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Welfare Gains and Losses under the Malaysian Rice Pricing Policy and their Relationships to the Self-Sufficiency Level

Nik Hashim Mustapha

ABSTRAK

Ekonomi kebajikan gunaan dipakai untuk menganalisis impak dasar awam terhadap program kawalan harga dalam industri beras. Berasaskan harga keseimbangan dalam pasaran tertutup, dasar harga kawalan menguntungkan pengguna dan merugikan pengeluar. Berdasarkan harga keseimbangan 1992, keuntungan kebajikan pengguna bernilai RM205 ribu setahun, manakala kerugian kebajikan pengeluar bernilai RM188 ribu setahun. Lebihan permintaan hasil daripada dasar harga kawalan ditampung dengan import berjumlah 2,535 tan metrik pada tahun berkenaan. Jumlah import yang diwakili oleh pembayaran kerajaan pada tahun tersebut bernilai RM248 ribu. Dasar harga kawalan mendatangkan kerugian kepada negara sebagaimana digambarkan oleh kesan bersih kebajikan yang bernilai RM232 ribu setahun. Kertas ini juga memberi fokus terhadap hubungkait antara harga kawalan dengan tingkat mampu diri dalam penggunaan beras, sebab bagi setiap harga kawalan, wujud anggaran kuantiti permintaan dan penawaran beras. Ekoran itu, dasar harga yang sesuai dapat dipilih bagi menghasilkan tingkat mampu diri yang dihajati dalam industri beras.

ABSTRACT

An applied welfare economics approach was utilised to analyse the impact of public policy on the rice industry arising from the adoption of a price control programme. Taking market clearing equilibrium price under the assumption of a closed economy, the imposition of price control was found to favour consumers at the expense of producers. Based on the 1992 equilibrium price level, welfare gain accrued to the consumers as represented by the consumerís surplus, was estimated at RM205 thousand per year, while a reduction in the producerís surplus,

constituting a welfare loss, was estimated at RM188 thousand. Excess demand resulting from the existing pricing policy was supplemented by rice imports, amounting to 2,535 metric tons during the year. The amount of government spending on rice import was RM248 thousand for the year. In total, there was a negative net welfare effect of RM232 thousand for the year analysed. The paper also discussed the interrelationship between pricing policy and the level of self-sufficiency, since for every level of controlled prices, corresponding quantities of rice supplied and demanded can be obtained. Hence, an appropriate pricing policy may be chosen to acquire the required level of rice self-sufficiency in the industry.

INTRODUCTION

A simple applied welfare economics approach is developed and employed in this article with the primary objective of deriving estimates of consumer surplus (CS), producer surplus (PS) and government cost or revenue (GP). Estimates of CS, PS and GP obtained from the supply and demand equations are used to assess the welfare economic impact arising from the guaranteed minimum price (GMP) for rice in Malaysia.

In most developing countries the extent of government intervention is quite pervasive, perhaps due to the colonial roots when it was necessary to intervene for the welfare of the society. Many of such policies especially on food pricing have been passed down from the past programmes initiated by the agricultural ministries without any major revamping of the system. Malaysia has adopted some of these perhaps misconstrued pricing policies, as suitable for the food policy of the country. This is the case with the current national rice policy in Malaysia. The Guaranteed Minimum Price (GMP) that claims to offer a fair price for both producers and consumers has been in existence for decades since the inception of the food pricing system implemented from the colonial era. Although changes have occurred along the rectification of the self-sufficiency ratio (SSR) and the upgrading of the GMP level, nonetheless as its name connotes, GMP guarantees a minimum price to producers and consumers. It is therefore, imperative to investigate who are actually the gainers or losers under the present supposedly equitable GMP pricing policy. Analysis will also be undertaken to identify the direction of changes in the aggregate welfare of the producers and consumers in particular with the changes in the

composition of rice self-sufficiency ratio. The analysis is based on the domestic autarky equilibrium as rice is a controlled item in Malaysia and hence the relevant price is deemed to be the domestic equilibrium price.

WELFARE ECONOMICS APPROACH

Welfare economics encompass observable and non-observable variables such as individual consumption and utility. The aggregate consumer surplus and producer surplus are obviously related to the utility, therefore they represent approximate measures of changes in economic welfare. However, the exact measures of utility are the compensating variation (CV), or "the income needed to obtain the intended utility level at the original price minus the income needed to achieve the intended utility level after the price change". Alternatively, the equivalent variation (EV), "the income needed to achieve the final level of utility with prices at their original level, minus the income needed to achieve the final utility level after the price changes" can also be used (Zerbe and Dively 1994). However, these measures are difficult to estimate and require the derivation of the compensated demand function by holding utility constant. An alternative method to approximate CV and EV is obtained from the consumerís ordinary demand curve and the producer surplus in which income is held constant. The current study uses the ordinary demand curve approach together with the producer surplus function.

