Rice Yield Gap between Myanmar and Vietnam: A Matter of Price Policy or Public Investment in Technology?

Koji Kubo
Institute of Developing Economies (IDE-JETRO), Thailand
Email: koji_kubo@ide-jetro.org

ABSTRACT

This paper examines the rice yield gap between Myanmar and Vietnam, two countries that show a stark contrast in terms of rice production in the past two decades. It considers the impact on yield of price policies and public investments in production technology. While domestic rice prices were once controlled in both countries, no clear deterioration or improvement in terms of trade for rice producers were confirmed in the past two decades. Rather, the widening yield gap in this period might be attributable to differences in technological changes due to public investments. It is implied that Myanmar needs more effective public investments in agriculture to upgrade production technology. Furthermore, the experience of the two countries suggests that delegating the budget to local governments might raise the effectiveness of public investments.

Keywords: price policy, public investment, yield gap, Myanmar, Vietnam
JEL classification: Q18, O13, O57

INTRODUCTION

The performances of Myanmar and Vietnam in rice exports in the past two decades are in stark contrast. Myanmar used to be the world's largest rice exporter in the 1930s; its annual exports of milled rice reached around 3 million tons (t). In recent years, annual exports have been several hundred thousand tons only. In contrast, Vietnam used to be a rice importing country in the 1980s. In 1989, it suddenly emerged as a rice exporter, with annual exports of over 1 million t. The export level has increased to around 6 million t per annum in recent years.

The sharp difference in the two countries' rice export performance is mostly a reflection of changes in rice yield.[1] In 1990, Myanmar's average annual rice yield was 2.85 tons per hectare (t/ha), whereas Vietnam's was 3.18 t/ha. In recent years, Myanmar's yield level remained below 3 t/ha, while Vietnam's surpassed 5 t/ha. In terms of rice yield, Vietnam is one of the top countries in Southeast Asia.

1 Myanmar yield data in this portion were obtained from the Production, Supply and Distribution Online (PSD) of the United States Department of Agriculture (USDA). Those of Vietnam were from the Statistical Yearbook of the General Statistical Office, Vietnam.

The economic importance of rice as a source of employment, food staple, and export earnings has led both countries' governments to implement various policies for the rice sector. Until the 1980s, both governments imposed direct controls on rice prices in the domestic market. Starting in the 1990s, they began using export controls as a measure to stabilize domestic rice prices. At the same time, they invested considerable resources (relative to the size of their respective economies) to enhance rice yield.

A number of studies had related the performance of rice production mostly with repression on rice producers. The stagnation of Myanmar's rice production, for instance, was associated by Fujita and Okamoto (2009) with repressive rice price policy. In the case of Vietnam, Nghiem and Coelli (2002) attributed the growth in rice yield mainly to changes in incentives of producers as a result of policy reforms.

This paper evaluates the impacts of rice policies and public investments on the rice sector of Myanmar and Vietnam by focusing on changes in the rice yields of the two countries. Rice yield level is affected not only by economic factors such as price controls but also by environmental conditions like climate, soil, and availability of water. Thus, it is not appropriate to evaluate the impact of policies and public investments by comparing yield levels only. By assuming that other conditions remain constant, however, a comparison of the rice yields changes in the two countries would allow the evaluation of the impact of policy changes.

This paper is structured as follows. The following section offers the framework of policy analysis. It illustrates the impacts on yield of price controls, subsidies on inputs, and public investments in production technology. The third section summarizes the indices on rice production and production technologies, including the trends in diffusion of modern high-yielding rice varieties (HYVs) and in irrigation development. In addition to macro data, this section introduces some existing micro data analyses on the roles of HYVs and irrigation facilities. The fourth section describes the price policies adopted by Myanmar and Vietnam, and examines price control changes in the past two decades. The fifth section examines how the differences in the two countries' budget allocation systems had affected the outcomes of public investments. Conclusions are presented in the sixth section.

FRAMEWORK OF POLICY ANALYSIS

This section presents the framework used to analyze the impact of policies on rice production. The framework illustrates how (1) price policies including export controls, (2) subsidies on inputs, and (3) public investments in production technology affect yields. The analysis is static and presumes profit-maximizing farmers along with diminishing return to scale production technology. It also assumes that farmers do not adjust planted areas but do adjust amounts of inputs. This assumption is particularly appropriate for Myanmar where the government had limited farmers' crop choice in favor of rice production.[2] This assumption allows the study to focus on the productivity of a rice field unit.

Price Policies

Price policies are regulations that affect the farmers' unit selling price of rice.[3] They include forced procurement from farmers by

2 Tin Soe (2004) argues that Myanmar's agricultural policy emphasized output maximization rather than producer's income.

the government at a set official price and export controls. For rice exporting countries like Myanmar and Vietnam, when there is no export control, the producer price converges with the export price minus marketing costs. Export controls impede this convergence, leaving the producer price lower than it should be. A multiple exchange rate system along with the surrender requirement on exporter earnings has a similar effect on domestic rice price. Export controls are a consumer protection policy to secure an ample supply of rice for the domestic market at an affordable price.

Here, the effect of export controls on yield is considered. Profit-maximizing farmers would choose the amount of variable inputs (e.g., chemical fertilizer) that equates the marginal cost with the marginal revenue. The marginal revenue equals the marginal product of input multiplied by the producer price of output. As export controls lower the producer price, given the diminishing return to scale technology, farmers would reduce the amount of input, decreasing yield to a lower level than it would be without export controls.

Subsidies

In the above example, the policy lowering the domestic rice price reduces yield. The government may harmonize the goals of protecting consumers by controlling the rice price and of encouraging rice production by providing subsidies to producers (e.g., subsidizing the cost of chemical fertilizers and providing seasonal loans at a subsidized low interest rate). As subsidies lower the marginal cost of input, farmers would increase input, thus raising yield. Depending on the relative magnitude of subsidies and the price repression by export controls, a rise in yield due to subsidies could more than compensate for the decline in yield due to export controls. The implication is that the relative prices of inputs and output, or the terms of trade, should be considered rather than just focusing on the output price level. The existing studies on the rice economies of Myanmar and Vietnam had paid attention to the terms of trade.[4]

Public Investment in Production Technology

Via public investments in production technology, production may also be encouraged while controlling domestic rice price. Public investments to induce technological change cover infrastructure (e.g., irrigation and drainage) and research and development (HYV breeding). Since infrastructure and research and development have the characteristics of public goods in terms of non-rivalness and non-exclusivity, their provision through the market would result in undersupply, hence the need for public investments.

Technological progress raises the marginal product for a given level of input. Accordingly, ceteris paribus, it raises yield due to: (1) an increase in output without a change in the amount of input and (2) an increase in input (i.e., as the marginal product of input increases, farmers use more input until the increased marginal revenue is equal to the marginal cost). With the policy mix of price control and public investments for technological progress, the government can harmonize the goals of consumer protection and yield growth, respectively.

Finally, it is worthwhile comparing the impact on yield of price liberalization and

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3 Price policies do not always reduce domestic producer price. Import controls as a means of price policy were implemented in Indonesia and the Philippines and raised domestic producer price (Kajisa and Akiyama 2005).

4 For example, Fujita and Okamoto (2009) for Myanmar and Nielsen (2003) for Vietnam.

public investment in technology. Regarding price liberalization, how much an increase in the producer price stimulates production partially depends on the marginal product of inputs. When the change in the marginal product is small, the yield growth due to price liberalization is limited. A number of empirical studies have confirmed that the price elasticity of the supply of food crop is small (Fan and Pardey 1997; Rosegrant, Kasryno, and Perez 1998; Kanwar 2006). Their common implication is that technological changes have a more significant effect on yield than price liberalization.

TRENDS IN PRODUCTION AND PRODUCTION TECHNOLOGY

Production Statistics

Figure 1 illustrates the trends of rice production and areas planted to rice since 1990 in Myanmar. As there is concern of overestimation in the production statistics of the Myanmar government, the production data in Figure 1 are complemented by estimates from the United States Department of Agriculture (USDA).

The gap between the two data sets widened in the 2000s. The official statistics of the Myanmar government shows that production increased by 133 percent from 1990 to 2010. On the other hand, the USDA estimates indicate only a 20 percent growth rate for the same period. In the meantime, rice exports remained stagnant at around several hundred thousand tons per annum, while population increased by 40 percent. Assuming no significant change in per capita consumption, the USDA estimates imply a rice shortage in the domestic market.[5] The Myanmar government data, on the other hand, imply that several million tons of rice disappeared or were smuggled each year. It is conjectured that the actual production amount lies somewhere between the two estimates.

The growth in production can be decomposed into changes in planted areas and in yield. According to USDA data, annual production increased by 20 percent between 1990 and 2010, and the planted areas by 46 percent. These indicate that average yield declined by approximately 18 percent in the period. On the other hand, the Myanmar government statistics indicates that annual production increased by 133 percent, and the planted areas by 63 percent, or an average yield increase by approximately 43 percent.

Figure 2 summarizes the changes in average yields. Cropping seasons are classified into dry and monsoon (wet) seasons. While the Myanmar government statistics reports yields by seasons, USDA does not. Similar with Vietnam, the yield of the dry season crop in Myanmar is higher than that of the monsoon season crop.

