COMPARATIVE ADVANTAGE OF SELECTED RICE VARIETIES (SHWEBO PAWSAN AND AYEYARMIN) IN SHWEBO TOWNSHIP, SAGAING REGION

A thesis presented by

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to

The Postgraduate Committee of the Yezin Agricultural University as a requirement for the degree of Master of Agricultural Science (Agricultural Economics)

Yezin Agricultural University

October 2013

The thesis attached hereto, entitled **"Comparative Advantage of Selected Rice Varieties (Shwebo Pawsan and Ayeyarmin) in Shwebo Township, Sagaing Region"** was prepared and submitted by Cho Cho Win under the direction of the chairperson of the candidate supervisory committee and has been approved by all members of that committee and board of examiners as a partial fulfillment of the requirements for the degree of Master of Agricultural Science (Agricultural Economics).

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DECLARATION OF ORIGINALITY

This thesis represents the original work of the author, except where otherwise stated. It has not been submitted previously for a degree or any other University.

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ACKNOWLEDGEMENT

I would like to express my deep and sincere gratitude to Dr. Tin Htut, Rector, Dr. Myo Kywe (Pro-Rector, Academic) and Dr. Maung Maung Myint (Pro-Rector, Administration), Yezin Agricultural University, for their kind permission, administrative support to do my research work, and valuable suggestions to improve this dissertation. This study was partially funded by Mitsubishi Corporation. It is a pleasure to express my special gratitude to Mitsubishi.

I wish to express my deeply grateful to U Kyaw Win, Director General, Department of Agriculture, Nay Pyi Taw and I am thankful for his kind permission for my study leave.

I wish to express my serious gratitude to Dr. Cho Cho San, Professor, Department of Agricultural Economics, Yezin Agricultural University, for her invaluable advice and kind help to be able to complete my research work.

I sincerely thanks to external examiner, Dr. Khin Oo, Professor and Principal (Retd.), YAU, for her kind help, cooperation and valuable suggestions for this manuscript.

I would like to express my deepest appreciation and gratitude to my supervisor Dr. Hnin Yu Lwin, Assistant Lecturer, Department of Agricultural Economics, YAU, for her keen interest, guidance, invaluable advices, generous helps, motherly concern, encouragements, moral support, valuable supervisions and understanding to me throughout my study.

Sincere appreciation and gratitude go to supervisory committee members, Dr. Theingi Myint, Associate Professor, Department of Agricultural Economics, and Dr. Nyein Nyein Htwe, Lecturer, Department of Agronomy, YAU, for their guidance to my difficulty, encouragement, moral support, and kindness during the study, and their critical and patient reading, and comments on this manuscript.

My special thanks to Daw Win Win Thein, Lecturer, Department of English, University of Forestry, for her valuable correction in English writing for the thesis.

I would like to mention my sincere appreciation to U Than Kyaing, Director, Department of Agriculture for his generous helps, kindness, suggestions and his valuable support of necessary data and some reports. Moreover, Daw Jenny Lue, Deputy Director and Daw Than Than Htay, Assistance Director of the Department of Agriculture, for their kind assistances to obtain the necessary data for my study. I am really indebted to all my colleagues at the Department of Agriculture for taking care of my duties at Project

Planning Management and Evaluation Division during my study at Yezin Agricultural University.

My special thanks also extend to U Swe, Staff Officer, Department of Agriculture, Shwebo Township, for his kind help. My special thanks are also extended to Daw Zar Zar Min, Department of Agriculture, Shwebo Township and to the sample farmers in Shwebo Township for their patient answers to the long questionnaires. I am grateful to all of the staff from Department of Agriculture, Shwebo Township, for their help in obtaining the necessary primary and secondary data for this thesis. It is an enormous pleasure to say my thanks to the rice exporters, millers and wholesalers in Shwebo Township for answering my long survey questionnaires kindly and patiently.

My deep thanks should also go to U Myo Kyaw (Manager), Agro Asia Star Company and Daw Khin Su Su Han (Assistant General Manager), Nilar Yoma Trading Company for their invaluable support to the data gathering procedure.

I would like to extend my thanks particularly to my colleagues, namely Ma Khine Zar Wai, Ma Htet Htet Htun, Ko Myo Htwe, Ma Aye Aye Tun, Ma Thin Thin Oo and Ma Wah Wah Mon for their encouragement, kind understanding and patient assistance through my study life.

Last but not least, my deepest and greatest dedication is to my beloved parents, U Swe Win and Daw Aye Win, my beloved younger sister, Ma Cho Cho Latt and my beloved youngest brother Mg Ye Zaw Theik for their never-ending love, encouragement, understanding, moral support, a lot of help and especially generous financial support whenever I need.

Comparative Advantage of Selected Rice Varieties (Shwebo Pawsan and Ayeyarmin) in Shwebo Township, Sagaing Region

Dr. Hnin Yu Lwin Cho Cho Win

ABSTRACT

This study was conducted in Shwebo Township which is one of the most rice growing areas in Sagaing Region and export rice mostly to China. Shwebo Pawsan, quality rice variety which was introduced in 2007 and Ayeyarmin, high yielding variety were exported rice varieties.

The objectives of the study were to study the effects of government intervention policies on the private and social profitability of selected rice productions (Shwebo Pawsan and Ayeyarmin), to compare the comparative advantage of selected rice production and export marketing activities by using Domestic Resource Cost (DRC) analysis and to point out the effects of changes in the key variable factors such as different yield levels, world prices and exchange rates of selected rice varieties on DRC ratio. The survey was carried out during September 2012. The primary data were not only collected from 120 farmers in 3villages but also from 8 wholesalers, 5 millers, 5 retailers and 3 exporters interviewed in Shwebo Township. Analysis of DRC was used to catch up the objectives of the study.

Private Benefit- Cost ratio of Shwebo Pawsan was 1.18 and Social Benefit- Cost ratio was 1.83. For Ayeyarmin, Private Benefit- Cost ratio of was 1.35 and Social Benefit-Cost ratio was 0.99. DRC in Shwebo Pawsan was 0.39 and Ayeyarmin was 0.80. The value of Nominal Protection Coefficient (NPC) for Revenue of Shwebo Pawsan was 0.70 and Ayeyarmin was 1.52. The value of Nominal Protection Coefficient (NPCI) for tradable in Shwebo Pawsan and Ayeyarmin were greater than 1. The value of Effective Protection Coefficient (EPC) in Shwebo Pawsan was 0.62 and Ayeyarmin was 1.55. From the results of sensitivity analysis, higher comparative advantage was found at the high world price, high yield level, and high exchange rate for both rice productions.

Based on the research findings, Shwebo Pawsan should be enhanced to exploit the international market by reducing implicit tax because of its low DRC ratio and lowNPC. Although DRC ratio of Ayeyarmin was less than 1, its NPC value (>1) indicated the less potential of exportable crop at the current market price. In order to increase the economic efficiency of rice production, government should reduce the explicit and implicit tax or the market failure on tradable inputs. The concept of comparative advantage should be introduced in decision making process of crop cultivation.

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LIST OF ABBREVIATIONS AND CONVERSION FACTORS

Co. Ltd.	Company Limited
DoA	Department of Agriculture
FAO	Food and Agriculture Organization
MOAI	Ministy of Agriculture and Irrigation
MOC	Ministry of Commence
MIS	Market Information Service
1 Basket of paddy	20.86 Kilogram
1 Hectare	2.47 Acres
1 Metric ton	1000 Kilograms
1 Metric ton	2.5 Cardloads of farm yard manure

CHAPTER I

INTRODUCTION

1.1 Background Information of Agricultural Sector in Myanmar

Myanmar is an agro-based country and its economy mainly depends on the agriculture sector. It will keep essential for food production with the growing population as well as for the country to occupy a large part of the export earnings. The agriculture sector performs 32% of GDP and 15.4% of total export earnings. In Myanmar, 61.2% of population reside in rural area and are employed in agriculture, livestock, and fishery sector for their livelihoods (MOAI 2010).

Rice (*Oryza sativa* L.) is not only the main staple food but also marked as an important national crop in Myanmar. Rice has been the main source of income for millions of people, and it will maintain a mainstay of life for future generation. As Myanmar has the favorable conditions for growing rice, it is one of the most important crops for the export earnings. The 34% of total cultivated area were covered with rice and contributed 17.5% of the total agricultural product export's value (MOAI 2011).

Rice is becoming a nationally important crop for the social and political stability of Myanmar throughout history. The stabilization of essential rice prices at a low level conforms to the main objective, which is to avoid social unrest. This explains why rice policies in Myanmar have a strong inclination towards production increases for their own sakes while paying rather less attention to farmers' income and welfare (Hnin Yu Lwin 2010).

Myanmar people are living at very low-income level using the 79% of household expenditure only for food items. Besides, Myanmar farmers were taxed because of the ban on private-sector exports of paddy and rice. The international price of rice was higher than domestic prices; the government monopoly means that the price received by paddy farmers was about a third lower than if they could export freely.

The policy should be to focus on facilitating the open market trading through the creation of certainly regarding the governmental role (e. g. policy consistency) in rice marketing. The development of infrastructure by the state plays a significant role in the conducts of market participants which led to the lower marketing costs and margins to be more efficient marketing system (Theingi Myint et al. 2006).

1.2 Trading Policies and Export Trend of Myanmar Rice Sector

Rice plays an important role in Myanmar's economy as a staple food and high amount of foreign exchange earning comes through export. Myanmar used to be the world's largest exporter in the 1930s, and its annual exports of milled rice reached around 3 million tons. As of 1961, Myanmar and Thailand competed for the top position in export volume of rice in the international market, and annual exports amounted to 1.5 million tons. Since then, Myanmar exports declined, and annual exports have seldom surpassed 1 million tons. However, the annual exports have shifted to several hundred thousand tons in the past two decades.

Since 1988, the centrally planned economy in Myanmar has been transformed into a more liberalized, market-oriented economic system with the introduction of some economic reforms (Young et al. 1998). Two liberalizations of rice marketing had been done in 1987 and 2003. The first liberalization implemented by allowing free domestic marketing and private export of some agricultural products except rice. However, the marketing of rice, which is the main point for the agricultural reform, remained under the state control and rice export was government monopoly. Rice procurement and rationing systems were abolished under the second liberalization. Therefore, the rice marketing system works within the boundaries and limitations of a halfway-liberalized economy which triggers questions about the structure, conduct and performance of rice marketing system in Myanmar (Okamoto 2005).

Rice production and export amount in Myanmar after the second market liberalization is shown in Appendix 1. The export amount was 168 thousand metric ton and 0.74% of total rice production in 2003-2004. However, rice production increased about 31 thousand metric ton but rice export drastically declined 15 thousand metric ton and 0.05% of total export in 2006-2007. Then, the export quantity reached 818 thousand metric ton, 2.5% of rice production in 2009-2010. The amount of rice export decreased in 2010-2011 and 2011-2012 comparing with the export amount of rice in 2009-2010. Therefore, the production of rice was increased year by year but the amount of rice export was not increased by comparing with the rice production amount.

Appendix 2 shows rice production and export of Myanmar and neighboring countries in 2010-2011. Total world rice production was about 687 million metric tons and export amount was about 33.08 million metric tons. Total production of rice in Thailand was 31 million metric tons and export amount was about 9.20 million

metric tons. In Vietnam, total production of rice was 38 million metric tons and export amount was about 4.56 million metric tons. Myanmar produced about 33 million metric tons of rice but export amount was about 0.54 million metric ton. Rice production of Myanmar, Thailand and Vietnam were nearly the same in 2010 much lower than but rice export amount of Myanmar was much lower than those two countries.

The amount of total rice export and border rice export through Muse from 2007-2008 to 2012-2013 is shown in Appendix 3 according to MOAI 2012 and MOC 2012. In 2007-2008, when the total export amount was 359 thousand metric tons, the border export through Muse was 1.98 thousand metric tons, which was 0.55% of total rice export. In 2011 and 2012, the border export through Muse was sharply increased about 400.52 thousand metric tons, which was 28.61% of total export amount.

The trend of world rice price and domestic production cost in Myanmar from 2003 to 2010 was indicated in Appendix 4 (FAOSTAT 2013; MOAI 2012). The world rice price was 256 USD per metric ton (USD/MT) in 2003 and it was increased year by year until 2008. In 2008, the world price was 675 USD/MT which was the highest world rice price. But it was decreased 642 USD/MT in 2009 and 594 USD/MT in 2010. The domestic production cost was continuously increased in Myanmar. In 2003, the domestic production cost was 162,350 kyats per hectare (Ks/ha) whereas it was 538,060 Ks/ha was in 2010.

World rice price difference according to the quality of Thai rice varieties was shown in Appendix 5 (FAO Rice Market Monitor 2008 and 2013). The price of Thai rice which possesses fragrant and high quality was higher than the low quality of Thai rice. The price of high quality Thai rice was 449 USD/MT and the low quality Thai rice was 176 USD/MT in 2003. In 2010, the price of high quality Thai rice was 1202 USD/MT and the low quality Thai rice was 557 USD/MT in 2010. Therefore, the high quality Thai rice price was two times higher than the low quality Thai rice price in 2010.

1.3 Rice Varieties in Myanmar

In Myanmar, rice can be grown in various parts of the country. Regarding the rice production, Ayeyarwaddy Region, Bago Region and Mon State are major rice producing and surplus areas in the lower part of Myanmar. Magway, Mandalay Regions and Chin State are the rice deficit areas. Sagaing Region is also one of the

surplus areas in central Myanmar because its ecological environment is favorable for rice production and it mainly supplies not only to the domestic consumption but also to the international market especially to China.