Studies on producer surplus or economic rent and the consumer surplus are nonetheless not new since supply and demand are the forerunner and basic foundation of economic theory. In 1829, the economic rent concept was first used by Ricardo when he discussed the effect of England corn Laws, while Dupuit (1844) used the notion of consumer surplus in the assessment of social effect from the building of a bridge (Just at al. 1982). After Marshall had further developed its application, the consumer surplus concept and its appeal to empirical investigation and economic analysts have become widespread. However, his contribution was not without criticism. The serviceable money measures of utility that Marshall developed were only appropriate for measuring the total welfare affecting society. His trend of thinking is often classified as the old welfare economic thought. The greatest criticism to the Marshallian concept of consumer surplus came from Paul A. Samuelson in 1942 who disputed that consumer surplus is not a unique money measure of utility and therefore it is not a well-defined concept (Just at al. 1982). Hicks (1943) suggested the term 'willingness

to pay' to substitute for the controversial concept of welfare gains and losses. But it was Willig's work that appeared in 1976 that cleared off doubts about consumer and producer surpluses as serviceable welfare approximates for CV and EV. Welfare economics has also been criticised for the failure to capture the overall effect outside the partial equilibrium or piece meal analysis. An example of such criticism as cited by Just at al. (1982) in his book is "distortions must also exist in other sectors in order to make everyone as well off as possible". Despite the fact that these age-old fundamental economic concepts have been under constant criticisms, nevertheless their use in applied welfare economics has been rather popular, especially in measuring social impacts arising from public projects. In particular, Krutilla (1980) during his presidential address at the Annual Meeting of Environmental and Resource Economics in 1980 addressed this issue when he said, "Applied welfare economics has flourished throughout this period as though (if not actually) innocent of the controversy."

We have employed the welfare economics approach to analyse the impact of public policy on rice industry with the view to identify the effect of the GMP pricing policy programme on society. The aggregate nature of the policy outcomes can only be valid in generalised recommendations and may be conflicting when comparisons between individuals are made. For instance, when BMP is said to generate welfare gains to the consumers, it does not guarantee that all consumers are well off. There will be some displaced consumers left out from the welfare gains because of social or economic factors, such as poverty. Their willingness to pay which is assumed to have the same marginal utility may differ from the willingness to pay of the rich. Further, the question of distribution cannot be answered with certainty. There may be several individual consumers who gained from changes in pricing policy at the expense of many individual producers. Thus, we can only say with confidence that the change in total consumer surplus is higher or lower for a given GMP programme based on the non-satiety principle.

THEORETICAL FRAMEWORK FOR ANALYSING RICE SUPPLY AND DEMAND

This section attempts to model and estimate the existing supply and demand for rice under a competitive market structure for Malaysia's rice industry. The results were obtained from Two-Stage Least Square (2SLS) estimations using double-log linear equations assumed in this study. Given that the domestic rice supply, Qs is the function of the

independent variables Pr and Yi, and the domestic demand for rice, Qd is a function of the independent variables Pr and Zi, these equations can then be written as

$$Q_s = \omega_1 P_r^{\alpha}{}_1 Y_i^{\alpha}{}_i e_1 \qquad \text{for } i = 1, 2, \ldots, n \quad \alpha_1 > 0 \qquad (1)$$

$$Q_d = \omega_2 P_r^{\beta}{}_1 Z_k^{\beta}{}_k e_2 \qquad \text{for } k(i = 2, \ldots, m \quad \beta_1 < 0 \qquad (2)$$

where ω_1 and ω_2 are constant terms for the respective supply and demand equations, α_1, α_i, β_1, and β_k are the regression coefficients of the supply and demand independent variables, and e_1, e_2 are the disturbance terms. Holding the levels of Y_i and Z_k as constants at current quantities, the supply and demand functions thus become a single quantity-price relationship. These one to one quantity-price functions can be rewritten as equations (3) and (4) as follows;

$$Q_s = \omega P_r^{\alpha} \qquad \alpha > 0 \qquad (3)$$

$$Q_s = \delta P_r^{\beta} \qquad \beta < 0 \qquad (4)$$

where $\omega = \omega_1 Y_i^{\alpha i} e_1$, $\delta = \omega_2 Z_k^{\beta k} e_2$ and for simplicity the subscript 1 from the price elasticities of supply and demand, (1 and (1, are dropped from equations (3) and (4). Given the market clearing quantity for which $Q_s = Q_d$, the equilibrium price level, P_r^* can be subsequently derived which should be equal to;

$$P_s^* = (\delta/\omega)^{1/\alpha+\beta} \qquad (5)$$

$$Q_s^* = \omega(\delta/\omega)^{\alpha/\alpha+\beta} \qquad (6.1)$$

$$Q_d^* = \delta(\delta/\omega)^{-\beta/\alpha+\beta} \qquad \text{for } Q_s^* = Q_d^* \qquad (6.2)$$

Using the general equilibrium conditions in (5) and (6.1) or (6.2), the effects of deviation from the equilibrium quantities and values can be computed to determine whether or not the consumers, producers or private or public sector gains or losses from the observed economic policy changes.

Suppose that a price ceiling is imposed by the government at a price level P_1 which is lower than P_r^*, then there will be a reduction in the quantity of rice supplied equivalent to a level, say Q_1, below the

equilibrium quantity Q_s^*. However, the quantity demanded at the controlled price P_1 will be Q_2 corresponding to the demand curve which is greater than the equilibrium quantity Q_s^* or Q_d^*. Hence the change in welfare of consumers, producers and the government payment in importing rice to compensate for the shortages can be subsequently estimated.

