Economic Development and Agricultural Growth in Asia

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I. Introduction

Asian economy as a whole now accounts for nearly 32 percent of total global economic activity and plays a vital role in sustaining the interconnected world economy. Asia has been growing faster than any other region in recent decades, representing the most dynamic region in the world. Per capita GDP grew 6.3 percent on average over the period of 1980~2004 in East and Southeast Asia, while the rest of the global economy grew only 1.4 percent over the same period (Anderson and Martin, 2008). Further, Asian economy is considered vigorous enough to be expected to lead the world to recovery from the 2008 global financial crisis (Sachs, 2009). This transformation is a remarkable accomplishment from the disoriented times of the colonial controls before WWII to a promising region of the global economy. While Asian economy is confronted with a broad array of political, social, and institutional challenges that need to be overcome for the promise to materialize to the full potential extent, this article focuses on addressing agriculture-related issues that are deemed critical in economic development of many Asian countries.

There exist substantial disparities in economic development across sub-regions in Asia: some countries are nearly industrialized; others belong to middle-income group; yet others are just emerging to start the process of economic transformation. While not critical to economic growth in industrialized countries, agricultural growth is considered an essential factor for the middle-income countries to boost economic growth and for the emerging countries to initiate the take-off from agrarian societies. Consequently, agriculture offers a clue for many Asian countries in catching up with developed countries.

From a global perspective, Asia poses a profound challenge when it comes to the issue of addressing potential imbalance in food demand and supply in the future. Whereas global food demand is expected to double by 2050, there is a great deal of uncertainties as to whether or not our agriculture would be capable of meeting the increases in food demand that stem from growth in population and income along with urbanization (McCalla, 1998; FAO, 2009; Alston, Beddow, and Pardey, 2009; Pingali, 2009). Especially, considering the expected shortage of water resource, soil erosion, and adverse effects of climate change, it is tremendously important for our global society to make concerted efforts to perform up to the challenge of enhancing agricultural production capacity. China and India alone represent more than 30 percent of the world population and undergoing sustained double-digit economic growth rates along with

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rapid urbanization, calling for systematic inquiries into their short and long run impacts on the global economics of food, agriculture, and the environment.

There are other sub-regions in Asia facing unique and heterogeneous problems relating to agriculture, food and the environment. Three industrialized Far Eastern countries, including Korea, Japan, and Taiwan, have intrinsic comparative disadvantages in agricultural production and have considerably lower food self-sufficiency rates when compared to other industrialized nations. It remains to be seen how these countries would cope with the growing dependence on foreign imports for food. On the other hand, with rich natural and forestry resources, Southeastern Asian countries have been growing fast in recent decades, yet suffering from relatively high incidences of poverty. While agriculture is considered the main engine for reducing poverty and fueling the growth of overall economy, sustainable development balancing industrialization and environmental conservation remains a major challenge. In brief, Asia faces diverse challenges ranging from poverty and the need for increasing agricultural productivity (Southeastern region) to low food self-sufficiency rates (Far Eastern region) to anticipated growth in demand for food and natural resources (particularly energy sources) needed for economic growth (China and India).

Given that agriculture is at the center of these challenges, this article focuses on analyzing the performance of agriculture in selected Asian countries. Methodologically, we approach the objective in three steps. First, we review extant theories/concepts/ideas as well as empirical literature that shed lights on the role of agriculture in the process of economic development. Second, the performances of agricultural sectors in selected Asian countries are analyzed based on data from Asian Development Bank and World Bank. We deliberately selected three groups of countries at different stages of economic development, thereby enabling us to contrast varying roles of agriculture across the three groups. Finally, insights both from theories and data analyses are integrated to draw conclusions about the performances of agricultural sectors and its contribution to the development of overall economy.

In light of this three-step approach, the remainder of this article is organized as follows. The ensuing section reviews theories illustrating how thinking about development evolved over the last half century. The third section assesses the role of agriculture in the course of economic transformation by probing agricultural development theories. The fourth section assesses the performances of agricultural sectors in selected Asian countries in recent decades focusing on evaluating agricultural productivity. The fifth section addresses international trade issues of importance to developing countries such as WTO trade liberalization talks and protectionism, followed by concluding remarks.

II. Evolution of Thinking about Economic Development

The backwardness of Eastern Europe in the 1930s and 1940s is considered to have spawned the atmosphere for inspiring economists in the West to contemplate about ways to foster economic development in those countries (Mellor and Mudahar, 1992). Yet, the generally accepted view is that development economics started in earnest with the motivation to understand the nature and causes of the underdevelopment of the newly independent countries from colonialism after WWII. Over the last six decades, development economics has progressed into a distinct field within economics with theories/ideas evolving in association with expanding knowledge about the success and failure experiences of development in poor countries. Development economics builds on

the premise/recognition that the economies of developing countries have structural differences when compared to the economies of the developed and therefore the former needs analytical tools for scientific inquiry different from the latter (Lewis, 1984). We can gain substantial insights into the design of optimal strategies for Asian countries by examining how development theories have adapted in connection with the actual experiences of developing countries. For the sake of convenience, this article divides the history of development economics into first (1945~1970) and second (after 1970s) generations.

The First Generation Development Economists

Obviously, industrialization was the key concept for the early efforts in theorizing how economies and societies grow and change. The early models commonly emphasized the role of savings and capital accumulations in the process of industrialization. In observation of the economies of the East European countries, Rosenstein-Rodan (1943) provided the first model conceptualizing how a country transforms from an agrarian to an industrialized society and argued that underdeveloped countries need so called "big push" (i.e., large-scale investments to achieve balanced growth across various sectors) in industrialization to take advantage of network effects and economies of scale and scope. Nurkse (1953) advocated the theory of big push to help developing countries to escape "vicious circle of poverty". Opposed to the notion of balanced growth in view of the scarcity of resources (capital) in poor countries, Hirshman (1958) proposed a theory of unbalanced growth where, through the trickle-down effect, the benefits of growth in a selected sector would spread throughout the economy.

Rostow (1960) viewed an economy as transforming across five stages including (i) the traditional society, (ii) the pre-condition for take-off, (iii) the take-off, (iv) the drive to take-off, and (v) the mass-consumption society. He recognizes increases in agricultural productivity as an essential condition for the take-off. Lewis (1954) introduced a two-sector model where labor transfers from the large traditional (agricultural) sector with unlimited labor supply to the modern (capitalist) sector was the starting point of economic development. Taking advantage of the surplus labor, the modern sector in the Lewis model plays the key role in fueling economic growth through reinvestment of profits and savings.

Treating Lewis's model as the first stage of economic development, Fei and Ranis (1963) extended Lewis's dualistic model by envisaging the second stage where marginal product of labor becomes positive in the traditional sector and, agricultural output falls as labor moves out of agricultural sector, thereby turning the terms of trade against the capitalist sector. Resulting wage increases in the traditional sector poses a problem for further development of the capitalist sector, and investment to the agricultural sector occurs to increase agricultural productivity and cheapen agricultural commodities. Then the capitalist sector can grow again until surplus labor does not exist any longer in the traditional sector. This model represents unbalanced growth in the short-run, yet growth taking place in the traditional sector in the long-run.

The two-sector models popularized the term "dualism" in economics representing the dualistic economic structure of developing countries. In view of the disparity between the traditional and modern sectors that may exist in developing countries in terms of the availability and marginal contribution of production factors (labor and capital). Ranis (2003) contend that dualism models explain the economies of developing countries better than one-sector neoclassical models (that are introduced below).

While such early development theories in the 1950s and 1960s focused on how the structure of an economy transforms in accordance with the saving or capital accumulation rates, some economists focused on modeling the process of economic 'growth' (output), a concept narrower than 'development'. Harrod-Domar (1946) developed a simple model of production function where output growth rate is determined by savings and capital. Solow (1956) extended it to incorporate labor as another factor of production and technical change as the residual of output growth not explained by the labor and capital. Diminishing returns to capital, steady-state equilibrium, economic growth rates are determined exogenously in the Solow model. These exogenous assumptions generate the implications that developing countries would grow faster than developed countries and there would be convergence in incomes between them.

