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Abstract

Trade in food and other agricultural products is increasingly important across East and Southeast Asia, where high-income Asian economies have driven significant agricultural expansion, and the momentous growth of the People's Republic of China (PRC) promises more stimulus to agrofood activity in the region. The PRC is expected to become a net importer of agrofood in the coming decades, which will have significant implications within the region. As its middle class continues to emerge, the resource intensity of food consumption (e.g., meat and dairy) will lead to net imports and require expansion of agricultural capacity elsewhere. Because low-income Southeast Asia is generally seen to be well below its agrofood potential, this situation suggests a significant opportunity for self-directed poverty reduction through regional agrofood market expansion. This paper reviews the history of high-income Asia and the PRC's emergence in the region's agrofood markets. Finally, the Greater Mekong Subregion's role is analyzed for the potential of Asian agrofood trade to contribute to poverty reduction in the region.

I. Introduction

A number of factors have improved the prospects of and the need for increased regional trade within Asia. The prospects were triggered by the loss of momentum in the latest round of multilateral trade negotiations, combined with a rise in freight costs due to higher fuel prices. This is particularly true for agriculture, a primary obstacle to the World Trade Organization (WTO) negotiations and a sector in which Asia has significant demand and supply potential. The need for enhanced regional trade has been compounded by the recession in industrial countries, which calls for rebalancing growth by creating regional demand (ADB 2009a); and for broadening openness by expanding regional trade within Asia (ADB 2009b). To elucidate the means by which Asia can improve its agricultural productivity and food security and promote economic growth, this study uses a multicountry general equilibrium model to assess agricultural trade growth between the People's Republic of China (PRC) and the Greater Mekong Subregion (GMS) countries. The PRC has over the last decade gone from being a small net exporter of agricultural products to become one of the world's largest importers, a trend that appears likely to continue. At the same time, the Mekong region, a subregion that encompasses some of the poorest countries in Asia, has agricultural capacity well beyond its current production. Moreover, agriculture is identified as one of the priority sectors under the GMS Economic Cooperation Program to address poverty in the GMS countries, which is largely a rural phenomenon (ADB 2007).

As historical trends from high-income Asian (HIA) countries suggest, increased agrofood trade with the PRC could significantly contribute to growth, reduce poverty in the GMS, and contribute to two important policy objectives of the Asian Development Bank (ADB)—greater Asian cooperation, and more inclusive development. By focusing on GMS engagement, this study will also showcase one of ADB's most important infrastructure commitments, the two road corridors that transect the subregion. The paper uses detailed information on the corridors' contributions to local development for regional agricultural trade.

The objective of this paper is to demonstrate the longer-term benefits of enhanced trade extending across and between developing Asian economies. Because indirect effects can far outweigh direct or negotiated trade effects, a general equilibrium (GE) assessment gives a more complete picture of the inclusive benefits of such cooperation. More comprehensive assessment such as this implicates a much larger universe of stakeholders, and represents an essential justification of both the policy agenda (integration, inclusion, etc.) and supporting investments like the GMS corridors.

II. Motivation and Background

This report begins with an extensive background review of the drivers of agrofood trade in East and Southeast Asia over the last few decades. The rise of higher-income Asian economies provided an early wave of demand stimulus, accompanied by agrofood supply chain development and technology transfer around the region. This was followed by rising middle class consumption in rapidly emerging Asian economies and, finally, the dramatic emergence of demand from the PRC in the last two decades.

A. Evidence from High-Income Asia

Experiences of HIA countries such as Japan; the Republic of Korea; and Taipei,China are useful for predicting the scope of the PRC's agrofood trade patterns for two reasons. First, these countries were also densely populated before industrialization and can therefore serve as a model of what to expect as the PRC industrializes. Second, compared to western consumption preferences, these countries have similar preferences and diets, and as the PRC industrializes, its diet is likely to shift in a similar fashion as the HIA countries. Therefore reviewing the history of how HIA food consumption patterns have changed and have driven agrofood trade patterns over the past decades is essential in understanding how the emergence of the PRC might impact global agricultural markets.

1. Rice Consumption

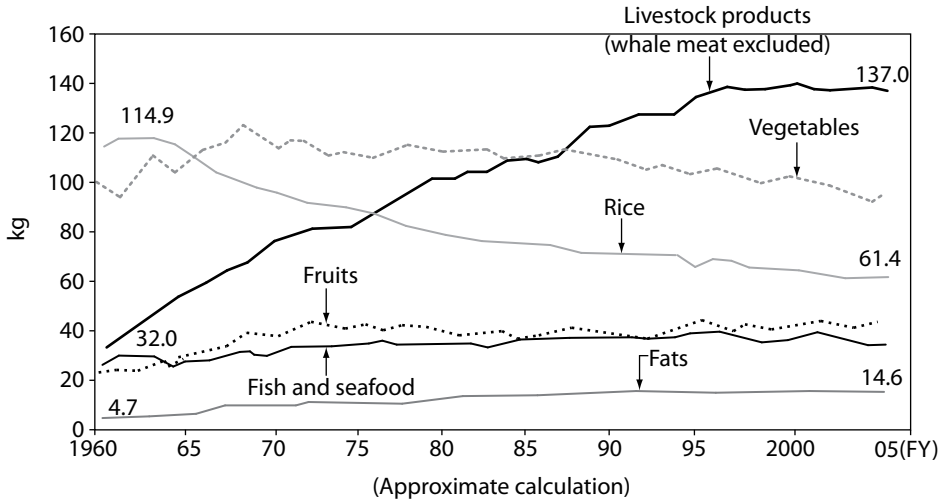
Any discussion on HIA food consumption patterns must begin with rice. Rice is by far the most important crop throughout Asia as 90% of the world's production and consumption occurs in this region (Chern et al. 2003). In general, as per capita incomes rise, diets will begin to diversify away from a starchy staple (such as rice) to a more diverse offering including meats, fresh fruits and vegetables, and dairy products. Japan, having reached a higher per capita income much faster than any other Asian nation, clearly demonstrates this pattern. Looking at annual per capita rice consumption in Japan, quantities have been declining for several decades. From a peak of almost 120 kilograms (kg) per year in the early 1960s, rice consumption has fallen drastically to almost half this level by the mid-2000s (Figure 1). The Republic of Korea has also seen a fall in its rice consumption. In 1985, the Republic of Korea's annual per capita rice consumption was 128.1 kg/year, but by 2004 this number had fallen to 82 kg/year (MAFROK 2006). Taipei,China provides even further evidence. In 1956, per capita levels were 132.6 kg/year, and by 1995 rice consumption had fallen to 59.1 kg/year (Table 1).

Table 1: Annual Food Consumption in Taipei,China (kilograms/year)

Item	1956	1960	1970	1980	1990	1995
Polished rice	132.6	137.7	134.5	105.5	65.9	59.1
Sweet potatoes	64.2	65.4	18.4	4.1	2.7	2.5
Wheat flour	16.6	20	25.4	23.6	28.7	31.9
Sugar	9.4	9.4	15	24	29.8	24.2
Pulses, nuts, and seeds	10.9	11.4	18.3	18.8	29	31.7
Vegetables	58.4	61.1	84.8	129.6	93.3	101.9
Fruits	14.5	22.1	45.8	70.2	131.5	137.4
Meat	17	16.2	25.3	39.6	62.9	76.1
Eggs	1.6	1.6	4.1	8	12.1	16.2
Fish	18.8	21.7	34.2	38.7	47.5	38.4
Milk	6	3.2	11	27.6	43	58.8
Oils and fats	3.7	4.7	7.7	10.8	23.3	26.3

Source: Sun et al. (1998).

Figure 1: Transition of Per Capita Annual Consumption of Food by Category in Japan



Source: MAFFJ (2006).

Because there is such a clear trend that rice consumption decreases as income rises, many economists have claimed rice is an inferior good. In fact, it is often argued that rice became an inferior good in Japan as early as several decades ago. Understanding this relationship is crucial for future rice projections throughout Asia, because if rice is an inferior good, classical economic theory predicts rice consumption will fall as per capita income rises. It is generally accepted among economic researchers that income elasticities for food staples decline as per capita income increases. While the initial data suggests rice is an inferior good, there is conflicting evidence on the subject. Perhaps the most influential study on rice consumption in Asia comes from Ito, Peterson, and Grant (1989). The authors concluded that rice was an inferior good in HIA by looking at aggregate national-level data and estimating income elasticities. In Japan, the authors

found the income elasticity of rice to be 0.091 in 1964 and –0.708 in 1984, which signals rice as an inferior good. Another study produced by Kako, Gemma, and Ito (1997) further strengthened the claims that rice is an inferior good. These authors projected rice demand using a log-linear function estimated by ordinary least squares using time series data from 1970 to 1991. They estimated own-price elasticity at –0.130 and expenditure elasticity at –0.308. Price and Gislason (2001) used time series survey data from 1963 to 1991 to investigate the habit of consumption in Japan. The authors concluded that the expenditure elasticity of cereal (including rice) was –0.01 in the short term and –0.015 in the long term, signaling rice as an inferior good.

Looking at the other side of the argument, Bouis (1991) objected to the study produced by Ito, Peterson, and Grant (1989), claiming that the estimates of grain consumption have a downward bias due to the urban–rural migration pattern and the decreasing importance of rice production. Other studies produced by Bouis and Haddad (1992) and Bouis (1994) claimed that cross-sectional data estimates of income elasticity are upwardly biased due to leakage of actual consumption from meals for guests and animal feeding in developing countries. Finally, others have pointed out (Chern 2000, Huang and Bouis 1986) that plotting aggregate consumption against per capita income simply showed the correlation between variables, and does not reveal the causation.

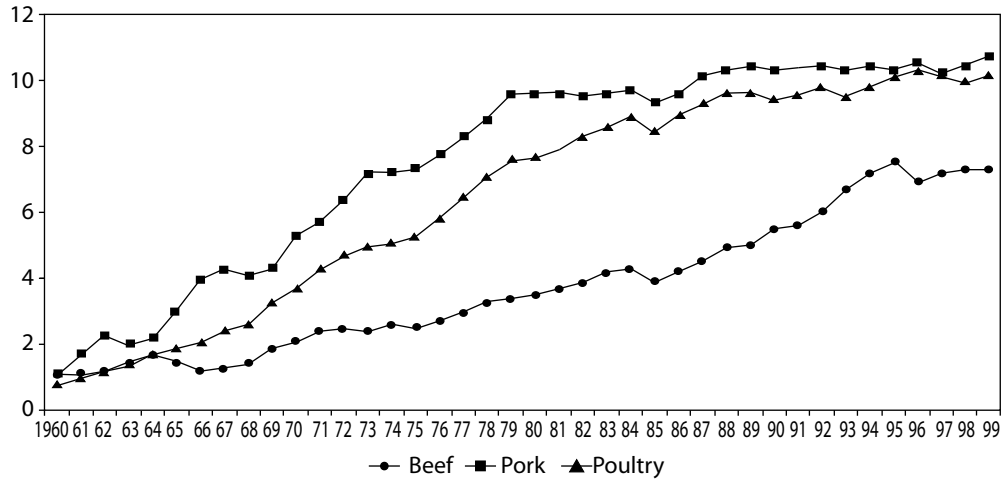
Although there are conflicting arguments, the data for HIA clearly shows a significant reduction in rice consumption over the past several decades. Whether or not rice is an inferior good is not certain, but if the PRC is to behave similarly as other HIA countries, then rice consumption should decrease significantly as the PRC continues to industrialize.

2. Meat Consumption

Data on meat consumption in HIA is another strong indicator of how tastes and preferences change as per capita income rises. As income increases, so does the consumption of meat, because it transitions into the daily diet and is no longer a rare luxury. In Japan, meat consumption has increased significantly over the past decades. Diets in Japan have become increasingly “westernized” in the sense that people are consuming more meat and poultry than traditional grain products. Since the 1960s, both meat and poultry consumption has increased steadily. Relatively more pork is consumed than beef, but consumption appears to have leveled off since the 1980s. Initially, beef consumption did not increase as rapidly as pork and poultry, but since the mid-1980s, beef consumption has been increasing more rapidly (Figure 2). However, according to the most recent data, beef consumption per capita appears to have leveled off to about 8 kg/year (FAOSTAT 2008a). Compared to 1960 levels, beef consumption was 7.5 times greater by 1995, and poultry consumption had increased by nearly 14 times. Households in Japan still consume more fish than meat and poultry by weight, which is a unique feature of the consumption patterns in Japan and is a result of cultural and geographical reasons. However, in terms of caloric intake, meat and poultry have become a larger

source of calories than fish since the 1980s. Meat and poultry provide a higher caloric intake than fish, which explains this discrepancy.

Figure 2: Annual per Capita Beef, Pork, and Poultry Consumption in Japan, 1960–1999 (kilograms/year)



Source: MAFF (2001).

The Republic of Korea shows similar trends to Japan. Pork is also the preferred meat in the Republic of Korea and consumption per capita tripled from 6.3 kg/year in 1980 to 17.8 kg/year in 2004. Beef consumption has also increased from 2.6 kg/year in 1980 to 6.8 kg/year in 2004. Poultry consumption is much lower in the Republic of Korea than in Japan, but has increased nonetheless from 2.4 kg/year in 1980 to 6.6 kg/year in 2004 (MAFROK 2006). In Taipei,China, similar trends have occurred although the data is not disaggregated. Meat consumption per capita quadrupled from 17 kg/year in 1956 to 76.1 kg/year in 1995 (Table 1). Meat is unquestionably a normal good, and as per capita income increases, meat and poultry consumption are bound to increase as well. This has significant implications because newly industrialized economies (NIE) demand significant amounts of meat, which in turn require even larger amounts of resources such as animal feed to produce the livestock. This will have tremendous impacts on the global economy as the PRC continues to industrialize and increase its demand for meat.

3. Other Food Consumption Categories

Although rice and meat are two of the most important categories for assessing food consumption patterns in HIA, there have been a variety of other changes as well. Much has been said about Japan's diet becoming increasingly westernized in the past 30 years, as the purchases of traditional Japanese foods have decreased while purchases of nontraditional foods have increased. In terms of food categories, this is represented as significant increases in meat (especially beef) and dairy products, while consumption in

rice, fish, fresh fruits, and fresh and processed vegetables have all decreased (Table 2). Household food expenditure shares of 10 aggregate food groups in 1997 in Japan are similar to that of the United States (US). The only large differences are fresh vegetables (10% in Japan versus 5% in the US), dairy (6% in Japan versus 12% in the US), and meat and fish (12% and 18% in Japan versus 22% and 3% in the US). However, if meat and fish are aggregated into one category, their shares are approximately the same. Generally speaking, foods that had a significantly higher expenditure share in Japan than in the US have decreased their shares over time in Japan. Conversely, foods that had a lower share in Japan than in the US have increased their shares over time in Japan (Chern et al. 2003).

Table 2: Changes in Quantities Purchased in Japan, 1970–1995 (percent)

Decrease		Neutral	Increase	
Cereal		Oil/Fats	**Meat**	**6**
Nonglutinous rice	–50		Beef	41
Fish	**–24**		Pork	–13
Fresh vegetables	**–24**		Poultry	8
Fresh fruits	**–45**		Ground beef	19
Processed vegetables			**Dairy**	
Dried mushrooms	–60		Milk	20
Bean curd	–10		**Nonalcoholic beverages**	
Pickled radishes	–46		Black tea	13
Nonalcoholic beverages			Coffee	143
Green tea	–33			

Source: Chern et al. (2003).

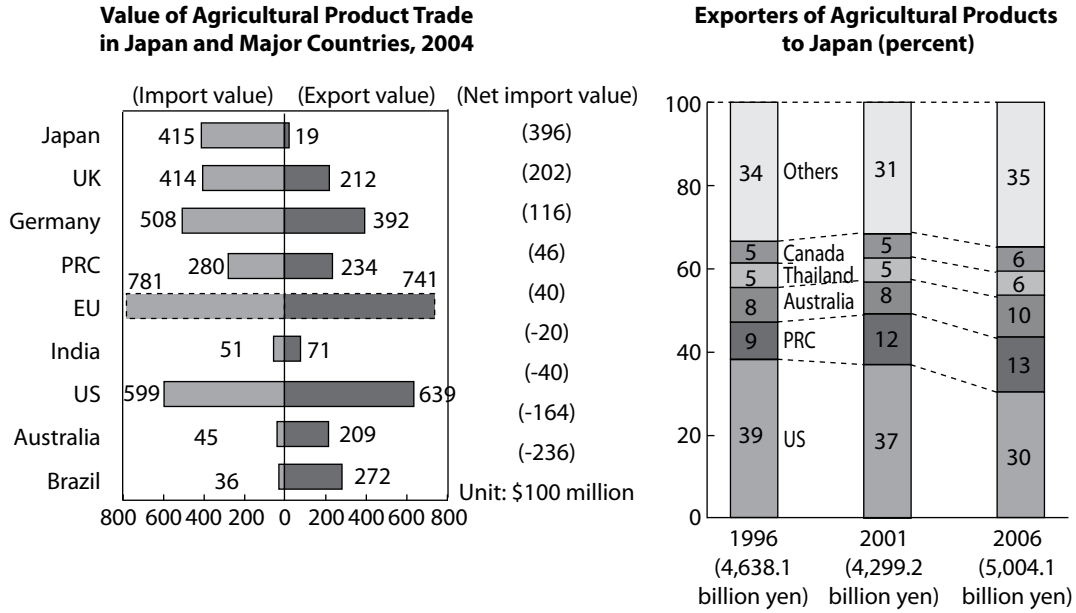
In the Republic of Korea, another significant trend since the 1970s has been the reduction in consumption of food crops (rice, barley, wheat, soybeans, corn, and potato). While consumption per capita of wheat, soybeans, and corn have actually increased slightly, large decreases in rice, barley, and potatoes have shrunk the entire category. Since 1980, food crop consumption per capita has decreased from 195.1 kg/year to 142 kg/year in 2003. The decline in food crop consumption can be attributed to the increase in livestock products, as well as fresh fruits and vegetables. Vegetable consumption per capita has increased from 120.3 kg/year in 1980 to 145 kg/year in 2003, while fruit consumption per capita has increased from 22.3 kg/year in 1980 to 55.8 kg/year in 2003 (MAFROK 2006).