The change in welfare of the consumers is given by the change in the consumer surplus (ΔCS) from the equilibrium quantity and value. This is equal to the area under the demand curve;

$$(\Delta CS) = [\int_0^{Qd} f_1(Q)dQ - P_1Q_2] - [\int_0^{Q2} f_1(Q)dQ - P_1^*Q_2^*] \quad (7)$$

where $f_1(Q) = [\delta(Q_d)^{-1}]^{1/\beta}$ represents the demand equation. For a linear supply and demand equation, the change in consumer surplus can be approximated by the area under the demand curve with the base Q_2, and the height represented by the difference between the equilibrium price, P_r^* and the price ceiling P_1, and both sides of the trapezoid Q_d^* and Q_2. Therefore, the desired change that is the gain in the consumer surplus should equal to the following;

$$\Delta CS \cong 1/2\ (Q_2)(Q_d^* + Q_2)(P_r^* - P_1) \quad (8)$$

The gain in consumer surplus due to this pricing policy is achieved at the expense of welfare loss to the producers represented by a reduction in the producer surplus (ΔPS);

$$(\Delta PS) = [P_0^*Q_s - \int_0^{Q^*}(Q)dQ] - [P_1Q_1 - \int_0^{Q_1} f_2(Q)dQ] \quad (9)$$

$$= (P_r^*Q_s^* - \varphi Q_s^{*\theta}) - (P_1Q_1 - \varphi Q_s^{\theta})$$

where $f_r(Q) = \omega^{-1}Q_s^{\theta}$, $\varphi = \omega^{-1}/\theta + 1$ and $\theta = 1/\alpha$ is derived from the supply function in (3). The first term in bracket of RHS of equation (9) is the producer surplus above the supply function evaluated at the equilibrium supply Q_s^* and price level P_r^*. The second term in the bracket of RHS of equation (9) is the producer surplus evaluated at the controlled supply Q_1 at the ceiling price P_1. The ΔPS can be approximated by the area of the trapezium above the supply curve which should equal to;

$$\Delta PS \cong 1/2\ (Q_s^*)(Q_1 + Q_s)(P_r^* - P_1) \quad (10)$$

The value of government payment resulting from price distortion above is represented by the area equivalent to $P_1(Q_2 - Q_1)$. The cost of government payment is borne by the taxpayers, and this value is paid to get the quantity of rice import needed for substantiating the shortage due to price ceiling policy. The government must sell this quantity in the wholesale market at a price which is generally lower than the imported rice price for which it was initially acquired. The net welfare effect can be computed from the change in consumer surplus from equation (8) less the producer surplus in equation (10) and the net effect of government payment and/or revenue.

To estimate the impact of changing self-sufficiency ratio (SSR) associated with the imposition of the GMP, on the consumer surplus, producer surplus and government payment or revenue, we started initially defining $SSR=Q_s/Q_d^*$. By setting SSR arbitrarily at a selected level we then estimate the likely quantity supplied. If SSR=q, where q is a constant we obtain the following;

$$Q_s = q\, Q_d^* \tag{11}$$

$$P_s^g = (1/(\omega * Q_s^*)^{1/\alpha} = (1/(\omega * qQ_s^*)^{1/\alpha} \tag{12}$$

Equation (12) shows the estimate of GMP associated with the supply curve. We then proceed to get an estimate of the quantity demanded under this new GMP pricing scheme by substituting (12) into the demand equation as in equation (13) below,

$$Q_d = \delta\{[/\omega(qQ_d^*)^{1/\alpha}\}^{\beta} = \delta\{[/\omega(qQ_d^*)^{\beta/\alpha} \tag{13}$$

From equations (11) and (13) the magnitude of $SSR=Q_s/Q_d$ can be re-evaluated in order to obtain the actual value of SSR. Changes in consumer surplus and producer surplus are estimated from equations (7) and (9). With a simple manipulation to simplify the computation, ΔCS is presented in (14) below;

$$\Delta CS = \{[/\delta(Q_d^{-1})^{\eta}\, Q_d/-\eta+1]-\infty\}-P_d^*Q_d^*-\{[/\delta(Q_d^{*-1})^{\eta}Q_d/ - \eta+1]-\infty\}-P_d^*Q_d^* \tag{14}$$

where $\eta=1/\beta$, P_d^g and O_d^g represent the price level and quantity demanded at the GMP respectively. Since infinity above can be cancelled out, equation (14) thus yields an estimate of ΔCS. The

estimate for the change in producer surplus is similar to the one presented in equation (9).

RESULTS OF SUPPLY AND DEMAND ANALYSES

This section utilises the estimated regression results of supply and demand equations in (6) and (7) as shown in Appendix Table 1A to evaluate whether the current policy direction is appropriately implemented in the light of applied welfare economics. Central to the discussion is to assess the welfare effect arising from the current rice pricing policy and the near self-sufficiency goal, which is the primary reason for government intervention in the rice industry. The GMP has always claimed to provide a fair pricing system to the producers and consumers alike, but it has never been thoroughly studied in the context of welfare economics. This allegation needs to be analysed as it affects the societal welfare particularly the producers and consumers.

