

Making the Rice Bowl Bigger: Agricultural Output and Rural Poverty in Thailand

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Abstract

This article examines agricultural output and rural poverty in Thailand, a transforming economy in which agriculture plays a shrinking but still important role. It analyzes the effectiveness of strategies to reduce poverty and increase output, while noting that these can exacerbate inequality. These strategies range from investing in human development, to agricultural research and development, to financial and trade policies. Strategies to minimize inequality without stifling growth are briefly covered. Also considered is the future of the Green Revolution: how can Thailand maintain technological progress and increases in total factor productivity while minimizing degradation of the environment?

I. Introduction

Thailand has experienced high GDP growth in the past several decades, changing from a low-income to middle-income country. This has been accompanied by an increase in agricultural output, which is both a cause and effect of GDP growth. Though agriculture has declined in relative importance in the economy, it remains an important means of reducing rural poverty, which is still a problem in Thailand. Income inequality means that though the incidence of poverty has decreased, the severity has increased at least in relative terms.

This paper examines strategies to increase agricultural growth in Thailand, with a specific focus on rural poverty reduction. These include investment in agricultural research and development, investment in machinery and other agricultural capital, increased cultivation of land, sustainable irrigation, and investment in human capital. Wise macroeconomic policies are important as well, though their effects can be complex. This paper also looks at other strategies for reducing rural poverty, including migration and a shift of employment to non-agricultural activities. In addition, the growing issue of environmental degradation is examined.

II. Brief Literature Review

There are various publications that have focused on examining Thai agriculture within the last 15 years, including among others Coxhead and Plangpraphan (1998), Krasachat (1999), Mundlak, Larson and Butzer (2004), and most recently, Suphannachart and Warr (2011).

Coxhead and Plangpraphan (1998) describe the changes in agriculture in the 1970s-1990s in Thailand. This was a period of remarkable economic growth and investment, but agriculture did not share in most of these gains and declined as a fraction of GDP. The authors emphasize that a decrease in the importance of agriculture is typical for countries experiencing fast growth and industrialization and is not a problem *per se*. However, they argue that helping the agricultural sector has implications for poverty reduction. For example, if migrant workers returned to rural areas from the cities, it could help alleviate urban unemployment. Yet workers are reluctant to return to rural areas because of the increased mechanization of agriculture. If agriculture were more significant in the economy, it could provide a “safety net” for economic slowdowns. The authors also model investment in agriculture and show that it largely depends on non-agricultural factors. For example, it decreases with increased investment in other sectors of the economy.

Krasachat (1999) showed that the growth in Thai agriculture in the 1960s-1990s was due to increases in cultivated land through deforestation but that this was unsustainable. Though economies of scale exist for all periods between 1972 and 1994, the coefficient of returns to scale has decreased. He states that there is still room for growth through increasing cultivated land but that technical advances will play a greater role in the future. In the past technical progress was low because of government policies such as tariffs and price controls. There was negative technical progress between 1972 and 1977. Technical progress in the following periods was positive but low.

Mundlak, Larson and Butzer (2004) argue that, while total factor productivity (TFP) was important in increasing Thai agricultural output during the Green Revolution of the 1960s and 1970s when technology was improving rapidly, today the major limitations in output growth are the availability of capital and land. They favor public investment in infrastructure and capital, as well as the relaxation of rules governing capital markets. According to their estimates, accumulations in capital, land, labor, and other factors accounted for 73 percent of agricultural output growth in Thailand between 1981 and 1995. They predict that major changes in technology will be less important in driving output growth. Instead, reducing constraints to the spread of available technology will be important in growth.

Suphannachart and Warr (2011) show that public investment in agricultural research and development (R&D) is effective in increasing agricultural productivity in Thailand by increasing TFP. The rate of return to investment was estimated to be 30 percent higher than that of a typical public investment. Part of this is due to a lack of private investment in agricultural science because of the challenge in profiting from it. Thus they recommend increasing investment in R&D and improved collaboration between domestic and foreign research agencies to improve productivity and thus output growth.

