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The Consequences of China's WTO Accession on its Neighbours

Abstract

Southeast Asian industrial exports are now facing intense competition from Chinese industrial exports. How much more would competition increase with China's recent accession to the World Trade Organization? Would Indonesia, Malaysia, Philippines and Thailand (the ASEAN-4) de-industrialize and return to their roles in the 1950s and 1960s as primary commodity exporters? Or would there be sufficient lucrative niches within the manufacturing production chains that the ASEAN-4 could specialize in? This paper explores these issues using a global simulation model called the G-Cubed (Asia pacific) model. We find that China's WTO accession *per se* is likely to:

- generate substantial benefits for China,
- have little impact on the OECD economies, and
- will only create significant welfare losses in the ASEAN-4 if there is significant redirection of FDI away from these countries to China and even in this case only if the ASEAN-4 countries are ineffective in quickly upgrading their abilities to absorb new foreign technologies and to engage in indigenous technical innovations.

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1. China's emergence as a major trading nation

At the end of 1978, China made the historic decision to initiate the process of allowing its economy to converge to a normal market economy, which is characterized by the predominance of private ownership and by integration into the international economic system. Before this momentous decision, China had withheld a quarter of the world's population from participating in the international division of labor. During the period of China's self-imposed isolation, the rest of the world created new wealth on an unprecedented scale (with some notable exceptions, such as Africa). It is now conventional wisdom to attribute this generalized increase in prosperity to the open international trading system that was institutionalized at the end of World War II.[1] Clearly, China agrees with this conventional wisdom. China has stated numerous times that its full participation in the international trading system is fundamental to keeping its economic growth sustainable.[2] This explains why China has tenaciously pursued arduous trade negotiations with the United States for over a decade in order to win WTO membership.

Although there is general agreement that China's WTO accession would benefit China, there is no general agreement that it would also benefit other countries, especially China's neighbors in East and Southeast Asia. For example, in his address to the country on its national day in 2001, the Prime Minister of Singapore, Goh Chok Tong, told his fellow citizens that:

1 Sachs and Warner (1995) present convincing evidence in support of this professional consensus.
2 For an overview of China's economic growth and a survey of the competing interpretations on the sources of the growth, see Woo (1998, 1999a, 1999b, 2001), Sachs and Woo (forthcoming), and Lardy (2002).

> ... China poses a big economic challenge. Some economists describe China as an *800-pound trading gorilla.* A Hong Kong newspaper added that this gorilla was *very hungry* ... Even India is being flooded with cheap but good quality Chinese goods. Some Indian manufacturers are finding it hard to compete. So they have done the next best thing. They stick “Made in China” labels on their products to boost sales...
> Our biggest challenge is therefore to secure a niche for ourselves as China swamps the world with her high quality but cheaper products. China's economy is potentially ten times the size of Japan's. Just ask yourself: how does Singapore compete against ten post-war Japans, all industrializing and exporting to the world at the same time?
> I do not mean that China will overpower every other economy, and grow at the expense of everybody else. As China develops and exports more, its imports will grow too. There will be many opportunities to invest in China. We must grasp those opportunities.

Mr. Goh is certainly correct in pointing out that China cannot be an exporter without also being an importer. But the crucial issue is whether the composition of goods that China would import would require a complete overhaul of the production structures of East and Southeast Asia. Will Indonesia, Malaysia, the Philippines, and Thailand (the ASEAN-4) de-industrialize and return to the roles they had in the 1950s and 1960s as primary commodity exporters? Or will there be sufficient lucrative niches in which the ASEAN-4 could specialize within the manufacturing production chains?

The second scenario is certainly a possibility, particularly for Singapore, Taiwan, and South Korea. Examples of niches abound: "the Swiss make watches and run top banks, and the Italians produce shoes for the elite."[3] In the opinion of Stanley Fischer, the former deputy managing director of the IMF:

> ... there is little cause for fear ... a big dynamic economy in the neighborhood is a benefit, not a curse, for those around it—look at Canada or Mexico ... Or, one might add, look at Asia after Japan emerged as an economic power from the 1970s onward.[4]

3 "Rising China to be key importer of ASEAN goods," *The Straits Times*, 30 August 2002.
4 "Don't fear China threat," *The Straits Times*, 4 September 2001. Hong Kong-based analysts at Goldman-Sachs and the Deutsche Bank have also disputed the notion that China's rise will be deleterious to its neighbors; see Anderson (2002) and "Report plays down China's drain on Asean," *South China Morning Post*, 4 February 4 2003, respectively.

Boom or doom? This is the question that is the focus of this paper. To anticipate our quantitative analysis, our short answer to this question is that, beyond the underlying international repercussions generated by China's emergence into the international economy, China's WTO accession is likely to

- generate additional substantial benefits for China;
- have little additional impact on the OECD economies; and
- create significant welfare losses in the ASEAN-4 only if foreign direct investment (FDI) is significantly redirected away from these countries to China and, even in this case, only if the ASEAN-4 countries fail to absorb new foreign technologies quickly and to engage in indigenous technical innovations.

2. Guidance from theory

An adherent of standard international trade theory, as embodied by the Heckscher-Ohlin (H-O) model, might find it amusing that a large part of this paper focuses on the implications of China's WTO membership for *other* economies. It is amusing because China's WTO membership means the lowering of China's trade barriers, and the H-O model shows unambiguously that the welfare of China's trade partners have only upward potential: their welfare will be either unaffected or higher. What is not obvious from the H-O model is the impact of China's tariff reduction on its own welfare. The answer depends to a large extent on whether China is a small country in the economic sense. A *small economy* is defined as a price-taker in the international markets, that is, its terms of trade are exogenous.

If China is a small country in the economic sense, then its tariff reduction will definitely benefit itself, and (by definition) will have no repercussions on other economies. However, if

there are short-run rigidities in labor movements (such as sticky nominal wages) in China, then the additional imports will create (temporary) unemployment immediately, and this cost has to be balanced against the present discount value of the long-run benefits from the more efficient allocation of resources. So, if China is a small country, the interesting question about China's WTO membership is not its welfare implications for other economies but its welfare implications for China's economy.

If China is a large country in the economic sense, then the answer depends on where its present effective tariff rate stands with respect to what we will call the optimum tariff rate (t_A), the threshold tariff rate (t_B), and the trade-terminating tariff rate (t_C). Figure 1 identifies the locations of these three tariff rates in the inverted U-curve, which shows the relationship between China's welfare level and its tariff rate. The U-shape emerges from the changes in two different welfare components induced by an increase in the tariff rate: (a) a welfare decline from reduced consumption of the imported good and (b) a welfare gain from the improvement in the terms of trade.

<figures 1 and 2 near here>

Figure 2 shows the relationship between the welfare level of a hypothetical trade partner and China's tariff rate. This is a monotonically declining relationship because an increase in China's tariff rate will (1) drive down the amount of goods it will export to China (a negative quantity-welfare effect) and (2) drive down the price of the reduced amount of goods that it will export (a negative price-welfare effect). The unambiguous conclusion is that any lowering of China's trade barriers will increase the welfare of the trade partner. As in the (China as a) small country case, the interesting question about China's WTO membership is not its impact on *other* economies but its impact on China's own economy.

We will now state two "stylized facts." On the basis of the agreements reached in order for China to become a WTO member, the first stylized fact is that, to a first approximation, WTO membership will require China to lower its effective tariff rate to a low enough level that the resulting welfare level is close to the free trade welfare level. The second stylized fact is that China's present tariff rate is likely to be above t_B. This conclusion comes from two considerations. First, China was virtually an autarkic economy before 1978, and since then the biggest reductions in trade barriers occurred in the area of imported inputs required by the export-processing industries. Trade barriers to final consumption goods are in general still very high in China. Second, China was not coerced by its trading partners to join the WTO, it sought WTO membership voluntarily and pursued the matter with great tenacity (the U.S.-China bilateral trade negotiations took over a decade to complete). Such perseverance indicates that the effective tariff rates in 2000 created a welfare level that is lower than the free trade welfare level.

The puzzling point about China's pursuit of WTO membership that we want to raise is that even if China's present effective rate were indeed higher than t_B, the best thing to do is not to move to the WTO-required almost free-trade position but to t_A, the optimum tariff. In short, if China were indeed a large country, then it is not clear why it should not undertake the amount of unilateral tariff reduction required to bring it to t_A, rather than to join WTO. Obviously WTO membership must involve another benefit that has been missed in the literature.

To summarize the discussion so far, the H-O model can explain China's eagerness to join WTO only if China is a small economy in the economic sense, whereby tariff reduction will surely increase its welfare. If China is a large country, then China's eagerness to join WTO is a mystery, because H-O would predict that China would reduce its tariff from beyond t_B to t_A, but not to the very low tariff rate agreed to during the WTO negotiations. Furthermore, the H-O

model cannot explain why some of China's trade partners, especially the Southeast Asian economies, have been so anxious about China's WTO membership. Because we do not regard any of the following three reasons—ignorance in China about optimum tariff, pervasive paranoia in Southeast Asia, and widespread macroeconomic rigidities in Southeast Asian economies—to be the motivating factor behind China's eagerness to join WTO and behind Southeast Asia's worries, we conclude that there is something missing in the logic of the H-O model about China's WTO membership.

Before we turn to discussing the additional elements that are needed to make the H-O model's analysis more relevant to the focus of this analysis, we temper the strong conclusions of the H-O to arrive at what we see to be the two most useful broad messages from standard international trade theory. First, it is likely that the economy that will experience the biggest impacts will be China. Second, it is likely that the majority of China's trade partners will experience few significant negative effects.

3. Supplementing theory with the specific situation in East Asia

The fundamental reason for China's enthusiasm for WTO membership, which is missed by the H-O model, is that WTO membership will greatly enhance China's economic security. Until China became a WTO member, it required annual approval from the U.S. Congress for most-favored-nation (MFN) status in order for its exports to compete in the U.S. markets on equal terms against the exports from WTO countries. This annual congressional approval process inevitably rendered China's exports vulnerable to passing passions in the U.S. political arena over accidents such as military airplane collisions in the South China Sea, and the burning of the U.S. consulate in Chengdu following the unintended U.S. bombing of the Chinese embassy in

Belgrade. The importance to China of continuing high export growth and maintaining the access of its exports to the U.S. market is hard to overstate.

The high and growing global demand for China's exports in the last two decades has been a powerful force in hastening the transformation of China from a subsistence peasant economy to an industrialized economy. The contribution of exports to China's growth has become more important since 1998, when the quickened pace of state enterprise reform interacted with the dysfunctional financial system to impart a deflationary tendency to the economy. Deficit spending and exports are the two growth engines that have kept recent GDP growth rates above 7 percent. The problem is that China's weak fiscal position makes deficit spending an unsustainable engine of growth.[5] The present fiscal situation is marked by the constant need to recapitalize the state banks, the need to fund future pension claims, and the inability of the government to increase revenue collection substantially. Hence, if exporting is also not a sustainable engine of growth, then a drastic slowdown in growth is inevitable.

The United States is China's biggest export market. The United States, until the recent restrictions on steel imports, had been perceived as ideologically committed to free trade and consequently less prone to protectionism than Europe and Japan.[6] Clearly, in order for exports to be a sustainable growth engine, China must secure assured access to its biggest market. And only WTO membership can prevent the United States from the impulsive unilateral action of switching off one of China's most important growth engines by simply denying MFN status to China in any year.

5 See Sachs and Woo (forthcoming) for a discussion of China's difficulties in macroeconomic management—a situation that is increasingly recognized in the press; for example, "Public Spending Explodes," *Far Eastern Economic Review*, 30 January 2003.

6 A recent well-known example of a Europe-China trade dispute is the imposition of restrictions on Chinese cigarette lighters, and a recent example of a Japan-China trade dispute is over the alleged dumping of Chinese garlic.

What are the implications of China's enhanced economic security for its trade partners? By removing the annual uncertainty about China's exports, WTO membership has increased China's reliability as a supplier to the international markets. This development has two immediate consequences. First, buyers can source a larger proportion of their purchases from Chinese producers without increasing the risk of nondelivery or late delivery. Second, producers of labor-intensive goods destined for sale in the high-income economies can now reduce management costs by reducing the geographical diversification of its production facilities.

The primary competitors to China's mostly labor-intensive exports are its East Asian neighbors: South Korea, Taiwan, Hong Kong, Singapore, Indonesia, Malaysia, the Philippines, and Thailand. Of these countries, the last four, commonly referred to as the ASEAN-4, engage in export-processing activities and are competitors to China for FDI. The ASEAN-4, therefore, are likely to be negatively affected through two channels from China's enhanced reliability as a supplier. The fact that labor costs in China are lower than those in the ASEAN-4 magnifies these two negative effects.

<tables 1 and 2 near here>

Before discussing the possible diversion of FDI to China from its trade partners, we turn to tables 1 and 2 to review the relative importance of FDI to growth in the Asian economies. Table 1 reports the inward and outflow FDI *stock* as a proportion of GDP in selected economies, and table 2 reports the inward and outward FDI *flow* as a proportion of investment. The net FDI[7] stock (normalized by GDP) data show that Japan has been a capital exporter at least since 1980, and Taiwan has become a capital exporter by 1990. South Korea, Hong Kong, Singapore, and the ASEAN-4 are the net capital importers. Combining the FDI stock data in table 1 with the FDI flow data in table 2, we see that Hong Kong and South Korea, until the Asian financial crisis of

7 Net FDI is inward FDI minus outward FDI.

1997–99, were in the process of relocating a significant amount of their labor-intensive industries abroad. This is evident from their outward FDI flow being bigger than their inward FDI flow during 1990–95. The biggest recipients of the outward FDI flows from Japan, Taiwan, South Korea, and Hong Kong were China and the ASEAN-4.