The Second Generation Development Economists

The first generation development economics was grandiose and high-flying in conceptualizing the mechanism of how an economy transforms to a rich country. They highlighted the role of savings and capital in economic development with a focus on industrial sector. Judging that markets critical for development (i.e., capital, education, and technology) were either missing or imperfect particularly in developing countries, they believed that a strong role of government in accumulating/distributing capital, investing in R&D, disseminating new technologies, and subsidizing the industrial sector would accelerate industrialization. Whereas such models were highly successful in positioning development economics as a distinctive field of economic inquiry, their policy prescriptions largely failed in helping low-income countries accelerate development and catch up with developed economies. Simply saying, convergence in incomes did not take place between poor and rich countries. The failure is attributed to the lack of sophisticated understanding of the nature and causes of underdevelopment specific to developing countries.

In efforts to overcome the naivety and inadequacies of the first generation strategies, the second generation development economists turned their attention to more narrowly focused- sets of concepts such as: (i) economics of human capital (encompassing knowledge, ideas, entrepreneurship, technological changes, education, health/nutrition, human capital), (ii) market and institution, (iii) neo-Marxian theories of development, and (iv) the role of trade and globalization. These new sets of concepts represent a fundamental shift from a focus on the process of development in a big scale to an emphasis on microeconomic features of underdevelopment. The shift permitted policy-makers to possess a loaded set of instruments that can impact the process of development. In connection with the shift, Meier (2001) observed that "grand theories of the earlier periods came to be viewed as less useful than highly specific applications." We briefly review the four sets of concepts below.

The importance of human capital, knowledge, or ideas in economic development was recognized as early as in the 1960s (e.g., Schultz, 1961). However, we had to wait almost three more decades to witness research explicitly incorporating such intangibles into analytic growth models. The most direct reason responsible for the emergence of such analytical models in the 1980s was the predictions of the neoclassical growth models (shown in previous section) that have failed to be supported by real world experiences: i.e., most developing countries did not grow faster than developed countries in the 1970s and 1980s and there was no convergence of income across the world. These

limitations of the neoclassical models gave rise to modern growth theory called "endogenous growth theory" that highlights the role of knowledge, innovations, and ideas in economic growth while capitalizing on increasing returns to capital (Romer, 1986; Romer, 1989; Rucas, 1988; Kosempel, 2004).

While conceptually not very novel (Niosi, 2008), incorporating the notion of increasing returns to capital into economic growth models was innovative from modeling perspective at that time. Increasing returns to capital implies that there are positive externalities associated with investments in human/physical capital and R&D with such externalities preventing marginal product of capital from falling. The model emphasizes the endogenous nature of technological innovations primarily induced by the needs of institutions. Technological progress is the consequence of a society's investment behavior toward education, training, knowledge, idea, R&D, or simply human capital. The endogenous growth model indicates that policies promoting openness, competition, change and innovation will result in higher economic growth. Observed widening disparities between poor and rich countries could now be explained by the endogenous growth models. [2]

It was noted earlier that the first generation development economists were advocates of strong governmental role in economic development due to a variety of reasons (e.g., imperfect market for credit). However, research showed that consequences of government interventions (i.e., price distortions, high effective rates of protection, and rent-seeking) were exerting adverse effects on the economies of developing countries (Meier, 2001).Recognizing that governments in many developing countries have not been as effective as ideally envisioned, the second generation economists tended to rely on markets to guide development policies. Yet, such market-oriented tendency was complemented by "theory of information" (Stiglitz, 1989) that immediately caught the attention of development economists. The theory of information points to a new set of market failures such as the existence of imperfect (often asymmetric) and costly information, transaction costs, or imperfect (absence of) market for risk. These extensions of neoclassical microeconomics helped to explain frequently underperforming agricultural and financial markets in developing countries (Meier, 2001).

Having noted of the importance of markets and correcting market failures in the course of economic development, the role of institution dictating the operation of markets and the process of dealing with market failures also received considerable attention from economists (North, 1990; 1994; Williamson, 1998; Williamson, 2000; Myint, 1985). With this recognition, developing countries now needed to "get institutions right" as well as to "get prices right" to move forward in their pursuit of economic development. Essentially, institutions are the incentive structure of a society. Possessing right institutions greatly facilitates the efficient operation of markets and help government rationally handle market failures.

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[2] The endogenous nature of technical change was asserted by Schumpeter in the 1920s (Rosenberg, 2000), while the concept of increasing returns to scale was introduced by Sraffa in the 1920s and further discussed by Kaldor in the 70s and 80s (Targetti and Thirwall, 1989). Krugman (1991) used increasing returns to scale to explain the linkage between economic growth and geography.

While neoclassical economics was the predominant theoretical framework that underlies the generation of development policies, political economy had some impact on the discourse of development issues throughout 60s, 70s, and 80s. Rooted in the proposition of deteriorating terms of trade between underdeveloped and developed countries over time (Singer, 1950; Prebisch, 1950), Neo-Marxian dependency theory advocates that countries should achieve development by import substitution of manufactured goods rather than agricultural (primary goods) export (Baran, 1957; Amin, 1976). With the terms of trade turning against low-income countries that export primary products and import manufactures, dependency theory characterizes such countries as 'the periphery', while developed countries being referred as 'the center'. The periphery goes through underdevelopment as a result of its integration into the world capitalist system. The world capitalist system embeds unequal exchange between the periphery and the center. This theory generated two major real-world impacts: (i) downplayed the role of agriculture and (ii) at the same time popularized inward-looking import substitution development strategy in many developing countries

In sum, agricultural development/growth was not viewed as the ultimate goal of developing countries but as a stepping stone at most for economic development and industrialization. Economic growth literature in the 1980s and 1990s refers to the following as determinants of long-run economic growth: political stability, institution (governance), technological advances, innovation, ideas, tangible and intangible capital (social capital, physical capital, human capital), openness (trade), FDI, Geography, and culture/history. The role of agriculture is missing from this literature. We have to turn to agricultural development economists to find any theory that respects the role of agriculture in economic development process.

III. The Role of Agriculture in Economic Development

Some models we considered above explicitly include agricultural sector in delineating the process of economic development. In particular, the dualistic two-sector models regard agriculture as a source of both surplus labor and capital for the industrial sector. Emphasizing the importance of industrial sectors, they posit that agriculture would play a supporting role in the process of economic development. In essence, these models viewed agriculture as a mere provider of surpluses including labor, foreign exchange, and savings to foster the growth of industrial sector (Norton, 2004; pages 3-13). The central implication of these early models was to expedite the growth of industrial sector at the expense of agricultural sector (Staatz amd Eicher, 1998, page 9).

The experiences of development in developed countries clearly demonstrate that the relative share of agriculture declines as an economy grows. For example, the share of agriculture in the GDP of Korea underwent a sharp decrease from nearly 38 percent in 1961 to 3 percent in 2008. When combined with the view of early Western development economists, the declining share of agricultural output in overall GDP and of agricultural employment in the total labor force further contributed to the tendency of undervaluing the role of agricultural sector in economic growth. These two characteristics (theory and structural transformation) gave rise to a widespread misconception that agriculture is unimportant and does not deserve investment and favorable policy during the process of economic transformation (Timmer, 1988). A major policy implication of such a perception was that agricultural sector needs to be taxed directly and/or indirectly through policies that would depress the prices of agricultural commodities, thereby artificially favoring the growth of the rest of the economy. This line of thinking about

the role of agriculture in economic growth significantly influenced the design of development strategies in some countries in Latin America and Asia in the 1960s and 1970s.

However, this perceived negligible role of agriculture was challenged as theoretical research grew to assign more positive roles for agriculture in economic development and support the view that it is difficult to achieve growth in the rest of the economy without parallel growth in agricultural production and productivity. In particular, Johnson and Mellor (1961) paved the way for theorizing the critical functions that agriculture performs in the process of economic development and opening the door for further generation of novel ideas about agricultural development itself. Specifically, they put forth five major roles of agriculture encompassing;

1. Meeting increased demand for food (due to population growth and higher income elasticity in developing countries),
2. Supplying foreign exchanges from exports of agricultural commodities,
3. Transferring labor from agriculture to nonagricultural sectors,
4. Contributing to capital formation needed for the expansion of manufacturing enterprises and infrastructure like highways, education, and research
5. Increasing rural income, thus providing market for industrial output.

Their theory underscored the importance of concurrent growth between agricultural and industrial sectors. Although they distanced their position from the argument that agricultural development should precede industrialization, they laid the groundwork for subsequent models of agricultural development.

