Viet Nam

Household welfare and pricing of rice: Does the Large-Scale Field Model matter for Viet Nam?

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Abstract

Since 2006, Viet Nam's rice exports have soared, and in 2011 the country surpassed Thailand to become the world's largest rice exporter. Even though one would expect higher rice exports to directly benefit rural households at all levels of well-being, most rice producers in Viet Nam are still poor, living on less than USD 2 per day. The government's efforts to ensure a minimum rate of return for farmers by imposing price floors (minimum prices) have not been successful, as there is no enforcement mechanism in place. This study examines the potential impact on household welfare in Viet Nam of value chain upgrading in rice production through the Large-Scale Field Model. The possible effects of the adoption of such a model are: (a) an increase in the farm gate price of rice, (b) an increase in the productivity of rice farmers, and (c) a reduction in farmers' production costs. The study shows how these changes would affect household welfare, taking into account the ripple effect that a change in the farm gate price of rice would have on other prices in the economy, and hence on household consumption, production, and wage income. The policy simulations in this study assume that farmers do not pass on any cost reductions and productivity improvements to the price of paddy. The results suggest that the implementation of the Large-Scale Field Model in the Mekong River Delta would increase the welfare of households by 4.1 per cent in the short term and 4.9 per cent in the longer term, and reduce poverty rates by approximately 0.55 per cent among the 10 per cent poorest households and by 0.42 per cent among the 20 per cent poorest households in that region.

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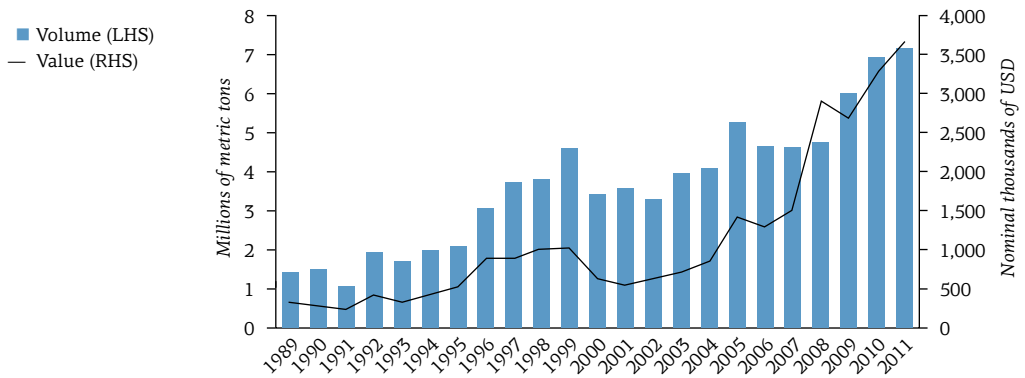
1 Introduction

Doi Moi, a Vietnamese term meaning "renovation", marked the beginning of Viet Nam's transition from a centrally planned to a more market-driven economy. Initiated by the Communist Party Congress in 1986, *Doi Moi* became a major phenomenon in Viet Nam during 1986–1990. Its main aim was to promote a multi-sectoral economic system encompassing both state-owned and private enterprises. In the framework of the *Doi Moi* policy, state-owned enterprises were reformed, private sector enterprises and companies with foreign investment emerged *de novo*, and the domestic market was liberalized to allow for free market prices. In agriculture, Politburo Resolution No. 10 made it possible to conclude "end-product contracts" with households; and land use rights were granted for 15 years in 1988, a period further extended to 20 years in 1993 (Pham *et al.*, 2007).

One of the most striking features of Viet Nam's transition was a high growth rate of the gross domestic product (GDP), coupled with a remarkable increase in exports. Before the *Doi Moi*, Viet Nam had to import food for domestic consumption. After the agricultural reforms in 1988, agricultural output rose tremendously and in 1989, Viet Nam became a rice exporter (Pham *et al.*, 2007). The value of the country's rice exports has soared particularly since 2006 (Figure 1). In 2011, Viet Nam surpassed Thailand to become the world's largest rice exporter, with more than 7 million metric tons of rice exported, of which 95 per cent was contributed by farmers – net rice producers – in the Mekong River Delta (Jaffee, 2012a).

Figure 1 Viet Nam's rice exports, 1989–2011

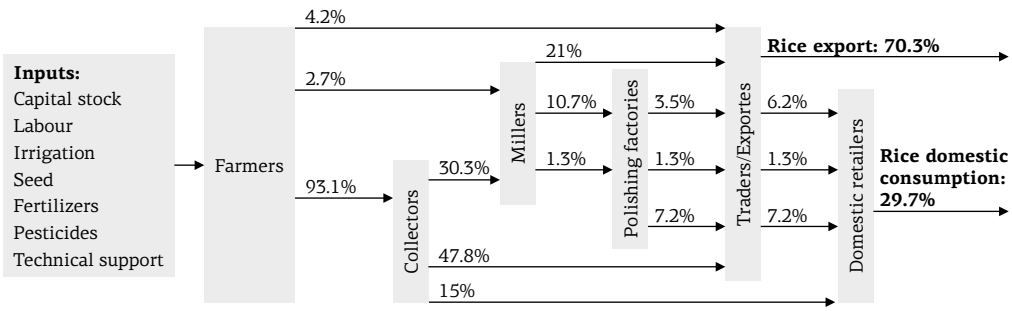


Source: Authors' calculations, based on data from the Vietnam Food Association (VFA, 2006) and General Statistics Office (GSO) of Viet Nam.
Note: LHS stands for left-hand scale, RHS for right-hand scale.

Although higher rice exports could be expected to directly benefit rural households at all levels of well-being, most rice producers in Viet Nam remain poor, living on less than USD 2 per capita per day (Coxhead *et al.*, 2012).

Viet Nam's current rice value chain, shown in Figure 2, explains the main reason for the low incomes of Vietnamese farmers. Owing to the many intermediaries in the chain, the benefits of the remarkable increase in rice export volumes and prices have not accrued to the households that actually grow the rice. As a matter of fact, 95.8 per cent of total paddy rice produced by those households is sold to collectors and (subsequently) to millers, and only 4.2 per cent is sold directly to exporters.

Figure 2 Viet Nam's rice value chain, 2010



Source: Vo and Nguyen (2011).

Collectors, who tend to participate more actively in the value chain (millers or polishing factories act as service providers for collectors), earned 10 times more than farmers in 2011 (Tran *et al.*, 2013). Having more market power than farmers, collectors usually set low prices, particularly if there is a good crop (a surplus of paddy rice supply). Additionally, as most farmers are poor, their biggest need for cash is in the period right after the harvest. They therefore have to sell their output as quickly as possible and at any price (usually lower than the floor farm gate price, i.e. the minimum price set by the government) to settle their debts in time. Table 1 shows that interest payments on farmers' loans alone account for more than 17 per cent of total costs related to rice cultivation. Another problem is the losses directly attributable to poor post-harvest technologies, which do not allow farmers to retain rice for later sale. Post-harvest losses occur as a result of the lack of storage facilities (most farmers use small storehouses and have no storage systems), as well as inadequate paddy drying technology. To save on costs, most farmers prefer sun drying. However, as sun

drying is associated with a number of technical constraints,[1] most farmers sell their wet paddy to collectors at considerably lower prices because longer delays mean a higher water loss, which causes shrinkage and loss of weight of their wet paddy harvest.[2]

Table 1 Share of inputs in costs of paddy cultivation (per cent)

	Inputs	Per cent
1	Seed, fertilizers, pesticides	42.4
2	Labour (self-employed)	9.6
3	Labour (hired)	20.6
4	Capital stock (including depreciation)	2.8
5	Irrigation fee	2.5
6	Interest (loan of inputs)	2.8
7	Interest (bank loan)	14.4
8	Transportation	1.6
9	Other (commission for collectors)	3.3
	Total	100.0

Source: Vo and Nguyen (2011).

Over the past five years, the Vietnamese government has experimented with a number of price policy instruments aimed at ensuring a minimum rate of return of 30 per cent for farmers who are engaged in growing paddy. The main instrument consists of "floor prices" for paddy both for exports (minimum export free on board (FOB) price) and for purchases from rice farmers (minimum farm gate price for paddy).[3] Exporters are requested not to sell rice for a price lower than the floor export FOB price, the level

[1] First, sun drying is not possible during rain and at night, so there is a risk that farmers will not be able to dry their paddy right after harvest. Second, the process is labour-intensive and has high requirements with regard to the size of drying pavements/mats that need to be available. Third, temperature control is difficult, with a high likelihood of overheating or rewetting of grains, which in turn can result in low milling quality because of cracks developing in the kernels (IRRI, 2006).

[2] According to Tran *et al.* (2013), only 5 per cent of farmers sell dry paddy to collectors.

