Land Reform, Market Adjustment, and Rice Market Growth in Vietnam

Thanapan Laiprakobsup* & Sunisa Chorkaew

Abstract

Vietnam is in transition in terms of economic development. Its economic sectors have seen incredible growth for decades, including agriculture. Vietnam's rice sector has increasingly expanded for decades regarding production and exports, while the country has experienced structural adjustment and policy reform, such as land reform. This article examines the production and trade effect of policy reform on the rice sector in Vietnam from 1976 to 2014. Using ordinary least squares model and marginal effects, the study found that policy reform has a positive effect on rice production and exports in Vietnam. Moreover, it was found that the Doi Moi macroeconomic reform has had a strong and positive effect on rice exports. This result shows that policy transition contributes to an increase in rice production and exports.

Key words: land reform, Doi Moi, rice production, rice exports, Vietnam.

Introduction

Vietnam is one of the emerging markets that is in a transitional period. Its economy has gradually grown for decades. Its gross domestic product (GDP) has increased at 6 percent on average since 1990 (World Bank, 2017), and its economic structure has shifted from an agricultural-based to a manufacturing-based economy. In 2015, manufacturing represented approximately 33 percent of its GDP, while agriculture was approximately 16 percent of its GDP (World Bank, 2017). Not only has its economy transitioned, but Vietnam has also shifted its policy to be more liberal since the late 1980s. Since the implementation of the Doi Moi, Vietnam has initiated a series of policy shifts, including structural adjustment, abandonment of tax barriers, and exposure to free trade agreements, and this series of policy shifts has contributed to the country's economic growth, including the rice sector. Although Vietnam's economy has relied less upon agriculture, it has become one of the top 25 largest food exporters in the world (Worldatlas, 2017). Agriculture is significant to Vietnam's economy, and rice is the most significant agricultural commodity for Vietnam in terms of exports. According to Vietnam's real GDP in 2017, the agricultural sector was the third largest economic sector in Vietnam. Its GDP (214,853 billion VND) was only smaller than the manufacturing (243,971 billion VND) and service (522,339 billion VND) sectors (Trading Economics, 2017). Rice exports were approximately 40 percent out of Vietnam's total agricultural exports. The country has been one of the top rice exporters in the world for decades and has transformed itself from a rice-importing to a rice-exporting country.

Scholars have indicated a close association between the growth of the agricultural market and policy reform, especially policy liberalization (Anderson & Martin, 2009; Laiprakobsup, 2014b). Nonetheless, previous work has usually focused on examining the association between policy reform (especially market liberalization) and agricultural growth in more open political contexts. Examination of the impact of policy reform on the growth of the agricultural market in emerging markets with close political regimes such as that in Vietnam has received some attention (Griffin, 2016; Lawry et al., 2017). Unfortunately, scholars did not systematically examine the direct effect of policy reform on agricultural productivity, production, and exports. This paper examines the

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impact of policy reform on the agricultural sector, especially the rice sector, in Vietnam. It argues that policy reform (i.e., land reform) has had a positive impact on rice production and exports in Vietnam. Since the government has decided to distribute land tenure rights to farmers, farmers now have an incentive to increase their productivity, which contributes to an increase in the country's rice production and exports. Ordinary least squares and marginal effects models are employed to examine the effects of macroeconomic policy reforms on agricultural productivity, production, and exports. This paper is organized as follows. The second section reviews the literature on policy reform, especially regarding market reform and growth in agricultural policy shifts in developing countries. The third section then reviews the rice policy, rice production, and exports in Vietnam. The fourth section explains the data, the variables, and the method used in this paper. The fifth section represents the findings, while the sixth section discusses and concludes the paper.

Policy reform and growth of agricultural production and market

The agricultural market and production in developing countries have increasingly grown, and the growth of the agricultural market in these countries has occurred in the midst of agricultural policy shifts. Scholars have indicated that the government in several developing countries has shifted its policies from imposing all forms of taxes to abandoning tax barriers (Anderson & Martin, 2009; Laiprakobsup, 2014b). The policy shift in agriculture is due in part to the macroeconomic policy reform in developing countries. First, developing countries have decided to structurally adjust their market system by reducing tariffs on exportable commodities (Anderson, 2009). Second, the governments have abandoned the commodity price control of the domestic market, and have relied more on a market price system (Anderson & Martin, 2009). Third, they have abandoned foreign exchange control on exportable commodities so that producers are able to sell their commodities in accordance with market prices. For instance, Thailand and Malaysia have not imposed foreign exchange control on agricultural export commodities since 1997 (Siamwalla & Setboonsarng, 1991; Athukorala & Loke, 2009). A series of reforms have given incentive to domestic producers and foreign investors to increasingly produce and invest more in the market. The agricultural market in developing countries is positively affected by macroeconomic policy reform. The abandonment of tax barriers and controls regarding exportable agricultural commodities has encouraged the growth of agricultural exports in developing countries. Exporters are encouraged to export more commodities to new markets because fewer taxes are imposed on them by the government. Further, the abandonment of agricultural price control has encouraged the growth of agricultural production in developing countries – farmers and producers are encouraged to produce more commodities because they are able to sell their commodities at the market price. Examining the trade impact of the abandonment of rice export tax and other trade restrictions in Thailand, Laiprakobsup (2012) finds that the abandonment contributes to the growth of Thai rice exports by 236,593.08 metric tons in the first month after the abandonment.

Previous research indicated a close association between agricultural policy reform and an agricultural market shift in developing countries. Gulati and Pursell (2008), for example, indicated that agricultural production and exports have increasingly grown since governments decided to pursue market reform and trade liberalization in the 1990s in India. Lopes et al. (2008) pointed out the positive association between trade reform in the 2000s and the growth of agricultural exports in Brazil. Having studied the effect of trade openness in Southeast Asian countries, Laiprakobsup (2014b) argued that trade openness pursued by governments has contributed to the liberalization of the agricultural market and the growth of the agricultural market in Southeast Asia.

Scholars usually concentrated on countries whose political regimes were in transition to democracy and more open political regimes, such as Indonesia and the Philippines (Laiprakobsup, 2014a). However, agricultural policy reform has also occurred in politically restricted countries. Authoritarian governments in some developing countries have pursued agricultural policy reform, such as the abandonment of tax barriers and land tenure, and these policy reforms were initiated by a dominating political party. Vietnam is an example of a developing country whose political regime is authoritarian, and the regime has initiated policy reform. More importantly, the rice market has grown during the 1990s-2000s (i.e. policy reform) (Athukorala et al., 2009). Figure 1

illustrates that Vietnam's food and rice exports have steadily grown since 1986. Policy reform (i.e., land reform and structural adjustment) encourages producers and exporters to increase their productivity and exports since the government abandons restrictions and barriers that previously discouraged them from producing and exporting. Three main hypotheses are made to examine whether policy reform is positively associated with the growth of the rice market in Vietnam.

H_1: The effectiveness of land reform leads to the growth of paddy rice productivity.

H_2: The effectiveness of land reform leads to the growth of milled rice production.