Important insights as to how agricultural growth occurs were offered by two models of induced technical change and induced institutional change (Hayami and Ruttan, 1971; 1985; Ruttan and Hayami, 1985; Ruttan, 1997). In view of historical facts and interpretations, these models conceptualize about the interrelationships among resource and cultural endowment, technological advances, and institutional changes. The theory of induced technical change posits that technical changes are not given exogenously but occur as consequences of a society's collective choice in response to changes in the constraints of resource endowments and relative factor prices. The model of induced institutional change is an effort to elaborate on the sources of changes in institution. According to their theory, demand for institutional innovation is induced by changes in relative resource endowments, product demand, and technology. They define institutions as "the rules of a society or of organizations that facilitate coordination among people by helping them form expectations which each person can reasonably hold in dealing with others." They contend that institutional innovations are demanded to overcome the dissonances resulting from changes in factor endowments, product demand, and technological advance as an economy develops.

Timmer (1988) offered a theory of agricultural development process highlighting how agriculture transforms as the economy grows. His theory consists of four evolving stages: (i) Mosher Environment where the primary concern is to get agriculture moving and to extract investable resources by taxing agriculture, (ii) Johnston-Mellor Environment where the agricultural sector makes a significant contribution to the growth of the overall economy through the five main functions of agriculture outlined in Johnston and Mellor (1961); (iii) Schultz-Ruttan Environment where the agricultural sector is integrated into the rest of the economy through the development of more efficient labor and credit markets which links rural and urban economies; and (iv) D. G.

Johnson Environment where the agricultural sector receives massive subsidies from the government given the two characteristics (low share of labor force engaged in agriculture and low share of food expenditures from household budgets). Each of the four stages is associated appropriate set of policies.

IV. Current Literature on the Linkage between Agriculture and Economic Growth

The prior sections reviewed two schools of thinking about the role of agriculture in economic development: (i) development economists who see only limited role of agriculture in economic growth and (ii) agricultural development economists underscoring the crucial role of agriculture. The contrasting thoughts of the two schools have constituted a theoretical debate about the role of agriculture in economic growth. In recent years, the debate has spawned a host of empirical studies investigating inter-sectoral linkages between agriculture and other sector. This nascent revival of interest in the role of agriculture is very encouraging given that the results of these studies are likely to bear profound implications for low-income countries seeking development strategies that would strike an optimal balance in investment between agriculture and industrial sector.

Some studies support the view of the early Western development economists. For example, Matsuyama (1992) developed a theoretical model demonstrating that agricultural productivity has a negative linkage with economic growth for a small open economy, while maintaining a positive link for a closed economy case. When prices are determined in the world markets, the model suggests that rising agricultural productivity attracts resources to agriculture and drives out the industrial sector. Gemmell, Lloyd and Mathew (2000) support the neoclassical argument that "the benefits of higher productivity in manufacturing tend to spill over to agriculture, encouraging productivity convergence. Specific to petroleum-producing countries, Okonkwo (1989) addresses the deteriorating performance of agricultural exports in connection with policies designed to support petroleum export in Nigeria.

Notwithstanding these studies downplaying the role of agriculture, a large econometric literature supporting the position of agricultural development economists appears to be substantially more solid (Bhagwati and Srinivasan, 1975; Eicher and Staatz, 1984; Dowrick and Gemmell, 1991, Datt and Ravallion, 1998; Thirtle, Lin, and Piesse, 2003; Gollin, Pabente, and Rogerson, 2002; Tiffin and Irz, 2006; Gollin, Parente, and Rogerson, 2007; and Awokuse, 2009). In particular, Gollin, Pabente, and Rogerson (2002) contend that growth in agricultural productivity is important in explaining the growth of per capita GDP for developing countries, specifically showing that per capita GDP growth can be decomposed into agriculture (54 percent), followed by sectoral shifts (29 percent) and manufacturing sector (17 percent). For developed countries, they show that improvements in the productivity of nonagricultural sector will determine economic growth in the long-run. This study is particularly important for designing development strategies for countries that did not start industrialization yet, or are on the verge of take-off. Self and Grabowski (2007) show that agricultural technology/modernization has a substantive effect on long-run economic growth and human development. Tiffin and Irz (2006) used the Granger causality test in the panel data analyzed by Gardner for 85 countries and find overwhelming evidence that supports the conclusion that agricultural value added is the causal variable in developing countries, while the direction of causality in developed countries is unclear. In principle, these studies show

that insufficient growth in agricultural production and productivity results in poor performances in overall economic growth.

World Bank reports and other descriptive studies further highlight the indispensable role of agriculture in economic growth. For example, World Bank was strongly convinced about its position of the role of agriculture in development process as reflected in the following paragraph from its report in 1982 (requoted from Timmer, 1988).

> "The continuing importance of agriculture of the developing countries is reflected in the association between the growth of agriculture and of the economy as a whole. Among countries where the agricultural share of GDP was greater than 20 percent in 1970, agricultural growth in the 1970s exceeded 3 percent a year in 17 of the 23 countries whose GDP growth was above 5 percent a year. During the same period, 11 of the 17 countries with GDP growth below 3 percent a year managed agricultural growth of only 1 percent or less. Agricultural and GDP growth differed by less than two percentage points in 11 of 15 countries experiencing moderate growth. There have been exceptions, of course, but they prove the rule: fast GDP growth and sluggish agriculture was a feature of some of the oil- or mineral-based economies such as Algeria, Ecuador, Moroco, and Nigeria."

Along with the declining share of agriculture in a country's share of labor force and total output, Timmer (1988) considers rapid agricultural growth as one of two uniform phenomena associated with development process. In addition, Johnson (1997) shows that the performance of agriculture in developed countries over the last century exceeded that of manufacturing sector both in terms of annual rates of agricultural output and productivity growth. According to a report by World Bank in 1993, while labor and capital in the case of East Asian countries was transferred from agricultural to industrial sectors, the transfer took place because of the rising wages for labor and returns for capital, but not because of public policies biased against agriculture. Hence, productive factors were "pulled into manufacturing sector rather than squeezed out of agriculture." (World Bank, 1993). This point is important because the successful industrialization of East Asian countries were often considered as a consequence of explicit policies intentionally distorting terms of trade against agriculture. In his recent article, Timmer (2005) asserts that "no country has been able to sustain a rapid transition out of poverty without raising productivity in its agricultural sector.

Pro-poor Growth and Agriculture

The role of agriculture becomes even more important when we consider the critical role that agriculture plays in alleviating poverty, hunger, and malnutrition in developing countries (FAO, 2008; Anrequez and Stamoulis, 2007). With the benefits of economic growth often not transmitted to people living with less than $1 a day, the United Nations (UN) developed the Millennium Development Goals with a particular target of halving the prevalence of extreme poverty by 2015. Given the fact that more than two-thirds of the poor people live in farm/rural areas, or migrate from them in search of other job opportunities, agriculture is an industry that can make the most immediate effect on the reduction of poverty by increasing farm/rural incomes via increased agricultural production and enhanced productivity.

Reduced poverty and resultant enhancement in nutrition and health will lead to increased labor productivity, further fostering overall economic growth. In light of these multiple roles of agriculture in development process, Timmer (2005) observed that "an

agriculture-driven growth strategy, if it does not sacrifice aggregate growth, directs a greater share of income to the poor; i.e. it is more pro-poor", thereby placing agriculture at the center of the pro-poor development strategy. In fact, there is a huge empirical literature highlighting a positive linkage between improvements in agricultural productivity and poverty reduction (e.g., Thirtle, Lin, and Piesse, 2002; Ravallion and Datt, 1996; Fan, Hazell and Thorat, 2000; Christiaensen et al, 2006). In the wake of the burgeoning statistical evidence that confirms the role of agriculture in poverty reduction, policy-makers in developing countries, donor countries, and international development organizations have started to pay renewed interest to agriculture (Timmer, 2005).

Pingali (2009) used the expression "agriculture renaissance" to denote this renewed interest in the role of agriculture in development process and poverty reduction. He notes that agriculture renaissance means different approaches to countries at different stages of development: i.e., for least developed countries, it means fully utilizing agriculture as the primary engine of economic growth; for emerging economies, it implies government efforts to sustain productivity gains and to address the needs of marginal regions and populations left behind; for developed countries, it connotes promotion of agriculture's multifunctional roles such as recreational opportunities, rural amenities, and ecosystem services.

Summary

The somewhat lengthy discussion about the role of agriculture in the course of economic development appears to point to the broad conclusion that agriculture counts in the process of industrialization, yet with the caveat that such role differs across the different stages of structural transformation. Hence, agricultures of the three groups of countries selected for this study are expected to play differential roles in accordance with respective stage of economic development.

