# Impacts of Agricultural Trade Liberalization on Foodcrop Production and Farm Income: The Situation of Java's Lowland, Indonesia

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## Introduction

The world is becoming much more integrated as a consequence of multilateral (GATT/WTO), regional (APEC and AFTA) and unilateral reforms. These reforms are implemented simultaneously. For Indonesia this means new export market opportunities abroad as well as increased import competition in its domestic market. It means also more obligations to open up and further liberalize its own economy. While that may at times be painful for some groups and adds to political pressures, the net additional economic gains from further deregulation are expected to continue to be substantial. Anderson and Pangestu (1995) argue that there are basically two alternative approaches for the Indonesian government. One is to resist the liberalization thrust and seek special favors to slow the relative decline of agricultural sector, as was done in Japan and Korea. The other is to embrace the reform thrust for agriculture in return for accelerated reform in the more protected non-farm sectors, as is being done in Australia and New Zealand.

Undoubtedly Indonesia has chosen the second option. Public intervention in agriculture has already been considerably reduced and the domestic market is becoming more liberalized. However, as there is a widening gap between agricultural and non-agricultural income, and because of the urban problems associated with increasing rural migrations, the Indonesian authorities are still very keen to maintain specific support to farmers. This concerns those farmers who are not able to adapt easily to strong competition accompanying a liberalized environ- ment.

Even if the economic growth of the last ten years is impressive in the international context, the agricultural sector still plays a major role in the economy. More than 50% of the workforce is still employed in agriculture, with around 70% of that in the food crop sub-sector. In 1993 agriculture, including fishery and forestry, is the largest non service sector of the economy with 18% of GDP and over 37% of the value of non oil exports (World Bank, 1996). The issue of impact of agricultural liberalization is thus important.

Considering the multiplication of agricultural policy objectives that are not fully compatible, decision making in this domain is becoming more and more difficult. To identify the best or the less worse compromise between these alternative choices, policy makers need analytical tools which are able to assess the potential effect of their decisions in such a complex policy setting. This paper presents how a model based on a set of farming systems can help the policy makers to understand the impact of various policy options with regard to the development of soybean production in Indonesia. After a brief description of the methodology of the model, discussion on selected farming systems are presented. The third part discusses trends in foodcrop production, the government's past and current policies and ways to simulate liberalization of agricultural inputs and outputs. In the fourth section, the results of the simulations are briefly presented, both at aggregate and farm levels.

## Model Analysis and Approach

This study used the agricultural production module of the MATA (Multilevel Analysis Tool for the Agricultural Sector) model which has been built for the analysis of the impact of changes in policies both at aggregate and farm level. The MATA model is a micro-macro approach, based on a detailed representation of

farming systems through opportunities and constraints related with agricultural production. Opportunities and constraints are determined by agro-climatic and socio-economic conditions for each type of farming system. Then, one "jumps" to the regional level through scale parameters representing the share of each farming system. The model must reproduce farmers' behavior, evaluate the response to policy and estimate the impact on economic characteristics at the farm and production level. Detail discussion on the model is presented in, among others, Gerard, et al. (1994).

## Lowland Farming in Java

The following discussion draws heavily in Gerard and Erwidodo (1996) and Marty et al. (1997). Indonesian agriculture is characterized by diversity of the bio-physical and socio-economic conditions. Farming in Java and the outer islands differs considerably. In Java, agriculture is very intensive because of the abundant availability of water and the very small average size of farm holding (0.56 ha). In Java the diversity of farms is high. One can distinguish irrigated versus rainfed agriculture, lowland versus upland conditions, and also flatland versus hillside cultivation. To simplify this exercise in estimating the impact of liberalization, we propose to focus on Java lowland. Java represents 60% of the total population, and only 7% of the landmass of the archipelago. Java produces about 60% of the food crops in Indonesia, and especially the lowlands with 90% of the rice and 60% of the soybean production of Java.