H_3: The effectiveness of structural adjustment leads to the growth of the rice exports in Vietnam.
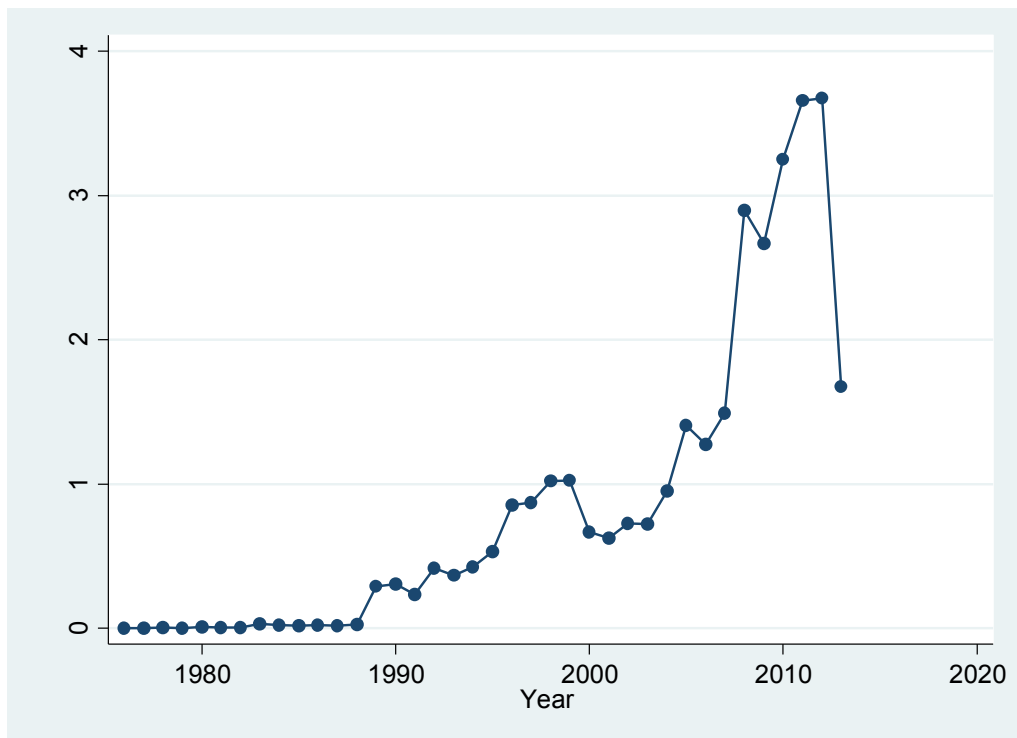

Figure 1: Trend of rice export

Source: FAO 2017

Rice policy, rice production, and rice exports in Vietnam

After the Vietnam War, Vietnam's rice policy can be divided into three periods. **The first period (1977-1987)** was the government control period, where the economy was centrally planned by the Vietnamese Communist Party (Gavagnin et al., 2016). The government imposed several types of policy restrictions on the rice market. Having been influenced by socialist ideology, the government strictly controlled rice production and exports. Concerning rice production, the rice farmers were allowed by the government to harvest, but they were not given land tenure or the rights to farmland. Due to the collectivist policy, farmers were only allowed to sell their rice to the government, not to the market. In other words, farmers did not have private property rights to land or to their commodity. Regarding rice prices, the government strictly controlled the paddy

rice price (i.e., farm-gate price) in order to lower the price of rice in the domestic market for consumers. The government imposed a high protective tariff on imported commodities in order to protect state enterprises and domestic industries. It imposed several types of taxes and premiums on rice exports in order to accrue foreign exchange and revenue from the rice sector (Athukorala et al., 2009). Farmers were affected by the government's policy in that they did not have incentive to increase or develop their productivity.

However, in the early 1980s there was a sign of policy reform initiated by the government. In 1981, the government implemented the "output contract system," which allowed farmers to keep their remaining production and sell it to the market after delivering the agreed production quota to the government (Gavagnin et al., 2016). Moreover, the program led to the allocation of plots of land to individual farmers and production delivery quotas, based on the average yield over previous years (Giesecke, Tran, Corong, & Jaffee, 2013; Gavagnin et al., 2016)

The second period (1988-2000) was the beginning of the market reform period. After the government declared the Doi Moi in 1988, it continuously generated and implemented a series of policy reforms in the rice market. First, the government implemented a land reform policy in the mid and late 1990s, and it began to implement the Land Law policy in 1993, which gave land rights to farmers for 20 years (Marsh & MacAulay, 2006; OECD, 2015). Then, the government revised the law in 1998, 2001, and 2003. The new Land Law gave land tenure to farmers, and allowed farmers to exchange, sell, lease, mortgage, and inherit land (Gavagnin et al., 2016; Marsh & MacAulay, 2006; OECD, 2015). Second, the government established a government assistance fund in order to provide loans and subsidies for rice farmers (OECD, 2015). One of the most important policies was the decision to recognize the family as the basic unit of agricultural development (Gavagnin et al., 2016; Menon, Rodgers, & Kennedy, 2017). The farmers were allowed to own their production. In 1993, the government generated loans and credits for farmers' families. Third, the government relaxed taxation and the quota restrictions on rice exports by reducing the tax rate on rice exports and giving larger rice export quotas to private companies (OECD, 2015). Moreover, the government began to use a price support policy in order to support the price of paddy rice and to increase farmers' income and encourage them to maintain their productivity.

Nonetheless, the government retained some restriction of the rice market in this period. First, the government established a Price Stabilization Fund in order to control the prices of important commodities such as rice and coffee (OECD, 2015). Second, it established state enterprises (i.e., VINAFOOD I and II) for controlling the export of agricultural commodities, especially rice, in 1995. They were VINAFOOD I (located in Hanoi) and II (located in Ho Chi Minh City). Having been authorized to export rice, private companies had to be members of VINAFOOD I or II. In other words, rice exports were controlled by the government.

The third period (2001-present) was the internationalization and liberalization of the rice market. Due to its commitment to the international trade agreement regarding trade liberalization (WTO and ASEAN), the government increasingly abandoned export taxes and export quotas on rice, and it structurally reformed the state enterprises in that it decreased its shares in VINAFOOD I and II. In 2016, the government decided to reduce its shares in VINAFOOD II to 51 percent (Vietnam Investment Review, 2013). This decision encouraged private enterprises to become the owners of state-owned companies. Moreover, the role of VINAFOOD in rice exports seemed to decline. In 2012, the percentage share of Vietnam's rice exports was 34 percent of total rice exports.

However, the government's policy of industrialization negatively affected agriculture (Thanh et al., 2015). The country's economy increasingly relied on manufacturing exports, and the government wanted to transition to an industrialized economy. The exposure to the international market led Vietnam to transform agricultural land to factories, industrial parks, and urban cities (Gavagnin et al., 2016), and this transformation aggravated the conflict between the state and farmers.