The economic health of the ASEAN-4 has become highly dependent upon foreign capital, with some apparent exceptions (tables 1 and 2). Although Indonesia has been experiencing net FDI outflow since the Asian financial crisis, its net FDI stock/GDP ratio in 2000 still stood at 38 percent, which is the same as Malaysia's ratio and higher than Thailand's ratio of 18 percent. While the net FDI stock/GDP ratio of 14 percent for the Philippines in 2000 makes it the lowest ratio among the ASEAN-4, the proportion of Philippine investment funded by net FDI inflow was over 7 percent during 1990–95, and reached 8.4 percent in 2000. The degree of foreign financing in the Philippine's investment in 2000 was lower than that in Thailand (10.2 percent) but higher than that in Malaysia (7.7 percent).

The above conclusion about the great importance of FDI to the economies of the ASEAN-4 also holds for China's economy. China's net FDI stock/GDP ratio of 30 percent places it below Malaysia and Indonesia but above Thailand. Net FDI inflow has been accounting for an increasing proportion of China's investment, rising from an average of 8.4 percent in 1990–95 to 10.3 percent in 2000. On the eve of China's WTO accession, China resembled the ASEAN-4 with regard to its strategy of harnessing FDI to accelerate economic development.

<table 3 near here>

Our conclusion on the importance of FDI to the economic development of the ASEAN-4 is confirmed by the inward FDI performance index for 140 countries that was constructed by the United Nations Conference on Trade and Development (UNCTAD 2002). Table 3 allows a

comparison of the inward FDI performance indexes for selected Asian and OECD countries. The value of the FDI performance index for a particular country is the ratio of its share in global FDI to its share in global GDP. A value of 1 on the performance index denotes that the country is receiving FDI exactly in line with its relative economic production. The index values in 1988–90 for the ASEAN-4 were generally very high, the value for Malaysia was 4.4, Thailand was 2.6, the Philippines was 2.6, and Indonesia was almost 1.

China's attractiveness as a location for FDI in 1988–90 was the same as Indonesia's. Their respective rank of 61 and 63 were greatly below those of Malaysia (8), Thailand (25), and the Philippines (39). In the aftermath of the Asian financial crisis and after a decade more of economic opening by China, however, China's value on the performance index rose whereas those of the ASEAN-4 fell. In 1998–2000, China's rank was 47 compared with 41 for Thailand, 44 for Malaysia, 89 for the Philippines, and 138 for Indonesia. There is little doubt that most of the downward movement in the rankings of the ASEAN-4 was caused by the Asian financial crisis, but one cannot rule out that a part of the downward movement was due to the diversion of FDI from the ASEAN-4 to China.

Analytically, the removal of the MFN threat when China officially became a WTO member at the end of 2001 is equivalent to a reduction in the risk premium demanded by investors in China's export-oriented industries. The complete picture of China's WTO membership is more than a reduction in China's effective tariffs; it also includes a reduction in the risk premium for investment in export-oriented production inside China. The effect of the tariff reduction is to reallocate the composition of China's output from importables to exportables and nontradeables, and the effect of the risk premium is to reconfigure the global distribution of FDI in China's favor.

There is indeed evidence of the FDI diversion effect created by China's WTO membership. The Japan Bank for International Cooperation (JBIC) conducts an annual survey of Japanese trans-national corporations (TNCs) to find out which countries will be the top 10 locations for manufacturing FDI over the next three years. Table 4 contains the results from the surveys undertaken in 1996, 2000, and 2001. The survey indicates that 68 percent of Japanese TNCs listed China as one of the top 10 locations in 1996, and 65 percent did so in 2000. These responses made China the most frequently identified promising location for FDI in both years, that is, China was ranked first in the list of 10 locations.

<table 4 near here>

The evidence in favor of our FDI diversion hypothesis is captured in the 2001 survey. It became clear to the international community at the end of 2000 that China's accession to WTO was imminent. The upshot was that the proportion of Japanese TNCs in 2001 that identified China as one of the 10 most promising locations for manufacturing FDI jumped to 82 percent from 65 percent in 2000. Most telling of all, the "identification gap" between China and the United States, which were ranked first and second, respectively, in 2000 and 2001, widened from 24 percentage points in 2000 to 50 percentage points in 2001.

The frequency with which the ASEAN-4 economies were identified as top 10 locations for FDI dropped between 1996 and 2000, and the most important reason for this change in the TNC's perception could be the Asian financial crisis. The frequency that Thailand was identified as a top 10 location for FDI fell from 36 percent to 24 percent, Indonesia from 34 percent to 15 percent, Malaysia from 20 percent to 12 percent, and the Philippines from 13 percent to 8 percent. In terms of ranking within the 10 most-cited locations, Thailand slipped from 2 to 3, Indonesia from 3 to 4, and the Philippines from 8 to 10, whereas Malaysia improved from 6 to 5.

As the Asian financial crisis was over by early 2000, the changes in the frequency of identification and ranking of the ASEAN-4 economies on the list of profitable FDI locations between 2000 and 2001 could therefore justifiably be attributed to the WTO-created improvement in China's reliability as an international supplier. Thailand and Indonesia were identified as desirable FDI locations with nearly equal frequencies in 2000 and 2001, but the gaps between their frequencies of identification and that of China increased significantly. The China-Thailand gap went up from 41 percentage points to 57 percentage points, and the China-Indonesia gap from 50 percentage points to 68 percentage points. The frequency that Malaysia was cited in the top 10 declined from 12 percent to 8 percent, and the Philippines dropped out of the top 10 list. Malaysia's rank moved from 5 to 9, and the China-Malaysia identification gap soared from 53 percentage points to 74 percentage points. These differences in the survey results of 2000 and 2001 are certainly consistent with our hypothesis of WTO-induced diversion of FDI to China.

Even more direct evidence of our FDI diversion hypothesis is found in a survey undertaken by the Japan External Trade Organization (JETRO) in October 2001. JETRO asked Japanese transnational corporations (TNCs) whether they would relocate their existing production facilities to China in response to China's accession to WTO, and 21 percent replied that they were planning to do so. Of those intending to relocate, 67.5 percent of them would be relocating from Japan, 9.0 percent from Hong Kong, 6.6 percent from Taiwan, and 6.0 percent from the ASEAN-4. The complete breakdown of the locations to be abandoned is given in table 5. Although 99 percent of Japanese TNCs with existing investments in ASEAN-4 and Singapore stated in another survey that they would stay put, UNCTAD (2002, 44) insightfully noted that

"[this] does not, of course, mean that their production in China will not expand faster than in ASEAN."

<table 5 near here>

The two main findings from the JBIC survey and JETRO survey are as follows:

- there was a 17 percentage point jump in 2001 in the frequency that China was identified as a top FDI location, and a general decline in the frequencies that the ASEAN-4 economies were identified as top FDI locations; and
- 21 percent of firms indicated that they would move their existing production to China.

It therefore appears reasonable to us to conclude from these findings that China's WTO membership is encouraging producers to choose China over the other East Asian economies as the site for their investments in additional capacity and/or to move their existing production capacity to China. We realize that the JBIC and JETRO surveys did not cover non-Japanese TNCs, but anecdotal evidence from the authors' visits to East Asia suggests that (1) there is ongoing relocation of existing investments to China, and (2) the location of new production capacity in China also applies to U.S., Hong Kong, South Korean, and Taiwanese producers.

A recent news report makes clear that the drop in inward FDI in Malaysia has been substantial in 2002, and that the Malaysia government has no doubt that much of the drop is attributable to FDI diversion to China:

> Malaysia attracted approved manufacturing FDI of only RM 2.16 billion ... for the first six months of this year [2002]. This is a sharp drop from the RM 18.82 billion it pulled in for the whole of last year.
> ... 'Everybody is feeling the pinch because the amount of FDIs has shrunk and then, a lot of that is going to China,' Dr. Mahatir [Prime Malaysia] told a news conference later.[8]

8 "Malaysia turns inward for growth," *The Straits Times*, 21 September, 2002. Six months later, The Straits Times reported ("Malaysia is losing investors to China, Vietnam," 6 February 2003) that "Asia-Taiwan Businesses Association honorary president Tan Kun Huang said that the 82-percent contraction [in FDI from Taiwan] compared with the previous year was largely due to Malaysia losing its edge as a cheap labor market. Sin Chew [a newspaper]

Indeed, the consulting firm, A.T. Kearney, just released in September 2002 a survey of senior executives of the world's largest corporations that found that "China has for the first time supplanted the US as the most attractive destination for foreign direct investment."[9]

We now ask whether the effects generated by the diversion of FDI from the ASEAN-4 can be fully captured by a decrease in the capital stock of the ASEAN-4 and a corresponding increase in the capital stock of China. In our opinion the answer is no, for at least two reasons. The first reason is that the diversion of FDI does not necessarily produce a new steady state in which there are winners and losers. In a dynamic, optimizing general equilibrium model, the new steady state could have only winners, distinguished by big winners versus small winners. *Ceteris paribus*, an increase in the rate of return on investments in China (i.e., a decrease in the size of the risk premium required for investments in China), could motivate the world to save more, and produce a larger global capital stock in the new steady state. The fact that a bigger proportion of the expanded global capital stock is now located in China does not rule out the possibility that the final capital stock in the ASEAN-4 would be larger than the original capital stock. We note that it is almost a mathematical necessity that a zero-sum outcome in economic welfare is very more likely in a static general equilibrium model [such as a computable general equilibrium (CGE) model] because the size of the global stock is fixed by assumption. In short, we can analyze FDI diversion adequately only if we use a model where the global capital stock is endogenously generated.

The second reason why FDI diversion should not be thought of as a simple relocation of the capital stock is because FDI could also generate externalities. The East Asian experience

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quoted Datuk Tan as saying that Taiwanese investors were looking increasingly towards cheap and large labor pools in China and Vietnam .... Meanwhile, Nanyang Siang Pau [a newspaper] reported than an influx of cheap China-made goods was threatening the competitiveness of local businesses."

9 "China attracts more foreign investors than US," *Financial Times*, 22 September 2002.

suggests that FDI could facilitate technological transfers (i.e., generate technological spillovers) not only to domestic firms in the same industry but also to domestic firms in other industries.[10] Furthermore, FDI could help solve the difficulties of access to the international markets in these goods. In short, a country gaining FDI could experience not only a bigger capital stock but also possibly a (perhaps temporary) increase in its total factor productivity (TFP) growth rate, whereas a country losing FDI could experience a (perhaps temporary) slowdown in TFP growth as well as a (perhaps temporary) lower capital stock.

We now close the theoretical discussion by summarizing the guidance provided by standard international trade theory on thinking about China's WTO membership and the analysis of how to supplement standard theory in order to analyze the issue more adequately. There are three levels of answers to this question.

The first level is the most straightforward because it is the standard analysis of a unilateral cut in effective lower rates. The expectation is that the biggest impact from the WTO accession would be on China and that there would be a zero or a positive impact on most trade partners. We call the first-level answer the *naive analysis*.

The second-level answer recognizes that not only would there be tariff cuts as required by WTO membership but also the removal of the annual MFN threat to China would likely lower the risk premium required for investing in China. The expectation generated by the latter development is that there would be diversion of FDI to China, especially from its East and Southeast Asian neighbors. We call this second-level answer the *FDI diversion analysis*.

The third-level answer enriches the second-level answer by pointing out that FDI would not only increase the domestic capital stock but would also increase technological transfers to the

10 See Okabe (2002) for a recent confirmation of the existence of these technological spillovers.

whole economy and improve the access of more Chinese goods to foreign markets. We call this the *analysis of the diversion of FDI with technological spillovers*.

4. Modeling China's economic linkages to the world: the G-cubed (Asia-Pacific) model

Any analysis of the implications of China joining the WTO on the Asia-Pacific region needs to be undertaken with a model that adequately captures the important linkages between China and the region through the trade of goods and services and capital flows. The G-cubed Asia Pacific (AP-GCUBED) model is ideal for such analysis, having both a detailed country coverage of the region and rich links between countries through goods and asset markets.[11] The AP-GCUBED model encompasses the United States, Japan, Australia, New Zealand, South Korea, the rest of OECD (ROECD), China, Indonesia, Malaysia, the Philippines, Taiwan, Thailand, Hong Kong, Singapore, India, OPEC, EEFSU (Eastern Europe and the former Soviet Union), and the rest of the world (ROW). Each of the 18 countries in the AP-GCUBED model has six sectors: energy, mining, agriculture, durable manufacturing, non-durable manufacturing, and services.

Each core economy or region in the model consists of several economic agents: households, the government, the financial sector, and the six production sectors. Intertemporal budget constraints on households, governments, and nations (the latter through accumulations of foreign debt) are imposed. To accommodate these constraints, forward-looking behavior is incorporated in consumption and investment decisions. The investment process is assumed to be

11 Full details of the model, including a list of equations and parameters, can be found online at http://www.msgpl.com.au/msgpl/apgcubed46n/index.htm The AP-GCUBED is based on the GCUBED model (described in McKibbin and Wilcoxen 1998), which is in turn an expansion of the MSG2 model founded by McKibbin and Sachs (1991). Roughly speaking, the parameters are estimated from data up to 1996, and we performed the simulations by shifting the constants in all the equations to ensure that the starting point of our projections is 2000. In short, the model starts off in 2000 with all the variables having their actual values in 2000, for example, the model uses the actual pattern of trade in 2000 to generate the simulations in this study.

subject to rising marginal costs of installation. Aggregate consumption is chosen to maximize an intertemporal utility function subject to the constraint that the present value of consumption be equal to human wealth plus initial financial assets.