III. Empirical Background

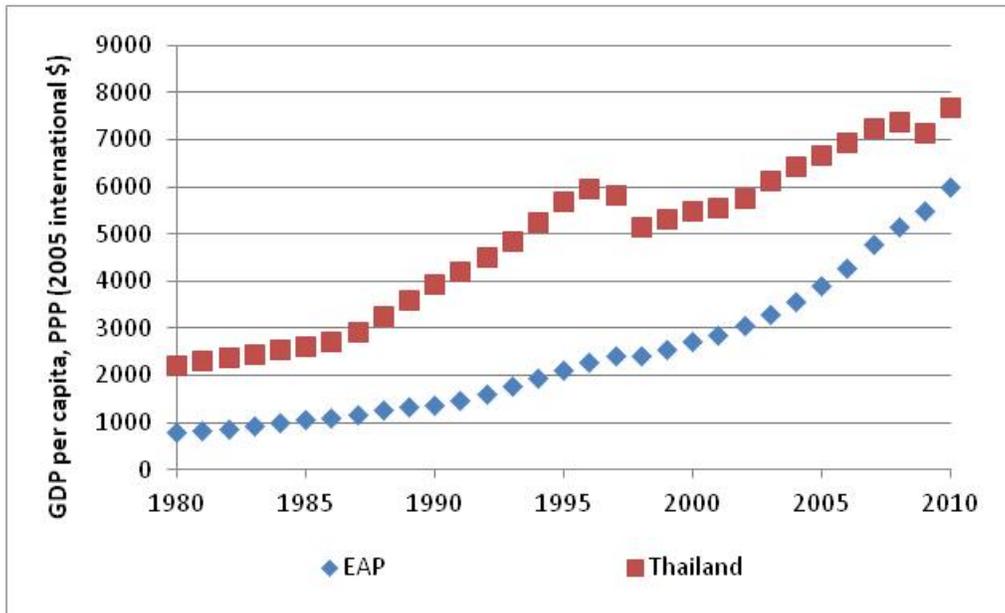
In the 1970s, the Green Revolution brought improvements in agricultural technology to the developing world, leading to great increases in agricultural productivity. In Thailand one of the most important changes was the introduction of modern varieties of rice. There was also a rise of

labor-saving technology: power tillers were introduced in the 1960s, mechanical threshers in the 1970s, and labor-reducing methods of planting in the 1980s. Between 1987 and 1998, total labor in most regions declined by half or more (Isvilanonda, Ahmad and Hossain, 2000). Agricultural growth increased in this time.

At the same time, the economy as a whole was booming, with an average GDP growth rate of 8.5 percent between 1970 and 1995 (World Bank, 2012). Thailand’s transition from a low- to middle-income country is a regional success story: the Philippines, for example, experienced little more than half this growth in the same time period. Though there were many factors in Thailand’s growth, agriculture was particularly important, accounting for over half of total growth between 1961 and 1967 (Mundlak et al., 2004).

As Figure 1 shows, since 1980, Thailand’s GDP per capita in purchasing power parity (PPP) has been significantly higher than the average in East Asia and the Pacific (EAP). Between the late 1980s and 1996, Thailand’s GDP per capita increased at a faster rate than the EAP average. There was a slight dip coinciding with the financial crisis of 1997, but growth recovered in 1999. GDP per capita has continued increasing since then, albeit at a lower rate.