The rice situation in a comparative perspective

The rice productivity of Vietnam has increased since 1970. In 1970, the average rice yield was about 21,534 kilograms per hectare while the average rice yield in 2015 was 57,200 kilograms per hectare (FAO, 2017). Compared to Thailand, Vietnam's productivity was better than its counterpart. Figure

1 illustrates that, on average, Vietnam's rice productivity in 2015 was about 60,000 kilograms per hectare, while Thailand's rice productivity was only about 28,000 kilograms per hectare. The figure shows that Vietnam was able to increase its rice productivity, while Thailand struggled to increase its productivity.
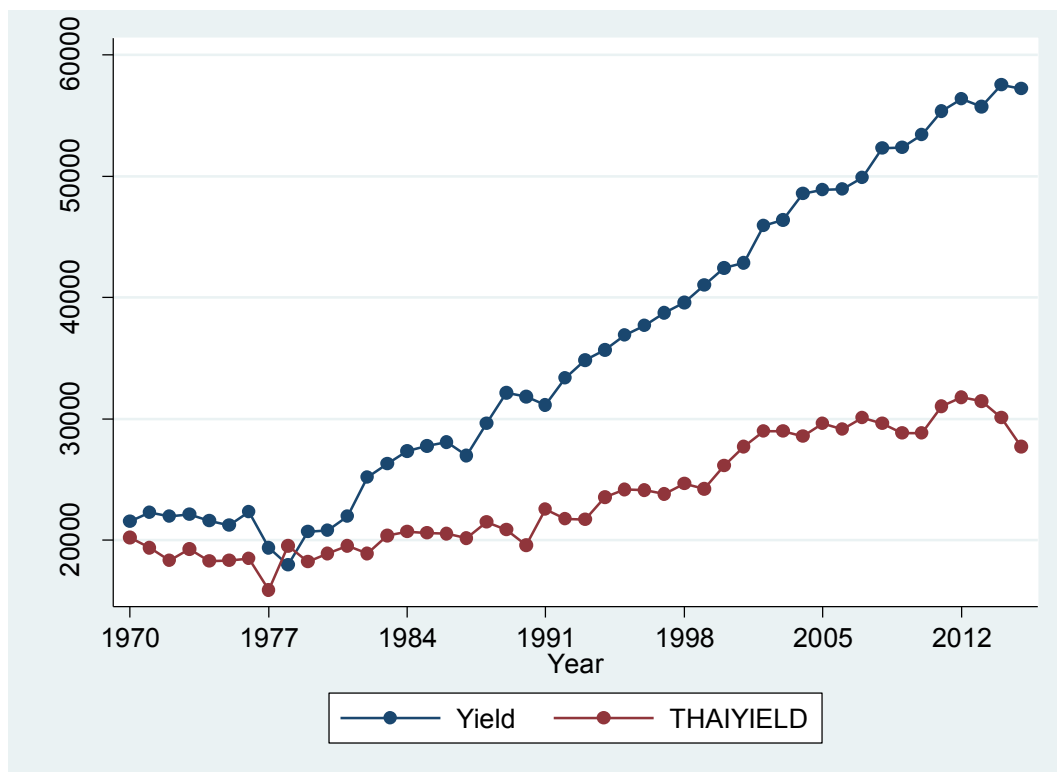

Figure 2: Comparison of rice yield of Vietnam and Thailand, 1970-2015

Source: FAO 2017

Regarding the production of rice, Vietnam has increased its production for several decades. In 1970, its production was about 10 million tons, while its production increased to 44 million tons in 2014. During the 1970s and 1980s, Vietnam struggled to increase its production to more than 15 million tons. However, it was able to increase its production to more than 20 million tons in 1992 (4 years after the Doi Moi). Compared to Thailand, Vietnam produced rice more than its competitor. Figure 2 shows that in 2014 Vietnam's rice production was about 44 million tons, while Thailand's rice production was about 10 million tons in 2013. This indicates that Vietnam was able to increase its rice production, while Thailand struggled to increase its production during these years.
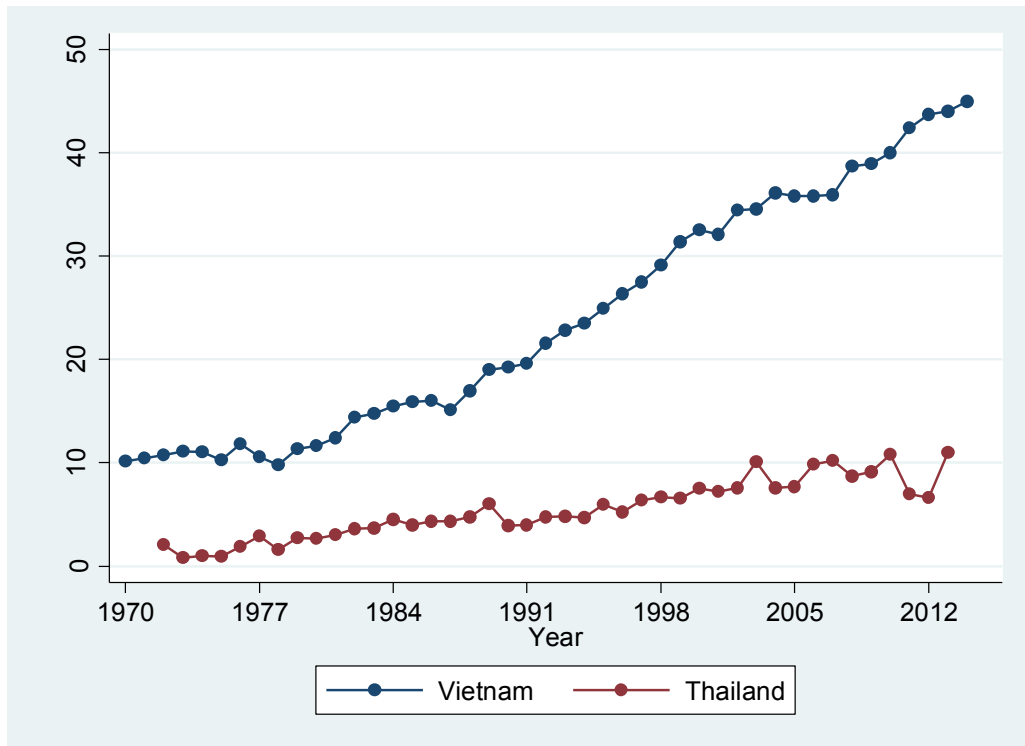
Figure 3: Comparison of rice production of Vietnam and Thailand, 1970-2014

Source: FAO 2017

Vietnam's rice exports have gradually increased since 1970. Vietnam exported only about 18,000 tons then, while it exported about 6 million tons. From the 1970s to 1980s, Vietnam exported only 100,000 tons. The turning point was 1989 (1 year after the Doi Moi), when Vietnam first exported more than 1 million tons. It has exported more than 1 million tons since then. This shows a sharp increase in rice exports of Vietnam over the last four decades. In 1970, Thailand exported over 1 million tons of rice to the world market. In 2014, Thailand exported more than 9 million tons, while Vietnam exported more than 6 million tons.
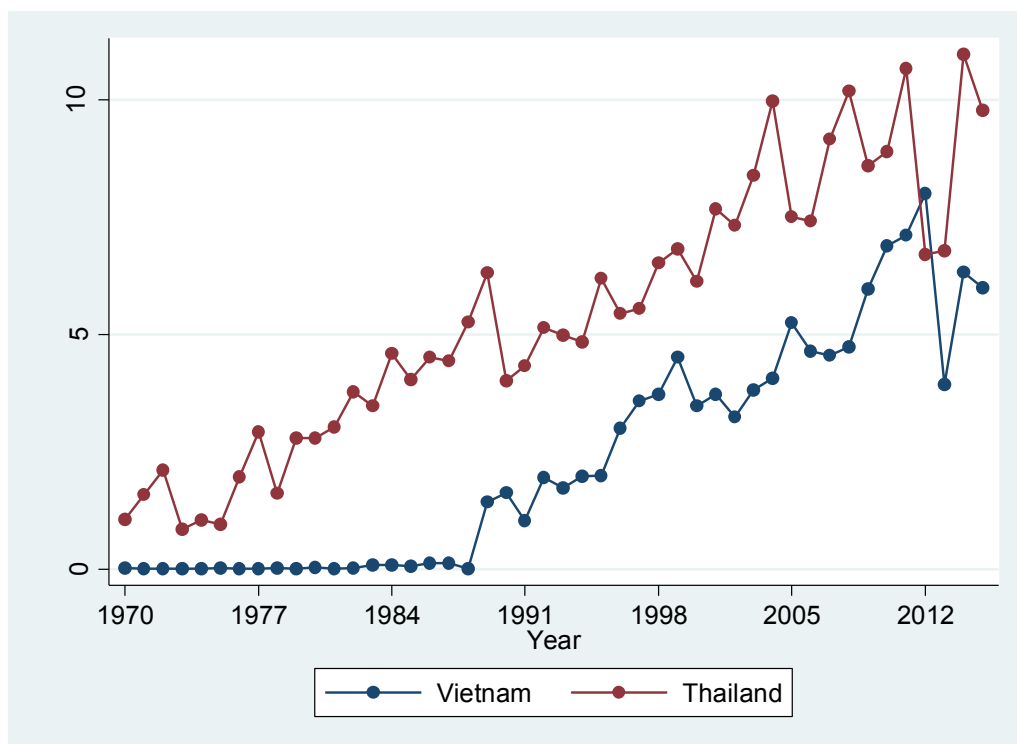
Figure 4: Comparison of rice exports of Vietnam and Thailand, 1970-20144