In Taipei,China, many of the same trends can be seen. In addition to the large decline in rice consumption, sweet potato consumption has declined drastically as well. From 64.2 kg/year per capita in 1956, consumption has fallen all the way to 2.5 kg/year in 1995. The steep declines in both rice and sweet potato consumption in Taipei,China has been replaced by increases in animal products, fish, vegetables, and fruits. Vegetable consumption per capita has increased from 58.4 kg/year in 1956 to 101.9 kg/year in 1995, while fruit consumption per capita has increased from 14.5 kg/year in 1956 to 137.4 kg/year in 1995. Other large increases included milk (from 6 kg/year in 1956 to 58.8 kg/year in 1995) and wheat (from 16.6 kg/year in 1956 to 31.9 kg/year in 1995) (Table 1).

4. HIA Agrofood Trade Trends

HIA countries have all had similar shifts in food consumption preferences, which have resulted in profound effects on agrofood trade. Looking at Japan first, it is one of the largest importers of food and agricultural products, and its shifting preferences have significantly altered food balance sheets. Domestically, rice producers in Japan have been hurt as the wholesale price of rice has fallen approximately 30% since 1990, matching the large decrease in demand. Rice represents a quarter of Japan's total value of agriculture production, which put significant pressure on many lower-income commercial farms (MAFFJ 2003). In terms of imports, Japan imported a record level of agricultural goods in 2007, worth Y5,530.4 billion. Japan is the world's biggest net importer of agricultural products, and is characterized by a heavy dependence on specified countries as demonstrated by the fact that more than 60% of imported agricultural products are from just five countries, including the PRC, Thailand, and the US (Figure 3).

Figure 3: Japan's Dependence on Agricultural Trade

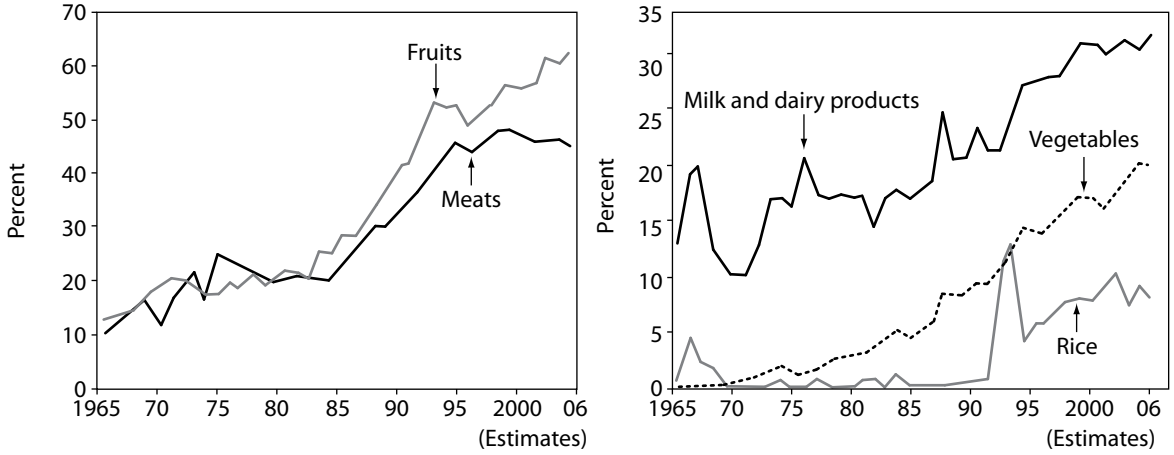


Source: MAFFJ (2006).

Japan's large reliance on agricultural imports has caused its food self-sufficiency ratio to decrease for numerous years. The ratio has decreased from 73% in 1965 to 40% in 1998, where it has remained since. This decrease in the self-sufficiency ratio can be attributed to the dietary changes in Japan, namely the increase in imports of agriculture products that are difficult to supply through domestic production, matched by the decline of rice consumption, which can be self-supplied. On a caloric basis, Japan's food self-sufficiency ratio is the lowest among the major industrialized countries. In terms of grain

self-sufficiency, Japan ranks even lower at 124th among 173 countries in the region. This is due to Japan's increased appetite for meat but a drastic shortage of land, requiring Japan to rely on imports. Vast agricultural lands are needed to produce the feed grains necessary for the production of livestock. Estimates for the amount of land needed to match Japan's main imported agricultural products are approximately 12.45 million hectares, which is roughly 2.7 times larger than the current farmland area (MAFFJ 2007). Since the mid-1980s, a continuing appreciation of the yen, matched with increased demand, has fueled a large increase in the rate of imports of fruits, meats, milk and diary products, and vegetables (Figure 4). Additionally, there has been a significant increase in imports of processed food, due to changing taste and preferences. The total value of imported food products and groceries is now equivalent to half the output of domestic agriculture and fisheries (MAFFJ 2007).

Figure 4: Average Import Rate for Key Agricultural Products in Japan



Source: MAFFJ (2007).

Much like Japan, the Republic of Korea is a net importer of agricultural products. The majority of the Republic of Korea's imports are food crops such as corn, flour, and beans, and represent 50.9% of the total share in 2003. The rest of the agricultural imports comprise livestock products (mainly beef), forestry, and fish. These categories represent roughly the same share each at approximately 16%. The Republic of Korea receives most of its agricultural imports from the US followed by the PRC, Australia, and Indonesia, respectively. Due to the increase of livestock production to meet the growing demand for meat products, the Republic of Korea's demand for wheat as feed has been rapidly increasing, all of which is served by imports (Table 3).

Table 3: The Republic of Korea's Supply and Demand of Wheat

Year	Carryover from the Previous Year	Supply			Demand					Carryover to the Next Year	Self-sufficiency Rate (%)
		Production	Import	Total	For Food	For Processing	For Feed	For Seed	Total		
1985	249	11	2,996	3,256	1,005	1,031	932	20	2,988	268	0.4
1990	237	1	2,239	2,477	903	992	98	12	2,005	472	0.05
1995	910	10	2,777	3,697	1,070	1,024	1,225	16	3,335	362	0.3
2000	472	2	3,266	3,740	1,363	880	1,026	20	3,279	461	0.1
2001	461	3	3,251	3,715	1,263	887	1,051	63	3,264	451	0.1
2002	451	6	3,830	4,287	1,294	884	1,661	36	3,875	412	0.2
2003	412	10	3,753	4,175	1,138	932	1,656	30	3,756	419	0.3
2004(P)	419	10	3,397	3,826	1,200	971	1,162	30	3,363	463	0.3

Source: MAFROK (2006).

Another large category of agricultural imports comes from soybeans resulting in trade liberalization and the growing demand for processing and feed. Consequently as imports rise, the self-sufficiency ratio has collapsed in recent years, from 20.1% in 1990 to 7.3% in 2003. Corn is another category that is almost exclusively served by imports due to increased demand for processing and feed for livestock. Imports have increased from approximately 3 million tons in 1985 to 9 million tons in 2004, resulting to a fall in the self-sufficiency ratio from 1.9% to 0.8%. In the 1970s, the import of beef was introduced to stabilize the supply and price of livestock to meet the rapidly growing demand. The rate of imported beef has grown from 6.9% in 1980 to 47.5% in 1990, all the way to 65.1% in 2000. As expected, the self-sufficiency ratio for beef has fallen as imports increase, and has decreased by 43.3% since 1980 (Table 4). Pork however, has been largely domestically supplied and has a relatively high self-sufficiency ratio compared to other forms of livestock. During the same period, pork's ratio fell by only 8.5% (MAFROK 2006).

Table 4: The Republic of Korea's Supply and Demand for Beef

	Demand	Supply		Consumption per Capita	Self-sufficiency
		Domestic	Import		
1980	100.0	93.1	6.9	2.6	93.1
1985	120.4	115.7	4.7	2.9	96.1
1990	180.6	94.8	85.8	4.1	52.5
1995	301.2	154.7	146.5	6.7	51.4
2000	402.4	214.1	261.8	8.5	52.4
2004	327.9	144.9	183.6	6.8	44.2

Source: MAFROK (2006).

Taipei,China's story is a little different than in the Republic of Korea and Japan. Taipei,China's agricultural industry was fueled by large amounts of foreign direct investment (FDI) in the 1950s and 1960s. This increase in FDI gave Taipei,China the capital goods it needed for industrial development, while simultaneously producing enough food to satisfy domestic food requirements and produce exports as well. Agricultural products became a key part of Taipei,China's export industry, representing over 90% of all exports in the 1950s. However as the country industrialized, its share of agricultural exports decreased significantly (to 4.7% in 1996), even though the total value was increasing. The vast majority of these exports went to Japan, which was also one of the largest donors of FDI. In 1996, Japan received 44.8% of the total of Taipei,China's agricultural exports, followed by Hong Kong, China (18.1%) and the US (9.1%). Total agricultural imports began to increase rapidly as Taipei,China moved into a more industrialized society. Agricultural imports increased from $75.8 million to $9,986.6 million, a 132-fold increase in a period of 36 years. The sharp rise in agricultural imports reflects the shift in Taipei,China's diet, as it must import large quantities of feed grains, oilseeds, meats, fruits, and vegetables to meet changing consumer preferences. The US is Taipei,China's main supplier of agricultural imports, providing 54.5% of the total in 1996. Other sources of imports come from Malaysia (9.3%), Australia (5.5%), Indonesia (4.5%), Thailand (3.4%), and Japan (2%) (see Sun et al. 1998 and Table 5). Taipei,China turned from a net exporter of agriculture in the 1950s to a net importer by the 1990s.

Table 5: Agricultural Trade in Taipei,China

Year	Agricultural Exports	Agricultural Imports	Agriculture's Share of Total Exports	Agriculture's Share of Total Imports
	$ Million		Percent	
1952	114.2	66.5	95.5	32.1
1955	124.4	65.5	92.8	34.5
1960	121	75.8	71	30.1
1965	286.5	153.8	63.7	27.7
1970	388.1	376.5	26.2	24.7
1975	1,041.70	1,244.70	19.6	20.9
1980	2,251	3,088.70	11.4	15.7
1985	2,294.70	3,413.50	7.5	17
1990	3,661.40	6,088.30	5.5	11.1
1995	5,638.80	9,763.90	5.1	9.4
1996	5,484.90	9,986.60	4.7	9.8

Source: Sun et al. (1998).

Clear trends emerge when looking at HIA agricultural trade patterns. Most noticeably, HIA countries have all had significant increases in meat imports as well as feed grains to fuel domestic production. Vast areas of farmland are needed to yield the grains necessary to raise cattle and other livestock, and as HIA countries are densely populated and industrialized, they simply cannot produce the quantities needed. Therefore, HIA countries are dependent on imports of grain in addition to meat products in many cases,

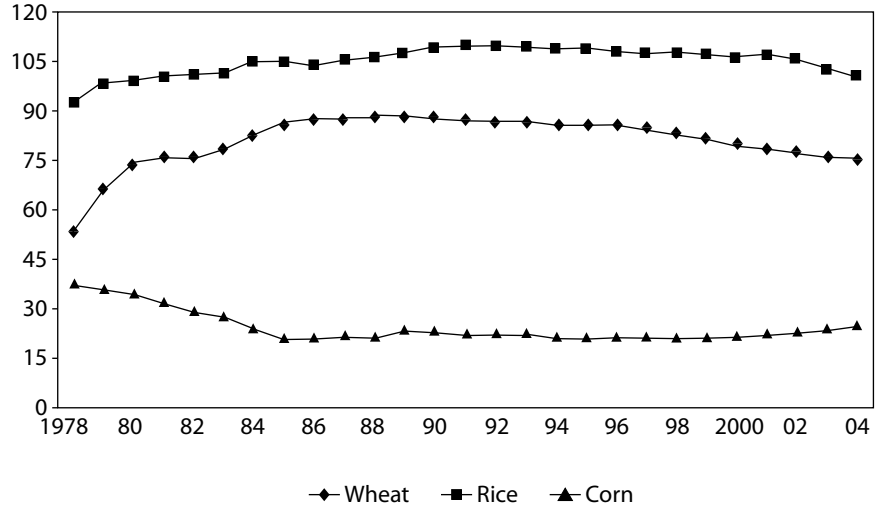
and the self-sufficiency ratios have been declining for numerous years. By 1980, HIA accounted for 16% of world grain imports and 8% of all meat imports, up from 8 and 1% respectively in 1960 (Tyers and Anderson 1985). These trends present a very interesting issue in terms of the PRC, because as the PRC continues to increase its meat demand, vast quantities of grain will be needed, which will create tremendous pressure on global agricultural markets. Another important trend has been the emergence of Southeast Asia as a food supplier for HIA. Traditionally, the Mekong region has been the rice basket for many of these countries, but more recently, meat has been playing an increasingly important role, especially poultry from Thailand. Thailand represents one of the most important trading partners in HIA and has had success that other Southeast Asian countries hope to attain as the PRC transitions into a net importer of agricultural products.

B. People's Republic of China

1. The PRC's Consumption Patterns

Since market reforms in 1978, the PRC's economic growth has been phenomenal. Due to its ever rising gross domestic product (GDP) levels and growing middle class, there has been a great deal of discussion as to how the PRC will impact agricultural markets in the world. The PRC has already begun industrialization, and consumer tastes and preferences have started to shift as more people are lifted out of poverty. Numerous studies of food demand in the PRC have revealed that households tend to consume more meats, poultry, fish, dairy products, and fruit as their incomes rise, while their consumption of tradition staple grains remains stable or declines (Chern 1997, Gould 2002, Guo et al. 2000, Xin et al. 2005). Looking first at food staples, the PRC exhibits similar characteristics to HIA countries. Before 1990, per capita consumption for rice and wheat increased at an average annual rate of 1.3% and 4.4% respectively, which was fueled by rising incomes, allowing the poor to be able to consume more. Since the early 1990s however, per capita consumption of rice and wheat has started to decline slightly because more individuals are able to diversify their diets. Looking at corn, per capita consumption initially fell after market reforms because people preferred fine grain to coarse grains and were able to consume more fine grains as income increased. All together, since 1985, per capita consumption in all three grain categories has been quite stable. From 1985 to 2004, per capita rice consumption averaged 106.5 kg/year; wheat consumption averaged 83.8 kg/year; and corn consumption averaged 22.5 kg/year (Figure 5). Although these categories have stabilized somewhat in recent years, they can be expected to decline as citizens from the PRC continue to diversify their diet.

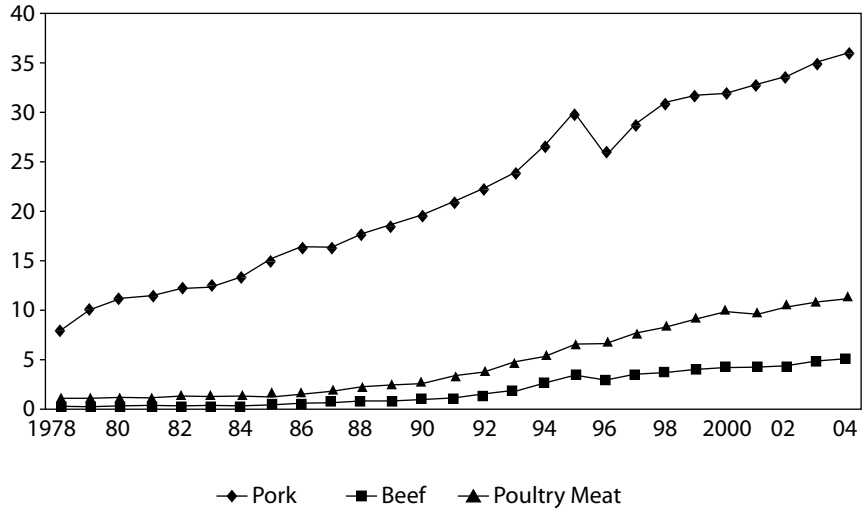
Figure 5: The PRC's Per Capita Consumption of Rice, Wheat, and Corn, 1978–2004 (kilograms)



Source: Zhuang and Koo (2007).

Much like HIA, meat consumption in the PRC has been steadily increasing for the past several decades. In 1978, per capita consumption of pork was 8 kg/year; beef, 0.3 kg/year; and poultry, 1.3 kg/year. However by 2004, these numbers increased to 35.9 kg/year for pork, 5.2 kg/year for beef, and 11.3 kg/year for poultry (Figure 6). These amounts are well within the bounds of HIA and have already begun to create massive reverberations for agricultural trade in the PRC.

Figure 6: The PRC's Per Capita Consumption of Pork, Beef, and Poultry Meat, 1978–2004 (kilograms)



Source: Zhuang and Koo (2007).

Clear trends demonstrate the shifting consumer preferences in the PRC. However, as the PRC is a country characterized by large inequality, it is worth examining how food consumption patterns vary across income classes. Income and food expenditure growth have been disproportionately concentrated in the upper classes. Therefore, the consumption patterns of high-income households may have been disproportionally influencing food demand and market developments. As incomes rise, households in the PRC tend to change the structure of their diets, but different classes behave differently. For low-income urban households, pork and eggs are the dominant source of animal protein, but purchases of fish and poultry rise more quickly as income increases. Among the lowest-income households, pork purchases are more than double the fish and seafood purchases. However, among the PRC's highest-income households, purchases of pork are roughly equal to purchases of fish and seafood. Another discrepancy occurs with eggs and poultry. Low-income households purchase more eggs while high-income households purchase roughly equal amounts of eggs and poultry. In terms of traditional staple foods, average rice and wheat flour consumption is lower among high-income households, while consumption of grain products tends to rise as income increases in low-income households. Consumption of cooking oil is nearly the same across all income levels. The demand for quantity diminishes as income rises, and the upper-income households appear to have reached a saturation point in quantity consumed of most food items. Most additional food spending by high-income consumers is on higher quality or food in restaurants. The vast majority of households in the PRC are rural (about 60% of the population) and low-income urban households (20%) that still demand increased quantities of many foods as their income rises. These patterns suggest that the growth in the quantity of food demanded has been much slower than would be expected by the PRC's rapid economic growth. High-income households are purchasing greater value-added products rather than increased quantity, which has caused much of the food expenditure growth. Low-income households have been experiencing less rapid income growth and thus growth of their food spending has been slower. This slow growth in quantity of food demanded is one possible explanation as to how the PRC has been able to remain largely self-sufficient for many food items. However, as more and more low-income individuals incomes continue to increase the true test of the PRC's agricultural production will be seen (Gale and Huang 2007).

