced countries. Foreign direct investment (FDI) and multinational companies (MNCs) play key roles here.

H-O and FDI

Although the basic Heckscher-Ohlin model does not provide for either FDI or multinationals, its precepts can provide guidance for predicting capital flows and explaining observed movements of FDI. Specifically, the bulk of vertical FDI would be expected to flow from capital-rich, advanced economies to labor-abundant emerging economies, or from more advanced emerging economies to less advanced emerging economies. Such flows are typically accompanied or followed by exports of capital goods from the former to the latter. Capital goods are composed of equipment, machinery, robotics, and other materials needed for the erection of production facilities.

If the emerging economy will be the source of end-product assembly, then FDI inflows would be expected to be followed by inflows of parts and components from the more advanced, FDI-supplying countries (and possibly from third parties)and by exports of finished products either to the FDI-supplying countries or to third parties. As noted, this would be the expected pattern if the role of the emerging economy in the production network is to provide labor-intensive assembly.

If, instead, the role of that country is to provide labor-intensive components for further processing by other members of the production network, then FDI inflows are expected to be followed by exports of parts and components. It is clear that patterns of trade will vary across

industries. In the auto-industry, relatively labor-intensive assembly is performed in Mexico, while in the aircraft sector relatively skill-intensive assembly is performed in the United States.

Charts 1 and 2 provide an example of the aforementioned patterns for Singapore and China. There was a rapid expansion of Singaporean FDI flows into the manufacturing sector of China, beginning in the early to mid-nineties. It was accompanied and/or followed in Chart 1 by rapid expansion of electronics parts imports and finished electronics exports by China. Cointegration and other tests confirm the statistical significance of the relationships. This suggests that FDI flows established production capacity for assembly of end products. In Chart 2, Chinese exports of electronics parts are seen to rise during the same period. The relationship between FDI and exports is also statistically significant, suggesting that FDI inflows also served to establish capacity for the production of labor-intensive parts and components for export.[2]

These trade and investment patterns are thus quite consistent with traditional comparative advantage considerations based on factor proportions. In a related study using panel regressions, Rahman (2007) finds that endowment differences among countries play a significant role in explaining patterns of vertical intra-industry trade.

Although we are observing this intra-industry trade at the country level, we know that multinationals play key roles in production sharing and production networks. The various phases of a production process may be carried out in different countries, but those activities are often undertaken by the overseas affiliates of multinational companies.[3]

Hence, production sharing relies heavily on coordination and transportation services. The activities of network partners must be coordinated and parts and products at various stages of completion must be repeatedly moved among network partners. Jones and Kierzkowski

(2000) provide a detailed analysis of the costs of "service links." Production sharing will take place only when the cost savings in production per se exceed the additional costs of service links.

In the standard H-O model, transportation and communication costs are ignored. In the trade literature, of course, such costs have long been modeled in the same manner as tariffs. To the extent, however, that communication costs, as well as transportation to a lesser extent, are subject to strong scale economies, the burden of those costs will decline as volumes grow. Once a communication network is in place, the associated fixed costs may be spread more widely as the level of production and trade increases.

To the extent that both communication and transportation costs are determined by the quality of infra-structure, two countries satisfying the comparative-advantage criteria of the factor-proportions model equally well, may nevertheless differ widely in terms of service-link costs. One will become involved in a production network, while the other will not. Differences in service-link costs may be due to inferior infrastructure, but also to governmental regulatory and other policies, etc. They may also arise as a consequence of legal issues, including contract and property rights. If hold-up and other dangers are more severe in one country than another, the former's "tariff" burden will be larger and its involvement in production networks more limited or non-existent.[4]

Production Sharing and the Gravity Model

To the extent that transportation costs vary with distance, the service-cost burden will rise and the involvement in production networks will be more limited. This suggests that variables associated with the gravity model may provide additional explanations for observed patterns of trade and FDI. As distance rises, the "tax" wedge expands and outsourcing and component trade shrink. It is important to note that in a multi-country production network, distance is a more

complex variable as the number of participating countries rises. If, for example, country A receives upstream components from country B, undertakes some processing and then ships the processed components to country C, then transportation costs in both directions will affect the profitability of production sharing. This suggests that clusters of countries in a region, such as South-East Asia, may be attractive network partners.

