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Assessing the Comparative Advantage of Malaysian Ruminant Production: A Policy Analysis Matrix Approach

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ABSTRACT

The comparative advantage of ruminant sector is measured in selected state Peninsular Malaysia using a modified Policy Analysis Matrix (PAM) to determine whether ruminant production has comparative advantage if produced under commercial, medium, or small farm size. This study showed that Peninsular Malaysia has a strong comparative advantage in commercial production of ruminant products. The result indicates that producing the one unit value added of ruminant products in commercial farm size can be achieved by using less than one unit of the domestic resource factors. It means that ruminant products in Peninsular Malaysia are more profitable to produce in commercial sized farms than to import them

Keywords: PAM, comparative advantage, ruminant, production, Peninsular Malaysia

INTRODUCTION

Ninth Malaysian Plan (9MP) spelled out policies to increase food production. In the 9MP, the government has been promoting the revitalization of the agricultural sector as the third engine of economic growth. The new agricultural programs involve greater orientation of a development program toward more modern and commercial scale production of agro-products to spur the domestic food production including livestock products.

The policy to increase food production is closely related to free trade agreements that will provide opportunities for agricultural products from foreign countries to conduct trade in Malaysia. Free trade also provides opportunities for Malaysian agricultural products in international markets. The existence of a policy to increase food

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production is expected to increase the number and quality of food products, making Malaysian agricultural products competitive with similar products from abroad.

The argument behind the idea of free trade basically refers to the concept of comparative advantage and the benefits that can be achieved through specialization in accordance with comparative advantage. Livestock product is the one commodity that participates in free trade, both as an import substitute product or as an export promotion product.

THE LIVESTOCK INDUSTRY IN MALAYSIA

The livestock subsector in Malaysia grew 7.9% between January and December 2008 . The livestock was contributing around 10.1% to the overall performance of the agriculture sector in 2008. The value-added of the livestock subsector continued to grow 5.2 % in the period from January to December 2009 driven by higher production of poultry and beef cattle. The production of poultry expanded 5.5% in that period in 2009**.** The introduction and implementation of transferring effective microorganism technology, modern poultry farming as well as incentives for farm enhancement contributed to the increase in poultry production. Value added of cattle and goat farming increased from 12.5% and 38.8% respectively in the period 2009, as a consequence of integrated and commercial feedlot farming as well as the implementation of Livestock Sector Entrepreneurship Transformation Scheme (Ministry of Finance, 2009).

According to Federation of Livestock Farmers Association of Malaysia (2009), the ruminant sector lags far behind with the majority of beef and goat still owned by individual farmers who rear these animals as part of their overall rural agricultural activities. The total ex-farm output value of beef is estimated to be about RM759.60 million and goat about RM50.01 million in 2008. Increasingly, though there is some effort at raising beef as an integrated activity with palm oil cultivation in view of its potential as an effective replacement for herbicide use in keeping down vegetative growth among the trees, and as a tool for organic recycling of the vegetative soil cover.

Livestock in Malaysia is dominated by poultry meat that has the largest share of production with 59.21%, followed by eggs, pork, beef, and goat that have a production share of 26.86%, 12.02%, 1.82%, and 0.09% respectively. Among these products number of poultry meat productions is the largest. In the last five years, average production of chicken meat is 1,039,198 metric tons. This amount is large compared with the average production of eggs of 471,360 metric tons or pork with average production of 211,068 metric tons. In fact, the average production of poultry meat is very large when compared with the average production of beef and goat meat of which only 31,945 and 1,610 metric tons are produced respectively (Department of Statistic Malaysia, 2008).

In addition, the level of self-sufficiency

for beef, goat, pork, poultry meat, and poultry eggs are 25.88%, 9.15%, 121.41%, 121.58%, and 114.19% respectively (Department of Veterinary Services, 2009).