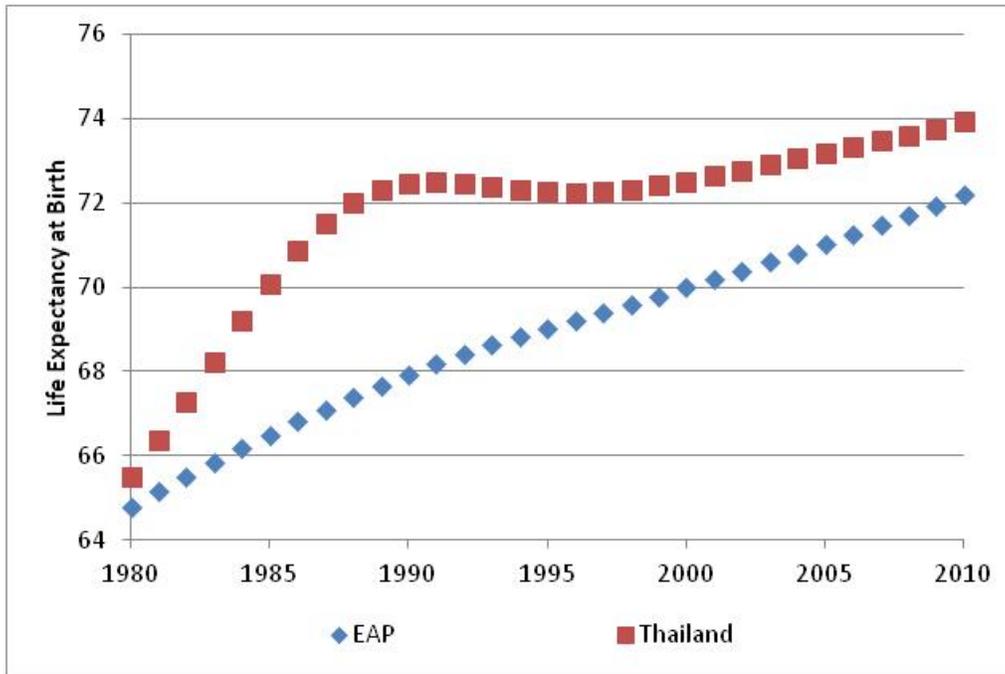
Figure 1: GDP per capita in Thailand and EAP, 1980-2010



Source: Created by author based on World Bank (2012).

In 1980, life expectancy in Thailand was 65 years, approximately the same as the average in EAP. However, it then increased dramatically during the economic boom of the 1980s, before leveling off and falling slightly in the early 1990s (see Figure 2). Life expectancy in the late 1980s significantly exceeded the average in the region, but the gap has narrowed since then.

Figure 2: Life Expectancy at Birth in Thailand and EAP, 1980- 2010



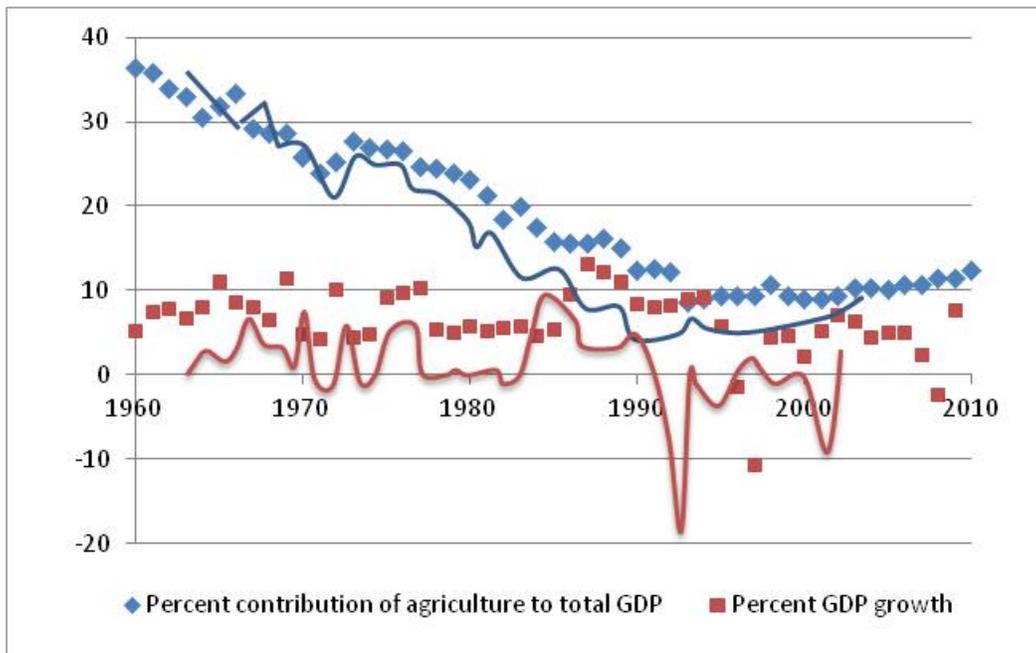
Source: Created by author based on World Bank (2012).