The gap of the annual average yield of two countries can be broken down into the weight of wet and dry season crops, on one hand, and the crop yield in each season, on the other. Based on Myanmar government data, the annual average yield trend followed closely that of the monsoon crop yield. This was because the monsoon season crop was dominant in terms of the net planted areas. This contrasts with Vietnam where dry season crop yield is much higher than that of Myanmar. Furthermore, the yields of both wet and dry season crops, according to the Myanmar government statistics, were lower than those of Vietnam.

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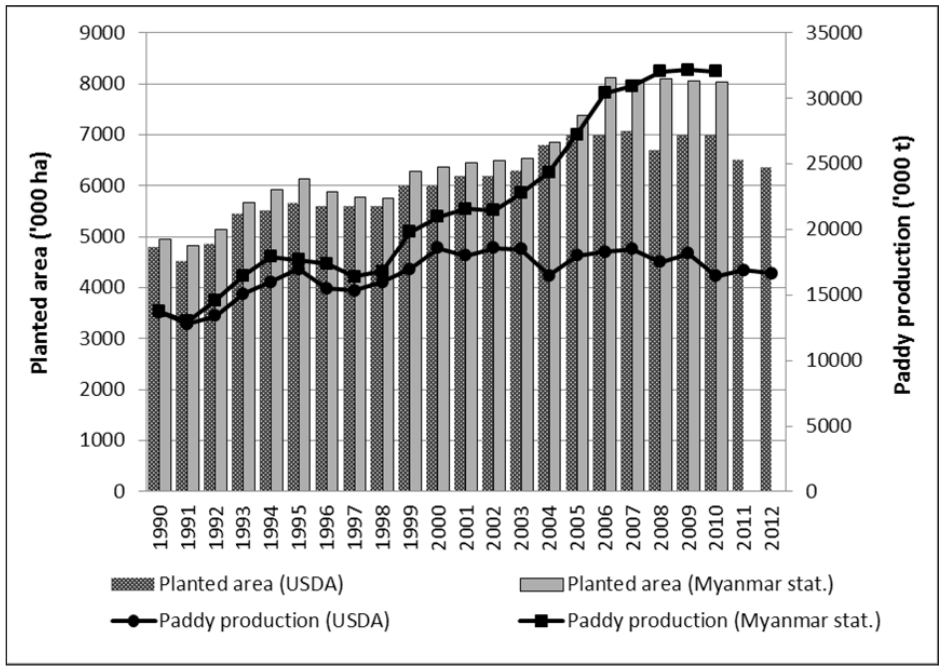
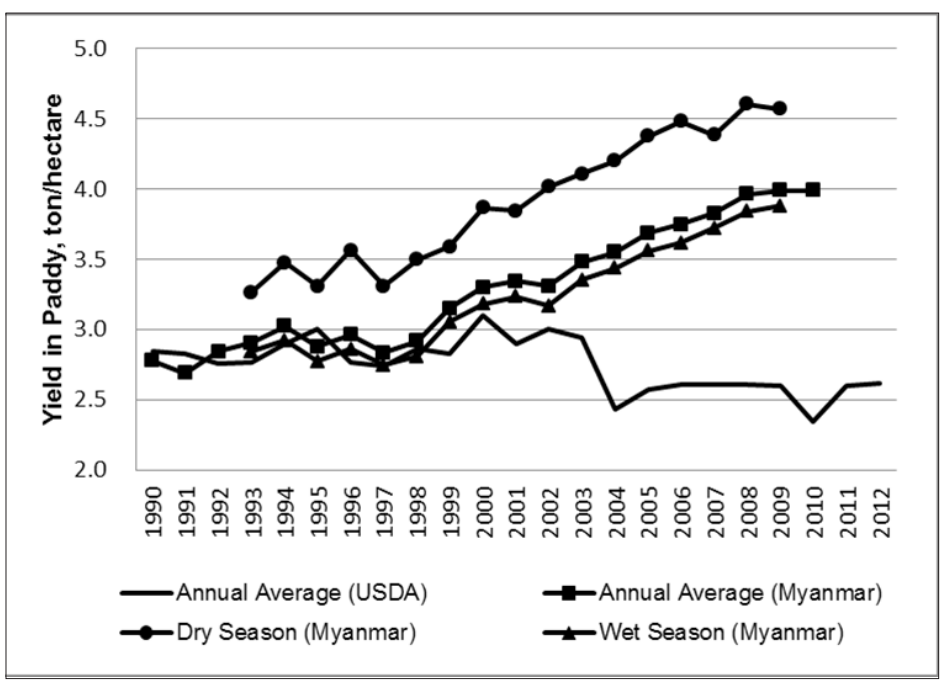
5 It might be that considerable smuggling of exports was already present as of 1990, and smuggling functioned as a buffer to prevent rice shortage in the domestic market. Another inference is that storage served as a buffer. A precise analysis is impeded due to unavailability of data.

Figure 1. Trends in rice production (paddy) and planted areas in Myanmar, 1990–2012



Source: See Appendix Table 1

Figure 2. Rice yield trend in Myanmar, 1990–2012



Source: See Appendix Table 1

In the case of Vietnam, the trends of its rice production and planted areas are given in Figure 3. The official government statistics reports production and planted areas by season —dry season (spring), wet season (autumn), and wet season (winter). Some areas undertake triple cropping. From 1990 to 2011, annual production almost doubled, from 19.23 million t to 42.33 million t. The net planted areas increased from 1990 to 1999, then declined gradually.

Figure 4 shows the trends of yields by cropping season. The annual average yield was 3.18 t/ha in 1990, increasing to 5.53 t/ha by 2011. This was more than twice higher than that of Myanmar in 2011 (2.60 t/ha, USDA estimate). Similar with Myanmar, Vietnam's rice yield was much higher in the dry season than the wet season. On the other hand, Vietnam's proportion of dry season crops in net planted areas was higher than Myanmar's.

Dawe, Pandey, and Nelson (2010) calculated the decomposition of yield growth into two components for selected South and Southeast Asian countries including Vietnam: growth in yield within each crop season or a specific ecosystem (e.g., irrigated area or not) and growth in yield due to change in weight of crop seasons and ecosystem. The results revealed that yield growth within each crop season or a specific ecosystem was prevalent in Vietnam and in all countries in the sample. That is, sustained yield growth of both wet and dry season crops in Vietnam was one of the important reasons for the widening yield gap with Myanmar.

Yield and Production Technology

This subsection considers the production technology that had been conducive to yield growth, especially in Vietnam. This was the Green Revolution, which started in the late 1960s through the 1970s and the 1980s. It mainly involved the diffusion of HYVs, which, among others, were responsive to increased dosages of chemical fertilizer and had short growing periods, facilitating multiple croppings in a year.

The diffusion of HYVs in Myanmar and Vietnam followed contrasting paths. In Myanmar, the government led the 'all township special high-yield rice production plan' starting in 1977 to encourage production of HYVs (Takahashi 1992). The share of HYV-planted areas to total area planted to rice was as low as 9 percent in 1976.[6] It rapidly went up to 48 percent in 1981. However, the spread of HYVs had remained stagnant thereafter, reaching 59 percent only in 1993 (the last year in the continuous time series data available). In Vietnam, the spread of HYVs was gradual but steady; the share of HYV-planted areas to total rice production area rose from 6 percent in 1976 to 94 percent in 2002.

HYVs can achieve their potential when required conditions are provided. First, irrigation and drainage facilities are indispensable. Irrigation makes it possible to plant rice in seasons when rainwater is scarce. Drainage facilities complement irrigation in terms of controlling the water level in rice fields, especially since some HYVs are vulnerable to floods or droughts. The dry season is suitable for HYV planting for at least two reasons: (1) the water level is easier to control once the water supply is secured by irrigation, and (2) the longer hours of sunlight help the growth of rice. Second is chemical fertilizer application. Since HYVs are responsive to chemical fertilizer dosage, chemical fertilizer is the most important variable input.