2. The PRC's Agrofood Trade Trends

With 25% of the world's populations and only 7% of the world's arable land, agrofood trade is a crucial sector of the PRC's economy. However, its agriculture industry has been surprisingly self-sufficient given their resource constraints and has even emerged as an exporter of vegetables, fruits, and aquacultural products. Despite rising exports, the PRC remains a net importer of agricultural products.

While many researchers have cited the rising demand for meats to lead to an increase in the PRC's agricultural imports of meat and/or feed grains, the country's agricultural

imports have only really begun to take off in recent years. This has been driven by an increasing demand for vegetable oils, animal feed, and industrial inputs such as soybeans. Soybean imports have increased from $294 million in 1978 to $8.1 billion in 2006 (FAOSTAT 2008b). However, agricultural import growth was sluggish for many years until 2002 to 2004 when imports more than doubled. This happened as a result of large economic growth, lower barriers to imports, higher commodity prices, and tightening domestic commodity supplies. In total terms, agricultural imports increased from less than $11 billion in 2002 to $25.9 billion in 2004 (Gale 2005). Soybean imports were responsible for more than 30% of this growth, increasing from $2.5 billion in 2002 to $7 billion in 2004. Soybeans are used for making vegetable oil and high-protein animal and fish feed. However all these soybeans were not able to meet the PRC's demand for vegetable oil as imports of vegetable oil increased by $2.6 billion during this time period, accounting for another 17% of agricultural import growth. Wheat was another major food commodity that was responsible for the PRC's large agricultural import growth. Wheat imports rose from $100 million to $1.6 billion during 2002 to 2004, accounting for 10% of the increase in imports. Commodities used as raw materials were also significant contributors to agricultural import growth. Cotton was the biggest sector, increasing from $308 million in 2002 to $3.4 billion in 2004, representing 21% of the increase of the total import growth (Gale 2005).

Although the PRC's food demand is rising, the majority of food-related imports are concentrated in just two sectors: vegetable oils and soybeans. While there have been sharp increases in other imported food items such as meats, milk, cheese, wines, and fruits, these represent a relatively small share of the PRC's overall agriculture imports. Other than the large imports in vegetable oils and soybeans, the country remains very self-sufficient in nearly all food categories. The PRC is even mostly self-sufficient in poultry and meat production although it relies on imported soybeans for animal feed. However, the PRC produces its corn domestically, which is the largest ingredient in animal feed. Even its large imports of wheat represent a small fraction of the total consumption. Wheat imports in 2004 represented only 7% of the PRC's estimated wheat consumption (Gale 2005).

Looking at future agricultural import demands, the PRC is expected to continue to rely on soybean and vegetable oils, and a sharp decline in these imports is unlikely. Meat imports are expected to grow as well, due to increasing demand. Demand for imported pork is especially strong, as domestic outbreaks of avian influenza and a ban on US beef imports have induced many consumers to substitute pork for beef and poultry products. In addition to meat imports, feed grains are also expected to rise in the coming decades, eventually reaching 25 million to 35 million tons by 2020. Although the PRC's wheat imports represent a small percentage of its total consumption, in sheer numbers, the PRC is still a very large importer of wheat. In terms of global wheat markets, the PRC is responsible for nearly 15% of all wheat imports and thus predictions about world wheat markets rest heavily on the assessments of the PRC's future role. These predictions

are difficult to make as the PRC's wheat markets have unique characteristics in the sense that it is the only country in East and Southeast Asia that has both a large wheat-producing and wheat-consuming rural population (Rozelle and Huang 1998). The PRC's unique characteristics have caused many analysts to make conflicting claims. Some argue that the PRC will continue to demand large quantities of imported wheat, while others forecast that the country will gradually move to a position where domestic supply will meet the nation's demand. One of the most sweeping claims by Rozelle and Huang is that the PRC's wheat imports will rise before peaking and gradually declining through 2020.

While the PRC's agricultural imports may seem like a great potential for the GMS to capitalize on, other countries may largely fulfill the PRC's requirements for noncereal and high-value agriculture. The PRC is still a net exporter of agricultural products and is mostly self-sufficient in agricultural production. Its most important imports are soybeans and cotton and large agricultural suppliers such as the US and Brazil primarily meet demand. This means there are only a limited amount of imports the PRC needs and current demand is filled. For example, the US alone exported over 14 million metric tons of soybeans to the PRC in 2008. This is a massive number considering the PRC's exports of corn, wheat, and rice totaled only 4 million metric tons that same year. Therefore relatively small countries like Cambodia and Lao People's Democratic Republic (Lao PDR) might find it hard to supply the PRC in its current state, especially considering it must compete with global export giants. Of course as the PRC grows, its demands will change, but without current opportunities, this would be a risky investment without guaranteed demand.

The PRC's agricultural exports have also begun to take off in recent years, although at a slower pace than imports. During 2002–2004, exports increased by $3 billion, with the most important categories being processed foods, vegetables, and fruits. Pork exports rose by $250 million, but were offset by a decline in poultry exports. The PRC's corn exports peaked at nearly $1.8 billion in 2003, but declined significantly to $324 million in 2004 as the government cut corn export quotas. Japan is the largest market for the PRC's agriculture exports, accounting for approximately one third of the total in 2004 (Huang and Gale 2006). This is not surprising given that a large number of manufacturers from Japan have invested in the PRC. From 1985 to 2003, a total number of 310 food industry subsidiaries from Japan were set up in the PRC, and it is often remarked that the PRC has become the farm of Japan (Jin et al. 2006). Most of the PRC's other major markets are neighboring countries or regions and include Hong Kong, China and Southeast Asia (each accounted for 12% of the PRC's exports in 2004); the Republic of Korea (7%); and the Russian Federation (3%). The US is also one of the PRC's largest agricultural export markets, representing 9% of the total share. The US is one of the PRC's fastest growing markets, with agricultural imports increasing by 43% from 2002 to 2004 (Gale 2005).

C. Greater Mekong Subregion

Growth in the GMS has been robust for several years. From 1992 to 2006, the seven economies of the GMS grew 8.3% per year on average. This strong growth has been fueled in part by a very strong export sector. Exports from the GMS rose from $37 billion in 1992 to $154 billion in 2005. This corresponds to an annual rate of growth of 11.6%, which is larger than the world average of 8.4%. Growth in Viet Nam was the largest of all the GMS economies at 22%. By value, Thailand's exports are by far the largest, although its share of exports has declined from 87% in the early 1990s to 71% in 2005. Viet Nam has become a more important player in the GMS, increasing its share from 7% to 21% during this period. The vast majority of GMS trade has been in manufactured goods. With a relative abundance of agricultural resources, the GMS economies stand to benefit significantly from the globalization of processed food markets. The agricultural sector accounts for 50–70% of jobs in Cambodia, Lao PDR, and Viet Nam (CLV), and therefore growth in production and exports from this sector will be necessary to improve incomes and reduce poverty. Furthermore, the GMS economies are close to the PRC, and as the PRC continues to grow and demand more food, the GMS can be an important supplier (ADB 2007).

The PRC's growth, along with increasing integration into world markets and reduced trade barriers with GMS, is expected to have significant effects on the structure of regional production and trade. The GMS resource-abundant economies are expected to become more intensive in natural resource-based exports and transition away from the current labor-intensive manufacturing industry. This transition is expected as a result of two parts: first, through direct bilateral trade growth as the PRC demands more natural resource-based products, and second through direct competition with the PRC in global markets. The PRC's WTO accession has increased its market access and reduced the cost of intermediaries for its manufactures, which in turn has reduced the international competitiveness of key GMS manufacturing sectors (Ianchovichina and Walmsley 2003). Additionally, the implementation of the Agreement on Textiles and Clothing, which has dismantled the Multifiber Arrangement, is significant for the PRC's competiveness. Through the elimination of the Multifiber Arrangement's national quotas on apparel exports to the US and European Union, the PRC has become much more competitive in the global marketplace (Coxhead 2004).

One important tool for assessing how much the PRC will compete with other GMS economies comes from revealed comparative advantages (RCA). The PRC shows very low RCA for most agricultural sectors and natural resource sectors, while it has very high values for all types of assembly, furniture, garments, footwear, and accessories (Coxhead 2004). Looking at the GMS, Cambodia's advantage in primary products has shrunk over the years, reflecting its specialization in garment exports. Lao PDR, however, shows an increase and high levels in RCA in a number of agricultural and natural resource products. These categories include cereals, vegetables, crude rubber,

coffee, spices, silk, jute, copper, and zinc. Although Lao PDR's RCA in wood and wood products has decreased, the levels are still quite high overall. Viet Nam also possesses an advantage in a large number of agro-based products such as fresh and processed fish, rice, fresh fruit, nuts, coffee, tea, and spices (ADB 2007). Looking at the correlation coefficients of RCA values demonstrates how complementary GMS economies are with the PRC. Negative values of this measure indicate a tendency for countries to specialize in products other than those in which the PRC is specialized, while positive numbers indicate a greater overlap. Both Thailand and Viet Nam have positive correlations, meaning they are direct competitors with the PRC (Coxhead 2004). Therefore it would be prudent for Viet Nam and Thailand, along with the other GMS economies, to focus on agricultural products to become major suppliers to the PRC market. With the continued growth and size of the PRC, these opportunities are too important to pass up and this pattern is expected to become increasingly dominant in overall GMS trade.

Indirect effects are also pushing this trend. Clothing exports in Cambodia comprise close to 90% of total exports, and in Lao PDR they represent 80% of the manufactured exports (ADB 2007). In Viet Nam, textile and apparel production accounted for more than 24% of the manufacturing labor force and employed 4.6 million people in 2004. The loss of these revenue sources, and the lower wages that this will cause, will reduce labor costs in agricultural industries contributing directly to increased profitability, which will complement the direct effects from growth of the PRC's demand of these products. Another indirect driver will be changes in FDI inflows. Although the evidence is ambiguous, decreases in FDI are expected in industries in Southeast Asia where competition with the PRC is intense. The PRC's growth and globalization is likely to cause GMS economies to experience negative terms of trade shocks for their manufacturers and positive shocks for agricultural produces (Coxhead 2004).

1. Trends in Trade

A variety of factors helped fuel the tremendous growth in trade in the GMS. Starting in the latter half of the 1980s, many of the GMS economies began the process of transitioning to a market-based system. Generally speaking, the dominance of state-owned enterprises were reduced, prices and trade of goods and services were liberalized, and restrictions on the private sector were eased.

More specific examples of trade liberalization can be drawn from Cambodia, Lao PDR, and Viet Nam. In 1987, Cambodia abolished the state monopoly for foreign trade and allowed the private sector to engage in foreign trade in 1989. The reform program further accelerated following the national elections and the establishment of a democratic government in 1993. In the mid-1990s, quantitative restrictions on trade were mostly eliminated and by 2002, import tariffs were streamlined to a four-band structure (0%, 7%, 15%, and 35%). Despite political instability and notorious corruption, Cambodia was able

to achieve success in revamping and stabilizing its war-torn economy through greater outward orientation.

In Lao PDR, economic liberalization has brought on substantially lower tariffs with a major reduction in 1995 when a complex multiple tariff rate system with a 150% maximum rate was replaced by a simpler six-band structure (5%, 10%, 15%, 20%, 30%, and 40%). However, under this band structure all imports are still subject to some form of licensing. For example, importers must submit an annual business plan to the provincial trade unit and the one-stop service 6 months or a year in advance to obtain licenses.

In 1988, Viet Nam's enactment of the Law on Import and Export Duties marked the beginning of trade reforms. The original tariff schedule was replaced in 1992 by a detailed scheduled based on the Harmonized System of tariff nomenclature. The structure was finetuned in the following years and the maximum rate fell from 200% in 1997 to 113% in 2004. However this maximum rate is rarely used in practice as less than 1% of total tariff lines, accounting for about 4% of import value, had tariff rates above 50%. Additionally, quantitative restrictions have largely been dissolved, replaced by tariff rate quotas.

In addition to trade liberalization, private sector development and the encouragement of FDI have also been crucial elements of the market-oriented strategies of GMS countries. Over the past few decades, policies toward FDI have become increasingly liberal. Full foreign ownership is allowed in most industries, major reforms have been legislated to provide equal treatment to foreign and domestic investors, and procedures for approval and registration have been streamlined.

FDI has been a major facilitator of growth in many of the GMS economies. While the stories of the PRC and Thailand are particularly well known, FDI has also played important roles in less-developed countries. In Cambodia for example, FDI from Northeast Asia (primarily from the Republic of Korea; the PRC; and Taipei,China) helped propel its now flourishing garment export industry. This shift in production from countries with large manufacturing sectors occurred due to the eroding competitiveness of garment production with rising wages. Additionally, by shifting production to Cambodia, investors from the PRC were able to bypass the quotas in the main markets on garment imports from the PRC. FDI also played an important role in Lao PDR. Inflows in agriculture and forestry, as well as mining and hydropower projects as of late, have helped contribute to export growth. In Viet Nam, FDI was originally concentrated in the extraction of crude oil and gas. However, FDI has shifted over the last decade to manufacturing. Viet Nam is becoming linked to regional production chains, which is clearly reflected in the structural shift in export composition toward assembled electrical and electronic products. This process has been driven largely by foreign-invested enterprises (FIEs). While most FIEs have been small to medium-scale assembly plants, there are some large players as well. For example in 2006, Intel invested $1 billion in a chip assembly and testing factory that has provided a marked boost to the industry. FIEs are also driving exports in other crucial

products, such as footwear and garments. Overall, they accounted for 44% of total non-oil merchandise exports in 2005, up from only 3% in 1991 (ADB 2007).

2. Direction of Trade

Intraregional trade has been increasing faster than trade with the rest of the world. Excluding the PRC, intrasubregion exports have surged at an annual average rate of 19% from 1994 to 2006, compared with 11% for exports to other countries. The rate of trade with the PRC is even greater, increasing at an average annual rate of 22% during the same time period. Exports to non-GMS members of the Association of Southeast Asian Nations (ASEAN) Free Trade Area (AFTA) and to other East Asian countries rose slower than exports to the rest of the world at 9% annually on average. The patterns for imports were similar, except that imports from non-GMS AFTA rose faster than those from other countries outside the subregion. The GMS trade with ASEAN, as well as the US and European Union (EU), has mostly been determined by most-favored nation status, rather than favorable tariff rates (ADB 2007).

Generally speaking, from 1994 to 2006, the share of trade with other GMS countries, especially the PRC, rose significantly. The share of trade with non-GMS AFTA countries was stable, represented by a decrease in exports offset by an increase in imports. Trade shares with other East Asian countries and the rest of the world declined modestly. However, countries outside the ASEAN region still represent the GMS countries' largest trading partners due to their significantly larger markets and greater wealth.

3. Opportunities to Enhance Trade

Thanks to the diverse economies and abundance of natural resource wealth in the GMS, regional cooperation can provide numerous opportunities to facilitate growth. The diversity of the GMS can be its greatest strength. The PRC, Thailand, and Viet Nam all provide large markets and regional knowledge from which they can continue their own strong rates of growth, and from which other less developed GMS countries can learn. The process of regional cooperation has already begun and needs to continue for future economic development. Economic structures are in transition, with the roles of public and private sector transforming, especially in the poorer countries. Furthermore the economies are becoming more diversified and open to trade, and are attempting to integrate smoothly into both the regional and global economies. One of the most positive trends has been increased flows of intrasubregional trade, investment, and technology. The PRC and Thailand are especially important as private capital and technology flows to the other countries can better use land and labor to produce goods efficiently for the subregion or for export. Although capital and technology flows have already begun, they will increase as the investment climate improves, transport and trade facilitation gets better, and goods can move more easily across borders.

Trade and transport facilitation (TTF) are crucial for the development of the subregion, which makes cooperation policies particularly relevant. The World Bank has identified key policy recommendations it believes will help facilitate subregional trade. The creation of a subregional TTF initiative or project is necessary to build on what national TTF projects have achieved. Regional efforts can leverage collective will and motivate all to work together toward common TTF goals. Of course, creating any regional project will be difficult, especially given the varying degrees of economic interest in trade and investment within the GMS. For example, Lao PDR would stand to benefit more from a subregional TFF initiative than Cambodia or Viet Nam, given Lao PDR's high share of GDP from intra-GMS trade and investment. Both Thailand and the PRC's direct economic interest is low, but they have significant interest in the economic, social, and political stability of the subregion.

The importance of the private sector in each of the GMS countries must be addressed as well. Private capital and technology of the more developed countries of this region (particularly the PRC and Thailand) can combine beneficially with the abundant land and low-cost labor of its neighbors. However, this is assuming that such investments can be moved across borders to the export markets competitively, which means protectionist policies such as tariffs must be reduced. Additionally, infrastructure is crucial as well so that goods from investments can move quickly and cheaply across borders (ADBI 2009, Brooks and Hummels 2009).

There are three road corridors (East-West, North-South, and Southern) in the GMS that must be completed to add to the available sea and air links for subregional trade. Costs, both financial and time, of moving goods across land borders must come down to be competitive with the alternative of sea-transport, and improved TFF will be critical in achieving this goal. The recent signing of the Cross-Border Transport Agreement by all governments in the GMS was an important step in this direction. The improvement of the GMS roads has resulted in savings in vehicle operating costs and reduced travel times. Border-crossing in Cambodia, Lao PDR, and Viet Nam have all also been reduced. However, the road network still needs work as the implementation of the Cross-Border Transport Agreement is still pending, and missing infrastructure links have reduced the effectiveness of completed projects. While improved roads have increased national traffic, international traffic has been slow to grow partly due to the absence of an agreement to facilitate cross-border movement of vehicles.