Source: FAO 2017

Data, variables, and methods

Three dependent variables were used to measure the rice production and exports in Vietnam. The first dependent variable was the log average yield of paddy rice from 1970 to 2015. It measured the average yield of paddy rice of Vietnam in each year (FAO, 2017). The second dependent variable was the log average of milled rice production from 1970 to 2015. It measured Vietnam's milled rice production on average in each year (FAO, 2017). The third dependent variable was the log average of rice exports of Vietnam from 1970 to 2015. It measured Vietnam's rice exports on average in each year (FAO, 2017). Table 1 summarizes the descriptive statistics of the dependent variables. On average, Vietnam's rice yield was 35,911 kilograms per hectare, while Vietnam's rice production was 23.90 million tons. Vietnam exported 2.37 million tons, on average.

Table 1: Descriptive statistics of Vietnam's rice productivity, production, and exports

Dependent Variables	Observation	Mean	Standard Deviation	Minimum	Maximum
Yield	46	35911.09	12675.65	17922	57538
Production[1]	45	23.90	11.61	9.79	44.97
Export[2]	46	2.37	2.44	0.002	8.01

Note: 1. Unit is million tons; 2. Unit is million tons

Independent and control variables

Three independent variables were employed to measure land and policy reform. To operationalize and test the first and second hypothesis, two dummy variables were employed to measure the effect of land reform on rice productivity and production in Vietnam. The Vietnamese government implemented land distribution and rights for 20 years in 1993 (Marsh & MacAulay, 2006). Then, the government revised the law in 1998 (Marsh & MacAulay, 2006). Therefore, the effectiveness of land reform took place in 1993 and 1998. We created two dummy variables to capture the effectiveness of land reform. The first variable was LLI, capturing the effectiveness of land reform since 1993, while the second variable was RLL, capturing the effectiveness of land reform since 1998 (Marsh & MacAulay, 2006). We put 1 for the year that the government effectively implemented land reform. Otherwise, we put 0. A positive association between LLI and rice yield and production was expected. Similarly, a positive association between RLL and rice yield and production was expected.

In order to operationalize and test the third hypothesis, one dummy variable was employed to measure the effect of policy reform on rice exports in Vietnam. The Doi Moi is considered the beginning of policy reform of Vietnam and was first initiated in 1988 in order to pursue market liberalization (Athukorala et al., 2009). Since then, the government has continuously pursued a series of market liberalizations, such as the abandonment of protective tariffs, state control over the domestic market, and the structural reform of state-owned enterprises. We created a dummy variable, namely DoiMoi, to capture its effectiveness since 1988. We put 1 for the year that the government effectively implemented the Doi Moi. Otherwise, we put 0. A positive association between the Doi Moi and rice exports was expected.

Rice production and exports can be affected by a government's policies. To control for the effect of policy factors, the government's decision to subsidize (or tax) the rice sector was included. When a government subsidizes the rice sector, farmers have more incentive to increase their productivity. However, when it heavily taxes farmers, they are discouraged from increasing their productivity since the more they harvest, the more tax burdens they have to bear. The nominal rate of assistance (NRA) to the rice sector was employed to capture the government's decision to subsidize (or tax) this sector (Anderson, 2009). As Laiprakobsup (2014a, p. 8) explained the NRA, "It measures the extent to which the government sets the domestic producer price above (or below) the border (i.e., export) price (Anderson & Martin, 2009). The positive NRA percentage indicates that the government is likely to transfer revenues to the producers. In other words, the positive percentage implies that the government subsidizes the agricultural commodity sector in year t." On average, the NRA for the rice sector was -1.68, which indicates that Vietnam still had imposed taxes on the rice sector during all these years. A positive association between the NRA and rice production and exports was expected.

In addition, in order to control for the effect of policy factors, the government's decision to subsidize (or tax) agriculture was included. Once a government heavily supports agriculture, farmers have more incentive to increase their productivity. However, when it heavily taxes farmers, they are discouraged from increasing their productivity. The nominal rate of assistance (NRA) to agriculture was employed to the capture government's decision to subsidize (or tax) agriculture (Anderson, 2009). Similar to the rice sector, the NRA for agriculture was -0.04, which indicated that Vietnam had still taxed agriculture during all these years. A positive association between NRA and rice production and export was expected.

Subsidization of the non-agricultural sector could affect the growth of that sector. The government could accrue revenue from the rice sector and allocate revenue to other sectors. In developing countries, governments are likely to tax agriculture and transfer the tax revenue to other economic sectors, such as the manufacturing sector (Laiprakobsup, 2010; Varshney, 1995). This means that farmers are more likely to be taxed. Due to a high level of taxes, they are discouraged from increasing their production, while exporters are discouraged from exporting more commodities. We used a nominal rate of assistance for the non-agricultural sectors in order to capture the government's decision to subsidize (or tax) the non-agricultural sectors (Anderson, 2009). On average, the nominal rate of assistance for non-agriculture was 0.05. This indicates that Vietnam was more likely to support non-agriculture sectors. A negative association between rice

production and exports and the NRA for non-agricultural sectors was expected.

In order to control for the effect of the political factor, political regime was included. Political liberalization leads to the growth of the agricultural market via abandoning tax barriers. Previous work has indicated that political regimes have had a positive impact on agriculture. Laiprakobsup (2014a, 2014b), for example, pointed out that democratic regimes are more likely to subsidize agriculture, while authoritarianism is more likely to tax agriculture. Elected politicians often promise farmers that they will reduce taxes and provide more government assistance (Olper & Raimondi, 2013). We used the Freedom House index to measure the political characteristics in Vietnam. This index ranges from 1 (the most free society) to 7 (the least free society). A negative association between the Freedom House index and rice production and exports was expected to be found.