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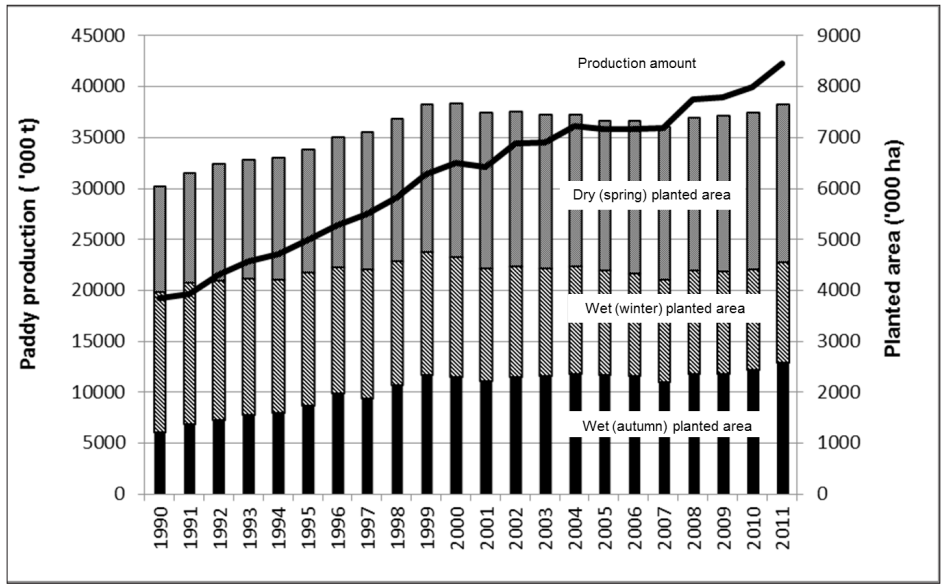
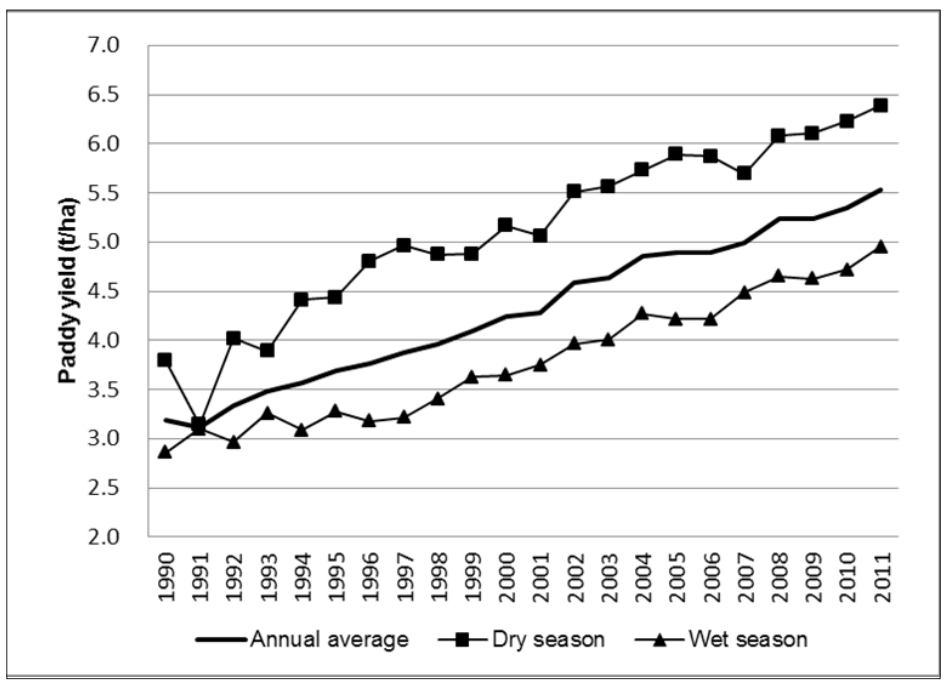
6 Data on share of HYV-planted areas to total area planted were from World Rice Statistics, International Rice Research Institute (2013).

Figure 3. Trends in rice production (paddy) and planted areas in Vietnam, 1990–2011



Source: See Appendix Table 2

Figure 4. Trend of yield in Vietnam, 1990–2011



Source: See Appendix Table 2

To see the extent of irrigation development in Vietnam, Table 1 summarizes the proportion of irrigated areas to total area planted to rice. The Red River Delta and the Mekong Delta are two major rice bowls; the latter produces nearly half of the total output of the entire nation. Table 1 indicates a rapid rate of irrigation construction in the Mekong Delta in the 1990s.

While similar data on Myanmar are not available, the relevant data summarized in Table 2 indicate the extent of underdevelopment of the irrigation facilities. "Irrigated Area" under "All Crops" does not cover rice fields only but all other cropped fields. The net proportion of irrigated areas to the total area planted to all crops remained as low as 17.1 percent in 2009. Furthermore, double cropping occurred in 15–36 percent only of the irrigated areas. Double cropping was done also in some areas where irrigation facilities were absent; the cropping combinations included rice during the monsoon and beans/pulses in the dry season. Beans and pulses do not require a lot of water supply. In the case of rice, the dry season crop accounted for less than 20 percent of the planted areas and was often planted in areas that were not cultivated in the monsoon season due to floods. Thus, the irrigated double cropping areas must be lower than 20 percent. These generally suggest underdeveloped irrigation facilities in Myanmar.

As to the relationship between quality of irrigation facilities and yields, Matsuno and Horino (2009) offered an analysis based on a farm household survey in Myanmar. The study examined how differences in irrigation designs

Table 1. Proportion of irrigated areas to total rice field, Vietnam, 1980–2002

Year	National Average	Red River Delta	Mekong Delta
1980	46	75	41
1985	49	73	46
1990	55	80	52
1995	64	89	64
1998	68	91	67
2002	85	100	91

Source: Adopted from Tran and Kajisa (2006,173).

Table 2. Irrigated areas and double cropping in Myanmar, 1974–2009

	All Crops				Rice	
Year	Planted Area (NET)	Double Crop Area (NET)	Irrigated Area (NET)	Double Crop Area under Irrigation	Wet Season Planted Area	Dry Season Planted Area
1974	8,103	1,397	976	144		
1984	8,359	2,156	1,085	190		
1989	8,209	1,643	1,005	157		
1994	8,951	3,191	1,555	356	4,849	1,077
1999	10,135	4,669	1,841	507	5,152	1,132
2004	11,415	6,016	1,927	686	5,824	1,034
2009	13,644	9,718	2,329	620	6,779	1,288

Sources: Central Statistical Organization (CSO), Statistical Yearbook; Myanmar Agricultural Statistics (1992/93 to 2004/05), Myanmar Agricultural Statistics (1997/98 to 2009/10).

affected yields, using the dataset from adjoining rice fields in one township. Differences in irrigation designs were observed to result in considerable variation in water availability between fields and consequently in yields. The implication was that both irrigation availability and quality matter to productivity.

The declining rice yield levels in Myanmar were aggravated by the limited supply of quality seeds. Farmers usually took seeds from the harvested paddy repeatedly for many years, hence, the performance of HYVs deteriorated. While the diffusion of HYVs was nominally as high as 59 percent in 1993,[7] it included planted areas where poor quality seeds were used.[8]

As for Vietnam, Tran and Kajisa (2006) offered a panel data analysis using farm household data on the use of HYVs. The study showed evidence that in addition to switching from traditional varieties to HYVs, farmers continued to use newly bred HYVs, which helped them to continuously raise their productivity. The findings are consistent with the decomposition of yield growth by Dawe, Pandey, and Nelson (2010). The improvement in productivity due to HYVs has not been a one-shot jump; rather, the continued breeding of new HYVs has led to growth in production in the country.

In summary, it is evident that rice production technology in terms of HYVs and irrigation has far advanced in Vietnam in the past two decades than in Myanmar.

RICE POLICIES IN MYANMAR AND VIETNAM

This section examines whether or not there had been changes in rice price control in the past two decades. If there had been no significant changes in price control, it can be argued that the changes in yield gap between Myanmar and Vietnam are associated with the difference in technological progress.

Myanmar's Policies

Until August 1987, the government used to control rice marketing via the procurement and distribution system. In principle, farmers had to surrender all their harvest except for a portion set aside for their own consumption and for use as seeds. The state procurement quota assigned to farmers was between 1.5 and 2.1 t/ha, but the quota was not always fulfilled. Total procured rice amounted to approximately 40 percent only of the total annual production. Moreover, commercial marketing of rice was prohibited, although the black market was tolerated (Tin Soe and Fisher 1990). As the procurement price was less than half of the black market price, the rice procurement system was effectively a heavy tax on the producers.

In August 1987, the government announced the abolition of the state rice procurement and distribution system, lifted the direct price controls, and permitted a free domestic market. However, it resumed the procurement and distribution system in 1988, though at a reduced scale. The procurement quota was decreased to 0.5–0.6 t/ha (Fujita and Okamoto 2009). The proportion of procured rice to total rice production was reduced to around 10 percent. This procurement and distribution system was maintained until April 2003.

The government monopolized rice exports by prohibiting rice exports by the private sector. It exported the remainder of procured rice after domestic distribution. While the government

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7 From IRRI's World Rice Statistics

8 For example, the government supplied 79,000 baskets (one basket is equal to 20.86 kilogramgs) of seeds in 2006. Since two baskets of seed paddy are necessary for one acre (0.405 ha), this means the supply covered only 0.2 percent of the total area planted to rice.

announced rice export liberalization after the abolition of the procurement system in 2003, it was not until December 2007 that export quotas were allocated to the private sector in the scale of several hundred thousand tons. The government imposed a 10 percent export tax on rice exports in the same way it did for other exports commodities.

Myanmar, like other countries that practiced multiple exchange rate systems, was often cited for its overvalued official exchange rate, which could function as an indirect tax on producers (World Bank 2007). In principle, however, the country had no surrender requirement on foreign exchange revenues for the private sector, so that the overvalued official exchange rate did not function as an indirect tax on producers.[9] On the contrary, since private exports resumed in 2007, private rice exporters have been permitted to retain foreign exchange and to dispose of it in the black market at a competitive exchange rate.

There had been a substantial gap between the official and black market rates[10] the official exchange rate had been fixed and never devalued for more than three decades, whereas the black market rate had chronically depreciated. This gap reached its peak in September 2007: the official rate was 5.56 Myanmar kyat (MMK) per US dollar (USD) while the prevalent black market rate was MMK 1,369 per USD. Nonetheless, owing to the absence of surrender requirements on export revenues, the gap did not affect much the rice exporters or producers. The trends of rice prices against this backdrop are examined first, followed by an analysis of the terms of trade for rice producers. Figure 5 summarizes the trends of the domestic retail and wholesale prices as well as the export price in real US dollar terms; prices were deflated using the US gross domestic product (GDP) deflator.[11] It includes the export price of Thai rice (100 percent Grade B, free on board (FOB) Bangkok) as a reference. It should be noted that the wholesale price in 1987 was under a direct price control; prices after 1988 were under a free market. Figure 5 shows that Myanmar's export price followed the Thai export price; their peaks and troughs mostly coincided with one another. In contrast, the domestic wholesale and retail prices moved independently from the Myanmar export price. This implies that the export controls had been effective in preventing the domestic price from converging with the rice prices in the global market.