Not only the indigenous rice varieties but also improved high yielding varieties are grown in Myanmar in order to fulfill the demand for domestic and international markets. Therefore, growing of quality rice is attractive to the farmers because of its high price, which compensates for losses of production cost due to its low yield (Khin Than Nwe and Tin Tin Myint 2004). Some farmers endeavor to grow the high quality rice to get a good price in Shwebo Township during a few past years under the market oriented economy.

Pawsan rice internationally known as "Myanmar Pearl Rice" is a fragrant rice with highest quality. It is famous for its excellent in eating quality, soft texture and very delightful fragrance. Pawsan was awarded World's Best Rice at the World Rice Conference 2011 held in Ho Chi Minh, Vietnam (http://www.guide for Myanmar.com/sagaing.html). On the other hand, high yielding rice varieties which grown popularly in Myanmar are Ayeyarmin, Shwethweyin, Manawthukha, and Sinthwelatt, etc.

1.3 Rice Production Situation in Shewbo Township, Sagaing Region

Sagaing Region covers 38 townships. Among them, Shwebo Township is located between Latitude 22˚ 39' - 22˚ 41' N and Longitude 95˚ 58'- 95˚ 59' E. The area of Shwebo Township is 106,760 hectares and the cultivated area is 78,639 hectares, 73.66% of total area. The majority of rice cultivation of Shwebo Township contributed about 45% of the total sown areas in 2010-2011 (DoA 2012).

Shwebo Township is one of the most rice growing areas in Sagaing Region and it exports rice to China. The rice varieties sown in Shwebo Township consist of Shwebo Pawsan, Ayeyarmin, Shwebo-1, Hmawbi-1, Manawthukha, Manawharee, Sinthwelatt, IR-747, Shwethweyin and many other rice varieties. Among these varieties, Shwebo Pawsan variety is famous for quality rice variety with high price. Then, Ayeyarmin is secondly renowned as high yielding variety with reasonable price.

Appendix 6 shows change of monsoon rice varieties cultivation in Shwebo Township. In 2007, Ayeyarmin variety was sown about 14,572 hectares and Shwebo Pawsan variety was initiated in that year. The sown area of Ayeyarmin variety was

decreased in 2008 (7,473 hectares) and then slightly increased in 2009 (10,749 hectares) and 2010 (10,202 hectares). On the other hand, the sown area of Shwebo Pawsan variety was 1,834 hectare in 2008 and then it was widely grown in 2009 and 2010. Sown area of Shwebo Pawsan variety was increased continuously which accounted for 15,462 hectares in 2009 and 17,065 hectares in 2010. Compared to the decreased growing area of Ayeyarmin rice variety cultivation, the sown area of Shwebo Pawsan was increased drastically since 2009.

In 2010-2011, total sown area of monsoon rice in Shwebo Township was 43,302 hectares. Among those areas, Shwebo Pawsan variety was the largest sown area 17,065 hectares which was 39% of monsoon rice cultivated areas. At the mean time, Ayeyarmin was the second largest sown area about 10,200 hectares (24%) and Manawthukha was the third sown areas accounted for 8,624 was hectares (20%) (Appendix 7).

1.4 Problem Statement

Myanmar agricultural marketing system was controlled by the government under the centrally planned economy lasting about a quarter of century. The market oriented policy was introduced in the beginning of 1988. Therefore, the domestic marketing was partially liberalized especially at border areas but the export was in the hand of the state. Liberalizations of rice marketing were implemented twice in 1987 and 2003 to accelerate a market oriented economy by favoring competitive market price for rice producers and consumers. The government abolished its monopoly of rice export in 2003 and allowed to private sector for rice export.

After the rice market liberalization, there was not prominent improvement in Myanmar's rice export by the private sector. While world rice price market was fluctuated but domestic rice production cost in Myanmar was increased year by year. Then, the price of high quality rice was higher than low quality rice in the world market. Therefore, there was a high price gap between high quality rice and low quality rice. When the current international rice trade is highly competitive, Myanmar's rice production depends on economic efficiency in terms of comparative advantage.

Myanmar was unable to meet demands for wide range of quality to expand the export due to the nature of the state marketing sector to place importance for quantity supplied rather than the quality. The volume of rice export is constrained by poor

grain quality, inadequate processing and marketing infrastructures, limited investment in irrigation and expansion of rice areas, and underdeveloped trading system, as well as marketing policies.

It is questionable that

- Is there any effect of current government intervention policies on the profitability of rice production and export?
- When domestic rice production cost is in increasing trend, is it possible to respond to low world rice price?
- Is there any room to be exploited in the world market by intensifying Myanmar's rice export?

Based on this concept, a study is needed to know whether Shwebo Pawsan and Ayeyarmin varieties occupy comparative advantage or not under existing production and marketing practices. After analyzing the comparative advantage of the exported rice varieties (Shwebo Pawsan and Ayeyarmin) in order to ascertain whether Myanmar is an efficient producer of these exported rice varieties is worth to study.

1.5 Objectives of the Study

The overall objective of the study is to ascertain whether Myanmar is an efficient producer of the selected rice varieties (Shwebo Pawsan and Ayeyarmin) in terms of comparative advantage.

The specific objectives of this study as follows:

(1) To study the effects of government intervention policies on the private and social profitability of Shwebo Pawsan and Ayeyarmin rice varieties;

(2) To compare the comparative advantage of selected rice varieties and export marketing activities by using Domestic Resource Cost (DRC) analysis; and

(3) To point out the effects of changes in the key variable factors such as different yield levels, world prices, and exchange rates of selected rice varieties on DRC ratio.

CHAPTER II

LITERATURE REVIEW

2.1 Theory of Comparative Advantage

Comparative advantage refers to economic efficiency of different kinds of production within the domestic economy, which are compared in terms of earning or saving a unit of foreign exchange. The costs of producing a commodity are compared to the costs incurred in an alternate domestic activity. The opportunity cost of foreign exchange is a good measure of the next best alternative activity since it indicates what the country as a whole would have to give up in terms of domestic currency to obtain an additional unit of foreign exchange (Tsakok 1990).

Comparative advantage indicates whether it is economically advantage for a country to expand production and trade of a specific commodity (Warr 1994). The principle of comparative advantage has central to trade theory, demonstrating the gains from trade. A country has a comparative advantage over another if a commodity was produced at a lower opportunity cost in terms of the foregone alternative commodities that could be produced (Todaro 1989).

Measures of comparative advantage are the most useful guides to optimal resource allocation in an open economy where international trade is vitally important. Economists have been applying the principle of specialization and comparative advantage to explain the theory of international trade for which the concepts of relative cost and price differences are basic. The doctrine of comparative advantage has been one of the most powerful influences upon economic policy making. Economic planning of a country always involves identification of the sources of comparative advantage with respect to world market. Because comparative advantage measures could indicate the economic efficiency of resource allocation in the production of traded commodities at the national level (Yang 1965).

The theory of comparative advantage was generally attributed to Ricardo (1817), who first extended the optimization principle defining efficient choice of output by firms into the arena of international trade. In the theory of comparative costs, David Ricardo suggested that countries will specialize and trade in goods and services in which they have comparative advantage. It is easy to see that if countries have an absolute advantage there are advantages to trade. If a country is able to produce more of a good or service with the same amount of resources or the same amount of a good or service with fewer resources, it has an absolute advantage over

its trading partners. Ricardo invoked factor endowments to explain why Portugal exported wine and Britain cloth. Subsequently, the principle of comparative advantage had come to be accepted as an almost universal law of economics.

While Ricardo placed emphasis on physical and natural influences over competitiveness, technological and human factors were given weight by later economists. A reading of the literature on comparative advantage reveals the continuity of the theoretical development from Ricardo (1817) via and Marshall (1919) to Heckscher (1965), Ohlin (1953) and Samuelson (1975). The modern treatment, a foundation for much empirical work, began with the Heckscher-Ohlin model. This model explained the international division of labor in terms of different endowments of different countries with two factors of production-labor and capital. The two fundamental hypotheses of the standard Heckscher-Ohlin model were that factors of production are immobile between countries and these factors are used in different combinations to produce different goods. A country will then possess a comparative advantage in good X if the country is relatively well endowed with factors that are used intensively in the production of X.

2.2 Review of Selected Empirical Studies of Policy Analysis Matrix (PAM)

The PAM framework involves the derivation of several important indicators of protection and comparative advantage. The first one defines profit as the difference between revenues and costs, measured in either private or social terms. The second identity measures the effects of distortions (distorting policies and/or market failures) as the difference between observed values and social values as indicated by the divergences raw in the PAM. These divergences are approximations because social values are evaluated at the initial distorted levels of outputs and inputs. Hence, the PAM provides guidance for incremental changes rather than wholesale ones.

The first row of PAM matrix provides a measure of private profitability, defined as the differences between observed revenues and costs valued at actual market prices. The measures reflect transfers and taxes. They show the competitiveness of the agricultural system, given current technologies, output values, input costs, and policy transfers. The second row of the matrix calculates social profitability measured at “social” prices that reflect social opportunity costs. Efficient outcomes are achieved when an economy aligns its private price signals to social prices. Social profits measure efficiency and provide a measure of comparative

advantage. At the margin, a positive social profit indicates that the system uses scarce resources efficiently and the commodity has a static comparative advantage. When social profits are negative, a sector cannot sustain its current output without assistance from the government, with a resulting waste. The cost of domestic production exceeds the cost of importing at the margin.

PAM is not useful for analyzing products that are not traded internationally since, by definition, there is no export price. In addition, it should not be applied to countries that make up a large share of world trade, since the world price would not be exogenous (and therefore not an efficiency price). However, for the majority of product-country combinations, these conditions are not relevant (Tsakok 1990).

The Policy Analysis Matrix (PAM) is a simple computational framework, developed by Monke and Pearson (1989) and augmented by Masters and Winter-Nelson (1995), for measuring input use efficiency in production, comparative advantage, and the degree of government interventions (Mohanty et al. 2002). PAM is suitable for agricultural price policy and efficiency. The economic analysis of profitability of the technology was analyzed using marginal analysis and Policy Analysis Matrix (PAM).

Masters and Winter-Nelson (1995) studied the Kenyan agricultural sector and demonstrated that DRC ratio method is biased against production that relies heavily on domestic resources. Their argument was based on the assumption that dependence on the domestic resources will be always cheaper. Dearorff (1984) identified that comparative advantage needs not to be based on low cheap domestic resources alone; it can also be achieved because market innovations and higher productivity of factors.

Yao (1997) analyzed the effects of government policies on diversification of products by using Policy Analysis Matrix (PAM). This study aimed to assess the costs and benefits of the Thai agricultural diversification policy in 1994–96. Three competitive crops (rice, soybeans and mungbeans) were selected in two provinces to study their comparative advantages in terms of a policy analysis matrix. The results suggested that rice was more profitable than soybeans and mungbeans, implying that government intervention might incur efficiency losses. Some sensitivity analyses, however, suggested that potential price changes, increasing water scarcity, and the effects of crop production on the environment were important concerns which might justify government intervention.

Talat (1999) investigated the production opportunities, marketing efficiency, and options of trade for fruits and vegetable in Palestine. This author discussed the comparative advantage of producing fruits and vegetables in the West Bank using DRC method described by Monke and Pearson (1989) through the policy analysis matrix (PAM) methodology.

Gonzales et al. (1984) measured that comparative advantage in the production of food crops in the Philippines by comparing the border price with the social or economic opportunity costs of production, processing, transportation, handling and marketing on incremental unit of the food industry. If the opportunity cost of were less than the border price, that country has a comparative advantage in the production of that commodity. They used three indicator of comparative; net social worth, the DRC ratio and the resource-cost ratio.

Mohanty et al. (2002) studied an application of Policy Analysis Matrix (PAM) approach to assess the efficiency of cotton production in five major producing states in India. The results indicated that cotton was not efficiently produced in the Maharashtra, second largest cotton producing state in the country. Without government interventions in this state, acreage moved away from cotton to more profitable crops such as sugarcane and groundnut, they had significant comparative advantages in that state over cotton. In addition, they concluded that cotton was not the most efficiently produced crop in the other four states, however, there was at least one crop in each state that was less efficiently produces than cotton. These findings suggested that Indian policies directed at maintaining the availability of cheap cotton for the handloom and textile sectors had induced major inefficiencies in the cotton sector.

Fang and Beghin (1999) assessed the comparative advantage and protection of China's major agricultural crops, early indica rice, late indica rice, japonica rice, south wheat, north wheat, south corn, north corn, sorghum, soybeans, rapeseed, cotton, tobacco, sugarcane, and a subset of fruits and vegetables using a modified Policy Analysis Matrix (PAM). The results strongly suggested that China had a comparative advantage in labor-intensive crops, and a disadvantage in land-intensive crops. Specifically, land-intensive oilseed crops (soybeans and rapeseed) and grains (wheat, corn, and sorghum) were less socially profitable than were labor-intensive fruits and vegetables, tobacco, cotton, and japonica rice. Within the grain sector, high quality

rice and high quality north wheat had more comparative advantages than early indica rice and south wheat, respectively.

Najafi (2005) studied the effect of government policies on wheat production in Iran with the application of Policy Analysis Matrix (PAM). He used the time series data from 1990 to 2001 period extracted from national survey. The result revealed that the Iranian government policies have had negative impact on wheat producer's income. This result caused decreasing the cultivated area and increasing import sharply toward the end of period under study. Finding of this study also indicated that wheat producers could earn higher profit in the absence of government intervention. The result of sensitivity analysis indicated that among income factors, changes in yield per hectare as well as foreign exchange value had greatest effect on comparative advantage of wheat.