We take each region's real government spending on goods and services to be a fixed share of GDP and assume that it is allocated among final goods (consisting of both domestically produced and imported goods) and services and labor in fixed proportions, which we set to 2000 values. We assume that agents will not hold government bonds unless they expect the bonds to be paid off eventually. A government that is running a budget deficit today must run an appropriate budget surplus in the future. Otherwise, the government would be unable to pay interest on the debt, and agents would not be willing to hold the government's bonds.

International trade imbalances are financed by flows of financial assets between countries (except where capital controls are in place). We assume that existing wedges between rates of return in different economies are generated by various restrictions that generate a risk premium on country-denominated assets. These wedges are assumed to be exogenous during simulation. Thus when the model is run, the induced changes in expected rates of return in different countries generate flows of financial capital reacting to return differentials at the margin.

As a result of this structure, the AP-GCUBED model contains rich dynamic behavior, driven on the one hand by asset accumulation and, on the other by wage adjustment to a neoclassical steady state. It embodies a wide range of assumptions about individual behavior and empirical regularities in a general equilibrium framework. The interdependencies are solved out using a computer algorithm that solves for the rational expectations equilibrium of the global economy. It is important to stress that the term 'general equilibrium' is used to signify that as many interactions as possible are captured, not that all economies are in a full market-clearing

equilibrium at each point in time. Although it is assumed that market forces eventually drive the world economy to a neoclassical steady-state growth equilibrium, unemployment does emerge for long periods, because of wage stickiness, to an extent that differs between countries resulting from differences in labor market institutions. The model has approximately 7,400 equations in its current form, with 140 jumping or forward-looking variables and 263 state variables.

To recapitulate, there are three significant qualitative differences between the AP-GCUBED model and the standard CGE model[12]:

1. The AP-GCUBED is based on explicit *intertemporal* optimization by the agents (consumers and firms) in each economy. In contrast to static CGE models, time and dynamics are of fundamental importance in the AP-GCUBED model.
2. There is an explicit treatment of the holding of a range of financial and real assets in the AP-GCUBED model (money, bonds, equity, household capital, physical capital, etc.). Money is introduced into the model through a restriction that households require money to purchase goods. The model distinguishes between the stickiness of physical capital within sectors and within countries and the flexibility of financial capital, which immediately flows to where expected returns are highest. This important distinction leads to a critical difference between the *quantity of physical capital* that is available at any time to produce goods and services, and the stock market *valuation of that capital* as a result of decisions about the allocation of financial capital. So the AP-GCUBED model has linkages between the financial markets and the real sectors, unlike the usual CGE models, which have real sectors only.
3. In the AP-GCUBED model, the behavior of agents is modified to allow for short-run deviations from optimal behavior resulting from either myopia or restrictions on the ability of

12 Adhikari and Yang (2002), Jiang (2002), Ianchivichina and Martin (2001), Lejour (2000), and Wang (2002) are recent examples of CGE-based analyses that ignored the role of capital flows and dynamic adjustment. Surveys of such CGE-based studies are undertaken in McKibbin and Tang (2000) and Morrison (2001).

households and firms to borrow at the risk-free bond rate on government debt. The model also allows for short-run nominal wage rigidity (by different degrees in different countries) and therefore allows for significant periods of unemployment, depending on the labor market institutions in each country. The deviations from intertemporal optimizing behavior take the form of rules of thumb, which are chosen to generate the same steady-state behavior as optimizing agents so that in the long run there is only a single intertemporal optimizing equilibrium of the model. The AP-GCUBED model's assumptions hence differ from the market-clearing assumption in most CGE models.

5. Specifications of the simulations

We will undertake four sets of simulations that are guided by the theoretical discussions in sections 2 and 3. These sets are (1) baseline simulations; (2) naive simulations; (3) reduction in risk premium simulations; and (4) diversion of FDI with technological spillovers simulations.

5.1. Baseline simulations

This simulation generates the future values of all the endogenous variables based on the assumption that the existing policy regimes in the world will persist indefinitely into the future, for example, China is not a WTO member. To generate the results we first solve the model from 1999 to 2070 to generate a model baseline based on a range of assumptions. One set of assumptions is that the year 2000 tariff rates are constant forever. Other crucial assumptions needed for generating the baseline include assumptions about population growth (from World bank projections) and sectoral productivity growth by country as well as fiscal and monetary policy settings. Productivity growth in each sector in each country is assumed to catch up to the

rate of productivity growth in the equivalent sector in United States, with the gap in the growth rates closing at 2 percent per year. The initial "productivity gaps" for each sector in each country are calibrated to be consistent with the underlying catch-up model and the average growth rates of economies from 1990 to 1995. The issue of projection using a model such as that used in this paper is discussed in detail in Bagnoli, McKibbin, and Wilcoxen (1996).

The tariff rates we use are based on the GTAP 4 database, which estimates both tariff and nontariff barriers. We assume that the tariff rates in 2000 are continued forever.

5.2. Counterfactual simulation no. 1: Naive simulation

This is the straightforward simulation where the only changes are the reduction in China's trade barriers (both tariff and nontariff barriers). We assume that trade barriers are reduced gradually over time by an equal amount (measured in percentage points) over the 10-year period of 2003 to 2012[13]. There is some uncertainty about the size and timing of tariff reductions. The assumptions we use in this paper are meant to be illustrative of the orders of magnitude of the changes. Specifically, for commodities, we specify that the following:

1. Energy tariffs are reduced by 0.1 percentage point (with respect to the baseline tariff rate) each year beginning in 2003 until they are reduced by a total of 1 percentage point (compared with the baseline) in 2012.
2. Mining tariffs are reduced by 0.2 percentage point each year to reach a total reduction of 2 percentage points in 2012.
3. Agriculture tariffs are reduced by 2.8 percentage points each year to reach a total reduction of 28 percentage points in 2012.

13 This assumption of proportional reductions is from Wang (2002) and is consistent with the reductions agreed to by China as part of the WTO accession negotiations.

4. The tariffs on manufactured durable goods are reduced by 0.6 percentage points each year to reach a total reduction of 6 percentage points in 2012.
5. Tariffs on manufactured non-durable goods are reduced by 1.2 percentage points each year to reach a total reduction of 12 percentage points in 2012.

An important aspect of China's accession to the WTO is the opening of trade in services that China has promised. This is a wide-ranging reform which will have important implications for the services sector in China. Our specification of the liberalization of services is based on the arguments in McKibbin, Stoeckel. and Tang (2000), namely that the entry of foreign service providers generally causes the formerly sheltered domestic service providers to improve their efficiency to meet the new competition. For example, the entry of McDonald's into Beijing has caused the domestic fast-food outlets to improve their service package, the most noticeable of which is the provision of clean toilets for the use of customers. In short, the liberalization of trade in services forces efficiency improvements that lower of the cost curves of the domestic service industries (hence improving the bottom lines of all concerned). We will hence specify the liberalization of the service sector as an improvement in labor-augmenting technology of 0.12 percentage point, beginning in 2003, to reach a total improvement of 1.08 percentage points (above baseline) in 2011, that is, a temporary rise in the rate of labor-augmenting technology growth for nine years.

We call this simulation the *naive case*.

5.3. Counterfactual simulation no. 2: A reduction in the risk premium demanded by FDI

This simulation supplements the naive simulation with a 1 percentage point reduction in the risk premium demanded by foreign investors in China. This 1 percentage point reduction is

small compared with the jump of 8 percentage points in the risk premium demanded by foreign investors in Southeast Asia at the height of the Asian financial crisis figure. We call this simulation the *FDI diversion case*.

5.4. Counterfactual simulation no. 3: FDI creates technological spillovers in the host economy

In the first two simulations there is a response of international capital flows to the changes in expected rates of return to capital. However, capital flows are assumed not to have any direct effect on technological change. There is a large debate on whether FDI flows might alter the rate of technical change in economies. In this simulation we incorporate this effect to illustrate how the results for the first two simulations might change as a result of FDI-induced technological change. Our modeling of possible technological spillovers created by FDI flow from a richer country to a poorer country is based on the following four assumptions.

Assumption 1 There is a "natural" steady-state total factor productivity (TFP) growth rate for every sector, and this rate is determined by the expansion of global scientific knowledge that is relevant to that sector. The difference between a developed economy and a developing economy is that the developed economy is on the “natural” steady-state TFP growth path, and the developing economy is operating below the frontier defined by the “natural” TFP growth path. This is illustrated in figure 3, where the developed economy is proceeding on the "frontier TFP" growth path, and the developing economy is operating at point O.

<figure 3 near here>

Assumption 2 Because of the natural process of technological diffusion, technological transfers from FDI, and catch-up programs in science established by the governments of the developing economy, the developing economy is converging toward the world TFP frontier at a

rate that is proportional to the distance between its present TFP level and the frontier TFP level. This is illustrated in figure 3, which shows the developing country catching up to the (moving) technology frontier of the industrial economies via the "status quo" growth path (the catch-up TFP growth path) which is the baseline TFP growth rate of the developing economy.

Assumption 3 We assume that changes in FDI alter the speed of catch-up over a decade. When the FDI outflow from the richer economy increases, the TFP growth rate in the developing economy increases temporarily above the baseline TFP growth rate. The faster the developing economy can absorb the new technological knowledge contained in the additional FDI inflow, the higher is the TFP growth rate above the baseline TFP growth rate, and the shorter is the length of the transition period to the new catch-up path. In the limit, where the developing country instantaneously grasps the new knowledge fully, it jumps right onto the new catch-up TFP growth path. This is illustrated in figure 3 where the new TFP growth rate is higher than the baseline TFP growth rate for 10 years, and at the end of each year the developing economy is on a higher catch-up path.

Assumption 4 When the FDI outflow from the richer economy decreases, the TFP growth rate of the developing economy decreases (with the lower bound of zero growth rate). We assume that the authorities in the developing economies will at some point establish effective catch-up scientific programs to bring the TFP growth rate back to the baseline TFP growth rate. The result is that the developing economy will be on a lower catch-up TFP growth path. In the limit, where the authorities are able instantaneously to raise its scientific base adequately to prevent the slowdown in FDI inflow from lowering the TFP growth rate, then the developing country will stay on its baseline TFP growth path (the "status quo" path in figure 3).

In line with the above four assumptions, we supplement the simulation of the FDI diversion case with the following five conditions:

1. a temporary decrease in the TFP[14] growth rate of the manufactured durable goods industries located in Indonesia, Malaysia, the Philippines, and Thailand. We assume an annual decline of 1 percentage point beginning in 2003 until the TFP level is 10 percentage points below the baseline TFP level in 2112;
2. a temporary decrease in the TFP growth rate of the manufactured non-durable goods industries located in Indonesia, Malaysia, the Philippines, and Thailand. We assume an annual decline of 1 percentage point beginning in 2003 until the TFP level is 10 percentage points below baseline TFP level in 2112;
3. a temporary increase in the TFP growth rate of the manufactured durable goods industries in China. We assume an annual increase of 1 percentage point beginning in 2003 until the TFP level is 10 percentage points above the baseline TFP level in 2112;
4. a temporary increase in the TFP growth rate of the manufactured non-durable goods industries in China. We assume an annual increase of 1 percentage point beginning in 2003 until TFP level is 10 percentage points above the baseline TFP level in 2112; and
5. a temporary increase in the TFP growth rate of the service industries in China. We assume an annual increase of 1 percentage point beginning in 2003 until the TFP level is 10 percentage points above baseline TFP level in 2112.

We call this the case of *FDI with technological spillovers*. The above five conditions are assumptions about the stances of public policy and the steepness of the learning curves in the ASEAN-4 and China. We assume that it will take a decade for the ASEAN-4 to improve their

14 In our model, TFP growth is the residual contribution to output growth after the contribution from capital accumulation and the contribution from the growth of effective labor supply have been taken into account. Effective labor is "raw" labor multiplied by the level of labor-augmenting technology.

scientific bases sufficiently to offset the slowdown in technological diffusion resulting from the lower FDI inflows. We also assume that it will take a decade for the Chinese sectors to master fully the new technology contained in the diverted FDI. Again, these are assumptions rather than predictions, but they give indicative estimates of the impacts of a range of plausible assumptions.

5.5 Some considerations in thinking about the simulation results

It is important to keep in mind that we are not forecasting the future value of each variable; rather, we are forecasting the WTO-induced deviation in the future value of each variable under a range of different assumptions. We are not arguing that any of the simulations are more or less realistic but are presenting alternative possible scenarios for consideration. The closest we come to forecasts of future values are the baseline projections that are conducted under the assumption of the credible maintenance of the status quo (*existing policy regimes*) from 1999; for example, no WTO membership for China into the indefinite future. Our rules of thumb for simplifying the assessment of the simulation results are as follows:

1. deviations that are less than 1 percentage point from the baseline will be regarded as having little practical importance;
2. the deviation in 2005 will represent the short-run effect; and
3. the deviation in 2020 will represent the long-run effect.

The focus group of our study consists of China, the United States, Japan, Australia, New Zealand, South Korea, ROECD, Taiwan, Indonesia, Malaysia, the Philippines, and Thailand.

6. The results of the simulations

6.1 The naive simulation

The overall results indicate that, as long as the removal of trade barriers in China is not accompanied by a diversion of FDI into China, China's WTO membership will have significant economic effects only on China's economy. For the 11 countries in the focus group, all their deviations in exports, GDP, consumption, and investment are less than 1 percent from the baseline. Figure 4 indicates that China's exports will be slightly above the baseline, by 1 percentage point, in the long run. The next highest deviation is a long-run increase of 0.8 percentage point for U.S. exports. The short-run deviations in Chinese and U.S. exports are about half of the long-run deviations. The other 10 economies in our focus group have deviations that are less than 0.3 percentage point from the baseline.