Figure 6 illustrates Myanmar's rice prices in real domestic currency terms. The prices were deflated using the Myanmar consumer price index (CPI). The trend of export price was observed to have been dominated by changes in the exchange rate. For example, since 2006, the MMK experienced a sharp appreciation; its real exchange rate vis-à-vis the USD appreciated by nearly 200 percent, the sharpest among Southeast Asian countries (Kubo 2013). This resulted in a fall of the export price in real domestic currency terms.

The domestic retail and wholesale prices, on the other hand, were more stable in real domestic currency terms than in real US dollar terms; the stable domestic prices in real domestic currency terms confirm that increases in domestic prices in real USD terms since 2006 were due to the exchange rate appreciation. The domestic market prices mostly fluctuated in the

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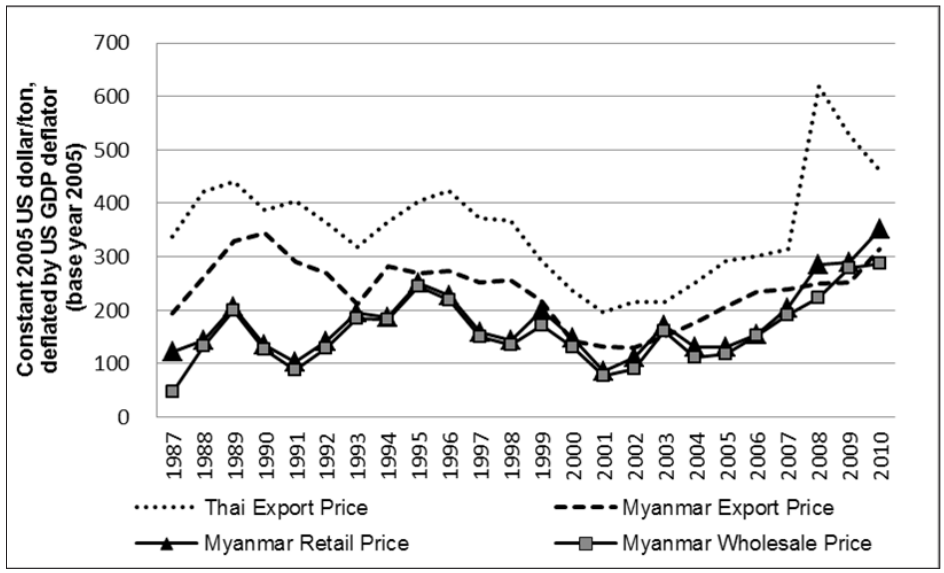
9 Kubo (2013) presented a comprehensive summary of Myanmar's foreign exchange system.

10 In this paper, unless otherwise mentioned, the exchange rate of Myanmar refers to the prevalent black market rate as monitored by a diplomatic mission in Myanmar.

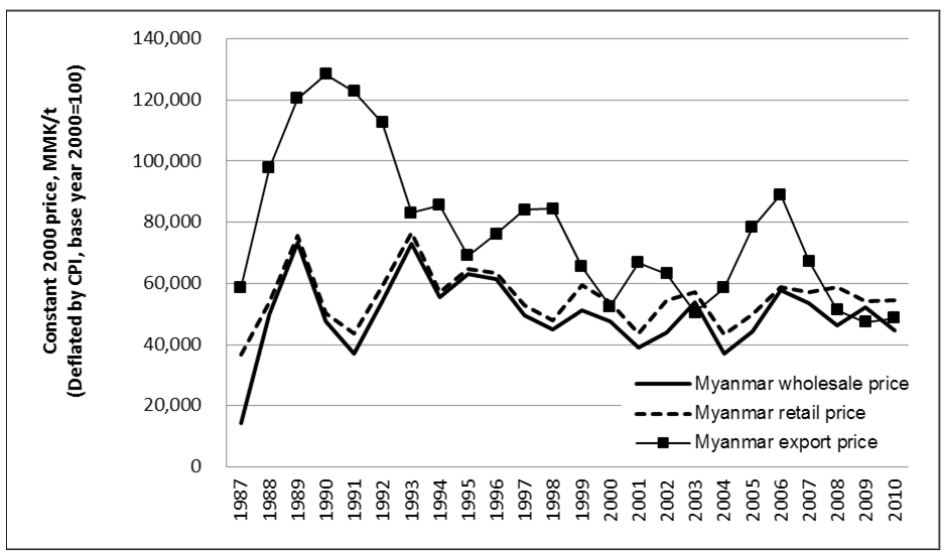
11 It should be noted that for Myanmar rice, these prices did not always refer to rice of the same quality; as such, the wholesale price sometimes surpassed the export price.

Figure 5. Trends of retail, wholesale, and export prices in constant 2005 USD, Myanmar, 1987–2010



Source: See Appendix Table 3

Figure 6. Trends of retail, wholesale, and export prices in constant 2000 MMK, Myanmar, 1987–2010



Source: See Appendix Table 3

range of MMK 40,000 and MMK 60,000. It is evident that there is no worsening trend of price control against producers.

Changes in the terms of trade for producers were considered also. Procurement at the low official price was reduced in 1988 and abolished in 2003. Such changes raised the producers' receipts. On the other hand, subsidies on chemical fertilizer were cut. Until 2001, the bulk of supply of chemical fertilizers came via government distribution. The government gradually raised the distribution price of chemical fertilizers; it was close to the market price when the distribution was terminated in 2003 (Fujita and Okamoto 2009). Moreover, the amount of distribution had been mostly at random due to fiscal budget limitation, making it difficult to quantify the effect of fertilizer distribution.

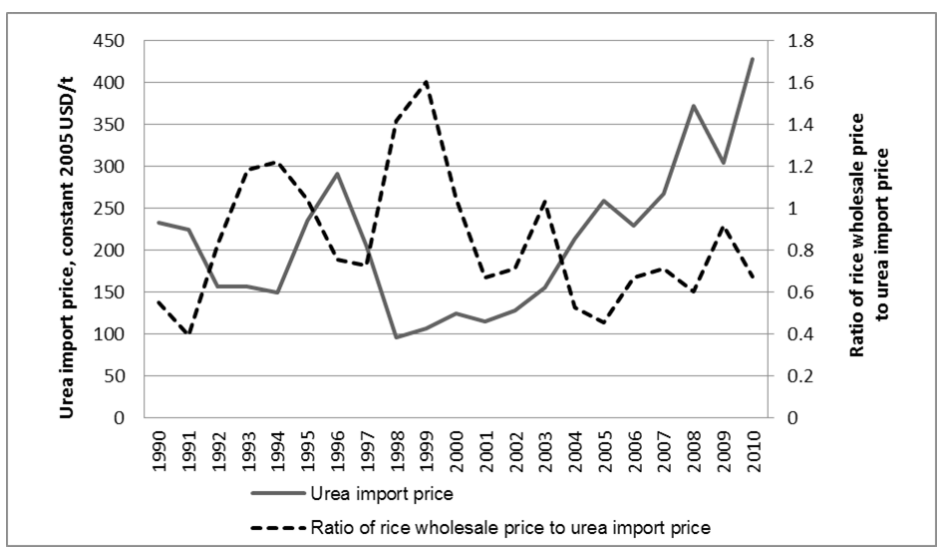
Starting from the harvest period of the monsoon paddy in 2003 where both rice procurement and chemical fertilizer distribution were discontinued, the terms of trade can be captured by comparing the wholesale price of rice and the import price of fertilizer. Figure 7 shows the import price of urea, one of the main chemical fertilizers, and the ratio of the wholesale rice price to the urea import price. The urea import price is an annual weighted average in real USD terms, deflated using the US GDP deflator. A rise in the ratio of the rice price to the urea price indicates an improvement in the terms of trade for producers. The figure shows that the fluctuation of the urea price translated into fluctuations in terms of trade. For the period from 2003, however, although the price of urea went up substantially, the appreciation of the MMK mostly set it off, leaving the terms of trade to improve.

To sum up, judging from the changes in the wholesale price of rice and the terms of trade, the repression on producers has not been intensified. Therefore, the stagnant performance of the rice economy in Myanmar cannot be attributed only to the price repression.

Vietnam's Policies

In 1981, Vietnam started to reform its agricultural sector from the collective farms

Figure 7. Trends of urea fertilizer import price in Myanmar, 1990–2010



Source: See Appendix Table 3

based on agricultural cooperatives to the contract system, where farmers could freely dispose of their surplus products after the assigned production quota. The reform's milestone came via Decree 10 in 1988, which declared the shift from collective farming to individual household farming. The land use title was clarified, although it was initially relatively as short as 15 years. In addition, farmers were allowed to make decisions on their production and marketing. In 1993, the Agricultural Land Act extended the land use title to 20 years and enhanced the title holder's right to exchange, transfer, and inherit land. These series of reforms were considered to have stimulated the producers' incentive to expand rice production.