Chung-Gil and Weiguang (2004) analyzed the comparative advantage of Japonica rice between China and Korea by comparing domestic production cost to estimate production and trade of future correctly. After comparing the cost and its structure, it was found that the production of Japonica in China had more comparative advantage obviously. Japonica production cost of Korea is about 5-6 times than that of China. They forecasted that the gap between two countries would become smaller in the long term, while the inferior advantage of Korea could not be changed during short-midterm. The authors suggested that some measure should be adopted to develop the competitiveness of japonica in Korea, such as adjusting agricultural structure, enlarging the land scale, and making quality differentiation.

Muringai et al. (2004) analyzed that the assessment of the Zimbabwe's competitive and comparative advantages in fertilizer production using competitive advantage ratios and domestic resource cost ratios. They resulted that local firms in Zimbabwe could compete internationally in compound and phosphate fertilizer production. Then, their results showed that Zimbabwe had comparatively higher productivity due to lower opportunity costs of domestic resources and the comparatively low value of domestic currency relative to those of trading partners. This showed that the exchange rate used had an impact on the DRC. It was also noted that the country's comparative advantage was influenced by the exchange rate used, with a weakening of the local currency having an increase in comparative advantage. These finding recommended that the Zimbabwe produced phosphate and compound

fertilizers because the business was profitable and the country had comparative advantage in their production.

Shahabuddin and Dorosh (2002) studied the measurement of economic efficiency to assess comparative advantage of different crops in Bangladesh agriculture. The result demonstrated that Bangladesh had a comparative advantage in domestic production of rice for import substitution, but economic profitability of rice was generally less than economic profitability of many non-rice crops. It was indicated that Bangladesh had more profitable options other than production for rice export. This indicated that except for a few import-competing crops such as sugarcane, oilseeds and chilies, Bangladesh had a comparative advantage in the production of most agricultural crops. These finding suggested that the menu of crops in Bangladesh could produce efficiently either for import substitution or for export was quite large.

Nakhumwa et al. (1999) studied the evaluation of the country's economic efficiency resources in producing some crops: tobacco, paprika, macadamia, tea, cotton, hybrid and local maize, groundnuts, phaseolous beans and soya beans. This study compared the net private and social profitability, and sources of disparity between the two were traced. This revealed output transfers as being a major influence in the net policy effect in the agricultural sector. Thus, the wider gap between net social and net private profitability was mainly a result of low commodity market prices. This study results indicated that private profitability for most of the cash crops were far below the social profitability, it could be concluded that the government was taxing away a portion of the social profits for the commercial farmers (both smallholder and estate).

Mahlanza et al. (2003) used a Policy Analysis Matrix (PAM) to determine whether wheat production would have a comparative advantage if produced under organic practices in Agrekon of South Africa. Their results showed that an improvement in the comparative advantage of wheat production under organic practices. There was also a sharp contrast between tillage practices used for conventional production, with minimum tillage contributing more to the comparative advantage of wheat production than conventional tillage practices. As a result of government policies, farmers were paying input prices that were higher than world prices. DRC indicator showed that a weaker comparative advantage under organically because the certification costs for organic farming were high. However, certification

costs were expected to diminish with expansion of the system. Organic farming lower yields were realized, particularly in the establishment phase, whereas with continuous production.

Leung and Cai (2005) studied the appraisal of two approaches commonly used in the economic literature for comparative advantage assessment. One was the "domestic resource costs" (DRC) approach and the other was the "revealed comparative advantage" (RCA) approach. They attempted to review the concept of comparative advantage and discussed two approaches of comparative advantage assessment in the context of aquaculture development in five Southeast Asian countries. DRC ratios could provide information about the true economic viability and resource utilization efficiency of aquaculture activities, which was useful for determining aquaculture development priority. It should be borne in mind that the comparative advantage reflected by low DRC ratios may be transitory and unsustainable in the long run.

Kaliba and Engle (2003) provided a case study using the Policy Analysis Matrix (PAM) to examine the impact of market failures on the private and social profitability of catfish farming in Chicot County, Arkansas. This study demonstrated that significant divergences between market and shadow prices could exist because of market failures and provided a good illustration of shadow price estimation.

Mucavele (2000) analyzed an agricultural policies need to be evaluated in order to identify possible instrument policies that might introduce inefficiencies into the production and agricultural trade in Mozambique. Protection policies aimed at providing poor consumers in large urban areas. Most often these protection measures were introduced with the intent to achieve food security; however, this security was not achieved. It was concluded that institutional arrangements such as legal systems, weights, grades, measures, and enforceable contracts should be established to improve agricultural marketing. In addition, liberalized markets required institutional arrangements to provide incentives for producers.

Jabra and Thomson (1980) studied the comparative advantage in the agricultural sector in Senegal under international prices uncertainty. They showed that the pattern of comparative advantage was less clear cut when the price and yield had uncertainties. They also indicated that comparative advantage was influenced by relative weight that planners attached to risk from different sources. Comparative advantage was a static concept but its measure was variable. It changed according to

changes in market signals and the adoption of new technologies among other things. This was evident not only a problem with a concept but also with the input data and method used to test the sensitivity of measure. However, it suggested the need for careful processing of input data and adoption of methods to ensure conceptually appropriate results.

2.3 Selected Empirical Studies of Comparative Advantage by Using Domestic Resource Cost (DRC) Analysis

DRC is an indicator of the efficiency with which a country's domestic resources, such as labor and capital, are converted into useful output. More precisely, it is the ratio of the true economic cost of these domestic resources to the value added created. This value added is measured in terms of world market prices, which are an indicator of the true economic value of internationally traded resources.

DRC analysis estimates the economic as well as the financial profitability of entire value chains, as well as individual segments within these chains. It also calculates the degree to which the chains are subject to positive or negative protection in relation to world market conditions. The analysis identifies ways in which tariffs, subsidies, and non-tariff barriers to trade affect the prices of outputs and inputs, as well as variations in benefits and costs associated with location of production, location of markets, scale of activity, and other factors.

When measured in terms of a common currency that reflects the true economic value of foreign exchange, the DRC is a measure of comparative advantage in a particular subsector. If the value of domestic resources used in production is less than the value added created, the DRC ratio is less than one, and the country has a comparative advantage in the sub-sector. If the value of domestic resources used in production is greater than the value added created, the DRC ratio is greater than one, and the country has a comparative disadvantage in the sub-sector (Stryker et al. 2009).

Stryker et al. (2009) studied Domestic resource cost (DRC) models of comparative costs and incentives have been used for analyzing the agricultural and industrial sectors of less developed countries, those economies have been highly distorted by overvalued exchange rates and restrictive trade policies. Most of these models have emphasized the calculation of domestic resource cost (DRC) as an indicator of comparative costs and of nominal and effective protection coefficients (NPC and EPC) as measures of incentives. Domestic resource cost (DRC) is an

indicator of the efficiency with which a country's factors of production (land, labor, and capital) are converted into useful output.

Javed et al. (2006) assessed the comparative advantage of cotton production in Pakistan and determined that how far the current set of policies is consistent with the comparative advantage. The Domestic Resource Cost (DRC), Nominal Protection Coefficient (NPC) and Effective Protection Coefficient (EPC) were used for the analysis of data for the harvesting years, 1998-99 to 2002-2003. The analysis was carried out in the context of Policy Analysis Matrix (PAM). The Domestic Resource Cost (DRC) analysis for Punjab concluded that farmers in Punjab had comparative advantage in producing seed cotton for the study period. The value of Nominal Protection Coefficient showed that the seed cotton farmers in Punjab were taxed. This was further confirmed by the values of Effective Protection Coefficient. The analysis showed that Sindh had more comparative advantage than Punjab.

Ismail et al. (2009) applied domestic resource cost (DRC) method to investigate comparative advantages of these two technologies for steel industry. This result concluded that the best economically method is Blast Furnace rather than Direct Reduction iron to produce crude steel in Iran.

Shahabuddin (2000) examined that comparative advantage of different crops using two indicators-net economic profitability and domestic resource cost ratio. The profitability estimates and estimated domestic cost ratio suggested that except for a few import-competing crops. There were a number of crops, e.g. vegetables, potato, cotton and onion whose financial and economic returns compare favorably with that of HYV rice. This analysis had important implications for scope and incentive for crop diversification in the country. The longer term comparative advantage, assessed in term of expected technological innovations and changes in future word market conditions suggests that although the profitability of HYV boro was likely to worsen in future substantial improvements in both financial and economic profitability could be expected for most other crops.

The domestic resource cost developed simultaneously in 1967 by Bruno is defined as the shadow value of non-tradable factor inputs used in an activity per unit of tradable value added. Bruno was seeking to measure the gain from expanding profitable projects, while Krueger wanted to measure the cost of maintaining unprofitable activities through trade protection. In both cases they needed a ratio counterpart to the concept of net social profit (Masters and Winter-Nerson 1995).

Scandizzo and Bruce (1980) viewed that the main determinants of the DRC ratio and benefit-cost (B/C) ratio were relative yields and relative border prices where land and labor requirements for different crops within specific areas did not vary substantially. In such cases, the analysis of comparative advantage or comp etitiveness could be simplified by comparing the border prices multiplied by the yields for each crop. However, benefit-cost ratio was as much as easy to calculate and it was not necessary to clear which were domestic resources and which were foreign resources.

Muhammad and Quddusand (2011) measured the comparative advantage and competitiveness of Pakistan's major crops (wheat, rice, sugarcane, cotton) by using economic profitability and the domestic resource cost (DRC) ratio. The PAM results showed that Punjab had a comparative advantage in the domestic production of wheat and sugarcane but not for export purposes. Punjab had comparative advantage in basmati and cotton production. The results suggested that Punjab should not produce wheat for export given the current conditions and policies. Policies conducive to cotton and basmati production in the province were also important. Sugarcane production for export was not an economic proposition. Increasing production for export was an economic proposition.

Ismail et al. (2008) studied the evaluation comparative advantage in the Malaysian food processing industry using the DRC measure. They examined the levels of benefit-cost ratios for various productions of food products to analyze the comparative advantages of food processing before and after the 1997 financial crisis. Processed foods with a high comparative advantage sustained after the crisis could be considered as viable to compete with foreign products in domestic and overseas markets. Meat products in import substitutions, palm oil, kernel oil, sago and tapioca, and cocoa in traditional exports and fish products in emerging exports were examples of food sub-sectors that were gaining competitiveness in the post crisis period.

Michel (1999) analyzed the comparative advantage and future prospects of the U.S. poultry industry in the international arena. The domestic resource cost (DRC) ratio was estimated for the five largest poultry exporters in the world. The DRC ratio provided a comparison of economic advantages or disadvantages in poultry trade. In addition, an analysis of the future of international poultry trade was conducted based on published forecasts. Published studies had shown that poultry production and consumption were expected to increase in most countries. The United States, having

one of the better DRC ratios, was predicted to retain its majority position in international poultry trade as export growth slows in the European Union and Thailand. However, domestic production in Hong Kong/China would pose a threat to U.S. exports along with the expected growth in the Brazilian poultry industry.

In Myanmar, DRC analysis and PAM were applied for estimating the effects of government interventions on sugarcane production, and for determining the comparative advantage of sugarcane production and export marketing in the selected state-owned sugar mills (No.2 and No.3) areas in Pyinmana Township (Dolly Kyaw 2000). The results showed that there was a comparative advantage for sugarcane production at present production practices and world reference prices of USD 262.5 and 315. Sugarcane production in Myanmar had a potential to increase the income of sugarcane producer as well as to contribute to foreign exchange earnings. However, expansion of sugarcane production especially in the state-owned sugar mill areas could not provide the full benefit to the state due to the output price distortion together with overvalued exchange rate which against the welfare of sugarcane producers in Myanmar. The sugarcane enterprise faced with the challenge for maintaining comparative advantage in producing sugarcane and it deserved continue government supports of not only tradable inputs but also domestic factors.

Aye Aye Mon (2002) studied the long-run comparative advantage of black gram (*Vignamungo*) and green gram (*Vigna radiate*) in four study areas, Pyinmana, Hinthada, Thonegwa, and Magway in Myanmar. The purpose of this study was to determine whether Myanmar was an efficient producer of these pulses in terms of internationally comparative advantage. The results indicated that the green gram and black gram in four study areas were financially and economically viable under current conditions. The results of PAM revealed the need for economic reform to liberalize the economy further and to remove distortions caused by direct and indirect effects of government intervention on agriculture incentives. This study also showed that the resources for green gram and black gram production were efficiently allocated to the national welfare.

Swe Mon Aung (2006) studied the economic potential and its comparative advantage of kenaf growing in Taungoo, Hinthada and Maubin Zones of Myanmar. DRC and PAM were used to measure the comparative advantage of kenaf with other alternative crops. According to the result of DRC and PAM, all selected crops had comparative advantages. Other alternatives had both private and social profits.

Producers were implicitly taxed on their output and tradable inputs used. However, they obtained subsidies on their domestic factor costs. Kenaf and jute production were not profitable to growers because of high labor cost, lack of improved variety, lack of high technologies for fiber extraction and low procurement prices as a result of market failure and policy distortion. But kenaf and jute were profitable at the social price. Other crops such as pulses, maize and paddy were profitable at both private and social prices. Kenaf, jute, all pulses, paddy and maize had comparative advantage to compare with other trading partners. It meant that the domestic resources for the production were efficient to national welfare.

Aye Moe San (2008) studied that comparative advantage of the currently exported rice varieties (Manawthukha and Pawsan) in Pathein and Phyapone Townships. Domestic Resource Cost (DRC) analysis to measure comparative advantages and Policy Analysis Matrix (PAM) were used to determine the effects of existing interventions on Manawthukha and Pawsan rice varieties. The overall results of this study showed that there were comparative advantages for Manawthukha and Pawsan rice production at present production practices and world prices in Pathein and Phyapone townships. This result indicated that domestic resources for Manawthukha and Pawsan production were efficient for the national welfare. Moreover, there were still financially and economically viable under existing technologies and government interventions on export of rice. Among these two rice production, Phyapone Pawsan production had the greatest comparative advantage for export marketing.