The data above shows the numbers of poultry production have exceeded the demand in this country. This condition provides opportunities for poultry products to enter the export trade with the intention of raising foreign exchange for the country. Moreover, the production of ruminant products (beef and mutton) still cannot suffice demand. This is in accordance with the theory of trade, where the excess production can be used for export while the lack of production will be met through import (Tsakok, 1990).

The above data shows the ruminant products needed to increase production numbers in order to accomplish a demand for domestic beef and goat meat as well as reduce dependence on imports. In relationto the Third National Agricultural Policy (NAP3), the production of fresh beef, mutton and milk will increase for the domestic market. Private sector led commercial production will be actively encouraged to adopt modern approaches and farming on a large-scale basis. Smallholder livestock activities with a potential will continue to be transformed into larger commercial operations to improve efficiency. Therefore, the main question is whether Malaysia has the comparative advantage in the production of beef and mutton?

THE POLICY ANALYSIS MATRIX

This study aims to determine the comparative advantages of ruminant subsector in Malaysia. The Policy Analysis Matrix (PAM) is used as an analytical tool for investigating which commodity system within an economy's agriculture sector hold a comparative advantage (Morrison, 2002). According to Yao (1997) the structure of a PAM can be described as a product of two accounting identities: one defining profit as the difference between revenues and costs, and the other measuring the effects of divergence (distorting policies and market failures) as the difference between observed parameters and parameters that would exist if the divergences were removed. The primary objective of constructing a PAM is to derive a few important policy parameters for policy analysis. In this paper, four most commonly used parameters are:

i. Nominal Protection Coefficient of Output (NPCO)
ii. Nominal Protection Coefficient of Input (NPCI)
iii. Effective Protection Coefficient (EPC)
iv. Domestic Resource Cost (DRC) ratio

PAM as presented in Table 1, has three rows. The first row of the PAM is calculated with the private prices or financial prices. The private prices are the prices actually received or paid by the economic actors. The second row is a calculation based on social prices (economic prices), which describe the price or social value of the economic value for the elements of cost and performance. The third row involves the calculation of the price difference in private cost and the social

cost as a result of the impact of government policies or existing market distortions.

The first row of the PAM is the calculation of private profitability (D), defined revenue (A) minus total costs (B+C). Where, B and C are tradable and domestic inputs, respectively (Table 1). In other words, the first row of the PAM contains the value for the accounting identity measured at private prices, which are the price actually used by local producers to purchase their inputs and sell their outputs. Private profitability in the first row, demonstrates the competitiveness of the livestock production system, given current prices for inputs, outputs and policy. The second row of the PAM calculates the social profit that reflects social opportunity costs. Social profits measure efficiency and comparative advantage. Social profitability (H) measures revenue valued at social prices less value of tradable and domestic input both valued at social prices. A positive social profit indicates that the system uses scarce resources efficiently and contributes to national income (Nelson, 1991). The negative social profits indicate social inefficiencies suggest that production at social cost exceed the cost of import. In other words, the sector cannot survive without government support when social profits are negative. The final row of PAM represents the extent to which policies distort revenues and cost from international levels.

The PAM framework can also be used to calculate important indicators for policy analysis. These include NPCO, NPCI, EPC, and DRC . The Nominal Protection Coefficient measures the impact of commodity specific price interventions such as import tariffs. NPCO is given by the ratio of private revenue to social revenue (A/E). An NPCO greater than one implies that the domestic output is protected and vice versa, if the ratio is less than one. NPCI is expressed as B/F (the ratio of value of tradable inputs at local market prices or private prices to value tradable inputs at world market prices or social prices). EPC will measure the total effect of government

TABEL 1
Structure of the Policy Analysis Matrix (PAM)

		COST		PROFIT
	REVENUE	INPUTS TRADABLE	INPUTS NON-TRADABLE	
Private Prices	A	B	C	D = A - B - C
Social Prices	E	F	G	H = E – F - G
Divergence	I = A – E	J = B – F	K = C – G	L = I - J - K= D - H