The fundamental query of development economics was why some countries are richer than others, and why some countries grow faster than others. In consequence, since WWII, identification of the causes of economic growth has been a task of central importance within development economics. The Industrial Revolution in the 18th and 19th centuries in England was the historic juncture of the beginning of divergence in incomes across countries. The early adopters of innovative production methods from the Industrial Revolution include Britain and France, followed by North America, German and Japan. Then, after WWII, Korea and Taiwan underwent successful transformation into industrialized nations, while other countries in Asia (China, India, Malaysia, Thailand, Indonesia, Philippines) are in the middle of catching up with the earlier industrialized nations.

Without an exception, considerable improvements in agricultural productivity preceded or occurred concurrently with industrialization in all the developed countries. This is a critically important lesson for the middle-income and emerging economies in Southeast Asia.

V. Performances of Agricultural Sectors in Asia

Overview

Given the near-consensus that agriculture plays a critical role in the process of economic development, this section describes the historical performances of agricultural sectors in Asia over the period of 1995-2008. Table 1 presents seven major economic

indicators including per capita GDP, per capita GNI, the shares of agriculture, manufacturing, and service sectors in GDP, the share of agricultural labor in total labor force, and proportion of population below $2 a day. When combined, these indicators tend to divide these countries into three groups: (i) industrialized nations (Korea, Taiwan), (ii) middle-income countries (Malaysia, Thailand, Indonesia, Philippines, and China); and (iii) emerging countries (Cambodia, Laos, Viet Nam, and India). What is notable here is that the per capita GDP of Philippines fell behind that of other neighboring countries. In the mid-70s, Philippines had the highest income among Southeast Asian countries but did not grow as fast as other countries in the last decades. The share of agriculture in overall GDP is all less than 15 percent in the middle-income countries, while ranging between about 22 to 32 percent for emerging countries. Yet, the share of agricultural labor is higher than 35 percent in the middle-income countries (except for Malaysia) and higher than 60 percent in China and the emerging economies. Representing a common characteristic across the economies of the Southeast Asian countries, China, and India, the high share of agricultural labor presents a major challenge to these countries in terms of enhancing agricultural per capita GDP and reducing poverty rates.

Table 1. Major Economic and Agricultural Indicators for Selected Asian Countries in 2007.

	Per Capita GDP ($)	*Per Capita GNI ($)*	*Share of Agriculture in GDP (%)*	*Share of Industry in GDP (%)*	*Share of Service in GDP (%)*	*Share of Agricultural Labor (%)*	*Population below $2 a Day (%) 2005(1995)*
Far East Asia							
China	5958	2370	11.3	48.6	40.1	63.9	36.3(78.6)
Taiwan	30942	17230	1.7	25.9	72.4		--
Korea	27620	19730	2.5	37.1	60.3	6.4	--
Southeast Asia							
Malaysia	13816	6420	10.1	47.6	42.3	14.3	7.8(11.0)
Thailand	8216	3400	11.6	45.1	43.3	45.9	11.5(25.6)
Indonesia	3975	1650	14.4	48.1	37.5	40.2	53.8(84.6)
Philipines	3507	1620	14.9	26.0	53.5	35.7	45.0(52.6)
Viet Nam	2788	770	22.1	39.7	38.2	64.7	48.4(85.7)
Cambodia	2030	550	32.5	22.4	45.1	68.7	53.8(84.6)
Lao PDR	2387	630	32.1	27.8	40.1	79.1	76.9(84.8)
South Asia							
India	2923	950	17.6	29.0	53.4	49.9	75.6(81.7)

Source: Asian Development Bank, 2008. Per Capita GDP at Purchasing Power Parity (current international dollar).

All of the eleven countries considered in this study exhibited excellent performances in terms of overall economic growth (Tables 2 and 3). They maintained growth rates ranging from 3.6 percent (Thailand) to 9.7 percent (China) on average over the last decade (Table 1). These high growth rates strongly indicate that these economies are on the right track toward industrialization and economic development. Successfully managing the hardships of the financial crisis in 1997 that swept through Asia, the economies of Korea, Malaysia, Thailand, and Indonesia came back on growth track. It is interesting to note that, after two decades of dismal economic performances in the 70s

Table 2. GDP growth rates in Asian Countries over the period 1995-2008.

	1995	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*
Far East Asia														
China	10.9	10.0	9.3	7.8	7.6	8.4	8.3	9.1	10.0	10.1	10.4	11.6	13.0	9.0
Taiwan	6.5	6.3	6.6	4.5	5.7	5.8	-2.2	4.6	3.5	6.2	4.2	4.8	5.7	0.1
Korea	9.2	7.0	4.7	-6.9	9.5	8.5	4.0	7.2	2.8	4.6	4.0	5.2	5.1	2.2
Southeast Asia														
Malaysia	9.8	10.0	7.3	-7.4	6.1	8.9	0.5	5.4	5.8	6.8	5.3	5.8	6.2	4.6
Thailand	9.2	5.9	-1.4	-10.5	4.4	4.8	2.2	5.3	7.1	6.3	4.6	5.2	4.9	2.6
Indonesia	8.2	7.8	4.7	-13.1	0.8	4.9	3.8	4.3	4.8	5.0	5.7	5.5	6.3	6.1
Philipines	4.7	5.9	5.2	-0.6	3.4	4.4	1.8	4.4	4.9	6.4	5.0	5.3	7.1	3.8
Viet Nam	9.5	9.3	8.2	5.8	4.8	6.8	6.9	7.1	7.3	7.8	8.4	8.2	8.5	6.2
Cambodia	6.5	5.3	5.7	5.0	12.6	8.4	7.7	7.0	8.5	10.3	13.3	10.8	10.2	6.7
Lao PDR	7.1	6.9	6.9	4.0	7.3	6.3	4.6	6.9	6.2	7.0	6.8	8.7	7.8	7.2
South Asia														
India	7.3	8.0	4.3	6.7	6.4	4.4	5.8	3.8	8.5	7.5	9.5	9.7	9.0	6.7

Source: World Development Indicator, 2009.

and 80s, Philippines are back on the growth track again. In addition, particularly remarkable is the growth rates of the emerging economies of Viet Nam, Cambodia, and Lao PDR: they grew on average nearly 8 percent over the period of 1995-2008, indicating that these economies are certainly on a momentous path toward catching up with the middle-income countries.

Table 3. Overall and Agricultural GDP Growth: Average over 1995-2008.

	Overall GDP Growth Rate	*Agricultural GDP Growth Rate*
Far East Asia		
China	9.68	4.0
Taiwan	4.45	-0.61
Korea	4.79	2.02
Southeast Asia		
Malaysia	5.36	2.36
Thailand	3.61	2.83
Indonesia	3.91	2.78
Philippines	4.41	3.41
Viet Nam	7.49	4.1
Cambodia	8.43	4.31
Lao PDR	6.57	3.53
South Asia		
India	6.97	3.11

Source: World Development Indicators, 2009.

Various factors underlie such a remarkable performance in the last decade in Asian economies. With continued robust (albeit at lower rates than previous decades) growth in the 1990s and 2000s (except for the two years associated with the financial crisis in 1998), Korea and Taiwan seem to be on their way to joining the ranks of industrialized nations. In particular, given that Korea was forced by the financial crisis to undertake drastic reforms in the governance of corporate and banking management, the comeback

of the Korean economy to a sustained growth path suggests that it is on the verge of overcoming gaps with countries industrialized earlier in terms of management practices and technologies. The growth of China and Viet Nam is no doubt attributed to the revolutionary transition from a centrally planned economy to a market-oriented system in late 1970s and 1980s, respectively. India's growth is associated with the replacement of inward-looking strategy of import-substitution with export-oriented outward-looking strategy. In general, Rosegrant and Hazel (2000) showed that the accumulation of labor and capital was more important than productivity growth in the expansion of Asian economies.

Agricultural Growth and Structural Transformation

We measure the performance of agricultural sector with the following indicators: (i) agricultural GDP and its growth rates, (ii) agricultural share in overall GDP, (iii) partial productivity including cereal yields per hectare and per capita agricultural GDP, and (iv) total factor productivity. In relation to these measures, Gardner (2005) brings up two important points worthwhile to note in interpreting data on those measures: (i) growth rate of agricultural output may not be appropriate measure of performance because output could rise as a result of a larger labor force or more land for agricultural production, and (ii) growth of agricultural productivity may not be an appropriate measure of rural living standards because growing productivity can lower the prices of agricultural commodities and hurt farm incomes.

