Economic Effects of China's Accession to the WTO on the Asia-Pacific Economies*

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China's entry to the World Trade Organization (WTO) will have an influence on the trade patterns of the Asia-Pacific economies in two ways. The first one is a static impact effect that to be realized immediately after China's accession to the WTO. The second is a dynamic one that will occur as a result of China's internal policy reform. For this dynamic effect to occur, however, China needs to solve several problems associated with political and systemic constraints. In this paper, a simple general equilibrium model of China is set up to determine both the static and dynamic effects and the gravity equations of China's Asia-Pacific neighbors are estimated to assess the welfare effects of China's accession to the WTO. This paper raises a question regarding the economic effects of China's entry to the WTO, that is, whether China's accession to the WTO will contribute to overall regional growth rather than benefiting only a small number of countries (or only China). In light of the analysis in this paper, the answer to this question is affirmative. As long as the Asia-Pacific Economic Cooperation (APEC) economies remain open, not only China itself, but also the other members will benefit from China's accession to the WTO. Another question this paper deals with is the static and dynamic effects of China's accession to the WTO on the other APEC members. China's accession to the WTO will have effects on its own policy-making. The internal reform following its accession to the WTO will enhance China's total factor productivity (TFP) as the changes imposed by the WTO will remove barriers to efficiency and increase investment in human and physical capital.

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1. INTRODUCTION

After fifteen long years of negotiation, China has gained entry to the World Trade Organization, which signals that China is ready to take its place amongst the global economic powerhouses and that it is prepared to assume the responsibility of playing by its rules. China's accession to the WTO provides opportunities and challenges for both China and the rest of the world in general, and the Asia-Pacific economies in particular. Market access and tariff reduction¹ will offer potentially enormous commercial opportunities for foreign firms. China's new WTO membership will increase the amount of bilateral trade flow with its trading partners, as China becomes more open to new imports and obtains good prospects for new growth in various sectors of the economy.

The world economy has already benefited from the expanding trade relationship with China over the past twenty years. The outside world will continue to gain from China's accession to the WTO. China is one of the world's largest markets. China's share of the world's imports was 3.14 percent in 2001. It is the second largest market in Asia behind Japan whose world import share was 5.44 percent in 2001. Exports to China will provide jobs in those sectors that are key parts of the engine of growth in many countries. It is true that the outside world would incur short-term losses in some sectors such as footwear and textiles, but these short-term dislocation costs should be weighed against the long-term benefits ascribable to the operation of comparative advantage. It is notable that China will be taking jobs primarily from those countries in Latin America and Southeast Asia.

With unprecedented access to China, opportunities in sectors such as agriculture will expand remarkably. A range of other industries will expand as well, notably financial services, telecommunications and information technology. It is also important to note the benefits to foreign consumers who have access to inexpensive imports. China's entry into the WTO will help foreign consumers to enjoy low-price imports from China such as toys, sporting goods, footwear, clothes, plastic goods, suitcases, and furniture.

China has already become the world's seventh largest trading country, yet it has avoided the constraints posed by the international trading system, by remaining outside the system. What has caused the Chinese government to comply with the standards of the international trading system? China has agreed to the terms of the WTO to take advantage of the increased foreign competition as a means of accelerating its domestic economic reform program.² With the help of increased international competition, China can look forward to facilitating the process of transforming inefficient state-owned-enterprises. At the same time, as Peter Nolan (2001) puts it, China can

¹ China's industrial tariffs will be down to 17 percent from an average of 21 percent, and agricultural duties to 14.5-15 percent. China will also end export subsidies of agricultural products. In the services area, such as telecommunications and financial services, foreign firms are expected to benefit from increased market access.

² Nicholas R. Lardy (2002).

take advantage of market opening to catch up with the world's leading corporations. China has resorted to industrial policies with a view to building large corporations comparable to those based in more advanced countries. While China's large firms had achieved huge advances by the late 1990s, global firms improved revolutionarily, leaving China's large firms even further behind the global leaders than before its economic reform.

By strengthening the private sector, China's entry into the WTO will help invigorate the position of the private enterprises and allow many Chinese to work outside of the state system. The presence of more foreign firms operating in China will enhance competition in the marketplace, which will raise productivity and income. This will help improve both working and environmental conditions in China. Getting resources into the hands of the Chinese citizenry is also the best way for them to articulate demands and press for reform over the long term.

China's commitment to open its markets requires a more profound transformation of its economy. While China's membership to the WTO will contribute to achieving higher standards of living for its citizens and increased growth for its economy, it will bring pressure on the Chinese government to abide by the rules of the global trading system. China will have to undertake further economic reforms that will change the country into a more market-oriented one.

China's accession to the WTO will inevitably induce policy changes. The benefits of an appropriate economic policy cannot be exaggerated. Parente and Prescott (2000) show how policy differences across countries lead to differences in the total factor productivity (TFP) among them, which in turn explains differences in income. They define aggregate production³ as the maximum output that can be produced given not only the technology constraints but also the policy constraints on the use of technologies.⁴ With increasing factor mobility, therefore, it is the differences in policies not in the stock of useable knowledge or physical capital that help explain the differences in income levels across countries. If the Chinese government policies change to facilitate enhancing the TFP, welfare effect ensuing the China's entry to the WTO will be reinforced.

Given these external and internal welfare effects of China's accession to the WTO, two sources of the economic effects can be inferred. From the viewpoint of the outside world, the first one is a direct effect of China's integration into the world trading system, which is attributable to market expansion and is expected to ripple through the outside world. The second one, an indirect effect, feeds back from its effect on the productivity and output changes in China resulting from the transformation of the economic structure and policy measures.

By focusing on these two sources of the effects that China's entry to the WTO will have, this paper looks into the implications of China's accession to the WTO for the trade relationship between China and the outside world, particularly in the

³ It is defined as the maximum output that can be produced given the quantities of the aggregate inputs.

⁴ See Parente and Prescott (2000) chapter 6 for details.

context of China's relationship with its Asia-Pacific Economic Cooperation (APEC) neighbors.

The rest of the paper is organized as follows. Section II will first assess the current condition of China as a major trading partner of the Asia-Pacific region, which indirectly indicates the extent of the effects that China's entry to the WTO will have on its neighbors. Then it will provide some implications of China's accession to the WTO. Then Section III will discuss the welfare effects of China's accession to the WTO on the Asia-Pacific economies. Section III will also provide a simple general equilibrium analysis of the counterfactual shocks ensuing China's entry to the WTO. Then it will employ the estimation results of the gravity model to assess the effects on the trade flows of China's neighbors in the Asia-Pacific region. Section IV will conclude the paper.

II. CONTEXTS AND IMPLICATIONS OF CHINA'S ACCESSION TO THE WTO

The effects of China's entry to the WTO on the Asia-Pacific economies will be determined by those variables that have been instrumental in shaping the trade relationship between China and its neighbors in the Asia-Pacific region. Among others, China's current economic conditions have important implications for that trade relationship and so are the various constraints and problems that China's economic system faces.

A. Current Economic Conditions of China

*Economic Fundamentals*⁵

Despite a prolonged slowdown in major power's economies, China has showed a remarkable economic performance. In terms of economic growth, price stability, export performance, foreign reserve holdings, and trade balances, China's records have been exceptional. Moreover, China's economy possesses a great resilience. When the financial crisis afflicted the Asian economies, some experts predicted that China would end up in the list of the victims. That prediction proved wrong. Instead, China was able to take advantage of the Asian economic crisis. This indirectly shows that China has taken a different path from that of the other Asian countries in pursuit of its economic development.

China's economic progress owes much to its vast growth potential. One of the most important sources is political stability. The Chinese government has relied on socialist elitism in order to maintain its political stability. Under strong political lead-

⁵ The following is based on APEC (2001).

ership, it has been able to carry out unwavering open-door policies. For example, having faced the threat of economic downturn, China has continually carried out active fiscal policy along with expansionary monetary policy. It has cut down interest rates eight times during the past four years and has issued bonds worth US\$ 3.8 billion in order to finance social overhead capital projects.

Another source of growth is the foreign firms stationed in China. They have taken the lead in expanding China's exports. As long as the foreign direct investment flowing into China continues to increase, these firms will continue to enhance China's economic resilience. It is very likely that the flow of foreign direct investment will continue to increase because, with an almost unlimited supply of labor, China is able to provide labor to foreign investors for modest wage rates.

Still another source is scale and network economies. Undoubtedly, China is one of the few countries that can accomplish scale economies in its own market. Accomplishing economies of scale within a country has not been possible even for either Russia or Japan. For the European countries, it was not until the passage of the Single European Act that they began to look forward to realizing the economies of scale throughout Europe. At the same time, overseas Chinese merchants make available business networks that can be intensively used to expand export markets, facilitate capital movement, and technology transfer.

Finally, two exogenous factors have contributed to the sustained economic growth: self-sufficiency in food production and energy supply and relatively stable political relations with the United States. Self-sufficiency in food and energy has made it possible for China to increase its net foreign reserve holdings, while the warm relations with the United States have induced the World Bank and Asia Development Bank to provide financial resources to China's public investment. The United States has provided a market for China's exports and allowed its production facilities to be moved to China.

*External Economic Relations and Trade Policy Regime*⁶

As one of the largest trading countries in the world, China now accounts for about 4.3 percent of the world's exports and 3.8 percent of world imports in 2001. Given the fact that China's world export and import shares were both less than one percent in 1980, it is remarkable that China has become a major trading partner of the outside world over the years. China's export share in the APEC's total exports has also increased from 2.6 percent in 1980 to 9.3 percent in 2001, while its import share in the APEC's total imports has increased from 2.7 percent to 7.8 percent. China's exports and imports have been growing faster than any other economies in the region.

In line with its open door policy, China has continuously lowered its tariff rates.

⁶ The following is based on China's 2001 Individual Action Plan.

The simple average tariff rate was brought down to 23 percent from 36 percent as of the end of 1996. It was further reduced down to 17 percent in 1997 and to 16.7 percent in 1999. As of 2001, China's simple average tariff rate was 15.3 percent. With the tariff adjustments made on 3462 items (HS 8-digit) which account for 49 percent of all tariff lines, China's import tariff lines have come to cover 7111 items (HS 8-digit). With its accession to the WTO, China has promised to bind all the tariff lines and reduce the tariff rates in accordance with the time schedule described in the terms of entry. At the same time, in order to enhance the stability and transparency of China's tariff policy, the Chinese government instituted legal procedures that stipulate how to identify items suitable for imposing tariffs, and that specify how to adjust the tariff rates.