Source : Pearson, 2003

Note : A = Revenue in Private Price; B = Inputs Tradable in Private Price; C = Inputs Non-Tradable in Private Price
D = Private Profitability; E = Revenue in Social Price; F = Inputs Tradable in Social Price
G = Inputs Non-Tradable in Social Price; H = Social Profitability; I = Output Transfer; J = Input Transfer
K = Factor Transfer; L = Net Transfer

interventions; it can be computed from the PAM as a ratio of value added in local market prices (A-B) to the value added in the world prices (E-F). If EPC is greater than one, it means that government intervention has favored local production, although it is more economical to import the commodity (Legese, 2007).

DRC is the ratio of the domestic production in social values (G) to value added again in social terms (E-F). It indicates the cost of domestic factors that has to be incurred to obtain one unit of value added in social terms. A DRC value between zero and less than one implies that commodity has a comparative advantage while the value above one and those negative indicate that an activity is wasting scarce resources that could be used efficiently elsewhere (Mahlanza *et al.*, 2003).

DATA AND GENERAL ASSUMPTION

The secondary data are published data, which was obtained from various resources. Basically, the data from Department of Statistic, Department of Veterinary Services (DVS), Ministry of Agriculture (MOA), Ministry of Finance (MOF), and other related sources were utilized. The primary data were collected from a survey conducted in 2009 for livestock farms. The said survey took into account data on the information on the production for the year of 2008 which included reports on quantities of farm production inputs and outputs, scale of farm, prices paid and received by livestock producer. The ruminant subsector consisted of beef and goat farming. Each farm is classified into a commercial, medium and small scale farm as shown in table 2. Classification of farms facilitated comparison of the different farm class where there are variations in cost of production and revenue due to the differences in utilization of resources and prices of output and input.

This survey was implemented in Negeri Sembilan, Perak and Selangor. The location was based on the potential resources of livestock in the center ar ea of livestock products in Peninsular Malaysia. The number of samples used in this survey are 39 beef producers and 40 goat producers from the research area. The techniques of data collection on each element of the respondents were carried out with a structured questionnaire.

TABEL 2
Classification of Farms

COMODITY	FARM SIZE	POPULATION
Goat	Commercial	>500 heads/year
	Medium	100 - 500 heads/year
	Small	<100 heads/year
Beef	Commercial	>250 heads/year
	Medium	50 - 250 heads/year
	Small	<50 heads/year

Source: Department of Veterinary Services (DVS), 2005

The major information collected from the survey were from: (1) Livestock reconciliation table and estimation of farm production and (2) Cost profile for each livestock enterprise. The presentation of the livestock reconciliation table was based on the format being used by Tan *et al.* (1989). The total physical output (production) for both categories was estimated as follows:

Production
= Live weight gain over the production (per kg of Live weight)
= Sales (kg Live weight)
+ home consumption (kg Live weight)
+ closing stock (kg Live weight)
− opening stock (kg Live weight)

The compilation of revenue and production cost, trading and processing cost profiles collected from the farms were in the private value. These private values need to be converted into social value prior to DRC calculations. Conversion Factors (CF) were used to convert the private to social values. The CF of a selected item that had a direct involvement in the production of livestock was estimated using the formula obtained from Veitch M.D (1986). The selected items that have no CF, the CF need to be estimated and was categorized into immediate inputs and primary inputs. The immediate inputs included the following: feed, MVS (medicine, vaccine, and supplement), livestock purchased, fuel,

TABEL 3
Conversion Factors from Financial to Economic Analysis

INTERMEDIATE INPUT			CONFERSION FACTOR
	Feed		0.95
	MVS		0.88
	Livestock Purchase		0.95
	Fuel		0.88
	Repairs & Maintenance		0.78
	Water		0.75
	Electricity		0.84
	Office Supplies		0.90
TAX			0.00
LAND RENT			1.00
LICENCE			0.00
PRIMARY INPUT			
	Labor		0.82
	Depreciation		
		Building	0.86
		Equipment	0.90
		Transportation	0.70
	Interest		1.30
LOSSES			1.00

Source: Veitch, 1986

repair and maintenance, utility, and office supplies. The primary inputs included labour, depreciation, interest and land rent. Other items included were TAX, license and losses.