<Figures 4, 5, 6 near here>

Figure 5 displays the deviations from baseline GDP, private consumption, and investment, respectively. None of the GDP deviations are more than 0.2 percent from the baseline, and all of the consumption and investment deviations are less than 1 percent from the baseline. Figure 6 shows that the short-run impact on China's GDP, consumption, and investment are almost negligible, and the long-run impacts on these variables are , respectively, 2.5, 1.2, and 0.8 percentage points above the baseline. The interesting feature of this naive simulation is that it shows that the immediate impact (2003 and 2004) on China is slightly deflationary, reflecting perhaps the increase inflow of imports.

<figures 7 near here>

6.2 Simulation of the FDI diversion case

The overall results in the FDI diversion case are qualitatively similar to those in the naive case in the long run, but the key difference is that the quantitative effects on China are

magnified. Figure 7 reports an interesting flip-flop impact on China' exports. In 2005, China's exports will be 7 percent lower than the baseline, but, in 2020, they will be almost 4 percent higher. There are two alternative (and equivalent) ways of thinking about the adjustment. The export drop in 2005 is caused by the rise in consumption and investment (whose movements we will explain later), and the rise in the domestic absorption of goods and services means less goods and services are leftover for exports. China's investment boom (see figure 9) will mean that more capital goods (i.e., manufactured durable goods) will be imported. The alternative insight is that the large inflow of capital into China causes a real exchange rate appreciation in the short run that makes Chinese exports more expensive and Chinese imports cheaper. The inflow of real resources is accomplished by the exchange rate adjustment and the net deterioration in net exports. Over time the returns to the foreign investment in China are repatriated to foreigners, and this shows as an improvement in Chinese net exports induced by a weakening exchange rate. The inflow of capital into China is an outflow of capital from the United States, which weakens the U.S. dollar and increases the demand for U.S. exports. Some of these exports are capital goods to China. For the rest of the countries in the focus group, the export deviations are minor.

<figures 8 and 9 near here>

Figure 8 reveals that while the deviations in GDP for all of the countries except for China (figure 12) are negative, their magnitudes are trivial. In 2020, the deviations of 10 economies are below 0.3 percent, and South Korea's deviation is almost 0.5 percent. It is hard to say that any of the 11 economies are hurt in a nontrivial way. Figure 9 shows China embarking upon a sustained boom upon WTO accession. China's GDP jumps to 3.6 percent above baseline in the first year, slows down in the following three years, and then resumes its high growth to be 5 percent higher

than the baseline in 2020. The end of the annual MFN threat to China's exports increases the effective rate of return on capital in China and causes the long-run level of investment to be almost 20 percent above the baseline. The significant but temporary rise in China's consumption in the short run may reflect the relaxation of the liquidity constraints imposed by China's inefficient financial system. Given China's expected higher future income, it would be rational for economic agents to smooth their consumption, but the absence of consumer credit prevents this from occurring. The WTO-induced inflow of foreign funds relaxes the liquidity constraint and allows consumption to jump.

6.3 Simulation of the case of FDI with technological spillovers

The overall results for the case where FDI outflows induce slower technological change and inflows induce faster technological change, show large gains for China and sizeable losses for the ASEAN-4 (Indonesia, Malaysia, the Philippines, and Thailand). There is very little impact on the other countries, other than Hong Kong. Figure 10 shows a long-run increase in China's exports that is 31 percent above baseline, whereas Indonesian exports are down by 1.7 percent, Malaysian exports are down by 6.4 percent, Philippines's exports are down by 4.7 percent, and Thai exports are down by 6.8 percent. The other countries shown in Figure 10 have export deviations of less than 1 percent from baseline export levels.

<figures 10, 11, and 12 near here>

Figure 11 shows substantial long-run GDP losses by four Southeast Asian economies: 7 percent for Thailand, 5 percent for Malaysia and the Philippines, and 3 percent for Indonesia. Figure 12 shows that China's GDP, consumption, and investment decline initially but then recover to move strongly to reach long-run levels that are, respectively, 25 percent, 15 percent,

and 30 percent above their baselines. Although not shown in the figures presented here, we note that, because Hong Kong is so deeply integrated into China's economy, China's high growth raised Hong Kong's GDP 2.7 percent higher than its baseline. This high growth still does not generate much positive growth effects on the other non-ASEAN trade partners, even on East Asian neighbors that do not depend much on FDI: Japan's GDP is only 0.4 percent higher in 2020, South Korea's GDP is 0.6 percent higher, Taiwan's GDP is 0.3 percent higher, and the rest of the OECD's GDP is 0.3 percent higher.

7. Changes in the composition of exports: De-industrialization or new niches

In this section, we quantify the changes in the export compositions of China's trade partners in each scenario. Table 6 shows the total exports of each economy (or grouping) generated by the four sets of simulation. The naive and FDI diversion simulations show no case (not even for China) where exports deviated more than 5 percent from the baseline. Large deviations in the simulation of the diversion of FDI with technological spillovers were seen for four countries: China (31 percent), Malaysia (6.4 percent), Philippines (4.7 percent) and Thailand (6.8 percent)—suggesting that these four economies might be the ones with the biggest changes in their production structures.

<table 6 near here>

There are two other noteworthy points from table 6. First, the main reason why the developed countries appear to be relatively unaffected by China's WTO accession may be because China's imports of advanced capital goods account only for a small portion of OECD's exports. The outcome is that even a large percentage change in the amount of China's imports from OECD would not cause total OECD exports to show noticeable changes.

<table 7 near here>

Second, it is important to note that, during the adjustment period, competitiveness improvements in China caused by lower tariffs and cost reductions resulting from induced technical change make Chinese exports more competitive, but the capital inflows induced by a rise in the return to capital in China causes an appreciation of the Chinese real exchange rate, which makes Chinese exports less competitive overall. These two offsetting effects explain why trade flows respond by less in the short to medium term than might be expected.

When we examine the export composition in each scenario for every country and the changes in each export component, we find no substantial changes in any country under the naive simulation. The only export composition under the FDI diversion simulation that shows substantial changes was China's (see table 7). In the export compositions from the technological spillover simulation, we observe significant deviations from the baseline only in the ASEAN-4 and China.[15] Table 7 indicates the following:

1. China shows that manufacturing exports accounted for 27 percentage points of the 33 percent increase in total exports above the baseline.
2. The manufacturing sectors in the ASEAN-4 show substantial long-run declines vis-à-vis their baselines. In Indonesia and the Philippines, the drop in manufactured exports exceed the drop in total exports; and in Malaysia and Thailand the decline in manufactured exports accounted for, respectively, 97 percent and 91 percent of the fall in total exports.

The only economies that may be de-industrialized by China's WTO accession are the ASEAN-4, but for that to happen they will have to be slow in reversing the reduced rate of technological diffusion, a byproduct of the reduced FDI inflow. When the ASEAN-4 are able to correct this problem quickly, then we are back in the FDI diversion case. In the FDI diversion

15 The rest of the countries do not show large deviations in their top 2 exports.

case, China's insertion of one-third more workers into the international division of labor leads to further division of labor (i.e., to even finer specialization in production activities) within the manufacturing sector worldwide rather than to the displacement of the ASEAN-4 from manufacturing. The lengthening of the production chains in manufacturing creates niches in manufacturing activities that the ASEAN-4 can fit themselves in because they are technologically versatile. For the ASEAN-4 to have such versatility, their governments must invest in strengthening the scientific and technological capability of their citizens.

8. Changing the course of the fate of the ASEAN-4

There are two ways for the ASEAN-4 to enhance their technological capacity and get new cutting-edge technology. The first way is to have the ability to innovate indigenously. The second way is to have the ability to obtain technology transfer from elsewhere, for example technological diffusion via foreign direct investment. The *Global Competitiveness Report 2000* published by the World Economic Forum has an overall ranking of 59 countries according to technological capacity. This technological capacity index is determined by averaging two other indices, the indigenous innovation index and the technology transfer index. The three right-hand-side columns in table 8 show the national ranking in the two component indices and in the overall technology index.

<table 8 near here>

We see in the ranking of the overall technology index that Malaysia (18), the Philippines (32), and Thailand (43) are above China (48), whereas Indonesia (50) is only slightly below China in ranking. However, when we see that the higher average rank of the ASEAN-4 comes from the higher technology transfer from abroad—the rank of Malaysia is 7, the Philippines is

19, Thailand is 36, China is 43, and Indonesia is 45—we realize how critically the average ASEAN-4 depends on technological diffusion through FDI. FDI diversion from China's WTO membership is therefore likely to cause the future rank of Indonesia, Malaysia, the Philippines, and Thailand in the overall technology index to fall, and that of China to rise.

The ASEAN-4 have a lot of work to do in enhancing their indigenous technological capabilities. In the indigenous innovation index, China ranks almost as high as Malaysia, and significantly higher than the Philippines, Thailand, and Indonesia.

Of course, the growth rate of a country depends on several other important factors besides technological capacity. For example, the story of the Soviet Union is the story of world-class accomplishments in basic scientific research but of abysmal performance in applied scientific research, and, hence, in overall economic growth. The fundamental problem in the former Soviet Union was the absence of a market economy, which meant that there were grossly inadequate incentives to mobilize people to translate basic research into commercial applications. For market economies, factors such as economic openness, meritocracy, adequacy of infrastructure, efficiency and incorruptible government, quality of financial institutions, and astuteness in macroeconomic management are of fundamental importance in economic growth. The general low ranking of the ASEAN-4 in these other dimensions, along with their low ranking in technological capacity, help explain why these countries have performed quite poorly in the final index for growth competitiveness for the 59 countries, as shown in the left-hand-side column in table 8. The high rankings that Hong Kong has in these other dimensions (e.g., 1 in trade openness and 4 in sophistication of financial markets) boosted its overall ranking despite being ranked 30 in technology level.

Clearly, while the ASEAN-4 should boost technological capacity by focusing on applied research, it also needs people at the frontier of research. It means that there should be more investment in higher education and not in airplane factories. The establishment of linkages between the universities and the business sector should be fostered, and the establishment of state-owned factories be stopped.

We should be clear that our suggestion that aggressive technology policies be adopted in Southeast Asia is compatible with our acceptance of the comparative advantage principle, and the importance of pursuing market-compatible economic policies. Specifically, the comparative advantage principle would counsel against the use of industrial policies to ensure that a country's chief export be technology-intensive goods when the inherited factor endowment of the country shows a higher ratio of unskilled labor to skilled labor compared with the ratios in other countries.[16] The comparative advantage principle would not, however, counsel against policies to increase human capital formation and to enhance technology and capital transfers from abroad, so that the country will begin to export more goods that are technology-intensive. Our point is simply that there is no inconsistency between producing an output composition that is in accordance with the existing relative factor endowment of the country, and seeking to change the relative factor endowment by increasing the amount of human capital and raising the level of technology. This is the reason why the U.S. government, one of the most laissez-faire-oriented governments in the world, is spending US$90 billion this year to increase the technological capacity of the United States.

16 The theoretically more correct ratio is the ratio of unskilled labor to total capital stock (human capital and physical capital).

9. Final remarks

The naive simulation confirms the prediction from standard trade theory that the tariff reductions required of China by WTO membership would render China better off (GDP is 2.5 percent above baseline in the long run) without hurting any of its trade partners. When we take into account that the removal of the annual MFN threat over China's exports would divert FDI toward China, China's welfare is increased further (GDP is then 5 percent above baseline), again with, practically speaking, no negative repercussions on other economies.

If we now assume that it is possible that FDI inflow into a developing economy creates technological spillovers, then we see that the 25 percent higher GDP in China is accompanied by GDP losses of 7 percent in Thailand, 5 percent in Malaysia and the Philippines, and 3 percent for Indonesia. We must mention, however, that these results were generated under the assumption that it would take 10 years of improvements in the scientific bases of the ASEAN-4 before they could restore the TFP growth rates in their domestic manufacturing sectors to the steady-state TFP growth rates in the manufacturing sectors of the advanced economies. If the improvements in the ASEAN-4 scientific bases could occur faster, then their GDP losses would be smaller. A key part of the adjustment for ASEAN-4 in response to the diversion of FDI to China should be an accelerated upgrading of their indigenous technological capabilities, a large part of which consists of raising the skill level of the workforce and widening the range of skills within the workforce.

Our simulations suggest that the full integration of China's huge labor force into the international division of labor will not reduce the size of the manufacturing sectors in the OECD. Only the ASEAN-4 face the possibility of de-industrialization, but this will happen only if FDI flows affect domestic technological change (and this is an open question), and if the ASEAN-4

economies allow the drop in FDI inflow to lower the rate of technological diffusion to their economies. If the ASEAN-4 can prevent themselves from falling behind technologically, then they can also find lucrative niches in the lengthened production chains in manufacturing activities. This finding suggests that the ASEAN-4 must give the highest priority to deepening and widening their pools of human capital by speeding up the diffusion of new knowledge to their scientists and managers, and providing appropriate retraining programs for the displaced workers.

The entry of China to take its place in the international economic system will permit further specialization of tasks in the workplace, and this is a wealth-creating outcome. The country that can provide its workforce with the depth and range of scientific training required in the new workplace will be in line to receive some of the newly created wealth. The country that is slow in building up its scientific and technological capability is one that does not understand the right remedy for the constant structural adjustment forced by globalization.

Finally, we must mention that the estimates presented here are conditional on many assumptions, and there are the three key assumptions to which we want to draw particular attention. The first assumption concerns our use of GTAP's estimates of effective protection rates. There are claims that GTAP's estimates of nontariff barriers are too low, and this means that our estimates of the increases in exports to China from the rest of the world might be understated. The changes to China's imports reported here should perhaps be regarded as the lower limit of how much China's imports would increase with China's WTO accession.

