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The Policy Analysis Matrix of Profitability and Competitiveness of Rice Farming in Malaysia

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In recent years, the Malaysian rice sector has experienced structural changes to increase its competitiveness within a dynamic environment that is influenced by political, technical, economic and international trade challenges. Using a Policy Analysis Matrix, this paper examines whether Malaysia would have the comparative advantage in rice production under different scenarios of existing policies and economic reforms. The empirical results show that the rice farming is marginally competitive and generates relatively low social profits. Other empirical results show that three out of four states have comparative advantages in producing rice with Domestic Resource Cost values or DRCs less than one. Conversely, the results indicate no comparative advantage for rice production in the KETARA granary area, as DRC is greater than one.

Keywords: policy analysis matrix, comparative advantage, rice production, Malaysia

JEL codes:

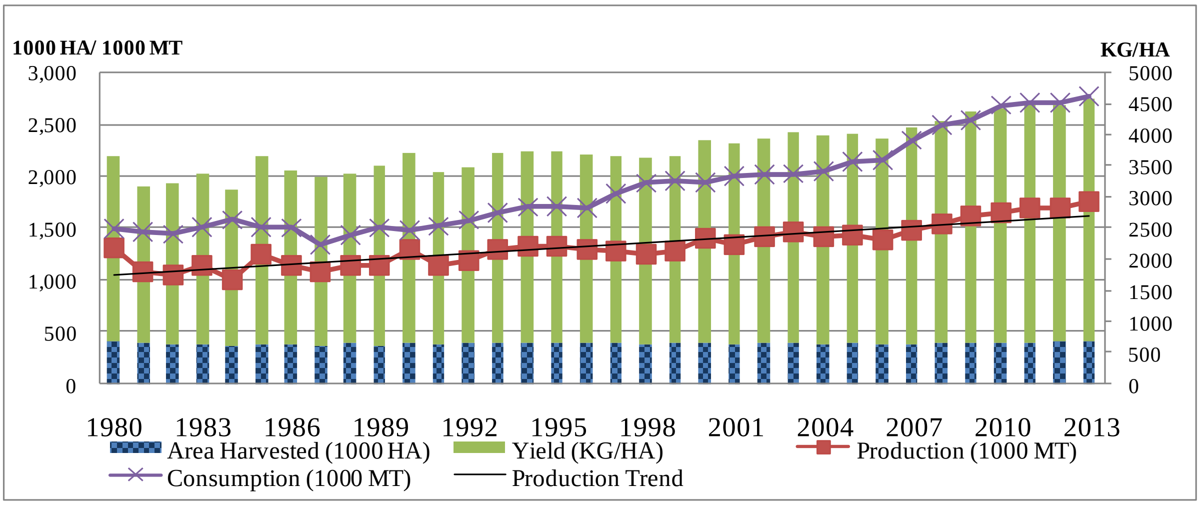
IAAE

Introduction

The rice crop has an important role in Malaysian society as it fosters agricultural activity and contributes to the nourishment of a rising population. This sector is an important source of employment and constitutes a significant pillar of the Malaysian agricultural production. However, its contribution to the agricultural economy is relatively small compared to industrial export crops such as palm oil and rubber. The contribution of the rice sector to the agriculture GDP was only 4.1 percent of total value added of the sector. Rice occupied only 6.9 percent of the total agricultural land in 1995, a share which increased slightly to about 9.7 percent in 2005. This increase was partly due to the opening up of new regions for rice production. Industrial export crops such as rubber and palm oil dominated agricultural sector and together accounted for 77 percent of total agricultural land use in the country in 2005.

Malaysia's rice production has fluctuated over the last two decades. However, production has exceeded the long-term trend in recent years (2006- 2013, see Figure 1). In response to the government's investments in infrastructure, high yielding varieties and generally favorable growing conditions (USDA, 2012), production area and yields increased above previous trends. The harvested area increased from 660,000 ha in 2005 to 690,000 ha in 2013. With higher productivity leading to an increase in yields, the production of rice has recorded an increasing trend over the period.

Figure 1: Rice Production, Consumption, Yield and Harvested Area in Malaysia (1980- 2013)



Source: FAOSTAT (2014)

However, the country's rice yield is below the world's average and the levels of productivity among the major producing states in the country vary. In 2011, the government launched the National Agro-food Policy (2012- 2020) in tandem to increase rice production. A total of RM19.6 million (US$6.5 million) was spent in 2012 in order to improve paddy yields by introducing high yielding varieties and improve irrigation infrastructure. Through these measures, the government hopes to enhance rice yields to 5 tons per hectare, compared to the 3.91 tons per hectare currently (MAAIM, 2011). As part of the policy to boost production, a new planted area had been identified in East Malaysia and planted with high yielding paddy. The aim is to plant an additional area of 5,100 hectares by the year 2020. Apart from providing assistance in basic infrastructure, the government is also promoting a System of Rice Intensification (SRI) technology in some rice growing states. SRI requires less water and chemical fertilizer to enhance rice productivity under rain fed conditions. These efforts and incentives could explain the recent productivity gains among the rice growing states in the country.

The consumption of rice has increased consistently since the 1980s and had nearly doubled by 2010. It is further forecasted to increase slightly in 2014/2015 in accordance with population growth and the increasing number of tourists and immigrant workers in Malaysia (USDA, 2013). Rice is considered a daily staple food and Malaysians consume between 2.6 million to 2.8 million tons of rice annually. However, the current production is not able to meet the growing demand since Malaysia only produces 70 percent of its total rice needs. The other 30 percent are imported from suppliers such as Thailand, Vietnam and Pakistan. Clearly, as the population increases and rice consumption grows, the gap between demand and supply of rice will widen further. Malaysia's lack of self-sufficiency in rice results in heavy dependence on rice imports which cost the country millions of ringgit annually and increasing Malaysia's trade deficit.