Additionally, the observed comparative advantages of GMS countries represent an opportunity to further enhance trade. Comparative advantages depend on a number of factors in addition to resource endowments. Some examples include trade policy (such as tariff and nontariff barriers); technology; geography (such as a country's proximity to large markets and easy access to ports and navigable waters); quality of institutions and infrastructure; and level of education and knowledge of its workers. While some of these factors, such as geography, are relatively fixed, others are able to evolve because

of government policy or because of feedback effects as a country develops. As these determinants change, so does a country's comparative advantage—along with its pattern of trade. Therefore, further trade facilitation by GMS countries will depend directly on the factors countries can control, such as trade policy, social and physical infrastructure, and development of institutions, matched with policies to maintain macroeconomic stability (ADB 2007).

Taking a closer look at geography, we can see how a distant landlocked country such as Lao PDR faces natural disadvantages in foreign trade both in terms of cost of transportation and the time involved in meeting customers' demand. However, there are still opportunities to enhance trade flows. For example, improvements in infrastructure would lower the cost and time of trade, thus increasing flows and benefit sectors that use infrastructure services more intensively (ADB 2007). This was found to be true in a study of Latin American countries, which found that the main beneficiaries of reduced transport costs were agriculture, natural-resource-intensive, and labor-intensive sectors (de Ferranti et al. 2002). In a country like Lao PDR, rich in all these sectors, the improvement of infrastructure to facilitate trade should be a priority.

4. Impediments to Trade and Challenges

As previously discussed, increasing integration into world markets should place more competitive pressure on GMS domestic industries. These competitive pressures both from within the subregion as well as other countries, demonstrates the need to further reduce impediments to trade, improve the business climate, and raise overall economic competitiveness.

Although tariff rates have fallen over the past decade and a half in the GMS, trade policy could be improved further. Lao PDR, for example, still has numerous licensing requirements for imports and exports, especially at the provincial level. Additionally, Lao PDR, as well as Cambodia and Viet Nam, has a cascading tariff structure where rates escalate with the degree of processing. Tariffs and nontariff barriers are especially damaging because they raise the cost of imported inputs for companies. This hurts CLV countries especially, because they are small compared to world markets and are unable to raise prices in international markets to absorb these higher costs. Exporters are at a disadvantage relative to producers in the domestic market as producers are protected by these tariffs. Furthermore, as tariff rates escalate with the degree of processing, the effective rate of protection is even higher than the implied nominal tariff rate (ADB 2007).

However there are other trade costs that need to be addressed as well, such as regulatory burdens, inadequate infrastructure, and inefficient customs procedures and logistics of moving goods across borders. In fact, as tariffs and quantities restrictions have been reduced in the GMS, these problems have become more significant. For example, trade costs from inadequate infrastructure and cumbersome regulatory environment are

thought to be significantly higher than those from tariffs and nontariff barriers (Anderson and van Wincoop 2004). The costs of transit delays are especially high for time-sensitive goods, such as perishable agricultural products and seasonal or fashion apparel. As these are some of the products in which CLV countries have a comparative advantage, the importance of infrastructure and logistics is obvious. Additionally as GMS countries begin to specialize in particular stages of production in regional or global supply chains, the improved quality of transport infrastructure becomes even more pertinent. The frequent need to import intermediate goods for processing and reexport requires a reliable and well-functioning transport and logistics network (ADB 2007).

In all of the GMS countries, most of the time required to trade is spent on preparing documents and the time required in CLV countries is significantly higher than those in Thailand and the PRC. Lao PDR has the longest process for document preparation, reflecting elaborate licensing and approval procedures for imports and exports. For example, Lao PDR requires 16 documents for imports compared with 12 in Cambodia and nine in Viet Nam. For exports, 12 documents are required in Lao PDR, versus just six in Cambodia and Viet Nam. The customs procedure also takes longer in Lao PDR as well as Viet Nam. In both Lao PDR and Viet Nam, it takes an average of 7 days for exports and 5 days for imports to clear customs, versus just 2 days in the PRC and Thailand.

Other important constraints to address include impediments on the domestic investment environment, which can impose substantial costs on businesses, decreasing the ability to compete in international markets. The top constraints vary by country. In Cambodia, businesses state that governance issues such as corruption, crime, legal, and regulatory uncertainty are the main constraints. In Lao PDR, businesses perceive deficient infrastructure, regulatory uncertainty, and access to financial markets as the biggest handicaps. Businesses in Viet Nam find inadequate access to land, financial markets, and poor infrastructure as the main obstacles (ADB 2007).

a. Cambodia

Although Cambodia has emerged as a large garment exporter in recent years, agriculture is still a crucial part of the economy. Agriculture accounted for 39% of GDP in 2006, and is relied upon by many rural households. With 81% of the population classified as rural, the development of the agricultural industry is crucial to the growth of Cambodia. The Cambodian Ministry of Agriculture, Forestry and Fisheries (MAFF) estimates the most growth in this sector can come from the development of the livestock and fishery industries. As a result, the expansion of these industries has been made a top priority. In 2004, Cambodia was admitted membership to the WTO, which has helped fuel the tremendous growth in Cambodia's clothing manufacturing industry. However, exports of logs, rice, sawn timber, and fish products are all rising (Burgos et al. 2008).

Agricultural land makes up 30.1% of the total land available in Cambodia. While this is higher than neighboring countries such as Lao PDR, it is still far below countries such as the PRC, and signals the potential for development. Growth in agricultural land, especially pastureland, has been increasing since the 1980s (FAO 2005a).

The livestock industry represents approximately 21% of agricultural GDP, and 7.6% of total GDP. Smallholders currently dominate the livestock sector. Most poor families own chickens and may raise a pig or two as well. More wealthy farmers generally own a pair of draught and breeding cattle. In Cambodia, cattle tend to be more important than swine as farmers rely on them for a variety of fieldwork activities. Recently, large-scale commercial businesses entering the livestock industry have been emerging, but these are few and represent less than 1% of livestock owners.

Cambodia is a net importer of goods. Its main exports are garments, which account for almost 40% of all exports and are followed by forestry products that account for 18% of exports. Livestock trade is very minimal as Cambodia exports a small amount of live animals. Cambodia's main imports are cigarettes, petroleum products, rice, and sugar. Cambodia's major trading partners include neighboring countries, Japan, and the US. It has signed bilateral trade agreements with the PRC, the Republic of Korea, and the US.

The Government of Cambodia plans to increase both livestock production and productivity, and has created the following seven development objectives: (i) promotion of "household animal raising"; (ii) reduction and elimination of selected animal diseases; (iii) increasing feed quality and improvement of breeding and animal husbandry techniques; (iv) encouragement of medium-scale businesses and investment in animal raising; (v) development of the meat-processing industry to stimulate exports; (vi) promotion of better management and control of animal drugs; and (vii) development of community-based and private livestock services.

Cambodia's direction of trade has shifted rapidly since 1994. From 1994 to 1996, the GMS and non-GMS AFTA represented 76.1% of Cambodia's direction of trade. However, by 2004–2006, this number dropped sharply to 33.7%. This shift can be explained by Cambodia trading much more with the rest of the world, and by 2004–2006, over 50% of Cambodia's direction of trade was in this category. Exports show an even more striking transition. In 1994–1996, 42.3% of Cambodia's exports were within the GMS compared to 33.9% for the rest of the world. By 2004–2006 however, exports to the subregion almost vanished at only 2.8%, while exports to the rest of the world more than doubled to 87%. This can be explained by Cambodia's specialization in garment manufacturing, with most of its exports heading to the US and to a lesser extent the EU. Imports show a slightly similar trend, with imports falling from the GMS excluding the PRC. Imports from the PRC actually increased from 3.8% during 1994–1996 to 16.9% during 2004–2006. Despite falling percentages of imports from the GMS excluding the PRC, Cambodia still received

27.9% of imports from the subregion during 2004–2006, the largest percentage in any category.

The successful development of the livestock industry in Cambodia presents a tremendous opportunity for the country. As the PRC continues to increase its demands for meat, Cambodia can become an important regional supplier.

b. Lao PDR

Much like Cambodia, Lao PDR is a low-income rural country. Agriculture accounted for 40.7% of total GDP in 2007, and employs more than 80% of the population (FAO 2007). Since New Economic Mechanisms (NEM) were adopted in 1986, Lao PDR has enjoyed a steady increase in the national output and improvements in the general standard of living. The current strategic objectives for agricultural development are to improve rural livelihoods, reduce vulnerability of poor households, create opportunities for diversifying livelihoods, and maintain environmental quality in rural areas. Increased rice production to achieve self-sufficiency contributes directly to these goals and has been made a top priority (Bestari et al. 2006).

Rice is an extremely important crop in Lao PDR as it is a staple food and contributes to almost 70% of the caloric and protein intake of its citizens. Therefore self-sufficiency in rice has been equated with self-sufficiency in food, and has been a top priority goal for the country since the introduction of the NEM. Rice self-sufficiency was reported to have been achieved in 1999 at more than 2 million tons, but there is debate among observers if this is an accurate claim (Bestari et al. 2006).

Currently, rice represents over 80% of the total cropped area (Bestari et al. 2006). However, total cropped area in Lao PDR remains very small as it only represents 4.3% of the total land area. Therefore, there is tremendous potential for both the expansion of cropped area, and the overall expansion of agricultural land in Lao PDR. Agricultural land only represents 8.1% of the total land area (8,780 square kilometers out of 230,800 square kilometers) (FAO 2005b). In this sense, Lao PDR has a relative abundance of agricultural land, especially compared to neighboring countries such as the PRC. Thus, the successful development of this land is necessary as Lao PDR has the opportunity to eventually become an important supplier of agricultural products to the PRC.

Livestock is another important sector for potential development. As of 2005, livestock was responsible for 14.3% of agricultural GDP and 9% of total GDP. Virtually all of the livestock production is traditional, extensive, and low input. Different regions have preferred productions of animals. The central region is home to mostly cattle and buffalo, where they are grazed on the vacant cropping area for most of the year. In the highlands, pig production is an important livelihood, and most farmers tend to raise local chickens as well. Commercial pig and poultry operations can be found in large urban areas such as Vientiane, and are mostly small cottage industries with a few employees. Over the

past two decades meat supply has witnessed positive growth—however this was a result of increased number of animals while productivity levels remained stagnant. In fact, productivity levels are particularly low compared to developing countries' average. The National Growth and Poverty Eradication Program recognizes this low productivity and livestock diseases as priority issues for the poor; and furthermore, that the loss of livestock is one of the main causes of poverty. Development targets included a meat supply of 60 kg/year per capita as well as increased export of meat products for a total value of about $50 million.

Lao PDR is a net importer of goods, with approximately 20% of the imbalance due to agricultural trade. Main exports are coffee, live buffalos and cattle, and hides. Approximately 75% of cattle and buffalo in Lao PDR are produced and consumed domestically, and the remaining 25% are exported. Thailand is the most significant export market, and Lao PDR is believed to supply up to 20% of Thailand's livestock demand, accounting for about 100,000 animals per year. However, much of this export occurs through unrecorded and unregulated border trade so exact numbers are not known. Primary imports include nonalcoholic beverages, sugar, and rice. Lao PDR applied for WTO membership in 1997; is a current member of ASEAN; and has signed bilateral trade agreements with the PRC, Mongolia, and Viet Nam in the region.

Lao PDR's direction of trade is dominated by two categories: the GMS and the rest of the world. The GMS is arguably Lao PDR's most important trading partner as it represented 62% of all trade activities from 2004 to 2006. However, this large percentage of trade is largely explained by imports and the PRC, as exports to the GMS excluding the PRC fell from 62.6% during 1994–1996 to 44.6% during 2004–2006. Exports to the PRC have increased modestly from 1.9% during 1994–1996 to 3.5% during 2004–2006. The largest growth in exports has come from the rest of the world, increasing from 34.1% to 47.9% over the same time period. Out of all the GMS economies, Lao PDR is most dependent on the subregion for trade due to its landlocked geography and relatively greater remoteness from other major markets. However, its export dependence is decreasing as it becomes more linked with regional and global economies through cross-border infrastructure improvements and greater market access (ADB 2007). Looking at imports, this trend is actually reversing as the percentage of imports from the subregion has increased, while those from the rest of the world have fallen. From 1994 to 1996 and 2004 to 2006, imports have increased from 51.5% to 72% from the GMS excluding the PRC, and have increased from 3.5% to 10.4% from the PRC alone. During the same time, the percentage of imports from the rest of the world has fallen from 32.8% to 10.3%

c. Viet Nam

Viet Nam faces different challenges than Cambodia and Lao PDR. While it too is a low-income country, it has been making rapid economic gains recently, with GDP growth above 7% per year since the late 1980s. However this has been fueled largely from a booming manufacturing industry as Viet Nam continues to industrialize. Agriculture is only

responsible for approximately 22.6% of GDP, with 66.5% of the population employed in this sector. Agricultural land represents 29.3% of Viet Nam's total land area (FAO 2005d). Viet Nam is densely populated for a country of its size and as a result faces significant constraints on its agricultural resources. Arable land per person is low even by Asian standards. Nonetheless, Viet Nam makes good use of what agricultural resources it has.

Undoubtedly, Viet Nam's most important crop is rice. It produced an estimated 35.3 million tons of rice in 2007, an increase of 1.5% over 2006. Rice production uses 75.5% of Viet Nam's agricultural land. While domestic rice consumption has been declining over the past decade, Viet Nam has emerged as the second largest rice exporter in the world. An estimated 4.5 million tons valued at $1.45 billion were exported in 2007 (Quan 2008). Rice exports are expected rise to 5 million tons in 2009, according to the Government of Viet Nam. Asia represents Viet Nam's largest export market, accounting for 70% of total exports. The majority of these exports head to the Indonesia, Japan, Malaysia, Singapore, and the Philippines. The Philippines was the single largest buyer of rice from Viet Nam, importing 1.5 million tons in 2007. Indonesia was the second largest buyer at 1.2 million tons. Japan is seen as the most promising high-value market; however only about 64 thousand tons of rice was exported to Japan in 2007. Viet Nam also imports a significant quantity of rice from neighboring countries Cambodia and Lao PDR. Import volumes were estimated at approximately 450,000 tons in 2007—although accurate data is hard to obtain, as there is a large amount of informal trading along the borders. Reportedly, several farmers from Viet Nam also have paddy rice investments in Cambodia for additional rice production (Quan 2008).

Currently, livestock production is mostly in the hands of small farmers. They own approximately 40% of the cattle stock, 75% of the poultry stock, and 80% of the pig stock. However, semi-intensive to intensive pig and dairy farms are growing fast, as is Viet Nam's domestic demand for meat. Therefore, domestic production of livestock is expected to increase in the coming decades. The government is prioritizing pig and dairy cow sectors with the objective of increasing pig meat exports as well as reducing reliance on imported milk products. As a result, the poultry sector has not developed many large commercial operations and processing plants, as the pork sector receives the most attention and funds in the Ministry of Agriculture and Rural Development's plans. Viet Nam is already a large importer of feed and feed ingredients to meet livestock production, and these imports are expected to increase as consumption of livestock products grows (Quan 2008).

Viet Nam is a net importer of goods with total exports valued at $48.4 billion and imports valued at $60.8 billion in 2007. In addition to rice, major agricultural exports include coffee, cashews, pepper, rubber, and pig meat. Thanks to Viet Nam's abundant rainfall and vast network of waterways and estuaries, Viet Nam has begun to develop an expansive aquaculture system that supports its large and growing fish and seafood export industry. Viet Nam is now currently the world's third largest fishery producer and the sixth

largest exporter of seafood products (Huong and Quan 2008). Viet Nam also relies on a significant amount of agricultural imports. It must import most, if not all, of its domestic consumption of wheat, cotton, wood, hides and skins, and dairy products (VMARD 2008). Other large agricultural imports include soybeans, palm oil, and cigarettes (FAO 2005d). The government is actively trying to increase domestic production of corn, soybean, cotton, and dairy, but has arguably unrealistic expectations as the amount of resource they can contribute to promote these industries is minimal. Despite this however, Viet Nam can be considered a successful model for using agricultural trade to realize comparative advantages, especially given its significant land constraints.

Viet Nam's direction of trade is characterized by a decline of the role of non-GMS Asian countries. Non-GMS AFTA and other East Asian countries accounted for 53% of Viet Nam's total trade during 1994–1996, but declined to 35.5% by 2004–2006. The PRC has become a very important trading partner with Viet Nam, increasing from 4.2% of total trade in 1994–1996 to 12.4% in 2004–2006. Looking at the destinations of exports further demonstrates these trends, as exports have decreased to non-GMS AFTA and other East Asian countries. The GMS, excluding the PRC, receives just a small percentage of Viet Nam's exports (3.8% in 1994–1996 and 4% in 2004–2006). The percentage of exports sent to the PRC has increased modestly (5.8% to 8.1%). The largest destination of exports goes to the rest of the world, increasing from 38.1% in 1994–1996 to 60.1% in 2004–2006. Viet Nam's sources of imports predominantly come from outside of the GMS, although the percentages are falling, while the role of the GMS is increasing. Most noticeably, the PRC has emerged as a very important source of imports, increasing from 3.2% of total imports in 1994–1996 to 16% in 2004–2006.

d. Thailand

Thailand is the most developed economy in the GMS and has thriving rice and poultry export industries. GDP growth rates from 1985 to 1995 were 9%, and were among the highest in the world during this time. However, pressure on Thailand's currency in 1997 led to a financial crisis that caused the economy to plunge into recession, although it has been recovering steadily ever since. Agricultural production accounts for 10.3% of national GDP, signaling the role Thailand has created as an important manufacturer. Despite the small role agriculture plays in the economy, 47.4% of the population still works in this sector. Agricultural land represents 39.5% of Thailand's total land area. These trends demonstrate that although Thailand has become an important manufacturer in the region, agriculture is still a large part of the economy although this is not necessarily seen in pure value terms.