The second assumption in this analysis is that China will be able to adjust relatively smoothly to the massive structural shifts forced by the economic opening required by WTO membership. This is clearly a debatable assumption. As Sachs and Woo (forthcoming) put it:

"Conservatively, almost a fifth of China's workers might have to change jobs, and this could be a politically destabilizing process if not handled adeptly, and if external shocks were to slow down economic growth." The state-owned enterprise (SOE) sector employs over 60 percent of the urban labor force, and at least one-third of SOEs have been losing money for a decade and would have been closed if not for continued state subsidies and trade protection. Furthermore, about a third of the loans extended by the monopoly state-owned banking sector are nonperforming. WTO membership will now require China to stop the subsidization of the SOEs, and to give foreign banks national treatment within five years. It is no wonder that Gordon Chang (2001) has received so much attention from his warning of forthcoming industrial depression and financial sector collapse. In our opinion, such a pessimistic scenario is a possibility, but we think that China has the ability to handle this problem; see Sachs and Woo (forthcoming).

The third key assumption in our simulation is that the world economy will continue to have stable economic growth. The international situation in the beginning of February 2003 certainly requires one to have second thoughts about this assumption. Japan shows no signs of recovering from its decade-long stagnation; the two largest economies within the European Union are being pressed to reduce their budget deficits (as required by the Stability Pact) when both show sluggish growth; and international economic activities are being threatened by possible conflicts in Iraq and North Korea. If one were superstitious, one would also note that the Chinese-Vietnamese-Korean Lunar New Year, which fell on 1 February 2003, began on a most inauspicious note—the disintegration of the space shuttle Columbia. Although we are not beginning the Year of the Ram with a flying start, we remain hopeful that the best is yet to be.

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Table 1: Inward and outward FDI stocks as a percentage of gross domestic product by economy (percentage)

Economy	1980	1990	2000	Economy	1980	1990	2000
China							
Inward	3.1	7.0	32.3				
Outward	—	0.7	2.4				
Selected OCED Economies				**Selected Asian Economies**			
United States				**Taiwan**			
Inward	3.0	6.9	12.4	Inward	5.8	6.1	9.0
Outward	7.8	7.5	13.2	Outward	0.2	8.0	15.9
Canada				**Hong Kong**			
Inward	20.4	19.6	28.8	Inward	436.2	198.1	263.8
Outward	8.9	14.7	32.4	Outward	0.5	15.9	224.9
Japan				**Singapore**			
Inward	0.3	0.3	1.1	Inward	52.9	77.9	103.8
Outward	1.8	6.6	5.8	Outward	31.7	21.3	57.5
South Korea				**Indonesia**			
Inward	2.1	2.3	13.7	Inward	13.2	34.0	39.6
Outward	0.2	0.9	11.1	Outward	—	0.1	1.5
Australia				**Malaysia**			
Inward	7.9	23.7	29.2	Inward	20.7	23.4	58.8
Outward	1.4	9.8	20.9	Outward	0.8	6.1	20.8
New Zealand				**Philippines**			
Inward	10.3	18.2	49.4	Inward	3.9	7.4	16.6
Outward	2.3	14.7	10.8	Outward	0.5	0.3	2.6

France				**Thailand**			
Inward	8.2	8.2	19.9	Inward	3.0	9.6	20.0
Outward	3.6	9.9	33.4	Outward	—	0.5	2.0
Germany							
Inward	3.9	7.1	24.1				
Outward	4.6	8.8	25.2				
Italy							
Inward	2.0	5.3	10.5				
Outward	1.6	5.2	16.8				
United Kingdom							
Inward	11.8	20.6	30.5				
Outward	15.0	23.2	63.2				

Source: *United Nations Conference on Trade and Development (2002).*

Table 2: Inward and outward FDI flows as a percentage of gross fixed capital formation by economy (percentage)

Economy	1990–95 (annual average)	2000	Economy	1990–95 (annual average)	2000
China					
Inward	9.8	10.5			
Outward	1.4	0.2			
Selected OECD Economies			**Selected Asian Economies**		
United States			**Taiwan**		
Inward	4.3	17.5	Inward	2.5	6.8
Outward	6.1	9.6	Outward	6.2	9.2
Canada			**Hong Kong**		
Inward	5.9	47.3	Inward	15.3	144.9
Outward	6.6	33.7	Outward	37.4	138.9
Japan			**Singapore**		
Inward	0.1	0.7	Inward	30.5	19.8
Outward	2.2	2.6	Outward	11.7	18.2
South Korea			**Indonesia**		
Inward	0.8	7.1	Inward	4.8	-12.2
Outward	1.4	3.8	Outward	2	0.4
Australia			**Malaysia**		
Inward	9	14.1	Inward	19.4	16.5
Outward	3.7	6	Outward	3.4	8.8
New Zealand			**Philippines**		
Inward	25.2	33.2	Inward	7.9	9.2
Outward	7.7	10	Outward	0.5	0.8

France			**Thailand**		
Inward	6	16.9	Inward	4.4	10.4
Outward	8.8	69.1	Outward	0.6	0.2
Germany					
Inward	0.9	48.7			
Outward	5.3	12.4			
Italy					
Inward	1.8	6.3			
Outward	3	5.8			
United Kingdom					
Inward	9.7	46.4			
Outward	14.7	101			

Source: *United Nations Conference on Trade and Development (2002).*

Table 3. Values of and country rankings by the UNCTAD inward FDI performance index (from sample of 140 countries)

	Value		Rank	
	1988–90	**1998–2000**	**1988–90**	**1998–2000**
China	0.9	1.2	61	47
Selected OECD economies				
United States	1.1	0.8	50	74
Canada	1.3	1.6	46	30
Japan	0.0	0.1	128	131
South Korea	0.5	0.6	93	87
Australia	2.8	0.6	22	88
New Zealand	4.0	1.0	10	54
France	0.9	0.8	60	69
Germany	0.3	1.3	106	43
Italy	0.6	0.2	79	115
United Kingdom	3.3	1.8	16	25
Selected Asian economies				
Taiwan	0.9	0.3	58	112
Hong Kong	5.4	5.9	4	2
Singapore	13.8	2.2	1	18
Indonesia	0.8	–0.6	63	138
Malaysia	4.4	1.2	8	44
Philippines	1.7	0.6	39	89
Thailand	2.6	1.3	25	41

Source: *United Nations Conference on Trade and Development (2002).*

Note: *Value of FDI performance index is the ratio of a country's share in global FDI flows to its share in global GDP. Value of 1 denotes that the country is receiving FDI exactly in line with their relative economic share.*

Table 4. The 10 most promising destinations for manufacturing FDI by Japanese TNCs over the next three years (frequency, expressed in percent, that the country is identified by Japanese firms responding to annual surveys conducted by Japan Bank for International Cooperation, JBIC)

Rank	1996 survey	Ratio	2000 survey	Ratio	2001 survey	Ratio
1	China	68	China	65	China	82
2	Thailand	36	United States	41	United States	32
3	Indonesia	34	Thailand	24	Thailand	25
4	United States	32	Indonesia	15	Indonesia	14
5	Vietnam	27	Malaysia	12	India	13
6	Malaysia	20	Taiwan province of China	11	Vietnam	12
7	India	18	India	10	Taiwan province of China	11
8	Philippines	13	Vietnam	9	Rep. of Korea	8
9	Singapore	10	Rep. of Korea	9	Malaysia	8
10	United Kingdom and Taiwan Province of China	7	Philippines	8	Singapore	6

Source: *United Nations Conference on Trade and Development (2002).*

Notes: *The share of firms that consider the country as promising in total respondent firms (multiple responses)*

Fiscal year.

Table 5. Survey undertaken in October 2001 of the 21 percent of Japanese TNCs that intend to move to China because of China's accession to WTO (survey by Japan External Trade Organization, JETRO)

Planned relocation of production sites of these Japanese TNCs (percentage of TNCs responding)	
From	**Distributive share**
Japan	67.5
Hong Kong, China	9.0
Taiwan Province of China	6.6
ASEAN-4:	6.0
Malaysia	3.0
Indonesia	1.2
Philippines	1.2
Thailand	0.6
United States	4.2
Singapore	1.8
Republic of Korea	1.2
Other Asian countries	1.2
Mexico	1.2
United Kingdom	1.2

Table 6. Total exports in 2020 (US$ billion, 1999 prices)

	Baseline	Naive case	FDI diversion case	Diversion of FDI with technological spillovers
United States	1,334.52	1,344.79	1,345.97	1,343.25
Japan	761.17	760.77	763.09	759.45
Australia	123.05	123.24	123.24	123.43
New Zealand	32.31	32.34	32.35	32.31
Indonesia	108.52	108.68	108.90	105.05
Malaysia	154.18	154.15	154.11	143.46
Philippines	48.42	48.48	48.48	45.89
Singapore	276.82	276.99	277.15	275.96
Thailand	134.06	134.14	134.01	123.21
China	313.03	318.01	324.62	415.21
India	55.92	55.93	55.89	55.94
Taiwan	227.75	227.64	227.25	227.50
South Korea	297.33	298.19	298.50	299.48
Hong Kong	123.34	124.43	125.40	126.35
ROECD	2,173.98	2,168.48	2,172.59	2,159.56
LDC	799.15	801.35	802.14	799.82
EEFSU	316.33	316.56	317.14	316.78
OPEC	569.05	567.79	567.61	568.94

Table 7. Deviation of exports from baseline in 2020

	China	Indonesia	Malaysia	Philippines	Thailand
1. Simulation of FDI diversion					
Deviation of total exports from baseline, in percent					
	3.70	0.34	–0.04	0.12	–0.04
Contribution to deviation from baseline, in percentage points					
Energy	0.11	0.64	0.01	0.04	0.00
Mining	0.01	–0.02	0.00	0.01	0.00
Agriculture	–0.10	–0.02	0.08	0.04	0.12
Durable manufacturing	1.44	–0.01	–0.08	0.02	–0.01
Non-durable manufacturing	0.87	–0.14	0.01	0.02	–0.02
Services	1.36	–0.10	–0.06	–0.01	–0.13
2. Simulation of diverted FDI with technological spillovers					
Deviation of total exports from baseline, in percent					
	32.64	-3.20	–6.95	–5.22	–8.09
Contribution to deviation from baseline, in percentage points					
Energy	0.77	0.19	–0.02	0.02	0.00
Mining	0.16	0.00	0.00	–0.01	0.00
Agriculture	0.57	–0.20	–0.30	–0.11	–0.47
Durable manufacturing	14.34	–0.07	–4.59	–3.05	–3.94
Non-durable manufacturing	13.11	–3.28	–2.14	–2.36	–3.41
Services	3.69	0.15	0.10	0.28	–0.26

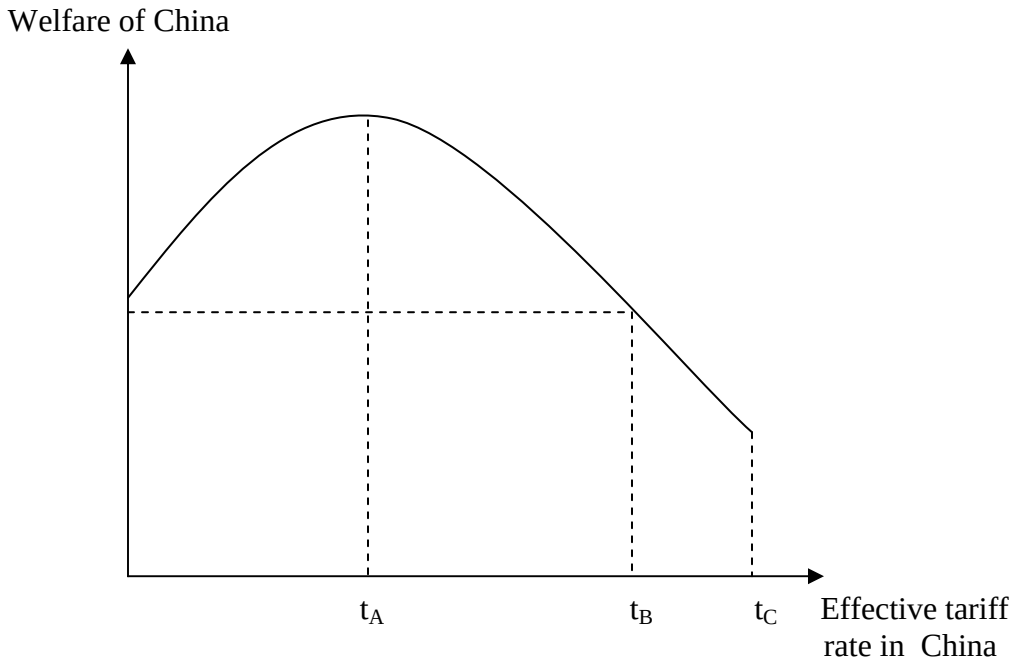
Table 8. Indices of technological capacity, and of growth competitiveness across countries in 2000