Table 4 shows agricultural GDP growth rates for selected Asian countries over the period of 1995-2008. Agricultural GDP was growing steadily at a modest rate over the last decade in all countries except for Taiwan (whose agriculture is shrinking in absolute term). Given that agricultural labor continues to shrink (although slowly) and the size of agricultural land hardly increased in these countries (Rosegrant and Hazell, 2000; WDI, 2009), neither land nor labor augmentation played a significant role in the growth of agricultural GDP. Hence, we conjecture that the agricultural GDP growth is the consequence of rising land productivity (yield per hectare) that is likely to be caused by using newer varieties and more fertilizers (further discussion will follow later about labor productivity when agricultural per capita GDP is analyzed). Agricultural GDP growth rates are lower than overall GDP growth rates in most of the countries considered in this study, indicating that the structural transformation associated with typical economic development is in progress with the shares of manufacturing and service sectors rising.

In fact, Table 5 shows that the share of agriculture in GDP has declined over the last decade consistently in all countries but Thailand. Yet, the rates of decline varied across countries. Lao PDR underwent the sharpest decline from 55 percent in 1995 to 32.1 percent in 2008, followed by Cambodia (from 49.6 percent to 32.5 percent). The share of agriculture in China declined nearly by half over the last decade from 20 percent in 1995 to 11.3 percent in 2008. The decline of agricultural share was not significant in Malaysia (from 12.7 percent in 1995 to 10.1 percent in 2008) and Indonesia (17.1 percent to 14.4). Intriguingly, the share of agriculture for Thailand increased from 9.5 percent in 1995 to 11.6 percent in 2008. We can interpret the cases of these three countries as suggesting the growth of agricultural sector was strong relative to manufacturing and services sectors. The agricultural share in Korea declined steadily over the last decade from 6.3 percent to 2.5, reaching the level of industrialized nations.

Table 4. Agricultural GDP growth rates in Asian Countries over the period 1995-2008.

	1995	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*
Far East Asia														
China	5.0	5.1	3.5	3.5	2.8	2.4	2.8	2.9	2.5	6.3	5.2	5.0	3.7	5.5
Taiwan	2.7	-0.3	-1.9	-6.3	2.7	1.2	-1.9	4.7	-0.1	-4.1	-8.1	6.1	-1.9	-1.4
Korea	5.3	2.3	4.6	-6.4	5.9	1.2	1.6	-2.2	-5.4	9.1	1.3	1.5	4.0	5.5
Southeast Asia														
Malaysia	-2.5	4.5	0.7	-2.8	0.5	6.1	-0.2	2.9	6.0	4.7	2.6	5.2	1.4	4.0
Thailand	4.0	4.4	-0.7	-1.5	2.3	7.2	3.2	0.7	12.7	-2.4	-1.8	4.6	1.8	5.1
Indonesia	4.4	3.1	1.0	-1.3	2.2	1.9	4.1	2.6	3.8	2.8	2.7	3.4	3.4	4.8
Philippines	0.9	3.8	3.1	-6.4	6.5	3.4	3.7	4.0	3.8	5.2	2.0	3.8	4.8	3.2
Viet Nam	4.8	4.4	4.3	3.5	5.2	4.6	3.0	4.2	3.6	4.4	4.0	3.7	3.8	4.1
Cambodia	3.5	1.2	5.5	5.1	3.7	-1.2	4.5	-3.5	10.5	-0.9	15.7	5.5	5.0	5.7
Lao PDR	3.1	2.8	7.0	3.1	8.2	4.2	-0.6	1.9	2.5	3.4	0.7	2.5	8.6	2.0
South Asia														
India	-0.7	9.9	-2.6	6.3	2.7	-0.2	6.3	-7.2	10.0	0.0	5.8	4.0	4.9	1.6

Source: World Development Indicator, 2009.

Table 5. Agricultural Share in GDP in Selected Asian Countries over the period 1995-2008.

	1995	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*
Far East Asia														
China	20.0	19.7	18.3	17.6	16.5	15.1	14.4	13.7	12.8	13.4	12.2	11.3	11.1	11.3
Taiwan	3.5	3.2	2.5	2.4	2.5	2.1	1.9	1.8	1.7	1.7	1.7	1.7	1.6	1.7
Korea	6.3	6.0	5.4	5.1	5.2	4.6	4.4	4.0	3.7	3.7	3.3	3.2	2.9	2.5
Southeast Asia														
Malaysia	12.7	11.3	10.7	12.5	10.3	8.3	7.7	8.7	9.1	9.1	8.2	8.6	10.0	10.1
Thailand	9.5	9.5	9.4	10.8	9.4	9.0	9.1	9.4	10.4	10.3	10.3	10.7	10.8	11.6
Indonesia	17.1	16.7	16.1	18.1	19.6	15.6	15.6	15.5	15.2	14.3	13.1	13.0	13.7	14.4
Philippines	21.6	20.6	18.9	17.0	17.1	15.8	15.1	15.1	14.6	15.1	14.3	14.2	14.2	14.9
Viet Nam	27.2	27.8	25.8	25.8	25.4	24.5	23.2	23.0	22.5	21.8	21.0	20.4	20.3	22.1
Cambodia	49.6	46.5	46.3	46.3	43.5	37.9	36.7	32.9	33.6	31.2	32.4	31.7	31.9	32.5
Lao PDR	55.0	52.9	52.8	53.3	53.7	48.5	45.5	42.7	41.0	39.0	36.7	32.4	33.4	32.1
South Asia														
India	26.5	27.4	26.1	26.0	25.0	23.4	23.2	20.9	21.0	19.2	19.1	18.2	18.1	17.6

Source: World Development Indicator, 2009.

A comparison of the share of agricultural labor with the shares of agriculture in overall GDP sheds light on the structures of these Asian economies. The shares of agricultural labor in these Asian countries (above 35 percent for the middle-income countries; above 60 percent for other emerging economies, Table 1) are substantially higher than its shares in GDP. While it is generally true that agricultural labor share in total labor force declines more slowly than its share in GDP, the comparison reveals that there is a large scope for improvements in labor productivity (Rosegrant and Hazell, 2000; Anderson and Martin, 2008).

Use of Irrigated Land, Fertilizer, and Machinery

In addition to agricultural land and labor, there are other types of major production inputs such as irrigation, fertilizers, and machinery. Table 6 displays agricultural input use patterns for two periods of time: 90-92 and 03-05. Irrigated land is denoted with percentage of entire cropland. Over the period of 2003-2005, Korea (47.1%), Vietnam

(33.9%), China (35.5%), and India (32.7%) had relatively high percentage of irrigated land. The percentage of irrigated land increased slightly in Cambodia, Lao PDR, India, and Thailand between the two periods of 90-92 and 03-05, while decreasing in other countries such as China, Vietnam, Indonesia, and Philippines.

Table 6. Agricultural Input Uses

	Irrigated land (% of cropland)		Fertilizer Consumption (hundred grams per hectare of arable land)		Agricultural Machinery (tractors per 100 sq. km of arable land)	
	90-92	*03-05*	*90-92*	*03-05*	*90-92*	*03-05*
Far East Asia						
China	36.9	35.5	2,321	3,214	64	65
Taiwan						
Korea	47.1	47.1	4,932	4,379	275	1,239
Southeast Asia						
Malaysia	4.8	4.8	5,264	8,536	161	241
Thailand	21.0	26.6	598	1,411	39	144
Indonesia	14.5	12.7	1,330	1,449	18	41
Philippines	15.7	14.5	935	1579	20	20
Viet Nam	44.6	33.9	1,299	3,309	60	247
Cambodia	6.6	7.0	19	50	3	7
Lao PDR	16.2	17.2	31		11	12
South Asia						
India	28.3	32.7	758	1,197	65	141

Source: World Development Indicators, 2009.

Malaysia used 853 kilograms per hectare of fertilizer, the largest quantity among the countries considered in this study, followed by Korea (493 kg), Vietnam (330 kg), China (321 kg), Philippines (158 kg), Indonesia (145 kg), Thailand (141 kg), and India (120 kg). Cambodia used only 5 kilograms per hectare in the period 03-05. Fertilizer use grew the fastest between 90-92 and 03-05 in Thailand (134 percent), followed by Vietnam (84 percent), India (57 percent) and Malaysia (58 percent). The use of agricultural machinery increased nearly five times in Korea from 275 to 1,239 tractors per 100 sq. km of arable land; from 39 to 144 in Thailand; from 60 to 247 in Vietnam; from 65 to 141 in India. The use of tractors remained very low in Indonesia (41), Philippines (20), Lao PDR (12), and Cambodia (7).