Figure 3 shows GDP growth and the contribution of agriculture to GDP between 1960 and 2010. Between 1960 and 1985 growth was volatile, fluctuating between about 5 and 10 percent and averaging 7.1 percent. In 1986 the country began experiencing a boom due to increased foreign direct investment as part of the “Asian economic miracle”. Growth peaked at 15.7 percent in 1987 and remained relatively high, until a financial crisis in 1997 plunged the country into a deep recession, with growth of -10.5 percent in that year. However, growth quickly recovered in the following year and remained moderately high during the 2000s, though with a mild recession due to the 2008 world economic slowdown.

The contribution of agriculture to GDP declined swiftly and steadily between 1960 and 1994 as the country became more industrialized. The decline leveled off in 1994 as the Asian miracle began to fall apart and the growth rate dropped. This suggests that the agricultural sector was not affected to the same degree by the crisis, as most of the capital had flowed to the industrial sector. In recent years agriculture has started to rise slightly as a percentage of GDP. In 2010, agriculture represented 12 percent of the Thai economy.

The number of rural poor has declined in Thailand. Between 1987 and 1998, poverty declined from 52.0 percent to 40.4 percent of the rural population. However, the intensity of poverty has increased, as measured by the poverty gap index and the squared poverty gap index (Isvilanonda, Ahmad and Hossain, 2000).

Figure 3: GDP Growth and Contribution of Agriculture to GDP in Thailand, 1960- 2010



Source: Created by author based on World Bank (2012).

IV. Discussion

IV. 1. Inequality in a Transforming Country

The 2008 World Development Report (WDR) describes the role of agriculture in three types of countries: agriculture-based, transforming, and urbanized. Thailand is best classified as a transforming country, one in which agriculture no longer represents a large portion of economic growth, but most of the poor live in rural areas. In 2010, 10.4 percent of the rural population was below the poverty line, compared to 3 percent of the urban population.

Inequality is common in transforming economies, particularly between rural and urban areas. Inequality increased between the 1980s and 1990s (Isvilanonda, Ahmad and Hossain, 2000), though it has since decreased. Thailand's Gini concentration coefficient was 40.0 in 2008, which is still relatively high for East Asia. The WDR's policy recommendations focus on providing pathways out of poverty for the rural population, while avoiding subsidies. They propose that transforming countries should facilitate migration to urban areas while also encouraging the expansion of industry to rural areas, as China has done. This appears to be happening in Thailand: non-farm activities (including labor, construction, and service industries) accounted for 34.3 percent of rural income in 1998.

Even those who do not work in these industries directly are affected, as remittances from family members represent a rising share of rural income. Remittances have a strong negative correlation (-0.46) with rural poverty. However, the rise of non-farm employment has not been evenly distributed in rural areas. Non-farm employment accounted for 30 percent of total inequality in 1998 (Isvilanonda, Ahmad and Hossain, 2000).