Indigenous innovation index		**Technology transfer index**		**Overall technology index**		**Growth competitiveness index**	
United States	1	Singapore	1	United States	1	United States	1
Finland	2	Ireland	2	Finland	2	Singapore	2
Germany	3	Luxembourg	3	Singapore	3	Luxembourg	3
Switzerland	4	Malaysia	7	Ireland	4	Netherlands	4
Japan	5	Taiwan	12	Germany	5	Ireland	5
Singapore	14	South Korea	13	Switzerland	6	Finland	6
Taiwan	16	Hong Kong	17	Japan	7	Canada	7
South Korea	22	Philippines	19	Malaysia	18	Hong Kong	8
Hong Kong	27	India	26	Taiwan	24	Taiwan	11
Malaysia	30	Thailand	36	South Korea	25	Japan	21
China	34	Japan	39	Hong Kong	30	Malaysia	25
India	38	China	43	Philippines	32	South Korea	28
Philippines	47	Indonesia	45	India	37	Thailand	31
Thailand	50	**ASEAN-4 (average)**	**27**	Thailand	43	Philippines	37
Indonesia	55			China	48	China	41
ASEAN-4 (average)	**46**			Indonesia	50	Indonesia	44
				Ecuador	58	India	49
				Bolivia	59	Bulgaria	58
				ASEAN-4 (average)	**36**	Ecuador	59
						ASEAN-4 (average)	**34**

Source: *World Economic Forum (2000).*

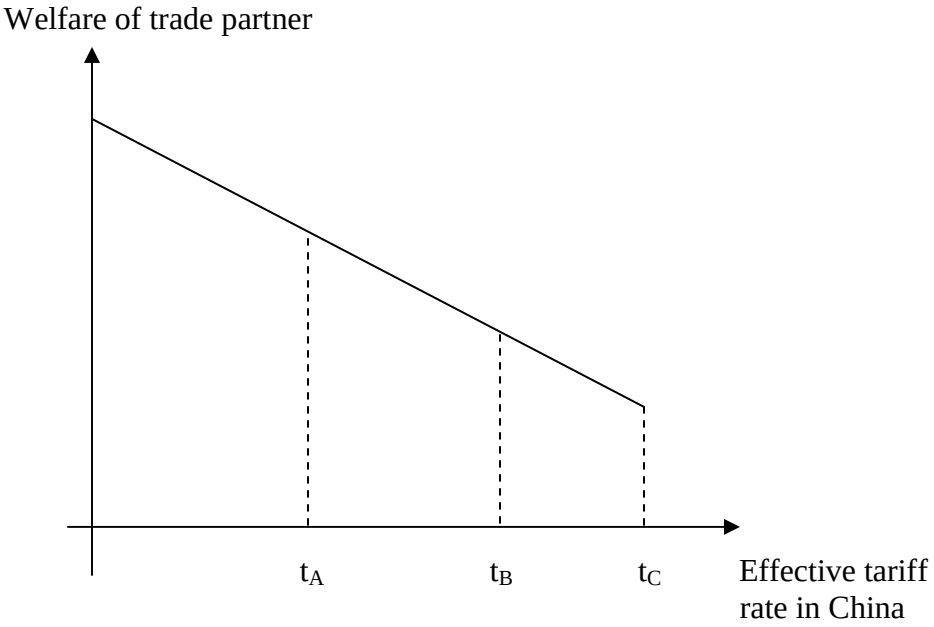
Note: *The indigenous innovation index and technology transfer index are the two components of the overall technology index. The overall technology index is combined with the startup index (relative ease in establishing a new firm) to produce the economic creativity index. The growth competitiveness index is constructed from the economic creativity index, the finance index (relative efficiency of the financial system), and the international index (degree of integration into the international economy).*

Figure 1: Relationship between welfare level and tariff rate in China



(The assumption is that China is a large economy.)

Figure 2: Relationship between welfare level of China's trade partner and China's tariff rate



(The assumption is that China is a large economy.)