Major reforms were simultaneously instigated on the rice market. In the domestic market, the government lifted the direct controls on rice prices and input prices such as chemical fertilizers in 1989. The participation of private distributers in the domestic rice market was progressively liberalized and they soon handled the bulk of the domestic marketing of rice.

On the other hand, state-owned enterprises have virtually monopolized rice exports from the very beginning when Vietnam resumed rice exports in 1989 until today. Two giant state-owned enterprises, Vinafood I and Vinafood II, had the lion's share of rice exports. The government gradually deregulated the rice exports, and in 2001 it finally stopped commanding quota allocation. Since then, the government has controlled rice exports by setting targets for the national export volume. Any authorized exporters may, in principle, export rice. Once the targets are reached, exports are halted. Despite the changes in export controls, the state-owned enterprises still occupy the majority of rice exports.

How did the changes in incentives for rice farmers and the series of rice market reforms affect the domestic rice price? Figure 8 summarizes the producer price and the retail price, and the export prices from two sources. One export price is FOB, 15 percent broken from *Rice Outlook* of USDA. The other is the weighted average export price calculated from the rice export data in FAOSTAT. The prices are in real USD terms. Producer price refers to the farm gate price of paddy converted in terms of milled rice price.[12]

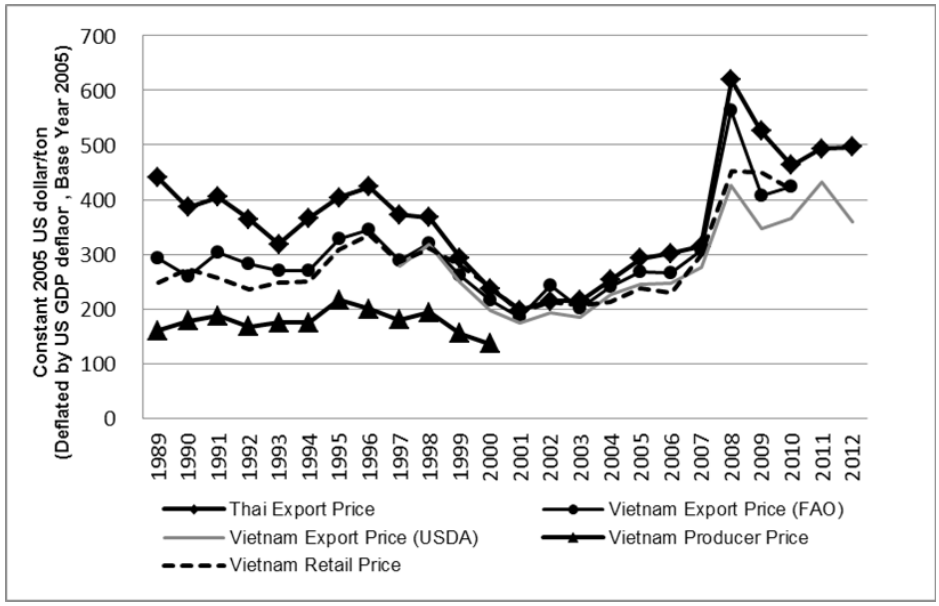
The Vietnamese export prices mostly synchronized with the Thai export price. The gap between the Thai export price and the weighted average Vietnamese export price (FAO) was narrower in the 2000s than in the 1990s. However, the gap between the weighted average export price (FAO) and 15 percent broken export price (USDA) got wider at the same time. These suggest that the quality of the Vietnamese rice for the export market improved in the 2000s.

The domestic producer and retail prices, on the other hand, moved in parallel with the export prices. The producer price was much lower than the export price since two prices are at different points in the marketing chain. Nonetheless, the peaks and troughs of the producer price weakly coincided with those of the export prices. This implies that price repression by export controls had a rather limited impact.

Figure 9 presents the producer, retail, and export prices in real domestic currency terms. Prices are deflated by the Vietnamese CPI. Apart from the rise due to the surge in cereal prices in the global market since 2007, the domestic prices did not exhibit any clear trends. As to the surge of the rice prices in 2008, the rise in the domestic retail price in real domestic

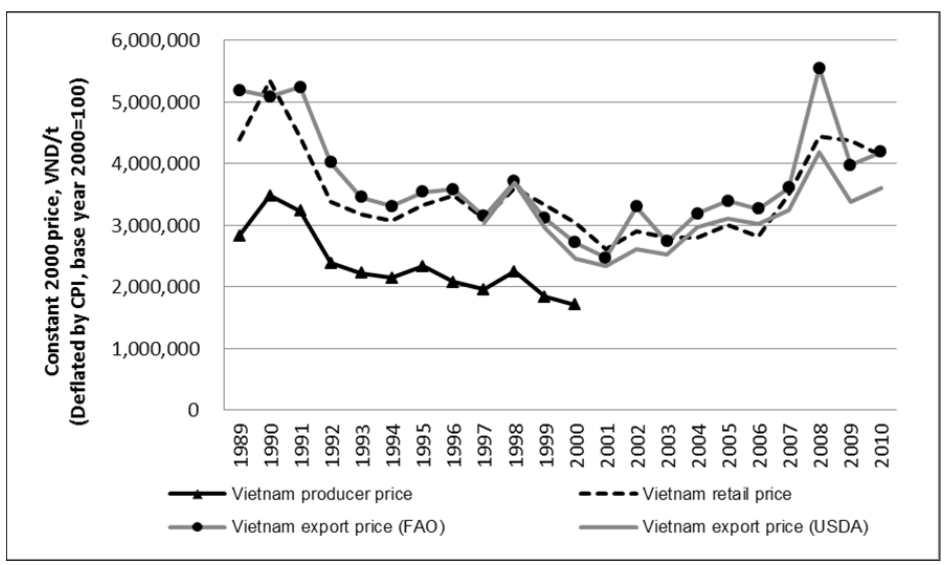
12 The producer price is quoted from Luu (2003, 150).

Figure 8. Producer, retail, and export prices in real USD, Vietnam, 1989–2012



Source: See Appendix Table 4

Figure 9. Producer, retail, and export prices in real VND, Vietnam, 1989–2010



Source: See Appendix Table 4

currency terms was much smaller than the rise in the Vietnamese export price; the former was 27 percent only whereas the latter (FAO) was 83 percent. This implies success in the government's intention to stabilize the domestic price.[13]

In summary, the domestic rice price remained rather stable in real terms until the surge in the global cereal price in 2007. Given that there was no significant upward trend in the terms of trade of producers in the past two decades, it is not appropriate to wholly attribute Vietnam's sustained growth in yield to the price incentives for rice farmers.

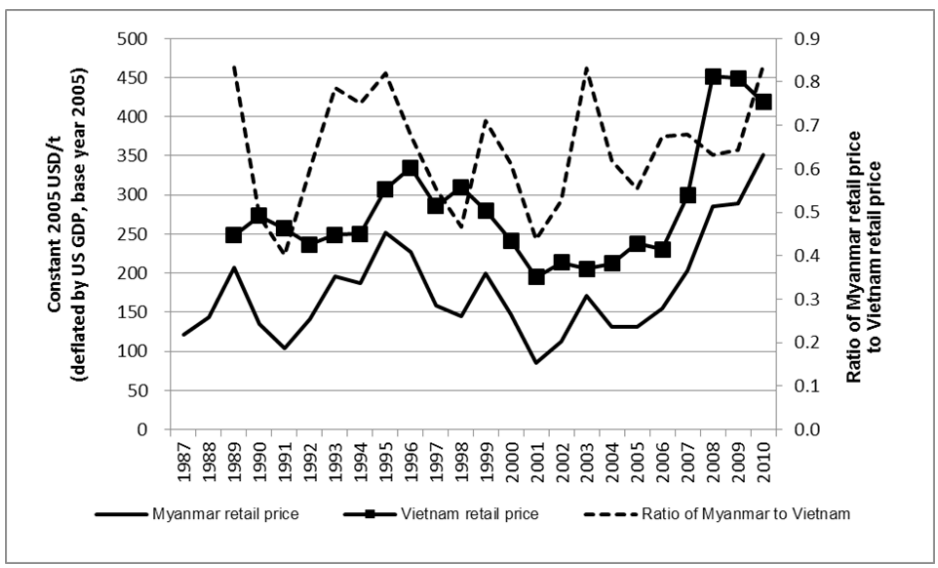
Comparison of the Level of Retail Rice Prices

The domestic retail rice prices of the two countries are compared in Figure 10. These prices are considered to represent prices at similar points in the marketing chain. The ratio of the Myanmar price to the Vietnamese price averaged 0.64 from 1989 through 2010.

It is true that the low rice price level in Myanmar might impede the yield growth through several channels. It aggravates the credit constraint of rice producers. It reduces the producers' profits and working capital. At the same time, the creditworthiness of producers could decline. These make it difficult for producers to increase their input, thus, yields would remain low. However, the difference in the absolute price levels does not deny the importance of technological progress in accounting for the widening yield gap between the two countries.

What is the prospect for Myanmar to compete with Vietnam in the global rice market? In both Myanmar and Vietnam, the retail prices in real USD terms increased sharply in the late 2000s. As discussed before, the price rise in

Figure 10. Comparison of retail rice prices, Myanmar and Vietnam, 1987–2010



Source: See Appendix Tables 3 and 4

13 To stabilize the domestic rice price, the Vietnamese government temporarily suspended permissions to export rice in 2008. Dawe (2009) argues that the rise in domestic price was due to speculations within the domestic market.