Using multi-factor analysis, three different types of agro-ecological area for food crops are identified, namely: (1) irrigated lowlands, with more or less water, (2) rainfed areas, non irrigated, usually in more sloping areas and (3) dryland areas, which are mostly uplands, where maize and cassava are the main food crops. Also, based on rainfall, three cropping seasons can be identified: a wet season and two dry seasons. Water availability is the main constraint to cultivation of food crops. It not only influences the number of cropping seasons possible during one year, but also the type of crops and the level of yields. Thus, we can further differentiate irrigated areas based on the water availability and the level of water management: high, intermediate and low level of water management. Irrigated areas are clasisfied into technically irrigated and simple irrigated areas. In the technically irrigated areas water comes from infrastructures such as dams and canals with high water control, while in simple irrigated areas water comes mainly from small rivulets and streams with low water control.

The differences in rice yields between high, moderate and low level of water control are not substantial. However, the cropping patterns are more diversified in areas with moderate and low water control. A secondary crop, which needs a lesser amount of water, is more profitable and less risky. The soybean yield varies between 800 and 1400 kg per ha, depending on soil conditions, water availability at the beginning of the crop season and input used by farmers.

In larger irrigated farms, animal traction and hand tractors are used. It is still not the case in the rainfed areas. Hand tractors are often rented by wealthier farmers or by a local firm, sometimes owned by groups of farmers. Mechanization allows farmers to plant the second crop earlier and thus improve potential yields of the third season crops that, if planted earlier, will get more rain. Animals are of little importance in most of Java's lowlands and represent less than 10% of farmers wealth. In contrast, off-farm income is an important part of household income. Around 20 and 30% of time of farmers is being spent on other activities than agriculture. These non agricultural activities are highly diversified and depend mainly on the proximity of urban areas and the capital availability. It can be some regular work, in services or production, or some seasonal activities such as drivers or construction workers.

Table 1 presents 9 main farm types found in Java's lowlands, based on endowment, type of land, cropping management and production.

Table 1 Main Lowland Farming Systems and Their Characteristics in Java.

| Farming System Characteristics | Technical irrigated with high level water control | | | Simple irrigated with moderate to low water control | | | | Rainfed | |
|---|---|---|---|---|---|---|---|---|---|
| | F1 | F2 | F3 | F4 | F5 | F6 | F7 | F8 | F9 |
| Area Controlled (ha) | 2.4 | 1.05 | 0.95 | 1.2 | 0.7 | 1.2 | 0.7 | 0.35 | 0.35 |
| Active person | 3.2 | 3.2 | 3.6 | 2.5 | 2.7 | 2.5 | 2.7 | 2.0 | 3 |
| Type of land | irt | irt | irt | irt | irt-irs | irt | irt-irs | rai | rai-dry |
| Cultivated area (%): | | | | | | | | | |
| Rice | 95 | 96 | 94 | 44 | 60 | 56 | 70 | 47 | 30 |
| Soybean | 2 | 1.5 | 1.3 | 36 | 36 | 8 | 6 | 3 | 2 |
| Maize | 0 | 0 | 0 | 19 | 4 | 36 | 24 | 30 | 29 |
| Other | 3 | 2.5 | 4.7 | 0 | 0 | 0 | 0 | 20 | 39 |
| Mechanization | yes | yes | yes | yes | yes | yes | yes | no | no |
| Yearly net income per cap (million rp) | 2.5 | 1 | 0.6 | 1.6 | 0.8 | 1.9 | 0.9 | 0.55 | 0.25 |
| Off-farm income (%) | 12 | 26 | 36 | 17 | 29 | 18 | 35 | 37 | 40 |
| Animal in total wealth (%) | 0.01 | 6.3 | 0.3 | 3.5 | 8.1 | 3.5 | 7 | 0.2 | 0.3 |

Notes:

**irt** is "technical irrigated", **irs** is "simple irrigated", **rai** is "rainfed land" and **dry** is "dryland"

Sources: SYGAP Database. Kawagoe, T. et.al. (1990)

The area controlled by households is between 0.3 and 2.4 ha. Some farmers rent part or all of operated land. Farmers in rainfed areas control less land than farmers in irrigated areas. As mentioned before, rice is the dominant crop in low wetlands, especially in areas of high level of water control where it occupies more than 90% of the total cultivated area. Off-farm income is more than 1/3 of total income for the poorest farmers. The income per active person varies in a scalable range from 1 to 7.