[3] The minimum export FOB price of rice is set based on the price of rice on the world market (Circular 89/2011/TT-BTC issued on 17 June 2011), whereas the farm gate price of paddy is set above the average production cost of paddy for each crop (Decree 109/2011/NDD-CP issued on 4 November 2010). Therefore, if the world price of rice falls, according to Circular 89/2011/TT-BTC, exporters have to maintain their profit by reducing other costs but not the farm gate price of paddy.

of which is set on the assumption that exporters would buy paddy directly from farmers for the recommended floor farm gate price.[4]

As shown in Figure 2, exporters (or even domestic retailers) almost never buy paddy from farmers, but rather from millers and/or polishing factories. What prevents farmers from selling directly to exporters and/or domestic retailers?

One of the main reasons is the imperfect competition among Vietnamese rice exporters. In Viet Nam, 50 per cent of rice is exported through government-to-government (G2G) contracts. The Vietnam Food Association has the right to allocate 80 per cent of total volume of G2G contracts to its members, which are mostly state-owned enterprises (SOEs) (Tran *et al.*, 2013).[5] As SOEs have little incentive to improve performance (Boycko *et al.*, 1996) and G2G contracts do not require high-quality rice, these public exporters have become less active in searching for new markets or improving the quality of exported rice. As a result, Viet Nam's current export prices are typically the lowest when compared with those of Thailand (see Table A1 in the Annex), India and Pakistan. The apparent lack of capacity of public exporters to bargain for a higher export price of Vietnamese rice puts pressure on them to lower the domestic price of rice to maximize their margin. Therefore, public exporters prefer to buy rice from collectors rather than directly from farmers, as this allows them to avoid paying the official floor farm gate price for paddy. The government currently lacks enforcement measures, so collectors, who are non-registered entities (i.e. operate in the informal sector), can evade the floor farm gate price enforcement.[6] As a result, in the event of a good crop, prices of paddy paid to farmers fall and exporters benefit from these lower prices offered by collectors.

Other reasons preventing a direct linkage between farmers and exporters are high transportation and transaction costs. One of the characteristics of the Mekong River Delta is the existence of interlacing drainage and irrigation canal systems, which also serve as transportation routes. Boat

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[4] Resolution No. 63/NQ-CP issued on 23 December 2009, and Decree 109/2011/NDD-CP issued on 4 November 2010.

[5] Two SOEs, Vinafood I and Vinafood II, which supply most of the volume of G2G contracts, accounted for 15 per cent and 41 per cent, respectively, of total rice export in 2008 (AgroInfor, 2009).

[6] According to Circular 89/2011/TT-BTC issued on 17 June 2011, exporters have to report their export prices to the VFA, but collectors do not have the same obligation. Since the linkages between collectors and farmers take place within the informal economy, it is very difficult for the VFA to determine which collectors buy from farmers and what volume/value of paddy they procure from them.

transportation is the only means for transporting paddy from the fields to the market. As paddy is grown in small fields, which mostly have a size of 0.5 to 2 hectares (ha) (see Figure 4 in Section 2.2), it is not possible for exporters to buy large volumes because these cannot be delivered by small individual farmers. Moreover, even if exporters could buy directly from farmers, it would be costly (in terms of transportation costs and losses directly attributed to transport) and less convenient (in terms of differences in harvest time). That is why collectors, who own small boats, have long played a key role in connecting small farmers who produce only limited volumes of rice for sale with exporters who require larger volumes of paddy to fulfil their export contracts.

Owing to the multi-layered rice value chain and the lack of a mechanism to effectively enforce the floor prices, efforts by the Vietnamese government to ensure a minimum rate of return for farmers by imposing price floors have not been successful. To address existing constraints and help farmers increase their income from growing rice, local authorities in the Mekong River Delta area have designed and are currently piloting a set of policy measures under a project called the Large-Scale Field Model (LSFM).

This study examines the potential impact of the LSFM on household welfare in Viet Nam. Possible effects of the adoption of the project are: (a) an increase in the farm gate price of rice, (b) an increase in the productivity of rice farmers, and (c) a reduction in farmers' production costs. The study shows how these changes would affect household welfare, taking into account the ripple effect that a change in the farm gate price of rice would have on other prices in the economy, and hence on household consumption, production, and wage income.

The policy simulation in this study suggests that implementation of the LSFM in the Mekong River Delta would increase the welfare of households by 4.1 per cent in the short term and 4.9 per cent in the longer term. It would also reduce poverty rates by approximately 0.55 per cent among the 10 per cent poorest households and by 0.42 per cent among the 20 per cent poorest households in that region.

The next section of this study explains the LSFM and the various channels through which it affects those involved in the rice production. Section 3 provides a literature review of the impact of rice price changes on household welfare in Viet Nam. Section 4 presents the methodology used to estimate *ex ante* price changes and welfare effects, and Section 5 describes data sources used in the estimations of price changes and welfare effects.

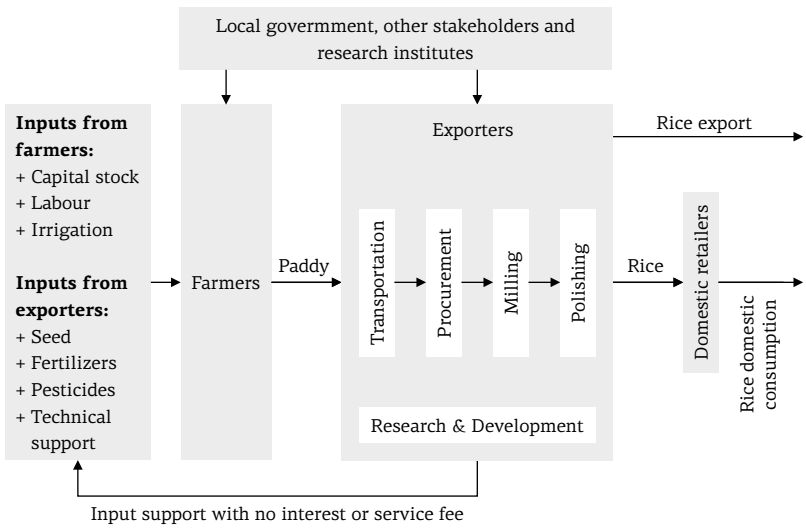
Section 6 presents the pass-through and price change estimations and Section 7 puts forth a policy simulation with *ex ante* estimations of the welfare effects of the LSFM. Section 8 summarizes the main findings and, based on them, proposes several policy recommendations.

2 The Large-Scale Field Model

2.1 How the Large-Scale Field Model works

Figure 3 shows the design of the LSFM, which is an upgrade all along the current rice value chain described in Figure 2. The core of the intervention is to set up a large-scale field with participation of farmers and exporters. Once the linkage between farmers and exporters has been established, the various actors previously involved in the relation between them (collectors, millers, and polishing factories) become superfluous, and paddy produced by farmers can be sold directly to exporters.

Figure 3 The LSFM – A value chain upgrading intervention



Source: Authors, based on the case of An Giang Plant Protection Joint Stock Company (Dao et al., 2013).

According to a study by Dao *et al.* (2013) of an LSFM recently put in place by the An Giang Plant Protection Joint Stock Company (AGPPS),[7] the LSFM works as follows:

- The government's land consolidation programme allows for the swapping of fragmented agricultural fields between households to form a large-scale field, without any change in title to the land.[8] Hence, a large-scale field can be set up under a common agreement among all participating small farmers, who continue to be responsible for the cultivation of a small portion of the aggregated large field.

- An exporter coordinates the agglomeration of all the small farmers. However, unlike the collective farming that dominated Viet Nam's agriculture between 1954 and 1988,[9] the LSFM is not a public entity. Its focus is on pursuing the objectives of efficiency and profit maximization rather than addressing the objectives of social welfare maximization set by the government.

- Once a farming agreement has been signed between farmers and the exporter, the exporter provides the following to control the quality of growing paddy: (a) inputs (e.g. seed, fertilizers, pesticides)[10] for rice production in the form of no-interest loans; (b) technical services conducted by the exporter's technical expert (called "farmer friend"), directly linked with the exporter's research institute (if any) or other research institutes; (c) free on-farm transportation and procurement services (because the volume of crop harvested from the LSFM is large enough to set up on-farm grain silos, traditional boat transportation is not necessary); (d) in the case of AGPPS, one month of free storage for paddy

[7] A total of 1,000 ha of large-scale fields were first piloted by AGPPS in An Giang Province for the winter-spring crop of 2010–2011. By 2013, the total area of the AGPPS LSFM had reached more than 80,000 ha located in three provinces of the Mekong River Delta: An Giang, Dong Thap, and Long An (Dao *et al.*, 2013).