The Chinese government has also made efforts to reduce non-tariff measures since 1992. As of the end of September 2001, only 351 HS tariff lines (HS 8-digit) were left among those non tariff measures. The accession to the WTO forces China to phase out most of the non-tariff measures in accordance with its commitments to the world trading body. As of the end of September 2001, the non-tariff measures were applied to 235 import lines (HS 8 digit). Among them 44 products (HS 8-digit) were subject to import license in China and 72 items (HS 8-digit) were included in the category of other non-tariff measures.

B. Constraints Facing China

While with the accession to the WTO China is most likely to continue to maintain its high economic growth, this is conditioned on its success in removing various constraints it faces in the transition of China's economy. In particular, the accession to the WTO will put pressure on China's hybrid "dual-track" system in which strong political controls and growing market influences coexist.

Dual-Track Economy

In carrying out the economic reform, China has been resorting to the "dual-track" system in which a market track and a plan track coexist in the state industrial sector. This system relies on "marginal" liberalization with "inmarketization" on the one hand and reduction of bureaucratic barriers to the state-owned enterprises on the other.⁷ In the dual-track system, the speed of liberalization can be adjusted to overcome the political constraints associated with price liberalization. The speed of liberalization is a function of these political constraints.

The dual-track system hinders a smooth change to an open economy unless a highly authoritarian political system is overhauled. China's accession to the WTO will work as public pressure against the dual track, which will force profound changes

Li (1997, 1081)

in the dual-track system. The dual-track system is prone to corruption. In this system, firms contract a fixed amount of deliveries between them at planned prices fixed and sell all residual output produced by firms at market prices, with all profits from this residual output accruing to firms.⁸ Since privileged buyers have the right to purchase goods at the planned price that is lower than the market price, they have an incentive to resell the goods on the market and cash in rents. The dual-track system has also contributed to increased diversion by officials in the plan track of the production under the planned quotas by reducing the transaction costs of selling goods diverted from the state enterprises. The new rents the dual-track system generates have been a source of the public discontent in China, where popular support for the reforms works as a precondition for their sustainability.⁹

Soft Budget Constraint

State ownership involves inefficient allocation of resources. At the same time, past reforms have left the state industrial sector littered with ineffective regulations.¹⁰ The cost of the state-owned enterprises is hard to defend. Investment is often wasted. State enterprises produce goods that are not sold. The soft-budget constraint problem refers to a situation in which the socialist planner cannot get rid of the money-losing state firms. Although this problem is found in both socialist and capitalist economies, it has been a more important concern in socialist economies.¹¹

The soft-budget constraint has made it difficult to restructure the unprofitable state owned enterprises, stop paying subsidies to the money-losing firms, reallocate resources across sectors, and keep the government expenditures under control. Cutting subsidies is one of many ways to "harden budget constraints," which will reverse the consequences of the soft-budget constraint. A more realistic way of dealing with this problem is to look at the effect of the increased incentives on productivity growth. The "hardening of budget constraint" can be defined as a matter of institutional design rather than a matter of policy choice.¹² In this regard, China's accession to the WTO is expected to bring in changes that will result in the hardening of budget constraint.¹³

The state industrial sector is still indispensable to China's economic and social stability as it employs more than 45 percent of the workforce.¹⁴ However, with easy sources of growth potential running out, China cannot afford to have luxury not to overhaul its state sector. It has to let the marketplace hold sway over allocating

⁸ Roland (2000, 132).

⁹ Roland (2000, 148).

¹⁰ See *the Economist* (2000) for a pessimistic interpretation of China's reform process.

¹¹ Roland (2000, 2: 3).

¹² Roland (2000, 214-215) provides discussion on soft budget constraints seen as a dynamic, endogenous, commitment problem.

¹³ It is a matter of controversy whether China changes as the result of WTO accession. See *the Economist* (2002) for dissenting opinion.

¹⁴ *The Economist* (2002, 4).

resources efficiently.

C. Challenges Ahead

Liberalization

Trade agreements are an external commitment that promises trade policy reforms. Both regional integration and WTO accession obligate China to accelerate its economic reform. China has already taken measures to fulfill its share of obligation toward achieving the goals of the APEC process and has made a great effort to liberalize its trade and investment regimes over the years. Nevertheless, the WTO disciplines will be much more comprehensive and forceful. While the APEC itself is in the form of a forum in which the members voluntarily undertake trade and investment liberalization, the WTO is an entity that rules over its members regarding trade policy, dispute settlements, and trade negotiations. The policy measures that had to be taken by China on its participation in the APEC process are not as significant as those that have to be taken in the wake of its entry to the WTO.¹⁵ The accession to the WTO, therefore, will play another important, but more critical role in China's liberalization process.

With China's entry to the WTO, significant changes are expected to be inevitable in China's conduct of foreign trade and investment policies. China's entry to the WTO will expedite its internal policy reform process, which should raise China's TFP. Parente and Prescott (2000) assert that a country experiencing a permanent change in its political economic institutions is able to converge to a significantly higher balanced growth path. Policy changes contribute to enhancing TFP so that the policy differences across countries account for a major part of the differences in international incomes.¹⁶ With almost identical rates of return on investment between countries and global availability of knowledge stock, the policy differences are instrumental in explaining the TFP differences. For example, Japan was far below its long run growth path before an increase in the TFP was made possible by the occupying American military forces. When they imposed major changes in Japan's political and economic institutions, however, Japan was able to converge to a higher growth path.¹⁷

While in general policy determines how technology is used or how its use is constrained, it will influence, particularly in case of China, how fast the transition from the dual-track to the market mechanism is made. Policy differences lead to the TFP differences because they change the aggregate production function of the economy through their effects on the use of technology. The aggregate production function is defined as the maximum amount of output that can be produced given both the

¹⁵ See Bacchetta and Drabek (2002) for the post-accession experience of the transition economies with regard to the effect of WTO accession on policy reforms.

¹⁶ For a total capital share in GDP equal to $2/3$, a given relative TFP difference results in relative steady-state output differences equal to a factor of 3.

¹⁷ Parente and Prescott (2000, Ch 5).

technology constraints and the constraints on the use of technology ascribable to policies.¹⁸ When a government protects those who are tied to a particular production process with vested interests, constraints on technology unfavorably alter the aggregate production function. Changes in policy regime induced by the WTO will reduce down barriers to enhancing firm's efficiency and investing in human and physical capital. The transition from the two-track to an entirely market-based economy is expected to accelerate after the WTO accession. The ensuing adjustment costs will be considerable, but should be more than the offset by efficiency gains. Such transition would be highly valuable, if China is able to change its domestic economic policy to enhance market accessibility, stamp out corruption, and improve governance.

Political Reform

It is troublesome, however, that the biggest challenge to the Chinese economy is not so much the structural economic reform as the sluggish political reform. The structural economic problems undoubtedly pose a threat to the Chinese economy: the liquidity problem in the financial sector, the increasing public debt, and the consequences of the economic downturn in the United States are all likely to aggravate the structural economic troubles. China is not alone in suffering from the aftermath of structural adjustment, and is not necessarily behind the other countries in coping with it. However, what is more critical in the long run is to consolidate the commitment of China's political leadership to the transition toward the market economy. Structural adjustment with a drastic political reform will make it possible for China to enhance its economic efficiency and to secure social stability. Moreover, it will rid China of the rampant corruption resulting from the abuse of power and establish the rule of law. Corruption has been responsible for lowering economic efficiency and has contributed to deepening economic inequality.

It is also ominous that the communist leadership does not want to lose control over its vested interests even though it has acquiesced to adopt the market principle marginally. In that case, China cannot fully take advantage of the market opening and reforms. For example, although thousands of the state-owned enterprises (SOEs) are suffering from debts, they are exempted from the reforms since the party leadership and local officials want to retain them as devices for sustaining their vested interests. If China does not take measures to reform the SOEs, the benefits of China's accession to the WTO will not come to full fruition. Moreover, since the ownership structure has a great influence on profitability and productivity, the reform of the SOEs is no longer a problem of firms only, but also a matter of governance structure and power and a control over the economic resources and vested interests. Although capital structures, taxes, and welfare burdens have had a significant effect on the performance of the Chinese enterprises, the SOE's productivity growth has lagged behind that

¹⁸ Parente and Prescott (2000, 82).

of the private firms with other ownership structures.¹⁹

Discussion

The question now is whether China will be able to keep up its remarkable economic performance in the future so that its impact on the trade patterns of the Asia-Pacific economies may persist. Is it possible for China to sustain high economic growth after its accession to the WTO? Despite complicated problems, cautious optimism prevails. It is based on several positive indicators concerning policy reforms.²⁰ First, the Chinese government's medium-to-long-term structural adjustment plans seem to have worked. They have succeeded in sustaining price stability and expanding growth potential. Second, China's external economic relationship is also promising. The coming Beijing Olympic Games as well as China's accession to the WTO will bolster final demand and contribute to income growth. Third, in the composition of the final demand, the share of consumption expenditure is increasing. China has relied on foreign import demands in its management of aggregate demand. China's export oriented development strategy has succeeded in attracting capital from Hong Kong and Taiwan that are readily combined with the vast supply of labor in China. On top of it, the emergence of middle-income households will boost China's domestic purchasing power. Consumption expenditure will constitute a solid component of the final demand in the future. Fourth, labor productivity will be increased by the infusion of high skilled labor educated abroad into China. Technocrats, foreign educated experts, and Chinese residents in Hong Kong and Taiwan all provide a pool of competitive human capital that will enhance the total factor productivity. Fifth, China is the second largest country in terms of foreign reserve holdings, which amount to about US\$ 240 billion. China is second only to Japan and is virtually free from the danger of foreign debt crisis. Sixth, China is about to establish several "local axes of growth" throughout the country, which will be spread out from the eastern coastal provinces toward the western inland areas. In the past, the regional development pattern was characterized by the inflow of foreign direct investment and mobilization of rural surplus labor. With market opening and reforms, the coastal provinces have attracted most of foreign direct investment and migrant labor into themselves. The differences in returns to capital and wage rates between the coastal areas and other provinces have contributed to the growth disparity. Thus, a balanced regional development resulting from the established local axes of growth will help build up the foundation for an ever increasing industrial and consumer demand.