Unlike horizontal economic integration, where trade and FDI are substitutes, we would expect them to be complements in the context of production sharing and production networks. In horizontal intra-industry trade, distance makes exporting more costly and thus tends to be replaced by FDI outflows and local production for the local market. FDI is a positive function of distance. In vertical intra-industry trade, distance raises the cost of moving parts and components among network partners, thus reducing the benefits of production sharing and hence vertical FDI outflows. FDI is a negative function of distance.[5]

Other variables identified in gravity models as inhibiting trade will thus also inhibit production sharing and thus vertical FDI. Such variables include borders, legal and regulatory barriers, and language and cultural differences. Hence, two developing countries with very similar factor endowments and technological know-how and thus potential production-sharing partners for a given advanced country, may be quite dissimilar in their respective distances from the partner or in the thickness of their border. One will participate in a production network, while the other will not.[6]

It is not possible to determine by inspection of published FDI flows whether they are horizontal or vertical in nature. However, inasmuch as horizontal FDI tends to replace exports with local production for local markets, such FDI inflows would be expected to be negatively correlated with a decline in imports of finished goods (allowing for a rise in imports of capital

goods, as noted above). Until recently, much of the empirical evidence confirmed this expectation, mainly because until recently horizontal FDI flows among the advanced countries made up the major share of global FDI flows. The FDI flows depicted in Charts 1 and 2 were not accompanied by declines in Chinese imports, suggesting that the main purpose of the FDI flows was vertical rather than horizontal in nature.

The Role of MNCs

Since MNCs play a key role in foreign direct investment, information on the activities of their affiliates in FDI-receiving countries may provide additional insights. There is evidence that FDI by U.S. and Japanese multinationals in East Asia tends to generate affiliate sales that are dominated by non-local sales, while FDI by those same multinationals in Latin America (excluding Mexico) generates mainly local sales.[7] It is not yet clear what lies behind these differences of behavior, but country-specific trade and regulatory policies appear to play a role.[8]

Up to this point, the focus has been mainly on trade patterns at national and industry levels. For the principles and criteria that have been used to explain trade and investment patterns, it has not been necessary to have information on industrial structure. The Heckscher-Ohlin criteria do not, in the first instance, depend on industry structure, although many of the specific results of the H-O model follow from the assumption of perfect competition. We know that FDI flows are managed by large companies, hence evidence of vertical FDI flows is evidence of imperfect competition; but the basic principles of comparative advantage still apply.

Nevertheless, it becomes important at some point to know more about the nature of the firms that engage in FDI and production sharing. Kimura and Ando (2003) and Ando et al. (2006) provide some evidence on Japanese companies involved in production networking in

South-East Asia. In the first study, Japanese firms with more than 1,000 employees operated the largest share of affiliates in East Asia in 1995 (around 30 percent), but even relatively small firms (in terms of number of employees) are involved in FDI. In manufacturing, for example, the share of firms with 200 employees or less was 27 percent compared with a 28.2 percent share for firms with over 1,000 employees. Smaller firms, however, tended to operate fewer affiliates abroad than larger firms.

3. *Domestic Effects of Production Networks*

Apart from its effects on trade, production sharing affects domestic output, employment, and factor returns. "Offshoring" has become a political issue in the United States because it is believed by many to reduce wages and create unemployment. The evidence is scant as yet and what evidence there is gives mixed results. It is certainly true that production sharing can reduce wages and employment; but it does not have to.

In the H-O model, production sharing (or intra-product specialization) raises output and employment in the sector in which it occurs, while reducing both in the rest of the economy. This is important: the outsourcing sector expands because the effect of outsourcing is equivalent to an improvement in technology. (The production possibility curve expands along the axis of the industry in which cross-border outsourcing takes place.)

Since the model assumes perfect inter-sectoral labor mobility and flexible wages and prices, there is no unemployment; just an inter-industry reshuffling of workers. In this model, outsourcing of labor-intensive activities in a labor-scarce country is equivalent to labor-saving technological change, but as noted, the effect is an increase in output and employment in the sector in which it occurs. In other words, overall employment rises in spite of the introduction of

outsourcing. Jobs are lost in the specific activity which is outsourced, but new jobs open up in other phases of production and the latter change dominates the former. Throughout the economy, wages rise relative to capital rentals or skilled wages if outsourcing occurs in the labor-intensive sector. If outsourcing of labor-intensive activities occurs in the capital- or skill-intensive sector, wages fall relative to capital rentals or skilled wages fall throughout the economy. When labor is sector-specific and thus not mobile, outsourcing opens inter-sectoral wage gaps.