[8] Before 1945, agricultural land in Viet Nam was privately owned; 24.5 per cent of land belonged to only 4 per cent of the population. From 1953 to 1957, when Viet Nam was divided into two separate states, 810,000 ha of agricultural land were redistributed to more than 2 million households in the north of the country, based on household size (Le, 2007). Redistribution of land was, however, not implemented in the south of Viet Nam. Therefore, while all households in the north have access to agricultural land today, poor households in the south do not have their own land. For this reason, land is highly fragmented in the north (Red River Delta) and less fragmented in the south (Mekong River Delta). However, households do not have the ownership title to their agricultural land (all land belongs to the state) but are only granted a land use right. In the framework of the *Doi Moi* policy, land use rights were granted for 15 years in 1988, a period further extended to 20 years in 1993. Land use rights are considered as assets and can be transferred or used as collateral.

grain, which allows farmers to keep rice for later sale; and (e) a commitment to buy all paddy harvested. If farmers for any reason do not want to sell their rice to the exporter, they have to compensate the exporter by refunding the inputs provided, the costs of packaging bags, transportation costs, and the costs of procurement services (if any).

As can be seen, applying the LSFM would provide a secure and stable supply source of high-quality paddy grain for rice exports.[11] Consequently, the exporter could bargain for a higher export price of Vietnamese rice on international markets. The profits from the increased export price would be shared between the farmers – through an increased farm gate price (pass-through effect) – and the exporters (who would thus also be compensated for the "free" transportation, milling, polishing, and storing services provided to the farmers).[12]

2.2 Location – Why not the Red River Delta?

In Viet Nam, the Red River Delta and the Mekong River Delta are the two main sources of rice supply.[13] While 95 per cent of rice exports are produced in the Mekong River Delta, rice from the Red River Delta is destined for domestic consumption. Therefore, the Mekong River Delta was the natural first choice as the location for the LSFM. Additionally, as shown in Figure 4, almost all farmers in the Red River Delta cultivate small farms (under 0.5 ha and even under 0.2 ha), whereas in the Mekong River Delta, more than 60 per cent of farmers have larger agricultural lands (0.5 ha and above). It is therefore more feasible to create a large-scale field needed for the project in the Mekong River Delta.[14]

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[9] Politburo Resolution No. 10 (1988) put an end to the collective farming model of the planned economy because of its inefficiency.

[10] Seed is important in determining the quality of exported rice. Paddy is sensitive to the natural condition of the flooded parcel of arable land (e.g. soil) as well as the technique of cultivation (the way farmers use fertilizers, pesticides, and water from irrigation). Using the wrong seed can lead to a low or even no crop yield.

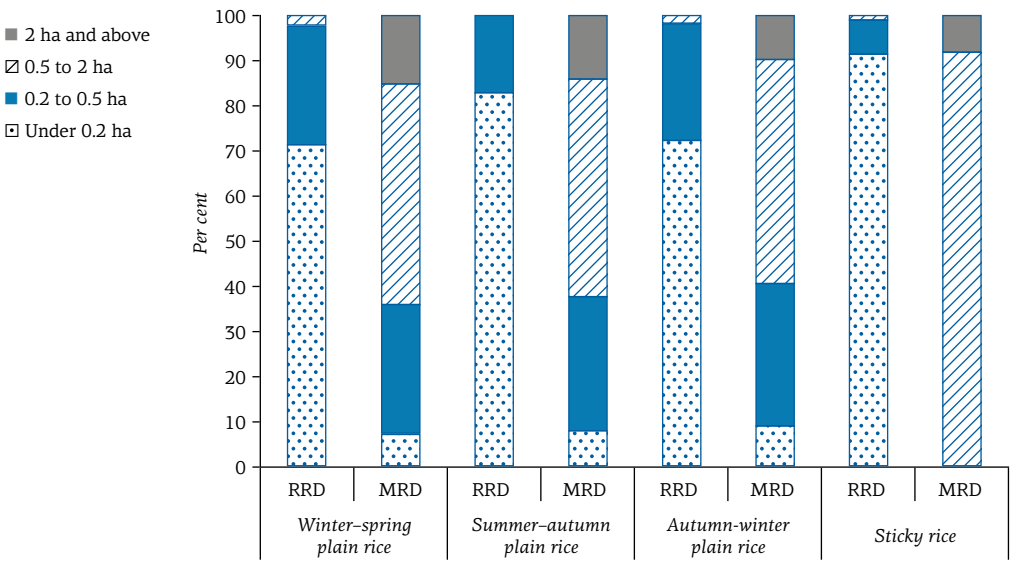
[11] Exporters would apply quality management procedures to assure that the cultivation process strictly follows the Vietnamese Good Agricultural Practices and the Global Good Agricultural Practices.

[12] As it is not expected that state-owned exporters would have an incentive to efficiently implement the LSFM scheme, private exporters who are not protected against competition will likely lead its implementation. However, in order to broaden the scope of the LSFM scheme, the government should also encourage it through policy measures.

[13] See Figure A3 in the Annex for the geographical location of the Red River Delta and the Mekong River Delta.

[14] Finally, the policy simulation's finding that farmers in the Red River Delta might not benefit from the LFSM's paddy price increase (see the baseline scenario in Section 7.2) provides more supporting evidence for the choice of location for the LSFM.

Figure 4 Farm size (per cent)



Source: Authors' calculation, based on the 2010 Viet Nam Household Living Standards Survey (VHLSS).
Note: RRD stands for Red River Delta, MRD stands for Mekong River Delta.

2.3 Paddy price increase

What would be the expected increase of the farm gate price if the LSFM were implemented? The increase is computed using information on the prices along the value chain from Vo and Nguyen (2011). The focus is on the best-case scenario for farmers under the assumption that rents previously captured by collectors, millers and polishing factories would be transferred to farmers. Furthermore, the export price of rice is assumed to remain unchanged at Vietnamese dong (VND) 9,737 per kilogram (kg). As shown in Table 2, under the best-case scenario for farmers, if total rents originally distributed among intermediaries were allocated to farmers, one could assume that the farm gate price of paddy would increase from VND 5,212 to 5,728 per kg. Hence, the marginal increase in the farm gate price of paddy would amount to 9.9 per cent.

Table 2 Price and value added in the current and upgraded rice export value chain (VND per kg)

	Current rice export value chain			Upgraded rice export value chain		
	Cost	Value added	Price	Cost	Value added	Price
Farmers	4,672	540	5,212	4,672	1,056	5,728
Collectors	1,208	280	6,700			0
Millers	447	186	7,333			0
Polishing factories	793	50	8,176			0
Exporter	1,139	422	9,737	3,587	422	9,737
Total	–	1,478	–	–	1,478	–

Source: Vo and Nguyen (2011) and authors' calculations.

As explained above, the current low quality of Vietnamese rice makes exporters less competitive in the international market. One of the benefits of the LSFM is that it facilitates the production of high-quality paddy. Because Viet Nam's rice export prices were similar to those of Thailand during 2008–2010, one could expect that, in the medium term, Viet Nam's export prices would increase by 11.4 per cent, which equals the smallest gap between Viet Nam's and Thailand's export prices in 2011–2013 (see Table A1 in the Annex). As can be computed from the data in Table 2, under the upgraded rice value chain, production cost per kg of exported rice (VND 5,728) accounts for about 59 per cent of the export price of rice (VND 9,737). If farmers could keep the same share of the increase in the export price of rice, there would be a further marginal increase of the farm gate price of paddy by an expected amount of 11.4 per cent.[15]

2.4 Reduction of production costs

A reduction of production costs would arise because farmers in Viet Nam currently cultivate fragmented agricultural land. The small size of plots prevents them from taking advantage of modern agricultural machinery (such as tractors) and thus raises labour costs (Markussen *et al.*, 2012). Table 3 shows the costs of growing paddy associated with three main crops per year observed among a group of farmers cultivating a

[15] Exporters could agree to pass on 59 per cent (which equals the share of production costs in the export price of rice) of the increase in the export price of rice to farmers, as their increased bargaining power in international markets would result from the higher quality of paddy produced by farmers under the LSFM.

large-scale field and another group cultivating fragmented fields. Table 3 shows that by achieving economies of scale, cost saving (1) would be VND 456 per kg of paddy, which equals 11.1 per cent of the average production costs under the case without the LSFM (VND 4,096 per kg of paddy). Farmers would benefit from direct linkages with exporters in terms of cost savings by having access to interest-free input-material loans, and free packaging bags for paddy storage. Thus, the cost saving (2) from having access to these services would be about 3 per cent of the farm gate price of paddy. Hence, the total cost saving (3) would be 14.1 per cent of the current average production costs under the case without the LSFM.[16]

Table 3 Production costs savings under the Large-Scale Field Model

	With the LSFM	Without the LSFM
1. Production costs per kg of paddy (VND)		
Winter-spring crop	2,951	3,309
Summer-autumn crop	3,921	4,311
Autumn-winter crop	4,050	4,669
Average production costs	3,640	4,096
Cost saving (1)	456	
Cost saving (1) as a share of the average production costs under the case without the LSFM (per cent)	11.1	
2. Benefits from exporters per kg of paddy (VND)		
No-interest loan on inputs	83	0
Free packaging bags	40	0
Cost saving (2)	123	
Cost saving (2) as a share of the average production costs under the case without the LSFM (per cent)	3.0	
3. Total cost saving (3) as a share of the average production costs under the case without the LSFM (per cent)	14.1	

Source: Authors' calculations, based on data from Dao et al. (2013).