GMP AND EQUILIBRIUM PRICE AND QUANTITY

With reference to the estimated 2SLS regression results of Appendix Appendix 2, the empirical supply and demand functions for rice are presented below:

$$\ln Q_s = e^{2.6073} + 0.9530 \ln (P_r/CPI) + 1.1977 \ln LN - 1.2717 \ln LA$$
$$(1.4970) \quad (3.0929) \quad (9.3112) \quad (-5.4481)$$
$$+ 0.1774 \ln T \quad R_\rho^2=0.929 \quad DW=2.470 \quad (15)$$
$$(3.2997)$$

$$\ln Q_d = e^{11.7720} - 0.4122 \ln (P_r/CPI) + 0.5732 \ln (GNP/POP) - 0.5417 \ln WM$$
$$(9.1916) \quad (-3.5275) \quad (3.9538) \quad (-4.1075)$$
$$+ 0.3961 \ln (Q/POP) \quad R_\rho^2=0.904 \quad DW=2.518$$
$$(3.7979) \quad (16)$$

Evaluated at the current (1992) levels of harvested area (670 thousand ha), agricultural labour (1,585 thousand employed workers), technological adoption (16 years) for equation (15); and per capita gross national product at constant price (RM4,739 per person) and an annual per worker manufacturing wage (RM16,387 per year), domestic rice production (2,070 thousand mt) and population (18,610 thousand persons) for equation (16), the simplified supply and demand equations become,

$$Q_s = 4.5845\ (Pr/CPI)^{0.9530} \quad (17)$$

$$Q_d = 36{,}213\ (Pr/CPI)^{-0.41215} \quad (18)$$

Solving the above equations the market clearing equilibrium price is found to be, $(P_r/CPI)^* = RM716.23$ per metric ton and the equilibrium quantity of supply and demand, $Q_s^* = Q_d^* = 2{,}410.79$ thousand metric tons. The equilibrium price is clearly higher than the CPI deflated average Malaysian Long Super (A1, A2 and A3) plus the Malaysian Long Super (B1, B2 and B3) which was estimated at RM633.54 per metric ton in 1992. The equilibrium quantity of Q_s^* and Q_d^* is also higher than the actual 1992 domestic rice production of 2,070 thousand metric tons. The estimated quantity of rice supply evaluated at the existing retail price of RM633.54 per metric ton from equation (13) is 2,144.8 thousand metric tons. These results revealed that the guaranteed minimum price (GMP) set by the National Paddy and Rice Board (LPN) or now BERNAS is below the equilibrium price level $(P_r/CPI)^*$.

There is a vast difference between the retail rice price paid by the consumers and the paddy price that the farmers actually receive at the farm gate. The difference may be due to the components of the marketing margin; cost of transportation, rewards to market intermediaries and some forms of market imperfection which seem to favour the market operators. In lieu of the significant price differential offered by the market intermediaries and the farmers, it is necessary to present estimate of the supply equation of the farm operators. Using farm gate price of paddy (Pp) the estimated supply equation for the farmers is as follows;

$$\ln Q_s^f = e^{3.0978} + 0.6513 \ln P_p + 1.2564 \ln LN - 1.0508 \ln LA + 0.1409 \ln T$$
$$(1.7873)(2.7232) \quad (9.5654) \quad (-5.2964) \quad (2.9530)$$
$$R_p^2 = 0.925 \quad DW = 2.486 \quad (19)$$

Setting LN, LA and T as constants by substituting their respective values in 1992, the simplified farm gate supply equation is,

$$Q_s^f = 50.4786\ (P_p/CPI)^{0.65132} \quad (20)$$

If the demand equation is identical to equation (13), the equilibrium price level for the farmers would be around RM484.53 per metric ton. The corresponding equilibrium quantity of paddy supplied to the market would be around 2,832 metric tons. Comparing this price with

the actual paddy price paid to the farmers which is RM317.88, the GMP for paddy is much lower. The price difference of RM166.65 is apparently significant that could be used as incentive to increase production. In other words, if the equilibrium price is paid to the farmers, they are most likely to respond to the above 2,830 metric tons equilibrium production.

Table 1 shows market equilibrium and the guaranteed minimum prices and quantities at the retail and farm gate levels. Currently farmers receive only about 50 percent of the retail GMP rice price as income, while another 50 percent may be used as payment for shipping, wages and reward or profit for handling performed by the market intermediaries.

TABLE 1. Equilibrium and GMP and quantities, Malaysia 1992

	Farm gate	Margin	Retail	Ratio (%)
Present GMP (RM per mt)	317.88	316	633.54	50.2
Quantity supplied (mt)	2152.20		2144.80	100.3
Quantity demanded (mt)	3369.50		2535.81	132.9
Difference in qtq. (%)	63.87		84.58	
Equilibrium price (RM per mt)	484.53	231	716.23	67.7
Equilibrium quantity (mt)	2832.12		2410.79	117.5

WELFARE GAINS AND LOSSES UNDER GMP

Based on the equilibrium and GMP and quantities derived from the supply and demand functions, welfare gains and losses to the involving parties can be determined. To estimate these values, we assume the GMP is fixed at RM633.54 per metric ton and the price movement is controlled at RM716.23 per metric ton. The slope of the demand curve relative to the supply curve appear to lead price oscillation to converge to the equilibrium point if no GMP is imposed (Figure 1). However, the GMP will drag back the oscillation price towards RM633.54 through the supply curve resulting in the contraction of the domestic rice production to the original condition of 2144.81 metric tons. Given these conditions, the imposition of ceiling price or GMP would result in the distortions of economic welfare. These distortions can be measured in terms of a reduction in the producer surplus, an increase in consumer surplus and additional costs borne by the government.

Taking equilibrium price as the initial condition, the imposition of GMP at RM633.54 per metric ton will generate changes as shown in Table 2.