In addition, for allocating the cost of inputs into the domestic and foreign components it is important to calculate the DRC. All Input or output that is not being traded across national boundaries of a particular country either because the cost of production or limited trade practices is named as domestic component. Cost of domestic component is also known as non-tradable cost. On the other hand, all input or output is traded if its production and consumption will affect the country's level of import or export on the margin named as the foreign component. Cost of foreign component is also known as tradable cost. The breakdown of domestic and foreign components is presented in Table 4.

TABEL 4
Allocation of Costs Between Domestic and Foreign Component

			Domestic (%)	Foreign (%)
Intermediate Input				
	Feed			
		Broiler	20	80
		Layer	20	80
		Beef	10	90
		Goat	20	80
	MVS		20	80
	Repairs & Maintenance		100	0
	Water		90	10
	Electricity		90	10
	Fuel		50	50
	Livestock Purchase			
		Broiler	50	50
		Layer	50	50
		Beef	50	50
		Goat	50	50
	Office Supplies		100	0
Tax			100	0
Land Rent			100	0
Licence			100	0
Primary Input				
	Labor		100	0
	Depreciation			
		Building	100	0
		Equipment	100	0
		Transportation	67	33
	Interest	Building	95	5
Losses			100	0

Source: Veitch, 1986

RESULT

In this study, the Policy Analysis Matrix (PAM) is used to evaluate the comparative advantage of alternative activities, namely beef, and goat in Malaysian livestock industry. The most prominent indicators used by the PAM are the Domestic Resource Cost (DRC) ratio and Social Profitability. A simple definition of the DRC is that it measures the ratio of the cost of domestic factors used by the commodity (production and marketing) system to the value added of the system, both measured at economic prices. In other words, the DRC measures the ratio of the cost of domestic resources used by the commodity system to the value created by the commodity system, both measured at social prices.

Similarly, social profits measure efficiency or comparative advantage, although outweighed by the DRC for comparison of different activities. The results can be taken directly from the second row of the PAM matrix, where social profits equal social revenues less total social costs (tradable and non-tradable costs).

In addition, the PAM framework can also be used to calculate important indicators for policy analysis. The nominal protection coefficient (NPC), a simple indicator of the incentives or disincentives in place, is defined as the ratio of private price to a comparable world (social) price. NPC can be calculated for both output (NPCO) and input (NPCI). The other indicator is an effective protection coefficient (EPC), which measures the total effect of government interventions. The summary result on protection coefficients on ruminant production in Peninsular Malaysia are reported in Table 5.

Analysis of Protection

The ratio formed to measure output transfers is called the Nominal Protection Coefficient of Output (NPCO), a term taken from the literature on international trade. NPCO shows how much domestic prices differ from social prices. If NPCO exceeds one, the domestic prices are higher than the import or export price and thus the system is receiving protection. If NPCO is less than one, the domestic price is lower than the comparable world price and the system is unprotected by policy. The NPCO for ruminant industry 1.05 which indicates that policies have caused domestic output price of livestock sectors in Peninsular Malaysia to be higher than the world price by approximately 5%[1]. Therefore, there has been a transfer of 5% gain from the customer to the producers of ruminant product. In other words, the condition of the current price of ruminant products has indirectly provided an incentive for the development of ruminant production in Peninsular Malaysia.