There have been a series of dramatic changes in the rice scenario globally, precipitated by a hike in the price of petroleum and unfolding world food prices, coupled with the rising price, particularly the tripling of Thai rice price and other major exporting countries in 2008 (Pandey, 2010; Jamora and von Cramon Taubadel, 2012). The 2008 food crisis led to an increase in input costs and reduced profits. While the input costs place further financial pressure on farmers, they continue to struggle to maximize profits and make end meets. Like in any other developing countries, Malaysia being a net importer of rice was caught in the tension of the food crisis (Tey et al, 2009; Timmer, 2007). Rice is an important staple food, particularly for food security among poor consumers in the country and as a major source for calorie provider; however this consumption competes with riceas the source of raw materials for vermicelli mills and other end use products.

By definition, the concept of food security at the national level is to have greater emphasize on providing adequate food in the context of food production while at the household and individual level, emphasis is on the ability and affordability of the household to obtain enough nutritious and safe food without any obstacles (FAO, 1983). As stepping up of ongoing efforts in food security, a bulk of new incentives and plans have been made to ensure citizens have access to sufficient food supplies. Malaysia has more than 100,000 farmers who depend solely on rice production and working in the rice related industries to make their living above the poverty level (Siwar, 2014). Thus, robust planning and coherent commitment from all parties are crucial for ensuring food security and addressing poverty.

This has prompted the Malaysian authorities to readdress the agricultural industry and structurally adjust policy in order to increase production and become 100 percent self-sufficient. The primary aim ofthe policy is to increase domestic paddy production by improving yields through the utilization optimal inputs, new technology, and improved farm management. Policy also provides incentives for paddy production such as price support and a yield increase incentive (Lira et al, 2014). In the Third National Agriculture Policy (1998-2010), eight granary areas were designated as permanent rice growing areas responsible for achieving at least 65% self-sufficiency. The Eight Malaysia Plan (2001-2005) increased this target to 72 percent, and the Ninth Malaysia Plan (2006-2010) increased it further to 90%. However, these targets were not met. Recently, the Minister of Agriculture and Agro-based Industry announced that Malaysia is determined to achieve its target to end rice imports and be fully self-sufficient by 2020 (New Straits Times, 2014).

Against this background, several pertinent questions can be raised: Is rice sufficiently profitable privately to provide farmers with the incentive to maintain or expand output? Is rice production in Malaysia socially profitable, and hence should Malaysia endeavor for self-sufficiency? Answers to these questions are essential in order to evaluate the current policy environment. If Malaysia is not competitive in rice production, then the government's plan to become self-sufficient by 2020 would impose costs on the rest of the economy. This might be politically desirable, but if rice is not competitive, then Malaysia would be better off putting its agricultural resources to other uses where they generate higher returns, and using these proceeds to import rice instead. Therefore, a comparative advantage assessment of rice production is required to address the issue of rice self-sufficiency in the country and shed light on these questions.

Policy measures in rice industry

Malaysia is one of the most liberalized trading nations with low tariffs on most commodities and products (Tengku Ahmad and Tawang, 1998). The concept of low tariffs as an agricultural protection is meant as a national security measure to: maintain food security and to make it available to all consumers at low prices, improve terms of trade, as a source of government revenue, protect domestic programs, balance trade deficit and enhance national health, safety and environment.

Since rice is considered a strategically important commodity, however, the Malaysian government intervenes more on the rice market than on most others. Policy measures for rice include:a monopoly on imports, controlled prices for milling,wholesale and retail rice, a fertilizer subsidy, pricesupport, provision of drainage and irrigation facilities, spurring innovation, andpublic investments inresearch and development (R&D) support.

The Malaysian government has been intervening in the rice industry since Independence in 1957. Since then, three main goals of rice policy have changed in relative importance over time. The transition from colonial to post independence government resulted in a shift of rice policy towards achieving self-sufficiency, to save on the rapidly rising food imports and reduce dependency on overseas supplies of staple food. Hence, self-sufficiency in food by 1963 was adopted as a target by the newly-elected independent government (Rudner, 1975). For rice specifically, 65 percent self-sufficiency was targeted in order to ensure accessibility and availability of rice especially during a food crisis. Beyond these 65%, the government argued that it is cheaper to import rice from the world market so as to release arable lands to more lucrative and profitable industrial crops that yield high value products and provide more export earnings.

Regarding sectoral constraints, one of the main problems is that rice production has developed in an instable market environment, characterized by price variability over time and fostered by strong fluctuations of product supply and demand (Amaya Montoya, 2011).Therefore, rice farmers are exposed to variable levels of profitability. Furthermore, the Malaysian rice sector constantly faced obstacles to increase its competitiveness within a dynamic environment influenced by political, technical, economic and trade challenges. Globalization and international trade have played an important role for national development in Malaysia, but they have important implications for the ricesector, which must compete with other international producers.

As a member of the World Trade Organization (WTO), Malaysia is bound by the resultsof the Uruguay Round Agreement on Agriculture. These commitments include rules and regulations in the area of domestic supports, export subsidies and market access in agriculture. Whether or not Malaysian rice production is profitable from a comprehensive economic perspective depends on its comparative advantage, under the conditions of no subsidies or with limited subsidies that have been permitted by the rules for all trading partners. Therefore, an assessment of comparative advantage of Malaysian rice production can be helpful in this respect.