As noted, the effect on unskilled wages relative to skilled wages or capital rentals depends on the industry or sector in which cross-border production sharing occurs. The basic Heckscher-Ohlin model starts with a situation in which both countries possess the ability to produce both goods (in a 2x2x2 model). They have the same technical know-how. In a production-sharing environment, the labor-abundant country outsources the capital- or skill-intensive component(s). As a practical matter, many emerging economies do not initially possess the required productive capacity and must import it via FDI inflows and technology transfers. The FDI inflow and creation of capacity has the effect of altering the country's factor endowment in favor of a larger capital stock. (The production possibility curve shifts out along the axis of the sector receiving the FDI, if capital is sector-specific; otherwise, shifts along both (all) axes take place.) From the point of view of an emerging economy, therefore, joining a production network is an important avenue toward capital and technology accumulation.

4. *Production Networks, the Trade Balance and the Exchange Rate*

Production sharing necessitates a reinterpretation of what trade balances and changes in trade balances tell us. When China exports finished electronics products to the United States, the

total value of those exports will be greater than the Chinese value-added that is embodied in them. If, as in an earlier example, China assembles 10 dollars worth of imported components into a finished product, which is then sold in the United States for $12, the traditional interpretation is that the U.S. bilateral trade balance with China has deteriorated by $12. While such an interpretation is not entirely incorrect, the information it conveys is inaccurate. Strictly speaking, the U.S. balance with China has deteriorated by $2, while deteriorating by $10 with respect to the countries which supplied China with components. In a world where more and more products are made in more than one country, bilateral trade balance considerations are rapidly losing their value.

In the first decade of this century, China's share of U.S. electronics imports rose sharply, while the shares of both Singapore and Taiwan fell. This is shown at the top of Charts 3 and 4 for the two countries, respectively. This clearly looks like China took market share away from the other two countries. At the same time, however, exports of electronics from Singapore and Taiwan to China rose steeply and rapidly. Most of those exports, moreover, consisted of electronics parts and components, while the bulk of the increase of China's shipments to the United States consisted of end products. This suggests that, rather than taking market share away from Taiwan and Singapore of the entire product, it is more likely to be the case that China took away market share only in labor-intensive electronics assembly.[9]

Finally, production sharing affects the sensitivity of the trade balance to exchange-rate variations. In the presence of production sharing, a rise or fall in the value of a country's currency affects imports and exports of network-based trade in offsetting directions. A depreciation of the Mexican peso against the U.S. dollar raises the peso price of imported components from the U.S., thus raising the cost of vehicles assembled in Mexico. But the

depreciation lowers the dollar price of the peso and thus the dollar price of vehicles imported from Mexico. The traditional effect of the peso depreciation is thus limited to the Mexican value-added contained in the exported passenger vehicles. The effect of exchange-rate changes on network-based trade is weakened.

5. Concluding Remarks

The emergence of cross-border production networks has breathed new life into the traditional Heckscher-Ohlin model. Comparative advantage based on factor proportions is able to explain a significant part of vertical intra-industry trade and foreign direct investment. The patterns of intra-industry trade and investment flows that have been observed in recent years are fundamentally different from those that have existed for decades. In addition to explaining existing patterns, consideration of comparative advantage based on factor proportions makes it possible to think coherently about where future challenges to the competitiveness of advanced countries are likely to come from.

Cross-border production sharing means that traded end-products may contain components from many countries, which not only reduces the value of bilateral trade-balance calculations, but which implies that trade policy actions taken against the country which exports the finished product will end up affecting not only that country, but all countries whose components are embodied in the product.

End Notes

1. These issues have been explored at the theoretical level by, for example, Arndt (1997, 1998), Deardorff (2001), ...

2. Similar patterns can be found for U.S. and Japanese FDI in China. For details, see Johnson and Rahman (2007).

3. In a recent study, Ando et al. (2006) find that although the affiliates of MNCs play a key role in production networks, particularly early in their formation, arms-length trade with local companies tends to rise as networks become more established and agglomeration and clustering occur.

4. See Helpman (2006) for a comprehensive discussion.

5. See Barba Navaretti and Venables (2004).

6. In a recent study of vertical intra-industry trade involving China, Ruiz et al. (2007) find significant effects associated with a number of gravity-equation variables.