Impact of divergence and government policies contained in the tradable inputs is indicated by the value of a nominal protection coefficient on input (NPCI). Shaped policy on tradable inputs and domestic factors can form trade policy and subsidies and taxes, while other forms of divergence can be results of market distortions. NPCI shows how much domestic prices of tradable

[1]Mahlanza *et al*., 2003

TABEL 5
Analysis of Protection

KIND OF FARM	FARM CLASS	NOMINAL PROTECTION COEFFICIENT OF OUTPUT (NPCO)	NOMINAL PROTECTION COEFFICIENT OF INPUT (NPCI)	EFFECTIVE PROTECTION COEFFICIENT (EPC)
BEEF	Small	1.05	1.06	1.05
	Medium	1.05	1.06	1.05
	Commercial	1.05	1.05	1.05
	All Size	1.05	1.05	1.05
GOAT	Small	1.05	1.06	1.05
	Medium	1.05	1.06	1.05
	Commercial	1.05	1.05	1.05
	All Size	1.05	1.06	1.05

Source: Farm survey conducted on Peninsular Malaysia, 2009.

inputs differ from their social prices. If NPCI exceeds one, the domestic input cost is higher than the input cost at world prices and the system is taxed by policy. If NPCI is less than one, the domestic prices are lower than the comparable world price and system is subsidized by policy[2].

According to evaluation of government protection in Table 5, NPCI Malaysian ruminant industry ranged in between 1.05-1.06. These coefficients suggest that producers are paying 5%-6% more for their tradable inputs than they would have been able to obtain them at their respective social price[3]. This means the policy provide 5%-6% tax per unit of tradable input paid by domestic producer[4].

The existence of government policy in the form of value added tax on input production in the ruminant subsector relate with the higher portion of foreign component of the inputs used in the ruminant production such as feed and MVS. The feed for beef and goat has 90% and 80% of foreign component respectively even as the input MVS for ruminant production using 80% of foreign component. The higher foreign component used on input caused the price to rise due to import tariff, which created a negative transfer from the entire set of policies affecting tradable inputs.

Effective Protection Coefficient (EPC) is the indicator that shows the full impact of a set of policies and includes both output price-enhancing effects (import tariffs) and cost-reducing effects (inputs subsidies). As can be seen in Table 5, all kinds of farms in ruminant sub sectors generated EPC of about 1.05. It is indicating that the net impact of government policy influencing product markets on output price policy and tradable-input price policy is to allowing the depicted beef and goat production to have a value added in private prices 5% greater than the value added without policy transfers (as measured in social prices).

[2]Pearson, 2003
[3]Morrison, 2002
[4]Joubert, 2000

EPC on ruminant sub sectors is greater than one which indicates positive incentive effects of commodity policy. This policy shows the government has given heavy support of 5% for value added on both beef and mutton production, which has been beneficial to the producers. In other words, EPC greater than one shows the government policy and market performance has been supporting the activities of ruminant production in Peninsular Malaysia.

Analysis of Social Profitability

In general, the cost of livestock purchased has a large portion to the total production costs for beef farm. In addition, the high cost of feed and labor apparently affects the profit earned in the production of beef. In case of small size farm, on average they suffer losses amounting to RM2.98 per kg LW where 32% of total production cost are livestock purchased, then the cost for feed and labor used 20% and 21% of the total cost respectively. The medium size farm also suffered losses amounting to RM1.78 Per kg LW with the portion about 51% of total production cost for livestock purchased, 17% for feed cost and 15% for labor cost.

At the same time, as it can be seen from Table 6 that it appears that among the three types of scale in beef farm, only in the farm of commercial scale could provide benefits. That farm has a social profitability (SP) ratio of 0.87 which means every one kilogram of beef produced will give profit about RM0.87/ kg LW. Beef farm size on commercial beef usually purchased in large numbers (> 300 head / year), which are preserved in three to six months then continue to sell to their customers. This business recorded cost of livestock purchased with the portion about 86% of total production cost, while the cost for labor and feed was only the remaining amount of 5% and 3% respectively.