Table 2: Description and operationalization of variables and expected sign

Variables	Description	Operationalization	Expected Results
LLI	The effectiveness of land reform since 1993	Dummy 0 = Ineffectiveness 1 = Effectiveness	+
RLL	The effectiveness of land reform since 1998	Dummy 0 = Ineffectiveness 1 = Effectiveness	+
DoiMoi	The effectiveness of macroeconomic reform since 1988	Dummy 0 = Ineffectiveness 1 = Effectiveness	+
Nrarice	The nominal rate of assistance (NRA) to the rice sector	Nominal Index (See Anderson, 2009)	+
Nraagri	The nominal rate of assistance (NRA) to the agricultural sector	Nominal Index (See Anderson, 2009)	+
Nranonagri	The nominal rate of assistance (NRA) to the non-agricultural sector	Nominal Index (See Anderson, 2009)	-
liberty	Freedom of expression	The Freedom House Index 1 = most free 7= least free	-

Source: authors' compilation

In examining the effects of the policy reform and other factors, ordinary least squares (OLS) was employed. Misspecification tests were used to examine the validity of the statistical inferences. The tests were heteroskedasticity (White, 1980), the Ramsey RESET for omitted variables (Ramsey, 1969), the variance inflation factor for multicollinearity, the Lagrange Multiplier (LM) test for serial correlation (Breusch, 1978; Goffrey, 1978), and the Durbin-Watson for autocorrelation (Durbin & Watson, 1950). Moreover, we used Akaike's information criterion (Akaike, 1973) and the Bayesian information criterion (Schwarz, 1978) to measure which model performed better in terms of predicting the effect of policy reform on rice production and exports. Models 1, 2, and 3 examined the effect of policy reform on the rice yield in Vietnam. Models 4, 5, and 6 examined the effect of policy reform on the rice production in Vietnam, and Model 7 and 8 examined the effect of policy reform on the rice exports in Vietnam.

Results

Policy reform and rice productivity

Table 2 shows the statistical results from models 1, 2, and 3. All of the models performed very well in terms of predicting the effect of policy reform on rice productivity. The joint F-statistics were statistically significant at $p < 0.01$, which indicates that the explanatory variables jointly had a significant impact on the rice yield of Vietnam. The joint F-statistics were statistically significant at $p < 0.01$, which indicates that the explanatory variables jointly had a significant impact on rice productivity. The adjusted R^2 statistics indicated that all of the models were able to predict the change in the dependent variable well. According to the AIC and BIC statistics, model 2 seemed to be the best model to explain the effect of all the explanatory variables on rice yield.

As expected, the land and policy reform variables (i.e., LLI, RLL, and Doimoi) had a positive effect on rice yield. The LLI, RLL, and Doimoi variables were statistically significant at $p < 0.05$. Holding other factors constant, a unit increase in the LLI score was associated with the increase of 3,263.34, 3,636.91, and 3,491.62 ton points of rice yield in Vietnam, respectively (see table A1 in the appendix). Meanwhile, holding other factors constant, a unit increase in the RLL score was associated with the increase of 3,076.88, 3,575.84, and 3,289.31 kilogram points of rice yield in Vietnam, respectively (see table A1 in the appendix). The effectiveness of the Doi Moi had a positive impact on rice productivity in Vietnam. Holding other factors constant, a unit increase in the Doimoi score was associated with the increase of 3,276.57, 3,086.46, and 3,172.68 ton points of rice yield in Vietnam, respectively (see table A1 in the appendix).

Table 3: Effect of land and policy reform on rice productivity in Vietnam (Dependent variable = rice yield (natural log))

Variables	Model 1	Model 2	Model 3
LLI	0.109** (0.038)	0.11*** (0.033)	0.112** (0.389)
RLL	0.086** (0.04)	0.097** (0.039)	0.091** (0.038)
Thai yield (log)	0.472 (0.286)	0.412* (0.22)	0.424 (0.291)
Nraagri	-0.037 (0.102)		
Nranonagri		-0.078 (0.02)	
Nrarice			-000 (0.001)
Liberty	-0.063 (0.050)	-0.073*** (0.023)	-0.061 (0.049)
Doimoi	0.119*** (0.038)	0.111** (0.039)	0.114** (0.041)
Constant	5.972* (3.112)	6.653** (2.310)	6.442* (3.150)
N	20	24	19
Standard Error of Regression	0.621	0.960	0.541
Adjusted R^2	0.942	0.961	0.938
F-Statistics	53.24***	94.36***	46.60***
Durbin-Watson	2.16	2.12	2.22
LM ($\chi2(1)$)	2.003	2.928*	2.494
RESET	0.86	0.19	0.27
White ($\chi2(1)$)	0.00	0.01	0.01
VIF	5.47	5.37	4.38
AIC	-63.49	-79.99	-60.32
BIC	-56.52	-71.74	-53.71

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The numbers in parentheses are standard errors (S.E.). VIF stands for variance inflation for the independent factors. Briefly, if the value of the mean VIF is lower than 10, then the models are less likely to be affected by the multi-collinearity problem.

The misspecification tests are shown in F-statistic terms. In model 1, the Lagrange multiplier (LM) first-order serial correlation was 2.003 (with a p-value of 0.18), while the Ramsay RESET result was 0.86 (with a p-value of 0.49). White's heteroskedasticity test result was 0.00 (with a p-value of 0.99). The result of the Variance Inflation for the Independent Factors (VIF) test was 5.47. In model 2, the LM statistics was 1.24 (with a p-value of 0.08), while the RESET result was 0.19 (with a p-value of 0.90). White's test result was 0.01 (with a p-value of 0.91), and the result of the VIF test was 5.37. In model 3, the LM statistics was 2.49 (with a p-value of 0.13), while the RESET result was 0.27 (with a p-value of 0.84). White's test result was 0.01 (with a p-value of 0.90), and the result of the VIF test was 4.38. Even though the LM statistics in model 2 was significant at $p < 0.10$, the omitted variable problem weakly affected the model. The misspecification tests showed that none of the models was plagued by misspecification problems.

The marginal effects of land and policy reform on the rice productivity in Vietnam were calculated over the range of the other control factors in order to better understand the extent to which the land and policy reform affected the rice productivity in Vietnam. Table 3 indicates that the predicted size of the rice yield was likely to increase when land and policy reform was effectively implemented. All marginal-effects coefficients were statistically significant at $p < 0.01$. When a government initiated land reform and gave land tenure to rice farmers, productivity was more likely to increase.

Table 4: Marginal effects of land and policy reform on predicted rice productivity (Unit: kilograms per hectare)

Independent Variables	Model 1	Model 2	Model 3
LLI	0 = 35,503.93*** 0.5 = 37,135.6*** 1 = 38,767.27***	0 = 37,258.10*** 0.5 = 39,076.56*** 1 = 40,895.02***	0 = 34,826.91*** 0.5 = 36,572.73*** 1 = 38,318.55***
RLL	0 = 36,394.35*** 0.5 = 37,923.79*** 1 = 39,471.23***	0 = 38,046.33*** 0.5 = 39,834.29*** 1 = 41,622.17***	0 = 35,820.31*** 0.5 = 37,464.96*** 1 = 39,109.61***
Doimoi	0 = 34,676.18*** 0.5 = 36,314.47*** 1 = 37,952.76***	0 = 37,004.99*** 0.5 = 38,548.22*** 1 = 40,091.46***	0 = 34,193.44*** 0.5 = 35,799.78*** 1 = 37,366.12***

Note: *** $p < 0.01$. Coefficients are marginal effects coefficients. 0 = Policy reform is not effective; 0.5 = Policy reform is partly effective; 1 = Policy reform is fully effective.

Policy reform and rice production

Table 4 shows the statistical results for models 4, 5, and 6. All of the models performed very well in terms of predicting the effect of policy reform on rice productivity. The joint F-statistics were statistically significant at $p < 0.01$, which indicates that the explanatory variables jointly had a significant impact on the rice yield of Vietnam. The joint F-statistics were statistically significant at $p < 0.01$, which indicates that the explanatory variables jointly had a significant impact on rice production. The adjusted R^2 statistics indicated that all of the models were able to predict the change in the dependent variable well. According to the AIC and BIC statistics, model 5 seemed to be the best model to explain the effect of all explanatory variables on rice yield.