Methodology of the study: Policy Analysis Matrix

The policy analysis matrix (PAM), as developed by Monke and Pearson (1989), is a double entry bookkeeping analytical framework that helps policymakers to address central issues regarding the agricultural policy developments. PAM is widely used for measuring the impact of policy on competitiveness and farm level profits, the influence of public investments on the efficiency of the agricultural system, and the effects of the agricultural research and development on economic efficiency and comparative advantage (Siggel, E., 2006 and Masters and Winter-Nelson, 1995).

PAM takes into account policy influences on costs and returns of agricultural production and investment projects. The principal strength of PAM is that it provides a straightforward policy-induced transfer analysis and allows varying levels of disaggregation. In addition, PAM results show the net effects under the complex and contradictory policies as well as the individual effects of these policies. However PAM also suffers from weaknesses, one of which is the assumption of fixed input-output coefficients or static nature. Production is described by a string of techniques of which each has a fixed input-output coefficient and represents some share of total production, whereas some do not consider the results to be realistic in a dynamic setting (Nelson and Panggabean, 1991).

There are two cost columns in the PAM (Table 1); one for tradable inputs and the other for domestic factors. Intermediate inputs consist of fertilizers, pesticides, compound feed, transportation, electricity, fuel and purchased seeds are divided into tradable inputs and domestic factor components. This disaggregation process allows for intermediate goods to be separated into four categories: tradable inputs, domestic factors, transfers (taxes or subsidies that are set aside in the social evaluations), and non-tradable inputs (which have to be further disaggregated so that all the costs will be classified under tradable inputs, domestic factors and transfers).

The first row of the matrix provides a measure of private profitability (D), defined as revenues (A) minus total costs (B+C) which assess the values of all outputs and inputs at private prices, reflecting the actual market or financial prices received by the farmers, processors, or merchants in the agricultural system (Monke and Pearson, 1989; Nelson and Panggabean, 1991). This private or financial price includes the underlying economic costs and valuation together with the effects of all policies and market failures. The private profitability calculations thus provide the competitiveness of the agricultural system under the current technologies, inputs costs, output values and policy transfers.

Table 1: Policy Analysis Matrix

Items	Revenues	Costs		Profits
		Tradable Inputs	Domestic Factors	
Private prices	$A = P_i^D$	$B = \sum_{j=1}^{k} a_{ij} P_j^D$	$C = \sum_{j=k+1}^{n} a_{ij} W_j^D$	***D = A-B-C***
Social prices	$E = P_i^S$	$F = \sum_{j=1}^{k} a_{ij} P_j^S$	$G = \sum_{j=k+1}^{n} a_{ij} W_j^S$	***H= E-F-G***
Effects of divergences and efficient policy	***I= A - E***	***J= B - F***	***K= C - G***	***L= D – H = I – J - K***

Source: Monke and Pearson (1989)

Note:
The subscript *i*refers to outputs and the subscript *j* refers to inputs,
$a_{ij}$for (j= 1 to k) are technical coefficients for traded inputs in the production of i;
a_{ij} for(j=k+1 to n) are technical coefficients for domestic inputs in the production of i;
P_i* is the price of output *i*, evaluated privately (*=*D*) or socially (*=*S*);
P_j* is the price of traded input *j*, evaluated privately (*=*D*) or socially (*=*S*);
W_j* is the price of domestic input *j*, evaluated privately (*=*D*) or socially (*=*S*);
D (= A-B-C) measures Private profit;
H (=E-F-G) measures Social profits;
I (= A-E) measures Output transfers;
J (=B-F) measures Input transfers;
K (=C-G) measures Factor transfers;
L (= D-H; or I-J-K) measures Net transfers.

The second row of the table measures the social profits (H) which reflect a comparative advantage, efficiency of the agricultural system or resources use. Efficient outcomes are attainable when an economy´s resource is used in such a way that creates the highest level of outputs and income. To determine social profits, social prices are used for valuation of inputs and outputs. Social values or prices demonstrate a policy benchmark for comparisons because they are considered to be the prevailing prices in a free market in the absence of any policy interventions, distortions or market failures (Monke and Person, 1989 and Kanaka and Chinnadurai, 2013). Social prices also reflect the value to society as whole rather than an individual in order to achieve objectives of optimizing income and social welfare. Thus, social profits are efficient since output (E) and inputs (F+G) are valued at social prices that reflect the scarcity values or opportunity costs. For outputs (E) and inputs (F) traded internationally, the world prices (free on board) for exports are used.The cost insurance freight prices(CIF) are used for domestic factors which are not traded in the international market.The valuation is determined by estimation of the forgone net income as the factor is not employed in its best alternative use. Social profits indicate the foreign exchange saved by reducing imports or earned by expanding exports of each unit of production. A positive value indicates that production contributes to national income, while a negative value suggests that the country would be better off in terms of national growth by not producing the commodity. Thus, it is a signal of measuring international comparative advantage (Kanaka and Chinnaduari, 2013).

The second identity of the accounting matrix in the third row measures divergences, which is defined as the differences between private and social valuations of revenues, costs and profits. Any divergence between private and social prices, which is measured vertically, must be explained by the effects of the policies. The effects of divergences are disaggregated into three categories- distorting policies, market failure and efficient policies. If market failure correction policies by the government do not exist, then the divergences between private and social prices of tradable outputs and inputs are caused by distorting policies. However, if efficient policies enacted by the government are able to correct or offset market failures and create greater income, the differences between private and social valuations will be reduced, since efficient policies correct divergences (Monke and Pearson, 1989; Masters and Winter-Nelson, 1995). The PAM framework also provides important indicator for calculating the protection rate by different ratio such as NPC, EPC, DRC, and SCB for measuring comparative advantage that are used throughout this study.