Much like the other GMS countries, rice is an incredibly important crop for Thailand. It is especially important for Thailand, as it is the world's leading exporter of rice. Rice production levels were approximately 18.5 million tons in 2008, up 1.6% from the previous year due to better weather conditions and yield improvements. Thailand also has a second crop production system, especially in the lower central area where flooding

is minimal and there is a longer winter season. Yields for second crop production were 4.5 million tons in 2008. Some paddy fields have even begun to shift to third crop corn cultivation, particularly in the lower northern region where water shortages are likely to occur. Consumption of rice in Thailand is still considered a staple good at 110 kg/year per capita, although levels have been decreasing as is common in countries with rising incomes. Thai exports of rice were forecast to decline to 8–9 million tons in 2008–2009 due to a limited amount of exportable supplies. However, this is still a very large amount and is approximately double what Viet Nam exports. In 2007, Thai rice exports surged to 9.6 million tons due to competitor rice export bans, most noticeably bans placed in African countries. In 2007, Thai rice exports to African countries increased to 3.9 million tons, with the largest fraction going to Nigeria (327,025 tons); Senegal (680,155 tons); Cote d'Ivoire (397,569 tons); and South Africa (532,369 tons). In the region, Thailand's largest export markets were the PRC (462,152 tons); Indonesia (456,158 tons); Malaysia (414,028); and Hong Kong, China (313,843) (FAOSTAT 2008b).

Thailand's livestock industry is dominated by poultry production. Thailand produced 1.4 million tons of broiler meat in 2002, which is significantly larger than its second largest category of pig meat at 646,100 tons (FAO 2005c). In 2007, broiler meat production decreased to 1.13 million tons, although growth increased by 8% in 2008. Furthermore, Thailand's broiler meat production is forecast to increase by a further 6% in 2009, as the industry faces strong demand both domestically and internationally. Cooked poultry meat production is also expected to increase in 2009 due to increased export demands. Despite increasing production costs, the Thai poultry industry has continued to perform well by transferring increased costs to consumers in both domestic and overseas markets.

The principal reasons costs have been rising due to global feed costs. Prices for corn and soybean meal, which account for 85–90% of broiler feed, increased by 21% and 60% in the first 7 months of 2008 (Preechajarn 2008). Over the last 15–20 years, farm sizes have increased significantly largely from increased flows of FDI. The corresponding technology transfers have improved breeds, and enhanced feed technology and housing and farm management. All of these factors have contributed to Thailand becoming the fourth largest poultry-exporting country in the world (FAO 2005c). Thailand's major export markets include Japan and the EU (all cooked products), as well as Viet Nam; Singapore; the Republic of Korea; and Hong Kong, China within the region. The PRC currently acts as a major competitor to the Japanese market, although it is forecast to lose its competitiveness due to growing domestic consumption and increased concern from trading partners about the safety of food products from the PRC (Preechajarn 2008). Besides poultry production, domestic meat demand is largely met by domestic production although Thailand does import small amounts of beef and pig meat (FAO 2005c).

Thailand is a net exporter of goods, including agricultural products. Despite being the world's largest exporter of rice and fourth largest poultry exporter, Thailand's leading

agricultural export product by value is natural dry rubber. Other important exports are sugar, cassava and pineapples (FAOSTAT 2008d). Corn exports have been increasing in recent years due to increasing global prices. Most corn exports occur intraregionally with Lao PDR, Cambodia, Viet Nam, Malaysia, and Indonesia being the most important markets (Prasertsri 2008). Thailand's top five agricultural imports by value in 2004 were cotton, soybeans, soybean cakes, dry skim cow milk, and wheat (FAOSTAT 2008b). Cotton imports are relied upon heavily for Thailand's extensive textile manufacturing industry. Similarly, soybeans are needed as feed for Thailand's large livestock industry. The large imports of dairy and wheat reflect Thailand's shifts in food consumption preferences as income rises. Wheat consumption has been rising for many years, most noticeably in urban areas as demand for bakery and instant noodle products continues to grow. Wheat production is insignificant in Thailand and is limited to just 550 hectares (Prasertsri 2008).

Thailand's direction of trade looks similar to Viet Nam's, although it has less volatility. Trade with the GMS, excluding the PRC, is very small at 3.4% in 2004–2006, although it has risen since 1994–1996. Trade with the PRC has increased as well, from 2.7% of total trade in 1994–1996 to 9% in 2004–2006. The rest of the categories have remained fairly constant, with a slight increase to non-GMS AFTA and slight decreases to East Asia and the rest of the world. Thailand's destinations of exports have also remained relatively constant. The role of the GMS has increased, with the GMS—excluding the PRC—rising from 2% to 4.3% of total exports. Exports to the PRC have increased even more, from 2.8% to 8.3%. Although Thailand is by far the largest exporter in the subregion (excluding the PRC), exports to the rest of the world decreased from 53.8% to 49.4%. Imports show similar trends as well, with the PRC representing a large increase from 2.6% of total imports in 1994–1996 to 9.7% in 2004–2006. Imports from the GMS excluding the PRC also increased but much more modestly (from 0.4% to 2.5%).

III. The Dynamic Forecasting Model

The complexities of today's global economy make it very unlikely that policy makers relying on intuition or rules-of-thumb will achieve anything approaching optimality in either the international or domestic arenas. Market interactions are so pervasive, and market forces so powerful in determining economic outcomes that more sophisticated empirical research tools are needed to improve visibility for both public and private sector decision makers. The preferred tool for detailed empirical analysis of economic policy is now the calibrated general equilibrium (CGE) model. It is ideally suited to trade analysis because it can detail structural adjustments within national economies and elucidate their interactions in international markets. The model is more extensively discussed in an appendix and the underlying methodology is fully documented elsewhere, but a few

general comments will facilitate discussion and interpretation of the scenario results that follow.[1]

Technically, a CGE model is a system of simultaneous equations that simulate price-directed interactions between firms and households in commodity and factor markets. The roles of government, capital markets, and other trading partners are also specified, with varying degrees of detail and passivity, to close the model and account for economywide resource allocation, production, and income determination.

The role of markets is to mediate exchange, usually with a flexible system of prices, the most important endogenous variables in a typical CGE model. As in a real market economy, commodity and factor price changes induce changes in the level and composition of supply and demand, production and income, and the remaining endogenous variables in the system. In CGE models, an equation system is solved for prices that correspond to equilibrium in markets and satisfy the accounting identities governing economic behavior. If such a system is precisely specified, equilibrium always exists and such a consistent model can be calibrated to a base period data set. The resulting calibrated general equilibrium model is then used to simulate the economywide (and regional) effects of alternative policies or external events.

The distinguishing feature of a general equilibrium model, applied or theoretical, is its closed-form specification of all activities in the economic system under study. This can be contrasted with more traditional partial equilibrium analysis, where linkages to other domestic markets and agents are deliberately excluded from consideration. A large and growing body of evidence suggests that indirect effects (e.g., upstream and downstream production linkages) arising from policy changes are not only substantial, but may in some cases even outweigh direct effects. Only a model that consistently specifies economywide interactions can fully assess the implications of economic policies or business strategies. In a multicountry model like the one used in this study, indirect effects include the trade linkages between countries and regions, which themselves can have policy implications.

The present global modeling facility has been constructed according to generally accepted specification standards, implemented in the GAMS programming language, and calibrated to Version 7 of the GTAP global economic database.[2] The result is a 13-country/region, 10-sector global CGE model, calibrated over a 16-year time path from 2005 to 2020. Apart from its traditional neoclassical roots, an important feature of this model is product differentiation, where we specify that imports are differentiated by country of origin and exports are differentiated by country of destination. This feature allows the model to capture the pervasive phenomenon of intra-industry trade, where a

[1] The model used here is typical of modern global models and is based on the LINKAGE model developed at the World Bank (van der Mensbrugghe 2008).

[2] See, e.g., Hertel (2008) for GTAP.

country is both an importer and exporter of similar commodities, and avoids tendencies toward extreme specialization.

A. Scenarios

As discussed, the model is calibrated to a 2005 reference global database obtained from GTAP Version 7. While GTAP details global economic structure and trade flows for 57 sectors and 118 countries and regions, for tractability in the present study, we focus on an aggregation of 10 sectors and 13 countries and regions set forth in Table 6.

Table 6: Countries, Regions, and Sectors

Abbreviation	Name
PRC	People's Republic of China
eur	Europe 27
HIA	High-Income Asia
CAM	Cambodia
LAC	Latin America and Caribbean
LAO	Lao PDR
row	Rest of the World
THA	Thailand
USA	United States
VIE	Viet Nam
roa	Rest of Asia
XSA	South Asia
XSE	Other Southeast Asia
ric	Rice
ocr	Other crops
lvs	Livestock
ffl	Fossil fuels
mtd	Meat and dairy
ofd	Other processed food
omf	Other manufactures
trd	Trade and transport services
prv	Other private services
pub	Public services

Using this aggregation, the dynamic CGE model is calibrated to a baseline time series reflecting a business-as-usual scenario over 2006–2020. This baseline comprises consensus forecasts for real GDP obtained from independent sources (e.g., International Monetary Fund, Data Resources International, and Cambridge Econometrics). The model is then run forward to meet these targets, making average capital productivity growth for each country and/or region endogenous. This calibration yields productivity growth that would be needed to attain the macro trajectories, and these are then held fixed in the model under other policy scenarios. Other exogenous macro forecasts could have been used and compared, but this is the standard way to calibrate these models.

As outlined in the introduction, the main objective of the present forecasting exercise is to assess the potential for increased agrofood capacity to promote growth and reduce poverty in the GMS. To assess this potential, we consider three primary drivers of growth and two types of risk to growth.

(i) *Productivity Growth in Agriculture and Related Food Industries.* In the first category, agricultural yields and productivity in livestock production are far below their ultimate potential in lower income GMS economies. Because of relatively small-scale land tenure patterns, it is unlikely that rural households in these countries can achieve significant livelihood improvements unless output per hectare improves, and migration trends suggest that higher output per household member will also be essential.

(ii) *Facilitation of Trade and Market Access.* Most rural agricultural households in the GMS live behind high walls of market access barriers, including high transactions and transport costs with respect to remote markets, and these are often compounded by infrastructure and information constraints. As long as distribution margins remain high, low income agrofood enterprises with relatively low-value products will be prevented from accessing markets. By converse reasoning, lowering market access costs and related margins enlarges the horizon of profitable trade for all, increasing commerce, capturing value-added, and promoting self-directed poverty reduction.

(iii) *Foreign Direct Investment.* One of the defining characteristics of low-income economies everywhere is limited reserves of domestic savings, which in turn limits the progress of development by restricting investment in productive assets and enterprise expansion. The era of globalization has changed the nature of this constraint; however, the advent of transboundary investment permits low-income countries to leverage foreign savings for domestic investment. To help low-income GMS countries achieve their economic potential in the most timely fashion, FDI can be an essential catalyst.

(iv) *Persistent Macroeconomic Slowdown in Industrial Countries.* While the Asian economies have exhibited a relatively robust recovery from the recent global economic downturn, industrial economies continue to experience serious credit constraints, extensive distressed asset challenges, and sluggish recovery of aggregate demand. To a significant extent, the demand shortfalls that have already been experienced have reset the growth path for the global economy. This will be compounded, however, if the largest markets are slower to recover. To give an indication of how this process might retard regional growth, we include a scenario where baseline growth rates for the Organisation for Economic Co-operation and Development (OECD) economies fall to zero in 2009 and return to trend linearly over the next 5 years.

(v) *Highly Pathogenic Avian Influenza and/or Other Serious Livestock Disease Outbreaks.* Since its emergence in 1996 in the PRC, the highly pathogenic avian influenza H5N1 virus has infected 61 countries, been associated with more than 260 human fatalities, and resulted in disease mortality and culling of several hundred million domestic birds. Analogously, blue-ear disease in the PRC has killed several million swine. In each case, a large-scale animal disease outbreak has caused serious regional meat shortages, threatened livelihoods, and presented threats to public health. To assess the linkage effects of such a supply chain disruption, we examine the effects of a 20% decline in livestock productivity across Asian economies. Although we do not consider human health impacts, this is admittedly a relatively extreme scenario.

The main scenarios we evaluated represent the first three of these categories. As summarized below, each of these components makes an incremental contribution to agrofood development and overall economic growth. On agricultural productivity growth, based on a review of the relevant literature and international historical data, we have experimented with 1%–6% annual output growth for the three agricultural sectors in the three low-income GMS countries considered (Cambodia, Lao PDR, and Viet Nam).[3] The highest rate would double output over 2008–2020, but an upper-midrange value of 4% is probably more sustainable based on the historical evidence summarized in Table 7.

For trade facilitation, we recognize the important regional initiatives of ADB and GMS national governments to establish large transit corridors. These will significantly lower medium and long-distance market access costs, and can be expected to foster complementary infrastructure for feeder road and rail access that achieves more extensive participation. For the present scenario, we chose a central case that reduces trade, transport, and transit (TTT) margins for the low-income GMS by 50%.

Finally, FDI has been a dramatic agent of growth elsewhere in the Asian region, and is likely to exert significant growth leverage on the low-income GMS as new opportunities arise for agrofood development and market access increases the average profitability of regional investments by reducing costs. As our reference case, we assume that FDI in each low-income GMS country rises linearly to 4% of GDP by 2020. For reference, this would place them in the world's top quartile by this metric, including both high-income (Singapore = 12%) and low-income countries (Mongolia = 11%).

[3] Unfortunately, data for Myanmar in the current version of GTAP were not deemed reliable enough to be incorporated individually in this analysis.

Table 7: Average Annual Growth of Agricultural Output

	1970–1979	1980–1989	1990–1999	2000–2006
Sub-Saharan Africa	1.31	2.6	3.1	2.2
Latin America and Caribbean	3.07	2.37	2.87	3.13
Brazil	3.83	3.73	3.29	4.41
Middle East and North Africa	2.94	3.37	2.73	2.34
NE Asia, High	2.15	1.03	-0.01	–0.01
NE Asia, Low	3.11	4.55	5.06	3.85
PRC	3.09	4.6	5.17	3.87
SE Asia	3.68	3.59	3.13	3.54
South Asia	2.56	3.39	3	2.19
India	2.69	3.52	2.94	2
North America	2.17	0.73	2.03	1.1
Oceania	1.79	1.25	2.93	–0.04
Western Europe	1.54	0.94	0.46	–0.35
Eastern Europe	1.8	0.25	–2.18	–0.19
Russian Federation	1.32	0.98	–4.62	2.7
Developing Countries	2.82	3.46	3.64	3.09
Developed Countries	1.88	0.86	1.21	0.39
Russian Federation and Eastern Europe	1.47	0.77	–3.88	1.81
World	2.23	2.13	2.04	2.22

NE = northeast, SE = southeast.
Source: Fuglie (2008).

Table 8 summarizes the five core scenarios. Firstly, around the median values used for these three primary growth components, we evaluated a distribution of alternative values. Overall, simulation results are robust with respect to these differences, and what variation they exhibit is consistent with economic intuition and the results interpretation that follows. Two additional scenarios were included to illustrate the diverse scope of potential policy application for this model.

Table 8: General Scenarios

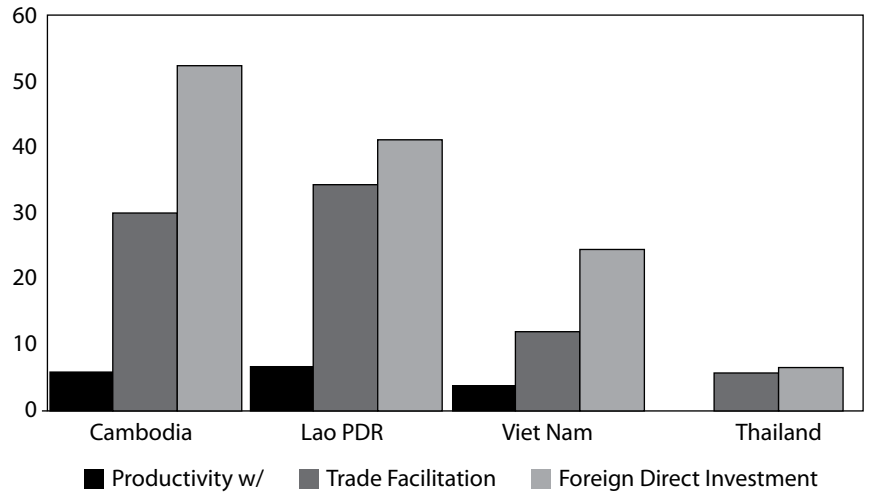
Scenario	Name	Description
1	Agrofood Productivity	Assume that total factor productivity grows at 4% annually in agriculture and food processing sectors
2	Trade Facilitation	In addition to Scenario 1, assume trade, transport, and transit margins to and from and through low-income GMS countries are reduced by 50%.
3	Foreign Direct Investment	In addition to Scenario 2, assume that FDI in the low-income GMS countries rises to 4% of GDP by 2020.
4	OECD Recession	Assume OECD growth rates fall to zero in 2009 and return to baseline trends linearly in 5 years.
5	Livestock Epidemic	Assume 2009 livestock productivity in Asia falls 20%, returning to trend 5 years later.

GDP = gross domestic product, GMS = Greater Mekong Subregion, FDI = foreign direct investment,
OECD = Organisation for Economic Co-operation and Development.

B. Simulation Results

The macroeconomic results for the three archetype scenarios are summarized in the following tables, and Figure 7 illustrates the real GDP results for GMS economies considered. The most arresting feature of the GDP estimates is the pro-poor impact of the combined policies. When all three scenarios are considered together, the lowest-income country (Cambodia) has the highest relative gain; the second lowest (Lao PDR) is next; followed by Viet Nam, which would enjoy 20% higher real GDP in 2020. This finding is a logical consequence of several facts about low-income GMS (and indeed Asian) economies, including higher initial agrofood dependence, higher initial barriers to market access, and tighter domestic saving/investment constraints (Figure 7).

Figure 7: Real GDP (as percent change from baseline in 2020)



There are also several immediate general policy lessons from these findings. Firstly, the GMS in particular and many other poor agrarian economic regions can achieve self-directed poverty reduction with determined policies that yield higher agrofood productivity and improved market access, complemented with private agency that contributes in both these areas but also facilitates investment.