TABLE 2. Welfare gains and losses associated with imposition of guaranteed minimum price (GMP), Malaysia 1977-1992

	Computational Equation	Estimated Value of Gains/Losses (RM per yr)
Change in producer surplus (ΔPS)	$[P^{*}Q^{*} \int_0^{Q^{*}} 0.20235Q_s^{1.04932}dQ_s]$ $-[PgQg- \int_0^{Q^{*}} 0.20235Qs^{1.04932}dQ_s]$	188354
or ≡	$1/2(P^{*}-P^{g})(Q^{*}+Q_s^{g})$	188351
Change in consumer surplus (ΔCS)	$[\int_0^{Qg} (36213.3361Q_d^{-1})^{2.4263}dQ_d-P^{g}Q_d^{g}]$ $- [\int_0 (36213.3361Q_d^{-1})^{2.4263}dQ_d-P^{*}Q^{*}]$	204368
or ≡	$1/2(P^{*}-P^{g})(Q^{*}+Q_d^{g})$	204517
Approximated value of area		
A	$(P^{c}-P^{*})Q_s^{g}$ = (951.13-716.23)2144.80	503814
B	$1/2(Q^{*}-Q_s^{g})(P^{c}-P^{*})$=1/2(265.99)(234.9)	31241
C	$(P^{*}-P^{g})Q_s^{g}$ =(716.23-633.54)2144.80	177354
D	$1/2(P^{*}-P^{g})(Q^{**}-Q_s^{g})$ =1/2(82.69)(265.99)	10997
E	$1/2(Q_d^{g}-Q_s^{g})(P^{*}-P^{g})$ =1/2(391.01)(82.69)	16166
Government payment for import (GP)	$(Q_d^{g}-Q_s^{g})P^{g}$ =(2535.81-2144.80)633.54	247720
Net welfare effect (NWE)	ΔPS + ΔCS + GP	-231706

Note: P^{g} stands for guaranteed minimum price
P^{*} stands for equilibrium price
Q_d^{g} stands for quantity demanded at guaranteed minimum price
Q_s^{g} stands for quantity supplied at guaranteed minimum price

The change in producer surplus is estimated at RM188353 per year. Since GMP is below the equilibrium price, (PS is actually a loss to the producers. In other words, there is a reduction in the value of the total producer surplus from the initial value of RM884082 per year at the equilibrium level to about RM695729 per year at the GMP level.

Unfortunately the Cobb-Douglas demand function does not allow us to calculate the total consumer surplus the same way we do for the producer surplus, but the change in consumer surplus can still be approximated. The change in consumer surplus, as a result of GMP imposition, amounts to RM204 thousand per year for 1992, while an approximate method yields a slightly higher, that is RM205 thousand per year (Table 2). This ΔCS is a gain since GMP is lower than the equilibrium price, and can only be realised if the government is willing to provide the excess quantity demanded to the level where GMP intercepts the demand function, that is when Qd=2,536 metric tons. The excess demand can be met either from a portion of the domestic rice stockpile release or directly from rice import.

If the government is to restrict domestic supply price at the RM633.54 per ton GMP level, producers will only produce 2,144.8 metric tons. At this market rationing GMP quantity, consumers will be willing to pay an exceptionally high price, RM951.13 per metric ton. Evaluating at the equilibrium price, the consumersí satisfaction derived from the purchase is equivalent to the area of A+B (see Figure 1).

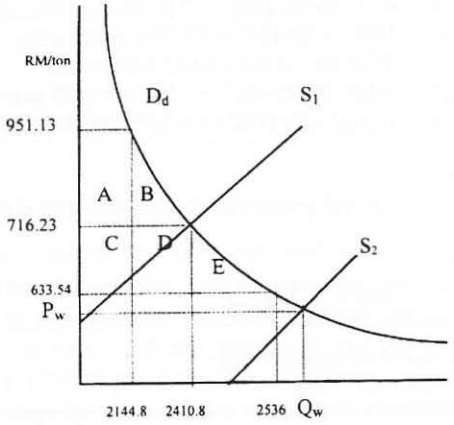

FIGURE 1. Estimates of welfare gains and losses

However, at the GMP level the consumers actual purchases equal the area of A+C. Therefore, consumers' net gain or loss depends on the value of B and C, that is they gain when C>B and lose otherwise. Estimates of the equivalent monetary values of the respective areas are given in Table 2. As noted the consumers will gain if the government

or BERNAS restrains rice production at the GMP level without import. The gain in the consumer surplus amounts to some RM146 thousand per year. As evident, this is not the case since Malaysia's rice policy is inclined to depend more on rice import rather than on domestic production. Presently, almost all the excess demand are being met by rice import which is close to 2,535.8 metric tons (actual import is 2,514 mt in 1992). It would be safe to say that the imposition of GMP, which is a price ceiling, appears to benefit consumers at the expense of the producers.

Since Malaysia chooses to accommodate supply shortages via importing rice at the world price Pw, it has to incur some expenses on foreign exchange. This expenditure is treated as government payment (GP) on food or rice import whose estimate amounts to some RM247720.48 during 1992. The GP is clearly a cost to the society, which is paid out of government revenue collected from the taxpayers. However, the value of GP may be recovered by government when the lower price of imported rice is released to the market at the GMP price level and the cost of GP is passed to the consumers of imported rice. The government or BERNAS will have to bear the cost of shipping and maintaining rice stockpiles.