D. Trade Relationship in the Asia-Pacific Region

The trade structure of the Asia-Pacific region will determine the extent to which

¹⁹ Zhang et al. (2002).

²⁰ See Lardy (2002) for related discussion.

the effects of China's accession to the WTO are felt on its neighbors in the Asia-Pacific region. The trade-related features of the Asia-Pacific economies shape the conditions through which the spillover effects are transferred.

Intra-regional Trade

Diversity and interdependence characterize the Asia-Pacific economies. While these economies differ in their stages of development, income levels, market size, and openness, they are experiencing a growing interdependence among themselves. This increasing interdependence is unambiguously indicated by the increasing amount of trade flows within the region. In particular, the ratio of intra-regional trade in the Asia-Pacific region is much larger than that of the North American Free Trade Agreement (NAFTA), and even larger than that of the European Union.

It is important to note that the Asia-Pacific region has become not only a vast market for its own exports, but also a principal source of its imports. The increasing ratio of regional exports and imports indicates the growing importance of the Asia-Pacific community to itself relative to the outside world. At the same time, the rate of change in this direction is accelerating. Given the large differences in income levels and absorption capability, increasing interdependence is remarkable.

Bilateral Trade Flows

The composition of intra-regional trade is also changing.²¹ In the majority of the cases, each member's share of the imports from the other members in its total amount of imports is increasing relative to that of the exports. This increase in the individual share reveals that each member's dependence on the other members as its source of resources becomes increasingly more important than its dependence on them as an income source. The fact that the importance of regional trade partners as the import sources is increasing implies that the reverberating effects of China's accession to the WTO on its trading partners will be substantial since China has already become an important source of the imports for the other member economies.

On the other hand, economic diversity in the region has caused the member economies to have different export patterns in different markets, which implies that their production (diversification) patterns are different. The developing economies in the Asia-Pacific region have experienced a unique process of industrialization in which a leading country's comparative advantage in certain sectors of manufacturing moves from the leading country to others.²² In consequence, manufacturing has spread out all over the region, and the less developed area in the region has adopted specialization patterns in accordance

²¹ See Lee and Ryou (1997) for further discussion.

²² This advantage initially allows firms in the leading country to pay higher wages than those in other countries. However, with an increasing demand for their goods, they can no longer afford to pay higher wages. Overtime, firms have to move their plants to another country as they find it profitable to set up manufacturing base elsewhere.

with changing comparative advantage.

Intra-industry Trade

The pattern of comparative advantage is not the only mechanism that explains the trade flows across borders. Trade based on increasing returns to scale (IRS) and product differentiation explains trade in the identical industries particularly when the differences in factor proportions are not very large between countries. The Grubel-Lloyd index²³ is a useful tool for assessing the degree of such intra-industry trade flows.

As shown in Table 1, across each of their respective trading partners in the region, Peru has the lowest average Grubel-Lloyd index with a value of 0.038, and Hong Kong has the highest value of 0.579. The fact that Hong Kong has the highest index can be attributed to its special trade relations with China: Hong Kong has long played a significant role in providing an outlet for China, whereas China has provided Hong Kong with access to its production base. Countries with lower indices are expected to have a substantial amount of the trade based on comparative advantage, while those with higher indices are more likely to engage in the trade based on product differentiation and scale economies.²⁴

China's Grubel-Lloyd indices is just below the average of the APEC members included in the data set. Under the assumption that the excluded APEC members are relatively labor-abundant, however, China's is likely to be above average in the complete data set. This implies that the effects of China's accession to the WTO in the Asia-Pacific region will be fallen "significantly" on those countries with the Grubel-Lloyd indices similar to that of China. The top notch of those countries whose specialization pattern rests on comparative advantage will be as much affected as the lower end of those countries whose specialization is based on scales economies and product differentiation. Yet this conjecture should be taken with caution, since index is not a perfect indicator. Inconsistency in industrial classification and the presence of trade in intermediate goods

²³ The Grubel-Lloyd index indicates the extent to which intra-industry trade based on increasing returns to scale (IRS) and product differentiation enables a country to simultaneously import and export varieties of a particular product. This index is calculated from the share of intra-industry trade in total trade.

$$GL^i = 1 - \left[\frac{\sum_k [M_k^i \cdots M_k^i]}{\sum_k (M_k^i + M_k^i)} \right]$$

GL^i is equal to zero in the absence of intra-industry trade, but it is equal to one if there is only intra-industry trade. Thus, if the bilateral Grubel-Lloyd indexes are relatively large in a group of samples, it can be inferred that a relatively large proportion of bilateral trade in this group is two-way trade in differentiated products. See Evenett and Keller (2002, 288).

²⁴ The bilateral Grubel-Lloyd indices of seventeen members are calculated from data on all manufactured goods traded at the four-digit SITC for country pairs with positive amounts of trade. Each of these seventeen countries has up to twenty bilateral import relations against its respective trading partners, and each of them buys up to 82 four-digit SITC items from every economy in the Asia-Pacific region. The bilateral data sets for the seventeen members cover from the nineteen to twenty four year time periods.

may prevent the indices from exactly measuring the share of trade attributable to IRS and product differentiation.²⁵

TABLE 1. AVERAGE GRUBEL-LLOYD INDICES

Grubel-Lloyd Index			Grubel-Lloyd Index		
	?	?		?	?
Australia	0.226	0.151	Malaysia	0.228	0.200
Canada	0.153	0.147	New Zealand	0.150	0.132
Chile	0.053	0.073	Peru	0.038	0.065
China	0.190	0.161	Philippines	0.157	0.156
Hong Kong	0.579	0.208	Singapore	0.285	0.202
Indonesia	0.115	0.113	Thai	0.168	0.166
Japan	0.153	0.128	Taiwan	0.195	0.171
Korea	0.202	0.171	U.S.	0.291	0.194
Mexico	0.139	0.162	Average	0.195	0.153

III. ASSESSING THE SPILLOVER EFFECTS ON THE ASIA-PACIFIC ECONOMIES

China's entry to the WTO will have an influence on the trade patterns of the Asia-Pacific economies in two ways. The first one is a static impact effect to be realized immediately after China's accession to the WTO. The second one is a dynamic effect that results from the internal policy reform. Before the dynamic effect is to be fully realized, however, several problems have to be solved. Political and systemic constraints have to be addressed as discussed in the previous section. In this section, both the static impact effect and the indirect dynamic effect will be incorporated into the analytical framework for assessing the welfare effects of China's accession to the WTO. To that end, a simple general equilibrium model of China is set up and the gravity equations of China's Asia-Pacific neighbors are estimated.

A. A Simple General Equilibrium Model

A simple general equilibrium model referred to as the "1-2-3 model" based on *Microsoft Excel*²⁶ is used to capture a rough picture of the short-term shocks and the long-term policy changes ensuing China's accession to the WTO.²⁷ This model is

²⁵ Evenett and Keller (2002, 288).

²⁶ It is a trademark of Microsoft Corporation.

²⁷ The model draws on Devarajan et al. (1997). Unlike the more sophisticated CGE models, this model cannot properly deal with the multi-sector economy. Yet some of the results obtained from multi-sector

based on a structure consisting of one-country, two-productive sectors, and three goods, and it has three actors: a producer, a household, and the rest of the world. The country in the model is assumed to be small in the world markets.

The two productive sectors, tradable goods sector and non-tradable goods sector, are specified into a constant elasticity of transformation (CET) function with transformation elasticity. They produce two commodities: an export good, E , which is sold to foreigners and a domestic good, D , which is sold domestically. The domestic production possibility frontier, a CET function, shows the combinations of E and D that the economy can supply which is identical to real GDP.

One representative household receives all income and consumes a composite commodity made up of a domestic good, D , and an import, M . Imports and domestic goods are assumed to be imperfect substitutes, which satisfy the Armington assumption. The composite commodity is given by a constant elasticity of substitution (CES) function of M and D with substitution elasticity². Consumer is maximizing utility or maximizing the composite commodity.

Alternatively, the "1-2-3" model can be referred to as a programming problem in which social welfare is maximized with respect to M , E , D under the constraints of technological feasibility, balance of trade, and domestic equilibrium. A graphical version of this model is shown in Figure 1. The transformation function determines the equilibrium amounts of the domestic and export goods (E/D) at the point of tangency with a given price ratio p^d/p^e . The balance of trade is obtained on the 45-degree line through the origin. With the inflow of foreign capital, the balance-of-trade line, however, shifts up by the amount of capital movement. The composite commodity is constructed as a function of the domestic and imported goods (M and D). Their equilibrium amounts (M/D) are determined by the tangency between the indifference curves and the "consumption possibility frontier" at a given price ratio p^d/p^m .

Graphical representation facilitates understanding the direct effect of the shocks and the indirect effect of the policy changes following China's entry to the WTO. For simplicity, suppose that the shocks (the policy changes) are taking place "sequentially" over time: for example, reduction in trade barriers, inflows of capital, and changes in institutional arrangements in this order. First, if China lowers its trade barriers in accordance with the terms of entry, the impact effect of such tariff reform will come in the form of the changes in the relative price of goods and the allocation of resources. Then, with greater economic growth potential in prospect, China may gain access to the friendlier world capital markets and see an increased amount of foreign direct investment. The inflow of foreign capital induced by the initial trade reform shifts up both the balance of the trade line (from B to B') and the consumption possibility frontier or the production possibility frontier of the composite commodity $Q = F(M, D)$ from the one containing C to that containing C' . Finally, if China accelerates and completes internal policy reform in compliance with the WTO's re-

² models can be anticipated here.

Different equilibrium points can be traced out with the progression of the sequential policy changes and external shocks. First, consumption equilibrium points obtain at the points of tangency between the social indifference curves and the consumption possibility frontiers. The short-run equilibrium immediately following a tariff reform is attained at C . The short-to-medium run equilibrium with the capital inflow is reached at C' . The medium-to-long run equilibrium after the completion of the internal reform is established at C'' . The production equilibrium points obtain at the tangency between the production possibility frontiers and p^d/p^* . The short-run production point is attained at P , the short-to-medium run production point at P' , and the medium-to-long run production point at P'' . Note that the production possibility frontier does not shift until the internal policy reform is taking place, so that both P and P' are on the same production possibility frontier.