The above usage patterns for fertilizer and machinery reveal several trends of interest; (i) Korea is in the process of using more machines and less fertilizers; (ii) Vietnam, Thailand, and India started to use more of both fertilizer and machines; (iii) Cambodia and Lao PDR are at a very early stage of utilizing modern inputs, and (iv) countries other than Korea have a great potential to improve labor productivity by mechanizing their agricultural production.

Partial Productivity for Land and Labor

Table 7 presents two measures of agricultural productivity as reported in World Development Indicators (World Bank, 2008): (i) cereal yield per hectare (land productivity), and (ii) per capita agricultural GDP (labor productivity). Cereal yield measured in kilograms per hectare of harvested land, includes wheat, rice, maize, barley, oats, rye, millet, sorghum, and buckwheat. Agricultural GDP deducts the value

of inputs purchased from outside agricultural sector from all value added within agriculture, hence a proper measure of living standards for farmers. Cereal yield is the highest in Korea with 6,400 kg per hectare and lowest in Cambodia and India with 2,428 kg. Other Southeast Asian countries exhibit a similar level of yields around 3,000-4,000 kg. Between the two periods of 90-92 and 02-04, cereal yield grew faster in the emerging economies of Cambodia, Lao PDR, and Viet Nam (73.7, 62.5, and 52.4 percent, respectively) than other countries, indicating that cereal yield (land productivity) is converging among the countries considered in this study.

Table 7. Measures of Productivity: Cereal Yield and Agriculture Value Added Per Worker

	Cereal Yield (Kg Per hectare)			Agricultural Value Added Per worker (2000 $)		
	1990-1992	*2002-2004*	*Growth rate (%)*	*1990-1992*	*2002-2004*	*Growth rate (%)*
Far East Asia						
China	4,307	5,237	21.6	254	401	57.9
Taiwan						
Korea	5,885	6,400	8.80	5,679	11,286	98.7
Southeast Asia						
Malaysia	2,827	3,317	17.3	3,803	5,126	34.8
Thailand	2,186	2,976	36.1	497	621	24.9
Indonesia	3,826	4,354	13.8	484	583	_
Philippines	2,070	3,074	48.5	905	1,075	18.7
Viet Nam	3,096	4,717	52.4	214	305	42.5
Cambodia	1,356	2,356	73.7		306	
Lao PDR	2,341	3,804	62.5	360	458	27.2
South Asia						
India	1,947	2,428	24.7	324	392	20.9

Source: World Development Indicators, 2009.
Note: cereal yield, measured in kilograms per hectare of harvested land, includes wheat, rice, maize, barley, oats, rye, millet, sorghum, buckwheat. Agricultural value added per worker is calculated by dividing total agricultural value added with the number of workers in agriculture.

Agricultural GDP per worker is generally very low in most countries ranging from about $300 to $600 except for Korea and Malaysia. This low per worker agricultural GDP is closely connected with the relatively high share of agricultural labor in the countries. Two explanations are possible for this. First, labor productivity was not growing as fast as land productivity because Asian countries were keen on developing land-saving agricultural technologies (Rosegrant and Hazell, 2000). Second, the rest of the economy (manufacturing and service sectors) failed to provide sufficient economic incentives to lure rural laborers into their sectors. Deeply associated with this low per worker agricultural GDP is the high incidences of poverty living under $2 a day, ranging from 53.8 percent in Indonesia to 76.9 percent in Lao PDR (Table 1). Hence, the logical causal flow goes from lagging labor productivity improvements to high agricultural labor share to low per capita agricultural GDP and ultimately to high incidences of poverty.

Despite the substantial improvements in cereal yield per hectare in Southeast Asian countries between the periods of 90-92 and 02-04, the increases in agricultural per worker GDP were mediocre over the same period of time in Southeast Asia and India with the growth rates ranging from 20 percent in Lao PDR to 34 percent in Malaysia

(Viet Nam was the highest with 42.5 percent). China and Korea exhibited relatively strong performances in this category with the growth rates of 58 and 98 percent, respectively.

Total Factor Productivity (TFP)

While shedding considerable lights into the performance of agricultural sector, partial productivity is not able to discern the role of technical change and other factors in agricultural growth. In this regard, the concept of total factor productivity can be of use in complementing the measures of partial productivity. As shown in table 3, agricultural GDP in Asian countries grew fairly rapidly, ranging from on average 2.5 percent (Philippines) to 6.7 percent (Cambodia) over the period of 1995-2008. Agricultural growth can be explained in principle by an increase in input use and improvement in total factor productivity (TFP).

TFP is defined as a residual in output growth over time after accounting for the growth of inputs. Whereas partial productivity is a measure of average factor productivity such as labor or land productivity, total factor productivity is the outcome of allowing for the effect of changes in all inputs and measures the net effect of changes in technology (Mundlak, 2000, pp 195-196). More generally, TFP is attributed not only to technology but also to intangible factors such as quality of labor (human capital), quality of management and governance, strength of institutions, geography and climate, property rights, and cultural factors (Abu-Qarn and Abu-Bader, 2007). Setting these intangibles aside, the growth in TFP can be equated with technical progress when the production function underlying firms' behavior exhibit constant return to scale and all firms are operating on the frontier of the production function. Given that these two conditions may not hold in real world, the growth in TFP can be decomposed to three components including (i) technical progress, (ii) increasing return to scale, and (iii) cost inefficiencies. Figure 1 illustrates the decomposition using a simple production function. A move from point (A) to (B) represents an improvement in technical efficiency, while from (B) to (C) denoting growth in output due to increasing return to scale. Finally, transition from c to d represent output growth due to advances in underlying technology.

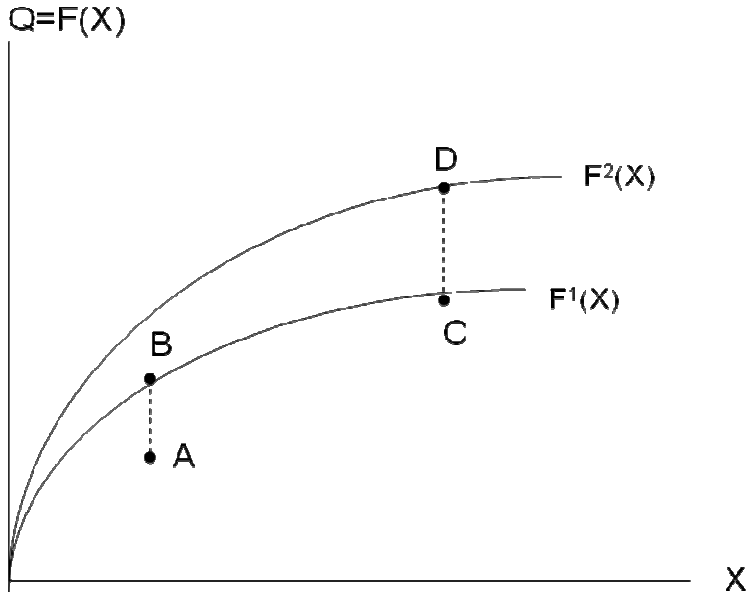
For India over the period of 1957-1985, the rate of growth in TFP in the crops sector was about 1 percent per annum (Rosegrant and Evenson,1992). Given that total output grew at the rate of 3 percent per annum over the same period of time, growth in TFP accounted for roughly one-third of total output growth in the Indian crops sector, indicating that the increased use of inputs is responsible for the remaining two-thirds of the output growth.

In their efforts to measure TFP for 18 developing countries, Fulginiti and Perrin (1998) conclude that output growth is generally attributed to the increased use of fertilizers and machinery. In addition, they decomposed the productivity change into technical progress and efficiency gains and showed that for some countries (Argentina and Korea) TFP was declining due to technical regression but with improvement in technical efficiency.

Coelli and Prasada Rao (2003) estimated growth in agricultural TFP for 93 countries over the period of 1980-2000. The study shows that TFP grew 2.1 percent annually on average across the countries with technical change and efficiency gains explaining 1.2 percent and 0.9 percent, respectively. With 2.9 percent TFP growth, Asia as a group

outperformed any other region including Africa, Europe, and North and South America. Table 8 presents efficiency change, technical change, and TFP growth for the Asian

Figure 1. Decomposition of TFP into Technical Change, Scale Economies, and Efficiency



countries considered in our study. China and Cambodia stand out as the best performer with growth rates of 6 percent and 5.7 percent, respectively.