One of the most widely used methods to measure price distortions is the Nominal Protection Coefficient (NPC) (Gulati et al., 1990; Taylor and Phillips, 1991; Sadoulet and de Janvry, 1995; Fang and Beghin, 2000), which is defined as:

$$\text{NPC}_i = P_i^D / P_i^S$$

The Nominal Protection Coefficient (NPC) is the ratio which compares the private price with a social price of the commodity. This ratio shows the impact of policy between the two prices; domestic price compared to the world price that causes a divergence. NPC can be calculated for both inputs (NPCI) and outputs (NPCO). Subsidies on outputs are indicated by NPCO (which is A/E) if its value is larger than one, while input subsidies are represented by NPCI (which is B/F) if its value is smaller than one (Fang and Beghin, 2000). From a strictly trade theoretical point of view, if NPC>1, producers are protected and consumers taxed, which suggests that there is inefficiency in producing and the price is heavily affected by government policies or other factors of that commodity.

The effective protection coefficient (EPC) is defined as the ratio of distorted tradable value added at market price to its undistorted value at border prices. EPC captures the effect of government policies on input as well as output markets (Bureau and Kalaitzandonakes, 1995; Sadoulet and de Janvry, 1995; Anwar, 2004). EPC is defined as:

$$\text{EPC}= (P_i^D - \sum_{j=1}^{k} a_{ij} P_j^D / (P_i^S - \sum_{j=1}^{k} a_{ij} P_j^S)$$

From the PAM table, EPC is a ratio of value added in private prices (A-B) to value added in social prices (E-F). This coefficient indicates the degree of policy transfer from output and tradable input distortions. A value greater (or less) than one indicates a net subsidy (or net tax) to value added (Beghin and Fang, 2002; Monke and Pearson, 1989). Additionally, if EPC>1, it suggests that government policies provide positive incentives to producers while EPC<1 indicates that producers are not protected through policy interventions (Mohanty et al, 2002).

The domestic resources cost (DRC) is widely used to measure comparative advantages or relative efficiency between agricultural commodities (e.g. von Cramon-Taubadel et al, 2008 and 2009). DRC was developed simultaneously in the 1960s by Bruno (1965) in Israel and by Krueger (1966) in United States. The DRC is defined as the shadow value of non-tradable inputs used in an activity per unit of tradable value added (G/ (E-F)) the formula for DRC is given as;

$$DRC= \sum_{j=k+1}^{n} a_{ij} W_j^S \;/\; (P_i^S - \sum_{j=1}^{k} a_{ij} P_j^S)$$

DRC indicates whether the use of domestic factors is socially profitable (DRC<1) or not (DRC>1). We calculate the DRCs to enable cross-commodity comparisons in each Malaysian state. The commodities can be ranked according to the DRC values and thus can provide indications on comparative advantage or disadvantage within that state. A state is said to have a comparative advantage in a given crop if the value of the DRC for that crop is lower than the DRC for other crops grown in that state.

The Social Cost Benefit (SCB) is defined as (F+G)/E, with interpretation similar to DRC. Finally, the indicators private net return to land (PNRL) and social net return to land (SNRL) are used to measure the return to this fixed factor for this study. Scandizzo and Bruce (1980) state that the net economic benefit per unit of land is likely to be more appropriate when ranking the crops, compared with that of per unit (or ringgit/domestic currency) of the domestic resources. The PAM table provides PNRL, which is defined as A-B-C without the cost of land use and SNRL as E-F-G without the cost of land use. Greater values of PNRL indicate the crop is more desirable for the producer but not necessarily for the society while higher value of SNRL suggests both; stronger competitiveness as well as desirable for the society (Fang and Beghin, 2000; Scandizzo and Bruce, 1980; Yao, 1997).

Data collection

In the 1980s, the government confined further irrigation developments in order to enable rice double cropping toeight designated Granary Areas (Appendix 1). Of these, four have been chosen as the study areas: Muda Agricultural Development Authority (MADA);Kemubu Agricultural Development Authority (KADA); Barat Laut Selangor Integrated Agricultural Development (BLS);

and North Terengganu Integrated Agricultural Development (KETARA). The contributions of the four granary areas are presented in Appendix 2.

The data employed in this study are collected from various national and international published and unpublished resources. For estimating the PAM, we required a comprehensive set of data including yields, input requirements and the markets and social prices of inputs and outputs. The aggregated output and input data for the four study granary areas are taken from R.Terano et al (2013) and KADA (2014). The authors used a fairly large scale survey that covers different agro ecological zones which focus on generating information on production costs of rice for the provinces over the period 2011-2012. These output and input coefficients were then complied on per hectare basis of land.

The output (rice) and input farm gate prices (urea, compound or TSP, NPK and organic fertilizers, pesticides and lime) are taken from national and international published and unpublished sources. Social prices of tradable commodities are based on import parity prices or export parity prices, depending on the trade status of the commodity in question. Since Malaysia frequently imports rice, an import parity price is used to measure the social price of rice. The CIF price of 25 percent broken rice and official exchange rate were collected from FAO andCentral Bank Malaysia respectively.CIF prices for fertilizers including urea (Europe), TSP (US Gulf ports), organic and NPKare from the World Bank, IRRI, and various issues of the FAO food outlook. The fuel price was obtained from Domestic Trade and Consumer Affairs Ministry, Malaysia whereas the data pertaining to lime, pesticides and wages were collected from Ministry of International Trade and Industry, Department of Statistics Malaysia, and FAOSTAT.