Figure 3: Transition dynamics from changes in FDI Flows

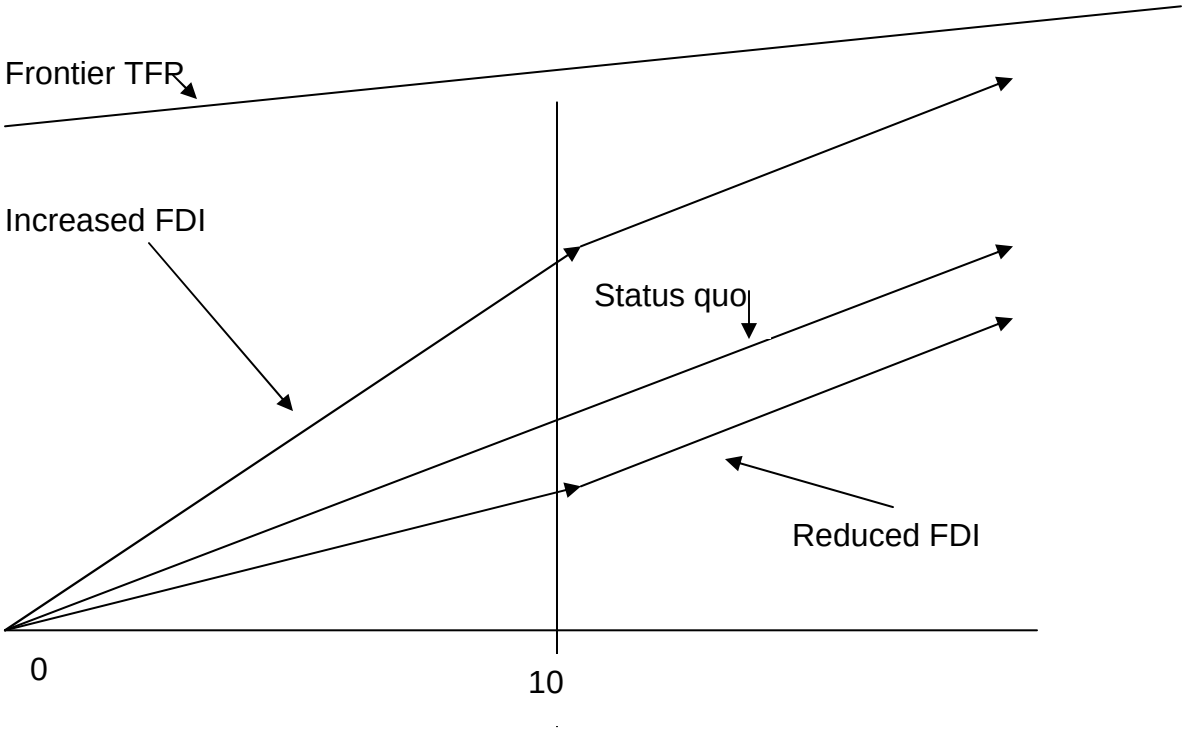


Fig 4: Change in Exports -- Naive Case

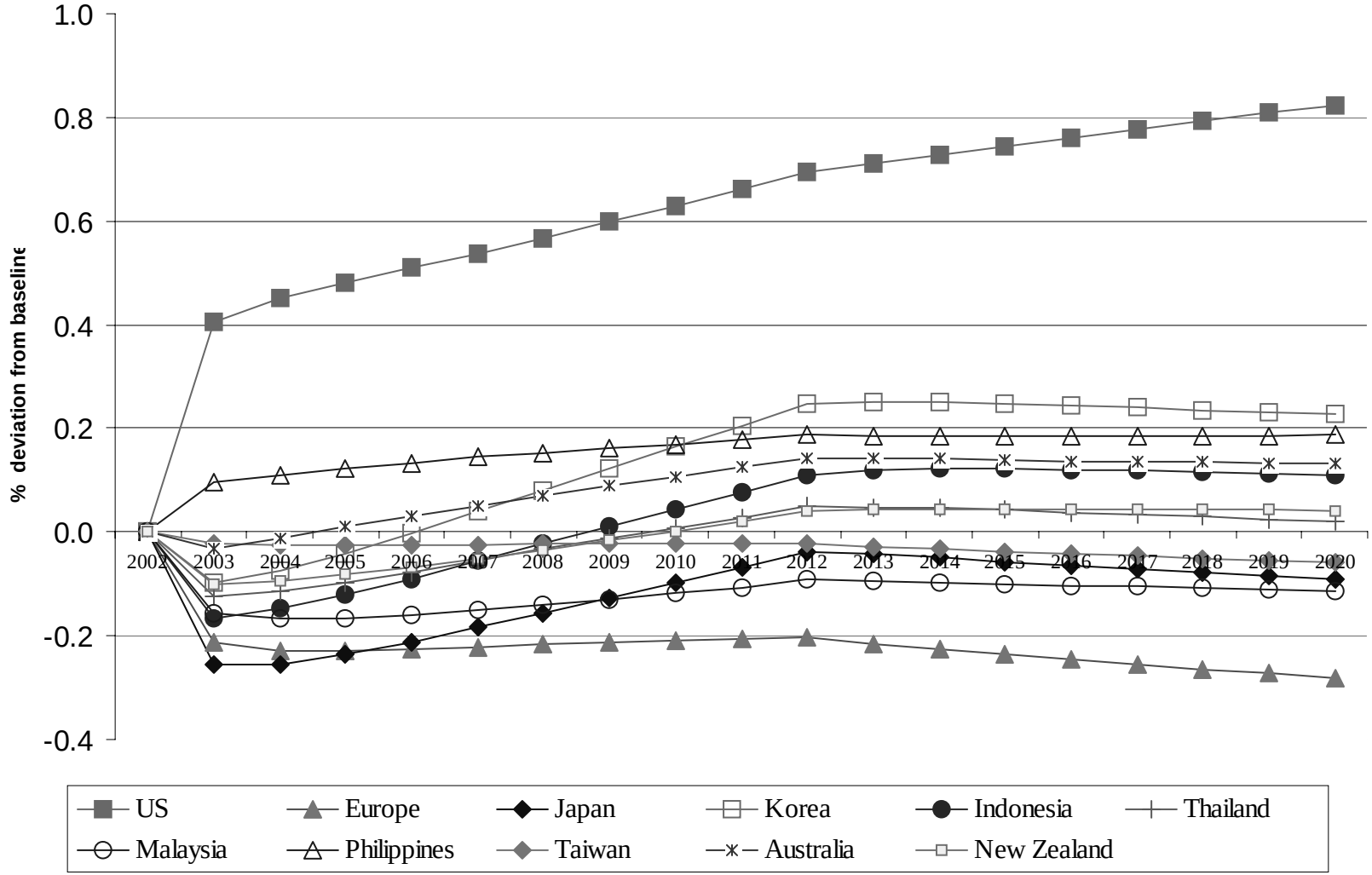


Fig 5: Change in Real GDP in Other Countries -- Naive Case

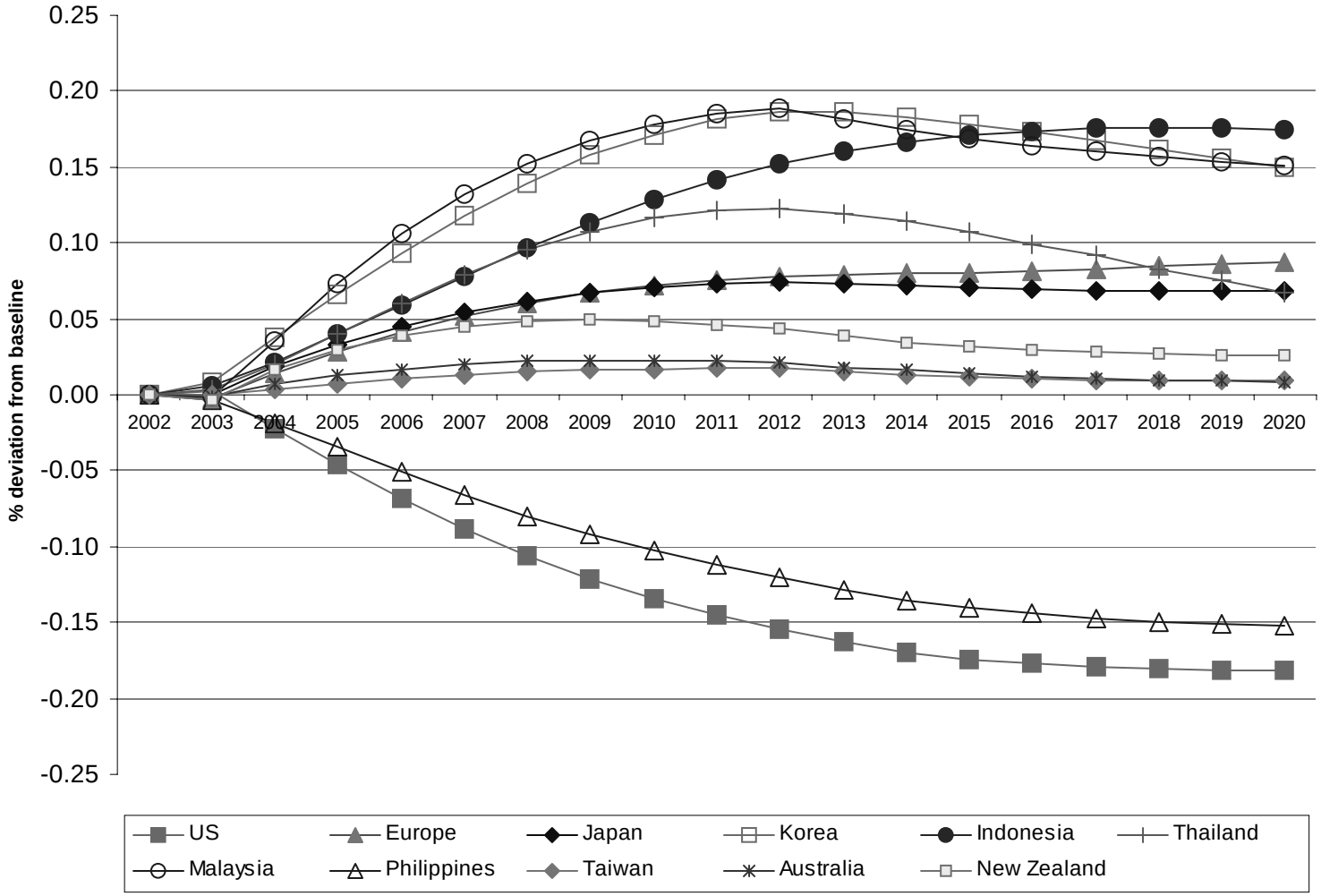


Figure 6: Real Effects on China -- Naive Case

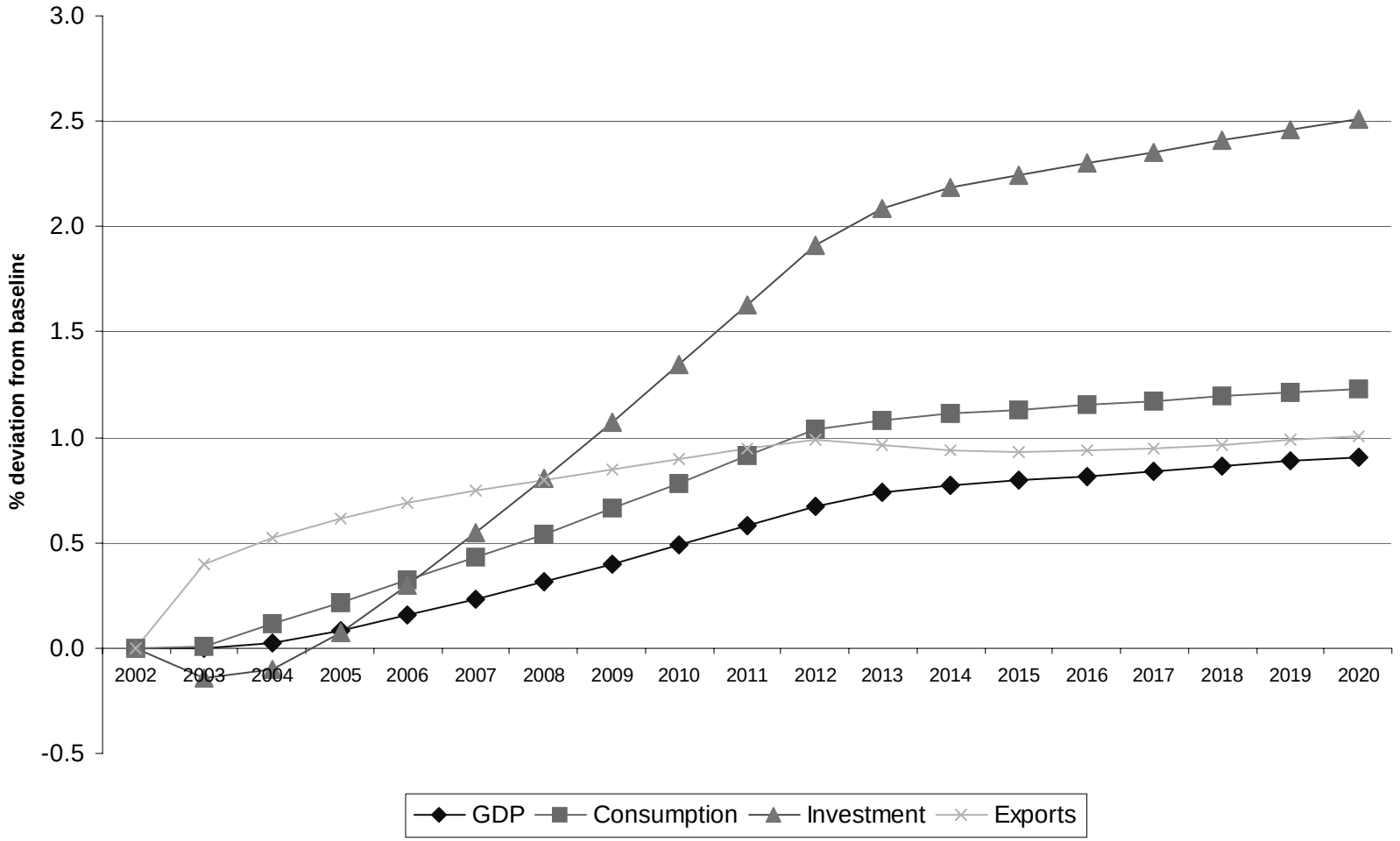


Figure 7: Change in Exports -- FDI Diversion Case

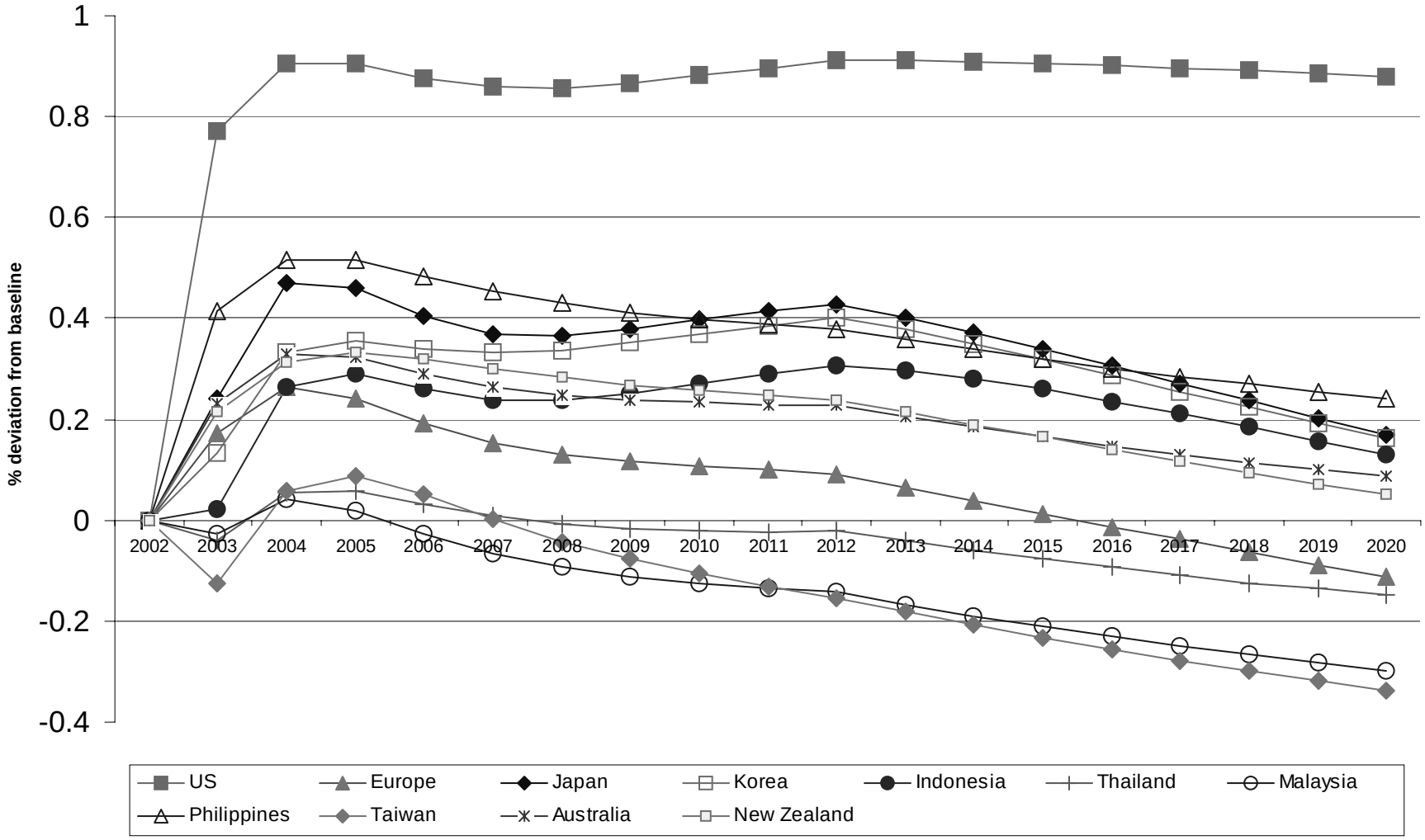


Figure 8 :Change in Real GDP in Other Countries - FDI Diversion Case