Figure 1 is a four-quadrant diagram illustrating the relationship between the Domestic Market, Composite Good, External Balance, and Transformation Curve. The vertical axis is labeled M (top) and D_s (bottom). The horizontal axis is labeled D_d (left) and E (right).

- Top-Left Quadrant (Composite Good):** Shows indifference curves and a budget line labeled $Q = F(M, D_d)$. Points C and C'' are marked on the budget line. The slope of the budget line is labeled pd/pm .
- Top-Right Quadrant (External Balance):** Shows the External Balance line. The line $B=0$ is a straight line passing through the origin. The line $B>0$ is a steeper line. An arrow indicates the direction of increasing B .
- Bottom-Right Quadrant (Transformation Curve):** Shows the Transformation Curve and the Rybczynski Line. Points P , P' , and P'' are marked on the Transformation Curve. The slope of the Rybczynski Line is labeled pd/pe .
- Bottom-Left Quadrant (Domestic Market):** Labeled "Domestic Market".
- Bottom-Right Quadrant (Transformation Curve):** Labeled "Transformation Curve".

The diagram illustrates the relationship between the Domestic Market, Composite Good, External Balance, and Transformation Curve. The vertical axis is labeled M (top) and D_s (bottom). The horizontal axis is labeled D_d (left) and E (right). The top-left quadrant shows indifference curves and a budget line labeled $Q = F(M, D_d)$. The top-right quadrant shows the External Balance line with $B=0$ and $B>0$. The bottom-right quadrant shows the Transformation Curve and the Rybczynski Line. The bottom-left quadrant is labeled "Domestic Market". Various points (C , C'' , G , P , P' , P'') and slopes (pd/pm , pd/pe) are marked.

The external shocks and policy changes in the "1-2-3" model can be numerically

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evaluated in Exel, a spreadsheet program. Setting up a model in an Excel program involves four steps: defining parameters and variables, entering data, assigning initial values to parameters and variables, and specifying equations.²⁹ The Solver command can be used to carry out numerical simulations.

The equations of the model and their variables and parameters shown in Appendix A are self-explanatory. Most parameters and variables are calibrated to reproduce the original data as a solution to the model. Exceptions are elasticities and policy barrier parameters. The elasticities of the production and consumption frontiers are assumed 1.95 and 0.75 respectively. These numbers are arbitrarily chosen without any theoretical support. Yet the value of policy barriers parameter is based on the estimation of the TFP improvement in China's SOEs done by Li (1997). He shows that the growth in the TFP attributable to the reform in China's SOEs explains almost 73 percent of their total output growth.³⁰ It can be inferred from this study that, had it not been for the policy reform, 73 percent of the output growth would have disappeared. In a sense, the reform removed the barriers to the TFP improvement and made it possible to enhance the TFP and output growth. Positing on the assumption that WTO accession will reproduce the same effect as that of the past reform in the SOEs, the numerical value of the policy barriers parameter in the present model is set to be 0.35 to replicate the number 0.73 as barriers to the TFP improvement. However, since the reform process takes time, the CET function is assumed to contain the barriers-to-TFP improvement parameter only in the medium-to-long run model.

C. Simulations

In the assessment of the economic effects of China's entry to the WTO, three scenarios characterized by different time span are considered. The first one involves the impact effect of a tariff reform only. The second one includes the additional effect of an increase in the inflow of private capital induced by China's reform prospect. The third one allows simultaneous changes in all three variables: a tariff reform, an increased inflow of foreign capital, and an internal policy reform to be completed over time. The tariff reform is carried out through a reduction in the tax collection rate (import tariff divided by imports), which is to be cut by *fifty* percent. The inflow of capital is to increase by *fifty* percent in anticipation of a tariff reform and other reform prospects. The internal policy reform removes the barriers to the TFP improvement.³¹

The simulation results presented in Table 2 show that most of the economic effects are realized in the medium-to-long run and that the internal policy reform is much

²⁹ The program used in the present analysis, which itself is a modified one of Devarajan et al. (1997), can be readily provided on request.

³⁰ Li (1997, 1081).

³¹ Another scenario may include the government budget constraint, in which subsidies to the state sector are reduced. This possibility is not considered in the following, since there is no difference in the method of analysis.

more influential in bringing about substantial changes in macroeconomic indicators. Indeed, it is contingent on the success of the ensuing internal policy reform removing barriers to the TFP that a tariff reform together with the inflow of foreign capital succeeds in accomplishing economic growth and stability.

In the short run, a fifty percent reduction in the tariff collection rate induces 2.02 percent increase in imports and 1.86 percent increase in exports. It will also increase consumption by 0.64 percent, but decrease aggregate savings by 0.85 percent, to which government savings reduction due to the loss of tariff revenue contributes substantially. Investment decreases due to the reduction in aggregate savings. All in all the total income is reduced by 0.95 percent. The real exchange rate is depreciated because of a decrease in the price of the domestic good.

TABLE 2. EFFECTS OF LIBERALIZATION AND INTERNAL REFORM
(PERCENTAGE CHANGES FROM THE BENCHMARK VALUES)

	Impact Effect Tariff Reform*	Short-to-Medium Run Plus Capital Inflows**	Medium-to-Long Run Plus Internal Reform***
Income	-0.95	-0.96	25.51
Consumption	0.64	0.63	27.45
Aggregate Savings	-0.85	-0.84	27.58
Government Savings	-4.20	-4.18	-39.80
Tax Revenue	-1.30	-1.30	3.08
Investment	-0.75	-0.73	36.54
Real Exchange Rate	-1.22	-1.22	-1.21
Exports	1.86	1.85	1.97
Imports	2.02	2.02	2.15

Note: * A fifty percent reduction in the tariff collection rate.

** A fifty percent reduction in the tariff collection rate and a fifty percent increase in private capital inflows.

*** A fifty percent reduction in the tariff collection rate, a fifty percent increase in capital inflows, and a complete removal of barriers to TFP improvement.

The inflow of foreign capital following the tariff reform does not change the short-run result very much. The increase in the flow of foreign capital is realized through a fifty percent increase in net profits and dividends, whose value is less than five percent of the total imports. The relatively small size of foreign capital inflow brings in a relatively insubstantial change in the macro economic indicators in comparison with the tariff reform. In this model, the inflow of capital may possibly cause "Dutch Disease" in which the non-tradable sector expands at the expense of the tradable sector. Both exports and imports decrease slightly, while the demand for and supply of domestic goods increases. Yet, as shown in the following, there is only a slim chance for this possibility in the case of China.

Unlike the tariff reform and the inflow of capital, the internal policy reform changes

the simulation results much more substantially. Aggregate income increases 25.5 percent over time. Savings and investment increase 27.6 percent and 36.5 percent respectively. Consumption increases 27.5 percent. The non-tradable sector (domestic good production and consumption) increases much faster than the tradable sector (exports and imports) expands, so that the relative share of the tradable sector decreases in comparison with the first two scenarios. In other words, the internal policy reform may result in "pseudo-Dutch-disease," as it is set to remove much more effectively the inefficiencies in the state industry or the "plan-track" of the dual-track economy than the tradable sector that pursues a market-track of the economy. Consequently, the state industry expands much faster than that of the market economy in the third scenario.

D. Gravity Equation Analysis

While the simulation results are suitable for assessing the direct and indirect effects of China's entry to the WTO on itself, they are not for assessing the spillover effects on China's neighbors in the Asia-Pacific region. Gravity equation analysis is a method used here to estimate the spillover effects of China's entry to the WTO on its neighbors. The gravity equation model based on the monopolistic competition model is used, which is better than the standard trade model in explaining the trade patterns of the world in which a multitude of goods are traded across countries. Under the assumption that demand is identical and homothetic across countries, this gravity model explains trade in these varieties as intra-industry trade in which a variety produced in any country is sent to all the other countries in proportion to their GDP.

For the estimation of the gravity equation, seventeen sets of panel data have been used.³² Among them, China's has the minimum number of observations, 263, and Japan's has the maximum of 408 observations. The structure of the regression model is an "effects" model in which variations across countries or time are captured in the changes in the intercepts. The fixed effects and random effects for both one-and two-factor models along with the pooled classical OLS model have been estimated. For presentation, however, only the best of those five types of estimates is reported for each country. The estimates of the two-factor (time and country effects) model are not selected, because the one-factor (country effect) model does provide "better" estimates. The two-factor model is not usually applied in practice for two reasons. First, it incurs the loss in the degree of freedom, and, second, time trend can be better represented by other variables than the dummy variable.³³ The one factor model also gets the better of the OLS model, as evidenced by its Lagrange multiplier test results. Large values of the Lagrange multiplier statistic favor one of the one-factor models against the classical regression with no country specific effects. At any significance level,³⁴

³² The following is based on Lee (2002).

³³ See Greene (2000, 563), for example.

³⁴ The probability value of this statistic (or significance level) is practically zero.

the one-factor model is favored. The choice between the fixed effects and variable effects models have been made based on the Houseman test statistics at the 5 percent significance level. When the Houseman test statistic is sufficiently high, the results of the fixed effects model are chosen.

The regression equation relates the amount of bilateral trade flows to the sum of GDPs, the product of relative country sizes (or size "dispersion"), the degree of "product differentiation" (or the "putative" number of varieties), transport costs deflated by the exchange rate variability, and exporter's price relative to importer's. Statistical significance of the estimates has been tested at the 5 percent level.

Regression on Bilateral Export Flows

The log sum of the country's GDPs is expected to have a positive sign and be equal to 1. The regression estimates of this coefficient for all countries selected are positive, but they are not always close to 1. China, Indonesia, Malaysia, Thailand, Chile, and Mexico' exports (in the descending order) are very responsive to the expansion of the bilateral market size. However, for Peru, its estimate is statistically insignificant.

The product of the country shares is supposed to have a positive sign as the volume of trade increases with the increasing similarity between the two trading partners. Except for Thailand, the estimates on this term are all positive and significant. Regression results bear out what Helpman and Krugman (1985) have predicted.

Eleven out of seventeen countries have negative signs on the number of the variety (product differentiation) term along with positive signs on the relative price (comparative advantage) term. Negative sign on the number of the variety (product differentiation) term complies with what has been predicted. However, only six of them are statistically significant. Australia, Chile, Korea, Mexico, and New Zealand have negative coefficients, but theirs are not statistically significant. Only China, Indonesia, Japan, Malaysia, Thailand, and the United States have a statistically significant negative signs. On the other hand, Canada, Hong Kong, Peru, the Philippines, Singapore, and Taiwan have unexpected positive signs on the product differentiation term, while they have negative sign on the relative price term. These estimates except Peru's are all statistically significant. For these countries, comparative advantage seems to prevail in explaining a major portion of their trade.