2.4 Proper Combination of Production Factors

An enterprise budget is a detailed accounting of revenues and expenses related to a profit center within a business. Enterprise budgets are important tools in determining profitability of individual ventures (Peabody 2007).

An enterprise budget is generally defined as a crop or type of livestock produced for profit. Enterprise budget are constructed from whole-farm records by allocating the income and expense items for the whole farm to individual enterprises. From an accounting perspective, this can be done at the end of the year or during the year as the transactions take place (Klonsky 1989).

An enterprise budget contains all of the income and expense which including direct and indirect expenses. Direct expenses are those that are directly associated

with the enterprise and relatively easy to estimate. Indirect expense must be allocated to all associated enterprises. The term “enterprise budget” is used to refer to both projections and summaries of costs and returns. Projection of annual costs and returns for an enterprise are called enterprise budgets, but they are also known as gross margin calculations, projected budgets. Summarizes of costs and returns for an historic period may also be called enterprise budgets, but they are often referred to as cost of production studies, income and expense budgets, enterprise statements, or enterprise accounts.

At the prevailing level of technological development and for each type of farming system, there is normally an optimum proportional combination of production factors. Too much land or capital and too little labor means low labor efficiency and earnings and thus a level of living below the conventional standard in the area.

The conventional combination of resources, which influence the production, is the result of many years of trial and adjustments. And it provides a guide to enable farm planners to start in the right direction. While taking into consideration of the differences in a farmer and his family, in the quality of land, and the available capital, farm planners must also consider the most recent technological changes and economic development. It is important to adapt the combination of production factors to the new conditions.

After condition of the above mention factors, there is still a need to obtain a proper proportion in the combination of production factors. This proper proportion is essential for the farmers’ welfare and efficiency of production. Farm planning must begin, therefore, with the proper alleviation of farm resources. If the farm area is too small, or the labor force too large, for the particular type and system of farming in the region, plans must be made either to expand the land area or to reduce the labor force on the farm , or else to do both (Yang 1965).

Kay (1986) stated that an enterprise budget is an important tool for farm planning. It is a summary of projected income and expenses for a small unit such as one acre for a crop of one head for a livestock enterprise. All costs, including both fixed and variable are part of an enterprise budget whose purpose is to estimate the profit from a single unit of the enterprise. An enterprise budget can be used to calculate the cost of production, break-even prices and yields and to make decision in either short-run or long-run farm plans.

Enterprise budgets project costs and returns for an activity such as raising livestock, producing grain, or growing vegetables for a production period. Each budget specifies a system of production, inputs required, and the annual sequence of operations, as well as summarizes the costs and returns associated with the process. Most budgets are based on one year. For enterprises where production spans more than one year (for example, pecans or cow-calf), a budget generally includes income and expenses for a representative one-year period. Reviewing the budgets for a specific geographic area may bring attention to certain cost items and price relationships that might be overlooked.

Interpretation of the enterprise budget requires an understanding of both economic and production concepts because it incorporates information about specific resources, management practices, and technology used in production. For instance, separate enterprise budgets are specified for different calving seasons and feeding systems in cow-calf operations.

Enterprise budgets are designed to provide a decision framework for short- and long-range economic analyses of production agriculture. Enterprise budgets assist in understanding the costs and returns of a production activity, identifying potential sources of risk, and evaluating alternatives. Knowledge of budgeting and the ability to use them helps producers make sound business decisions (Doye and Sahs 2009).

Enterprise budgets are important decision making tools. They can help individual producers determine the most profitable crops to grow, develop marketing strategies, obtain financing necessary to implement production plans, and make other farm business decisions. An enterprise budget is a physical and financial plan for raising and selling a particular crop or livestock commodity. It is a physical plan because it indicates the type and quantity of production inputs and the output, or yield, per unit. It is also a financial plan, because it assigns costs to all the inputs used in producing the commodity. Budgets are calculated in units of one acre to facilitate budgeting for different enterprise sizes and to simplify calculations (Carkner 2000).

CHAPTER III
METHODOLOGY

3.1 Data Sources and Data Collection

The survey was carried out during September 2012. Shwebo Township was purposively selected due to its large sown areas of Shwebo Pawsan and Ayeyarmin rice varieties in Sagaing Region. All sorts of technical and socio-economic data such as family size, farm size, area planted, crop yield, input-output prices, resources used, marketing costs of selected rice productions were collected by interviewing 120 farmers from 3 villages in Shwebo Township.

The import parity prices and export parity prices were estimated by using border price, market exchange rates and wage rates. These data were taken from published and official records of Ministry of Agriculture and Irrigation (MOAI), Department of Agriculture, Ministry of Commence (MOC), Agro Asia Star Co. Ltd. and Nilar Yoma Trading Co. Ltd.

To obtain the data regarding input prices, marketing costs, processing costs, transportation costs, farm gate and wholesale prices of products, (5) retailers, (5) millers, (8) local wholesalers, (3) exporters from Myanmar Rice Trader Association in Shwebo Township, Agro Asia Star Co. Ltd. and Nilar Yoma Trading Co. Ltd. were also interviewed.

3.2 General Description of Study Area

The percentage share of land utilization in Shwebo Township, 2010-2011 was shown in Figure 3.1. Shwebo Township occupied a land area of about 106 thousand hectares. The area of lowland farm was about 48 thousand hectares which was 45% of total land area. The area of dryland farm was about 30 thousand hectares which was 28% of total land area. The area of reserved and other forest was 3 thousand hectares (3%) and other lands occupied 25 thousand hectares (24%) in Shwebo Township.

Shwebo Township is one of the most rice cultivated areas in Sagaing Region. It is growing not only the improved high yielding varieties but also the high quality rice varieties in order to fulfill the demand for domestic and international markets. The varieties sown in Shwebo Township consist of Shwebo Pawsan, Ayeyarmin, Manawthukha, Shwebo-1, Hmawbi-1, Manawharee, 120-days, Sinthwelatt, IR-747, Shwethweyin and etc. A map of the study area is showed in Appendix 1.

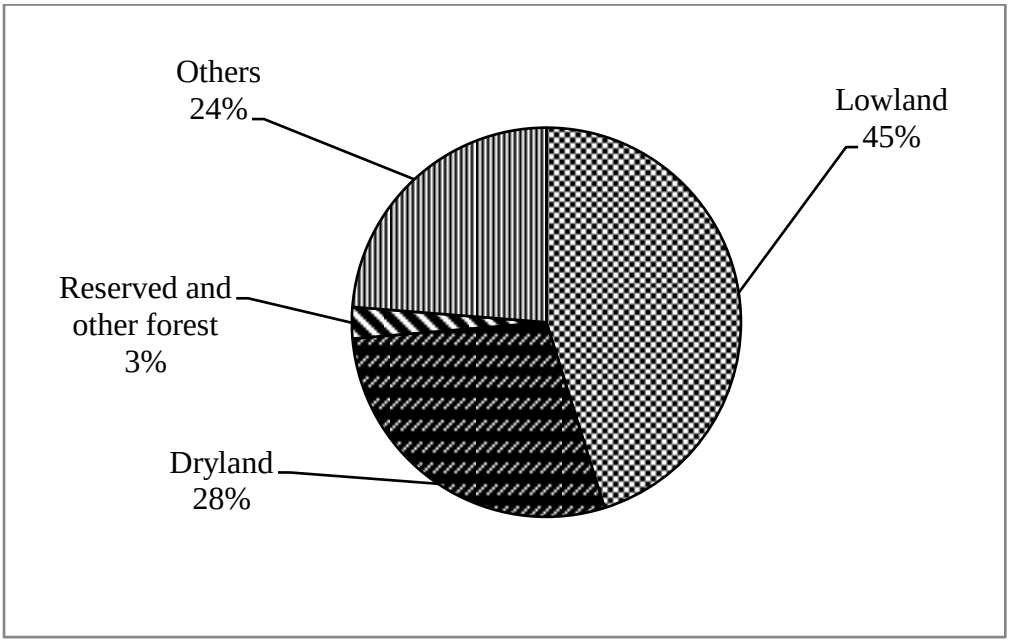

Figure 3.1 Percentage Share of Land Utilization in Shwebo Township (2010-2011)

Source: DoA 2011

3.3 Methods of Analysis

After collecting the primary and secondary data, Microsoft Excel program was used for the compilation and analysis of data. The Statistical Packages for Social Science (SPSS) software was employed for descriptive analysis of actual farm data. Mean of amount of resources used, production costs, and other required data were calculated.

In this study, comparative advantages in production of Shwebo Pawsan and Ayeyarmin rice varieties were measured by using Domestic Resource Cost (DRC) ratio derived from Policy Analysis Matrix (PAM) approach. DRC method was developed simultaneously by Bruno (1967) and Krueger (1969). Estimation of DRC can be a convenient method of generally assessing the comparative advantage of a single dominant crop by indicating the economic profitability of keeping resources in its production instead of allocating them elsewhere. There are many approaches for calculating DRC. Among them, the estimation of DRC that had been described by Monke and Pearson (1989) derived from Policy Analysis Matrix (PAM) was applied for this study.

The effects of government intervention on the private and social profitability of domestic producers were determined by using Policy Analysis Matrix (PAM) for exported Shwebo Pawsan and Ayeyarmin rice production in Shwebo Township. The effects of changes in different yield levels, border prices of crops and exchange rates on DRC ratios were examined by conducting sensitivity analyses.

3.4 Steps in Calculating DRC for Shwebo Pawsan and Ayeyarmin Rice Varieties in Study Area

There were six steps in calculating the DRC (Monke and Pearson 1989) and they are as follows:

Step 1: Developing enterprise budgets

Domestic Resource Cost (DRC) is the most important policy indicator to estimate the comparative advantage. DRC analysis in the selected township began with the development of an enterprise budget for each production alternative being compared. Budgets were used to compare economic profitability of different production activities or enterprises within or among farms, to indicate whether a proposed change will be profitable under a given set of circumstances, and to explore

conditions under which certain farm practices become profitable or unprofitable, in such a way to help for decision making.

Enterprise budgets were prepared to estimate costs, returns and profit per unit area of each of selected rice productions under study area. Benefit-Cost ratio was calculated by establishing the enterprise budget. One important use of the enterprise budget was to permit opportunity costing of primary factors of production (e.g.; land, labor, and capital). The input and output data and unit price (market prices) were required for calculating the enterprise budgets of Shwebo Pawsan and Ayeyarmin rice varieties were shown in Section 4.2.

Step 2: Classifying inputs and outputs

After enterprise budgets in market prices have been constructed and verified, all inputs and outputs were classified as primary factors (non-tradable) or tradable. Non-traded good is one whose domestic production cost is above its FOB price but below its CIF price (assuming no taxes or subsidies). Essentially, there are no incentives to buy (sell) the product from (to) another country. Traded good is one whose domestic production cost is either lower than its FOB price or greater than the CIF price. Basically this implies that there exist economic incentives to move the good from one country to another for profitable sale and gains in welfare (Gittinger 1982). This distinction was necessary because DRCs were calculated as the ratio of the total opportunity cost of primary factors and the value added to tradable.

In this study, non-traded goods that were internationally such as land, family and hired labors, manure, cattle, and transportation cost. Non-tradable goods were valued at their returns in alternative opportunities. Tradable goods were milled rice, fertilizers, insecticide, weedicide, rodenticide, furadum 3G and diesel were taken as traded factors and they were valued at their world price equivalent adjusted for tax, transport costs and current market exchange rates.

Step 3: Determining market prices and social prices

After the tradable and non-tradable inputs were classified, the market prices of inputs were transformed into economic or social prices in Section 4.3. Market price is a price at which a good or service is actually exchanged for another good or service as money. Social price is the true economic value of goods and services in the absence of

taxes, subsidies, import tariff, quotas, price controls, and other government policies. Accurate estimation of social prices is critically important in DRC analysis, because these prices represent the opportunity costs to the economy of inputs and outputs.

Market prices were used to calculate the private values by means of financial analysis. Social prices of non-tradable and tradable inputs were determined to conduct the economic analysis for the overall economy. All world market prices were converted into national currency to the domestic price level by using a shadow exchange rate factor (SERF). Standard conversion factors were used to measure the economic prices of traded and non-traded components at world market prices.

Standard conversion factors were used to measure the economic prices of traded and non-traded components at world market prices. Conversion factors enable the analyst to calculate the shadow price (economic price or social price or parity price) of a good or service by multiplying its market price (private price) by a simple coefficient.

$$\text{Conversion factor} = \frac{\text{Shadow price}}{\text{Market price}}$$

Conversion factors can be calculated for efficiency prices or social prices (Tallec 2005).

The standard conversion factors (SCF) were used to get the social values of outputs, tradable and domestic factors. Conversion factors for tradable inputs and outputs were calculated by dividing the economic farm gate price (parity price) to financial farm gate price (market price). After that, social prices of tradable outputs and inputs were obtained by multiplying the private prices with conversion factors.

Social prices were calculated by adjusting the private prices after eliminating the taxes, subsidies and other transfer charges. Social prices were determined differently for primary factors (non-tradable) and tradable inputs. Social prices of traded goods were calculated through border prices.

Tallec (2005) defined as the border price of a good or service is the price of this good at the point of entry (for imports) or exit (for exports) from the country. This is the FOB price for exports and the CIF price for imports, whether intermediate inputs or import substitute products.