The study reveals several noteworthy results. First, technical regression has occurred in several countries including Korea, Thailand, and Indonesia. This result is intriguing given that these countries exhibited solid growth rates in agricultural per capita GDP and cereal yield and it is somewhat hard to believe the occurrences of such technical regression. Second, for most countries (China, Vietnam, Philippines), growth in TFP is attributed to efficiency gains rather than technical change. For example, out of 6 percent growth in TFP in China, 4.5 percent is explained by efficiency gains ("catch-up"). Technical change played a greater role in explaining growth in TFP only in the case of Cambodia with technical change comprising 3.3 percent out of 5.5 percent growth in TFP.

Caution needs to be exercised in interpreting estimated TFP. Specifically, Chen (1998) argues that "it is not really meaningful to examine the role of technological change in economic growth in the context of growth accounting if we identify technological change only with disembodied technological change or TFP. This is because the measurement of TFP is so sensitive to the measurement of the factor inputs, specifically to the extent and scope of the adjustments of quality improvements made to the factor inputs." Consequently, TFP may be arbitrary as a measure of technical change because it does not account for quality improvements in inputs or technical change embodied in inputs. The traditional approach of treating TFP as residual not explained by the amounts of inputs, in fact, measures disembodied, exogenous and Hicks-neutral technological change (Chen, 1998). Some research showed that East Asian economies experienced small growth in TFP relative to industrialized countries in the West and argued that technological change was not a significant source

of the rapid economic growth of East Asian countries (Young, 1992; 1995; Krugman, 1994; Abu-Qarn and Abu-Bader, 2007). In a reply to this argument, Chen (1998) suggested that technical change in East Asian countries may have been associated with quality improvements in factor inputs or embodied technological change and disembodied technological change may not have been important in these countries.

Table 8. TFP and Decomposition into Technical Change and Efficiency Change: 1980-2000.

Country	*TFP Change (%)*	*Technical Change (%)*	*Efficiency Change (%)*
Far East Asia			
China	6	1.5	4.5
Taiwan	_	_	_
Korea	-0.5	0.0	-0.5
Southeast Asia			
Malaysia	0.4	0.0	0.4
Thailand	-0.5	0.0	-0.5
Indonesia	-0.19	-0.22	0.3
Philippines	0.8	0.0	0.8
Vietnam	2.4	-0.3	2.7
Cambodia	5.7	3.3	2.4
Lao PDR	3.4	1.1	2.2
South Asia			
India	1.4	0.6	0.8

Source: Coelli and Rao (2003)

Causes of Agriculture and Productivity Growth

An issue of overriding importance to agricultural development economists over the last half century was to explain what causes agricultural and productivity growth over time or differentials across countries. Schultz (1965) noted that improvements in the quality of agricultural inputs purchased outside of agriculture are the main causes of agricultural growth: fertilizers, machineries, chemicals, and schooling and the skills of farm people. Hayami and Ruttan (1970) categorize the sources of agricultural productivity differences across countries into three broad groups: (a) resource endowments, (b) technology, as embodied in fixed or working capital, and (c) human capital, broadly conceived to include the education, skill, knowledge and capacity embodied in a country's population. Gardner (2005) notes that macroeconomic policy,

reasonable foreign exchange rate, the performance of other sectors have greater impact on the growth of agriculture than development economists would accept.

Craig, Pardey, and Roseboom (1997) consider the following as major factors explaining productivity differentials across countries or over time: chemical fertilizers, use of capital services (tractors), publicly provided infrastructure (better roads and transportation, irrigation services), local research and extension that may reduce the costs of disseminating information on better crop varieties and farming techniques, labor quality (literacy rates, life expectancy at birth) reflecting public spending on education and health care.

Taken together, the agricultural growth literature suggests that the following factors contributes to the growth of agriculture: macroeconomic and political stability, price policies, farm policy, institutions establishing appropriate incentives, access to competitive input markets (e.g., credit); remunerative output markets, enhancing new technology, and literacy.

Summary

We divided the eleven countries considered in this article into three groups: (i) industrialized, (ii) middle income, and (iii) emerging economies. While all countries are on a solid path toward industrialization, particularly impressive was the rapid economic growth of the emerging economies (Vietnam, Cambodia, and Lao PDR), China and India. These countries seem to be catching up with the middle-income countries, indicating that incomes may be converging between the two groups of countries. As a consequence of the rapid growth in the last decade, China and India now play an integral role in sustaining the global economy.

Consistent with the overall economic growth rates, the three emerging countries along with China and India were outperforming other countries in agricultural GDP growth, hinting that agriculture is highly correlated with the performance of overall economy. For the middle-income countries that are in the midst of structural transformation, agricultural share in GDP declined very little in Malaysia, Thailand, Indonesia, and Philippines over the last decade. This outcome is intriguing given that the rest of the economy was growing faster than agricultural GDP over the last decade.

A major implication from this discussion of the performance of agricultural sectors in Asia is that improvement in labor productivity is considerably lagging behind land productivity, suggesting that the economic well-being of the people in rural areas did not improve as much as the measures of agricultural growth rates and cereal yield. An array of factors determines labor productivity: (i) the speed of rural-urban migration, (ii) farm sizes, (iii) production of higher-value products, and (iv) agricultural mechanizations (Rosegrant and Hazell, 2000). The speed of migration to urban areas is determined largely by how fast manufacturing and service sectors grow and become able to absorb agricultural labor. The latter three factors are likely to be influenced by investments in research and development, managerial skills of farmers, market incentives (consumer demand and prices), farm policies, and international market trends. In sum, concurrent growth both in agriculture and the rest of the economy is necessary to facilitate improvements in labor productivity. In an attempt to show why enhancement of labor productivity is important for economic development, Gollin, Parente, and Rogerson (2002) contend that the rate of productivity change in agriculture determines the rate of the flow-out of agricultural labor to industrial sector,

and hence low agricultural labor productivity may hamper the progress of industrialization.

VI. Globalization, Protectionism, and Developing Countries

It is important to note that there are marked differences in global economic environment faced now by the middle-income and emerging countries when compared to the times of 1960s and 1970s when Far East Asian countries were developing rapidly. These differences may suggest different development strategies between these two groups of countries. Hence, this section addresses agricultural trade-related issues of importance to nurturing agricultural sectors in the middle-income and emerging countries in Asia.

Globalization and Agricultural Protectionism

Globalization is a compelling process that influences a wide range of our lives today encompassing political, social, cultural, and economic systems. It refers to the growing interconnectedness of people, institutions, and ways of lives across borders. At the center of the globalizing trend is the evolution of economic systems and institutions toward embracing more openness and efficiency. Economic globalization is intimately associated with neoliberalism, an economic ideology underscoring the role of liberal markets as a means of promoting economic development. Specifically, economic globalization strives to gain greater efficiency of resource allocation, thereby fostering economic growth both in developed and developing countries. As a matter of fact, the expansion of trade in industrial goods since World Word II has played a pivotal role in promoting economic growth across the world. The globalization trend now tries to foster global economic growth by reducing trade barriers for new areas such as services and agriculture.

Agriculture is no doubt being affected by the neoliberalism as manifested by the efforts of World Trade Organization (WTO) to reduce trade barriers and domestic farm subsidies so as to correct distortions in world agricultural markets. Yet, agriculture appears to be an area most resistant to the forces of globalization. The Doha Development Round (DDR) officially collapsed in 2008 and failed to reach a multilateral agreement on what to do with trade rules and farm subsidies after talks of eight years since 2000: it did not advance at all toward liberalized trade from the accomplishment of Uruguay Round agreement in 1994.

The history of agricultural protectionism goes as far back as the corn laws in 1856. Since then, government manipulation of agricultural markets has been prevalent across industrialized countries. For example, government intervention in the US started during the era of Great Depression primarily to provide safety nets for the one-fourth of the population engaged in farm industry and to reduce the disparity in incomes between farm and non-farm sectors. In the mid-1980s, the share of farm population dwindled to a 2 percent of the total population and farm incomes surpassed nonfarm sector income. Interestingly, agricultural protections did neither disappear nor diminish. They, in fact, grew considerably over the last half century. Not unique to the US, government subsidy has also been growing in other developed countries in Europe and East Asia.