For the population that remains in farming, the WDR recommends a shift to high-value crops. Again, this is in progress in Thailand. Non-rice crops (including water chestnuts, vegetables, mulberry trees, soybeans, and sugarcane) have increased as a share of income. In 1987 they represented 20.5 percent of rural income. By 1998 that had increased to 34.5 percent. However, the rise in these profitable crops has contributed to regional inequality. Shortages of water in the northeast region mean that farmers cannot devote much land to high-value crops. Non-rice crops are more common in the central plains. High-value crops contribute the most to inequality, accounting for about half of total inequality in 1998 (Isvilanonda, Ahmad and Hossain, 2000).

IV.2. Factors Affecting Agricultural Output Growth and Rural Poverty

Agricultural growth is key to reducing poverty in developing countries. Chien, Sukprasert and Thaipakdee (2011) tested whether agricultural growth led to overall economic growth, or vice versa. They found that there is a virtuous cycle between agriculture and GDP, with each contributing to the other. The impact of agriculture on economic growth is 0.142, and the impact of economic growth on agriculture is with 1.535 about ten times higher.

Several papers have analyzed the impact of different variables on agricultural output growth. One that has been the subject of much focus is total factor productivity (TFP). Particularly during the Green Revolution, increases in TFP were important as technology improved. Suphannachart and Warr (2011) emphasize the importance of TFP in minimizing environmental impacts and making good use of scarce natural resources. They found that TFP accounted for 20.74 percent of crop output growth between 1971 and 2006. However, they do not show how TFP has changed as a share of output over time. As Mundlak et al. (2004) argue, TFP was more important in the 1960s and 1970s when high-yielding varieties of crops were first introduced. In more recent decades, capital and inputs such as fertilizer have been the main limiting factors in agricultural output growth. They find that TFP accounted for 34 percent of growth between 1961 and 1980, and 27 percent of growth between 1981 and 1995. The growth of TFP has been slowing: from 1.27 percent annually between 1971 and 1981, to 0.87 percent annually between 1981 and 1995.

The slowdown in TFP progress suggests an opportunity for increased investment in agricultural research and development. Suphannachart and Warr (2011) analyze the impact of these investments and finds that they are cost-effective. The marginal internal rate of return is found to be 29.5 percent, better than that of most public spending. In the short run, TFP increases by 0.16 percent for every 1 percent increase in agricultural research spending. In the long run, the increase is 0.07 percent, an effect that is lasting. In addition to domestic research, foreign research produces long-term increases in TFP. The authors recommend increasing cooperation between Thai and foreign agricultural research, which is currently minimal.

Several other variables also affect TFP growth. State variables, including capital availability and product demand, affect technology implementation. They accounted for 89 percent of TFP between 1981 and 1995 (Mundlak et al., 2004). As discussed below, capital also influences output growth directly. The effect of market forces on productivity and output is demonstrated by the increase in TFP associated with an agricultural commodity boom (Suphannachart and Warr, 2011). However, the elasticity of agricultural output with prices is small: 0.034 (Mundlak et al., 2004). Another important state variable is infrastructure (Suphannachart and Warr, 2011; Mundlak et al., 2004). The adoption of modern varieties of rice provides an example of how resource availability affects technology implementation. Though modern varieties have a moderate impact on poverty, with a correlation of -0.45, their spread has been constrained by lack of irrigation (Isvilanonda,

Ahmad and Hossain, 2000). Limitations on land have also been a constraint on the spread of new technology (Mundlak et al., 2004). Mundlak et al. (2004) recommend investments in infrastructure and liberalizing capital markets to increase the availability of technology. However, Suphannachart and Warr (2011) find no evidence that trade openness has a statistically significant effect on TFP.

Capital accumulation accounted for 73 percent of output growth between 1981 and 1995, an increase from the previous decade. The marginal rate of return for capital is 20 percent, and the elasticity is 0.415 (Mundlak et al., 2004). However, the correlation between household non-land assets and rural poverty is weak, with a regression coefficient of -0.036 (Isvilanonda, Ahmad and Hossain, 2000).