Considering GP as a direct cost to the society the net welfare effect (NWE) of the current GMP pricing policy is given as the combined value of the changes in consumer surplus, producer surplus and the government payment. The calculated value of NWE is shown in Table 2 and is equal to -RM231706.35 per year based on the supply and demand equations estimated from data 1977-1992. As a result of government intervention in the GMP pricing policy the society is currently in a Pareto-inferior state. The producers are definitely losing under the existing GMP pricing policy, while the consumers are apparently gaining. Since the total cost of government payment is transferred to the consumers, as taxes paid, they too end up losing since the value of GP is greater than ΔCS by approximately RM43 thousand. The government or its agency may break-even or makes extra revenue out of the sale of imported rice. To improve the welfare economic condition the gainer should compensate the loser, in particular, the producers.

WELFARE GAINS AND LOSSES UNDER VARYING SELF-SUFFICIENCY RATIO

The self-sufficiency goal has played a vital role in the history of Malaysian rice economy. During the 1960's agriculture was a dominant sector, and full self-sufficiency in rice was the ultimate target then. This

was the time when high-yielding varieties during the era of global green revolution was introduced. Throughout the First and the Second Malaysia Plan (1956-65) efforts were geared towards infrastructure development; the construction of drainage and irrigation facilities. These efforts did not pay off well because of the low returns, but attaining full self-sufficiency was held as essential. The development of rice industry is an integral part of economic development where poverty was still high. Therefore a complete rice self-sufficiency target continued to be pursued until in 1972 when the World Bank openly announced its undesirable forecast for rice. A global over-supply of rice is expected to push down world rice prices. It was projected that Thai rice price would fall from $510 per ton (1968) to only $414 per ton (1971) (Abdul Rahman and Ani Arope 1971).

Hoping that Malaysia could import cheaper rice, the self-sufficiency target was revised to about 90 percent level. The outbreak of 1972-73 world food crisis alerted Malaysia to at least sustain the target. However, towards 1970's and 1980's, the food situation improved and no major food crisis occurred. Thus, Malaysia revised downward its target to about 80-85 percent self-sufficiency. By 1986 this target was further reduced to only 55-60 percent (Goh 1986; Nik Hashim 1992). In reality the self-sufficiency ratio is a guideline that has perhaps never been strictly abided to, by the planners.

SELF-SUFFICIENCY, SUPPLY AND DEMAND RELATIONSHIPS

Quantity supplied, quantity demanded, price and quantity imported with varying level of self-sufficiency are shown in Table 3. Assuming that the government has decided to revise the level of rice self-sufficiency say at q=30 percent (SSR=17.8%). This can be done by imposing GMP at RM202.48 per metric ton which automatically adjusts the quantity supplied and demanded to about 723 and 4,058 metric tons respectively. To ensure that the excess demand is met, the government can direct BERNAS to import some 3,335 metric tons of rice.

Table 3 provides the policy makers with necessary information desired for planning in case of the unforeseen fluctuations in the countryís rice supply and demand.

Malaysia may choose to be completely self-sufficient in rice by imposing GMP at RM716 per metric, or may even achieve a higher target of 10 percent over self-sufficiency by regulating the price to RM792 per metric ton. The latter policy action may not be a realistic target considering the present direction of the national agricultural policy

and the currently dynamic economic development plan that is focused on industrial development. However, based on the statistically significant estimate of supply and demand functions, it is not impossible to arrive at such a target.

TABLE 3. Quantity supplied, quantity demanded, price and quantity imported at varying level of self-sufficiency

Self-Sufficient Estimate(%) q=Q_s/Q^*	Quantity Supplied (1000mt) Q_s	Retail Price (RM/mt) P_r/CPI	Quantity Demanded (1000mt) Q_d	Quantity Imported. (1000mt) M	% SSR= Q_s/Q_d	M/Q_s	M/Q_s
10	241	64	6526	6285	3.7	26.0	0.96
20	482	132	4836	4353	10.0	9.0	0.90
30	723	202	4058	3335	17.8	4.6	0.82
40	964	274	3583	2619	26.9	2.7	0.73
50	1205	346	3254	2048	37.0	1.7	0.63
60	1447	419	3007	1560	48.1	1.1	0.52
70	1688	493	2813	1125	60.0	0.8	0.40
80	1929	567	2655	726	72.6	0.4	0.27
89	2145	634	2536	391	84.5	0.2	0.15
90	2170	641	2523	354	86.0	0.2	0.14
100	2411	716	2411	0	100.0	0	0
110	2652	792	2313	-338	115.0	-0.1	-0.15
120	2893	867	2228	-665	129.8	-0.2	-0.30

Note: [1] Current level of rice self-sufficiency is about 84 percent corresponding to q= 89 percent in the first column.

[2] negative import values in columns 5, 7 and 8 represent positive export values for the respective columns.

[3] these data are generated from the single quantity-price supply and demand functions.

With the GMP of RM634 per metric ton (RM957 per metric ton nominal price) supply and demand estimates from data 1977-1992 indicate that Malaysia is 84 percent self-sufficient in rice. The expected level of rice import amounts to 391 metric tons comparable to the actual import figure of 399.9 metric tons in 1991, but underestimates that of 44.9 metric tons in 1992. These data also illustrate the fact that the present level of import is about 18.2 percent of the domestic rice production, and 15.4 percent of the country's total rice consumption. Given the supply and demand quantities and prices at the varying level of self-sufficiency targets one can subsequently estimate the effect of

those changes on the economic rent and on producer and consumer surpluses.