It is also clear from the same results that agrofood productivity alone will not achieve higher growth. Without the facilitating measures for market access and complementary investment, larger harvests and livestock production will simply translate into excessive inventories with falling prices and little net value added.

Another important insight comes from the fourth and fifth scenarios, suggesting that macroeconomic cycles are of much lesser long-term significance than sustained support for microeconomic determinants of productivity and market access. Even if livestock had

a significant short-term setback, or if important OECD export markets experienced a 4–5 year recession, long-term growth potential will continue to be determined by detailed and localized economic fundamentals. For the lower-income GMS countries in particular, long-term growth potential depends much more on sustained modernization and market integration than on cyclical components for individual sectors or destination markets.

Finally, it is worth noting that there can be substantial benefits for neighboring intermediary economies like Thailand, which in this case achieves over 5% higher growth in the second and third scenarios by sharing the benefits of regional trade and investment. This highlights another important characteristic of complementary policies like trade and investment facilitation. Measures like these make individual development assistance incentives compatible for neighboring countries, creating new markets and commercial partnership opportunities that promote shared—and thereby more sustained—economic growth.

Table 9 presents more detailed results for the first agrofood productivity scenario. As one would expect, the countries targeted for productivity growth are the primary beneficiaries in the macroeconomic results of Table 9. Output in the lowest-income GMS countries considered, Cambodia and Lao PDR, rises by about 30% more by 2020 because of (assumed) steady improvements in the productivity of their rural sector (5% total factor productivity [TFP] growth per year). Because both countries remain focused on primary agriculture, value added (real GDP) rises by less than the value of national agrofood output. Viet Nam, by contrast, is less reliant on primary agriculture across the economy, and this means aggregate output grows less from the same agricultural stimulus, but downstream food linkages permit more value-added to be captured in agrofood supply chains. Thus the national GDP effect is more than double (9%) the simple output effect (4%).

Table 9: Scenario 1—Macro Results

	Cambodia	Lao PDR	Viet Nam	Thailand	Other SEA	High Asia	PRC	S. Asia	Other Asia
					Percent				
GDP	17	23	9	6	0	0	0	0	0
Output	30	29	4	6	0	0	0	0	0
Exports	29	33	8	14	0	2	0	0	0
Imports	41	48	24	17	0	2	0	0	0
Cons	53	55	32	10	0	1	0	0	0
CPI	–6	–4	1	4	0	0	0	0	0
EV Inc	54	57	32	10	0	1	0	0	0
					$ Million				
GDP	5,194	2,717	9,704	33,130	–220	26,733	–125	588	–3
Output	68,497	18,128	75,135	208,710	–4,177	502,089	29,402	6,378	–13
Exports	26,504	4,386	51,218	148,518	–3,315	251,547	897	470	81
Imports	31,153	7,398	151,158	197,432	–5,035	270,927	–24,018	-226	79
Cons	3,917	2,440	23,966	18,847	–294	16,787	–839	475	6
EV Inc	6,393	2,612	27,470	20,980	–278	31,395	–1,019	726	7

Source: Authors' estimates.

In all three countries, agrofood is closely linked to export markets, and the trade impact of productivity growth strongly stimulates export competitiveness and import purchasing power (assuming small countries or low terms-of-trade effects). This new external income, combined with domestic price declines following productivity growth, supports substantial growth of equivalent variation (EV) real income and consumption for households. It is also worth noting that, via trade linkages, neighboring Thailand benefits less but still significantly. Thailand participates indirectly in low-income GMS growth via discounted imports and export demand expansions.

The sector results in Table 10 give a clearer indication of how each country adapts to higher productivity potential in the three major primary agricultural products. Recalling that our model treats crops and livestock differently, it is not surprising that different countries respond differently to uniform TFP growth. In particular, because Viet Nam has a more advanced food processing sector, it is able to more completely absorb new agricultural potential, and thus we see the highest average output growth in crops and livestock. Perhaps ironically, this new potential pulls resources away from manufacturing to support dramatic expansion of the food processing sector. Given that Viet Nam's poor majority is firmly embedded in the rural sector, this resource reallocation may have greater antipoverty potential than traditional urban industrialization at this stage of the country's development.

Sector results in food processing suggest that Lao PDR is still constrained in its ability to expand agriculture with productivity. Thus it will release resources to other sectors when marginal costs rise enough in agricultural production, even though expansion is below that of Viet Nam. Without improved market access or complementary investment, agrofood cannot take full direct advantage of productivity improvements and ends up subsidizing a shift of resources to other sectors as they are liberated by higher productivity in agriculture.

The trade implications of higher productivity are summarized in Table 11. Here we see a sector and regional breakdown of trade by origin and destination.[4] Even without complementary policies that facilitate market access and investment, agrofood productivity growth has a potent effect on trade competitiveness. The three low-income GMS countries see dramatic percentage increases in export opportunities with respect to their neighbors. To the PRC, for example, each country increases exports by more than 450%. Although in many cases this change is with respect to a small baseline trade flow, the impetus is strong enough to suggest the potential for long-term growth leverage for the low-income exporter. Looking at level changes in the bottom panel of Table 11, we see that trade diversion (negative elements) plays a relatively minor role, and is far outweighed by trade creation. This is an essential characteristic of productivity-based competitiveness and is very important to multilateral promotion of this approach for regional poverty reduction. Beggar-thy-neighbor policies must be avoided as countries expand bilateral trade.

[4] An element T_{ij} of the trade table measures annual changes from baseline in exports from country i (row) to country j, in the terminal year (2020).

Table 10: Scenario 1—Sector Output Results

	Cambodia	Lao PDR	Viet Nam	Thailand	Other SEA	High Asia	PRC	S. Asia	Other Asia
					Percent				
Rice	56	51	80	–8	–2	0	0	0	2
Other Crops	55	93	155	–2	0	–1	0	0	0
Livestock	58	72	63	2	0	0	0	0	0
Fuels	32	15	9	11	0	1	0	0	0
Meat, Dairy	61	101	70	1	0	0	0	0	0
Other Processed Food	74	65	113	–7	0	0	0	0	1
Manufactures	24	5	–10	10	0	1	0	0	0
Trade and Transport	19	7	3	3	0	0	0	0	0
Private Service	42	21	11	6	0	1	0	0	0
Public Service	26	21	7	3	0	0	0	0	0
Total	30	27	6	6	0	0	0	0	0
					$ Million				
Rice	446	549	5,736	–1,142	–758	–165	98	–1	12
Other Crops	403	445	9,252	–448	64	–1,257	–219	–214	–1
Livestock	450	385	1,497	89	52	585	30	55	–2
Fuels	315	54	794	4,949	409	4,748	2,232	189	–4
Meat, Dairy	280	202	3,750	123	32	–110	57	13	–3
Other Processed Food	1,319	835	12,465	–2,067	92	–175	–1,053	55	118
Manufactures	4,896	161	–19,926	23,448	–538	51,218	3,846	501	–115
Trade and Transport	1,517	139	465	2,713	–8	14,521	–1,339	191	–12
Private Service	2,355	223	5,419	6,978	–232	23,360	–218	205	–1
Public Service	1,143	629	1,841	2,158	87	2,117	322	217	2
Total	13,125	3,621	21,294	36,801	–799	94,843	3,756	1,213	–6

Source: Authors' estimates.

Table 11: Scenario 1—Trade Flows

	Cambodia	Lao PDR	Viet Nam	Thailand	Other SEA	PRC	High Asia	S. Asia	Other Asia
					Percent				
Cambodia			747	446	18	459	13	4	5
Lao PDR			589	547	–14	460	–13	–17	
Viet Nam	51	453		699	14	798	–3	63	10
Thailand	96	94	168		–7	116	–6	–7	–9
Other SEA	–25	–28	-8	1	0	0	0	0	0
PRC	146	133	179	203	0		0	0	0
High Asia	–20	–20	–3	–1	0	0	0	0	0
S. Asia	–16	–21	–5	1	0	0	0	0	0
Other Asia	–16		–5	12	0	–1	0	0	0
					$ Million				
Cambodia	0	0	757	178	19	439	128	2	0
Lao PDR	0	0	381	435	–2	134	–19	–2	0
Viet Nam	1,453	269	0	2,163	574	14,931	-540	784	8
Thailand	994	657	2,844	0	–1,542	31,613	–2,081	–340	–53
Other SEA	–297	–6	-515	182	76	–599	233	25	3
PRC	2,875	304	16,982	22,046	–139	0	–909	–104	–2
High Asia	–541	–43	–849	–345	526	–2,134	653	78	21
S. Asia	–67	–6	–147	20	16	–158	26	9	2
Other Asia	–4	0	–7	148	–2	–36	–17	–2	1

Source: Authors' estimates.

The next set of tables (Tables 12–14) summarize impacts for the intermediate scenario, including both agrofood productivity and trade facilitation. As the macroeconomic results demonstrate, the full potential of higher productivity in primary sectors cannot be realized without reducing trade and transport margins to expand eligible markets. Interestingly, output growth increases moderately, but trade in both directions and value-added are nearly double that of the productivity only scenario. In other words, trade facilitation takes a similar amount of productive potential and articulates these goods into longer supply chains, including both higher exports and imports, stimulating trade as well as a broad array of intermediate services.

Table 12: Scenario 2—Macro Results

	Cambodia	Lao PDR	Viet Nam	Thailand	Other SEA	High Asia	PRC	S. Asia	Other Asia
					Percent				
GDP	30	30	14	6	0	1	0	0	0
Output	50	31	12	9	0	1	0	0	0
Exports	74	63	34	20	0	3	0	0	0
Imports	87	82	58	31	0	4	0	0	0
Cons	68	66	48	19	0	1	0	0	0
CPI	–4	4	5	7	0	1	0	0	0
EV Inc	70	65	48	18	0	1	0	0	0
					$ Million				
GDP	9,046	3,524	15,125	32,395	–380	47,859	126	1,028	–13
Output	116,570	19,742	228,670	297,902	–9,427	1,027,483	59,601	7,538	–115
Exports	66,816	8,214	207,636	221,610	–9,319	530,824	7,795	–1,524	31
Imports	65,878	12,698	364,527	358,554	–12,603	495,095	–45,002	–3,442	–49
Cons	5,101	2,896	36,152	36,467	–605	27,807	–1,363	658	–1
EV Inc	**8,215**	**2,999**	**40,568**	**40,419**	**–674**	**53,552**	**–1,758**	**810**	**–4**

Source: Authors' estimates.

This trade-driven supply chain expansion is evident in the sector results of Table 13, which shows both up and downstream increases in sectors related to agrofood production, processing, and trade. Each of these contributes to higher value-added, more broad-based employment growth, and more rapidly rising incomes in these low-income economies.

Table 13: Scenario 2—Sector Results

	Cambodia	Lao PDR	Viet Nam	Thailand	Other SEA	High Asia	PRC	S. Asia	Other Asia
					Percent				
Rice	53	49	124	−23	−4	−1	0	0	5
Other Crops	61	132	204	33	1	−2	0	0	0
Livestock	65	65	61	−3	0	1	0	0	0
Fuels	100	24	−7	32	1	2	0	0	0
Meat, Dairy	54	95	71	0	0	0	0	0	0
Other Processed Food	54	51	92	−11	0	1	0	0	2
Manufactures	52	12	0	10	0	1	0	0	0
Trade and Transport	27	5	7	5	0	1	0	0	0
Private Service	61	26	18	10	0	1	0	0	0
Public Service	26	28	7	4	0	0	0	0	0
Total	48	30	14	9	0	1	0	0	0
					$ Million				
Rice	425	538	8,900	−3,440	−1,137	−441	291	8	31
Other Crops	441	632	12,156	6,136	226	−4,514	−148	−127	−4
Livestock	502	350	1,459	−161	87	1,662	114	44	−3
Fuels	987	87	−611	14,262	679	12,971	2,844	179	−9
Meat, Dairy	249	190	3,806	−39	59	100	118	12	−6
Other Processed Food	955	661	10,227	−3,051	435	3,102	−202	74	186
Manufactures	10,781	381	−338	23,479	−1,662	106,222	7,156	396	−196
Trade and Transport	2,210	104	1,277	4,667	−96	22,338	−3,354	279	−24
Private Service	3,412	271	8,841	12,935	−394	39,805	−122	374	−7
Public Service	1,163	834	1,900	3,422	163	3,070	674	458	6
Total	21,125	4,048	47,617	58,209	−1,640	184,315	7,372	1,697	−26

Source: Authors' estimates.

Table 14 reveals the catalytic impact of trade facilitation. Again on relatively low initial conditions, we see very dramatic bilateral trade expansion in both directions for GMS neighbors. Again, because this trade stimulus is productivity-driven, trade growth far outweighs trade diversion. This means not only that established trade relations suffer very little from the improved circumstances of lower-income countries, but several of their neighbors are distinctly better off. Thailand sees 6% higher real GDP because of the improved fortunes of its neighbors, without sharing the productivity gains directly. Even HIA countries see 1% higher GDP growth by 2020, even as the small size of the GMS economies, their increased dependence on higher tech imports from HIA, as well as access to lower-cost food products benefits the latter and provides important incentives for regional cooperation to promote self-directed, trade-oriented poverty reduction.

Table 14: Scenario 2—Trade Flows

	Cambodia	Lao PDR	Viet Nam	Thailand	Other SEA	PRC	High Asia	S. Asia	Other Asia
					Percent				
Cambodia			1255	1836	45	710	39	17	19
Lao PDR			829	1246	–19	688	–9	–23	
Viet Nam	876	634		1028	40	1510	11	65	37
Thailand	315	185	337		–16	238	–15	–16	–21
Other SEA	–37	–40	–19	0	1	0	0	0	1
PRC	303	242	530	415	–1		–1	–1	0
High Asia	–34	–14	–13	–3	1	0	0	0	1
S. Asia	–32	–33	–14	–1	0	0	0	0	1
Other Asia	–30		–8	19	0	–1	0	0	1
					$ Million				
Cambodia	0	0	1,272	735	48	680	372	10	1
Lao PDR	0	0	536	992	–3	201	–14	–3	0
Viet Nam	2,487	377	0	3,183	1,652	28,256	2,005	807	32
Thailand	3,253	1,291	5,700	0	–3,589	65,196	–4,873	–794	–127
Other SEA	–450	–9	–1,277	–95	175	–91	316	74	5
PRC	5,982	553	50,390	45,050	–582	0	–3,796	–399	–28
High Asia	–936	–30	–3,957	–1,469	1,094	1,850	1,161	162	42
S. Asia	–133	–9	–397	–32	43	73	49	39	4
Other Asia	–8	0	–12	226	–2	–35	–16	-3	1

Source: Authors' estimates.

The third scenario encompasses both productivity growth and trade facilitation, but adds the FDI needed to help low-income countries overcome domestic saving insufficiency. As intuition would suggest and as the macroeconomic results of Table 15 clearly demonstrate, expanding investment opportunities in the presence of higher productivity and expanded market access yields both dramatic output growth and explosive trade expansion. Both of these responses translate into higher value-added (though less dramatic because of lower rental rates under capital expansion) and much higher real domestic incomes and consumption. These effects are very dramatic for the target economies, increasing real GDP between 24 and 52% by 2020, but they also directly benefit immediate neighbors like Thailand (6% GDP and 9% real income) and the PRC (1%).

Table 15: Scenario 3—Macro Results

	Cambodia	Lao PDR	Viet Nam	Thailand	Other SEA	High Asia	PRC	High Asia	S. Asia	Other Asia
					Percent					
GDP	52	41	24	6	0	0	1	0	0	0
Output	123	60	26	10	0	0	1	0	0	0
Exports	139	100	47	21	0	0	3	0	0	0
Imports	160	114	74	32	0	0	4	0	0	0
Cons	121	94	57	20	0	0	1	0	0	0
CPI	–7	5	5	7	0	0	1	0	0	0
EV Inc	119	91	57	19	0	0	1	0	0	0
					$ Million					
GDP	15,795	4,786	26,808	35,214	–285	277	49,665	277	885	–13
Output	284,453	38,335	509,129	312,275	–7,744	75,304	1,066,830	75,304	6,253	–52
Exports	125,344	13,140	284,063	228,970	–8,299	18,501	552,364	18,501	–1,649	70
Imports	120,805	17,687	466,043	368,287	–11,185	–29,972	516,988	–29,972	–3,494	–24
Cons	9,026	4,124	42,844	37,647	–491	–647	29,003	–647	556	0
EV Inc	14,006	4,186	47,884	41,715	–554	–780	55,667	–780	675	–3

Source: Authors' estimates.

Increased access to capital, formerly severely constrained in these countries, also means that growth will be more broad-based. Sectors participating in all supply chains (i.e., both exports and imports) experience less competitive pressure for resources and can expand at lower marginal cost (Table 16). In this way, alleviating capital constraints increases the number of winners within each economy. In the previous scenarios, growth of some sectors imposed scarcity costs on others, inducing reduced average profitability and even contraction.

FDI in this way facilitates not only output expansion in the higher productivity sectors along their supply chains, but also in sectors that would otherwise fail to capture the multiplier effects of target sector expansion. This is particularly apparent when agrofood productivity and trade facilitation combine to increase competitiveness of selected primary and tertiary sectors. Without external capital inflows, this process induces stagnation or even contraction on other sectors (Table 10), while we see more robust and balanced growth when FDI is available.