These nine types are not the only existing ones in Java lowlands, the diversity of farmers being far greater, but they cover the main characteristics of farming[1]. The selected farmers produce 95% of lowland rice, 100% of lowland maize and soybean of Java, and they are a large part of the Javanese agricultural workforce.

## Major agricultural policies on Foodcrops

### Input price policy

Since the early seventies the input price policy was widely used in Indonesia as an instrument to promote rice production within the BIMAS/INMAS programs. The government gave direct subsidies to fertilizers and pesticides producers and importers. After 1986, when trend-sufficiency in rice was reached, because of the high cost of this policy and the decline of government revenues from oil exports, the question of more economically efficient policy was raised. Fertilizer was the most subsidized input, reaching its peak in the early 1980's, ranging from 40 to 65% above the world price according to the type of fertilizers (BINUS, 1987; Hedley and Tabor, 1987; Gonzales, et.al. 1993). The government decided to reduce the subsidies of agricultural inputs not only to reduce the cost of the policy but also because some studies showed that the level of use was sometimes over-optimal. In Java, rice farmers have generally been using fertilizer 10-20% above the recommended rates (Sudaryanto et.al. 1992). For pesticides, the subsidies were gradually decreased from 75% in 1986 to 40% in 1987 and finally totally withdrawn in 1989.

In 1991, the retail prices of fertilizers were raised with 25% in 1987, 8% in 1988, 25.9% in 1990 and 23.5% in 1991. Subsidies for potassic fertilizers were removed in 1993 and for phosphatic fertilizers subsidies were removed in 1994. The budget allocation for fertilizer subsidies decreased from US$ 457 millions in 1987 to US$ 229 millions in 1993. In 1996 the subsidies were lifted for almost all inputs. For

[1] One major limitation of this exercise is the set-aside of sugar cane production. The profitability of sugar cane seems to be closely related to farm location, proximity to sugar mill factory, existence of constraint on labor, etc. (Collier, 1993). Moreover the policy on sugar cane was difficult to represent in this model, because sugar cane runs over 18 months while MATA is designed on the basis of an annual asset base (some area is presently still under sugar cane production quota).

fertilizers such as TSP and KCl farmers even paid higher than import parity prices.

## Rice production and support policy

Rice production grew at a rate of 4.7 percent per year over the period 1969-90 leading to self sufficiency in 1985. This success is in large part the result of the adoption of the high-yielding rice varieties, the increase in fertilizer utilization and expansion of the irrigated area. Through BIMAS and INMAS programs the government disseminates high yielding varieties of rice, provides extension services and distribution of fertilizer and pesticide at a highly subsidized price.

The INMAS program was designed to increase production through the use of improved seeds fertilizers, pesticides, water management, improved cultural practices. The BIMAS program, in addition to the INMAS program, provides farmers with credit to use modern inputs and cultivation practices. The INSUS scheme, as an improvement of BIMAS scheme, encourages farmers in continuous rice production to cooperate and make joint decisions about seeds, planting times, and crop choices in addition to rice.

As explained, after 1985 the subsidies were gradually reduced. In contrast, the main intervention instrument, the price policy, is still in use. It guarantees a stable price for rice through intervention in marketing. A floor price is widely announced before planting time and thus removes part of the seasonal price risk associated with rice production. The floor price is implemented by BULOG[2], which manages the storehouses in each district. During 1972-1989, the coefficient of variation of prices[3] is 0.16 for domestic prices and 0.59 for international prices (Gerard and Marty, 1995). The share of Java in all Indonesia rice production has been nearly constant around 60%.

International prices of rice are slightly lower and more unstable than domestic prices in Indonesia. Thus to represent the liberalization in a scenario, one can assume that rice price will decrease with 20% and that the gross margin variability will increase with 10% .

## Maize production and policy

During the 25 last years, maize production increased in Indonesia. The growth rates were 2.29% in average on the period 1970-76, 6.01% on 1976-82, 5.68% on 82-88 for the whole Indonesia and a little bit lower for Java (respectively 2.21, 5.58 and 4.36). Maize was the first secondary crop to have floor prices (1978). It was ineffective because market prices were always above the targeted floor prices (Timmer, 1992; BINUS, 1987; Altemeier, et.al. 1989; Rosegrant, Kasryno 1987). BULOG procure- ment never exceeded 3% of domestic production. In 1991 floor price was no longer fixed and import control has been the main market intervention since then. No ceiling prices were announced, but BULOG tries to iron out fluctuations in prices faced by the feed industry by releasing stocks.