In case of small ruminant subsector, goat farm is able to gain profits in both on commercial and medium farm size. Medium size farm gained a profit of 5.95 RM/kg LW while the goat on commercial size farm gain 9.75 RM/kg LW profit. In terms of proportion of labor and feed cost, the medium size farm incurred 16% and 13% labor and feed cost respectively, while the livestock purchased made up 48% of the total production cost. Whilst, goat farm on commercial size pay for labor and feed cost with a portion of 10% and 23% respectively, and livestock purchased made up of about 28% from the total production cost.

In case of small farm size, the labor and feed cost made up 21% and 24% respectively of the total cost, and livestock purchased is about 19% of the total production cost which is very low and the number of animals is too small to make profitable business. Large portions of food and labor costs lead to negative profits obtained in goat production for small size farm about 3.14 RM/kg LW.

Analysis of Comparative Advantage

The comparative advantage analysis is to measure the efficiency level of domestic resources used in order to gain or save foreign exchange. To estimate the comparative advantage in Malaysian livestock industry, the study implements

TABLE 6
Analysis of Comparative Advantage and Economic Profitability

KIND OF FARM	FARM CLASS	SOCIAL PROFITABILITY (SP)	DOMESTIC RESOURCES COST RATIO (DRCR)
BEEF	Small	(2.98)	1.71
	Medium	(1.78)	1.50
	Commercial	0.87	0.81
	All Size	0.59	0.87
GOAT	Small	(3.14)	1.23
	Medium	5.95	0.72
	Commercial	9.75	0.65
	All Size	2.81	0.86

Source: Farm survey conducted on Peninsular Malaysia, 2009.

the method of domestic resource cost (DRC) estimation described by Monke and Pearson (1989). In a simple definition, the DRC measures the ratio of the cost of domestic resources used by the commodity production system to value added created by the commodity production system, both measured at social prices.

The DRC result concludes by raising the issue as to whether the production of livestock products in Malaysia has a comparative advantage that reveals the efficiency of the use of domestic resources to save or earn one unit of foreign exchange. If DRC is less than one and greater than zero it indicates that ruminant production has a comparative advantage because the value of domestic resources used in production is less than the value of foreign exchange saved. If DRC is greater than one it indicates that ruminant production has the comparative disadvantage because the value of domestic resources used in production is greater than the value of foreign exchange saved.

Based on the findings provided in Table 6, the commercial beef farm has the comparative advantage in production of beef with DRC ratio of 0.81. However both the small and medium size farms do not have the comparative advantage in beef production. On the other hand, the small goat farm has the comparative disadvantage indicated by DRC ratio of 1.23. The commercial and medium size goat farms have the comparative advantage in mutton production with DRC ratio of 0.65 and 0.72 respectively. These ratios indicate both commercial and medium farms used domestic resources lower than the value of output produced.

The sensitivity analysis needs to be done to test the effect of changes in input prices on the analysis of comparative advantage in ruminant production subsector. It is known that beef productions have a comparative advantage only when produced in commercial size, but do not have a comparative advantage when produced in the medium and small size. Sensitivity analysis is conducted by increasing the input cost of production to understand the level of comparative advantage on

the production system. Decreasing the input cost of production is conducted to analyze whether the production system has a comparative advantage or not.

The total cost of inputs on beef production in Malaysia is dominated by labor costs and the cost of livestock purchased. Beef production in commercial size still has a comparative advantage when the labor cost is increased by 60%, but if the cost of livestock purchased is increased by 20% the commercial beef production has a comparative disadvantage. As both costs are simultaneously increased by 20%, then this production does not have a comparative advantage.

Beef production in the medium and small size sectors do not have a comparative advantage, so the sensitivity analysis is done by lowering input costs. Production of beef in the small size still does not have a comparative advantage even though the cost of labor decreased by 60%. The same condition also occurs in the medium beef productions. However, beef production in the medium size farm has a comparative advantage as the cost of purchased livestock decreased by 40%, while beef productions in the small size farm still do not have a comparative advantage as the cost of purchased livestock is reduced to 60%.