For non-tradable inputs such as family and hired labor, manure, seed, capital costs and transportation costs, social prices were equal to their opportunity costs. The

opportunity costs of labor and cattle were estimated by calculating their weighted average values in selected township.

Changes in the conversion factor directly affect the shadow wage rate and thus reveal the effects of possible changes in the opportunity costs as well as future labor supply and demand conditions on the efficiency of each crop. They also indicate the degree to which any possible error in estimating shadow wage rates is likely to affect the results of the DRC analysis (Morris et al. 1993). The shadow exchange rate was varied through changes in the exchange rate adjustment factors in order to ascertain the extent to which either any possible error in estimating the shadow exchange rate or any probable devaluation in official exchange rate of domestic currency to correct for its overvaluation is likely to affect the results of the analysis (Shahabuddin 2002).

Comparative advantage in the production of a given crop for a particular country or region was measured by comparing with its border price and the social or economic opportunity costs of producing, processing, transportation, handling, port charges and marketing an incremental unit of the commodity (Fang and Beghin 1999).

Parity means equal or equivalent. Parity pricing is making the price of a particular commodity equal or equivalent to a reference price for the same commodity in another location. Import and export parity prices are used to assess the incentives to trade as well as the incentives to produce where local producers are in competition with producers and suppliers from outside the country or across the border (Mabiso 2008).

For the imported farm items, the border prices were obtained by computing the import parity prices, which were the world market prices in domestic currency obtained after adjusting the transport costs and other market distortions to the domestic markets. In this case, custom duties, port charges, handling costs, and transport costs from port to farm gate were added to the based import CIF prices to obtain the farm gate prices of imported items in domestic markets.

For the exported farm products, the export parity prices were computed by correcting the world market prices for marketing and transport costs from the farm gates to the international reference markets. In this case, port charges, processing costs and transportation costs from farm gates to port were subtracted from the FOB export prices to arrive at the social prices equivalent to the export parity prices.

Step 4: Calculations of policy effects

A Policy Analysis Matrix (PAM) was used to measure the impact of government policy on the private and social profitability of economic activity. PAM is suitable for testing agricultural price policy and efficiency. PAM results show the individual and collective effects of prices and factor policies. The PAM analysis also provides essential baseline information for benefit-cost analysis of agricultural investment projects. The data requirements for construction of PAM include yields, input requirements and the market prices for inputs and outputs. Additional data such as transportation costs, port charges, storage costs, production subsidies, import/export tariffs, and exchange rates are also required to calculate social prices.

Policy Analysis Matrix (PAM) was described in Table 3.1 and the interpretation of PAM on policy effects was found in Table 3.2. In Table 3.1, the data for private revenues (A) and costs (B, C) typically were taken directly from enterprise budgets. The entries for social revenues (E) and social tradable input costs (F) were not directly obtained from the enterprise budgets and other related documents. The entries for social valuation of domestic factor costs (G) could also not be observed directly in the field.

The concept of profit was used as a main point of PAM analysis. Cost and return structures were presented in the form of a matrix, which allowed for easy presentation and interpretation results.

Step 5: Calculations of efficiency coefficients

In Table 3.3, Domestic Resource Cost (DRC) ratio, nominal protection coefficient on outputs and inputs (NPC, NPCI), and effective protection coefficient (EPC) were computed from PAM. A country may have a number of efficient production opportunities but in order to maximize economic growth, should pursue those for which it exhibits the strongest comparative advantage i.e. highest net economic returns and/or lowest domestic resource costs (The World Bank, 1992). Then, comparative advantage expressed the efficiency of using resources to produce the products by using a given production technology when measured against the possibilities of international trade.

Table 3.1 Policy Analysis Matrix

Value (per ton of commodity)	Revenue	Tradable input	Domestic Factor Cost	Profit
Private prices	A	B	C	D
Social prices	E	F	G	H
Policy effect or divergences	I	J	K	L

Source: Monke and Pearson 1989

Private profit D = A-(B+C)

Social profit H = E-(F+G)

Output policy I = A-E

Input policy J = B-F

Factor cost K = C-G

Net policy divergence L = D-H = I-(J+K)

Domestic Resource Cost ratio (DRC) = G/(E-F)

Nominal Protection Coefficient for Revenue (NPC) = A/E

Nominal Protection Coefficient for Tradable Inputs (NPCI) = B/F

Effective Protection Coefficient (EPC) = (A-B)/(E-F)

Table 3.2 Interpretation of PAM on Policy Effect

Policy effect	Definition	Interpretation
Net policy divergence (L)	D-H	Positive = domestic consumer prices are greater than world market prices or the product is more profitable privately than socially and domestic production is subsidized Negative = domestic prices are less than export parity prices or the product is more profitable socially than privately
Output policy (I)	A-E	Positive = the producers are supposed to receive a subsidy Negative = domestic producers are taxed
Input policy (J)	B- F	Effect of policy distortion from the divergence between domestic and border price of tradable inputs Positive = the private costs of tradable inputs are greater than the social costs. This indicates that the government is probably taxing the price of inputs used by farmers Negative = the private costs of tradable inputs are lower than the social costs. This means that the government is actually subsidizing the costs of inputs.
Factor cost (K)	C- G	Difference between market and economic values of domestic factor costs Positive = the government taxed on domestic factors, which is rarely in developing countries. Negative = the private costs of a domestic factor will be less than the social costs and production is subsidized.

Source: Monke and Pearson 1989

DRC is the ratio of domestic factor cost required to produce a certain amount of output valued at social prices to the value added created by the same resources at social prices. It is an indication of the total cost of production when prices are adjusted for taxes, subsidies, and market imperfection and resources valued at their opportunity costs.

DRC is a measure of the cost (to society) of intervention, which has been increasingly used to measure the cost of government intervention. In countries where import substitution or export promotion is an important objective, it is useful to estimate the economic profitability of that particular activity. The efficiency of producing a commodity can be evaluated from the amount of resources that goes into its production and the cost of domestic currency required saving or earning a unit of foreign exchange for that particular activity. In DRC estimation, all outputs and inputs are valued at economic prices.

In other word, DRC shows the price that a country pays in terms of domestic resources in order to save one unit of foreign exchange by not importing the product (or by exporting the product). In calculating DRC, factors of productions and outputs are differentiated each into tradable and non-tradable.

The formula of DRC ratio is

$$DRC = \frac{\text{(Value of non- traded inputs, DRCs)}}{\text{(Output value) - (Value of traded inputs, FRCs)}}$$

(or)

$$DRC = G/(E-F)$$

Where, FRC = Foreign resource costs

Traded inputs = Fertilizers

Non-traded inputs = Labor and cattle

The protection rates were common indicators used to measure the effects of government policies on agricultural prices.

Nominal Protection Coefficient (NPC) is a simple indicator of policy effects. It is defined as the ratio of its domestic price to its border price of a product. The NPC measures the rate by which the domestic price of the final output received by the producer deviates from the world or border price of comparable product, where such a product is not subject to quantitative restriction.

Nominal Protection Coefficient on tradable inputs (NPCI) is defined as the ratio between the private values of all tradable input components to their social values. It shows the degree of tradable input transfer. The nominal protection rates reflects the impacts of commodity-specific price interventions such as domestic procurement and distribution system, import tariff, export taxes, and quantitative restrictions on domestic trade.

The Effective Protection Coefficient (EPC) can be defined as the ratio of distorted value added at market price to an undistorted value at border prices. The Effective Protection Coefficient (EPC) as an alternate indicator to NPC, captures not only the policy effects on input or output prices but also net impact of all policies on value added of agricultural production systems. It reveals the degree of protection accorded to the value added process in the production activity of the relevant commodity.

Effective Protection Coefficient (EPC) measures the difference between domestic and border prices converted at the market exchange rate. While NPC and NPCI measure the policy distortions in the product and tradable input markets individually, EPC measures the combined policy effects in both markets. This coefficient indicates the degree of policy transfer from output and tradable input distortions (Huang et al. 2002).

Step 6: Conducting sensitivity analysis

The DRC measured only static efficiency and filed to account for the dynamics of price and quantity changes in input-output relations (Haque 1991). Capturing the market dynamics a generic problem to most economic analysis is not specific to the DRC alone. Sensitivity analysis may be worthwhile to examine the degree to which the efficiency measures estimated under the set of baseline assumptions are likely to be affected by changes in the values of key parameters. In fact, sensitivity analysis is warranted for two main reasons.

First, the profitability analysis is based on certain simplifying assumptions regarding production technologies as reflected in the input-output coefficients, market conditions, prices (both financial and economic prices), government policies etc. Since the values used for these parameters obviously affect the analysis, it is important to know the extent to which the empirical results are sensitive to the simplifying assumptions that were made.

Second, the efficiency rankings produced by the DRC framework are static in the sense that they represent a snapshot taken at a fixed point of time, whereas actual efficiency rankings are dynamic in the sense that they can, and do, change in response to changes in resource endowments, production technology, market conditions and government policies. Therefore, it is important to ascertain whether the results are likely to be affected by probable future changes in any of these basic parameters (Morris et al. 1997).

Then, one convenient feature of the DRC framework is to make a sensitivity analysis. The analyses are conducted to determine whether the results would be substantially altered by changes in the underlying assumptions (Yao 1997).

Policy Analysis Matrix (PAM) is a static model and it might generate results which were not realistic in a dynamic sense and potentially biased against government policies. To overcome this limitation, sensitivity analyses on DRC were done by changing in world reference prices for outputs, different exchange rates and different yield levels.

Sensitivity analysis is important because technical coefficients used in constructing enterprise budgets (e.g.; yields, uses of inputs) were often mean values calculated from a range of observed values, and because prices used in calculating social profitability (including the shadow exchange rate) were often estimated prices or projected prices.

3.5 Interpretation of Policy Coefficients

Table 3.5 represented the interpretation of policy coefficients. The appropriate value of DRC is between 1 and 0. If DRC>1, the value of domestic resources used to produce the commodity exceeds its value added at social prices. In other words, the opportunity cost of domestic resources used to produce the commodity is greater than the amount of foreign exchange generated from these resources. Therefore, production of the commodity does not represent an efficient use of the country's domestic resources or the country does not have comparative advantage in producing the product.

In contrast, if DRC<1, the value of domestic resources uses to produce the commodity is lower than its value added at social prices. Therefore, the country has a comparative advantage in producing the commodity or it is desirable to produce and

expand the production of the commodity from the social point of view. If DRC=1, the country is neutral in terms of comparative advantage of the product.

A lower value of DRC of a product indicates a lower relative cost of domestic resources which again exhibits a higher comparative for a country and vice versa. DRC may be biases against activities that rely heavily on domestic non-traded factors, i.e. land and labor.

The NPC can assume a range of numerical values showing the overall policy distortion. If NPC>1, the market price of output exceeds the social price, implying that the domestic producers receive higher price. This is called positive protection for producers who receive the output subsidy. For consumers it denotes negative protection.

If NPC is less than 1, the negative protection occurs for producers. The consumer is being favored while the producer is being discriminated against. It implies that the producer implicitly pays a tax on the product. If NPC=1, the protection is neutral. There may be no policy intervention on producers and consumers; therefore they are facing market prices that are equal to the social prices of outputs.

If NPCI<1, the private prices of inputs are lower than their social prices showing that policies are reducing input costs. In other words, the producers are subsidized in their input use. If NPCI > 1, they are taxed by purchasing the tradable inputs. If NPCI=1, it indicates that there is either no policy distortion or neutral situation.

If EPC>1, domestic producers are receiving a greater return on their resources given interventions than without interventions. They are enjoying positive protection. A positive EPC, however, denotes a potential incentive, not an actual one. If EPC<1, it implies that the producers have a net disincentive or an equivalent tax from the policies in both product and tradable input markets as a whole. They are receiving negative protection. Again, a negative EPC denotes a potential disincentive, not an actual one. The EPC is indicator of relative incentives in production. A ranking of EPCs for different crops is indicative of the relative efficiency of these production activities.

Table 3.3 Interpretation of Policy Coefficients

Efficient/Policy Coefficient	Definition	Interpretation
Domestic Resource Cost (DRC)	DRC = G/E-F	0 < DRC< 1 = CA (efficiency) DRC> 1 = No CA (inefficiency) DRC< 0 = No CA (inefficiency)
Nominal Protection Coefficient on Output (NPC)	NPC = A/E	NPC>1 = domestic price higher than world market prices NPC<1 = disincentive to domestic producers
Nominal Protection Coefficient on Tradable Input (NPCI)	NPCI = B/F	NPCI>1 = domestic producers are taxed by purchasing inputs NPCI<1 = producers are subsidized in their input use
Effective Protection Coefficient (EPC)	EPC=(A-B)/(E-F)	EPC>1 = incentive to production EPC<1 = disincentive to production

Source: Monke and Pearson 1989

CHAPTER IV
RESULTS AND DISCUSSIONS

4.1 Resource Uses and Yield of Rice Varieties in the Selected Area

In order to understand the economic conditions of the sample farmers in relation to their performances of rice cultivations, the summarized basis statistics data such as average yield level achieved by the respondents, sown areas of rice, amounts and costs of seed, home consumption, chemical fertilizers (urea, compound fertilizer, FYM (Farm Yard Manure), insecticide, weedicide, rodenticide, furadum 3G, diesel, and costs of human and animal labor used for rice cultivations were shown in Table 4.1 and Table 4.2.