This stabilization policy was successful. Compared with international prices the coefficient of variation of domestic prices was lower than for international markets (17.1% and 34.4% during 1972-1989). Some years the country imported maize because of the strong increase in demand for this commodity. However, increase of fertilizer use was encouraged through the fertilizer subsidies and intensification programs, promoting the adoption of improved varieties since 1983. Given the relatively slight intervention of the government, confirmed by comparison of international and domestic prices, no change in price level or variability is assumed after liberalization.

## Soybean production and Support Policy

In the early eighties the national soybean deficit increased very rapidly despite policy intending to achieve the goal of self-sufficiency. The soybean policy was based on two components: development and adaptation of technical packages[4] along with a reinforcement

[2] Badan Urusan Logistik: National Food Logistic Agency.

[3] The coefficient of variation is calculated on five years moving average.

[4] Between 1981 and 1991 no less than 15 soybean varieties were released by the Ministry of Agriculture, numerous package of technology were adapted to fit in the current

of extension services targeting soybean, and the establishment of a favorable and attractive economic environment through a price policy (Hermanto et.al. 1992).

During 1980-1992 on the price support side, BULOG intervened on domestic soybean markets through two instruments: a floor price on soybean and import control. The floor price was ineffective, the level of authorized import maintaining the domestic price of soybean well above the import parity price. BULOG is the sole importer of soybeans but, in practice, issues importing and processing contracts (for meal crushing) to the private sector.

Shifts in relative prices between rice, soybean, and especially maize (the major competing crop) explain to a large extend the attraction of soybean to farmers. Between 1980 and 1991, the average soybean price appreciated at an annual rate of 4.5% relative to the price of rice. This had a significant impact on soybean production which increased annually at a 10% growth rate from 1980 until 1992. The major part of this increase is due to area expansion, whereas yield increases count for only 3% of the total production increase. The increase in planted area results from various factors. On Java there is a shift in cropping patterns in favor of soybean during the dry season and cultivation of fallow field when water availability or pests management do not permit another rice crop. But the national production expansion comes mostly from opening new production zones outside Java.

After a regular increase in the first years of the soybean policy, soybean yields leveled off since the end of the eighties. This is due to two phenomena. First, a decline in the marginal yield increase (i.e. once the major components of the package are adopted by farmer, the yield growth slows down); second, the constraints in farming to further intensification of cropping.

In particular in irrigated areas with high cropping intensity indexes and where rice production intensification has already mobilized a large share of production factors, the boundary of farming intensity has been reached. Despite all efforts intending to increase both yields and area of the soybean production, the national production increased by much lower rates than its demand. As a result, import was growing steadily at around 8.5 percent per annum. Intensification of soybean production has been marked by the high yield variability. This risk is mainly related to the limited efficiency of pests control and to difficulties faced by farmers in water management (CGPRT 1992).

production environments (irrigated, rainfed and dry land) (CGPRT, 1992)

## Policy Changes and Simulation Scenarios

Liberalizing the food crops subsector will lead to changes in prices and variability. According to economic theory, domestic prices will adjust to international prices except if transaction costs are too important or if the domestic production is sufficiently high in comparison with the world production to influence prices[5]. For rice during 1972-1989, the coefficient of variation of prices is 0.59 on the international market and 0.16 for the domestic market (Gerard and Marty, 1995). Moreover, domestic prices are somewhat higher than international prices. The same may be said for soybean and maize in terms of price variability, while price levels of maize are similar to international prices and the price of soybean is around 50% higher than on the international market (Gonzales, et al., 1993).

In this paper, input market liberalization scenario is used to test the model ability to reproduce real evolution after a policy change takes place. The result is not presented but one can find it in Gerard and Erwidodo (1996). The simulation result of this scenario indicates that, as is proved empirically, input market liberalization contributes no significant changes in both land allocation and foodcrop production.