Land is another important factor in growth, but quality is at least as important as quantity. Irrigated land is more than twice as productive as rain-fed land (Mundlak et al., 2004). Owning land *per se* is not correlated with a reduction in poverty, but irrigation has a strong negative correlation with poverty (-0.70) (Isvilanonda, Ahmad and Hossain, 2000). However, it appears that the marginal value of irrigated land on output is less than that of rain-fed land, because the elasticity is lower (0.132 compared to 0.248) (Mundlak et al., 2004).

Labor has declined in importance in agriculture with the rise of labor-saving techniques. Though modern varieties of rice are more labor-intensive, mechanization has more than made up for their increase in demand for labor. In addition, new planting techniques saved labor (Isvilanonda, Ahmad and Hossain, 2000). Between 1970 and 1995, demand for labor grew more slowly than output did. The elasticity of labor is fairly low: 0.144 (Mundlak et al., 2004).

IV.3. Macroeconomic Factors

Macroeconomic policies, including financial, trade, and monetary policy, can significantly affect agriculture. In most cases, macroeconomic instability is predicted to decrease production. For example, the effect of inflation on production is negative. In Thailand, inflation has a particularly strong effect, with an elasticity of -0.323, compared to -0.104 in the Philippines (Mundlak et al., 2004).

The effects of financial instability, particularly exchange rate volatility, on agricultural markets are less clear. On the one hand, if producers are neutral or positive toward risk, then changes in the exchange rate can have a positive effect on exports, because they can wait for favorable terms of trade to sell their products. On the other hand, many agricultural products are perishable, so producers are risk-averse. Thus, May (2010) concludes that it seems more likely that exchange rate volatility would decrease agricultural exports. May (2010) models the effects of exchange rate volatility on exports of five important agricultural commodities: maize, rice, rubber, sugar, and tapioca. As predicted, fluctuations in exchange rates decreased export volume and value. This was shown to be due to a shift to selling in the domestic market rather than international markets, not because of an overall decrease in productivity. Exporters are thus hurt more by exchange rate volatility. If the rural poor own small farms that mainly produce for domestic markets, they will not be significantly affected by exchange rate volatility.

One of the major policy decisions for developing countries is whether to have a floating or fixed exchange rate. An exchange rate pegged to that of a trading partner can provide more stability but only if the business cycles of the countries are in sync. Otherwise, significant imbalances can result. In addition, fixed exchange rates are vulnerable to speculation, as demonstrated by the 1997

Thai financial crisis, which forced the country to switch from a fixed to floating exchange rate. However, floating exchange rates are often more volatile, due to political pressures and bad monetary policy. Because agriculture is a risk-averse industry, a fixed exchange rate seems to provide the greatest benefit.

Another macroeconomic variable with complex effects is global food prices. Though increases in food prices may be expected to help farmers, especially given that Thailand is a net food exporter, they can also harm poor consumers, who tend to spend a large portion of their budget on food. The effects on household expenditures are even more complicated than they appear at first glance, because demand and prices for other consumer goods shift with changes in food prices. The effects on profits are also complex and can vary between industries. Increases in food prices are assumed to cause greater agricultural output, which leads to higher demand for unskilled labor, increasing input costs for other industries (Warr, 2008). However, Mundlak et al. (2004) find that the elasticity of agricultural output with prices is low (0.034).

Between 2003 and 2008, both nominal and real prices increased for several agricultural commodities and inputs. The real prices of major Thai agricultural exports (rice, sugar, and cassava) increased by 62-212 percent. For Thai imports (maize, soybeans, wheat, petroleum, and urea), the increase was even greater, ranging from 124-316 percent. The rise in export prices increased GDP and total household consumption in all three cases but also increased the poverty incidence. This is shown to be because the rise in prices hurts households. Though farm owners benefit from the increased returns to land, farm workers, small business owners, and all other rural and urban groups are harmed, so the net effect is negative.