Social price of land is one of the much more important and complicated components among domestic factors. With regard to land valuation, Irvin (1978) and Gitinger (1982) describe the social cost of land which measured in border price, as the net value of production forgone when the land use changed from its ‘without use’ to ‘with use’. The market price of a piece of land will then reflect its economic value whenever there is free market in land. However, Van Schalkwyk& Van Zyl (1994) argue that non-farm factors such as policy distortions may get capitalized into market values and thus, land values tend not to reflect the true economic value to the society. In this respect, Monke and Pearson (1989) propose to use the rental value instead of market value that reflects the opportunity cost to use land. They further argue that in the absence of both financial cost and rental value that reflect the opportunity cost of a land, its ‘potential productive capacity’ can be used to access its value in the best alternative use. For example, if oil palm production represents the best alternative of rice production in granary areas, the social costs of land for rice is the social profits (excluding land) from the oil palm production.

In the study areas, many farmers preferred sharecropping or planting oil palm as a substitute commodity for rice (R.Terano et al, 2013). Hence, in estimating social prices for land, we use the average net income of oil palm in each granary area. As we face difficulties in estimating social profits from oil palm production, these figures however are based on the primary data from an agricultural officer and a land value officer in Selangor, Malaysia.

Result and Discussion

In this section, the results of the policy analysis matrix and sensitivity analysis are discussed sequentially and with necessary interpretations.

Policy analysis matrix under import parity price of rice

The main results of the protection and comparative advantage coefficients for four granary areas are shown in Table 2.

We estimate Domestic Resource Cost (DRC) and Social Cost Benefit (SCB) in order to measure the competitiveness of the rice sector in Malaysia. DRC compares the domestic resources costs measured at social price with the value added measured in the social prices. The use of the social prices in DRC measure allows us to test whether the employment of scarce domestic inputs in the production of rice generates positive returns for Malaysia (von Cramon Taubadel and Nivyeykyi, 2008).

Table 2: Summary results of different indicators of protection and comparative advantage

Areas	2011						2012					
	DRC	SCB	PC	SRP	PNRL	SNRL	DRC	SCB	PC	SRP	PNRL	SNRL
KADA	0.92	0.95	12.51	0.62	3432	274	0.90	0.93	8.15	0.47	2842	349
MADA	0.97	0.98	31.36	0.62	3262	104	0.84	0.88	5.11	0.48	3380	661
KETARA	1.19	1.11	-6.93	0.88	2874	-415	1.13	1.08	-6.84	0.60	2101	-307
BLS	0.86	0.91	10.89	0.88	5703	524	0.78	0.85	4.76	0.56	4239	891

The empirical analysis presented here demonstrates that three of four study areas(BLS, MADA and KADA) have comparative advantages in the production of rice (DRC<1) in 2011-2012. However, the results indicate no comparative advantage for rice production in KETARA area as the DRC is greater than one.

From the national viewpoint, it is desirable to produce rice in the three granary areas and expand its production since the social value added is greater than the cost of its import. However, the estimated DRCs are closer to unity, indicating that there may be some competing demand on resources for production of other crops.Moreover, the closer the DRC value is to one, the more a small change in prices can tip it which means the more sensitive it becomes. With the estimated DRC of rice grown in KETARA observed to be greater than one under import parity price, this shows no comparative advantage,and thus the emphasis on attainment of self-sufficiency in rice production appears to be uneconomically justified and remains debatable.

Nevertheless, average DRC results, such as those presented here, should be interpreted with caution. These results are based on aggregated data that most certainly conceals relevant variation and the underlying distribution of competitiveness across a set of heterogeneous producers (von CramonTaubadel et al, 2008). In other words, the results presented here aggregate very efficient farms that are more competitive than average with other less efficient farms that are less competitive than average. This can have great far-reaching implications for policy conclusions based on PAM results. For example, support based on the average competitiveness will over-support some farms and under-support others. Therefore, only cautious conclusions based on average DRC are drawn and further analysis of DRC distributions is required to determine what factors influence whether farms are competitive.

Another indicator of competitiveness can be expressed by the Social Cost Benefit (SCB) ratio.Our estimated SCB values are consistent with the results of our DRC calculations discussed above. The calculated SCB ratios,which are less than 1,indicateprofitability of rice farming in each granary area except for KETARA.With estimated SCB ratio exceeding unity, the KETARA granary area hardly displays a comparative advantage in rice production.

The measure of net transfer is further shown in the Profitability Coefficient (PC), which measures total incentive effects of all policies; including output, tradable and non-tradable input policies that may not be possibly estimated by NPC and EPC (Monke and Pearson, 1989). The values of PC are all positive in three of the granary areas with KETARA as the exception exhibiting negative PCs in both years. The results indicate that there is a net transfer from social to private profits, except in KETARA. The other ratio indicator to measure net transfer is the subsidy ratio to producers (SRP), which indicates how much incentives or disincentives influence divergences. The average values of SRP range between 0.47- 0.59 in 2012. This value is interpreted to mean that the divergences, which are almost entirely due to distortive policies in the case of this study, have increased the gross revenues in the whole system by almost half.

Further analyses are conducted to measure the private net return to land (PNRL) and social net return to land (SNRL), which are used to estimate the returns to the fixed factor - land. Both values of PNRL and SNRL are positive for three of the states, except for KETARA. This implies that it is desirable to grow rice for average rice producers in the granary areas KADA, MADA and BLS.