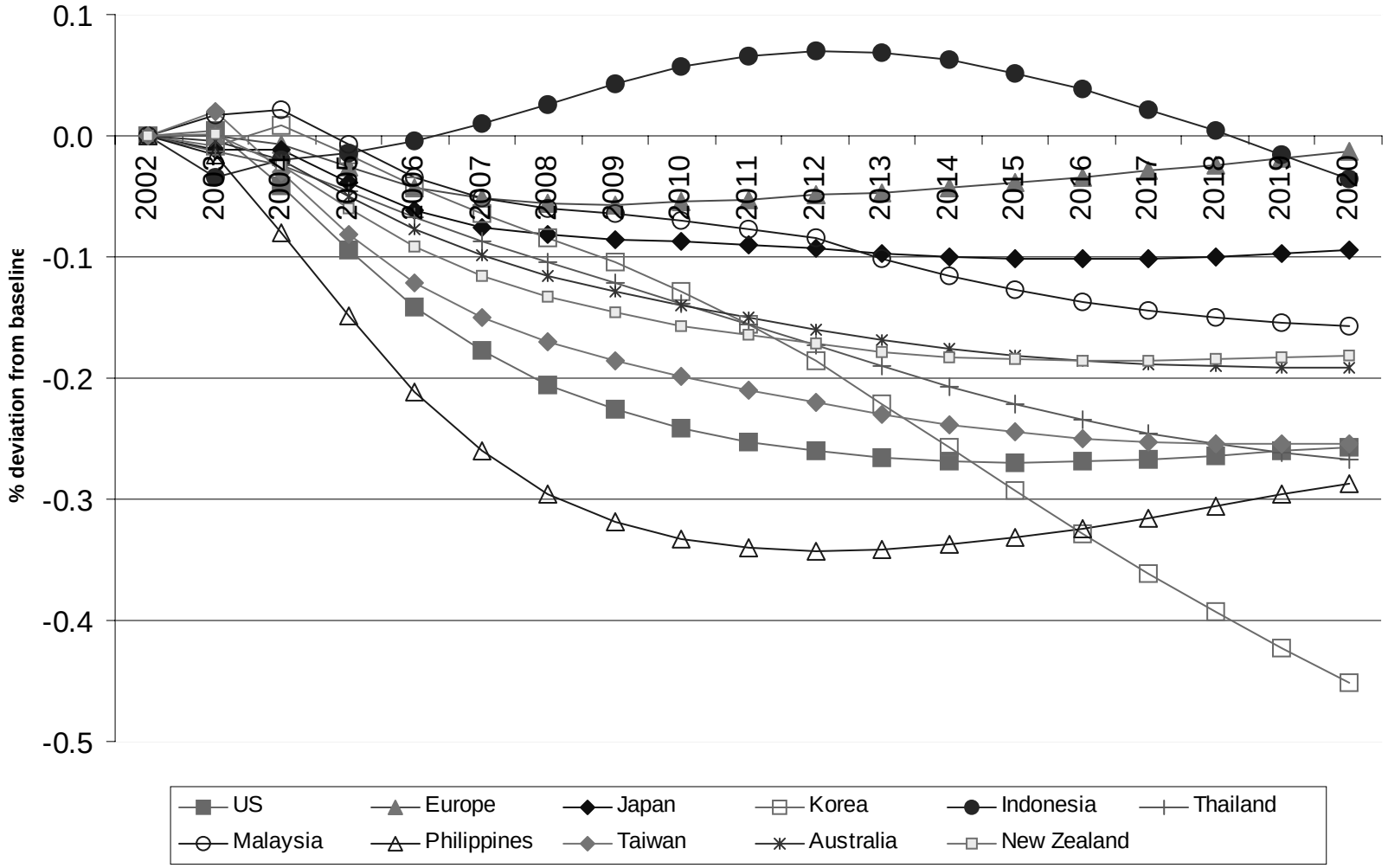


Figure 9: Real Effects on China -- FDI Diversion Case

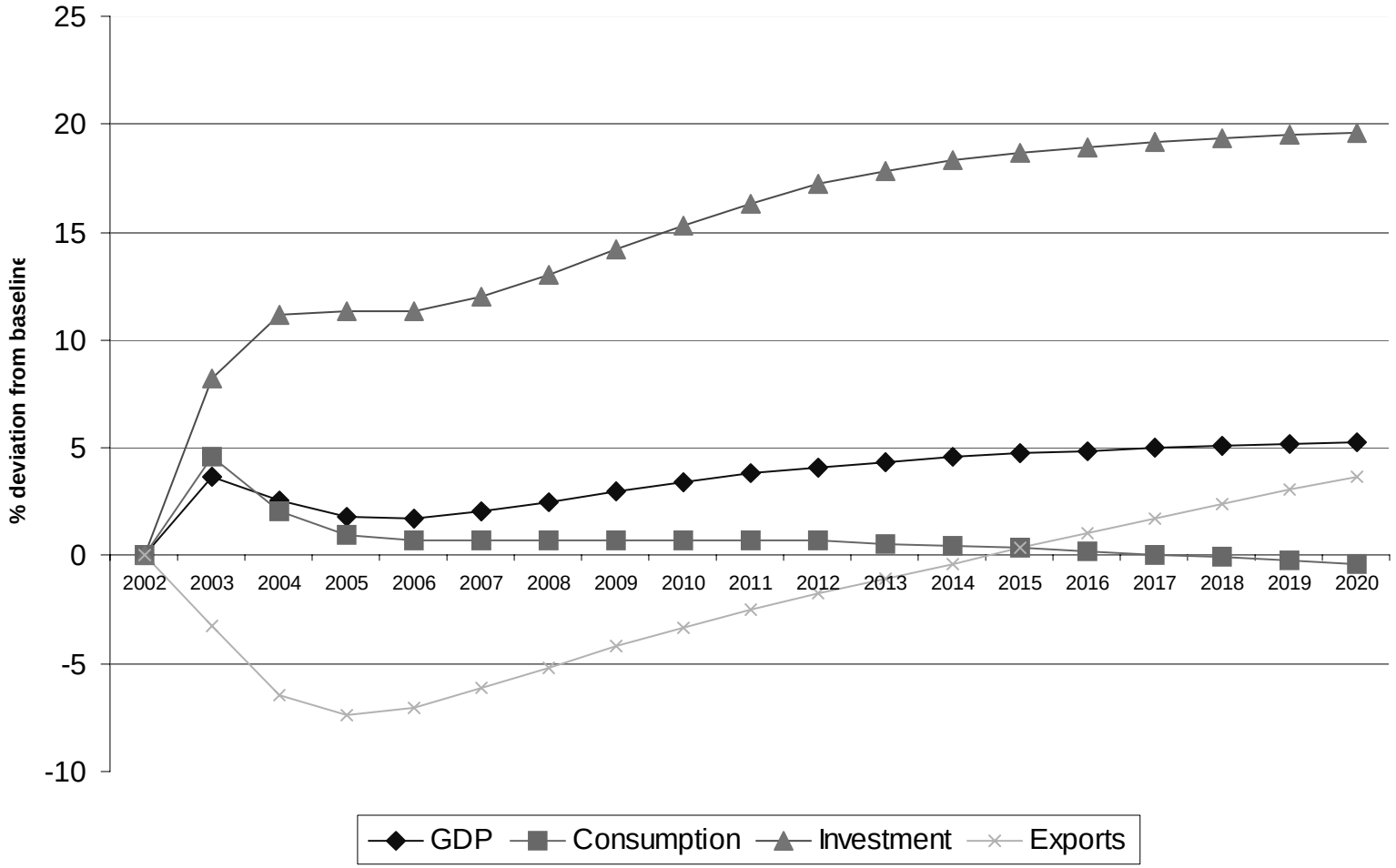


Figure 10: Change in Exports -- Case of FDI with Technological Spillovers

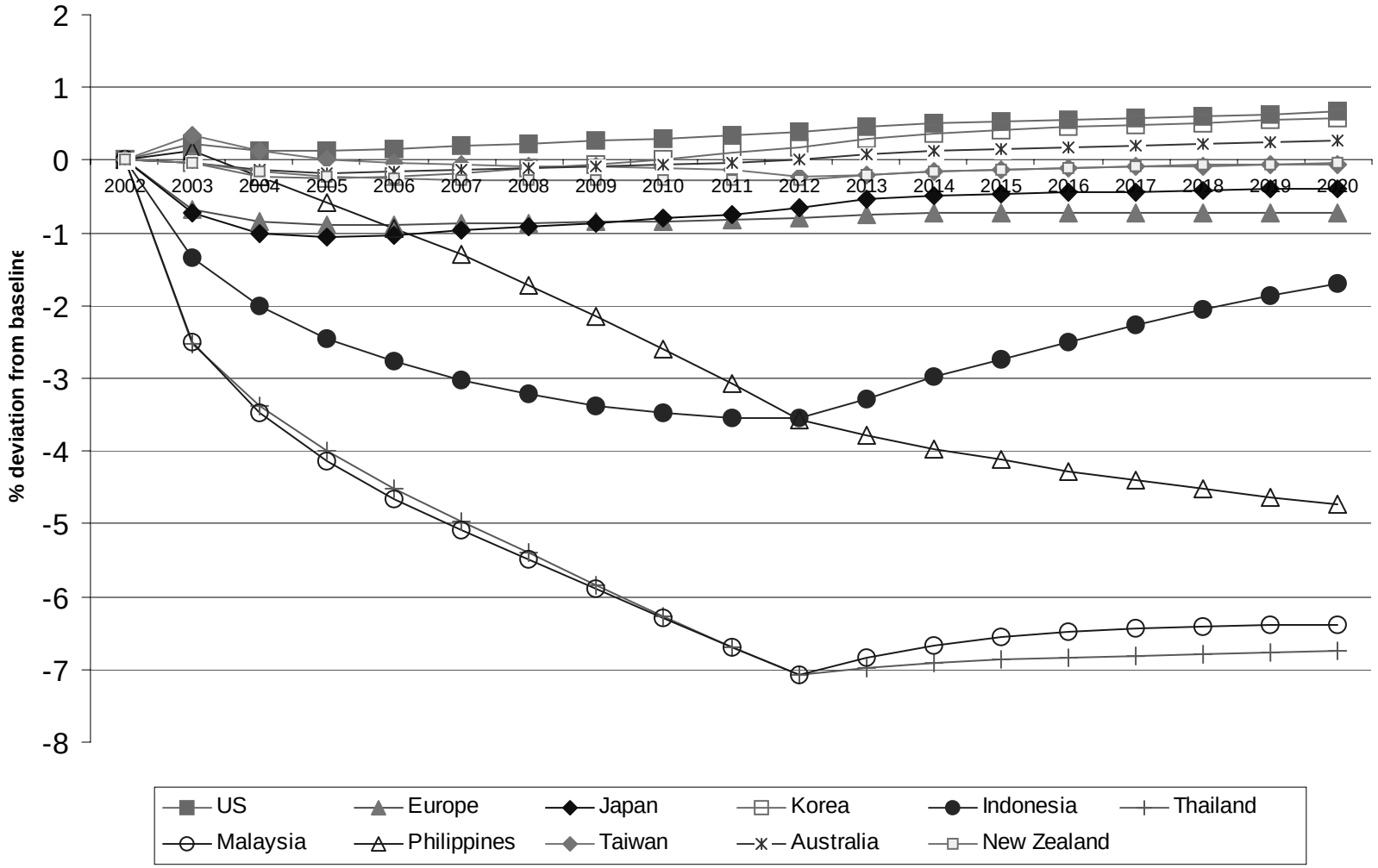


Figure 11: Change in Real GDP in Other Economies - Case of FDI with Technological Spillovers

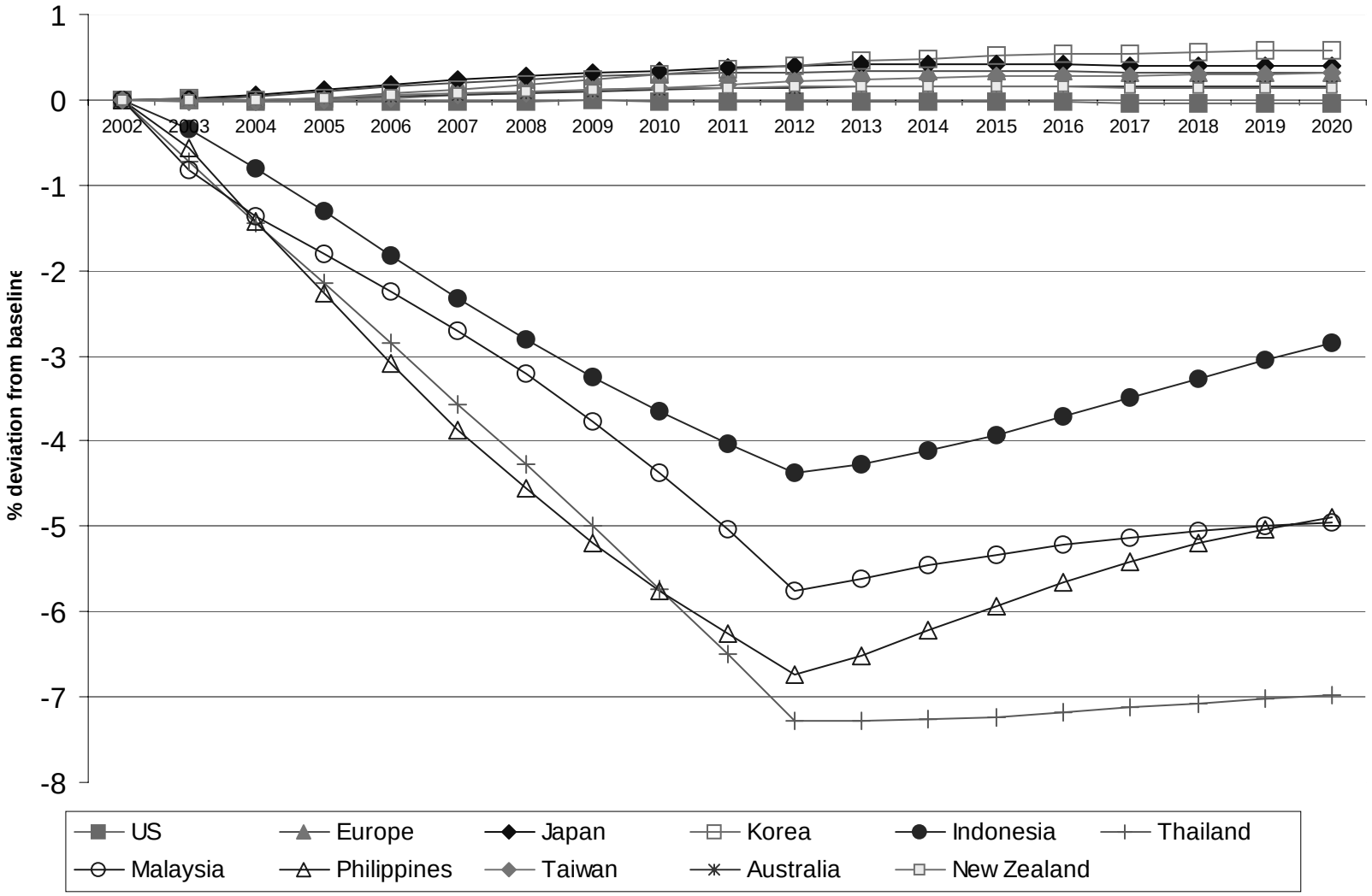
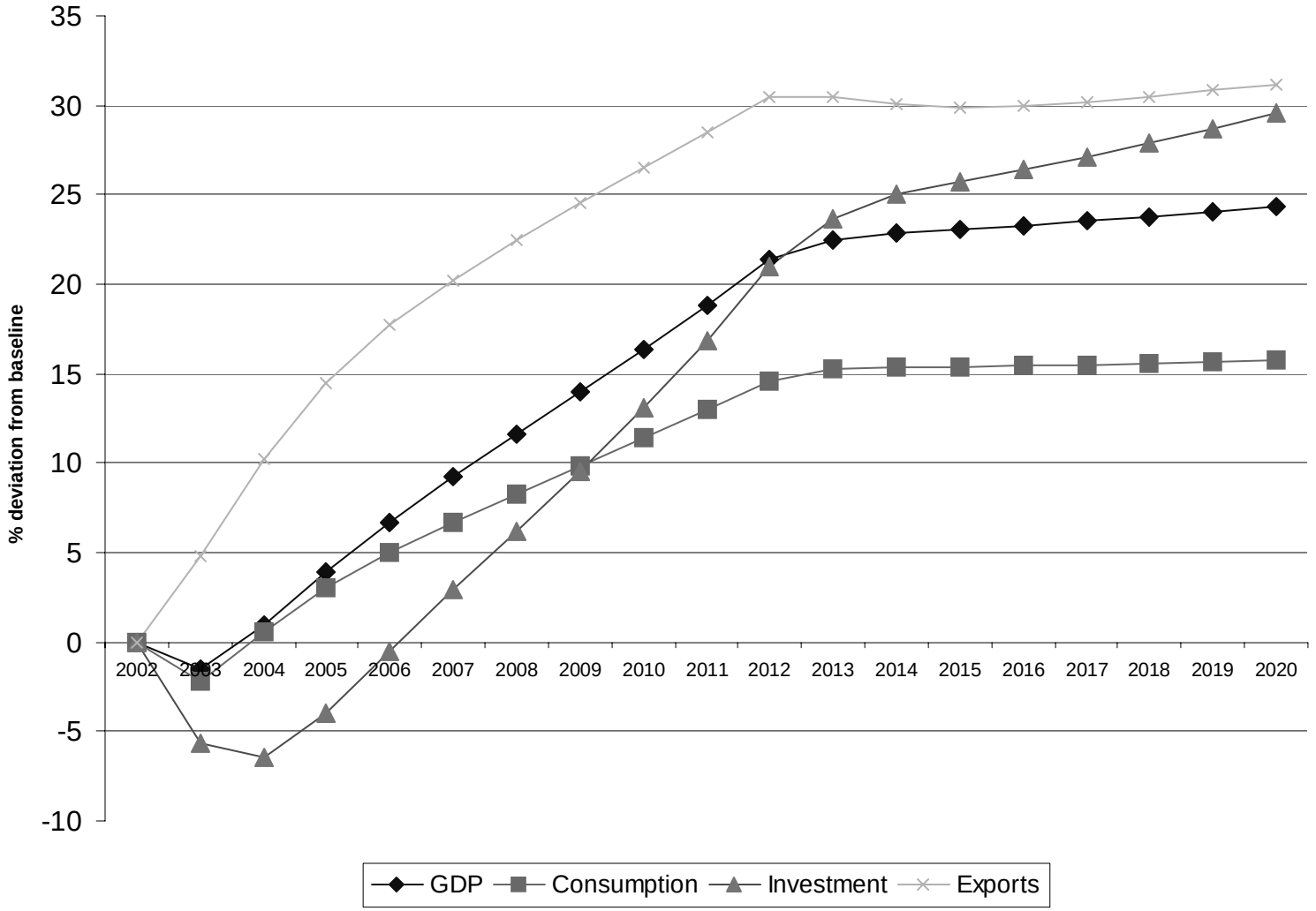


Figure 12: Real Effects on China -- Case of FDI with Technological Spillovers



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