7. See Ando et al. (2006) and Huemer (2007).

8. Huemer (2007) finds that the nature of investment treaties and their implementation make a difference.

9. These charts are taken from Schultz et al. (2007).

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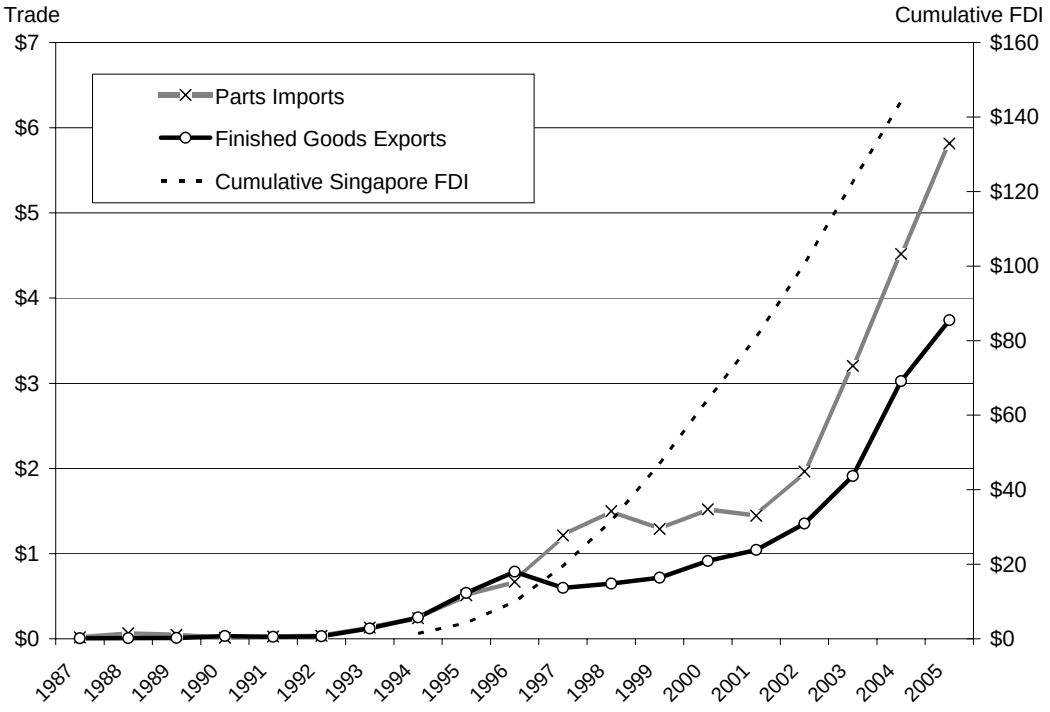