4.1.1 Resource uses and yield in Shwebo Pawsan rice production

Resource uses and yields of Shwebo Pawsan rice production for the sample farmers were summarized in Table 4.1. The average yield level of Shwebo Pawsan was 3.17 metric ton per hectare (MT/ha) ranging from 1.56 to 4.41 MT/ha. The average Shwebo Pawsan sown area of farmers was 2.51 hectares (ha) ranging from 0.40 to 16.59 ha. The average seed rate of Shwebo Pawsan variety was 103.78 kilograms per hectare (Kg/ha). Since the average seed price was 476.19 kyats per kilogram (Ks/kg), average seed cost was 49,419 kyats per hectare (Ks/ha) in Shwebo Township.

All sample farmers in Shwebo Township applied urea fertilizer in Shwebo Pawsan cultivation. The average amount of urea application was 149.91 Kg/ha and the average cost of urea was 65,105 Ks/ha in the study area. The sample farmers used the average amount of compound fertilizer was 156.80 Kg/ha and their average cost was 77,941 Ks/ha. All of the sample respondents in study area used FYM as a basal manure during seed bed and land preparation for Shwebo Pawsan rice cultivation. The average rate for FYM was 2.76 MT/ha and the average cost was 11,872 Ks/ha.

The average rate of insecticides was 2.58 liter per hectare (lit/ha) and the average cost was 13,870 Ks/ha. The average rate of weedicide was 1.14 Liter/ha and the average cost of weedicide was 8,095 Ks/ha. Rodent was the serious pest in rice production so the average rate of rodenticide (3.44 Kg/ha) was used by farmers and the average cost of rodenticide was 6,190 Ks/ha. The average rate of furadum 3G was 2.57 Kg/ha and the average cost of furadum 3G was 5,407 Ks/ha.

Most sample farmers in Shwebo Township used machinery for land preparation and threshing. Sample farmers used diesel with the average rate of 5.95 gallon per hectare (gal/ha) and their average cost was 20,660 Ks/ha. The average opportunity cost of family labors employed in Shwebo Pawsan cultivation was 210,319 Ks/ha and animal labors was 42,345 Ks/ha. The average cost of hired labors was 226,766 Ks/ha and the machine power cost was 42,345 Ks/ha in the study area.

Table 4. 1 Summary Statistics for Shwebo Pawsan Rice Production of the Sample Farmers in the Study Area

N = 60

Variables	Unit	Sample No.	Minimum	Maximum	Sample Mean
Yield	MT/ha	60	1.56	4.41	3.17
Sown area	ha	60	0.40	16.59	2.51
Seed rate	Kg/ha	60	103.78	103.78	103.78
Seed cost	Ks/ha	60	49,419	49,419	49,419
Uses of Chemical Inputs, FYM and Diesel					
Urea	Kg/ha	60	37.07	247.10	149.91
Compound	Kg/ha	56	123.55	370.65	156.80
FYM	MT/ha	55	1.24	4.94	2.76
Insecticide	Lit/ha	46	0.74	6.18	2.58
Weedicide	Lit/ha	36	0.49	2.97	1.14
Rodenticide	Kg/ha	51	2.47	5.88	3.44
Furadum 3G	Kg/ha	38	2.47	7.88	2.57
Diesel	gal/ha	59	3.71	7.41	5.95
Costs of Chemical Inputs, FYM and Diesel					
Urea	Ks/ha	60	16,309	118,608	65,105
Compound	Ks/ha	56	49,420	222,390	77,941
FYM	Ks/ha	55	4,942	24,710	11,872
Insecticide	Ks/ha	46	4,818	39,304	13,870
Weedicide	Ks/ha	36	3,459	21,349	8,095
Rodenticide	Ks/ha	51	3,707	19,768	6,190
Furadum 3G	Ks/ha	38	4,695	19,768	5,407
Diesel	Ks/ha	59	11,861	28,169	20,660
Costs of family labor from land preparation to threshing	Ks/ha	56	113,707	280,518	210,319
Costs of animal power from land preparation to threshing	Ks/ha	55	45,785	55,000	42,345
Costs of hired labor from land preparation to threshing	Ks/ha	60	71,906	363,237	226,766
Costs of machine power from land preparation to threshing	Ks/ha	57	5,188	16,413	42,345

Source: Field Survey 2012

4.1.2 Resource Uses and Yields in Ayeyarmin Rice Production

Resource uses and yield of Ayeyarmin rice production for the sample farmers were summarized in Table 4.2. The average yield level of Ayeyarmin rice production was 3.66 MT/ha ranging from 2.34 to 4.67 MT/ha. The average sown area of Ayeyarmin was 2.35 hectares (ha) ranging from 0.40 to 12.14 ha. The average seed rate of Ayeyarmin variety was 89.17 Kg/ha, the average seed price was 238.09 Ks/kg, the average seed cost was 21,231 Ks/ha in Shwebo Township.

All the sample farmers in Shwebo Township applied urea fertilizer in Ayeyarmin cultivation. The average amount of urea application was 146.20 Kg/ha and the average cost of urea was 65,763 Ks/ha in study area. The sample farmers used the average amount of compound fertilizer was 154.43 Kg/ha and their average cost was 58,660 Ks/ha. In the study area, all sample respondents used FYM as a basal manure during seed bed and land preparation for Ayeyarmin cultivation. The average rate of FYM used was 2.36 MT/ha and the average cost for FYM was 10,538 Ks/ha.

The average rate of insecticides was 0.42 Lit/ha and the average cost of insecticide was 2,303 Ks/ha. The average rate of weedicide was 0.83 Lit/ha and the average cost of weedicide was 5,938 Ks/ha. The average rate of rodenticide was 2.08 Kg/ha by farmers and the average cost of rodenticide was 3,747 Ks/ha. The average rate of furadum 3G was 1.60 Kg/ha and the average cost of furadum 3G was 3,352 Ks/ha.

Diesel was used by sample farmers with the average rate of 5.32 gal/ha and their average cost was 18,474 Ks/ha in land preparation and threshing. The average opportunity cost of family labor employed in Ayeyarmin cultivation was 33,160 Ks/ha and the animal power was 28,029 Ks/ha. The average cost of hired labor was 205,284 Ks/ha and animal labor was 47,147 Ks/ha in study area.

Table 4. 2 Summary Statistics for Ayeyarmin Rice Production of the Sample Farmers in the Study Area

N = 60

Variables	Unit	No.	Minimum	Maximum	Mean
Yield	MT/ha	60	2.34	4.67	3.66
Sown area	ha	60	0.40	12.14	2.35
Seed rate	Kg/ha	60	77.84	103.78	89.17
Seed cost	Ks/ha	60	18,533	24,710	21,231
Uses of Chemical Inputs, FYM and Diesel					
Urea	Kg/ha	60	61.78	247.10	146.20
Compound	Kg/ha	57	123.55	247.10	154.43
FYM	MT/ha	51	1.24	6.18	2.36
Insecticide	Lit/ha	23	0.25	1.5	0.42
Weedicide	Lit/ha	34	0.49	2.94	0.83
Rodenticide	Kg/ha	31	1.47	4.36	2.08
Furadum 3G	Kg/ha	42	1.20	2.70	1.60
Diesel	gal/ha	58	2.97	7.41	5.32
Costs of Chemical Inputs, FYM and Diesel					
Urea	Ks/ha	60	14,209	114,654	65,763
Compound	Ks/ha	57	11,120	177,912	58,660
FYM	Ks/ha	51	6,178	43,243	10,538
Insecticide	Ks/ha	23	1,930	5,830	2,303
Weedicide	Ks/ha	34	2,965	14,594	5,938
Rodenticide	Ks/ha	31	1,707	8,710	3,747
Furadum 3G	Ks/ha	42	2,718	8,154	3,352
Diesel	Ks/ha	58	10,378	29,652	18,474
Costs of family labor from land preparation to threshing	Ks/ha	57	2,730	195,703	33,160
Costs of animal power from land preparation to threshing	Ks/ha	59	7,942	52,117	28,029
Costs of family labor from land preparation to threshing	Ks/ha	60	27,181	395,360	205,284
Costs of machine labor from land preparation to threshing	Ks/ha	53	44,885	58,000	47,147

Source: Field Survey 2012

4.2 Developing Enterprise Budgets and Classifying Inputs and Outputs

The input, output data and private values were required for calculating the enterprise budgets of Shwebo Pawsan and Ayeyarmin rice varieties. In Table 4.3, the private value of gross return was 1,041,571 Ks/ha in Shwebo Pawsan and Ayeyarmin was 792,170 Ks/ha. Total variable costs of Shwebo Pawsan and Ayeyarmin were 883,502 Ks/ha and 585,754 Ks/ha respectively. Benefit-Cost ratio of Shwebo Pawsan was 1.18 and Ayeyarmin was 1.35 in private value.

The collected data of inputs and outputs in Shwebo Pawsan and Ayeyarmin rice productions were classified into tradable goods and non tradable goods (Table 4.4). Tradable goods were classified into tradable outputs and tradable inputs. Rice was tradable output and urea, compound, insecticide, weedicide, furadum 3G and diesel were tradable inputs. And then, non-traded goods were identified internationally such as land, family and hired labors, manure, cattle, and transportation cost.

Table 4. 3 Enterprise Budget for Shwebo Pawsan and Ayeyarmin Rice Production

N = 120

No.	Outputs and Inputs	Private value (Kyats/ha)	
		Shwebo Pawsan	**Ayeyarmin**
1	Average yield (kg/ha)	3,170	3,656
2	Average producer price (kyats/kg)	329	217
3	Gross return {(1)*(2)}	1,041,571	792,170
4	Reserved seed	49,420	200,958
	Non cash return	49,420	200,958
5	Crop sale {(3)-(4)}	992,151	591,211
	Cash return	992,151	591,211
6	Material Inputs (Purchased)		
	Seed	49,420	0
	Urea	65,105	65,763
	Compound fertilizer	77,941	58,660
	Insecticide	13,870	2,303
	Weedicide	8,095	5,938
	Rodenticide	6,190	3,746
	Furadum 3G	5,407	3,352
	Diesel	20,666	18,474
	Total material cash cost	246,693	158,237
7	Hired labor		
	Land preparation to threshing (labor)	226,766	205,284
	Land preparation and threshing (machine power)	42,345	47,141
	Total hired labor cost	269,111	252,426
8	Interest on cash cost	103,161	82,133
9	Total cash cost {(6)+(7)+(8)}	618,965	492,795
10	Material Inputs (Owned)		
	FYM	11,872	10,538
	Seed	0	21,231
	Total material non cash cost	11,872	31,769
11	Family labor cost		
	Land preparation to threshing (labor)	210,319	33,160
	Land preparation and threshing (animal power)	42,345	28,029
	Total family labor cost	252,664	31,769
12	Total non cash cost {(10)+(11)}	264,537	92,959
13	Total variable cost {(9)+(12)}	883,502	585,754
14	Return above variable cost {(3)-(13)}	158,070	206,416
15	Return above cash cost {(3)-(9)}	422,607	299,375
16	Benefit-Cost ratio {(3)/(13)}	1.18	1.35
17	Return per unit of cash cost {(3)/(9)}	1.68	1.61

Source: Field Survey 2012

Table 4. 4 Classification of Inputs and Outputs as Tradable or Non Tradable Goods in Shwebo Pawsan and Ayeyarmin Rice Production

No.	Outputs and Inputs	Tradable or Non tradable good
1	Rice	Tradable good
2	Urea	Tradable good
3	Compound fertilizer	Tradable good
4	Insecticide	Tradable good
5	Weedicide	Tradable good
6	Rodenticide	Tradable good
7	Furadum 3G	Tradable good
8	Diesel	Tradable good
9	Land preparation to threshing (labor)	Non tradable good
10	Land preparation and threshing (animal power)	Non tradable good
11	Land preparation and threshing (machine power)	Non tradable good
12	FYM	Non tradable good

Source: Field Survey 2012

4.3 Determining Market Prices and Social Prices

4.3.1 Weighted annual average cost of labor and animal power in Shwebo Pawsan and Ayeyarmin rice production in the study area

The social costs of labor and cattle using in Shwebo Pawsan and Ayeyarmin rice production were estimated, by using opportunity costs for domestic factors. The opportunity costs were used in the case of imperfect or missing market affecting non-traded items. For non-traded factors, social prices were equal to their opportunity cost value. Calculations of weighted annual average labor cost in Shwebo Pawsan and Ayeyarmin rice production were shown in Table 4.5 and Table 4.6.

The labor cost of peak period such as transplanting and harvesting time in Shwebo Pawsan rice production was 2,200 kyats per day (Ks/day) in the study area. Based on the survey in 2012, the proportion of labor used in transplanting and harvesting time was 67% of total labor use. Therefore, the weighted average shadow labor cost was 1,450 Ks/day in this time. Then, the labor cost in slack time such as land preparation, seeding, irrigation, sprayings insecticide and weedicide, FYM application, and fertilizer application was 1,300 Ks/day. The labor used in slack time was 33% of total labor use and its weighted average shadow labor cost was 429 Ks/day. The weighted average shadow labor cost from land preparation to harvesting was 1,879 Ks/day. The average labor cost from land preparation to harvesting was 1,750 Ks/day. The opportunity cost was obtained by dividing the average labor cost to weighted average shadow labor cost. Therefore, the opportunity cost of labor in Shwebo Pawsan rice production was 0.93 (Table 4.5).

As shown in Table 4.6, the labor cost in peak labor time was 2,200 Ks/day in Ayeyarmin rice production. The labor used in peak labor time was 65% of total labor use according to the survey data in 2012. Therefore, the weighted average of shadow labor cost was 1,430 Ks/day. The labor cost in slack time was 1,300 Ks/day. The labor used in slack time was 35% of total labor use and its weighted average shadow labor cost was 455 Ks/day. The weighted average shadow labor cost from land preparation to harvesting was 1,885 Ks/day. The average labor cost was 1,750 Ks/day and the opportunity cost of labor was 0.93 in Ayeyarmin rice production.