The assumption used in the base-run scenario (S0) respresents the actual or the most likely situation to happen, namely: soybean and maize prices increase, respectively, at 5% and 2.5 % annually during Y1-Y4 period; labor

[5] As Ellis (1998) remarked that for rice Indonesia faces a "large country, small world market problem" in all its dealing with the world rice market. Nevertheless we consider that Indonesia has no impact on world market rice price.

wages for both farm and off-farm increase at 5% rate; off-farm activities opportunities increase at 5%; annual population growth rate is 2%; and finally, other prices (inputs and outputs) are held constant

Under market liberalization one would expect a release of the import restrictions both on rice and soybeans. This is assumed in Scenario 1 (S1). Following economic theory, such a release would equalize domestic and international prices. In S1, we assume that: domestic price of rice decreases with 20% and risk increases with 200%, soybean prices decrease gradually towards 40%, no change in the price of maize, but its variability increases with 20%. Soybean prices on international market are more unstable than in the current domestic market. Because the risk on gross margins associated with soybean production is already high, due to yield variability and pests and diseases, it does not seem practical to increase it more in our scenario. Scenario two (S2) is the same as S1, except it assumes no change on rice.

In Scenario 3 (S3), we assume that some technical innovations on rice and soybeans take place to counteract the adverse effect of market liberalization. Because soybean yields are still low compared to potential yield level, we assume an increase of yield of 50%, thus slightly overcompensating the decrease of profitability associated with the decrease in prices. This assumption also applies on rice. In addition, because variability of yields is a major characteristic of and a major constraint to soybean production in Indonesia, here we assume a reduction on risk on gross margin by 60% resulting from technological improvement. It then corresponds to a slightly more risky crop than maize.

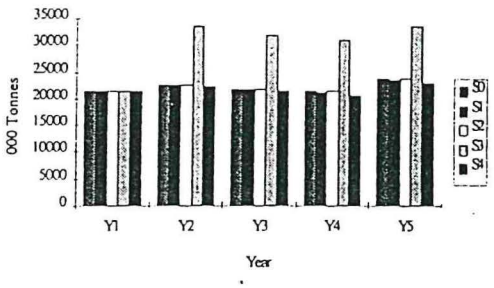
Finally, scenario 4 (S4) is market liberalization (as in S1) with labor market adjustment such that there is going to be quicker increase (10%) in off-farm activities in comparison with the base-run.

## Impacts of Market Liberalization

### Impacts on Land Allocation and Foodcrop Production

The main result in regional production is that rice production remains stable after the liberalization (Figure 1). In contrast, soybean production decreases sharply in the liberalization scenario (Figure 2), while maize production shows a strong increase (Figure 3), underlining the land competition between these two crops. Considering the importance of rice stabilization in Indonesia, the second scenario excludes this crop from the liberalization process. The impact is important in terms of income, as will be analyzed later, but not on regional production.

Figure 1. Impact of liberalization on regional rice production




Considering the adverse impact of the output market liberalization, two technical improvements were included in the third scenario on rice and soybean (increase of yield of 50% for both crops, with improvement in practice and material). Up to now, resources are, indeed, still devoted to researches on new varieties which could allow further increase in yields of rice and soybeans. For soybean, the actual level of yields, 800 kg per ha on average for Java lowland, the simulated increase will lead to a medium level in comparison with international performances. The supply response is important for these two products. The increase in soybean production is higher than the yield increase because more land is allocated to this crop. In fact, the technological improvement overcompensates the loss of profitability induced by the liberalization of trade. In some areas, the

crop becomes more profitable than maize and the production of this latter crop decreases.

Figure 2. Impact of liberalization on regional soybean production.

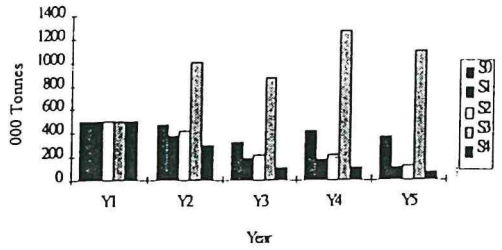
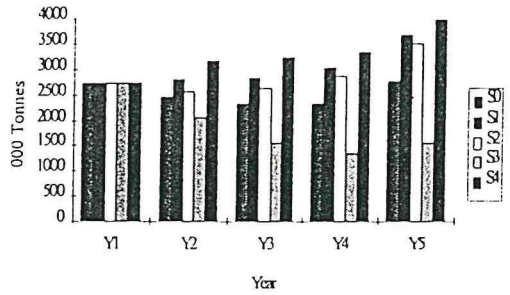



Figure 3. Impact of liberalization on regional maize production.