2.5 Productivity increase

The difference in productivity (yield per farm size) between large farms (2 ha and above) and small farms (under 0.2 ha) can be used as a proxy for

[16] This study assumes that there is no pass-through of cost reductions on the farm gate price of paddy. Further discussion of this assumption can be found in Section 4.3.

the expected productivity increase under the LSFM. Table 4 suggests that a large farm size could improve average yield by 14 per cent.[17]

Table 4 Productivity by farm size (kg per square metre)

Productivity	Winter–spring crop	Spring–autumn crop	Autumn–winter crop	Average yield
Under 0.2 ha (1)	0.577	0.448	0.44	
0.2 to 0.5 ha	0.602	0.449	0.418	
0.5 to 2 ha	0.65	0.477	0.467	
2 ha and above (2)	0.655	0.501	0.513	
Productivity improvement (per cent) if upgrade from small farm (1) to large farm size (2)	13.5	11.8	16.6	14.0

Source: Authors' calculations, based on the 2010 VHLSS.
Note: The average yield is computed as a simple average across the three crops.

3 Related literature

At the macroeconomic level, it is expected that trade liberalization would stimulate growth and that higher growth would in turn lead to welfare gains and poverty reduction. Chi-Chung *et al.* (2002) investigate the behaviour of main rice exporters (in Thailand, Viet Nam and the United States) and rice importers (in Brazil, Europe, Japan, the Philippines and the former Soviet Union) and find that there are welfare gains of USD 1,492 million when all trading countries comply with the free trade agreement (which implies that all countries are price takers and act as perfect competitors).

At the microeconomic level, there is consensus that households are affected by price changes: after a price increase, net consumers are worse off and net producers are better off. The impact of a price change of rice has been largely studied in Viet Nam. On the one hand, a number of authors have reported a positive impact of a price increase of rice exports on household welfare. Minot and Goletti (1998) find that rice export liberalization in Viet Nam would raise food prices but also increase average real income and reduce poverty. In a later study, they show that a rice price increase of 14 to 22 per cent could bring about USD 200 million in welfare gains, a quarter of which would be distributed to households and the rest to SOEs (Minot

[17] This study assumes that there is no pass-through of productivity increases on the farm gate price of paddy. Further discussion of this assumption can be found in Section 4.3.

and Goletti, 2000). Benjamin and Brandt (2002) find that significant increases in the price of rice have a largely beneficial impact on rural household welfare. On the other hand, Coxhead *et al.* (2012), using a macro-micro model, find a negative effect of an increase in the price of rice on household welfare, especially among the poor.

Despite the availability of numerous studies on the effects of rice price changes on household welfare, it is still not clear whether Vietnamese households would on average win or lose from rice price increases. One of the possible reasons may be that most of the studies were conducted long before Viet Nam's rice export prices soared in 2006. Since 2006, there has been a large change in policy instruments that have influenced both prices and volumes of rice exports. Another reason may be the limitation of data. In their macro-micro model, Coxhead *et al.* (2012) investigate the impact of the price change in 2008 but use the 2003 Social Accounting Matrix and the database of household income and expenditure in the 2004 VHLSS.

4 Methodology

As discussed in Section 2, the LSFM will affect household welfare through the effects that it will have on: (a) farm gate prices of paddy, (b) productivity of rice farmers, and (c) production costs. This section models how these changes would affect household welfare, taking into account the ripple effect that a change in the farm gate price of paddy would have on other prices in the economy, and hence on household consumption, production, and wage income.

4.1 Modelling price changes

One of the main channels through which the LSFM will affect household welfare is via the increase in farm gate prices of paddy. At the same time, any change in prices of paddy will result in changes in prices of other goods in the economy.

There are several ways of modelling the ripple effect that a change in the farm gate price of paddy would have on other prices in the economy. The econometric estimation model (Nicita *et al.*, 2005; Balat *et al.*, 2009) and the global simulation model (Francois and Hall, 2009) are useful for simulating effects of tariff reductions and global, regional, or unilateral trade policy changes. But they are not useful for simulating the effects of price changes of a certain sector's products on the prices of another sector's products in an economy. Moreover, the data limitation with regard to key

inputs (such as export-supply elasticities and import-demand elasticities) is a major constraint in these estimations, particularly in terms of reconciling the trade data classification with the living survey classification.

To estimate the price changes that result from a change in tariffs or prices of goods, one could use the Computable General Equilibrium (CGE) model (Chen and Ravallion, 2004). However, this model has many limitations in terms of assumptions with regard to the functioning of an economy. A major weakness of the CGE model is the limitation of data required to calibrate the parameters of the model to accurately represent the studied economy. Therefore, studies using CGE models to represent the Vietnamese economy have so far borrowed the parameters from other economies (Coxhead *et al.*, 2012).

Taking into account the methods and data availability, this study therefore prefers to use the cost-push Leontief price model to estimate the price changes (Miyazawa, 1976; Oosterhaven, 1996; Dietzenbacher, 1997; ten Raa, 2005; Miller and Blair, 2009). In this model, the value-added coefficient is the difference between the revenues per unit of output (the price of the commodity) and the material costs per unit of output. Hence, the cost-push Leontief price model has the following equation:

$$p = A' p + v \tag{1}$$

where p is the column vector of index prices (number of sectors (n)); v is the column vector of the value-added coefficient, i.e. value added per unit of output (number of sectors (n)), and A is a transposition of the input coefficient matrix (number of sectors (n) by number of sectors (n)).

If the farm gate price of paddy increases, which is considered a price shock, we could estimate the changes in prices of other goods using equation (1). Following Miyazawa (1976), we split the set of n sectors of the input-output (I – O) table into two subgroups: the P sector, which consists of the paddy sector, and the S sector, which consists of the rest of the $n - 1$ sectors of the economy. The $n \times n$ input coefficient matrix A is:

$$A = \begin{bmatrix} P & P_1 \\ S_1 & S \end{bmatrix} \tag{2}$$

where P (1×1) and S_1 ($n - 1 \times 1$) are the submatrices of input coefficients of the paddy sector, and P_1 ($1 \times n - 1$) and S ($n - 1 \times n - 1$) are the submatrices of input coefficients of the rest of the $n - 1$ sectors.

Equation (1) could be re-written for the two subgroups as follows:

$$\begin{cases} p_p = P' p_p + S_1' p_s + v_p \\ p_s = P_1' p_p + S' p_s + v_s \end{cases} \quad (3)$$

where p_p and p_s are column vectors of index prices of the P sector's product (which is paddy) and S sector's products (which are the rest of the $n-1$ products in the economy), respectively; v_p and v_s are P sector's and S sector's column vectors of value-added coefficients, respectively; and P', S_1', P_1' and S' are transpositions of the matrices P, S_1,P_1, and S, respectively.

As we want to estimate the effects of paddy rice price changes on prices of other goods in the economy, in system (3), we take p_p and v_s as exogenous variables, whereas p_s and v_p are endogenous variables.

Under the cost-push effect, if the price of paddy rises from p_p to $(p_p+\Delta p_p)$, we could determine the price increase in other S sectors by solving the system as follows:

$$\Delta p_s = (I - S')^{-1} P_1' \Delta p_p = T' P_1' \Delta p_p = (P_1 T)' \Delta p_p = T_1' \Delta p_p \quad (4)$$

Note that the price increase in other S sectors estimated under equation (4) could be viewed as a result of: (a) direct effects of change in the price of paddy, (b) second-order or indirect effects, and (c) paddy input in S sectors induced by internal propagation in S sector industries $T_1 = P_1 T = P_1 (I - S)^{-1}$ (Miyazawa, 1976).

4.2 Estimating labour income effects

Wages are the key source of income for many households. They depend on the prices of goods, particularly given the fact that the Vietnamese labour market is segmented (M4P2, 2009). To estimate the elasticity of wages with respect to changes in prices, we can modify system (3) by splitting the value-added component of each sector into a wage component w (compensation of employees per unit of output) and a capital stock component r (rent paid to capital stock per unit of output):

$$\begin{cases} p_p = P' p_p + S_1' p_s + w_p + r_p \\ p_s = P_1' p_p + S' p_s + w_s + r_s \end{cases} \quad (5)$$

where $\begin{cases} v_p = w_p + r_p \\ v_s = w_s + r_s \end{cases}$

If we take p_p and v_s as exogenous variables, whereas p_s and v_p are endogenous variables, from system (5), the variation of v_p could be seen as the change in wage in the *P* sector due to the change in price of the *P* sector's product (Miyazawa, 1976). Under the cost-push effect, if the price of the *P* sector's product increases from p_p to $(p_p + \Delta p_p)$, under the assumption that capital stock coefficients r_p and r_s are constant in the short term and thus have not been affected by price changes, we obtain:

$$\Delta w_p = \{ (I - P') - S_1' T' P_1' \} \Delta p_p \qquad (6)$$

The term Δw_p is the response of equilibrium wages in the *P* sector to the change in the prices of the *P* sector's product.