The cost of animal power in peak labor time and slack labor time were 3,000 Ks/day in each labor time for Shwebo Pawsan and Ayeyarmin rice productions. The cattle power used in peak labor time and slack labor time were 50% each. Therefore, the weighted average shadow costs in peak labor time and slack labor time were 1,500

Ks/day. The average cost of animal power was 3,000 Ks/day. The weighted average of shadow cost in animal power was also 3,000 Ks/day. The opportunity cost for animal power in Shwebo Pawsan and Ayeyarmin rice productions was 1.00 (Table 4.7).

The FYM was the non tradable input and all farmers used their owned FYM in Shwebo Pawsan and Ayeyarmin rice productions. Therefore, the opportunity cost of FYM in Shwebo Pawsan and Ayeyarmin was 1.00.

Table 4. 5 Calculation of Weighted Average Labor Cost in Shwebo Pawsan Rice Production (Financial Term)

N = 60

No.	Particular	Market labor cost (kyats/day)	% of labor used	Weighted average shadow labor cost (kyats/day)
1	Peak labor time (Transplanting and harvesting)	2,200	67	1,450
2	Slack labor time (Land preparation, seeding, irrigation, sprayings, etc)	1,300	33	429
3	Average labor cost	1,750		1879
4	Opportunity cost			0.93

Source: Field Survey 2012

Table 4. 6 Calculation of Weighted Average Labor Cost in Ayeyarmin Rice Production (Financial Term)

N = 60

No.	Particular	Market labor cost (kyats/day)	% of labor used	Weighted average shadow labor cost (kyats/day)
1	Peak labor time (Transplanting and harvesting)	2,200	65	1,430
2	Slack labor time (Land preparation, seeding, irrigation, sprayings, etc)	1,300	35	455
4	Average labor cost	1,750		1885
5	Opportunity cost			0.93

Source: Field Survey 2012

Table 4. 7 Calculation of Weighted Average Cattle Cost in Shwebo Pawsan and Ayeyarmin Rice Production (Financial Term)

N = 60

No.	Particular	Animal power cost (market) (kyats/day)	% of animal used	Weighted average shadow labor cost (kyats/day)
1	Peak labor time (Transplanting and harvesting)	3,000	50	1,500
2	Slack labor time (Land preparation, seeding, irrigation, sprayings, etc)	3,000	50	1,500
3	Average labor cost	3,000		3,000
4	Opportunity cost			1.00

Source: Field Survey 2012

4.3.2 Economic export parity prices of Shwebo Pawsan and Ayeyarmin rice varieties in the study area

Calculation of export parity prices at the farm gate were needed to estimate the economic values of traded commodities. These estimated prices at the farm gate level were obtained by adjusting all relevant charges from border prices at the point of border (Muse Township) to the farm gates.

The export parity prices of exported farm products were computed by correcting the world market prices for marketing and transport costs from the farm gates to the international reference markets. In this case, port charges, processing costs and transportation costs from farm gates to port were subtracted from the border prices to arrive at the social prices equivalent to the export parity prices.

The calculation of export parity prices for Shwebo Pawsan and Ayeyarmin rice varieties in Shwebo Township were shown in Appendix 9. At Muse, the average border export price of Shwebo Pawsan variety was 924 USD/MT and that of Ayeyarmin variety was 364 USD/MT. These border prices at Muse were obtained from the Ministry of Commence at the time of survey. These prices at Muse in foreign currencies were converted into domestic currencies by using current shadow exchange rate, 935 Ks/USD which was the average daily value at the exported time of rice in January, 2011.

At Muse, the export parity price of Shwebo Pawsan rice was 924 USD/MT which was 863,940 kyats per metric ton (Ks/MT) and that of Ayeyarmin rice was 364 USD/MT or 340,340 Ks/MT in domestic currency. The values of export taxes for exported rice were 17,280 Ks/MT for Shwebo Pawsan and 6,807 Ks/MT for Ayeyarmin. The transportation costs from wholesale market of Mandalay to border point were 50,000 Ks/MT for Shwebo Pawsan and Ayeyarmin. Then, the transportation costs from wholesale market of Shwebo to Mandalay were 10,000 Ks/MT and farm gate to wholesale market of Shwebo were 5,003 Ks/MT in both Shwebo Pawsan and Ayeyarmin rice production. The costs of packaging, handling and processing costs of Shwebo Pawsan and Ayeyarmin rice variety were 38,205 Ks/MT. Economic farm gate values of Shwebo Pawsan and Ayeyarmin rice were obtained from their respective border prices at Muse by subtracting of the export tax (2%), packaging, handling and processing costs and transportation costs from farm gates to Muse border point. Therefore, the economic farm gate values of Shwebo Pawsan and Ayeyarmin rice in domestic currencies were 743,452 Ks/MT and 230,325

Ks/MT. And then, their economic farm gate values in foreign exchange currencies were 795 USD/MT (Shwebo Pawsan) and 246 USD/MT (Ayeyarmin).

The financial farm gate values of rice were derived from field survey, 2012. Financial farm gate values of Shwebo Pawsan and Ayeyarmin rice were 520,000 Ks/MT and 350,000 Ks/MT. The conversion factors were calculated by dividing the economic farm gate value to the financial farm gate value of rice. The conversion factors for Shwebo Pawsan and Ayeyarmin rice varieties were 1.43 and 0.66 respectively.

Based on the financial farm-gate values of Shwebo Pawsan and Ayeyarmin, the proportion of cost and price difference (trade distortion) were mentioned in Appendix 10. The price difference between financial farm-gate value and economic farm-gate valued occupied large proportion accounted for 65% in Shwebo Pawsan rice production while transaction cost, transportation cost and export tax shared 11%, 15% and 5% respectively. On the other hand, Ayeyarmin rice production also had the high proportion price difference between financial farm-gate value (- 52%), while transaction cost, transportation cost and export tax were 11%, 15% and 5% respectively. In both rice productions, market did not reach a market clearing price which would achieve while operating under conditions of perfect competition. The enforcement of reducing trade distortion can create much more profit for Shwebo Pawsan rice production, in the mean time; it can also support reasonable price of Ayeyarmin rice varieties to the domestic consumers.

4.3.3 Economic import parity prices for urea, compound fertilizer, insecticide, weedicide, rodenticide, furadum 3G and diesel in the study area

The calculations of import parity prices for chemical inputs (urea fertilizer, compound fertilizer, insecticide, weedicide, rodenticide, furadum 3G and diesel) were calculated in Appendix 11 to 17. The calculation steps were based on the border import prices which were available from Department of Agriculture (DoA), the private fertilizer importing company (Agro Asia Star Co. Ltd.) and diesel importing company (Nilar Yoma Trading Co. Ltd.) in Yangon at the time of survey.

Handling costs, port charges, custom duties, transportation costs to the relevant local wholesale markets were added to the border import prices to obtain wholesale prices of urea fertilizer, compound fertilizer, insecticide, weedicide, rodenticide, furadum 3G and, diesel. The border prices of urea and compound

fertilizer were 220 USD/MT and 260 USD/MT. The import CIF prices of insecticide and weedicide were 1.8 and 1.5 USD per liter (USD/lit) respectively. Then, the import CIF prices of furadum 3G, rodenticide and diesel were 670 USD/MT, 800 USD/MT and 696 USD/MT respectively. These foreign currencies of chemical inputs were also converted into domestic currencies by using average shadow exchange rate. The average shadow exchange rate was 926 Ks/USD which was the average value from June to September, 2010 because farmers used chemical inputs during that period in monsoon rice cultivation.

After adjusting the relevant charges at the port, the wholesale prices in the inland markets of urea and compound fertilizers were 298,449 Ks/MT and 334,260 Ks/MT. The wholesale price of insecticide was 1,816 Ks/lit and weedicide was 1,539 Ks/lit. Moreover, the wholesale prices of rodenticide, furadum 3G and diesel were 862,721 Ks/MT, 742,385 Ks/MT and 713,575 Ks/MT, respectively. Economic farm gate prices of chemical inputs were calculated by adding local transportation costs from the wholesale markets to farm gate. If there were absence of import tariffs, subsidies and import ban, import parity prices were the maximum market prices which farmers have to pay for that tradable inputs.

The economic farm gate values of urea and compound fertilizers were 316,449 Ks/MT and 362,260 Ks/MT. The economic farm gate values of insecticide were 1,788 Ks/lit and weedicide was 1,511 Ks/lit. Moreover, economic farm gate values of rodenticide, furadum 3G and diesel were 834,721 Ks/MT, 714,385 Ks/MT and 831,700 Ks/MT, respectively.

The financial farm gate values (market prices) of urea and compound fertilizers were 434,330 Ks/MT and 497,091 Ks/MT. The financial farm gate values of insecticide were 5,374 Ks/lit and weedicide was 7,089 Ks/lit. Moreover, the financial farm gate values of rodenticide, furadum 3G and diesel were 1,654,286 Ks/MT, 1,938,095 Ks/MT and 903,788 Ks/MT, respectively.

Therefore, the conversion factors were urea fertilizer (0.73), compound fertilizer (0.73), insecticide (0.33), weedicide (0.21), rodenticide (0.50), furadum 3G (0.37), and diesel (0.92) of Shwebo Pawsan and Ayeyarmin rice productions in Shwebo Township.

Based on the financial farm-gate values of chemical input values and diesel, the proportion of cost and price difference (trade distortion) were mentioned in Appendix 18. The price difference between financial farm-gate value and economic

farm-gate valued in all chemical inputs especially in insecticide chemicals occupied high proportion ranged from 50% to 94%, while diesel was 28%. It means that rice farmers bought chemical inputs with 50% to 94% higher price than market clearing price of chemical inputs. It evidenced that the chemical input market was highly distorted. The enforcement of reducing trade distortion was an urgent need to reduce the cost of rice cultivation in the study area.

4.3.4 Private prices and social prices

Table 4.8 mentioned the average value of major inputs and outputs in terms of private (market) prices and social (economic) prices associated with Shwebo Pawsan rice production in the study area.

The private value of Shwebo Pawsan rice selling price was 329 Ks/kg. Its social price was obtained by multiplying the private price and conversion factor which was 470 Ks/kg. The private value of seed was 476 Ks/kg which was bought from the Department of Agriculture, Shwebo Township Office and social price was 681 Ks/kg. The privates of urea fertilizer and compound fertilizer were 21,715 kyats per 50kg (Ks/50kg) and 24,854 Ks/50kg and their social prices were 15,852 Ks/50kg and 18,143 Ks/50kg respectively. Then, the private and social values of FYM were 4,308 Ks/MT. The private values of insecticide and weedicide were 5,374 Ks/lit and 7,098 Ks/lit and their social prices were 1,773 Ks/lit and 1,489 Ks/lit. The private values of rodenticide and furadum 3G were 1,800 Ks/kg, 2,100 Ks/kg and their social values were 900 Ks/kg, 777 Ks/kg respectively. And then the private value of diesel was 3,473 Ks/gal and social value was 3,195 Ks/gal. The private values of hired labor cost and cattle were 1,750 Ks/day and 3,000 Ks/day for which social values were 1,628 Ks/day and 3,000 Ks/day respectively.

Table 4.9 showed the average value of major inputs and outputs in terms of private prices and social prices associated with Ayeyarmin rice production in the study area. Farmers who grown Ayeyarmin used their reserved seed from the previous year therefore the private values of Ayeyarmin rice selling price and seed price which was 217 Ks/kg were equal. Their social prices were obtained by multiplying the private price and conversion factor which was 143 Ks/kg. The private prices of urea fertilizer and compound fertilizer were 22,497 Ks/50kg and 18,992 Ks/50kg. Their social prices were 16,423 Ks/50kg and 13,864 Ks/50kg respectively. Then, the private and social value of FYM was 4,450 Ks/MT. The private values and social prices of

insecticide, weedicide, rodenticide, furadum 3G, diesel, hired labor and hired cattle applied in Ayeyarmin were also the same values with Shwebo Pawsan rice production.

Table 4. 8 Average Private and Social Values of Major Inputs and Outputs Associated with Shwebo Pawsan Production in the Study Area

N = 60

Value Items	Unit	Private (Market) Prices	Conversion Factor	Social (Economic) Prices
Rice selling price	Ks/kg	329	1.43	470
Seed (for growing) price	Ks/kg	476	1.43	681
Urea	Ks/50kg	21,715	0.73	15,852
Compound fertilizer	Ks/50kg	24,854	0.73	18,143
FYM	Ks/ton	4,308	1.00	4,308
Insecticide	Ks/lit	5,374	0.33	1,773
Weedicide	Ks/lit	7,089	0.21	1,489
Rodenticide	Ks/kg	1,800	0.50	900
Furadum 3G	Ks/kg	2,100	0.37	777
Diesel	Ks/gal	3,473	0.92	3,195
Hired labor	Ks/day	1,750	0.93	1,628
Hired cattle	Ks/day	3,000	1.00	3,000

Source: Field Survey 2012

Table 4. 9 Average Private and Social Values of Major Inputs and Outputs Associated with Ayeyarmin Rice Production in the Study Area

N = 60

Value Items	Unit	Private (Market) Prices	Conversion Factor	Social (Economic) Prices
Rice selling price	Ks/kg	217	0.66	143
Seed (for growing) price	Ks/kg	217	0.66	143
Urea	Ks/50kg	22,497	0.73	16,423
Compound fertilizer	Ks/50kg	18,992	0.73	13,864
FYM	Ks/ton	4,450	1.00	4,450
Insecticide	Ks/lit	5,374	0.33	1,773
Weedicide	Ks/lit	7,089	0.21	1,489
Rodenticide	Ks/kg	1,800	0.50	900
Furadum 3G	Ks/kg	2,100	0.37	777
Diesel	Ks/gal	3,473	0.92	3,195
Hired labor	Ks/day	1,750	0.93	1,628
Hired cattle	Ks/day	3,000	1.00	3,000

Source: Field Survey 2012

4.3.5 Cost and return analysis for Shwebo Pawsan and Ayeyarmin rice production

The enterprise budget for Shwebo Pawsan rice production was presented in Table 4.10. The average yield of private and social values in Shwebo Pawsan rice production were the same value, 3,170 kg/ha. The average producer price of private value was 329 Ks/kg. The social value of average producer price was 470 Ks/kg resulted by multiplying of private value in average producer price and its conversion factor 1.43. Total gross benefits in private and social values were 1,041,571 Ks/ha and 1,489,447 Ks/ha respectively. Crop sale was also known as cash return in Shwebo Pawsan cultivation. The private and social values of cash return and crop sale were equal and the cash return was 992,151 Ks/ha in private value and it was received by subtracting from gross return to non cash return. The social value of cash return was 1,418,777 Ks/ha and it was obtained by multiplying private value of crop sale and its conversion factor.