Table 16: Scenario 3—Sector Results

	Cambodia	Lao PDR	Viet Nam	Thailand	Other SEA	High Asia	PRC	High Asia	S. Asia	Other Asia
					Percent					
Rice	78	69	121	–22	–3	0	0	0	0	5
Other Crops	88	108	191	32	1	0	–2	0	0	0
Livestock	116	93	67	–2	0	0	1	0	0	0
Fuels	158	67	10	34	1	1	2	1	0	0
Meat, Dairy	93	115	81	1	0	0	0	0	0	–1
Other Processed Food	120	82	109	–11	0	0	1	0	0	2
Manufactures	128	53	15	10	0	0	1	0	0	0
Trade and Transport	104	30	20	5	0	0	1	0	0	0
Private Service	170	63	41	11	0	0	1	0	0	0
Public Service	54	42	11	4	0	0	0	0	0	0
Total	120	57	28	9	0	0	1	0	0	0
					$ Million					
Rice	624	747	8,678	–3,363	–970	298	–353	298	27	33
Other Crops	643	517	11,355	5,993	218	–127	–4,432	–127	–98	–3
Livestock	896	497	1,603	–92	82	124	1,636	124	36	–3
Fuels	1,556	237	882	15,568	621	6,156	13,826	6,156	132	–11
Meat, Dairy	424	230	4,332	80	55	109	77	109	10	–6
Other Processed Food	2,145	1,055	12,048	–3,079	396	–304	2,998	–304	69	198
Manufactures	26,591	1,722	30,523	24,005	–1,469	6,469	110,216	6,469	305	–195
Trade and Transport	8,365	626	3,551	4,832	–103	–3,300	22,860	–3,300	220	–28
Private Service	9,504	658	19,693	13,353	–299	274	41,332	274	363	–8
Public Service	2,409	1,240	2,988	3,521	145	640	3,188	640	368	5
Total	53,156	7,530	95,652	60,820	–1,324	10,340	191,350	10,340	1,432	–20

Source: Authors' estimates.

As the macroeconomic export and import results suggest for this scenario, bilateral trade growth is explosive when policies can achieve combined productivity, market access, and external investment (Table 17). The simple leveraging of external savings can increase domestic capacity for export, along with commensurate import purchasing power, but a multiple of three or four for these small economies. This provides not only an important source of new market income, but also permits access to essential imports of higher technology capital goods, consumer products, and services. Such technology transfer can in turn be expected to generate endogenous growth benefits that will further advance the progress of these low-income countries.

Finally despite the dramatic expansion of bilateral trade across this region, trade diversion is a small fraction of trade creation. Once again, we see that constructive trade promotion policies—ones that enhance productivity, market access, and investment opportunities—can advance the welfare of more needy economies without threatening established trade or livelihoods in more advanced economies. On the contrary, all Asian economies or

regions considered here are better off (or at least not worse off) in this scenario, which returns dramatic trade-induced poverty reduction in low-income GMS economies.

Table 17: Scenario 3—Trade Flows

	Cambodia	Lao PDR	Viet Nam	Thailand	Other SEA	PRC	High Asia	S. Asia	Other Asia
					Percent				
Cambodia			1743	2053	88	977	83	55	66
Lao PDR			1130	1277	−14	695	4	−18	
Viet Nam	1425	871		1128	43	1539	20	61	43
Thailand	488	238	386		−17	236	−15	−17	−21
Other SEA	−14	−29	−10	0	1	0	0	0	1
PRC	476	309	599	417	−1		−1	−1	0
High Asia	−5	−1	−3	−3	1	0	0	0	1
S. Asia	−3	−21	−4	0	0	0	0	0	1
Other Asia	−1		0	20	0	0	0	−1	1
					$ Million				
Cambodia	0	0	1,767	821	93	936	801	32	4
Lao PDR	0	0	730	1,017	−2	203	6	−2	0
Viet Nam	4,047	518	0	3,492	1,768	28,801	3,698	754	38
Thailand	5,046	1,662	6,532	0	−3,698	64,657	−5,062	−823	−131
Other SEA	−166	−7	−686	−21	175	4	255	55	5
PRC	9,375	704	56,960	45,240	−663	0	−4,391	−473	−37
High Asia	−150	−2	−907	−1,314	1,091	2,136	1,052	145	41
S. Asia	−11	−6	−129	−12	51	144	54	42	5
Other Asia	0	0	−1	238	−2	−27	−15	−3	1

Source: Authors' estimates.

IV. Conclusions and Policy Implications

Trade in food and other agricultural products is increasingly important across East and Southeast Asia, where high-income Asian economies have driven significant agricultural expansion and the PRC's momentous growth promises more stimulus to agrofood activity in the region. The PRC is expected to become a net importer of agrofood in the coming decades, which will have significant implications within the region. As its middle class continues to emerge, the resource intensity of food consumption (e.g., meat and dairy) will lead to net imports and require expansion of agricultural capacity elsewhere.

Because low-income Southeast Asia is generally seen to be well below its agrofood potential, this situation suggests a significant opportunity for self-directed poverty reduction through regional agrofood market expansion. This paper reviews the history of HIA and the PRC's emergence in the region's agrofood markets. Finally, the role of GMS is analyzed for the potential of Asian agrofood trade to contribute to poverty reduction.

After an extensive review of historical and initial conditions, we use a new dynamic simulation model to assess the prospects for rapid growth among low-income GMS economies. In particular, we examine empirically the potential contributions of agrofood productivity growth, trade facilitation, and FDI in these countries. Our results suggest that such potential is very significant, but can only be fully realized if policies are integrated and are complementary.

In particular, productivity growth alone will only generate low-value surpluses. Combining this with trade facilitation measures, including infrastructure investments like the GMS corridors, will amplify benefits but also lead to domestic resource rivalry. Finally, complementing the first two advantages with access to external investment funds achieves the highest benefit.

The estimated gains from these policies are very substantial for the low-income economies considered; moreover, they benefit neighboring countries that do not share the direct benefits. Just as importantly, dramatic trade expansion by the beneficiaries induces significant regional trade growth, but relatively minor trade diversion. This result supports the essential argument that trade-oriented, self-directed poverty reduction policies among low-income GMS countries are incentive-compatible for their wealthier neighbors. Intuition might suggest this, but trade rivalry has a long history in this region and elsewhere. For this reason, we believe it is important to develop empirical evidence that growth dividends propagate across the region and trade growth can be shared among regional partners without the need for intervention, trading rules, or even unrequited transfers.

Appendix 1: Model Summary

This paper uses a version of the World Bank's LINKAGE Model, a global, multiregion, multisector, dynamic applied general equilibrium model. The base data set—GTAP Version 7.0—is defined across 118 country and/or region groupings, and 57 economic sectors. For this paper, the model has been defined for an aggregation of 13 country and/or regions and 10 sectors, including sectors of importance to the poorer developing countries—grains, textiles, and apparel. The regional and sectoral concordances can be found in Table 6 in the main text. This Appendix outlines briefly the main characteristics of supply, demand, and policy instruments of the model.

Production

All sectors are assumed to operate under constant returns to scale and perfect competition. Production in each sector is modeled by a series of nested CES production functions that are intended to represent the different substitution and complementarity relations across the various inputs in each sector. There are material inputs that generate the input/output table, as well as factor inputs representing value-added.

Three different production archetypes are defined in the model—crops, livestock, and all other goods and services. The CES nests of the three archetypes are graphically depicted in Appendix Figures 1–3. Within each production archetype, sectors will be differentiated by different input combinations (share parameters) and different substitution elasticities. Share structures are largely determined by base year data, and the elasticities are given values by the modeler.

The key feature of the crop production structure is the substitution between intensive cropping versus extensive cropping, i.e., between fertilizer and land (Appendix Figure 1). Livestock production captures the important role played by feed versus land, i.e., between ranch-fed versus range-fed production (Appendix Figure 2). Production in the other sectors more closely matches the traditional role of capital/labor substitution, with energy introduced as an additional factor of production (Appendix Figure 3).

In each period, the supply of **primary** factors—capital, labor, and land—is usually predetermined. However, the supply of land is assumed to be sensitive to the contemporaneous price of land. Land is assumed to be partially mobile across agricultural sectors. Given the comparative static nature of the simulations that assume a longer-term horizon, both labor and capital are assumed to be perfectly mobile across sectors (though not internationally).

Model current specification has an innovation in the treatment of labor resources. The GTAP data set identifies two types of labor skills—skilled and unskilled. Under the standard specification, both types of labor are combined in a CES bundle to form aggregate sectoral labor demand, i.e., the two types of labor skills are directly substitutable. In the new specification, a new factor of production has been inserted, which we call *human* capital. It is combined with capital to form a physical *cum* human capital bundle, with an assumption that they are complements. On input, the user can specify the percentage of the skilled labor factor to allocate to the human capital factor.

Once the optimal combination of inputs is determined, sectoral output prices are calculated assuming competitive supply (zero-profit) conditions in all markets.

Consumption and Closure Rules

All income generated by economic activity is assumed to be distributed to a single representative household. The single consumer allocates optimally his or her disposable income among the consumer goods and saving. The consumption/saving decision is completely static: saving is treated as a "good" and its amount is determined simultaneously with the demands for the other goods, the price of saving being set arbitrarily equal to the average price of consumer goods.

Government collects income taxes, indirect taxes on intermediate and final consumption, taxes on production, tariffs, and export taxes and/or subsidies. Aggregate government expenditures are linked to changes in real GDP. The real government deficit is exogenous. Closure therefore implies that some fiscal instrument is endogenous in order to achieve a given government deficit. The standard fiscal closure rule is that the marginal income tax rate adjusts to maintain a given government fiscal stance. For example, a reduction or elimination of tariff rates is compensated by an increase in household direct taxation, ceteris paribus.

Each region runs a current-account surplus (deficit) that is fixed (in terms of the model numéraire). The counterpart of these imbalances is a net outflow (inflow) of capital, subtracted from (added to) the domestic flow of saving. In each period, the model equates gross investment to net saving (equal to the sum of saving by households, net budget position of the government, and foreign capital inflows). This particular closure rule implies that investment is driven by saving. The fixed-trade balance implies an endogenous real exchange rate. For example, removal of tariffs, which induces increased demand for imports, is compensated by increasing exports—which is achieved through real depreciation.

Foreign Trade

The world trade block is based on a set of regional bilateral flows. The basic assumption in LINKAGE is that imports originating in different regions are imperfect substitutes (Appendix Figure 4). Therefore in each region, total import demand for each good is allocated across trading partners according to the relationship between their export prices. This specification of imports—commonly referred to as the Armington specification—implies that each region faces a downward-sloping demand curve for its exports (Armington 1969). The Armington specification is implemented using two CES nests. At the top nest, domestic agents choose the optimal combination of the domestic good and an aggregate import good consistent with the agent's preference function. At the second nest, agents optimally allocate demand for the aggregate import good across the range of trading partners.

The bilateral supply of exports is specified in parallel fashion using a nesting of constant-elasticity-of-transformation functions. At the top level, domestic suppliers optimally allocate aggregate supply across the domestic market and the aggregate export market. At the second level, aggregate export supply is optimally allocated across each trading region as a function of relative prices.

Trade variables are fully bilateral and include both export and import taxes and/or subsidies. Trade and transport margins are also included; therefore world prices reflect the difference between free on board and cost, insurance, and freight pricing.

Prices

The LINKAGE model is fully homogeneous in prices, i.e., only relative prices are identified in the equilibrium solution. The price of a single good, or of a basket of goods, is arbitrarily chosen as the anchor to the price system. The price (index) of the Organisation for Economic Co-operation and Development (OECD) manufacturing exports has been chosen as the numéraire, and is set to 1.

Elasticities

Production elasticities are relatively standard and are available from the authors upon request. Aggregate labor and capital supplies are fixed, and within each economy they are perfectly mobile across sectors.

Equivalent Variation Aggregate National Income

Aggregate income gains and/or losses summarize the extent to which trade distortions are hindering growth prospects and the ability of economies to use the gains to help those whose income could potentially decline.

Real income is summarized by Hicksian equivalent variation (EV). This represents the income consumers would be willing to forego to achieve postreform well-being (u^p) compared to baseline well-being (u^b) at baseline prices (p^b):

$$EV = E\left(p^b, u^p\right) - E\left(p^b, u^b\right)$$

where E represents the expenditure function to achieve utility level u given a vector of prices p (the b superscript represents baseline levels, and p the post-reform levels). The model uses the extended linear expenditure system (ELES), which incorporates savings in the consumer's utility function. The discounted real income uses the following formula:

$$CEV = \sum_{t=2005}^{2015} \beta^{(t-2004)} EV_t^a \; / \sum_{t=2005}^{2015} \beta^{(t-2004)} Y_t^d$$

where CEV is the cumulative measure of real income (as a percent of baseline income), β is the discount factor (equal to $1/(1+r)$ where r is the subjective discount rate), Y^d is real disposable income, and EV^a is adjusted equivalent variation. The adjustment to EV extracts the component measuring the contribution of household saving, since this represents future consumption. Without the adjustment, the EV measure would be double counting. The saving component is included in the EV evaluation for the terminal year. Similar to the OECD, a subjective discount rate of 1.5% is assumed in the cumulative expressions.

Specification of Endogenous Productivity Growth

Productivity in manufacturing and services is the sum of three components:

(i) a uniform factor used as an instrument to target gross domestic product growth in the baseline simulation

(ii) a sector-specific fixed shifter that allows for relative differentials across sectors (for example, manufacturing productivity two percentage points higher than productivity in the services sectors)

(iii) a component linked to sectoral openness as measured by the export-to-output ratio

The openness component takes the following functional form:

$$\gamma_i^e = \chi_i^0 \left(\frac{E_i}{X_i} \right)^{\eta} \quad (1)$$

where γ^e is the growth in sectoral productivity due to the change in openness, χ^0 is a calibrated parameter, E and X represent respectively sectoral export and output, and η is the elasticity. The parameter χ^0 has been calibrated so that (on average) openness determines roughly 40% of productivity growth in the baseline simulation, and the elasticity has been set to 1.

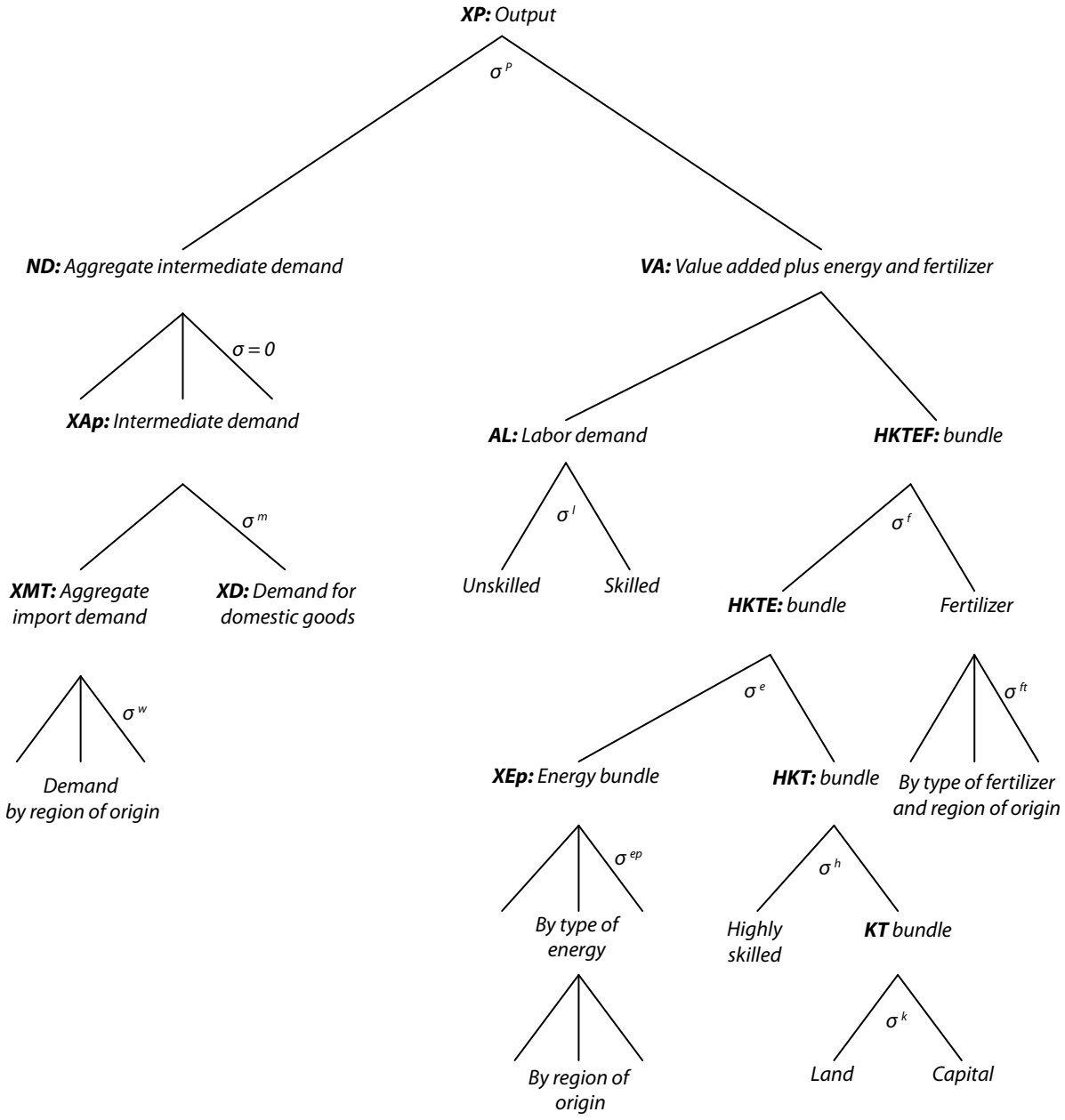
In agriculture, productivity is fixed in the baseline, set to 2.5% per annum in most developing countries. However, a share of the fixed productivity is attributed to openness, using equation (1).

In the baseline, GDP growth is given. Agricultural productivity is similarly given, and equation (1) is simply used to calibrate the shift parameter, χ^0, so that a share of agricultural productivity is determined by sectoral openness. Average productivity in the manufacturing and services sectors is endogenous and is calibrated in the baseline to achieve the given GDP growth target. The economywide (excluding agriculture) productivity parameter is endogenous. Equation (1) is used to calibrate the same χ^0 parameter, under the assumption that some share of sectoral productivity is determined by openness, for example 40%.