Because the Indonesian economy experiences continuously a high growth rate, the S4 assumes a quicker increase of off-farm activities in comparison with the base run (10% instead of 5% in the base run). There is a slightly negative impact on rice production (Figure 1), a negative impact on soybean (Figure 2) and a positive one on maize (Figure 3), underlining the low labor requirement of this latter crop.

## Impact on Farm Income

The decrease of agricultural income after liberalization of the whole food crop subsector is sharp for each farm type (Table 2). The situation is much better if rice is excluded from the liberalization process (S2). The technical innovation scenario (S3) has different impacts from one farm to another. For the farms with the high level of water control, agricultural incomes become bigger than in the base run (S0), because they are highly specialized in rice and in position to take advantage of the innovation. For the farms in the rainfed area, the situation is hardly better than in the liberalized scenario (S1), since the small areas under control do not allow them to take advantage of the technical innovation.

The simulation with the higher increase of off farm activities (S4) has the worst impact on agricultural income. But, in fact, if the whole income, including off farm activities, is included, this situation is the most favorable, except for the biggest farm from the high level of water control area. For this farm, the tension on labor market is very damaging, because it relies highly on hired labor for cultivation.

For all the other farms it is clear that the best way to increase rural income is to promote the development of off-farm activities such as processing and packaging of agricultural products or other small scale rural industry. The farmers which are worst off, in the liberalization scenario (S1), are the landless farmers (F3) and the farmers in the rainfed area (F8 and F9). The importance of off-farm activities allow them to maintain and not to decrease total income.

Table 2. Agricultural income in various scenarios after 4 years simulations (000 rp).

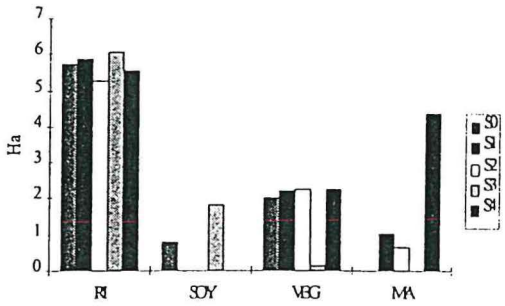
| Farm type Scenarios | Technical irrigated with high level water control | | | Simple irrigated with moderate to low water control | | | | Rainfed | |
|---|---|---|---|---|---|---|---|---|---|
| | F1 | F2 | F3 | F4 | F5 | F6 | F7 | F8 | F9 |
| S0 | 1979 | 664 | 353 | 1279 | 541 | 1586 | 575 | 183 | 61 |
| S1 | 1335 | 441 | 191 | 853 | 336 | 1186 | 428 | 112 | 35 |
| S2 | 1726 | 606 | 274 | 1022 | 434 | 1370 | 534 | 146 | 45 |
| S3 | 2018 | 901 | 354 | 945 | 385 | 1451 | 503 | 143 | 52 |
| S4 | 1135 | 384 | 245 | 705 | 358 | 1032 | 408 | 101 | 33 |

The three farm types, which represent roughly one and half million households and around 4 million active labour units, have very few incentives to stay in agricultural production in the liberalization scenario. However, they are already part time farmers, and if opportunities of off farm activities increase their income will go up. For good measure one needs to add that this implies at least strengthened seasonal migration and also longer term migration.

The analysis of land allocation of Farm 1 confirms the above analysis. This farm type, which has a relatively large area with good soil, under control, is able to adapt to a liberalized environment. In the second scenario, the land devoted to vegetables and maize increases; in scenario 3 more land is devoted to crops under technological innovations; soybean and rice.

Because of the difficulty to find hired labor in some periods in the fourth scenario, this farm type shifts from soybean and rice to maize.