ECONOMIC RENT AND SELF-SUFFICIENCY LEVEL

The effect of imposing GMP on the farmersí economic rent is illustrated in Table 4. In this special case the imposition of GMP at different self-sufficiency levels assumes a market situation of perfect competition. The producers in the rice industry are actually price takers since they accept whatever price or GMP imposed by the government. There exist a large number of producers and buyers in the industry and the commodity traded is rather homogeneous. Therefore, the producers aggregate total revenue is the product of constant GMP offered and the quantity supplied. In other words, rice producers are operating in a perfectly competitive output market while the input market may not necessarily be perfect. The economic rent or the producer surplus therefore rises with the increase in the GMP since each GMP level is equated to the marginal cost or supply equation, a condition for economic rent maximisation. From the producer viewpoint with a higher GMP level more output will be supplied in anticipation of a larger economic rent collected from the buyers.

The market clearing equilibrium condition whereby the producers and consumers are agreeable on the price forms the focal point in evaluating their welfare status. At the equilibrium pricing which corresponds to 100 percent self-sufficiency level, the economic rent is estimated at RM884 077.60 thousand per year. Any level of pricing scheme that deviates from the equilibrium condition is either a loss or gain to the parties. Table 4 only shows the total producer surplus since it is simply impossible to estimate the consumer surplus from the Cobb-Douglas demand function. Taking the current 84 percent self-sufficiency level as the deviation, producers are actually losing some RM188 thousand (RM884 078-RM695 736) in economic rent due to the GMP imposition of RM634 per metric ton. If the GMP level is set above the market equilibrium condition then the consumers economic welfare will be affected. Under the current GMP scheme consumers are gaining while producers losing. Table 4 also computes the welfare loss per unit of output under the existing GMP scheme, which amounts to approximately RM42.30 per metric ton.

TABLE 4. Economic rent or producer surplus under varying self-sufficiency level Malaysia 1977-1992

Self-sufficiency Estimate (%) $q=Q_s/Q^*$	Total Revenue (RM1000) P_rQ_s[g]	Variable Cost (RM1000) TVC[1]	Total Rent (RM1000) π[2]	Economic π/Q_s	$\pi^*/Q^*-\pi/Q_s$
10	15 413	7 521	7 892	33	334
20	63 796	31 132	32 665	68	299
30	146 442	71 462	74 980	104	263
40	264 061	128 859	135 202	140	227
50	417 161	203 570	213 591	177	190
60	606 138	295 788	310 350	215	152
70	831 317	405 673	425 644	252	115
80	1 092 977	533 360	559 617	290	77
89	1 358 828	663 092	695 736	324	42
90	1 391 358	678 966	712 391	328	38
100	1 726 675	842 597	884 078	367	0
110	2 099 121	1 024 346	1 074 774	405	-39
120	2 508 871	1 224 300	1 284 571	444	-77

Note: [1] Total variable cost is derived from the integral of the supply equation, TVC=0.098737336Qs2.049318

[2] Reduction in economic rent from the equilibrium condition should be equal to change in producer surplus, that is RM884 077.6-RM695 735.6 (RM188 350. Because of the rounding error in the computation we could not get the exact value.

SELF-SUFFICIENCY, PRODUCER AND CONSUMER SURPLUSES

Changes in producer and consumer surpluses, government payment and net welfare effect at varying level of self-sufficiency are shown in Table 5. Estimates of the current changes in producer surplus can only give a snapshot of the present welfare loss of RM188.4 thousand and simultaneously a welfare gain to the consumer amounting to RM204.4 thousand per year. The estimated cost borne by the government in payment for rice import accounts for another additional loss of welfare amounting to RM247.8 thousand per year. Together they contribute to the net welfare loss of about RM232 thousand per year which is the net effect resulting from operating below the market clearing equilibrium condition.

Varying the self-sufficiency level say from 10 to 100 percent the direction of change in those welfare policy variables occurred. For

instance with an increase in SSR or q the value of (CS tends to decline, while (PS tends to improve accordingly. The driving force behind the SSR movement is the ceiling price enforced by the government, that is the GMP in the case of Malaysia. Thus Table 5 provides policy makers with the necessary information on rice industry to decide on the most desirable SSR that will generate the maximum net welfare gain to society.

TABLE 5. Changes in producer surplus and consumer surplus, government payment and net welfare effect under varying self-sufficiency level, Malaysia 1977-1992

Self-Sufficiency Estimate (%) $q=Q_s/Q^*$	Change in Producer Surplus ΔPS	Change in Consumer Surplus ΔCS	Government Payment GP	Net Welfare Effect NWE[1]
10	876 191	2 227 530	401 809	949 529
20	851 420	1 848 871	576 020	421 430
30	809 108	1 539 587	675 188	55 289
40	748 890	1 268 193	717 108	-197 806
50	670 507	1 021 891	708 797	-357 414
60	573 757	793 900	653 845	-433 702
70	458 471	580 089	554 354	-432 736
80	324 509	377 713	411 662	-358 457
89	188 400	204 360	247 716	-231 757
90	171 746	184 830	226 667	-213 583
100	0	0	0	0
110	-190 609	-177 858	-267 890	280 641
120	-400 389	-349 622	-576 667	627 435

Note: [1] Change in producer surplus is a loss while change in consumer surplus is a gain. Therefore the former is deducted from NWE estimate and the latter is added to the NWE. Similarly government payment is a cost therefore its value is deducted from the NWE estimate.