As expected, the land and policy reform variables (i.e., LLI, RLL, and Doimoi) had a positive effect on rice production. The LLI, RLL, and Doimoi variables were statistically significant at $p < 0.05$. Holding other factors constant, a unit increase in the LLI score was associated with the increase of 5.46, 5.60, and 5.38 million ton points of rice production in Vietnam, respectively (see table A2 in the appendix). Meanwhile, holding other factors constant, a unit increase in the RLL score was associated with the increase of 5.26, 6.01, and 5.25 million ton points of rice production in Vietnam, respectively (see table A2 in the appendix). The effectiveness of the Doi Moi had a positive impact on rice productivity in Vietnam. Holding other factors constant, a unit increase in the

Doimoi score was associated with the increase of 3.51, 3.54, and 3.19 million ton points of rice production in Vietnam, respectively (see table A2 in the appendix).

Table 5: Effect of land and policy reform on rice production in Vietnam (Dependent variable = rice production (natural log))

Variables	Model 4	Model 5	Model 6
LLI	0.248*** (0.049)	0.245*** (0.046)	0.242*** (0.389)
RLL	0.190** (0.063)	0.220*** (0.061)	0.192** (0.063)
Thai production (log)	0.176 (0.157)	0.118 (0.131)	0.199 (0.157)
Nraagri	-0.101 (0.187)		
Nranonagri		-0.111 (0.189)	
Nrarice			-001 (0.001)
Liberty	-0.096 (0.055)	-0.072** (0.033)	-0.087 (0.058)
Doimoi	0.201*** (0.059)	0.189*** (0.062)	0.179** (0.067)
Constant	16.95*** (0.499)	16.898*** (0.383)	16.875*** (0.515)
N	20	24	19
Standard Error of Regression	1.531	2.073	1.395
Adjusted R^2	0.939	0.952	0.935
F-Statistics	49.82***	77.49***	44.33***
Durbin-Watson	1.83	1.86	1.83
LM ($\chi2(1)$)	1.582	2.427	1.620
RESET	0.37	1.10	0.40
White ($\chi2(1)$)	0.57	0.48	0.23
VIF	3.70	4.07	3.21
AIC	-44.19	-56.94	-41.41
BIC	-37.22	-48.69	-34.80

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The numbers in parentheses are standard errors (S.E.). VIF stands for variance inflation for the independent factors. Briefly, if the value of the mean VIF is lower than 10, then the models are less likely to be affected by the multi-collinearity problem.

The misspecification tests are shown in F-statistic terms. In model 4, the Lagrange multiplier (LM) first-order serial correlation was 1.582 (with a p-value of 0.25), while the Ramsay RESET result was 0.37 (with a p-value of 0.77). White's heteroskedasticity test result was 0.57 (with a p-value of 0.44). The result of the Variance Inflation for the Independent Factors (VIF) test was 3.70. In model 5, the LM statistics was 2.47 (with a p-value of 0.12), while the RESET result was 1.10 (with a p-value of 0.38). White's test result was 0.48 (with a p-value of 0.48), and the result of the VIF test was 4.07. In model 6, the LM statistics was 1.62 (with a p-value of 0.25), while the RESET result was 0.40 (with a p-value of 0.76). White's test result was 0.23 (with a p-value of 0.68), and the result of the VIF test was 3.21. The misspecification tests showed that none of the models was plagued by misspecification problems.

We also used the marginal effects to predict the effect of land and policy reform on rice production in Vietnam. Table 5 indicates that the predicted size of rice production was likely to increase

when land and policy reform was effectively implemented. All marginal-effects coefficients were statistically significant at p < 0.01. The more likely the reforms were to be fully effective, the more likely was the production to increase. When a government initiated land reform and gave land tenure to rice farmers, the production was more likely to increase. Similarly, Vietnam's rice production had increased since the Doi Moi was effectively implemented.

Table 6: Marginal effects of land and policy reform on predicted rice productivity (Unit: million tons)

Independent Variables	Model 4	Model 5	Model 6
LLI	0 = 22.40*** 0.5 = 25.13*** 1 = 27.86***	0 = 23.89*** 0.5 = 26.69*** 1 = 29.48***	0 = 34,826.91*** 0.5 = 36,572.73*** 1 = 38,318.55***
RLL	0 = 23.84*** 0.5 = 26.47*** 1 = 29.11***	0 = 24.85*** 0.5 = 27.85*** 1 = 30.86***	0 = 35,820.31*** 0.5 = 37,464.96*** 1 = 39,109.61***
Doimoi	0 = 22.79*** 0.5 = 24.54*** 1 = 26.30***	0 = 24.60*** 0.5 = 26.38*** 1 = 28.14***	0 = 34,193.44*** 0.5 = 35,799.78*** 1 = 37,366.12***

Note: *** $p < 0.01$. Coefficients are marginal effects coefficients. 0 = Policy reform is not effective; 0.5 = Policy reform is partly effective; 1 = Policy reform is fully effective.

Policy reform and rice export

Table 6 shows the statistical results for models 7 and 8.[1] All of the models performed very well in terms of predicting the effect of policy reform on rice export, even though the prediction power was not equal to that of models 1-6. The joint F-statistics were statistically significant at p < 0.01, which indicates that the explanatory variables jointly had a significant impact on the rice yield of Vietnam. The joint F-statistics were statistically significant at p < 0.01, which indicates that the explanatory variables jointly had a significant impact on rice exports. The adjusted R2 statistics indicated that all of the models were able to predict the change in the dependent variable well. According to the AIC and BIC statistics, model 7 seemed to be the best model to explain the effect of all explanatory variables on the rice yield.

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1   Unlike what we tested, the effect of policy and land reform on rice productivity and production, we decided to include the NRA for all agricultural sectors and the NRA for the rice sector in model 7 and 8. We decided to exclude the NRA from the non-agricultural sectors and the NRA for the rice sector. The main reason was that we faced misspecification problems (omitted variable and heteroskedasticity) when we ran the statistical models similar to what we did with rice productivity and production. In addition, we faced misspecification problems when we included the NRA for the non-agricultural sector and the NRA for the rice sector in the model. Therefore, we had to adjust the statistical models from what we did for rice productivity and rice production.

Table 7: Effect of land and policy reform on rice export in Vietnam (Dependent variable = Rice export (natural log))

Variables	Model 7	Model 8
LLI	1.344** (0.519)	
RLL		0.975 (0.738)
Thai export (log)	1.323 (1.799)	0.896 (2.115)
Philippine import (log)	-0.005 (0.075)	0.029 (0.084)
Nraagri	-1.618 (1.88)	-1.026 (2.196)
Liberty	-0.263 (0.624)	0.067 (0.736)
Doimoi	1.797** (0.688)	2.201** (0.785)
Constant	-7.016 (30.268)	-2.865 (0.786)
N	20	20
Standard Error of Regression	29.114	29.114
Adjusted R^2	0.650	0.532
F-Statistics	6.88***	4.61**
Durbin-Watson	1.88	1.72
LM ($\chi 2(1)$)	0.833	0.221
RESET	2.65	0.15
White ($\chi 2(1)$)	2.39	0.33
VIF	3.54	3.81
AIC	49.68	55.47
BIC	56.65	62.45

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The numbers in parentheses are standard errors (S.E.). VIF stands for variance inflation for the independent factors. Briefly, if the value of the mean VIF is lower than 10, then the models are less likely to be affected by the multi-collinearity problem.