The responses of the equilibrium wages to prices under equation (6) will differ across different sectors (industry wage premiums), but will be the same for household members working in the same sector, regardless of their labour skills.

4.3 Modelling welfare effects

Non-parametric density estimations and regressions are used here to study the distributional effects of rice price changes in relation to household characteristics, particularly living standards and geographical locations. The idea of non-parametric analysis was first introduced by Deaton (1989a) and then extensively used in various studies on welfare analysis (Deaton, 1989b; Budd, 1993; Benjamin and Deaton, 1993; Barrett and Dorosh, 1996; Sahn and Sarris, 1991). An extension of Deaton (1989a) considers the responses of the labour market because a change in the price of a good will affect labour demand and then the wage in the production sector of this good.

For each household, the welfare impact could then be calculated as follows:

$$du^h = \sum_p (\Phi_p^h - C_p^h) \, dp_p + \sum_{p,j} \theta_j^h \, \varepsilon\omega_p \, dp_p \qquad (7)$$

where Φ_p^h is the share of household income from production of good *p*; C_p^h is the income share of household consumption spent on good *p*; θ_j^h is the share of wage income in total household income for member *j*; and $\varepsilon\omega_p$ is the elasticity of wages earned with respect to the price of good *p*, estimated in equation (6).

Note the following:

- One would expect that farming must be fairly competitive, so cost reduction and productivity increases could lower the farm gate price of paddy. However, in the LSFM scheme, all paddy harvested in the large-scale fields will be purchased by exporters, as agreed upon by both parties under the contract. On the one hand, this ensures a secure source of high-quality rice for the exporter, on the other hand, farmers do not face competitive pressures (from other producers in the market), and hence do not need to reduce their paddy price.

- Therefore, in the policy simulation, we assume that there is no pass-through of productivity increases and production cost savings to the farm gate price of paddy sold by farmers who join the LSFM. Hence, the change in productivity and the lower cost of production only affect (positively) the household income from paddy production in which the productivity gain (crop yield) leads to higher income, and the saving with regard to costs results in a lower cost of growing paddy.

- The increase in the price of paddy and the change in the price of other goods (first step) affect both household incomes earned from production of these goods and household consumption of these goods. Slight increases in wages (second step) affect wage incomes of household members. Households' exposure to price and wage changes depends on the structure of their income and the allocation of their expenditure

5 Data access and availability

For estimation of the price changes, this study uses the 2007 national I-O table published by the General Statistics Office of Viet Nam, which is the latest national benchmark I-O table based on a direct full survey released in 2010. Viet Nam's 2007 I-O table classifies commodities and industries into 138 three-digit level commodities/industries.

For estimation of welfare effects, this study uses data from the 2010 Viet Nam Household Living Standards Survey, which was conducted by the GSO, with technical assistance from the United Nations Statistics Division, the World Bank, and Statistics Sweden. The surveys are representative at the national level.

In terms of sample design, the 2010 VHLSS is a classical three-stage stratified random survey covering ordinary households at the national level.

The sample size is quite large, with 45,000 households surveyed in the full sample each year. However, because a detailed questionnaire (including expenditures and other subject-specific modules) was applied to a random subsample of about 9,000 households, our policy simulations are based on the 9,000 households in the VHLSS that were selected for the full questionnaire out of the 45,000 households surveyed.

The 2010 VHLSS includes a number of modules providing information on demographics, education, employment, health, income, and labour supply. An expenditure module and extensive modules with information on farm activities related to agriculture, livestock, and aquaculture (including production, sale, inputs, and investment) are also included.

To reconcile the I-O table classification with the VHLSS sector classification, we aggregate the I-O table into 138 sectors and 81 sectors for estimations of household consumption/income effects and labour income effects, respectively.

Finally, we use data on monthly export prices of rice of Viet Nam and Thailand (in USD, current prices) as shown in Table A1 in the Annex. For the estimation of price transmission effects of the paddy price increase in the Mekong River Delta on other parts of the country (see Section 7.3), we use domestic prices of rice and farm gate prices of paddy (current prices) in the Mekong River Delta and the Red River Delta regions, which are available from the Information Center for Agriculture and Rural Development (AgroInfor) for the period from January 2008 to the present.

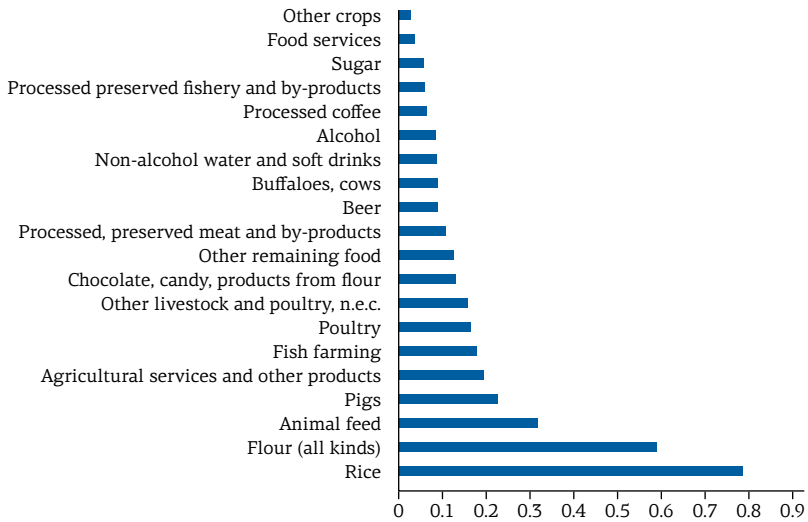
6 Estimation of price change

The Vietnamese 2007 I-O table classifies commodities and industries into 138 three-digit level categories. This classification is almost perfectly concordant with the household consumption data and production income data. For labour income effects, we have to reconcile the I-O table with sectors of the household survey containing data on labour income. We thus aggregate the 138 sectors with the 81-sector classification of the household survey's labour income data.

Figure 5 presents our estimation of the top 20 price increases (out of 138) resulting from a 1 per cent increase in the farm gate paddy price, using equation (4). This vector of price changes for the 138-sector classification is used for the estimation of the consumption and production income effects. The largest price increases are recorded for rice (0.8 per cent), flour

(0.6 per cent), animal feed (0.3 per cent), and other agricultural and aquacultural sectors. The cost-push effects tend to be concentrated in some agricultural commodities and processed foods.[18]

Figure 5 Estimation of the top 20 price increases due to a 1 per cent increase in the farm gate price of paddy (per cent)



Source: Authors' estimations.
Note: n.e.c. stands for not elsewhere classified.

7 Policy simulation

7.1 Scenario definition

This section uses the estimates for the farm gate price of paddy, productivity increases, and production cost reductions from Sections 2 and 6 to simulate the impact of the LSFM on household welfare in the Mekong River Delta and Red River Delta (only baseline scenario). Results from Section 2 are used to define the scenarios described in Table 5. The baseline scenario incorporates only a 1 per cent increase in paddy price. The objective of this scenario is to test the distributional effects of a 1 per cent increase in the farm gate price on the welfare of households in the Red River Delta and the Mekong River Delta, and hence, provide more supporting evidence for the choice of location for the LSFM.

[18] A comprehensive list of the 138-sector and 81-sector price changes, and the estimation of wage increases (using equation (6)) are available from the authors upon request.

Table 5 Definition of scenarios

	Location	Parameters
Baseline scenario	Red River Delta and Mekong River Delta, rural areas	Paddy price increase by 1 per cent
Scenario 1	Mekong River Delta, rural areas	Paddy price increase by 9.9 per cent (owing to the direct farmers-exporters linkage) Production cost reduction by 14.1 per cent Productivity increase by 14 per cent
Scenario 2	Mekong River Delta, rural areas	Paddy price increase by 9.9 per cent (owing to the direct farmers-exporters linkage) Production cost reduction by 14.1 per cent Productivity increase by 5 per cent
Scenario 3	Mekong River Delta, rural areas	Paddy price increase by 9.9 per cent (owing to the direct farmers-exporters linkage) Production cost reduction by 14.1 per cent Productivity increase by 10 per cent
Scenario 4	Mekong River Delta, rural areas	Paddy price increase by 9.9 per cent (owing to the direct farmers-exporters linkage) Further paddy price increase by 11.4 per cent (owing to the 11.4 per cent increase in the export price of rice) Production cost reduction by 14.1 per cent Productivity increase by 14 per cent

Source: Authors.