It was estimated that the 211 percent rise in rice prices led to an increase in poverty from 13.7 percent of the total population to 14.1 percent, or 240,000 people. As expected, increases in import prices also increase poverty. The increase in the prices of maize, soybeans, and wheat increases household expenses, while the increase in the price of agricultural inputs, urea and petroleum, decreases profit for farmers. However, the effect size for crops other than rice is not as large, because they are not as nationally important. In total, price increases increased poverty incidence by 0.68 percent of the population (Warr, 2008). Because rises in global food prices have been common in recent years, it is important for the Thai government to recognize the negative effects this has on the poor. The fact that Thailand is a net food exporter is no reason for complacency.

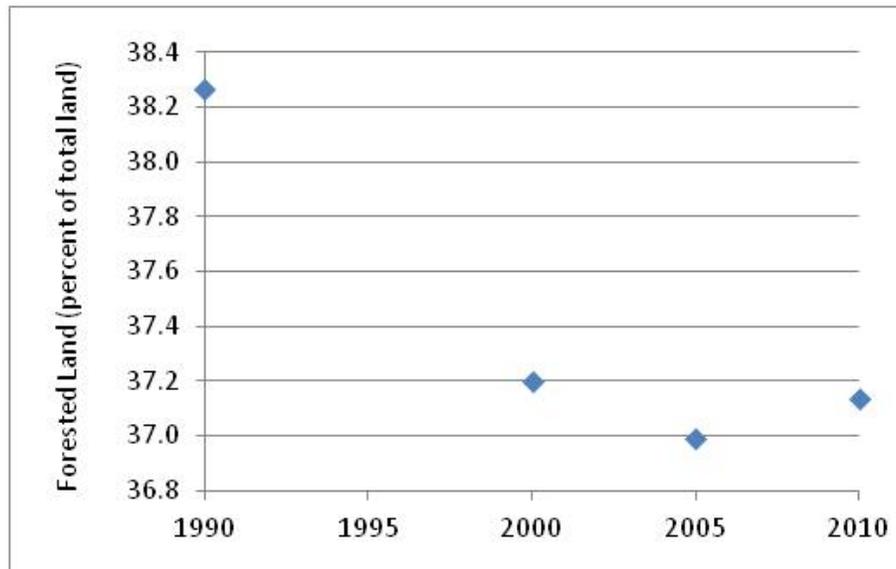
IV.4. Environmental Degradation

Many of the technologies of the Green Revolution, though beneficial to production, result in environmental degradation. These include pesticides, fertilizers, and mechanization, which decrease soil quality and biodiversity and result in contamination of food and water. Between 1963 and 2003, the percentage of farmers using only chemical fertilizers increased from 8 percent to 35 percent. Meanwhile, the percentage of farmers using only organic fertilizers decreased from 26 percent to 7 percent. Between 1978 and 2003, the percentage of farmers using chemical pesticides increased from 45 percent to 74 percent (Jiang et al., 2007). Though agricultural output increased between the 1960s and 1980s, this was due to an increase in cultivated land, not intensification. In fact, crop yields per unit of land began to decrease in the early 1980s because of a decline in soil quality (Phantumvanit and Sathirathai, 1988).

Another important form of environmental degradation has been deforestation, which has been a problem throughout the twentieth century. Between 1961 and 1986, the percentage of forested land

in Thailand declined from 53 percent to 19 percent. About 80 percent of this was due to the conversion of forestland to farmland (Phantumvanit and Sathirathai, 1988). The percentage of forested land continued to decline dramatically between 1990 and 2005, though it has recovered somewhat since then (Fig. 4).

Figure 4: Forested land area in Thailand (as percent of total land), 1990-2010



Source: Created by author based on World Bank (2012).