Vietnam was due to the transmission of the hike in the global cereal prices; in Myanmar, it was due to the autonomous currency appreciation. Given its poor postharvest technology and higher transportation costs, Myanmar requires ample margin to compete with other rice exporting countries. The sharp currency appreciation dampens the prospect for Myanmar to reemerge as a major rice exporting country.

EFFICIENCY OF PUBLIC INVESTMENT

The above analysis confirms that the large gap in rice yields between Myanmar and Vietnam in the past two decades had emerged in the absence of any clear changes in the repression on rice producers in both countries. This implies that the yield gap might be attributable to the differences in technological progress. On the other hand, technological progress such as the development of HYVs and irrigation hinges on public investments since they have the characteristics of public goods. This section sheds some light on the two countries' public investments that influenced technological progress, and discusses what determines the efficiency of public investments.

Amount of Public Investment

To check the scale of public investments in the agricultural sectors of Myanmar and Vietnam, Table 3 summarizes the indices of their public expenditure in the agricultural sector. In terms of percentage of GDP, Myanmar's public expenditure was around 0.7 percent, whereas Vietnam's was more than 1 percent. The corresponding figures for Indonesia and Thailand, on the other hand, are around 2 percent, so that the Vietnamese figure is relatively not high, more so that of Myanmar. Myanmar's proportion of agricultural sector expenditure to the total fiscal budget is higher than that of Vietnam. However, given that agricultural production accounts for the higher share in Myanmar's GDP, this figure does not necessarily indicate that the Myanmar government prioritized the agricultural sector in its budget allocation.

The fiscal budget for the agricultural sector can be classified into current and capital expenditures. Current expenditures include personnel costs of related government agencies, subsidies, and maintenance costs of the agricultural infrastructure. Capital expenditures include investments in agricultural infrastructure. In Vietnam, capital expenditure accounted for more than 70 percent of the total agricultural budget, the bulk of which was spent on irrigation development (World Bank 2000, 2005). The breakdown of Myanmar's capital expenditure was not available. However, given its smaller total fiscal budget, it is reasonable to presume that the total fiscal budget for irrigation in Myanmar was smaller in absolute terms compared with that of Vietnam.

There are two possible reasons for the

Table 3. Indices of agriculture-related government expenditure in Myanmar and Vietnam

	Myanmar (%)		Vietnam (%)	
	1992	2002	1992	2002
Agricultural budget				
Percentage of GDP	0.73	0.65	1.0	1.3
Percentage of total fiscal budget	6.6	10.4	5.4	5.2
Capital expenditure as share of total agricultural budget	40.7	60.4	76.5	76.8

Sources: CSO, *Statistical Yearbook*; World Bank (2000, 2005)

smaller fiscal budget for the agricultural sector, particularly irrigation investments, in Myanmar than in Vietnam. First, the fiscal revenues were smaller in Myanmar, hence, fiscal expenditures were also smaller. Second, the marginal return of irrigation investments might be lower in Myanmar than in Vietnam, so that the government allocated smaller resources for irrigation development. (More details on the marginal return of irrigation investment are discussed below in connection with the budget allocation system.)

Budget Allocation System

Fiscal decentralization might be related with the rate of return to irrigation investments. There are two economic rationales as to why more budget allocation to local governments might possibly enhance efficiency of public investments. First is information asymmetry between the central and local governments; when local governments have more abundant information on the local geography than the central government, the allocation of budget to local governments might lead to more efficient irrigation development. Second, when the budget allocation is combined with the delegation of revenue sources in terms of collection of irrigation fees from farmers, it provides an incentive for local governments to implement irrigation investments more effectively.

Myanmar and Vietnam starkly contrast in this regard. In Vietnam, the local government budget is 30–40 percent of the total fiscal budget, the highest among Southeast Asian countries. This places Vietnam among the ranks of federalist countries such as Australia and Germany (Vo 2005). The proportion of the local government budget for irrigation investment to the total fiscal budget is particularly high. Table 4 shows the breakdown of the irrigation-related budget of Vietnam's central and local governments from 1999 to 2002.[14] It is noted that the local government budget accounted for 50 percent of the total public investment in irrigation in 1999, and 78 percent in 2002.

Delegation of revenue sources to the local governments also differed considerably between the two countries. The irrigation fees in Vietnam (around USD 60 per hectare) were among the highest in Southeast Asia; the rate of collection was also high (Hussain 2005). Irrigation fees are one of the important revenue sources for local governments in Vietnam. In Myanmar, the regional branches of the central government (Irrigation Maintenance and Management Bureau, the Irrigation Department of the Ministry of Agriculture and Irrigation) collected the irrigation fees. In addition, the fee

Table 4. Delegation of budget from central to local governments in Vietnam, 1999–2002

	1999	2000	2001	2002
Budget for irrigation (billion VND)	3,241	3,620	4,678	4,211
Ministry of Agriculture and Rural Development	1,612	1,364	1,273	920
Local Governments	1,628	2,255	3,404	3,291

Source: Compiled from World Bank (2005, 91).

14 Data for this period only were available to the author.

had been fixed at MMK 10 per acre (equivalent to USD 0.02 per ha in 2007) for over a decade until 2007 (Matsuno, Horino, and Hatchou 2009).[15] This irrigation fee had been by far the lowest among Southeast Asian countries.

The high proportion of the local government budget for irrigation in Vietnam might be related with the peculiar characteristics of the country's irrigation development. The central government (Ministry of Agriculture and Rural Development) took charge of the large-scale primary canals, which extended across regions and provinces; the local governments (provincial or municipal) took charge of the smaller secondary and tertiary canals. Therefore, as irrigation development proceeded and the large-scale irrigation construction projects were completed, the proportion of the budget of local governments in charge of peripheral canal construction tended to have a higher share (World Bank 2005).

As for Myanmar, while quantitative data were not available, it is considered that the central government (Ministry of Agriculture and Irrigation) took charge of both primary and secondary canals, and the farmers bore the cost of tertiary canal construction (Fujita and Okamoto 2009; Matsuno, Horino, and Hatchou 2009). Allocation of budget to the local governments was minimal.

This conjecture is consistent with the data on the status of irrigation development given in Tables 1 and 2. The irrigated areas are not always suitable for growing rice in the dry season due to insufficient supply of water; the usable irrigated fields are often narrower than the designed irrigated fields. World Bank (2005) estimated that only 50–60 percent of Vietnam's irrigated fields are suitable for double cropping. As for Myanmar, only 15–36 percent of irrigated areas are used for double cropping as shown in Table 2. These suggest that the fiscal budget for irrigation was used more effectively in Vietnam than in Myanmar, and that the inefficient use of budget for irrigation, in turn, might have resulted in smaller allocation of budget for irrigation in Myanmar.

CONCLUSION

This paper investigated the reasons for the stagnant performance of Myanmar's rice economy in comparison with Vietnam for the past two decades. An examination of the rice prices and the terms of trade of producers showed that there has been no clear worsening trend in Myanmar, nor an improving trend in Vietnam. On the other hand, it is evident that rice production technology in terms of HYVs and irrigation has far advanced in Vietnam than in Myanmar. These suggest that the widening yield gap between the two countries might be attributable to technological changes rather than the changes in their rice price policies.

Due to their public goods nature, the elements of technological progress in rice production, (i.e., HYVs and irrigation) depend on public investments. Myanmar's public investments were less effective than those of Vietnam. This paper argued that allocating more fiscal budget to local governments would raise the marginal return to public investments. The extent of decentralization of fiscal budget for the agricultural sector is higher in Vietnam than in Myanmar. A policy implication for Myanmar is to allocate more agricultural budget to local governments, especially for irrigation development.

Finally, while the discussion in this paper implicitly assumed that Myanmar can spread irrigation in a similar extent as Vietnam has

15 In 2007, the irrigation fee was increased by 200 times to 1,950 kyat per acre (Matsuno, Horino, and Hatchou 2009). This was equivalent to USD 10 per ha, which was still lower than the fees in neighboring countries.

done, environmental conditions may not permit such development. Decision on public investments in irrigation should not be based on mere maximization of rice production as it used to be in Myanmar; it should take into account the social returns on public investments and the welfare of the national economy.

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REFERENCES

AGROINFO. various years. *Vietnam Rice Sector and Outlook*. Hanoi: Institute of Policy and Strategy for Agriculture and Rural Development.

CSO (Central Statistical Organization). various years. *Statistical Yearbook*. Yangon and Nay Pyi Taw: CSO, Ministry of National Planning and Economic Development, Myanmar.

———. various years. *Selected Monthly Economic Indicators*. Yangon and Nay Pyi Taw: CSO, Ministry of National Planning and Economic Development, Myanmar.

———. 2006. *Myanmar Agricultural Statistics (1992–93 to 2004–2005)*. Yangon: Central Statistical Organization in collaboration with Department of Agricultural Planning.

———. 2011. *Myanmar Agricultural Statistics (1997–98 to 2009–2010)*. Nay Pyi Taw: Central Statistical Organization in collaboration with Department of Agricultural Planning.

Dawe, David. 2009. "Cereal Price Transmission in Several Large Asian Countries during the Global Food Crisis." *Asian Journal of Agriculture and Development* 6 (1): 1–12.