At the same time, when both costs are reduced by 30% it is understood that beef productions in the medium size farm has a comparative advantage. However, beef production in the small size has a comparative advantage when both the cost is lowered by 50%.

As a result, the sensitivity analysis shows that changes in the cost of purchased livestock are highly influencing factors on the level of comparative advantage of beef production in Malaysia.

Goat meat production in Malaysia have a comparative advantage when produced in commercial and medium size, but do not have a comparative advantage when produced in small size.

The commercial goat production still has a comparative advantage when the labor cost or cost of livestock purchased increased up to 60%. This production still has a comparative advantage when both costs are simultaneously increased by 60%.

Production of goat in the medium size farm still has a comparative advantage as the cost of labor increased by 60%, but if the cost of livestock purchased increased by 60% this production has no comparative advantage. Goat productions in the medium size farm also have no comparative advantage when both costs are simultaneously reduced by 40%.

The cost of goat production in the commercial and medium size farms are dominated by labor costs and the cost of livestock purchased, in contrast to that, the cost of goat production in small size is dominated by the cost of feed and labor costs. The small goat production farms have a comparative advantage when feed costs or labor costs are reduced by up to 60%. Similarly, if both costs are simultaneously reduced by 30%, then this production could have a comparative advantage.

TABLE 7
Sensitivity Analysis

FARM SIZE	BEEF		GOAT	
	SENSITIVITY ANALYSIS	DRC	SENSITIVITY ANALYSIS	DRC
All size	normal	0.87	normal	0.86
	increased labor 60%	0.94	increased labor 60%	0.98
	increased livestock purchased 10%	1.00	increased livestock purchased 30%	1.05
	increased labor 10%+livestock purchased 10%	1.02	increased labor 20%+livestock purchased 20%	1.02
Commercial	normal	0.81	normal	0.65
	increased labor 60%	0.86	increased labor 60%	0.71
	increased livestock purchased 20%	1.09	increased livestock purchased 60%	0.80
	increased labor 20%+livestock purchased 20%	1.11	increased labor 60%+livestock purchased 60%	0.87
Medium	normal	1.50	normal	0.72
	decreased labor 60%	1.26	increased labor 60%	0.83
	decreased livestock purchased 40%	0.96	increased livestock purchased 60%	1.06
	decreased labor 30%+livestock purchased 30%	0.98	increased labor 40%+livestock purchased 40%	1.02
Small	normal	1.71	normal	1.23
	decreased labor 60%	1.37	decreased feed 60%	0.97
	decreased livestock purchased 60%	1.14	decreased labor 60%	0.99
	decreased labor 50%+livestock purchased 50%	0.99	decreased feed 30%+labor 30%	0.98

Source: Farm survey conducted on Peninsular Malaysia, 2009.

Based on the sensitivity analysis one can concluded that the comparative advantage indices in goat production are very much influenced by changes in the cost of livestock purchased especially by the commercial and medium size farm. However, the cost of feed has greatest influenced in small farm operation in order to maintain comparative advantage in goat production.

CONCLUSION AND RECOMMENDATION

The results of this study show that economically producing beef and goat in Peninsular Malaysia is efficient and profitable. However, practical ways to increase the competitiveness and efficiency are not explicitly found in this study. From this study, we can conclude that the analysis of comparative advantage only depicts the resource usage in terms of domestic savings. The analysis reveals that ruminant group has a comparative advantage in production of livestock product, especially when both beef and goat is produced on commercial scale. Beef farm has a comparative advantage in commercial scale, as shown by the DRC ratio of 0.81. This ratio indicates the beef farm on commercial scale used 0.81 (US$) of domestic resources to produce output with value about US$1. This means that the farm can save 0.19 (US$) of foreign exchange in every output produced. At the same time, goat farm on commercial scale only used 0.65 (US$) of domestic resources to produce output with value about US$1 and saved 0.35 (US$) of foreign exchange.