The results in Table 3 show the divergences between private and social profits, or in other words the effect of different policy transfers, such as output, input, factor and net policy transfers. The values of the output transfers (private revenues less social revenues) are all positive, while the values for input transfer (difference between private and social prices of tradable inputs) and the factor transfers (difference between private and social prices of non-tradable inputs or domestic factors) are all negative. The positive values of output transfers point to the system receiving protection, i.e. the government protective policies affect thesystem positively, resulting from a price subsidy scheme of RM240.1/mt. The negative values of the input transfers indicate that the producers buy inputs at a lower price than the world market price due to the subsidy policy on fertilizers, lime and pesticides. The same is true for the factor transfer values that demonstrate the costs of non-tradable inputs are lower than their social prices. This can be attributed to the primary factors of production, mainly land since the social and private values of land are determined in relation to alternative uses.

Overall, the net transfer policy for all regions is positive. The net transfer is the sum of output transfer, the tradable input transfer and factor transfer. The net transfer is the difference between private profits and social profits. Because social profits are positive in each granary areas except KETARA area, the systems could operate profitably without any policy transfers.

Table 3: PAM results of rice production in major granary areas in Malaysia in 2011-2012[1]

Granary Area	Year	Output Transfers (RM/ha)	Tradable Input Transfers (RM/ha)	Domestic Factor Transfers (RM/ha)	Private Profitability (RM/ha)	Social Profitability (RM/ha)	Net Policy Effects (RM/ha)
KADA	2011	1772.95	-284.38	-1100	3431.60	274.27	3157.33
	2012	1252.35	-140.6	-1100	2841.60	348.65	2492.95
MADA	2011	1571.15	-204.76	-1200	3324.64	348.73	2975.91
	2012	996.03	-122.66	-1600	3379.73	661.04	2718.69
KETARA	2011	1315.57	-204.66	-1100	1921.84	-698.39	2620.23
	2012	1161.45	-46.44	-1200	2100.95	-306.94	2407.89
BLS	2011	2284.75	-194.44	-1100	4165.28	586.09	3579.19
	2012	2064.27	-84.08	-1200	4239.07	890.72	3348.35

The results also show variations in profitability, both in private and social terms, across regions. We observethat the private profits per hectare of rice production in all granary areas are greater than zero. This is demonstrated with normal returnsand possible expand their productions, unless the farming areas are no more expandable or the substitute crops are more lucrative and profitable at private prices. Moreover, the social profits are positive in all areas that have DRCs less than 1, indicating that the rice producers in these areas are using scarce resources efficiently. Conversely, a

[1] Exchange rate: US$1= RM3.05 AND EUR€= 4.25 (Oct 21, 2011: US$1= RM3.06 and EUR€= 4.27 (Oct 31, 2012); US$1= RM2.96 and EUR€= 4.21 (Nov 30, 2014)

negative social profit value in KETARA reveals that the rice system is dependent upon the governmental assistance. The result of private profits clearly indicates that rice production is highly profitable in some granary areas at private prices. However, at social prices profitability is much lower.

Sensitivity analysis

It may be worthwhile to examine the degree to which the comparative advantage of rice production in Malaysia, under a set of baseline assumptions, is likely to be affected by the changes in the key parameter values. Morris et al. (1997) postulate that sensitivity analysis is sensible for two main reasons. Firstly, the profitability analysis is conducted on the basis of certain simplifying assumptions of production technologies as indicated in the output-input coefficients, government policies and prices. Since these values apparently affect the analysis, it is important to know the degree to which empirical results are likely to be sensitive towards the simplifying assumptions that are made. Secondly, the DRC frameworks produce efficiency rankings or comparative advantage, which are static as it represents a snapshot taken at a fixed point in time. However, in practice, actual efficiency is dynamic (it adjusts towards the changes in production technologies, prices and government policies). Therefore, it is crucial to determine whether the probable effect of changes in the parameters may likely change or affect the results.

The subsequent graphs summarize the results of the sensitivity analysis of the individual impact of determining factors on comparative advantage of rice in Malaysia in 2011. Figure 2 demonstrates that the estimated DRCs in rice production in each granary area are quite sensitive to changes in the international (reference) price of rice used in the calculation of import parity prices. An increase in international price by 20 percent would make the domestic production of rice in all areas socially profitable, with DRC values of less than one.

The impact of changes in other single factors namely traded inputs (imported fertilizer prices, seed, pesticides, and fuel prices) are presented in Table 5. As the country is progressing towards trade liberalization, the costs of these inputs are expected to rise, resulting in lessening comparative advantage of rice farming in all major granary areas. It is evident that if the costs of tradable inputs increase, the values of DRC also grow, but the magnitude of increasing or decreasing is highest in the case of fertilizer. The high share of fertilizeruse in rice production in all the granary areas, has negativelyaffected the comparative advantage in Malaysia. As the price of fertilizer increases by 25% in KADA or 10% in MADA, the social profits would then disappear. For the other inputs, however, profitability is quite robust.