Thai environmental policy has been improving in recent years. In the Ninth National Development Plan in place between 2002 and 2006, the government emphasized sustainable agriculture. One example of a success story has been the introduction of fruit trees, vegetables, and flowers to local farmers. The diversity of species grown by farmers has greatly increased, and farming is now less dependent on rice. This not only improves the health of the land but also decreases risk to farmers (Jiang et al., 2007). Also, as noted above, non-rice crops are often more valuable and can reduce poverty. On the other hand, high-value crops such as vegetables, herbs, flowers, ornamental plants, and orchard trees use the most fertilizer per unit area (Jiang et al., 2007).

However, this may be outweighed by their higher value. According to very rough calculations¹, one dollar of rice requires 0.11 kilograms of pesticide. A dollar of lettuce, a common crop in Thailand, requires 0.06 kilograms of pesticide. Thus some high-value crops may be more efficient, though more detailed calculations are needed. Fertilizer use per unit land area decreases consistently with farm size (Jiang et al., 2007). It is unclear why this is the case. It may be that larger farms take advantage of economies of scale, but it is also possible that larger farms grow different crops. To decrease the impact of chemical pesticides and fertilizers, Jiang et al. (2007) recommends a switch to more disease- and insect-resistant crops that do not require as much

¹ Calculations are based on the following sources: <http://data.worldbank.org/indicator/AG.YLD.CREL.KG>; <http://www.indexmundi.com/commodities/?commodity=rice&months=60>; <http://www.ces.ncsu.edu/depts/hort/hil/hil-11.html>; http://www.ams.usda.gov/mnreports/hc_fv020.txt

fertilizer. This is perhaps a role for genetically modified (GM) crops. They also recommend soil improvement and crop rotation to lessen land degradation.

One opportunity to promote sustainable agricultural practices is strengthening property rights. Without formal ownership of land, farmers do not have incentive to invest in their current farmland. Instead, they continually abandon land and cultivate new land through deforestation. They also may be unable to properly invest in their land because they cannot take out loans to purchase fertilizer and other resources, due to lack of collateral (Phantumvanit and Sathirathai, 1988). There is empirical evidence that ownership of land leads to more sustainable practices, because farmers have more interest in long-term benefits. There is a negative correlation between land ownership and chemical fertilizer use (Jiang et al., 2007).

Though proper incentives can help improve environmental quality, due to the externalities involved in land degradation, Jiang et al. (2007) recommend that the Thai government and NGOs should subsidize sustainable land management. For example, this can be done by offering subsidized credit to farmers practicing sustainable techniques, as well as tax reductions and credits for inputs in sustainable techniques. In addition, improved infrastructure, communication, and training can promote the spread of sustainable practices.

V. Conclusion

Thailand is in many ways a typical transforming economy. It has made the transition from a low- to middle-income country and is now in the process of industrialization. Agriculture has declined in importance and today only contributes 12 percent to GDP. However, it can still be an important driver of GDP growth and reducing rural poverty.

This paper has demonstrated the tradeoffs that exist in agricultural policy. First, what is good for output growth may not be good for the poor. This is demonstrated by the rise in global food prices, which benefits agricultural producers but is shown to increase poverty on net, because consumers must spend more of their budget. Even in a country that is a net food exporter, rising food prices are a concern. Second, what is good for some of the poor may not be good for inequality. Non-farm jobs are an important path out of poverty for many, but their benefits have been unequally distributed and have led to a rise in inequality. High-value crops are also an important source of income but have mainly benefited certain regions. Inequality is a particular concern in transforming economies, so it is important to design policies that minimize it. Third, what is good for agricultural output and the rural poor in the short term may not be good for the environment. The Green Revolution was powered by technologies such as chemical fertilizer and pesticide that can harm the environment. These may decrease the productivity of land in the long term.

Fortunately, certain policies address multiple issues. For example, it is possible to help both the environment and the rural poor by strengthening property rights, which gives farmers incentives to invest in their current land instead of cultivating new land. Targeted subsidies can also help the rural poor, while encouraging responsible environmental practices. Thailand has been a success story, and with the right policies it can achieve sustainable prosperity.

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