Bilateral trade flows are expected to fall as distance increases. This is one of the pillars of the gravity equation. Yet the regression results show that distance does not necessarily matter.³⁵ The effect of distance is not separately reported in the estimation result tables. Instead, the combined effect of distance and exchange rate variability on the bilateral trade flows has been reported. It is supposed to represent the "price" effect. In theory, it is obvious that "depreciation" should increase exports, while "appreciation" decreases exports. Moreover, exchange rate instability will impede the flow

³⁵ A similar result has been reported in Evenett and Keller (2002).

of trade across countries. Yet, the combined term does not show any substantial effect on the bilateral trade flows. In the cases of Chile, China, New Zealand, Peru, and Taiwan, the estimates have the wrong sign. Except for Peru, not all the estimates are statistically significant. Peru's case makes the only genuine exception. The reason why Peru has a statistically significant, and a positive sign can be attributed to sudden disruptions in its exchange rate that the regime experienced during the late 1980s and the early 1990s. Small changes in the exchange rates would not have made any difference to the amount of trade volume.

Regression on Bilateral Import Flows

Estimation results of the regression equation based on bilateral import flows show that all the individual country estimates (except Thailand's) on both the combined-market term and the size-dispersion term have the expected positive signs. Thailand is an exception, but its estimate on the size-dispersion term is not statistically significant.

As is the case with bilateral export flows, the estimates of product differentiation and comparative advantage terms have turned out to have opposite signs to each other. In twelve out of seventeen cases, the product differentiation term has the expected negative sign. Australia, Canada, Chile, China, Japan, Indonesia, Mexico, New Zealand, Peru, the Philippines, Singapore, and Taiwan have negative signs on the product differentiation term. Yet the estimates of the five countries (Australia, China, Japan, New Zealand and the Philippines) are statistically significant, while those of the other countries are not.

Except for the Philippines, distance combined with the exchange rate variability does not seem to have any significant influence on bilateral import flows. The estimates have a negative sign on the term for bilateral distance augmented by the price variability. Except for Chile, China, and Indonesia, they are all statistically insignificant.

Estimation results on the product differentiation and relative price terms differ a lot, depending on what trade flows data are used. Nine countries change their signs on these two terms when different dependent variables are used. Canada, Peru, the Philippines, Singapore, and Taiwan's coefficients of the product differentiation term (the relative price term) are positive (negative) when regressed on bilateral export flows, but they have negative (positive) values when regressed on the bilateral import flows. The opposite is true of Korea, Malaysia, Thailand, and United States. They have changed their sign on the product differentiation term from a negative one to a positive one. Australia, Chile, China, Indonesia, and Japan have retained their negative sign on the product differentiation term, while Hong Kong has a positive sign regardless of the data types used.

While the estimation results of the other countries are given in Appendix B, China's trade flow equations are shown in Table 3. It can be inferred from Table 3 that the bilateral export flows between China and its trading partners are very responsive to the scale and dispersion effects as well as to comparative advantage. The same

is true of bilateral import flows, but to a lesser degree. China's trade flows also show that there exists substitutability between product differentiation and comparative advantage in explaining trade patterns.

TABLE 3. TRADE FLOWS OF CHINA

China*		$\log(Y_i + Y_j)$	$\log(S_i S_j)$	$\log(Y_j/P_j * q)$	Distance	$\log(P_i/P_j)$	Constant	Adj R ² Sample
X _{ij}	Coeff.	4.72	4.24	-3.14	0.00	3.02		0.91
	t-ratio	29.71	11.08	-8.07	0.89	7.65		263
		$\log(Y_i + Y_j)$	$\log(S_i S_j)$	$\log(Y_i/P_i * q)$	Distance	$\log(P_j/P_i)$	Constant	Adj R ² Sample
M _{ij}	Coeff.	2.63	1.21	-1.38	0.00	1.35	8.99	0.86
	t-ratio	12.95	3.65	-3.06	0.10	3.01	1.26	263

E. Spillover Effects

The gravity equation is used to assess how the effects of China's accession to the WTO are spilled over to its Asia-Pacific neighbors through the changes in the flows of exports and imports. The changes in GDPs, exchange rate variability, and other aggregate variables caused by China's entry into the WTO should be plugged into the estimated gravity equation in order to calculate the spillover effects. These effects summarized in Table 4 are calculated as the sum of the direct effect ascribable to the changes in exports (imports) themselves and the indirect effect ascribable to the changes in exports (imports) associated with the changes in income.

In the short run, most of China's neighbors can anticipate their exports to China to increase moderately. The export growth rates are ranging from 0.86 percent (Taiwan) to 1.70 percent (Japan and Indonesia). Yet, if China's internal reform is accelerated by its entry to the WTO, the long-term effect will be felt most significantly in Taiwan (29.01 percent), Canada (26.43 percent), Peru (24.15 percent), and Chile (22.78 percent). The spillover effects are felt differently depending on the time horizon. In the short run, the impact effect will contribute to expanding the tradable sector substantially. However, in the long run, the relative size of the tradable sector will reduce pressures from import competition and change the import pattern of China.

The import growth rate in the short run is the highest in Thailand. On the other hand, imports from China are decreasing in Japan (-0.20 percent) and Mexico (-0.15 percent). In the long run, imports from China will increase most rapidly in Mexico (34.84 percent), Thailand (29.82 percent), and Malaysia (28.72 percent). However, Peru's imports from China will decrease by 6.32 percent.

With the growth rate changes in exports and imports, the rate of balance of trade improvement can be shown as in the B-O-P Improvement column in Table 4. In

the short run, Peru (-0.86), Thailand (-0.66 percent), the United States (-0.56 percent) and Hong Kong (-0.42 percent) will experience a deterioration of balance of trade. Yet, in the long run, it is Thailand (-26.17 percent), Malaysia (-20.36 percent), and Mexico (-14.28 percent) that will suffer the most. On the other hand, in the short run, balance of trade is expected to improve in Japan (1.90 percent), Australia (1.51 percent) and Mexico (1.33 percent). In the long run, it is Peru (30.47 percent), the Philippines (19.03 percent), and Chile (15.65 percent) that are expected to improve the trade balance most substantially.

TABLE 4. SPILLOVER EFFECTS ON THE ASIA-PACIFIC ECONOMIES
(PERCENTAGE CHANGE)

	Export Growth			Import Growth			B-O-P Improvement		
	S-Run	SMRun	MLRun	S-Run	SMRun	MLRun	S-Run	SMRun	MLRun
Australia	1.56	1.56	11.70	0.05	0.05	19.02	1.51	1.53	-7.32
Canada	1.08	1.07	26.43	0.01	-0.01	23.13	1.07	1.08	8.30
Chile	1.00	0.99	22.78	0.62	0.60	7.13	0.38	0.38	15.65
Hong Kong	1.60	1.60	10.83	2.03	2.01	5.91	-0.42	-0.41	4.92
Indonesia	1.70	1.69	7.44	0.53	0.51	18.74	1.17	1.18	-11.30
Japan	1.70	1.69	10.51	-0.20	-0.22	14.23	1.90	1.91	-3.73
Korea	1.24	1.23	16.47	1.44	1.43	17.31	-0.21	-0.20	-0.84
Mexico	1.18	1.18	20.56	-0.15	-0.17	34.84	1.33	1.35	-14.28
Malaysia	1.38	1.37	8.36	1.32	1.30	28.72	0.06	0.07	20.36
New Zealand	1.47	1.47	13.27	0.49	0.48	6.71	0.92	0.92	6.56
Peru	1.11	1.10	24.15	1.97	1.96	-6.32	-0.86	0.87	30.47
Philippines	1.33	1.32	20.81	1.07	1.06	1.78	0.26	0.26	19.03
Singapore	1.42	1.42	16.11	0.92	0.91	8.20	0.50	0.51	7.90
Thailand	1.46	1.46	3.66	2.12	2.09	29.82	-0.66	-0.64	26.17
Taiwan	0.86	0.84	29.61	1.01	0.99	19.00	-0.15	-0.14	10.61
U.S.	1.44	1.44	17.65	1.98	1.97	14.14	-0.54	0.54	3.50

Note: * S-Run : Short run impact effect.

** SMRun: Short-to-medium run effect.

*** MLRun: Medium-to-long run effect.

IV. CONCLUSION

Positing an optimistic scenario of China's future political and economic development, this paper has taken on several questions associated with the effects of China's accession to the WTO. In light of the analysis in this paper, it is likely that China's accession to the WTO will contribute to overall regional (or world) growth rather than benefiting

only a small number of countries (or only China). As long as the APEC economies remain open, not only China itself, but also the other members will benefit from China's accession to the WTO.

This paper has also assessed the extent of the effects both static and dynamic that China's accession to the WTO will have on the other APEC members. As evidenced by the empirical results, this can be substantial. The answer to this question depends on whether China's accession to the WTO will have an effect on its own policy-making, which this paper assumes to be positive. The internal reform following its accession will enhance China's TFP as the changes imposed by the WTO will remove barriers to efficiency and investment in human and physical capital. This presumption is hardly defensible unless the transition from the two-track economy to the full-fledged market economy is successfully completed in China.

Yet this paper leaves some questions unanswered. The first one is to explain how the policy differences lead to the TFP differences: that is, how policy can affect the aggregate production function of the economy. Instead, the mechanism through which policies are decided is assumed away. The second one is how to deal with the political economy considerations affecting China's economic relationship with the outside world. As it can be inferred from the fact that the terms of China's entry to the WTO allow the United States and other industrial nations to "manage" trade with China, this is a legitimate concern. Left alone, manipulation such as the application of special antidumping and safeguards is likely to diminish the potential benefits from China's accession to the WTO.