Figure 2: Change of Domestic resource cost (DRC) in the import rice prices in Malaysia

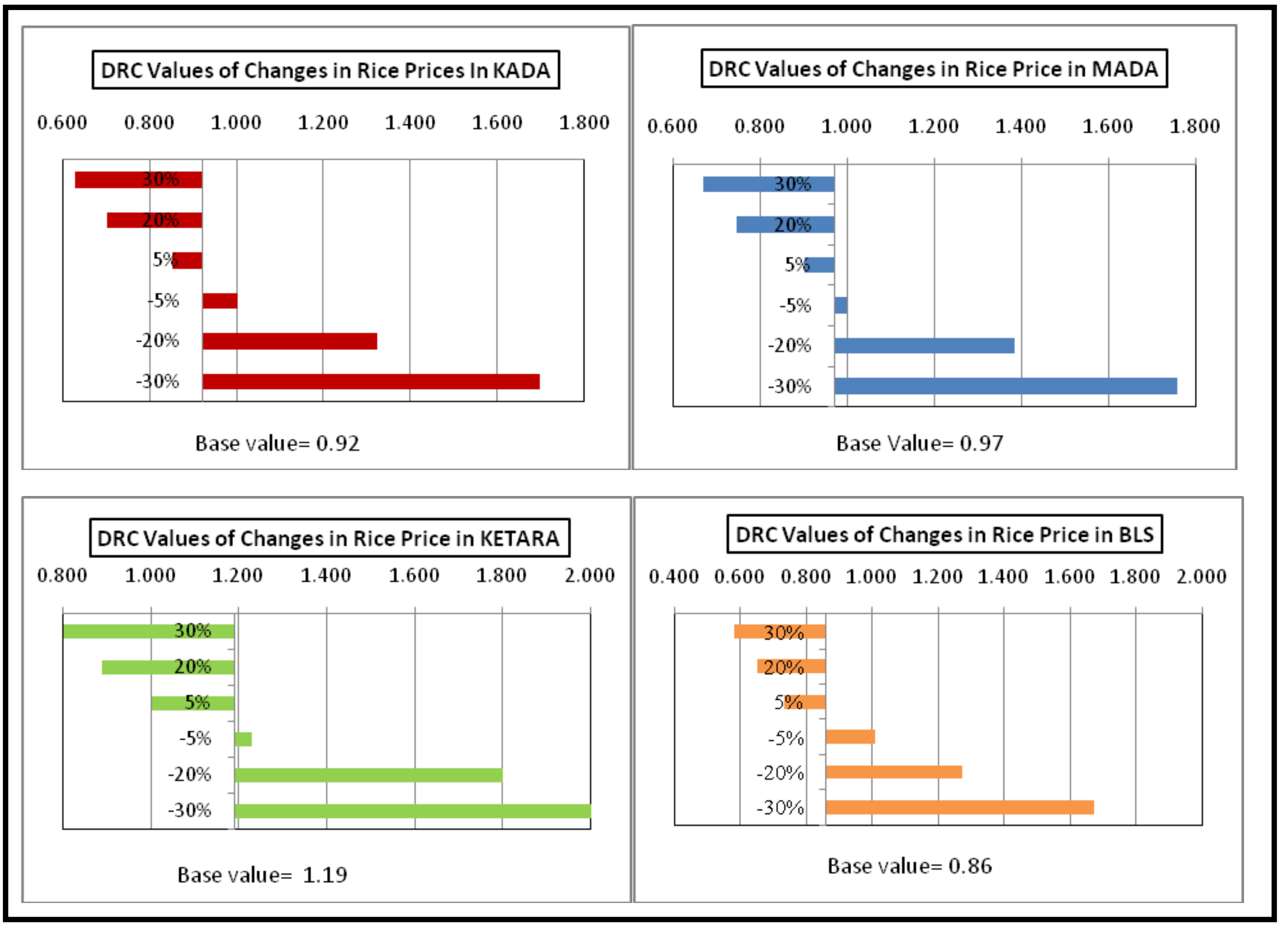


Table 4: Change in selected tradable input prices

Tradable inputs	Granary area	DRC Base value	10%	25%	45%	-10%	-25%	-45%
Fertilizer	KADA	0.92	0.949	1.000	1.076	0.889	0.849	0.824
	MADA	0.97	1.001	1.053	1.131	0.940	0.898	0.873
	KETARA	1.19	1.236	1.313	1.433	1.146	1.086	1.050
	BLS	0.86	0.891	0.939	1.001	0.835	0.796	0.773
Seed	KADA	0.92	0.921	0.926	0.932	0.915	0.910	0.907
	MADA	0.97	0.974	0.980	0.988	0.966	0.960	0.956
	KETARA	1.19	1.196	1.206	1.220	1.182	1.172	1.166
	BLS	0.86	0.867	0.875	0.885	0.857	0.850	0.845
Pesticides	KADA	0.92	0.923	0.931	0.942	0.913	0.905	0.900
	MADA	0.97	0.974	0.981	0.991	0.965	0.958	0.954
	KETARA	1.19	1.193	1.199	1.206	1.185	1.180	1.176
	BLS	0.86	0.864	0.868	0.872	0.860	0.857	0.854
Fuel	KADA	0.92	0.919	0.922	0.925	0.916	0.914	0.912
	MADA	0.97	0.971	0.972	0.974	0.969	0.967	0.966
	KETARA	1.19	1.191	1.194	1.198	1.187	1.184	1.182
	BLS	0.86	0.864	0.866	0.870	0.860	0.858	0.856

Source: Own estimation

The sensitivity analysis of increasing or decreasing the costs of imported rice, fertilizer, seed, pesticides and fuel shows that the coefficients follow similar directions of the competitiveness. There are possibilities that average Malaysian rice producers continue losing their comparative advantages in certain unfavorable economic conditions such as in the event of higher input costs particularly fertilizer cost and/or deterioration in the world price of rice.