Dawe, David, Sushil Pandey, and Andrew Nelson. 2010. "Emerging Trends and Spatial Patterns of Rice Production." In *Rice in the Global Economy: Strategic Research and Policy Issues for Food Security*, edited by S. Pandey, D. Byerlee, D. Dawe, A. Dobermann, S. Mohanty, S. Rozelle, and B. Hardy, 15–36. Manila: International Rice Research Institute.

Fan, Shenggen, and Philip G. Pardey. 1997. "Research, Productivity, and Output Growth in Chinese Agriculture." *Journal of Development Economics* 53 (1): 115–137.

FAO (Food and Agriculture Organization). various years. *FAOSTAT* database. Accessed July 15, 2013. http://faostat.fao.org/

Fujita, Koichi, and Ikuko Okamoto. 2009. "Overview of Agricultural Policies and the Development in Myanmar." In *The Economic Transition in Myanmar after 1988: Market Economy versus State Control*, edited by K. Fujita, F. Mieno, and I. Okamoto. Singapore: Kyoto University Press in association with NUS Press.

GSO (General Statistics Organization). various years. *Statistical Yearbook of Vietnam*. Hanoi: Statistical Publishing House.

Hussain, Intizar. 2005. "Pro-poor Intervention Strategies in Irrigated Agriculture in Asia." International Water Management Institute and Asian Development Bank. http://www.adb.org/water.actions/REG/IWMI-ADB-Final-Report-june-05.pdf

IMF (International Monetary Fund). *International Financial Statistics* online database. Accessed July 15, 2013. http://elibrary.imf.org/.

IRRI (International Rice Research Institute). 2013. *World Rice Statistics* Database. Accessed July 15, 2013. http://irri.org/index.php?option=com_k2&view=itemlist&layout=category&task=category&id=744&Itemid=100346&lang=en.

Kajisa, Kei, and Takamasa Akiyama. 2005. "The Evolution of Rice Price Policies over Four Decades: Thailand, Indonesia and the Philippines." *Oxford Development Studies* 33 (2): 305–329.

Kanwar, Sunil. 2006. "Relative Profitability, Supply Shifters and Dynamic Output Response, in a Developing Economy." *Journal of Policy Modeling* 28 (1): 67–88.

Kubo, Koji. 2013. "Real Exchange Rate Appreciation, Resource Boom, and Policy Reform in Myanmar." *Asian-Pacific Economic Literature* 27 (1): 110–126.

Luu, Thanh Duc Hai. 2003. *The Organization of the Liberalized Rice Market in Vietnam*. An Giang: An Giang University.

Matsuno, Yutaka, and Haruhiko Horino. 2009. "Impact of Irrigation Development Level on Dry-Season Rice Production: A Case in Southern Part of Lower Myanmar." *Kaihatsugaku Kenkyu* 19 (2): 15–23 [in Japanese].

Matsuno, Yutaka, Haruhiko Horino, and Nobumasa Hatchou. 2009. "Present Status and Prospect of Irrigation Management in Lower Plain of Myanmar." *The Japanese Society of Irrigation, Drainage, and Engineering Rural Annual Meeting Proceeding 2009,* 108–109 [in Japanese].

Myat Thein. 2004. *Economic Development of Myanmar*. Singapore: Institute of Southeast Asian Studies.

Nghiem, Hong Son, and Tim Coelli. 2002. "The Effect of Incentive Reforms upon Productivity: Evidence from the Vietnamese Rice Industry." *Journal of Development Studies* 39 (1): 74–93.

Nielsen, Chantal P. 2003. "Vietnam's Rice Policy: Recent Reforms and Future Opportunities." *Asian Economic Journal* 17 (1): 1–26.

Rosegrant, Mark W., Faisal Kasryno, and Nicostrato D. Perez. 1998. "Output Response to Prices and Public Investment in Agriculture: Indonesian Food Crops." *Journal of Development Economics* 55 (2): 333–352.

Takahashi, Akio. 1992. "A Rice Village in Burma Delta: Village Economy under the Rule of 'Socialism'." *IDE Research Series No. 423*. Tokyo: Institute of Developing Economies [in Japanese].

Tin Soe. 2004. "Myanmar in Economic Transition: Constraints and Related Issues Affecting the Agriculture Sector." *Asian Journal of Agriculture and Development* 1 (2): 57–68.

Tin Soe, and Brian S. Fisher. 1990. "An Economic Analysis of Burmese Rice-Price Policies." In *Myanmar Dilemmas and Options*, edited by Mya Than and J.L.H. Tan, 117–166. Singapore: Institute of Southeast Asian Studies.

Tran, Thi Ut, and Kei Kajisa. 2006. "The Impact of Green Revolution on Rice Production in Vietnam." *Developing Economies* 44 (2): 167–189.

UN COMTRADE (United Nations Commodity Trade). Statistics Database online. Accessed July 15, 2013. http://comtrade.un.org/db/.

USDA (United States Department of Agriculture). various issues. *Rice Outlook*. Economic Research Service, USDA. (various issues)

USDA. Production, Supply and Distribution Online database. Accessed July 15, 2013. http://www.fas.usda.gov/psdonline/

Vo, Duc Hong. 2005. "Fiscal Decentralisation in Vietnam: A Preliminary Investigation." *Working Paper No.05-16*. Australia: University of Western Australia.

World Bank. 2000. "Vietnam: Managing Public Resources Better: Public Expenditure Review 2000." *Report No. 21021-VN.* Washington, DC: World Bank.

———. 2005. "Vietnam: Managing Public Expenditure for Poverty Reduction and Growth: Public Expenditure Review and Integrated Fiduciary Assessment." *Report No. 30035-VN*. Washington, DC: World Bank.

———. 2007. *World Development Report 2008: Agriculture for Development*. Washington, DC: World Bank.

Appendix Table 1. Production statistics, Myanmar

Source	USDA[1]	CSO[2]	CSO[3]	CSO[3]	USDA[1]	CSO[2]	USDA[1]	CSO[2]	CSO[3]	CSO[3]	USDA[1]
	Planted Area				Paddy Production		Yield in Paddy				
	Annual Total ('000 ha)	Annual Total ('000 ha)	Wet Season ('000 ha)	Dry Season ('000 ha)	('000 t)	('000 t)	Annual Average (t/ha)	Annual Average (t/ha)	Wet Season (t/ha)	Dry Season (t/ha)	Milling Rate
1990	4,797	4,945			13,695	13,748	2.85	2.78			0.58
1991	4,524	4,830			12,800	12,993	2.83	2.69			0.58
1992	4,855	5,133			13,400	14,603	2.76	2.84			0.58
1993	5,443	5,674	4,804	870	15,086	16,495	2.77	2.91	2.84	3.26	0.58
1994	5,517	5,926	4,849	1,077	16,000	17,908	2.90	3.02	2.92	3.48	0.58
1995	5,666	6,137	4,917	1,221	17,000	17,670	3.00	2.88	2.77	3.31	0.58
1996	5,600	5,875	5,023	852	15,517	17,397	2.77	2.96	2.86	3.56	0.58
1997	5,600	5,785	4,898	886	15,345	16,391	2.74	2.83	2.75	3.31	0.58
1998	5,600	5,759	4,827	932	16,000	16,808	2.86	2.92	2.81	3.5	0.58
1999	6,000	6,284	5,152	1,132	17,000	19,808	2.83	3.15	3.06	3.59	0.58
2000	6,000	6,359	5,258	1,101	18,571	20,987	3.10	3.30	3.18	3.87	0.58
2001	6,200	6,451	5,287	1,163	18,000	21,569	2.90	3.34	3.23	3.84	0.58
2002	6,200	6,488	5,416	1,072	18,600	21,461	3.00	3.31	3.17	4.01	0.58
2003	6,300	6,543	5,435	1,108	18,500	22,770	2.94	3.48	3.35	4.11	0.58
2004	6,800	6,858	5,824	1,034	16,500	24,360	2.43	3.55	3.44	4.2	0.58
2005	7,000	7,389	6,237	1,152	18,000	27,246	2.57	3.69	3.56	4.37	0.58
2006	7,000	8,124	6,895	1,229	18,276	30,435	2.61	3.75	3.62	4.48	0.58
2007	7,085	8,090	6,821	1,269	18,500	30,954	2.61	3.83	3.72	4.39	0.64
2008	6,700	8,094	6,815	1,279	17,500	32,059	2.61	3.96	3.84	4.61	0.64
2009	7,000	8,067	6,779	1,288	18,191	32,166	2.60	3.99	3.88	4.57	0.64
2010	7,000	8,047			16,450	32,065	2.35	3.99			0.64
2011	6,500				16,900		2.60				0.64
2012	6,350				16,666		2.62				0.64

Sources: 1 USDA Production, Supply, and Distribution (PSD) Online;
2 General Statistical Organization (GSO), Statistical Yearbook
3 CSO Myanmar Agricultural Statistics