According to Tsakok (1990), the level of comparative advantage of each subsector is greatest if DRC ratio is closer to zero. As a result, the goat farm on commercial scale has a more comparative advantage compared with beef farms in Malaysian livestock industry.

In this study, it is indicated that commercial goat production can bring greater profits than the profits obtained from commercial beef production. Nevertheless, in reality, the selling price of domestic goat production is prohibitively expensive. High input costs make goat prices (per kg LW) very expensive compared with beef prices (per kg LW).

As describe d earlier, the higher cost in ruminant production relates to the higher portion of foreign component of the inputs used in the ruminant production such as feed cost. Goat feed used 80% of foreign component while beef feed used 90% of foreign component. This makes it difficult for the Malaysian government to regulate the level of the livestock price, because due to increased imports of livestock, prices would reduce the level of comparative advantage in production of ruminant product.

This study recommends that Malaysian government needs to advise the livestock producers to find or produce alternative feed. The alternative feed must use 50% higher domestic component in order to reduce dependence on import feed. Furthermore, government needs to consider building the animal feed industry in the country. In order to facilitate this, the government must begin examining ways to produce animal feed effectively and efficiently,

and required preliminary research on Malaysia's comparative advantage in producing ruminant feed.

REFERENCES

Department of Statistics, Malaysia. (2008). *Livestock Product Statistics*. March, 5th 2009. Retrieved from http://agrolink.moa.my/jph/dvs/statistics/statidx.html

Department of Veterinary Services (DVS), Malaysia. (2005). *Banci Pertanian 2005*. April, 17th 2009. Retrieved from http://www.jphpk.gov.my/JPH_Banci_Pertanian.pdf

Federation of Livestock Farmer's Association of Malaysia (FLFAM). (2009). *Overview of Livestock Industry*. March, 10th 2009. Retrieved from http://www.flfam.org.my/

Joubert, J., & Schalkwyk, H.D. (2000). The Effect of Policy on the South African Valencia Industry. *Agrekon, 39*(1), 82-89.

Legese, G., Debebe, S., & Alemu, T. (2007). Assessing the uncomperative advantage of malt barley production in Ethiopia. Application of a Policy Analysis Matrix. *African Corp Science Conference Proceedings*, *8*, 1227-1230.

Mahlanza, Mendez, & Vink. (2003). Comparative Advantage of Organic Wheat Production in The Western Cape. *Agrekon*, *42*(2), 144-162.

Ministry of Finance, Malaysia. (2009). *Economic Report 2008/2009*. March, 10th 2010. Retrieved from http://www.treasury.gov.my/

Morrison, J., & Balcombe, K. (2002). PAM: Beyond Simple Sensitivity Analysis. *Journal of International Development*, 459-471.

Nelson, C. G., & Pangabean, M. (1991). The Costs of Indonesian Sugar Policy: A Policy Analysis Matrix Approach. *American Journal of Agricultural Economics*, *73*(3), 703-712.

Pearson, S., Gotsch, C., & Bahri, S. (2003). *Policy Analysis Matrix (PAM) Application in Indonesia Agriculture*. June 2003. Retrieved from http://www.macrofoodpolicy.com

Tan S. H., Zainal, A. M., Eddie, C. F. C., & Shamsudin, M.N. (1989). *Government Incentives and Comparatives Advantage in Livestock and Feedstuffs Sectors in Malaysia, Vol II, and Vol III*. ISIS, Kuala Lumpur.

Tsakok, I. (1990). *Agricultural Price Policy*. Cornell University Press. Ithaca, New York.

Veitch, M. D. (1986). *National Parameters for Project Appraisal in Malaysia*. The Government of Malaysia, Malaysia.

Yao, S. (1997). Comparative Advantage and Corp Diversification: A PAM for Thai Agriculture. *Journal of Agricultural Economics*, *48*(2), 211-222.