[2] Computed from changes in producer and consumer surpluses equations displayed in Table 2.

In selecting the desirable GMP scheme or SSR, there are four options the policy makers have to consider in their decision making. First, they should avoid selecting GMP scheme associated with the SSR that will yield the highest net welfare loss, such as q=60 percent (SSR=48%) which listed the highest negative net welfare effect of RM434 thousand

per year. Second, the policy makers may choose to settle on a pricing scheme consistent with the equilibrium condition with no change in the producer and consumer surpluses and the government payment. This choice is also desirable from the domestic food security and food production sustainability viewpoints. The shortcomings of such a policy choice are; it tends to neglect the economic advantages of the international trade, and the benefit from the positive net welfare effect (NWE) of producing at certain GMP scheme. The positive NWE can be realised when GMP is set around q=10-30 percent (SSR=17.8% or less) and above 100 percent self-sufficiency target.

Third, if policy makers decide to impose GMP at an extremely low SSR in order to maximise the NEW, the country may encounter two possible problems. The country will be totally dependent on the imported rice that is risky and costly from the view-points of food security and production sustainability. The existing infrastructure development and resources will be left idle and perhaps unproductive to the economy. Labour force associated with rice industry at the grass root level will be forced out of employment temporarily. This may be a right direction in terms of eradicating poverty in this traditional sector, provided job opportunities are available to support the displaced labour. On the other hand, rice producers will be most affected and need to be compensated by the equivalent of the reduction in producer surplus. Fourth, alternatively policy makers may impose a GMP associated with the SSR that surpasses the equilibrium condition like 110 or 120 percent self-sufficiency. This option will have to forgo other investment potential, especially outside agricultural sector which may be economically more viable compared to the investment in rice. However, this option will certainly foster food security and sustainability if appropriate measures are taken to utilise environmentally-friendly farm practices. Finally a suitable option choice is dependent on the goal of the country food policy programs and problems that it wishes to solve.

CONCLUSION AND POLICY IMPLICATIONS

The estimated 2SLS supply and demand regression equations for rice are utilised to derive applied welfare economic policy variables. Using market clearing equilibrium condition as the basis, changes in consumer and producer surpluses and the government payment are calculated for two purposes. First, the welfare economic policy variables are estimated to determine deviations from the equilibrium condition. Second, the

welfare economic policy variables are computed under varying self-sufficiency ratios associated with the change in the GMP to approximate the net social welfare effect.

The present market clearing equilibrium price equals RM716.23 per metric ton and the equilibrium quantity is 2,410.8 metric tons. The imposition of RM633.54 per metric ton GMP reduces the producers' welfare by some RM188 400 per year while consumers' welfare increases by RM204 360 per year. Since the GMP is a ceiling price, there is excess demand that has to be met by the imported rice. In 1992 the government spent about RM247 716 on rice import to supplement the shortage. The effect of the present GMP policy is therefore a net loss amounting to RM231 757 per year as observed from the net welfare effect of the programme.

To investigate the impact of changing GMP on the welfare policy variables, the self-sufficiency ratio (SSR) is allowed to vary. Results of the analysis seem to support the fact that with decreasing SSR, producers tend to lose while consumers benefit from the change. These economic gains and losses are inferred from changes in the values of the consumer surplus and producer surplus, respectively. Based on the estimated supply and demand functions, the SSR=48 percent (q=60%) appears to indicate the highest net welfare loss to the countryís rice industry. This SSR is associated with the imposition of about RM419 per metric ton and the total welfare loss is estimated at RM433 702 per year.

Information on GMP and SSR and their respective impacts on the welfare economic variables is useful to the policy makers in planning the direction of national rice policy. As it is now we have been wrongly informed to believing that a near self-sufficient ratio of 50-65 percent would be economical to Malaysia as the country is a high cost producer. Our results show otherwise, in that, to maintain 60 percent rice self-sufficiency will increase the net welfare loss to the society. The increased net welfare loss is mainly due to reductions in producer and consumer surplus based on the existing demand for and supply of rice of this study.

Finally policy makers should realise the imposition of a specific level of GMP which can affect the SSR, is associated with food/rice security and its production sustainability. Thus, a 100 percent SSR will foster food security and sustainability in terms of ensuring domestic rice supply, provided that the methods that increase production are environmentally friendly. On the other hand, imposing GMP that yields10 percent SSR will be unsecured and non-sustainable to the

domestic rice supply. However, food security and its production sustainability can be resolved through food imports. In this case the possible degrading environmental effects in production is borne by the exporting country. Given that more pesticides and insecticides are used with increasing rice production, the external impact on the environment will therefore be passed on to the producing country. The employment level in the agricultural sector will be somewhat reduced but may not necessarily look as bad as we expect, since to some extent the incidence of poverty among rice farmers will be brought to a minimum. However, such a policy is obviously risky since the country will have to be largely dependent on other countries for its food supply as the large food import bill has been hotly debated during the current economic crisis.

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Faculty of Economics
Universiti Kebangsaan Malaysia
43600 UKM Bangi
Selangor Darul Ehsan