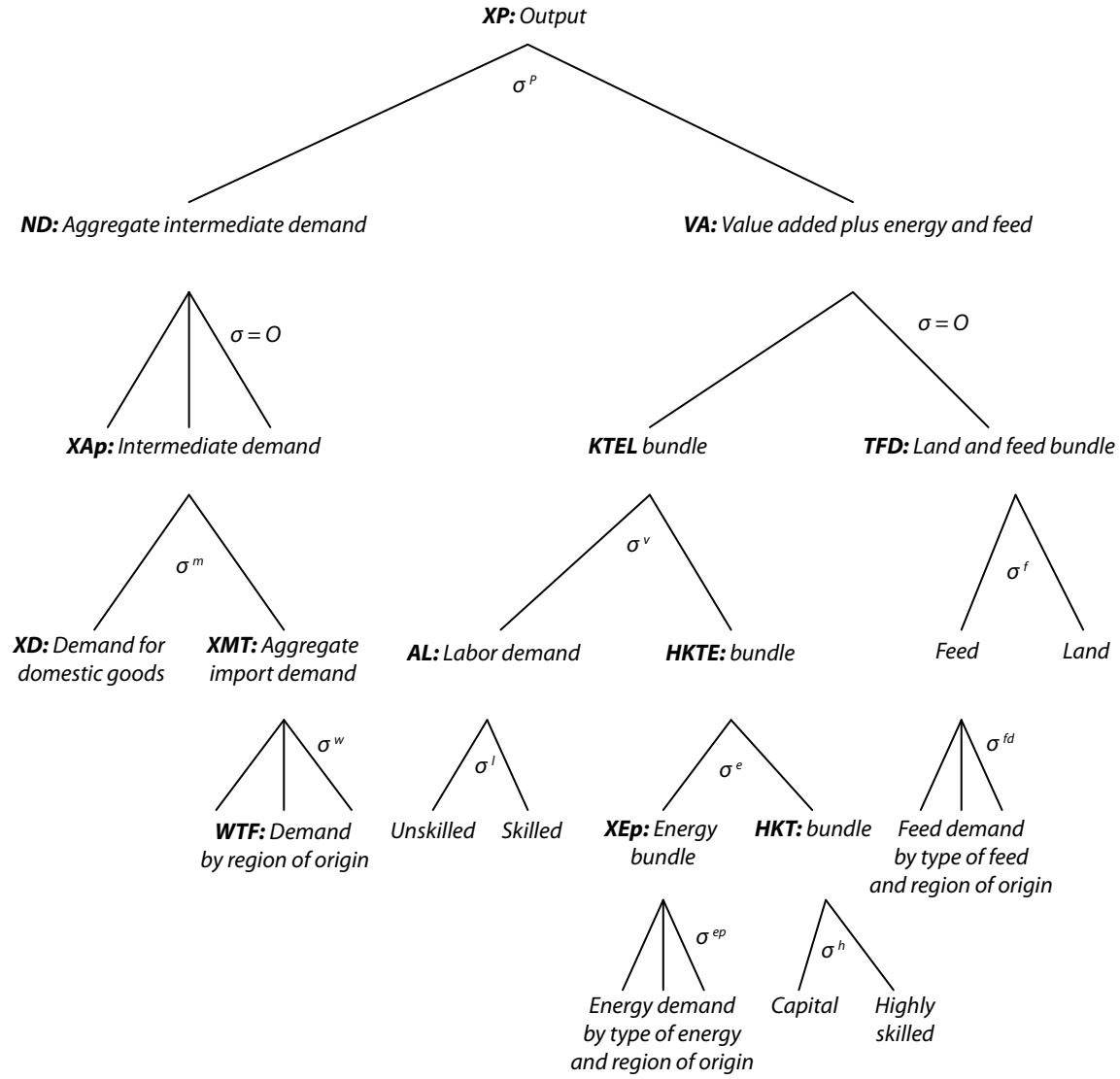
In policy simulations, the economywide productivity factor, along with other exogenous productivity factors (sector-specific shifters) are held fixed, but the openness-related part of productivity is endogenous and responds to changes in the sectoral export-to-output ratio. In the manufacturing and services sectors, the elasticity is set at 1. In the agricultural sectors it is set to 0.5.

Say sectoral productivity is 2.5%, and that 40% of it can be explained by openness, i.e., 1.0%, with the residual 1.5% explained by other factors. Assume sectoral openness increases by 10%. If the elasticity is 1, this implies that the openness-related productivity component will increase to 1.1% and total sectoral productivity will increase to 2.6% (implying that the total sectoral productivity increases by 4% with respect to the 10% increase in sectoral openness).

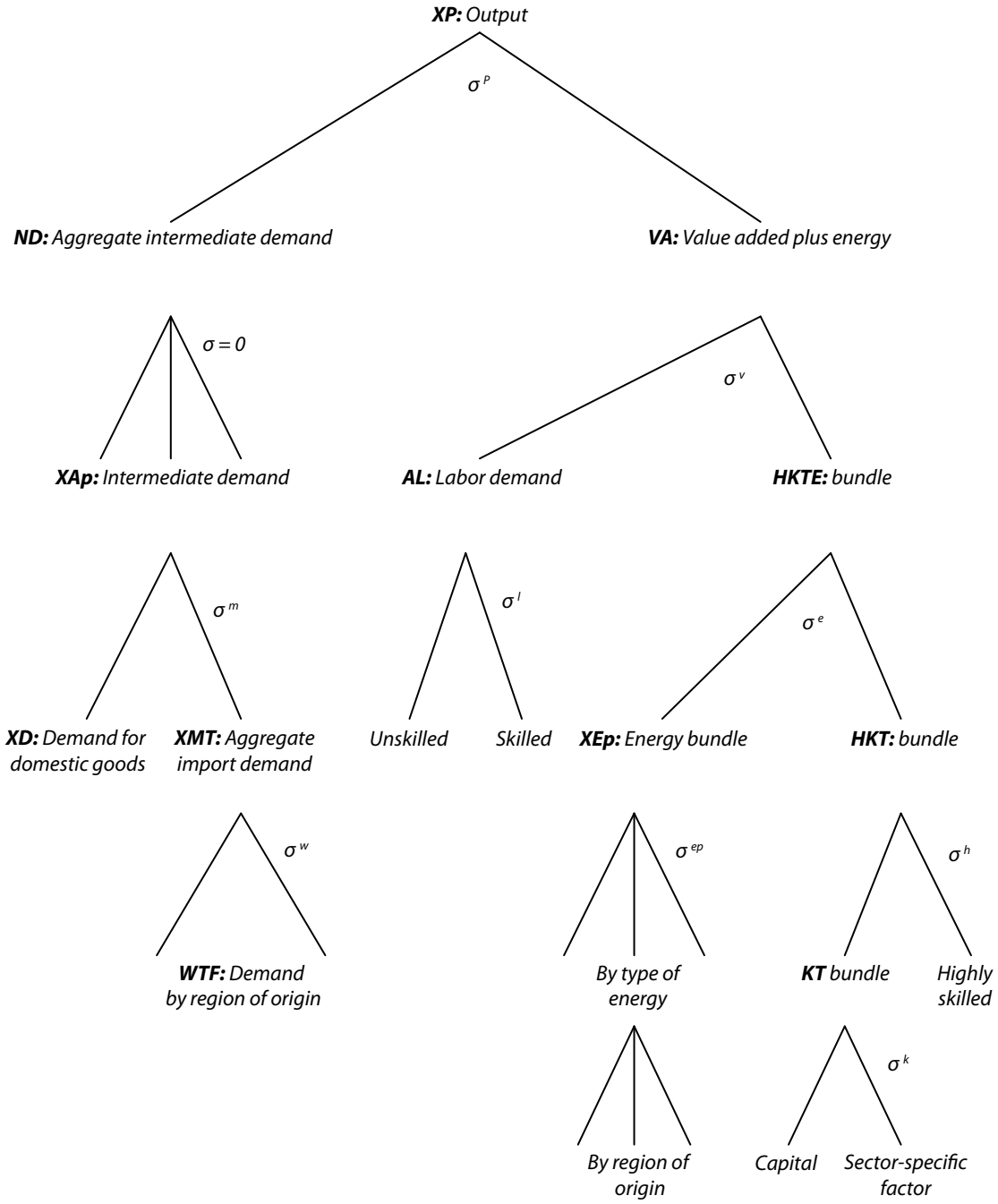
Appendix Figure 1: Production Function for Crops



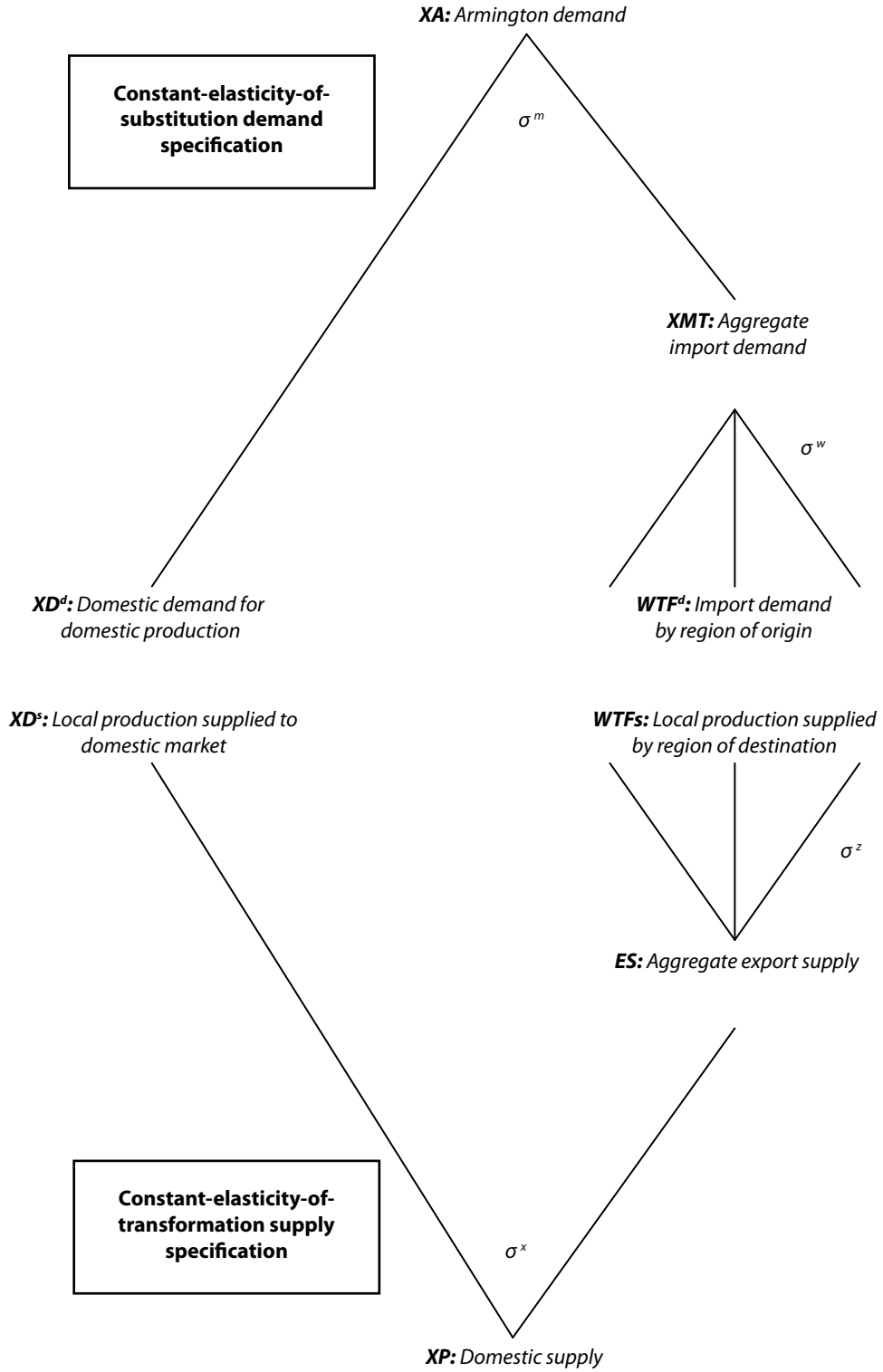
Appendix Figure 2: Production Function for Livestock



Appendix Figure 3: Production Function for Nonagriculture



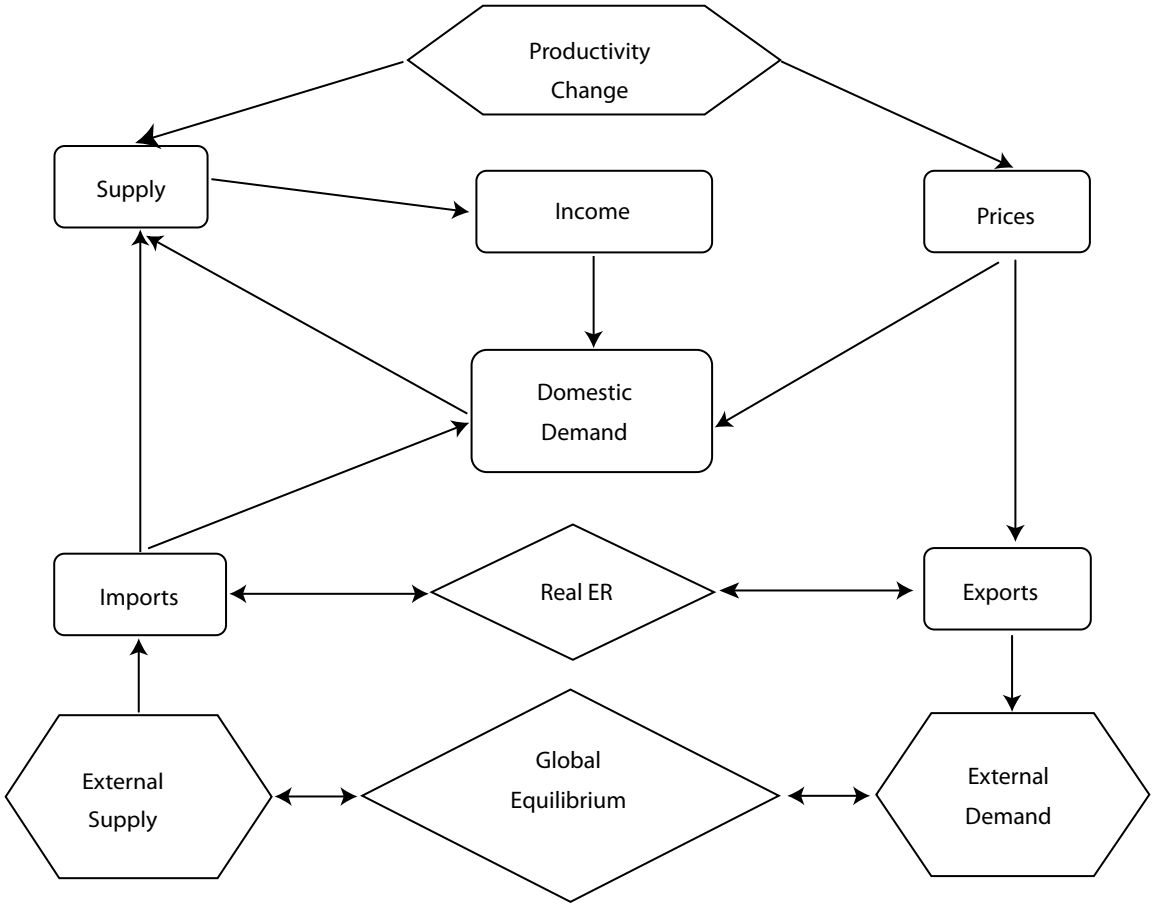
Appendix Figure 4: Trade Aggregation



Appendix 2: Model Calibration

The model is calibrated to country and regional real GDP growth rates, obtained as consensus estimates from independent sources (Data Resources International, International Monetary Fund, Cambridge Econometrics). Using exogenous rates of implied TFP growth, the model computes supply, demand, and trade patterns compatible with domestic and global equilibrium conditions. Equilibrium is achieved by adjustments in the relative prices of domestic resources and commodities, while international equilibrium is achieved by adjusting trade patterns and real exchange rates to satisfy fixed real balance of payments constraints. The general process is schematically represented in Appendix Figure 5.

Appendix Figure 5: General Equilibrium Calibration Mechanism



Appendix 3: Notes on the Adjustment Process

The calibration procedure highlights the two salient adjustment mechanisms in the model (as well as the real economies), domestic and international prices. General equilibrium price adjustments are generally well-understood by professional economists but in the multilateral context, the role of exchange rates can be a source of confusion. Generally, in a neoclassical model like this one, there are no nominal or financial variables and the function of the exchange rate is only to equalize real purchasing power between different economies.

Because models like this do not capture the aggregate price level or other nominal quantities, there is no nominal exchange rate in the sense of traditional macroeconomics or finance. Since there is no money metric in the model, all prices are relative prices, and the exchange rate (the composite relative price of foreign goods) is no exception. If there were financial assets in the model, one could define a nominal exchange rate as the relative price of two international financial assets (e.g., money and bonds). Without them, the exchange rate is defined in terms of real international purchasing power, i.e., the relative price of tradeable to nontradeable goods. In a multisector setting, the real exchange rate is defined as the ratio of an index of the value of all tradeables (on world markets) to an index of the value of all nontradeables.

Since any tax (or other price elevating distortion) on an import is an implicit tax on all tradeable goods, trade liberalization causes tradeable goods prices to fall and the real exchange rate depreciates. Real exchange rate depreciation also makes exports more competitive, one of the principal motives for unilateral liberalization. The general implication of this is that trade will expand rapidly for a country removing significant import protection, and more rapidly for countries removing more protection. The pattern of trade expansion, and the domestic demand and supply shifts that accompany it, depend upon initial conditions and adjustments among trading partners.

It should also be noted that even in a second-best world, removing price distortions also confers efficiency gains, increasing output potential and real incomes.

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About the Paper

Trade in food and other agricultural products is increasingly important across East and Southeast Asia, where high-income Asian economies have driven significant agricultural expansion and the People's Republic of China is expected to emerge as a major food importer. Shikha Jha, David Roland-Holst, and Songsak Sriboonchitta use a new dynamic simulation model to assess the prospects for rapid growth and poverty reduction among low-income Greater Mekong Subregion economies by tapping their potential for contributing to the expansion of agrofood trade across the region. Their results suggest that the potential contributions of agrofood productivity growth, trade facilitation, and foreign direct investment in these countries are very significant, but can only be fully realized if policies are integrated and are complementary.

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