Table 6 indicates that the land reform in 1993 and the Doi Moi had a positive impact on rice exports in Vietnam, while the land reform in 1998 did not have significant impact on Vietnam's rice exports. The LLI and Doimoi variables were associated with an increase in the rice export variable. The misspecification tests are shown in F-statistic terms. In model 7, the Lagrange multiplier (LM) first-order serial correlation was 0.83 (with a p-value of 0.46), while the Ramsay RESET result was 2.65 (with a p-value of 0.92). White's heteroskedasticity test result was 2.39 (with a p-value of 0.12). The result of the Variance Inflation for the Independent Factors (VIF) test was 3.54. In model 8, the LM statistics was 0.221 (with a p-value of 0.81), while the RESET result was 0.15 (with a p-value of 0.92). White's test result was 0.33 (with a p-value of 0.57), and the result of the VIF test was 4.07. In model 6, the LM statistics were 1.62 (with a p-value of 0.25), while the RESET result was 0.40 (with a p-value of 0.76). White's test result was 0.23 (with a p-value of 0.68), and the result of the VIF test was 3.81. The misspecification tests showed that none of the models was plagued by misspecification problems.

We also used the marginal effects to predict the effect of LLI and Doimoi on rice exports in Vietnam.[2] Table 7 indicates that the predicted size of rice exports was likely to increase when land and policy reform was effectively implemented. All marginal effects coefficients were statistically significant at $p < 0.05$. The more likely the reforms were to be fully effective, the more likely it was that exports would increase. Note that the Doimoi coefficients were increasingly significant. The variable was

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2   We did not test the RLL variable since it was not statistically significant.

statistically significant at $p < 0.05$ when it was ineffective. However, it was statistically significant at $p < 0.01$ when it was fully effective. This indicated that the more likely the government was to fully implement the Doi Moi, the more likely the size of rice exports was to expand.

Table 8: Marginal effects of land and policy reform on predicted rice exports (Unit: million tons)

Independent Variables	Model 7	Model 8
LLI	0 = 1.89*** 0.5 = 2.37*** 1 = 2.86***	N/A
Doimoi	0 = 1.74** 0.5 = 2.17*** 1 = 2.61***	0 = 1.39** 0.5 = 2.02*** 1 = 2.64***

Note: ** $p < 0.05$; *** $p < 0.01$. Coefficients are marginal effects coefficients. 0 = Policy reform is not effective; 0.5 = Policy reform is partly effective; 1 = Policy reform is fully effective. The result is not available because the LLI variable was not included in model 8.

Regarding the control variables, only the liberty variable significantly affected rice productivity and production in some circumstances. As expected, the liberty variable had a negative impact on rice yield and rice production, only when the NRA for the non-agriculture sectors was included (see models 2 and 5 in table 2 and 4). The more the government strictly controlled the political system, the less likely the productivity and production was to expand. The explanation was that once Vietnamese governments decided to strictly control politics, they probably slowed down every aspect of policy reform, including macroeconomic and land reforms.

Discussion and conclusion

Land and macroeconomic reforms in Vietnam, as discussed above, contribute to the growth of the agricultural market at every level. The reforms led to an increase in the rice productivity of farmers. The land reforms during the 1990s, which gave land tenure and rights to individual farmers, encouraged farmers to increase their productivity in that farmers knew that they were able to own, collect, and sell their commodities to the market. In other words, the governments decided not to intervene in farmers' rights to their commodities. Once the governments did not heavily control the farmers, they were free to make decisions about their commodities. Table 8 shows that the average yield grew gradually after the effectiveness of the Doi Moi (1988) and the land reforms in the 1990s. According to the table, the average rice yield of Vietnam grew by more than 30 percent, especially during the 1990s and 2000s.

Table 9: Average rice yield of Vietnam, 1970-2015

Year	Average Yield (Kilograms per hectare)	Average Growth (%) (from a previous decade)
1970-1979	21,095.60	
1980-1989 (the Doi Moi)	26,607.70	26.13
1990-1999 (Land Reforms)	36,072	35.57
2000-2009	47,853.90	32.66
2010-2015	55,936.33	16.88

Source: authors' calculations, based on FAO 2016

Table 9 and 10 present the average rice production and rice exports every ten years. Table 9 indicates that the average rice production grew increasingly, especially in the 1980s and the 1990s. The average Rice production in the 1990s was 62.30 percent higher than that in the 1980s, so the growth of rice exports was evident. The average rice exports in the 1970s were about 8,500 tons. By the end of the 1990s, the average rice exports in the 1980s were about 200,000 tons. In other words, the average rice exports in the 1980s were 2,252 percent higher than those in the 1970s. The rice exports in Vietnam in the 1990s kept growing; the average rice exports in the 1990s were 1,155 percent higher than those in the 1980s. The Doi Moi and the land reform contributed to the growth of rice production and exports in Vietnam.

Table 10: Average rice production of Vietnam, 1970-2015

Year	Average Production (Million tons)	Average Growth (%) (from a previous decade)
1970-1979	10.74	
1980-1989 (the Doi Moi)	15.17	41.25
1990-1999 (Land Reforms)	24.62	62.30
2000-2009	35.84	45.57
2010-2015	43.40	20.81

Source: authors' calculations, based on FAO 2016

Table 11: Average rice yield of Vietnam, 1970-2015

Year	Average Exports (Million tons)	Average Growth (%) (from a previous decade)
1970-1979	0.0085	
1980-1989 (the Doi Moi)	0.20	2,252
1990-1999 (Land Reforms)	2.51	1,155
2000-2009	4.35	73.31
2010-2015	6.38	46.67

Source: authors' calculations, based on FAO 2016

The implementation of land reforms encouraged rice farmers to grow and harvest more rice because the government allowed them to collect, exchange, and sell their commodities to the market. They received much higher prices than they had during the 1970s. Private rice businesses were encouraged by the Doi Moi's policy reform. Regarding the rice milling business, enormous amounts of paddy rice were transacted in the market since the collectivism policy was abandoned. Hence, rice millers had an incentive to develop their production and increase their milling capacity. The Doi Moi contributed to the technological upgrade of the rice production in Vietnam. Since the governments abandoned their protectionist policy, the import tax for agricultural machines was gradually reduced. Such a tax reduction encouraged private rice millers to import milling machines and technology from foreign countries. Moreover, the reduction of protective tariffs encouraged foreign investors to invest in the rice milling business in Vietnam. Having interviewed the former chairperson of the Thai Rice Miller Association, we found that foreign investors from Europe increasingly invested in the rice milling industry in Vietnam via importing milling machines to Vietnam. Foreign investors were encouraged to import rice milling machines and invest in rice milling houses because Vietnam had plenty of paddy rice at cheap prices in the market.[3] More importantly, the Vietnamese government supported foreign investment in the agricultural

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3   Interviewed on 11th October 2016.

industry.[4] Therefore, the continuity of policy reform led to the growth of agricultural production in Vietnam because it gave incentive for local and international rice businesses to invest in rice production there.
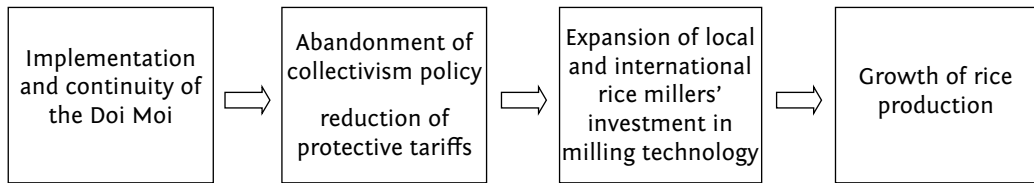
| Implementation and continuity of the Doi Moi | ⇒ | Abandonment of collectivism policy reduction of protective tariffs | ⇒ | Expansion of local and international rice millers' investment in milling technology | ⇒ | Growth of rice production |