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APPENDIX A: THE "1-2-3" MODEL

TABLE A.1. EQUATIONS

Real Flows

1. CET Production Possibility Frontier

$$X = A_X (\delta E^\rho + (1 - \delta) D_S^\rho)^{\frac{1}{\rho}} \quad \text{or} \quad X = A_X (\delta_1 E^\rho + (1 - \delta_1) \Psi^\rho D_S^\rho)^{\frac{1}{\rho}}$$

2. CES Consumption Possibility Frontier

$$Q = A_Q (\delta_2 M^\rho + (1 - \delta_2) D_S^\rho)^{\frac{1}{\rho}}$$

3. Equilibrium Relative Supply

$$\frac{E}{D_S} = \left(\frac{(1 - \delta_1) p^e}{\delta_1 p^d} \right)^{\frac{1}{\rho - 1}} \quad \text{or} \quad \frac{E}{D_S} = \left(\frac{(1 - \delta_1) \Psi^\rho p^e}{\delta_1 p^d} \right)^{\frac{1}{\rho - 1}}$$

$$4. \text{ Equilibrium Relative Demand} \quad \frac{M}{D_D} = \left(\frac{\delta_1 p^d}{(1 - \delta_1) p^m} \right)^{\frac{1}{1 - \rho}}$$

5. Aggregate Domestic Demand
- $YD = C + I + G$

Nominal Flows

6. Income Equation

$$Y = p_x X + p_q (\text{transfer}) + (\text{exchange rate})(\text{remittances})$$

7. Savings
- $S = s_Y Y (\text{exchange rate}) B + S_G$

$$8. \text{ Consumption} \quad C = \frac{(1 - t_Y - s_Y) Y}{p_t}$$

9. Government Revenue

$$T = p_m^w t_m (\text{exchange rate}) M + p_e t_e E + p_q t_s Q_D + t_Y Y$$

Prices

$$10. \text{ Import Price} \quad p_m = (1 - t_m) p_m^w$$

$$11. \text{ Export Price} \quad p_e = \frac{1}{(1 + t_m)} p_e^w$$

$$12. \text{ Sales Price} \quad p_t = (1 + t_s) p_q$$

13. GDP Deflator
$$p_x = \frac{P_s E + P_d D_s}{X}$$
14. CPI
$$p_q = \frac{P_m M + P_d D_d}{X}$$
15. Numeraire (Exchange Rate)
$$\text{exchange rate} = 1$$

Equilibrium Conditions

16. Domestic Good Market
$$D_d - D_s = 0$$
17. Composite Commodity Market
$$Q_d - Q_s = 0$$
18. Current Account Balance

$$CA = p_m^w M - p_e^w E \quad \text{transfer} - \text{remittances}$$

19. Government Budget Deficit

$$BD = T - p_t G - p_q \text{transfer} - (\text{exchange rate})(\text{foreign transfer})$$

** Parameters*

- Policy Barriers: π
- Barriers to TFP improvement: $-\frac{1}{(1+\pi)}$

TABLE A.2. DATA-CHINA, 2001

1	National Accounts	Yuan (BLN)	Output=1	3	Fiscal Account	Yuan (BLN)	Output=1
	Output (Value Added)	9593.3	1.00		Revenue	1667.00	0.17
	Wages	7253.2	0.76		Non-Tax	137.68	0.01
	GDP (Market Value)	9727.0	1.01		Current Expenditure	1498.10	0.16
	Private Consumption	4588.8	0.48		Goods & Services	1067.95	0.11
	Public Consumption	1513.8	0.16		Interest Payments	163.16	0.02
	Investment	3637.8	0.38		Transfers & Subsidies	266.99	0.03
	Exports	2203.0	0.23		Capital Expenditure	416.20	0.04
	Imports	2016.4	0.21		Fiscal Balance	-247.30	-0.03
2	Tax Revenue	Yuan (BLN)	Output=1	4	Balance of Payments	Yuan (BLN)	Output=1
	Sales & Excise Tax	1133.56	0.12		Exports-Imports	281.56	0.03
	Import Tariffs	133.4	0.01		Net Profits & Dividends	-207.79	-0.02
	Export Duties	0.01	0.00		Interest Payments	0.01	0.00
	Payroll Tax	200.0	0.02		Net Private Transfers	70.29	0.00
	Personal Income Tax	29.0	0.00		Net Official Transfers	0.01	0.00
	Capital Income Tax	33.3	0.00		Current Account Balance	144.06	0.02
	Total	1529.32	0.16		External Debt	1239.91	0.13
					Debt Service Payments	199.98	0.02

Benchmark Equilibrium

TABLE A.3. PARAMETER VALUES AND EVALUATED EQUATIONS

Parameter Values		Evaluated Equations		
Elasticity, CET (sr)	1.95	Real	CET Transformation Function	1.00
Elasticity, CES/Q (sq)	0.75		CES Composite Commodity	0.99
Policy Barriers (pi)	0.35		Aggregate Domestic Demand	0.99
Calibration			Relative Supply Ratio (E/D)	0.30
Scale Factor, CET	2.19		Relative Demand Ratio (M/D)	0.29
Product Share, CET	0.65	Nominal	Government Revenue	0.16
Barriers to TFP	0.74		Total Income	1.01
• for CET	1.51		Savings	0.50
Scale Factor, CES/Q	1.79		Consumption Function	0.43
Product Share, CES/Q	0.31		Import Price	1.00
• for CES	0.33	Prices	Export Price	1.00
			Domestic Sales Price	1.12
			Output Price (GDP Deflator)	1.00
			Composite Commodity Price (CPI)	1.00
			Numeraire (Exchange Rate)	1.00
		Equilibrium Conditions	Domestic Goods Market	0.00
			Composite Goods Market	0.00
			Current Account Balance	-0.01
			Government Budget Constraint	-0.01

TABLE A.4. A BENCHMARK EQUILIBRIUM

Exogenous Variables	Base	Current	Endogenous Variables	Base	Current	Cu/Ba
World Price of Imports (wpm)	0.94	0.94	Export Good (E)	0.23	0.23	1.00
World Price of Exports (wpe)	1.00	1.00	Import Good (M)	0.22	0.22	1.00
Import Tariffs (tm)	0.07	0.07	Supply of Domestic Good (Ds)	0.77	0.77	1.00
Export Duties (te)	0.00	0.00	Demand of Domestic Good (Dd)	0.77	0.77	1.00
Indirect Taxes (ts)	0.12	0.12	Supply of Composite Good (Qs)	0.99	0.99	1.00
Direct Taxes (ty)	0.02	0.02	Demand of Composite Good (Qd)	0.99	0.99	1.00
Savings Rate (sy)	0.51	0.51	Tax Revenue (TAX)	0.16	0.16	1.00
Government Consumption (G)	0.12	0.12	Total Income (Y)	1.02	1.01	1.00
Government Transfers (Tr)	0.03	0.03	Aggregate Savings (S)	0.50	0.50	1.00
Foreign Grants (Fr)	0.00	0.00	Consumption (CON)	0.43	0.43	1.00
Net Private Remittances (Re)	-0.01	-0.01	Import Price (pm)	1.00	1.00	1.00
Foreign Saving (B)	-0.01	-0.01	Export Price (pe)	1.00	1.00	1.00
Output (X)	1.00	1.00	Sales Price (pr)	1.12	1.12	1.00
			Composite Good Price - CPI (pg)	1.00	1.00	1.00
			Output Price-GDP Deflator (px)	1.00	1.00	1.00
			Domestic Good Price (pxd)	1.00	1.00	1.00
			Exchange Rate (xr)	1.00	1.00	1.00
			Investment (I)	0.34	0.44	1.31
			Government Savings (Sg)	-0.01	-0.01	1.00
			Walras Law (Investment-Savings)	-0.12	0.00	

Counterfactual Equilibria

1) Short Run (Impact) Effect (50 Percent Reduction in the Tariff Collection Rate)

TABLE A.5. PARAMETER VALUES AND EVALUATED EQUATIONS

Parameter Values		Evaluated Equations		
Elasticity, CET (st)	1.95	Real	CET Transformation Function	1.00
Elasticity, CES/Q (sq)	0.75		CES Composite Commodity	0.99
Policy Barriers (pi)	0.35		Aggregate Domestic Demand	0.99
Calibration			Relative Supply Ratio (E/D)	0.31
Scale Factor, CET	2.19	Nominal	Relative Demand Ratio (M/D)	0.30
Product Share, CET	0.65		Government Revenue	0.15
Barriers to TFP	0.74		Total Income	1.01
• for CET	1.51		Savings	0.49
Scale Factor, CES/Q	1.79	Prices	Consumption Function	0.43
Product Share, CES/Q	0.31		Import Price	0.97
• for CES	0.33		Export Price	1.00
			Domestic Sales Price	1.10
		Equilibrium Conditions	Output Price (GDP Deflator)	0.99
			Composite Commodity Price (CPI)	0.98
			Numeraire (Exchange Rate)	1.00
			Domestic Goods Market	0.00
			Composite Goods Market	0.00
			Current Account Balance	0.00
			Government Budget Constraint	-0.02

TABLE A.6. A SHORT RUN EQUILIBRIUM

Exogenous Variables	Base	Current	Endogenous Variables	Base	Current	Cu/Ba
World Price of Imports (wpm)	0.94	0.94	Export Good (E)	0.23	0.23	1.02
World Price of Exports (wpe)	1.00	1.00	Import Good (M)	0.22	0.23	1.02
Import Tariffs (tm)	0.03	0.03	Supply of Domestic Good (Ds)	0.77	0.77	0.99
Export Duties (te)	0.00	0.00	Demand of Domestic Good (Dd)	0.77	0.77	0.99
Indirect Taxes (ts)	0.12	0.12	Supply of Composite Good (Qs)	0.99	0.99	1.00
Direct Taxes (ty)	0.02	0.02	Demand of Composite Good (Qd)	0.99	0.99	1.00
Savings Rate (sy)	0.51	0.51	Tax Revenue (TAX)	0.15	0.15	0.99
Government Consumption (G)	0.12	0.12	Total Income (Y)	1.02	1.01	0.99
Government Transfers (Tr)	0.03	0.03	Aggregate Savings (S)	0.49	0.49	0.99
Foreign Grants (Ft)	0.00	0.00	Consumption (CON)	0.43	0.43	1.01
Net Private Remittances (Re)	-0.01	-0.01	Import Price (pm)	1.00	0.97	0.97
Foreign Saving (B)	0.00	0.00	Export Price (pe)	1.00	1.00	1.00
Output (X)	1.00	1.00	Sales Price (pr)	1.12	1.10	0.98
			Composite Good Price CPI (pg)	1.00	0.98	0.98
			Output Price-GDP Deflator (px)	1.00	0.99	0.99
			Domestic Good Price (pd)	1.00	0.99	0.99
			Exchange Rate (xr)	1.00	1.00	1.00
			Investment (I)	0.34	0.44	1.30
			Government Savings (Sg)	-0.02	-0.02	0.96
			Walras Law (Investment-Savings)	-0.11	0.00	