Chart 1

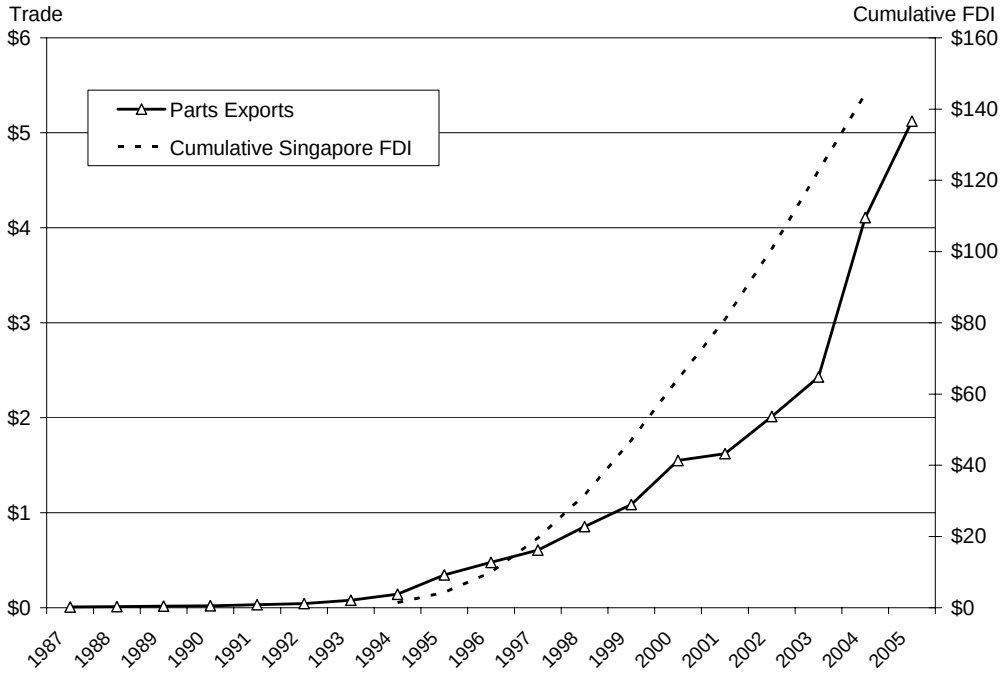

Chart 2

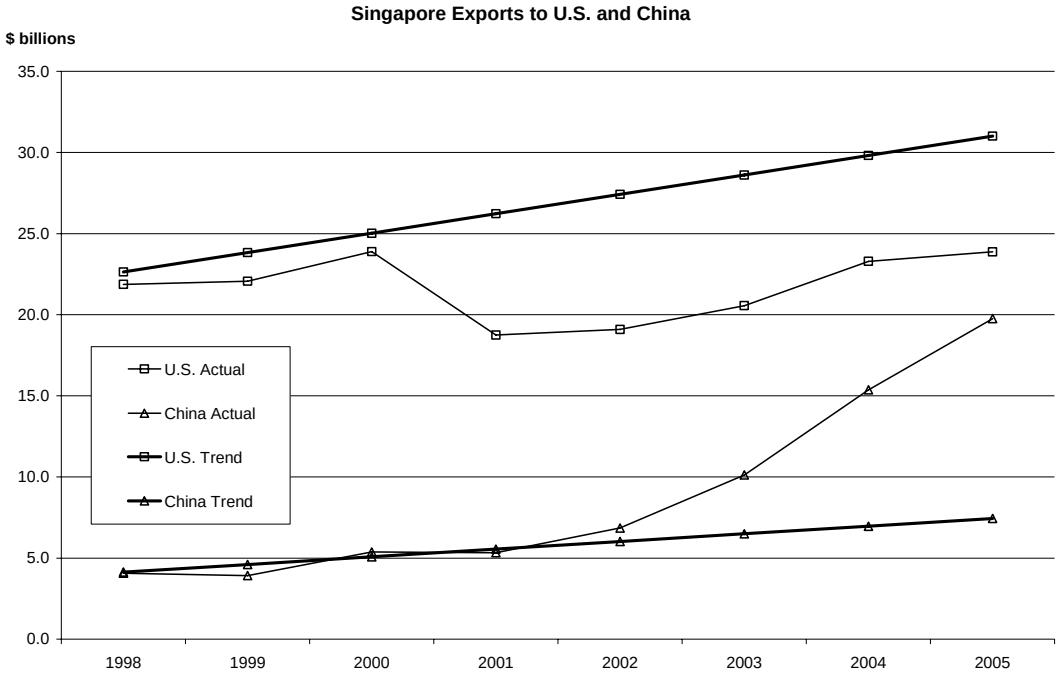

Chart 3

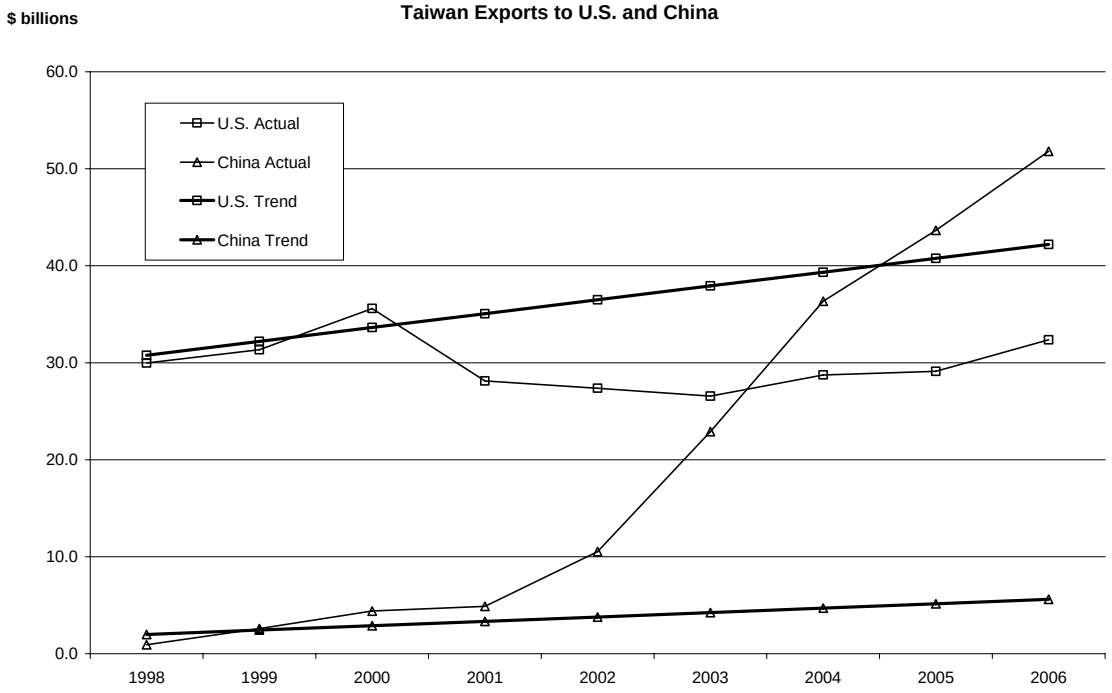

Chart 4