Figure 5: The Doi Moi and the growth of rice production in Vietnam

Source: author's illustration

The Doi Moi contributed to the expansion of rice exports in Vietnam. Previously, governments heavily controlled rice exports via imposing high rates of export taxes and restricting the quantity of rice exports. Such tax barriers discouraged private rice exporters from expanding their market because the more they exported, the more they were taxed. Due to the implementation of the Doi Moi, the governments gradually abandoned the tax barriers and regulations. Thus, rice exporters had more incentive to export more rice to the international market since all kinds of tax and legal burdens were greatly reduced, and they had more incentive to find new international markets for rice. Figure 5 indicates that the implementation of the Doi Moi led to the expansion of Vietnam's rice exports via an increase in the private rice exporters' incentive.
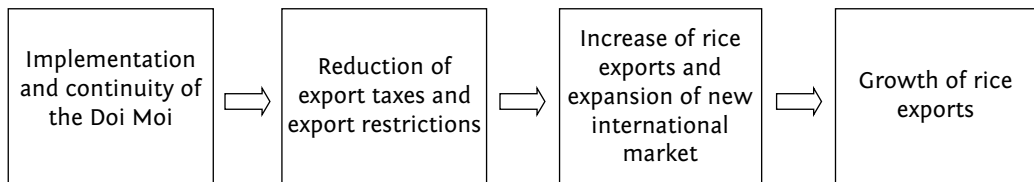
| Implementation and continuity of the Doi Moi | ⇒ | Reduction of export taxes and export restrictions | ⇒ | Increase of rice exports and expansion of new international market | ⇒ | Growth of rice exports |

Figure 6: The Doi Moi and the growth of rice exports in Vietnamm

Source: author's illustration

To conclude, Vietnam's rice market has increasingly grown and transformed for more than three decades. The growth of the rice market took place in the midst of the country's policy shift, especially the land and macroeconomic reforms in the 1980s and 1990s. This paper explains the association between land reform, structural adjustment, and the growth of the rice market in Vietnam. The main argument is that land and policy reforms lead to the growth of rice productivity, production, and exports in Vietnam. Since the Vietnamese government structurally adjusted the market in the late 1980s and distributed land tenure and rights in the 1990s, the rice farmers had incentive to increase and develop their rice productivity. As a consequence, rice production and exports increased due to these reforms. The statistical results showed that the land reform in 1993 had a positive effect on rice yield, production, and exports, while the land reform in 1998 had a positive effect on rice yield and production. The effectiveness of the Doi Moi (structural adjustment) in 1988 had a positive effect on the rice yield, production, and exports in Vietnam.

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4   The former chairperson even told us that rice milling technology in Vietnam was more advanced than that in Thailand. While the Vietnamese government reduced its control over the rice sector, the Thai government increasingly intervened in the rice sector via the rice pledging scheme.

Generally, policy reform which aims to distribute resources to producers has become one of the significant conditions for encouraging agricultural market growth in developing countries. Once producers are given rights to their land and commodities, they have an incentive to increase and develop their productivity. The increase in farmers' productivity is causally related to production and exports growth. In order to improve farmers' conditions and increase their productivity, governments in developing countries formulate and implement policies which redistribute public resources to individual farmers and decrease governmental restrictions on farmers' commodity rights. Market reform is also another key ingredient for agricultural market growth in developing countries. Previously, private businesses did not have an incentive to expand into the agricultural market because they were strictly controlled by taxes and government restrictions. Since governments have decided to abandon several types of restrictions, all tax and legal burdens were lifted. In a globalized and competitive market, governments should consider policy implementation that is able to improve farmers' capacity of production and allow them to have rights to land, inputs, and commodities. The governments should consider policy implementation that facilitates and encourages private businesses to compete efficiently with competitors rather than restricting them with taxes and rules.

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Acknowledgement

Appendix

Table A1: Effect of land and policy reform on rice productivity in Vietnam (Dependent variable = rice yield (kilograms per hectare))

Variables	Model A1	Model A2	Model A3
LLI	3263.34** (1459.07)	3636.91** (1319.20)	3491.63** (1450.50)
RLL	3076.88* (1499.33)	3575.84** (1604.05)	3289.30** (1470.97)
Thai yield (kilogram per hectare))	0.931* (0.468)	0.695* (0.36)	0.797 (0.48)
Nraagri	-1438.29 (3841.72)		
Nranonagri		-0.078 (0.02)	
Nrarice			-13.02 (31.86)
Liberty	-2157.00 (2082.44)	-3392.75*** (1010.91)	-2250.13 (2055.49)
Doimoi	3276.58** (1433.56)	3086.46* (1567.65)	3172.68* (1552.24)
Constant	23328 (23029.99)	37306.62** (13740.13)	26977.64 (22834.1)
N	20	24	19
Standard Error of Regression	1640.7	1645.1	1618.2
Adjusted R^2	0.941	0.957	0.935
F-Statistics	51.38***	87.06***	44.50***
Durbin-Watson	2.03	1.94	2.10
LM ($\chi2(1)$)	1.63	3.20*	2.30
RESET	1.10	0.23	0.45
White ($\chi2(1)$)	0.64	1.58	0.87
VIF	5.90	5.56	5.24
AIC	358.26	429.30	339.97
BIC	365.23	437.54	346.58

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The numbers in parentheses are standard errors (S.E.). VIF stands for variance inflation for the independent factors. Briefly, if the value of the mean VIF is lower than 10, then the models are less likely to be affected by the multi-collinearity problem.

Table A2: Effect of land and policy reform on rice production in Vietnam (Dependent variable = rice production (million tons))

Variables	Model A4	Model A5	Model A6
LLI	5.461*** (1.202)	5.600*** (1.15)	5.38*** (1.16)
RLL	5.264*** (1.544)	6.001*** (1.600)	5.252*** (1.54)
Thai production (million tons)	0.630 (0.604)	0.242 (0.521)	0.725 (0.593)
Nraagri	-1.227 (4.550)		
Nranonagri		-0.779 (4.963)	
Nrarice			-0.017 (0.037)
Liberty	-3.042** (1.393)	-2.824** (0.958)	-2.66* (1.47)
Doimoi	3.513** (1.460)	3.542** (1.62)	3.19* (1.626)
Constant	33.83** (10.957)	34.32*** (8.48)	31.002** (11.427)
N	20	24	19
Standard Error of Regression	1.728	1.73	1.732
Adjusted R^2	0.939	0.950	0.935
F-Statistics	50.14***	73.97***	44.38***
Durbin-Watson	2.00	1.98	2.05
LM ($\chi2(1)$)	1.504	3.007*	1.41
RESET	0.53	0.68	0.39
White ($\chi2(1)$)	0.14	0.26	0.21
VIF	3.57	4.12	3.08
AIC	84.03	100.18	80.06
BIC	91.00	108.42	86.68

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The numbers in parentheses are standard errors (S.E.). VIF stands for variance inflation for the independent factors. Briefly, if the value of the mean VIF is lower than 10, then the models are less likely to be affected by the multi-collinearity problem.