2) Short-to-Medium Run Effect (Tariff Reform and 50 Percent Increase in Capital Inflow)

TABLE A.7. PARAMETER VALUES AND EVALUATED EQUATIONS

Parameter Values		Evaluated Equations		
Elasticity, CET (st)	1.95	Real	CET Transformation Function	1.00
Elasticity, CES/Q (sq)	0.75		CES Composite Commodity	0.99
Policy Barriers (pi)	0.35		Aggregate Domestic Demand	0.99
Calibration			Relative Supply Ratio (E/D)	0.31
Scale Factor, CET	2.02	Nominal	Relative Demand Ratio (M/D)	0.30
Product Share, CET	0.58		Government Revenue	0.15
Barriers to TFP	0.74		Total Income	0.99
• for CET	1.51		Savings	0.49
Scale Factor, CES/Q	1.70	Prices	Consumption Function	0.43
Product Share, CES/Q	0.26		Import Price	0.97
• for CES	0.33		Export Price	1.00
			Domestic Sales Price	1.10
			Output Price (GDP Deflator)	0.99
			Composite Commodity Price (CPI)	0.98
			Numeraire (Exchange Rate)	1.00
			Domestic Goods Market	0.00
		Equilibrium Conditions	Composite Goods Market	0.00
			Current Account Balance	0.01
			Government Budget Constraint	-0.02

TABLE A.8. A SHORT-TO-MEDIUM RUN EQUILIBRIUM

Exogenous Variables	Base	Current	Endogenous Variables	Base	Current	Cu/Ba
World Price of Imports (wpm)	0.94	0.94	Export Good (E)	0.23	0.23	1.02
World Price of Exports (wpe)	1.00	1.00	Import Good (M)	0.22	0.23	1.02
Import Tariffs (tm)	0.03	0.03	Supply of Domestic Good (Ds)	0.77	0.77	0.99
Export Duties (te)	0.00	0.00	Demand of Domestic Good (Dd)	0.77	0.77	0.99
Indirect Taxes (ts)	0.12	0.12	Supply of Composite Good (Qs)	0.99	0.99	1.00
Direct Taxes (ty)	0.02	0.02	Demand of Composite Good (Qd)	0.99	0.99	1.00
Savings Rate (sy)	0.50	0.50	Tax Revenue (TAX)	0.15	0.15	0.99
Government Consumption (G)	0.12	0.12	Total Income (Y)	1.01	0.99	0.99
Government Transfers (Tr)	0.03	0.03	Aggregate Savings (S)	0.49	0.49	0.99
Foreign Grants (Ft)	0.00	0.00	Consumption (CON)	0.43	0.43	1.01
Net Private Remittances (Re)	-0.03	-0.03	Import Price (pm)	1.00	0.97	0.97
Foreign Saving (B)	0.01	0.01	Export Price (pe)	1.00	1.00	1.00
Output (X)	1.00	1.00	Sales Price (pt)	1.12	1.10	0.98
			Composite Good Price CPI (pg)	1.00	0.98	0.98
			Output Price-GDP Deflator (px)	1.00	0.99	0.99
			Domestic Good Price (pd)	1.00	0.99	0.99
			Exchange Rate (xr)	1.00	1.00	1.00
			Investment (I)	0.34	0.44	1.30
			Government Savings (Sg)	-0.02	-0.02	0.96
			Walras Law (Investment-Savings)	-0.11	0.00	

3) Medium-to-Long Run Effect (Tariff Reform, Capital Inflow, and Internal Reform)

TABLE A.9. PARAMETER VALUES AND EVALUATED EQUATIONS

Parameter Values		Evaluated Equations		
Elasticity, CET (st)	1.95	Real	CET Transformation Function	1.00
Elasticity, CES/Q (sq)	0.75		CES Composite Commodity	1.26
Policy Barriers (pi)	0.35		Aggregate Domestic Demand	1.26
Calibration			Relative Supply Ratio (E/D)	0.23
Scale Factor, CET	2.02	Nonrival	Relative Demand Ratio (M/D)	0.22
Product Share, CET	0.58		Government Revenue	0.15
Barriers to TFP	0.74		Total Income	1.26
• for CET	1.51		Savings	0.63
Scale Factor, CES/Q	1.70	Prices	Consumption Function	0.56
Product Share, CES/Q	0.26		Import Price	0.97
• for CES	0.33		Export Price	1.00
			Domestic Sales Price	1.08
		Equilibrium	Output Price (GDP Deflator)	1.26
			Composite Commodity Price (CPI)	0.98
			Numeraire (Exchange Rate)	1.00
			Domestic Goods Market	0.00
		Conditions	Composite Goods Market	0.00
			Current Account Balance	0.00
			Government Budget Constraint	-0.01

TABLE A.10. A MEDIUM-TO-LONG RUN EQUILIBRIUM

Exogenous Variables	Base	Current	Endogenous Variables	Base	Current	Cu/Ba
World Price of Imports (wpm)	0.94	0.94	Export Good (E)	0.23	0.23	1.02
World Price of Exports (wpe)	1.00	1.00	Import Good (M)	0.22	0.23	1.02
Import Tariffs (tm)	0.03	0.03	Supply of Domestic Good (Ds)	1.04	1.04	1.00
Export Duties (te)	0.00	0.00	Demand of Domestic Good (Dd)	1.04	1.04	1.00
Indirect Taxes (ts)	0.09	0.09	Supply of Composite Good (Qs)	1.26	1.26	1.00
Direct Taxes (ty)	0.02	0.02	Demand of Composite Good (Qd)	1.26	1.26	1.00
Savings Rate (sy)	0.50	0.50	Tax Revenue (TAX)	0.15	0.15	1.03
Government Consumption (G)	0.13	0.13	Total Income (Y)	1.01	1.26	1.25
Government Transfers (Tr)	0.03	0.03	Aggregate Savings (S)	0.49	0.63	1.27
Foreign Grants (Fr)	0.00	0.00	Consumption (CON)	0.44	0.56	1.27
Net Private Remittances (Re)	-0.03	-0.03	Import Price (pm)	1.00	0.97	0.97
Foreign Saving (B)	0.00	0.00	Export Price (pe)	1.00	1.00	1.00
Output (X)	1.00	1.00	Sales Price (pt)	1.09	1.08	0.98
			Composite Good Price (CPI (pq))	1.00	0.98	0.98
			Output Price-GDP Deflator (px)	1.00	1.26	1.26
			Domestic Good Price (pd)	1.00	0.99	0.99
			Exchange Rate (xt)	1.00	1.00	1.00
			Investment (I)	0.55	0.58	1.68
			Government Savings (Sg)	-0.02	-0.01	0.60
			Walras Law (Investment-Savings)	-0.11	0.00	

APPENDIX B: ESTIMATION OF THE GRAVITY EQUATION

Data

Data have been collected for the group of seventeen countries from various sources including World Economic Outlook 2002, International Financial Statistics, World International Trade Statistics, and the Penn World Table 5.6. The data set does not include all the APEC members. Four economies, Brunei Darussalam, Papua New Guinea, Russia, and Viet Nam, are excluded from the data set due to the paucity of information.

The source of the data on bilateral trade flows X^i_j / M^j is the Trade and Production Database whose construction was supported by the World Bank. The bilateral trade flows data are reported in current U.S. dollars. The data on variations in the exchange rates ($\Delta XR / XR$) with dollar come from the Penn World Table version 5.6. The exchange rates data are extended from 1993 to 1999 using Federal Reserve Statistical Release G.5A. For the other variables, proxies are used. The c.i.f.(cost, insurance and freight) / f.o.b.(free on board) factor (transportation costs) is represented by the bilateral distance between the capital cities measured in kilometers (DT) whose source is Jon Haveman's Useful Gravity Model Data set. The distance data combined with those on the exchange rate variations are used to represent transport costs (or trade barriers). The data on cross-country differences in the price level (P, P^*) with its base in 1985 and gross domestic product (GDP, GDP^*) in U.S. dollars come from the World Economic Outlook Database 2000 compiled by the International Monetary Fund.

Each member's data set covers a different time span: the end year is 1999 (except for Indonesia), but the beginning year differs. The number of the observations does not always equal the product of the time span and the number of the countries due to the omitted observations. The panel data sets are not necessarily balanced. Average exports and imports of the bilateral trade flows between the country concerned and the other members vary widely from 70 million US\$ and 100 million US\$ (Peru) to 11 billion US\$ and 17 billion US\$ (USA).

The Grubel-Lloyd indices are calculated from the data on the trade flows between country pairs that are included in the data set. Calculated at the four-digit SITC, these indices vary across countries from the low of less than 4 percent for Peru to the maximum of 56 percent for Hong Kong. The Grubel-Lloyd indices of Australia (0.244), China (0.211), Korea (0.223), and Taiwan (0.213) are near the average, while those of Malaysia (0.261), Singapore (0.320), the United States (0.324), and Hong Kong (0.561) are above the average. It is important to note that these values in Table 5 are different from those in Table 4, which has been based on the data of all 21 members instead of 17 members included in the data set.

Foreign GDP denotes the average income of the trading partners of the country concerned. The average incomes of the trading partners vary from 754 billion US\$ (Mexico) and 729 billion US\$ (China) to 304 billion US\$ (U.S.A.) and 429 billion

US\$ (Japan). However, home GDP differs vastly, reflecting the different stages of economic development among the member economies.

Average per capita GDP is highest in the United States (21,441 US\$), followed by Japan (21,318 US\$) and Canada (16,859 US\$). At the other extreme, China (468 US\$), Indonesia (682 US\$), and the Philippines (748 US\$) are among the countries with the lowest per capita GDP.

Per capita GDP has been used to make a proxy for. Under the assumption that technology is identical across countries, the average of per capita GDPs in the region has been used as the "common" equilibrium scale of the production for each country. Given, it is easy to derive the equilibrium number of varieties produced in each country.

Peru has an exceptionally high average inflation rates due to hyperinflation it experienced during the 1988-91 period (667 percent in 1988, 3,399 percent in 1989, 7,486 percent in 1990, and 410 percent in 1991). Mexico (46 percent), Chile (16 percent), Indonesia (13 percent) and the Philippines (12 percent) are among the other high inflation economies.