Scenario 1 is our short-term policy simulation, which incorporates not only the paddy price increase (9.9 per cent), but also the improvement in productivity (14 per cent) and the lower cost of paddy production (14.1 per cent).

It might be bold to assume that the increase in productivity following the LSFM would simply be equivalent to the difference in the observed productivity of large versus small farms. In scenarios 2 and 3, we therefore use productivity growth of only 5 and 10 per cent, respectively, to see how sensitive welfare is to changes in productivity growth.

It is important to note that the simulations assume that the farmers do not pass any cost reductions and productivity improvements on to the price of paddy. This assumption is based on the observed case of the LSFM run by the AGPPS (Dao *et al.*, 2013), where farmers who join the LSFM are not in competition with other farmers in the market (see Section 4.3).

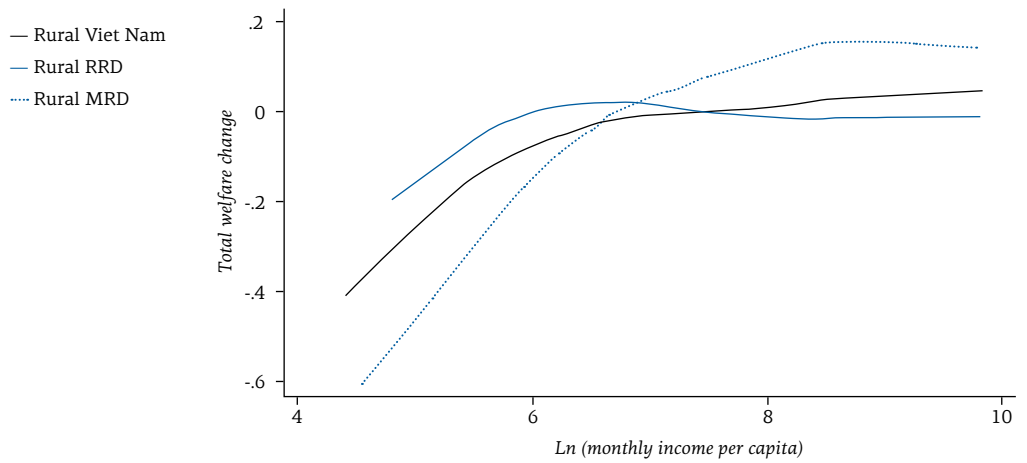
Scenario 4 is designed for a longer term: productivity grows by 14 per cent but, due to the upgrade of rice quality, exporters will have a stronger capacity to bargain for an increase in the export price of rice. As discussed in Section 2, they could then agree to pass 59 per cent (equal to the share of paddy price in the export price of rice) of the increase in the export price of rice on to the producers. This would result in an 11.4 per cent increase of the farm gate price of paddy, in addition to the 9.9 per cent increase due to the direct farmers-exporters linkage.

7.2 Results

7.2.1 Baseline scenario simulation

Figure 6 shows total welfare effects. For rural households in the Red River Delta, estimations show that a 1 per cent increase in the farm gate price of paddy would not benefit the average household welfare across the entire income distribution. Losses decrease as household income increases, but the total effects on poor households are found to be significantly negative. The middle-income and rich households would be neither hurt nor better off. Due to the very small size of farms in the Red River Delta, the poorer households tend to be net consumers of rice – their gains from selling paddy are not large enough to offset the negative consumption effect, whereas the labour income effect is zero. Therefore, it is not surprising that, even though most of the poor rural households in the Red River Delta are rice farmers, faced with the paddy price increase, they are not better off.[19]

Figure 6 Baseline scenario – Total welfare effects

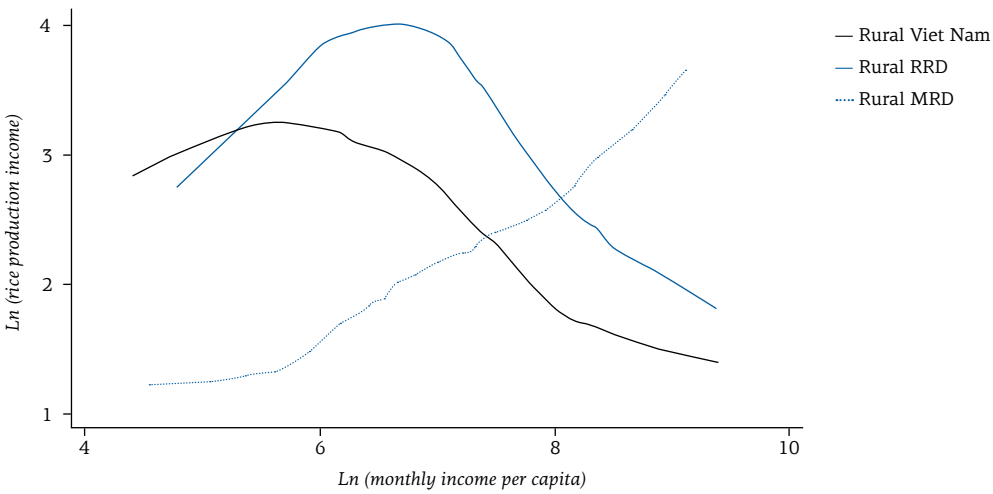


Source: Authors' calculations.

In the Mekong River Delta, we find a pro-rich bias in welfare gains. Welfare losses for poor households amount to 0.6 per cent of the initial income. For middle-income and rich households in the rural areas of the Mekong River Delta, total welfare effects are found to be positive and gains extend to nearly 0.2 per cent of initial income. The negative welfare effects on the poor in the Mekong River Delta are due to the fact that these households are larger net consumers of rice than richer households.[20]

Figure 7 highlights the difference in income from rice production between households in the Mekong River Delta and the Red River Delta. In the Red River Delta, only poor households depend on rice production income. This situation is reversed in the Mekong River Delta, where richer households earn a significant share of income from selling paddy.

Figure 7 Distribution of income from rice production



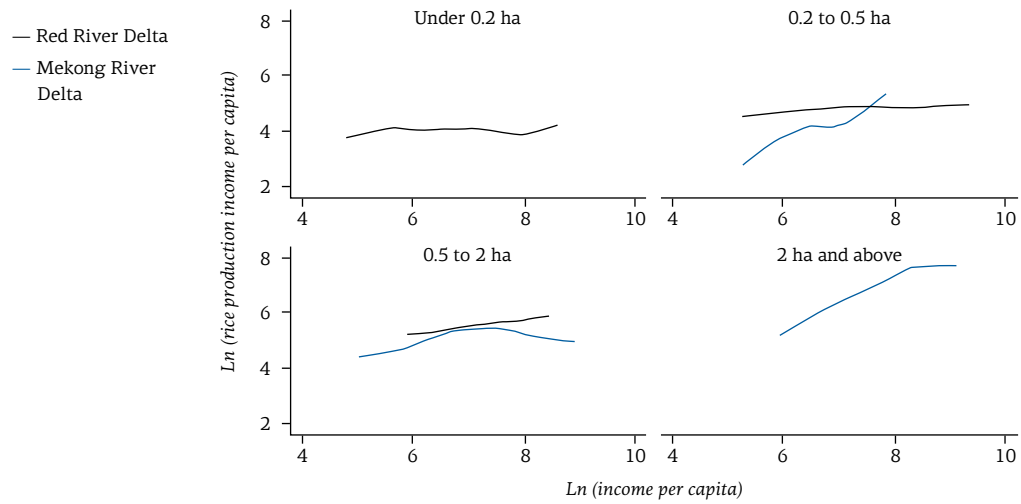
Source: Authors' calculations.

[19] Rice is the main source of calories in the diet of the Vietnamese population. It accounted for 57 per cent of the daily calorie intake in Viet Nam over 2005–2007, compared to 26 per cent in China, 38 per cent in Thailand, 48 per cent in the Philippines, and 49 per cent in Indonesia. Per capita consumption of rice in Viet Nam is 135 kg, the second highest among Asian countries, just after Myanmar (Jaffee *et al.*, 2012b). According to Jaffee's calculation, in-house rice consumption per capita is higher among rural populations and among the poorest income group.

[20] Figures A1 and A2 in the Annex focus only on the effects on consumption and production in the Mekong River Delta (effects on wage income are zero).

Figure 8 shows rice income by farm size. In the Red River Delta, income from rice production does not merely depend on farm size or the level of household income. As discussed in Section 2.2, larger fragmentation in the Red River Delta is a constraint for farmers to achieve economies of scale. In the Mekong River Delta, however, productivity gains would be higher and income earnings from rice production hence greater for larger farms and higher levels of household income (poor households usually have no land for cultivation and gain income by working for other richer households).[21]

Figure 8 Rice income by farm size



Source: Authors' calculations.