Conclusion

The challenges brought about by trade liberalization have created stiffer competition and tougher commitments for the country to strengthen economic growth. The rice sector in Malaysia, which is an important part of the economy in terms of both production value and source of employment, also faces these challenges. More than 100,000 farmers are involved in the rice farming. For the sake of those farmers who are mostly living in poverty, the government has intervened by providing huge amounts of supports to paddy producers to increase paddy production and for food security reasons. These incentives are to enhance rice production levels, notably as the country works to secure its goal to be 100 percent self-sufficient by 2020. Utilizing a PAM model, the study aims to investigate whether the governmental interventions make economic sense to be fully self-efficient by analyzing the competitiveness of rice production in the country particularly in the KADA, MADA, KETARA and BLS granary areas.

The results indicate that three out of four granary areas havecomparative advantages in producing rice with Domestic Resource Cost values or DRCs less than one. Conversely, the results indicate no comparative advantage for rice production in the KETARA area, as DRC is greater than one.Similarly, Social Cost Benefit or SCB values in these areas are less than 1, indicating that the comparative advantages in rice production are noteworthy.

With this regard, it is evidently that social profitability is appears given on average in three of the areas, and here there are clearly farms that produce a net surplus for the country. These farms have to be identified by further research using disaggregated data, and studied more closely. They generate social profits, but they might still depend on support to generate sufficient incomes for their families. In this case, policy should focus on encouraging structural change which enables these farms to grow to the point where they can generate sufficient income from social profits alone, ie. without (or with much less) subsidy. This way the government could get more self-sufficiency for less money. In the other region, the average farm is not producing a social profit. But here too there probably are farms that are profitable socially. In all four regions (and especially in the one) there must be many farms that are not producing a social profit. Thus, further research with disaggregated data is needed to determine why this is the case, and how the situation can be improved.

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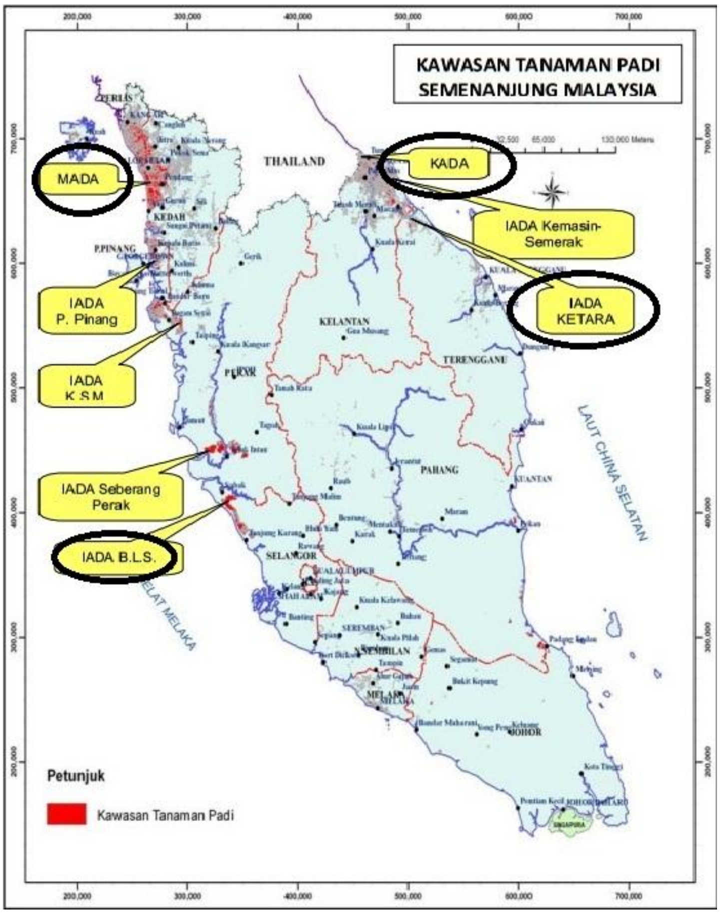
Appendix 1 Figure 1: Distribution of Eight Major Rice Growing Areas in Malaysia



Source: Soil Management Decision, Department of Agriculture, Peninsular, Paddy Statistics of Malaysia (2008).

Appendix 2: Rice Production in Major Granary Areas, Malaysia (2008- 2010)

Granary Area	Area (Ha)	% Area	Contribution to National Production (Metric ton and %)					
			2008	%	2009	%	2010	%
MADA	96,558	23.22	887,992	37.74	976,192	38.33	912,321	37.01
KADA	32,167	7.74	179,048	7.61	209.950	8.36	201,135	8.16
IADA K.S MANIK	27,829	6.69	169,753	7.21	187,117	7.45	184,563	7.08
IADA BLS	18,814	4.52	174,247	7.41	202,633	8.07	210	8.53
IADA P. PINANG	10,305	2.46	98,436	4.16	107,285	4.27	115,189	4.67
IADA S.PERAK	8,529	2.05	62,076	2.64	70,294	2.8	70,814	2.87
IADA KETARA	5,156	1.24	46,097	1.96	49,082	1.95	52,711	2.14
IADA K.SEMERAK	5,220	1.26	14,757	0.63	16,853	0.67	20,550	0.83
TOTAL GRANARY	204,578	49.20	1,632,406	69.38	1,609,666	72.46	1,557,493	71.31
TOTAL NON GRANARY	211,213	50.82	720,626	30.63	691,637	27.54	707,256	28.71
MALAYSIA	415,791	100	2,353,032	100	2,301,303	100	2,264,749	100

Source: Department of Agriculture (2010).

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