Appendix Table 2. Production statistics, Vietnam

Source	USDA[1]	GSO[2]	GSO[2]	GSO[2]	GSO[2]	USDA[1]	GSO[2]	USDA[1]	GSO[2]	GSO[2]	GSO[2]	GSO[2]	USDA[1]
	Harvested Area					Paddy Production		Yield in Paddy					Milling Rate
	Annual Average ('000 ha)	Annual Average ('000 ha)	Wet Season (Autumn) ('000 ha)	Wet Season (Winter) ('000 ha)	Dry Season (Spring) ('000 ha)	('000 t)	('000 t)	Annual Average (t/ha)	Annual Average (t/ha)	Wet Season (Autumn) (t/ha)	Wet Season (Winter) (t/ha)	Dry Season (Spring) (t/ha)	
1990	6,278	6,043	1,216	2,754	2,074	18,777	19,225	2.99	3.18	3.36	2.64	3.79	0.66
1991	6,490	6,303	1,382	2,760	2,161	22,179	19,622	3.42	3.11	3.41	2.94	3.14	0.66
1992	6,623	6,475	1,449	2,748	2,279	22,183	21,590	3.35	3.33	3.39	2.74	4.02	0.66
1993	6,643	6,559	1,549	2,687	2,324	24,317	22,837	3.66	3.48	3.64	3.04	3.89	0.66
1994	6,803	6,599	1,586	2,631	2,381	24,615	23,528	3.62	3.57	3.58	2.79	4.41	0.66
1995	7,124	6,766	1,742	2,602	2,421	26,792	24,964	3.76	3.69	3.73	2.97	4.43	0.66
1996	7,040	7,004	1,984	2,479	2,541	27,277	26,397	3.87	3.77	3.47	2.95	4.80	0.66
1997	7,377	7,100	1,885	2,532	2,683	28,930	27,524	3.92	3.88	3.52	2.99	4.96	0.66
1998	7,575	7,363	2,141	2,439	2,783	30,467	29,146	4.02	3.96	3.51	3.31	4.87	0.66
1999	7,660	7,654	2,341	2,424	2,890	31,706	31,394	4.14	4.10	3.74	3.52	4.88	0.66
2000	7,493	7,666	2,293	2,360	3,013	31,020	32,530	4.14	4.24	3.76	3.53	5.17	0.66
2001	7,471	7,493	2,211	2,225	3,057	31,873	32,108	4.27	4.29	3.77	3.73	5.06	0.66
2002	7,463	7,504	2,294	2,178	3,033	32,617	34,447	4.37	4.59	4.01	3.92	5.51	0.66
2003	7,468	7,452	2,320	2,109	3,023	33,458	34,569	4.48	4.64	4.05	3.96	5.57	0.66
2004	7,450	7,445	2,366	2,101	2,979	34,418	36,149	4.62	4.86	4.41	4.11	5.73	0.66
2005	7,314	7,329	2,349	2,038	2,942	34,503	35,833	4.72	4.89	4.44	3.96	5.89	0.66
2006	7,203	7,325	2,317	2,012	2,996	34,730	35,850	4.82	4.89	4.18	4.26	5.87	0.66
2007	7,412	7,207	2,204	2,016	2,988	36,932	35,943	4.98	4.99	4.60	4.36	5.70	0.66
2008	7,334	7,400	2,369	2,018	3,013	38,904	38,730	5.30	5.23	4.81	4.46	6.08	0.63
2009	7,415	7,437	2,358	2,018	3,061	39,989	38,950	5.39	5.24	4.75	4.48	6.11	0.63
2010	7,607	7,489	2,436	1,968	3,086	42,194	40,006	5.55	5.34	4.80	4.63	6.23	0.63
2011	7,740	7,651	2,585	1,970	3,097	43,443	42,325	5.61	5.53	5.16	4.67	6.39	0.63
2012	7,820					44,240		5.66					0.63

Sources: 1 USDA Production, Supply, and Distribution (PSD) Online
2 General Statistical Office (GSO), Statistical Yearbook

Appendix Table 3. Price statistics, Myanmar

Source	FAO[1]	CSO-SMEI[2]	FAO[1]	CSO-SMEI[2]	CSO-SY[3]	CSO-SY[3]		IMF[4]	UNCOM[5]	USDA[6]	IMF[4]
	Myanmar									Thailand	USA
	Export Volume ('000 t)	Export Volume ('000 t)	Export Price (Ave.) (USD/t)	Export Price (Ave.) (USD/t)	Whole-sale Price (MMK/50 kg bag)	Retail Price (MMK/Pyi)*	Exchange Rate MMK/USD**	Consumer Price Index (Base Year 2000)	Urea Import Price (USD/t)	Export Price (USD/t)	GDP Deflator Base Year 2005)
1987	303		126		46	5.04	30	6.5		219	64.8
1988	48		174		187	8.61	42	7.5		282	67.1
1989	168		230		349	15.31	50	9.5		306	69.6
1990	214	134	248		267	11.99	58	11.2	168	279	72.2
1991	183		217		275	13.80	84	14.8	168	302	74.7
1992	199	199	206	206	490	22.74	99	18.1	120	277	76.2
1993	263	261	165	168	867	38.93	120	23.8	122	248	77.9
1994	934	1,041	224	190	819	35.91	113	29.6	119	291	79.5
1995	354	354	219	221	1,164	51.06	117	37.0	191	329	81.4
1996	92	93	226	229	1,319	58.00	145	43.0	241	351	82.8
1997	28	28	213	214	1,386	62.64	220	55.8	173	315	84.4
1998	120	120	219	222	1,900	86.02	326	84.6	82	314	85.6
1999	54	55	190	189	2,556	127.06	345	100.1	93	255	86.8
2000	251	251	127	127	2,382	114.90	412	100.0	110	211	88.7
2001	939	939	119	119	2,366	112.25	680	121.1	104	179	90.7
2002	794	794	120	123	4,182	220.90	999	190.2	118	198	92.2
2003	388	168	142	136	6,991	317.09	926	259.8	147	203	94.1
2004	182	182	172	170	5,032	249.66	923	271.6	207	244	96.8
2005	180	180	207	207	6,596	314.85	1,122	297.0	259	292	100.0
2006	71	15	243	226	10,326	445.31	1,307	356.4	237	311	103.2
2007	359	359	254	280	12,884	585.26	1,274	481.1	284	334	106.2
2008	222	666	270	297	14,082	764.23	1,159	610.0	404	672	108.6
2009	250	818	277	311	16,146	714.40	1,058	619.2	333	576	109.5
2010	122	536	348	369	14,900	774.68	934	667.1	475	514	111.0
2011		707		378			801	700.3	503	559	113.3
2012									627	576	116.0

Sources: 1 FAO: exports of milled rice; weighted average export price in current US dollar, calculated by dividing the export amount by export volume

2 CSO Selected Monthly Economic Indicators: exports of rice, including broken rice; weighted average export price in current US dollar, calculated by dividing total export value by total export volume

3 CSO Statistical Yearbook: Emata 35% broken, average wholesale price at Yangon (price in 1987 was the controlled official price); Emata 35% broken, average retail price at Yangon

4 IMF: consumer price index, base year 2000; GDP deflator of the United States, base year 2005

5 UNCOMTRADE: weighted average price of urea (HS310210) exports to Myanmar

6 USDA: 100 percent Grade B, free on board Bangkok

Note: * 1 pyi is equivalent to 2.55718 liters

**Myat Thein (2004) showed a prevalent black market exchange rate of US dollar for the period 1987-1996; survey by a foreign mission in Myanmar for the period 1997-2011

Appendix Table 4. Price statistics, Vietnam

	FAO[1]	FAO[1]	USDA[2]	Luu[3]	Luu[3]	IMF[4]	IMF[4]
	Export Volume ('000 t)	Export Price (USD/t)	Export Price (USD/t)	Producer Price (VND/kg)	Retail Price (VND/kg)	Exchange Rate (VND/USD*)	CPI (2000=100)
1989	1,420	204		497	771	4,464	17.6
1990	1,624	188		833	1,279	6,483	23.9
1991	1,033	227		1,404	1,924	10,037	43.5
1992	1,946	215		1,427	2,020	11,202	59.9
1993	1,722	211		1,445	2,062	10,641	64.9
1994	1,983	214		1,523	2,179	10,966	71.1
1995	1,988	267		1,939	2,761	11,038	83.1
1996	3,003	285		1,822	3,057	11,033	87.7
1997	3,575	244	235	1,774	2,817	11,683	90.4
1998	3,730	273	272	2,198	3,516	13,268	97.8
1999	4,508	227	216	1,872	3,389	13,943	101.8
2000	3,477	192	174	1,708	3,032	14,168	100.0
2001	3,729	168	158		2,602	14,725	99.7
2002	3,241	224	177		3,005	15,280	103.8
2003	3,813	189	174		3,000	15,510	107.2
2004	4,063	234	218		3,235	15,746	115.6
2005	5,250	268	245		3,771	15,859	125.4
2006	4,642	275	254		3,798	15,994	134.8
2007	4,558	327	294		5,116	16,105	146.0
2008	4,735	612	462		7,991	16,302	179.8
2009	5,969	447	380		8,396	17,065	191.8
2010	6,886	472	405		8,645	18,613	209.5
2011			490			20,510	
2012			416				

Sources: 1 FAO: exports of milled rice; weighted average export price, calculated by dividing the export amount by export volume

2 USDA: 15 percent broken, free on board (Ho Chi Minh City)

3 Luu (2003): producer price in Cantho province, converted in terms of milled rice; retail price of ordinary rice in Cantho Province for the period 1989-2000; AGROINFO, retail price of ordinary rice in Cantho province for the period 2001-2010; consumer price index for the period 1989-1994

4 IMF: official exchange rate; consumer price index for the period 1995-2010, base year 2000