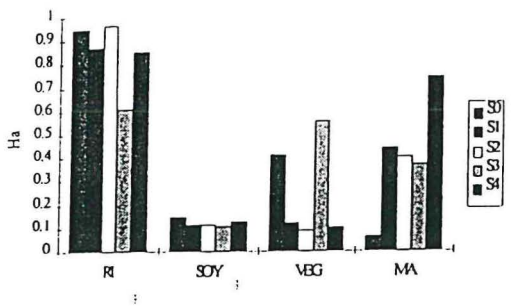
Figure 4. Yearly land allocation in various scenarios (Farm 1).




Farm 5 is strongly affected by the liberalization. Because soybean is actually the main secondary crop, maize takes this place in S1. The income decreases sharply and thus the risk aversion[6] increases and the liquidity constraint becomes tighter, leading to a reduction of the vegetable area.

[6] the risk aversion parameter is calculated as A = 1/coef*WH

Figure 5. Land allocation in various scenarios (Farm 5).




## Conclusion

Various scenarios concerning the liberalization of the food crop trade subsector were tested and analyzed in this study using the MATA model. The interesting feature of the model is that it enables an evaluation of the impact both at regional and farm levels. The specificities of the tool allow the representation in detail of the specific situation of each type of farm, and to take into account risk and market imperfections. It lead to more detailed results than found with a classic partial equilibrium model, such as the study by Altemeier and Bottema (1991).

At the aggregate level, agricultural market liberalization will not have a significant effect on rice production, showing the low supply substitution between rice and other crops and the high stability of rice production in the lowland farming systems in Java, even under changing economic policy. The high technology used in rice, and comparative advantage in labor inputs, account for the competitiveness of the Indonesian rice production. It is also a result from the high interdependency of farms on irrigation decisions, making it impossible for one individual farmer not to grow rice if all the lots around are flooded.

In contrast, the impact of market liberalization on soybean production is high. The liberalization of soybean trade is of course incompatible with the current policy objective of self sufficiency in this crop. In fact, substitution supply effects between secondary crops are strong and maize is much more competitive than soybean in the case of domestic market liberalization. Only important technical innovations able to improve yields and/or to decrease pests and disease, allow soybean production to increase under lifting of trade restrictions. Clearly, yield increase could compensate the price decrease in terms of profitability and the main constraint which hampers the soybean production with the actual high profitability is the associated risk. Without technological improvement in soybean, maize, or a crop with similar requirements, will replace soybean.

At farm level, impacts of trade liberalization are strongly negative on agricultural income. The decrease is less pronounced if rice is excluded from the trade liberalization. Technological improvement for rice and soybean are able to partially compensate the negative impact of trade liberalization on agricultural income. The farms in the irrigated area are even able to get a higher income as compared to the situation in the base-run. Increased off-farm job opportunities have a strong positive effect on household income except for the largest farm type of the study.

Finally, this study highlights the importance of technical innovations to maintain rural income in a trade liberalization process. Innovation could be induced by a variety of sources. Among these, biotechnology may play a part, the research and extension efforts play another, but the major role is to be played by the private sector. This means that private investment in R & D in agriculture becomes the driving force in the dynamics of the agricultural sector.

Nevertheless, when land distribution and population density are such that little land is available, it becomes very difficult to raise agricultural income. In such a situation the development of off-farm activities in rural areas is expected to increase household income, this may prevent massive migration, but also implies migration. Our investigation shows that claims on the positive effects of liberalization for farmers, because of efficiency gains, have to be reconsidered in a real life, or imperfect market context, at least in the short term. The liquidity constraints and the existence of risk aversion prevent farmers from specializing in the more profitable crops. This study also points out that the development of off-farm activities is necessary to increase rural income. The

liberalization of the agricultural trade will induce a sharp decrease in income, and for around 4 millions active members of the labour force, very few incentives will remain to stay in agricultural production. So, even if the liberalization process leads to more efficient factor allocation in the medium run, it could be worth considering, during the time of adjustment, to define accompanying policies to minimize adverse impacts. Earlier it was recalled that the agricultural sector is characterized by many policies, some of which may counteract. The reason is obvious; there are short term needs of people and medium term directions of "best economic" policy. One can only in a perfect economy expect the two to be in line.

The results of this study are scenario calculations. Essential are choices on the actual speed of the course of events. In reality there are many factors of influence on the actual speed of changes.

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