Agricultural economists were perplexed with the persistency in government involvement in agricultural markets and attempted to rationalize such intervention using a variety of explanations. One argument is that government is trying to correct market failures inherent in farm sector such as instability in prices and incomes,

imbalance in market power between farmers and middlemen, provision of information, and investment in R&D. Political economy theory hypothesizes that the interests of politicians, bureaucrats, and farm organizations are the driving forces increasing government protection. In fact, Gardner (1994) argued that agricultural economists (e.g., Gale Johnson, Tweenten) changed their view on agricultural protectionism from problem-solving to interest-group politics.

There are a large number of researches designed to empirically explain the growing agricultural protection in developed countries. For example, Gardner (1987) examined why the extent of government intervention (in the form of farm price support programs) differs by commodities in the US. The study showed that self-sufficiency rates in agricultural products were negatively related to the protection rates: i.e., if the commodity faces import competition, it is likely to receive greater protection. Low elasticities of demand and supply were positively associated with it. The share of commodity in aggregate agricultural output had a positive effect on the protection.

Using data across countries, the following factors have received attention from researchers in explaining agricultural protection: resource endowments, the share of agriculture in GNP and employment, agricultural income relative to other income, and the share of food in expenditure had measurable impact on the extent of protection. In particular, Swinnen (1994) highlighted the role of relative farm incomes and countercyclical nature of agricultural protection. Beghin and Kherallah (1993) showed that, after accounting for the effects of economic development, terms of trade, comparative advantages, and constraints on tax collection feasibility, agricultural protection level increases as the political system moves to a more pluralistic. Yet, the study showed that further transition to democratization causes partial dissipation of protection and agricultural protection may persist if transactions costs in connection with eliminating/reducing farm programs/policies are substantial.

Effects of Agricultural Protectionism on Developing Countries

The process of economic development in Korea and Taiwan started with investment in light manufacturing industries. Using cheap and abundant labor released from agriculture, these countries adopted export-oriented strategies so as to achieve economies of scale and gain competitive advantages in world markets. The world markets for these industries were fairly liberalized at the time when these countries started industrialization in 1960s. The emphasis on light manufacturing industries coupled with outward-looking strategies was the most rational choice given the insufficient sizes of domestic markets and comparative disadvantages in most areas of agriculture of these countries. In contrast, now emerging Southeast Asian countries have comparative advantages in some agricultural commodities. Hence, it would have been rational to focus on exporting agricultural commodities as the first step of developing their economies. Unfortunately, the prevalence of agricultural protectionism in developed countries severely distorted world commodity markets and Southeast Asian countries were deprived of the opportunities to use the exports of agricultural commodities as an engine for their economic growth.

Anderson et al (2006) estimate that removing distortions in merchandise trade including farm subsidies in developed countries will have a considerable impact on the well-being of the populations in developing countries by increasing farm employment, the real value of agricultural output and exports, and real net farm income. They note that agriculture is anticipated to enjoy the greatest gains from trade liberalization. In

particular, the poorest people (farmers and unskilled laborers) will gain most from the global trade liberalization. However, the prospect for agricultural trade liberalization is not very promising when considering all the unfavorable factors impacting WTO trade talks including the growing role of multifunctionality of agriculture in trade talks and domestic farm policy.

Multifunctional Roles of Agriculture in Developed Countries

Multifunctionality of agriculture refers to positive nonmarket benefits that agriculture produces with varying degrees of jointness with either market commodities or farmlands (Vatn, 2002; Batie, 2003). Such nonmarket benefits include national food security, rural amenities, recreational opportunities, viable rural economy, and a broad range of ecosystem services (e.g., flood control, nutrient recycling, groundwater recharge, wildlife habitat, atmospheric carbon dioxide sequestration). Emerging as a paradigm competing with the neo-liberalism, multifunctionality underlines the need for instituting a framework/mechanism that would coordinate farm, rural, environmental/ecological, and trade policies in order to ensure an optimal supply of such goods and services. Similar to the European Model of Agriculture (EMA), the concept of multifunctionality emphasizes the need for policies/programs that reduce negative environmental effects of agriculture, promote the sound management of the countryside, and maintain marginal producers in farming (Potter, 2004).

The multifunctional role of agriculture causes controversies in academic, trade, and policy circles because of the possibility of market failures: i.e., nonmarket goods (bads) are under (over) provided in the absence of government intervention. A divergence between private and public value of agriculture will result in a socially suboptimal agricultural sector in terms of its size, what it produces, and how it is produced. In short, markets do not reveal the strength of the demand for the multifunctional benefits of agriculture, potentially causing market failures and distorting societal resource allocation. Some research constructed theoretical models that internalize the demand for the multifunctional benefits of agriculture, thereby offering policy options that can correct market failures. For example, Paarlberg, Bredahl, and Lee (2002) developed an economic model that integrates the multifunctional outputs of agriculture and derived optimal conditions for domestic policy intervention, while Thornsbury, Moss, and Schmitz (2003) derived conditions for optimal trade distortions from a trade model that explicitly incorporates consumer demand for nonmarket outputs of agriculture.

Given the growing acceptance of the concept of multifunctional agriculture and its growing role in WTO multilateral trade talks, developed countries are anticipated to take full advantage of this concept to keep subsidizing their domestic agriculture. The UR agreement in 1994 instituted a unique and creative mechanism called "traffic light box system" designed to allow countries to support the supply of nonmarket goods and services of agriculture while ensuring that such support is decoupled from production, thereby minimizing the distortion of world commodity markets. The DDR was highly anticipated by the proponents of liberalized agricultural trade to advance rules and guidelines concerning the box system that was achieved from the UR agreement. To the frustration of agricultural exporting developing countries, the DDR collapsed officially in 2008 without producing any agreements on important agricultural issues and left agricultural protectionism intact.

VII. Concluding Remarks

The world has grown to become more ethical and desire to address the extreme inequality in the distribution of income between nations. In particular, as manifested through the Millenium Development Goals by World Bank, the global society has shown a strong desire to reduce extreme poverty, hunger, and malnutrition in developing countries. This desire led to the realization that agricultural growth is not only important for overall growth but also most effective in reducing rural and urban poverty. Supported by a large number of empirical studies, such realization has brought the attention on agriculture back to the forefront of development economics.

In terms of the linkage between agriculture and industrial sectors in economic development, there could be four different scenarios: (i) both of agriculture and industrial sector are not growing, (ii) agriculture is growing while industrial sector is not, (iii) industrial sector is growing while agriculture is not, and (iv) both of agriculture and industrial sector are growing simultaneously. The stage of economic development is likely to intervene in the nature of such relationships between agricultural and industrial sectors. For example, agricultural growth can be hypothesized to lead overall economic growth at an early stage of economic development. At a middle-income stage, the performances of agricultural and industrial sectors will have reciprocal influence on each other, whereas nonagricultural sectors play a dominant role in economic growth at a high income stage. The second case is not highly probable given that agricultural growth hinges to a large extent on the use of modern inputs that come from industrial sector. Generally speaking, the third case is feasible. Yet considering the high share of agricultural labor in most Southeast Asian countries, weak performance of agriculture would slow down the transfer of labor to industrial sectors and consequently their growth.

In view of the literature we reviewed in this article and the experiences of industrialized countries since the Industrial Revolution, our conclusion is that both sectors need to move together. We are convinced that it is pointless to test causality between the two sectors from a development policy perspective. Although it is feasible to hypothesize that one sector is the cause of the growth of other sector at the very beginning of a development process, beyond such a initial stage, the development should be a concurrent process between agriculture and industrial sector. The late-comers of Southeast Asia have been growing steadily in both sectors and we believe that they are on right track toward catching up with other neighboring developed Asian economies.

A question of profound importance in relation to economic growth models has been whether or not when a country starts industrialization matters in determining the degree of success in achieving economic growth. Several studies offer insights into this question. For example, Lucas (1998) developed a model showing that income between the early and late starters will converge primarily because of the spillover effects of knowledge (human capital externality). The implication of his model is that it will take less time for the late starters to industrialize and catch up with the early starters. The reality, however, is that there are barriers to technology adoption in most developing countries (Kosempel, 2004; Niosi, 2008). Hence, Lucas's prediction of convergence does not take place automatically in such countries. They should have manpower with skills to adopt new technologies as well as to adapt them to their particular environments (Niosi, 2008). Not surprisingly, successful development then winds down to investments in human capital.

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