In conclusion, our baseline scenario suggests that farmers in the Red River Delta who work on small farms are net consumers of rice and hence might not benefit from the paddy price increase under the LSFM. However, farmers in the Mekong River Delta are likely to be potential members of the LSFM policy target group. Because larger gains would be captured by richer households, households with a farm size of 2 ha or above would benefit more from participating in the LSFM.

[21] As explained above, agricultural land in Viet Nam belongs to the state and is only for lease for a 20-year period (according to the Land Law). Unlike farmers in the Red River Delta, to whom agricultural land was redistributed according to their household size during 1953–1957, farm size in the Mekong River Delta is a result of the historical development of this region and does not depend on the size of households.

7.2.2 Policy simulation: Scenarios 1 to 4

As farmers in the Red River Delta might not benefit from the LSFM scheme, our simulations only focus on the Mekong River Delta. Table 6 shows *ex-ante* average effects of policy simulation in terms of rural household welfare effects and poverty reduction effects in the Mekong River Delta. The LSFM would increase the average rural household welfare in the region. The average gains are 4.1 per cent of initial income in the short term (scenario 1) and 4.9 per cent of initial income in longer term (scenario 4).

Table 6 Simulation results (per cent)

Labour income	Production income	Consumption	Total effects	Reduction in poverty rate among the poorest 10 per cent	Reduction in poverty rate among the poorest 20 per cent
Scenario 1					
0	5.458	-1.337	4.121	0.548	0.082
Scenario 2					
0	4.956	-1.337	3.619	0.548	0.082
Scenario 3					
0	5.235	-1.337	3.898	0.548	0.082
Scenario 4					
0	7.808	-2.873	4.935	0.548	0.420

Source: Authors' calculations.
Note: When the poverty line is defined as the income of the richest among the 10 per cent poorest households in rural areas of the Mekong River Delta, the poverty rate is 5.5 per cent. When the poverty line is defined as the income of the richest among the 20 per cent poorest households in rural areas of the Mekong River Delta, the poverty rate is 13.46 per cent.

Figures 9 and 10 show the total distributional welfare effects in the Mekong River Delta under scenarios 1 (short term) and 4 (long term), respectively. The estimated total welfare curves all slope upward, indicating larger gains for richer rice producers. The average gains are positive and significantly different from zero at all levels of income in both scenarios 1 and 4, except for the poorest in scenario 4. Rural household gains are much larger in scenario 4 than in scenario 1 (the gains extend up to 8 per cent in scenario 4 instead of about 5 per cent in scenario 1). The results suggest that, in the long term, middle-income and rich households gain more from rice production income as a result of the increase in the price of paddy. Figures 9 and 10 show that production income for the richer households is up to

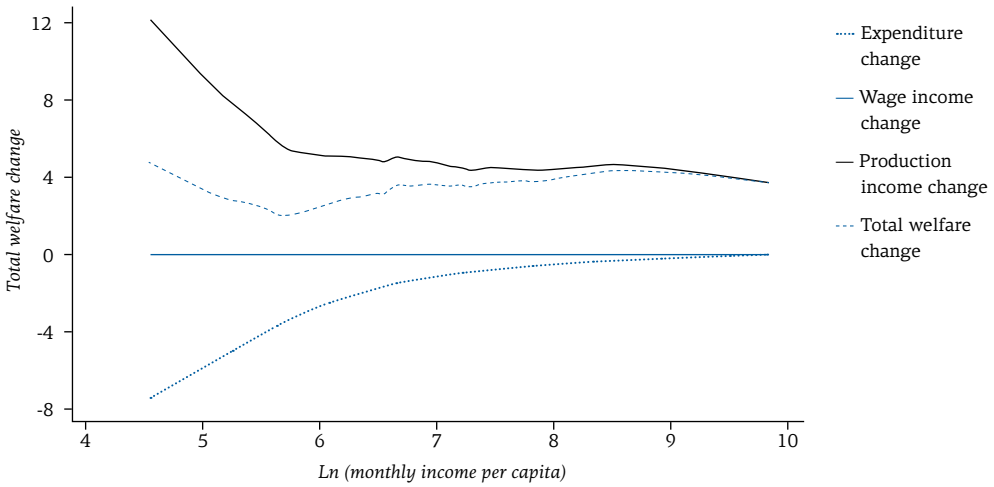
8 per cent in scenario 4 compared to 4 per cent in scenario 1. Expenditure on rice also increases for all households. However, the poorest households are the most adversely affected because their rice expenditure increases by 8 per cent in scenario 1 and by 16 per cent in scenario 4. This is more than the increase in these households' income from rice production, making the total welfare effect of the rice price increase negative for them.

Policy simulation results presented in Table 6 also show poverty reduction effects in the Mekong River Delta. Poverty rate estimations use per capita income from the 2010 VHLSS. In both short-term and longer-term scenarios, the reductions in the poverty rate among the poorest 10 per cent are the same, namely 0.548 per cent. This is because the poorest 10 per cent in the Mekong River Delta do not produce rice at all, as they do not have access to agricultural land, as explained above. Therefore, different scenarios only affect them as net consumers.

With regard to poverty reduction among the poorest 20 per cent, because we include one richer decile of households among the poorest rural deciles, an additional 11.4 per cent increase in the paddy price under scenario 4 does move some of the poor across the poverty line. As a result, attainable poverty reduction is higher in the longer term (0.420 per cent versus 0.082 per cent).

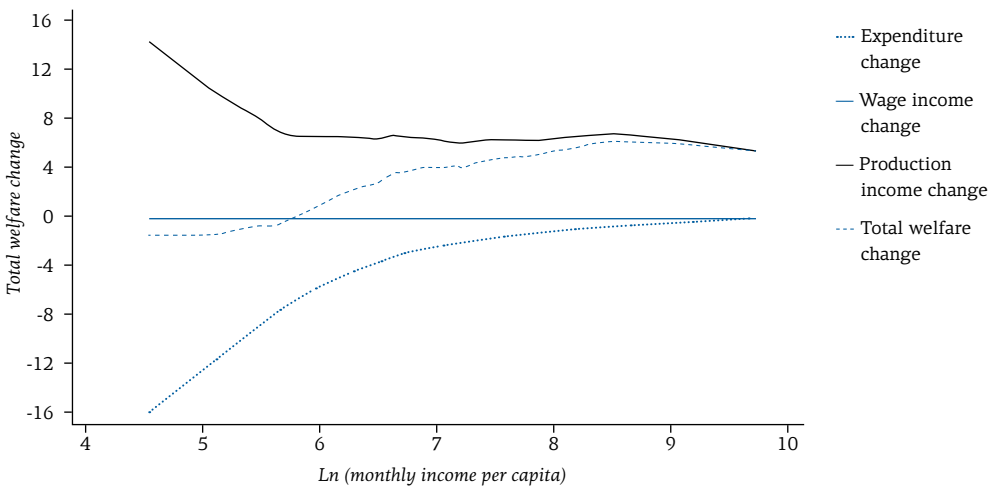
In scenarios 2 and 3, we try to see how sensitive our simulations are to the assumed productivity increase. Results presented in Table 6 show that total welfare effects decrease (due to the lower level of productivity gains) but that the impact on poverty reduction remains unchanged in both poverty rate definitions (10 per cent and 20 per cent, respectively).

Figure 9 Scenario 1 – Total welfare effects



Source: Authors' calculations.

Figure 10 Scenario 4 – Total welfare effects



Source: Authors' calculations.

7.3 Discussion of potential side effects of the Large-Scale Field Model

Although it is not quantitatively shown in our simulation results, the joint effects of the LSFM would not only increase rural household welfare in the Mekong River Delta but also increase the volume and value of rice exports (through productivity improvements and higher

export prices). Therefore, some side effects of the LSFM might be of concern to policymakers. These effects may relate to: (a) national food security – whether or not it could be compromised if and when the LSFM results in an increase in the value and the volume of rice exports, and (b) whether there would be price transmission effects of the paddy price increase in the Mekong River Delta on other parts of the country.

Regarding the first potential side effect, Jaffee *et al.* (2012b) show that, in 2030, the expected output would be far in excess of national food security needs even under the worst-case scenario of a reduction of paddy land to 3 million ha (from 4 million ha), given the current low level of productivity (5.8 metric tons per ha) and assuming that the domestic rice consumption remains at 120 kg per capita per year and there is no change in post-harvest losses (10 per cent at the farm level).