In terms of bilateral distances, Peru (13,797km) and Chile (13,725km) are the most "remote" economies. Capital per worker is highest in Canada (38,239 US\$), followed by Australia (36,428 US\$), the United States of America (33,504 US\$), New Zealand (32,899 US\$), and Japan (32,857 US\$). The Philippines (3,787 US\$), Thailand (4,819 US\$), and Peru (8,972 US\$) are among those countries with the lowest capital-labor ratios.

Estimation

The estimation strategy is to specify a bilateral trade flow equation based on the gravity equation derived above and augmented by additional considerations. Both export flows and import flows are separately estimated and compared. The basic regression equation is given by as follows.

$$\ln X^{ij} = \beta_1 \ln (Y_i + Y_j) + \beta_2 \ln (S_i S_j) + \beta_3 \ln \frac{Y_j}{q P_j} + \beta_4 \frac{\ln (DT)}{(1 + \Delta XR / XR)} + \beta_5 \frac{P_i}{P_j} + \varepsilon \quad (\text{B-1})$$

The first term appearing in the equation (B-1) represents the effect of the "market expansion." The second term represents the "size" dispersion effect, which reflects the effects of the IRS-based trade. The third term is in the above equation supposed to represent the "product differentiation" effect. Foreign income Y^j divided by its price level P^j represents the quantity supplied (or demanded in "imaginary" pre-trade equilibrium) of the "aggregate" differentiated product, which gives the equilibrium number of varieties when divided by q , the equilibrium quantity of the "supposedly identical" differentiated product. A large value of this term means that the foreign

country can provide its demand for differentiated goods relatively sufficiently from the local suppliers, needing relatively few imported varieties from the home country.

The fourth term in the equation denotes the transport cost term. It is approximated by the product of bilateral distances and exchange rate variation. Variations in the exchange rates are included as part of a transport cost regressor to represent the "price effect."

The fifth term comes directly from the relative price ratio term, which reflects the pattern of comparative advantage. It can be inferred from the standard trade model that exports are expected to decrease as the ratio of the home price to the foreign price increases, in accordance with the prediction of the comparative advantage.

One thing to note here is that the third and the fifth terms should have the opposite signs. To see why they are inversely related to each other in explaining bilateral trade flows, consider the following. While an increase in the demand for variety (that is, a decrease in the value of the third term) in foreign country is likely to raise exports, an increase in production costs (exporter's price) reduces exports. The larger the number of the variety equilibrium is, the lower is the price of each variety. If the size of the market becomes larger, the number of the variety that can be produced increases. However, the net increase in the number of the variety in a country with a larger local market is less than that in a smaller one, because the former has already been producing more varieties than the latter. As a result, the larger the number of locally produced varieties is, the smaller is the reduction in the local equilibrium price. Thus, if exports based on the product differentiation to a larger market decrease, then exports based on comparative advantage (relative price) increase. If the force of "product-differentiation-based" trade prevails, the force of "comparative-advantage-based" trade will diminish. That is, the negative sign of the number of the variety term should be accompanied by the positive sign of the relative price term. These two forces are expected to work in opposite direction. For example, if trade based on product differentiation prevails, then trade based on comparative advantage should get smaller, meaning that the relative price term has a positive sign. In this regard, equation (B-1) is set up with a view to estimating how IRS-based trade and comparative advantage-based trade are related to each other.

Another form of the gravity equation to be used on the import data is expressed as follows.

$$\begin{aligned} \ln M^{ij} = & \beta_1 \ln(Y_i + Y_j) + \beta_2 \ln(S_i S_j) + \beta_3 \ln \frac{Y_j}{q P_i} \\ & + \beta_4 \ln(DT) \left(1 + \frac{\Delta XR}{XR} \right) + \beta_5 \frac{P_j}{P_i} + \epsilon \end{aligned} \quad (\text{B-2})$$

TABLE B.1. GRAVITY EQUATION XIJ

Xij		$\log(Y_i + Y_j)$	$\log(S_i S_j)$	$\log(Y_i/P_i * Y_j/P_j)$	$\log(T_{ij}) / (1 + \sum_{k \neq i,j} X_{ik} X_{jk})$	$\log(P_i/P_j)$	Constant	Adj R2 Sample
Australia	Coeff.	1.46	1.02	-0.11	0.00	0.10	-6.31	0.95
	t-ratio	22.83	5.98	-0.93	-1.98	1.86	-3.69	357
Canada	Coeff.	1.11	0.46	0.45	0.00	-0.42	-14.97	0.97
	t-ratio	19.96	3.84	4.71	-0.45	-4.22	-8.74	574
Chile	Coeff.	2.23	0.75	0.35	0.00	0.37	-7.94	0.83
	t-ratio	17.33	3.10	1.76	0.41	1.81	-2.89	308
Hong Kong	Coeff.	1.32	1.50	0.33	0.00	-0.40	-10.16	0.96
	t-ratio	30.01	13.12	3.23	1.14	-3.77	-6.48	374
Indonesia	Coeff.	3.26	1.43	-1.26	0.00	1.41	2.12	0.67
	t-ratio	12.05	3.15	-4.18	-6.03	4.47	0.57	340
Japan	Coeff.	1.13	1.37	-0.64	0.00	0.67	1.58	0.97
	t-ratio	28.47	13.86	-6.97	-1.88	7.19	4.86	498
Korea	Coeff.	1.78	1.00	-0.14	0.00	0.05	-7.10	0.72
	t-ratio	16.14	3.55	-0.73	-0.27	0.24	-2.22	406
Mexico	Coeff.	2.06	1.25	-0.11	0.00	0.10	-11.66	0.82
	t-ratio	9.97	3.96	-6.52	-0.85	0.48	-3.71	297
Malaysia	Coeff.	2.58	1.33	-0.77	0.00	0.63	-0.25	0.95
	t-ratio	36.08	6.42	-5.07	-1.59	4.02	-0.11	374
New Zealand	Coeff.	1.20	0.48	-0.14	0.00	0.14	-5.17	0.90
	t-ratio	19.75	2.79	-1.25	0.10	1.27	-3.38	357
Peru	Coeff.	1.06	0.30	0.27	0.00	0.73	-14.30	0.60
	t-ratio	1.84	0.64	0.61	4.01	-0.56	2.75	401
Philippines	Coeff.	1.81	2.13	0.87	0.00	-0.90		1.00
	t-ratio	15.08	5.34	3.39	-0.55	-3.39		392
Singapore	Coeff.	1.19	1.32	0.57	0.00	-0.64		0.96
	t-ratio	21.42	12.19	4.93	-1.09	-3.33		337
Thailand	Coeff.	2.29	0.45	-1.34	0.00	1.20		0.85
	t-ratio	22.01	1.31	-4.95	-0.29	4.26		417
Taiwan	Coeff.	1.24	0.43	0.47	0.00	-0.48		0.95
	t-ratio	36.64	4.04	3.90	0.15	-3.89		393
U.S.	Coeff.	1.32	1.49	-0.68	0.00	0.70	7.10	0.98
	t-ratio	46.78	11.34	4.90	-0.41	5.04	2.56	374

TABLE B.2. GRAVITY EQUATION Mij

Mij		$\log(Y_i + Y_j)$	$\log(S_i S_j)$	$\log(Y_i/P_i * q)$	$\log(T_{ij})^*$ (1 + $\Delta XR/XR$)	$\log(P_j/P_i)$	Constant	Adj R2 Sample
Australia	Coeff.	1.36	0.37	-0.76	0.00	0.82	4.44	0.95
	t-ratio	17.99	2.42	-2.15	-1.40	2.32	0.69	357
Canada	Coeff.	1.81	0.51	-0.74	0.00	0.73	1.25	0.93
	t-ratio	14.21	2.59	-1.76	-1.03	1.75	0.16	374
Chile*	Coeff.	2.66	2.49	-0.85	0.00	0.78		0.70
	t-ratio	12.31	4.72	-1.87	0.05	1.71		308
Hong Kong	Coeff.	1.46	1.47	0.35	0.00	-0.27	-10.79	0.98
	t-ratio	11.95	11.92	1.35	-1.38	-1.04	-2.92	374
Indonesia	Coeff.	1.66	0.83	-0.39	0.00	0.44	-3.31	0.83
	t-ratio	12.65	2.86	-1.55	0.34	1.74	-0.75	340
Japan	Coeff.	1.53	0.42	1.31	0.00	1.25	15.45	0.95
	t-ratio	24.17	5.64	9.56	-1.78	9.25	7.01	408
Korea	Coeff.	1.71	1.18	0.18	0.00	-0.21	-12.19	0.80
	t-ratio	5.82	4.22	0.32	-0.37	-0.37	-1.50	406
Mexico*	Coeff.	3.47	2.42	-0.34	0.00	0.45		0.69
	t-ratio	11.43	4.31	-0.67	-0.71	0.84		297
Malaysia	Coeff.	1.78	0.45	0.60	0.00	-0.55	-19.57	0.93
	t-ratio	17.99	1.80	1.84	-0.78	-1.70	-3.92	374
New Zealand	Coeff.	1.33	1.08	-0.86	0.00	0.90	5.68	0.92
	t-ratio	15.74	4.69	-2.10	-0.43	2.21	0.88	357
Peru*	Coeff.	1.69	2.20	-0.29	0.00	0.22		0.63
	t-ratio	2.96	2.52	-0.35	-1.05	0.26		401
Philippines*	Coeff.	2.17	2.28	-0.62	0.00	0.62		1.00
	t-ratio	23.74	6.82	-2.03	-1.91	2.03		392
Singapore*	Coeff.	1.55	1.29	0.45	0.00	0.51		0.97
	t-ratio	10.46	8.16	-1.67	-1.22	1.87		337
Thailand*	Coeff.	1.32	-0.09	1.27	0.00	-1.21		0.80
	t-ratio	4.58	-0.22	1.60	-0.03	-1.52		407
Taiwan	Coeff.	1.63	0.83	-0.05	0.00	0.06	-8.08	0.95
	t-ratio	9.52	5.81	-0.16	-0.50	0.20	-1.80	393
U.S.*	Coeff.	1.68	0.37	0.42	0.00	-0.46	-20.06	0.96
	t-ratio	27.17	3.76	1.53	-1.59	-1.69	-3.64	374