Regarding the second side effect, because the paddy price change would directly affect the domestic price of rice, we could assume that the law of one price holds. This implies that any change in the farm gate price of paddy would be fully transmitted to the domestic price of rice in the Mekong River Delta. Therefore, we could apply a simple framework to examine the price transmission effects of the paddy price increase in the Mekong River Delta. The domestic price of rice in time t in the Red River Delta is a function of domestic prices of rice in the Mekong River Delta:

$$\ln p_t^{MRD} = \beta_o + \beta_1 \ln p_t^{RRD} + \varepsilon \qquad (8)$$

Econometric estimations use panel data on weekly domestic paddy prices from 1 January 2008 to 20 August 2013. The results are shown in Table A2 in the Annex. We use dummies for monthly fixed effects. The estimated pass-through elasticity is close to zero and statistically significant. This implies no price transmission between the Mekong River Delta and the Red River Delta. This result confirms that an increase in the farm gate price of paddy following the LSFM would not affect the domestic price of rice in the rest of Viet Nam.

If the LSFM were applied on a region-wide scale, it is likely that additional exporters would join the scheme. As the LSFM leads to productivity gains and cost reductions, one would expect the domestic price of paddy to decrease over the longer run (at least partially in the Mekong River Delta region), due to greater market competition among farmers.

8 Conclusions

This study has examined the potential impact of the adoption of the Large-Scale Field Model on household welfare and poverty reduction in the Mekong River Delta.

The study has first found that an increase of 1 per cent in the price of paddy would benefit households in the Mekong River Delta but not households in the Red River Delta. The larger fragmentation of land in the Red River Delta makes it difficult to implement the LSFM. We therefore suggest that farmers from the Mekong River Delta be given priority for the application of the LSFM. Within this policy target group, households with a farm size of 2 ha or above would likely benefit more from participating in the LSFM.

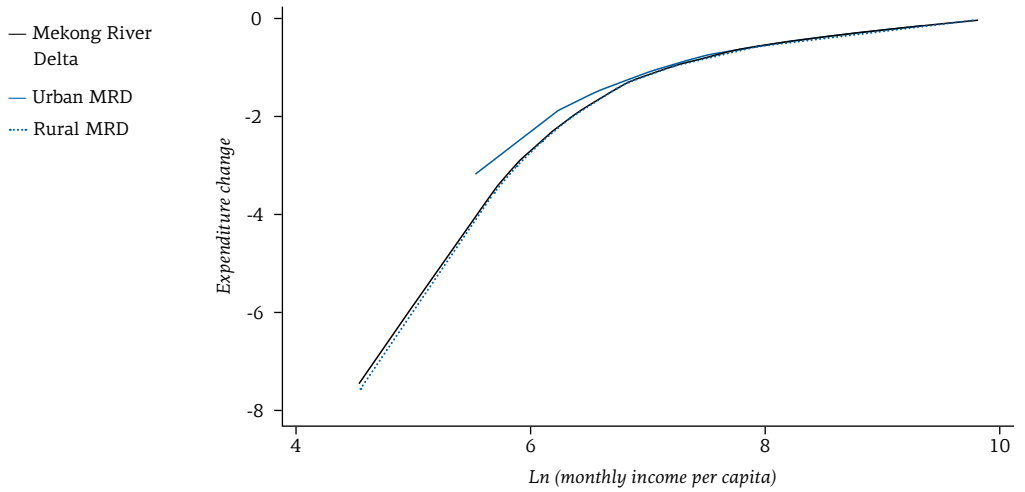
The estimation of *ex-ante* effects shows that the LSFM would improve average rural household welfare by 4.1 per cent in the short term and by 4.9 per cent in the longer term. In all scenarios, the LSFM would result in poverty reduction in the Mekong River Delta. The effective poverty reduction would be higher in the longer term, when exporters could bridge the gap between export prices of Viet Nam and Thailand.

As the LSFM idea has been met with considerable interest by the government of Viet Nam, as well as by local authorities in provinces in the Mekong River Delta, we suggest that to attain the government's objective of a minimum rate of return of 30 per cent for rice farmers, the LSFM might be a better policy option than setting price floors for export prices and farm gate prices of paddy.

As discussed above, the combined effects of the LSFM would not only improve household welfare in the region but also foster Vietnamese rice exports. As state-owned exporters may have fewer incentives to implement the changes proposed by the LSFM scheme, private exporters would likely be better candidates to lead the implementation of this policy. The rice export quota granted to SOEs could be a bottleneck, however, because the implementation of the LSFM requires that some level of competition be established among Vietnamese rice exporters.

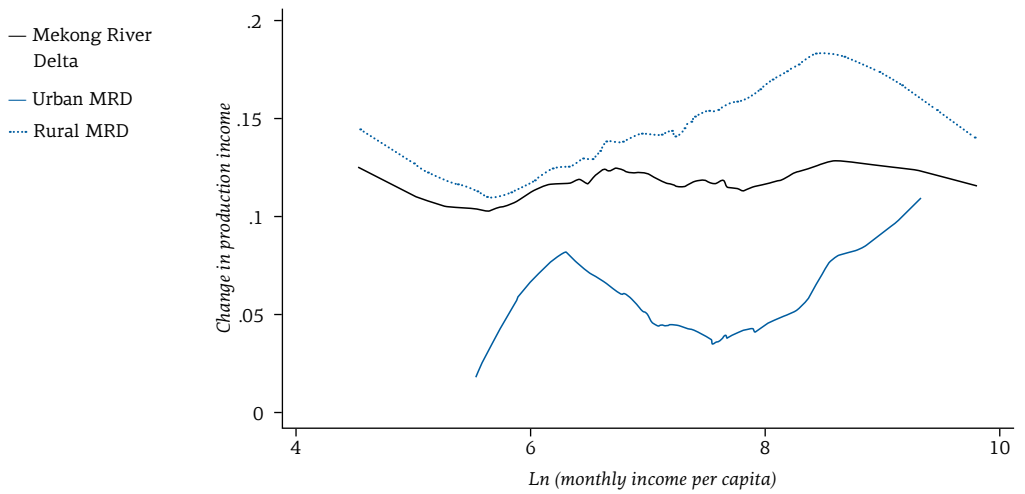
Annex

Figure A1 Baseline scenario – Consumption effects



Source: Authors' calculations.

Figure A2 Baseline scenario – Production income effects



Source: Authors' calculations.

Figure A3 Viet Nam regional map

Source: General Statistics Office of Viet Nam.

Note: The eight socio-ecological zones recognized by the GSO are: (1) Red River Delta, (2) North-East, (3) North-West, (4) North Central Coast, (5) South Central Coast, (6) Central Highlands, (7) South-East, and (8) Mekong River Delta.

Table A1 Monthly FOB export prices in Thailand and Viet Nam ports for 5 per cent broken rice, January 2011 – August 2013 (USD per metric ton)

Month	Year	Thailand	Viet Nam	Difference (per cent)
January	2011	519	501	3.4
February	2011	519	487	6.5
March	2011	487	469	3.8
April	2011	467	481	-3.0
May	2011	474	476	-0.3
June	2011	504	466	8.1
July	2011	522	503	3.7
August	2011	557	552	0.9
September	2011	590	557	5.9
October	2011	616	579	6.3
November	2011	604	565	7.0
December	2011	584	512	14.1
January	2012	538	477	12.8
February	2012	543	447	21.4
March	2012	536	430	24.8
April	2012	497	446	11.4
May	2012	591	447	32.4
June	2012	591	418	41.4
July	2012	581	414	40.4
August	2012	573	434	32.2
September	2012	585	462	26.7
October	2012	565	452	25.0
November	2012	551	455	21.2
December	2012	555	425	30.7
January	2013	564	411	37.0
February	2013	573	410	39.8
March	2013	562	409	37.2
April	2013	544	394	38.2
May	2013	562	380	47.7
June	2013	540	371	45.4
July	2013	480	397	21.0
August	2013	480	400	19.9

Source: Authors' calculations, based on data from AgroInfor.

Table A2 Price transmission effects – Dependent variable Ln (RRD paddy price)

	Ln (RRD paddy price)	**Ln (RRD rice price)**
Ln (MRD paddy price)	0.000222*** (24.49)	
Ln (MRD rice price)		0.0000852*** (26.77)
January	0.0776* (1.92)	–0.0146 (–0.54)
February	0.0842** (2.03)	–0.0334 (–1.22)
March	0.119*** (2.93)	–0.00776 (–0.29)
April	0.127*** (3.11)	0.0108 –0.40
May	0.123*** (3.06)	0.0328 (1.23)
June	0.110*** (2.74)	0.00687 (0.26)
July	0.0596 (1.49)	–0.0180 (–0.68)
August	0.0473 (1.17)	–0.0303 (–1.13)
September	–0.0405 (–0.96)	–0.0186 (–0.66)
October	–0.0436 (–1.06)	–0.0341 (–1.24)
November	–0.0213 (–0.51)	0.0113 (0.41)
Constant	7.593*** (127.48)	8.522*** (239.83)
Number of observations	331	331
Adjusted R^2	0.652	0.686

Source: Authors' estimations.
*Note: t-statistics in parentheses. *, ** and *** stand for p ≤ 10%, p ≤ 5% and p ≤ 1%, respectively.*

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