The private and social values of non cash return and reserved seed were the same and private value of the non-cash cost was 49,420 Ks/ha. The social value (70,671 Ks/ha) was obtained by multiplying of private value in non cash return and conversion factor. The total variable cost was obtained from the sum of total cash cost and total non cash cost. The total variable costs of Shwebo Pawsan in private and social values were 883,502 Ks/ha and 811,743 Ks/ha respectively. The total cash cost was received by the summation of total hired labor cost, total material cash cost and interest on cash cost. The total cash cost of private was 618,965 Ks/ha and social values was 561,929 Ks/ha. The total hired labor cost was obtained by the summation of labor and animal power in rice production. Total hired labor costs in private and social values were 269,111 Ks/ha and 253,237 Ks/ha.

The total material cost was calculated from the summation of values in seed, urea, compound, insecticide, weedicide, rodenticide, furadum 3G and diesel costs. Total material costs in private and social values were 246,693 kyats and 205,531 Ks/ha. Then, total non cash cost was obtained by adding the total family labor cost and total material non cash cost. The total non cash costs in private and social costs were 264,537 Ks/ha and 249,814 Ks/ha. The total family labor cost was resulted by the summation of labor and machine power from land preparation to threshing. Therefore, the total family labor cost of private value was 252,664 Ks/ha and social

value was 237,942 Ks/ha. The total material non cash costs which contain the value of FYM, therefore, these private and social value was the same value, 11,872 Ks/ha.

The return above variable cost was obtained from the subtraction of gross return and total variable costs in private and social values. The private value of return above variable cost was 158,070 Ks/ha and the social value was 677,704 Ks/ha. Moreover, return above cash cost was calculated by the subtraction of gross return and total cash costs in private and social values. The return above cash cost in private and social values were 422,607 Ks/ha and 927,518 Ks/ha. The benefit-cost ratio was obtained by dividing gross return and total variable cost in private and social values. Benefit-Cost ratio of private value was 1.18 and social value was 1.83. The return per unit of cash cost was resulted by dividing gross return and total cash cost in private and social values. The return per unit of cash cost in private value was 1.68 and social value was 2.65.

Table 4. 10 Cost and Return Analysis in Terms of Private and Social Values for Shwebo Pawsan Rice Production

N= 60

No.	Outputs and Inputs	Tradable/ Non-tradable	Private value (Kyats/ha)	Social value (Kyats/ha)	CF[a]
1	Average yield (kg/ha)	T	3,170	3,170	
2	Average producer price (kyats/kg)		329	470	1.43
3	Gross return {(1)*(2)}		1,041,571	1,489,447	
4	Reserved seed	T	49,420	70,671	1.43
	Non cash return		49,420	70,671	
5	Crop sale {(3)-(4)}	T	992,151	1,418,777	1.43
	Cash return		992,151	1,418,777	
6	Material Inputs (Purchased)				
	Seed	T	49,420	70,671	1.43
	Urea	T	65,105	47,526	0.73
	Compound	T	77,941	56,865	0.73
	Insecticide	T	13,870	4,615	0.33
	Weedicide	T	8,095	1,725	0.21
	Rodenticide	T	6,190	3,123	0.50
	Furadum 3G	T	5,407	1,993	0.37
	Diesel	T	20,666	19,013	0.92
	Total material cash cost		246,693	205,531	
7	Hired labor				
	Land preparation to threshing (labor)	NT	226,766	210,892	0.93
	Land preparation and threshing (machine power)	NT	42,345	42,345	1.00
	Total hired labor cost		269,111	253,237	
8	Interest on cash cost		103,161	103,161	
9	Total cash cost {(6)+(7)+(8)}		618,965	561,929	
10	Material Inputs (Owned)				
	FYM	NT	11,872	11,872	
	Total material non cash cost		11,872	11,872	
11	Family labor cost				
	Land preparation to threshing (labor)	NT	210,319	195,597	0.93
	Land preparation and threshing (animal power)	NT	42,345	42,345	1.00
	Total family labor cost		252,664	237,942	
12	Total non cash cost (10)+(11)}		264,537	249,814	
13	Total variable cost {(9)+(12)}		883,502	811,743	
14	Return above variable cost {(3)-(13)}		158,070	677,704	
15	Return above cash cost {(3)-(9)}		422,607	422,607	
16	Benefit-Cost ratio {(3)/(13)}		1.18	1.83	
17	Return per unit of cash cost {(3)/(9)}		1.68	2.65	

[a] = Conversion factor

Source: Field Survey 2012

The enterprise budget for Ayeyarmin rice production was presented in Table 4.11. The average yield of private and social values in Ayeyarmin rice production were the same value, 3,656 kg/ha. The average producer price of private value was 217 Ks/kg. Then, the social value of average producer price, 143 Ks/kg, was obtained by multiplying the private value in average producer price and conversion factor. The gross benefits in private and social values were 792,170 Ks/ha and 522,832 Ks/ha. The private and social values of cash return and crop sale were equal. The cash return was 591,211 Ks/ha in private value and received by subtracting from gross return from non cash return. The social value of cash return (390,200 Ks/ha) was obtained by multiplying private price and conversion factor. The non cash return and reserved seed were the same values in private and social. The non cash cost of private was 200,958 Ks/ha and social value was 132,633 Ks/ha was obtained by multiplying of private value in non cash cost and conversion factor.

The total variable cost was obtained from the summation of total cash cost and total non cash cost. The total variable costs of Ayeyarmin in private and social values were 585,754 Ks/ha and 523,784 Ks/ha. The total cash cost was received by the summation of total hired labor cost, total material cash cost and interest on cash cost. The total cash cost of private and social values were 492,795 Ks/ha and 433,147 Ks/ha. The total hired labor cost was the sum of labor and animal power from land preparation to threshing. Total hired labor costs in private and social values were 252,426 Ks/ha and 238,056 Ks/ha.

The total material cost was calculated from the summation of values in seed, urea, compound, insecticide, weedicide, rodenticide, furadum 3G and diesel costs. Total material costs in private and social values were 158,237 Ks/ha and 112,959 Ks/ha. Then, the total non cash cost was obtained by the addition of total family labor cost and total material non cash cost. The total non cash costs in private and social costs were 92,959 Ks/ha and 90,637 Ks/ha. The total family labor cost was resulted by the summation of labor and machine power from land preparation to threshing. The total material non cash cost was the sum of FYM and seed costs. The total material non cash cost was the sum of the values of FYM and seed. The private and social values of total material non cash cost were the same which were 31,769 Ks/ha in each value.

The return above variable cost was obtained from the subtraction of gross return and total variable costs in private and social values. The private value of return

above variable cost was 206,416 Ks/ha and the social value was -952 Ks/ha. Moreover, return above cash cost was calculated by the subtraction of gross return and total cash costs in private and social values. The return above cash cost in private and social values were 299,375 Ks/ha and 89,685 Ks/ha. Hence, the benefit-cost ratio was obtained by dividing gross return and total variable cost in private and social values. Benefit-Cost ratio of private value was 1.35 and social value was 0.99. The return per unit of cash cost was resulted by dividing gross return and total cash cost in private and social values. The return per unit of cash cost in private value was 1.61 and social value was 1.21.

Table 4. 11 Cost and Return Analysis in Terms of Private and Social Values for Ayeyarmin Rice Production

N = 60

No.	Outputs and Inputs	Trable/ Non-tradable	Private value (Kyats/ha)	Social value (Kyats/ha)	CF[a]
1	Average yield (kg/ha)	T	3,656	3,656	
2	Average producer price (kyats/kg)		217	143	0.66
3	Gross return {(1)*(2)}		792,170	522,832	
4	Home consumption	T	200,958	132,633	0.66
	Non cash return		200,958	132,633	
5	Crop sale {(3)-(4)}	T	591,211	390,200	0.66
	Cash return		591,211	390,200	
6	Material Inputs (Purchased)				
	Urea	T	65,763	48,007	0.73
	Compound	T	58,660	42,798	0.73
	Insecticide	T	2,303	766	0.33
	Weedicide	T	5,938	1,265	0.21
	Rodenticide	T	3,746	1,890	0.5
	Furadum 3G	T	3,352	1,236	0.37
	Diesel	T	18,474	16,996	0.92
	Total material cash cost		158,237	112,959	
7	Hired labor				
	Land preparation to threshing (labor)	NT	205,285	190,915	0.93
	Land preparation and threshing (machine power)	NT	47,141	47,141	1.00
	Total hired labor cost		252,426	238,056	
8	Interest on cash cost		82,133	82,133	
9	Total cash cost {(6)+(7)+(8)}		492,795	433,147	
10	Material Inputs (Owned)				
	Seed	NT	21,231	21,231	1.00
	FYM	NT	10,538	10,538	1.00
	Total material non cash cost		31,769	31,769	
11	Family labor cost				
	Land preparation to threshing (labor)	NT	33,160	30,839	0.93
	Land preparation and threshing (animal power)	NT	28,029	28,029	1.00
	Total family labor cost		61,190	58,868	
12	Total non cash cost (10)+(11)}		92 ,959	906,379	
13	Total variable cost {(9)+(12)}		585,754	523,784	
14	Return above variable cost{(3)-(13)}		206,416	-952	
15	Return above cash cost {(3)-(9)}		299,375	89,685	
16	Benefit-Cost ratio {(3)/(13)}		1.35	0.99	
17	Return per unit of cash cost {(3)/(9)}		1.61	1.21	

[a] = Conversion factor

Source: Field Survey 2012

4.4 Calculation of Policy Effects

Divergences appeared from market failures or distorting policies reveal constraints and possibilities for rice cultivations. A market failure occurred if a market fails to provide a competitive outcome and an efficient price. A distortion policy was a government intervention forcing a market price to diverge from its efficient values. It can occur due to trade restrictions, price regulation, taxes and subsidies.

Table 4.12 showed the comparison of the divergences between the private and social revenues, costs of tradable inputs and domestic factors, and profits of Shwebo Pawsan and Ayeyarmin rice production in the study area.

Divergences between private and social revenue (I) was negative value for Shwebo Pawsan variety. Divergences between private and social revenues (I) was positive value for Ayeyarmin variety. The divergence of Shwebo Pawsan variety was -447,875 Ks/ha and Ayeyarmin variety was 269,338 Ks/ha in Shwebo Township. A relative divergence in revenue of Shwebo Pawsan was -30% and that of Ayeyarmin was 52%. Divergences of revenue in Ayeyarmin variety was higher values than Shwebo Pawsan variety.

The negative value of relative divergence in revenue indicated that the producers obtained 30% decrease in revenue of private for Shwebo Pawsan variety because of implicit taxed by the government. In other words, the producers sold the output at lower prices than economic farm gate value of rice price (shadow price or export parity price of rice). Therefore, it can be interpreted that the farmers in study area was implicitly taxed on the production of Shwebo Pawsan variety.

The positive value of relative divergence in revenue indicated that the producers obtained 52% increase in revenue of private price because of lower world price than domestic price for Ayeyarmin variety in study area. In other words, the producers sold the output at higher prices than those prevailing in international markets. The positive divergence values in revenues indicated that the producers would be supposed to receive a subsidy or protected by the government.

There were the same interpretations of tradable input transfer (J) as those of tradable output transfer (I). Tradable input transfer (J) measured the extent of divergence between the private and social costs of tradable inputs as a whole. All of the divergences in costs of tradable inputs were positive values in the study area.

The divergence of tradable input costs for Shwebo Pawsan cultivation was 41,162 Ks/ha and Ayeyarmin cultivation was 45,278 Ks/ha. The positive divergences

in tradable inputs indicated that the private costs of tradable inputs were higher than the social costs and the government was probably taxing the prices of inputs used by farmers. The farmers were paying 20% private cost more than social costs for Shwebo Pawsan cultivation and 40% more than social costs were paid for Ayeyarmin production in the study area.

This was occurred because tradable inputs were available from under market distortion. Therefore, the prices paid by farmers for tradable inputs were high because the government did not subsidize any fertilizers to farmers. Moreover, the farmers were indirectly taxed by purchasing tradable inputs. The net effect of input policies was that the domestic prices of tradable inputs paid by farmers were greater than the social prices.

In this study, divergence on domestic factor costs (K) was influenced by the prices of domestic factors, especially wage. The divergences on costs of domestic factors were positive values for Shwebo Pawsan and Ayeyarmin production under the study area. In other words, the private costs of domestic factors were higher than the social costs.

The divergence of domestic factor costs for Shwebo Pawsan cultivation was 30,596 Ks/ha and that of Ayeyarmin cultivation was 16,548 Ks/ha. The private prices were greater than the social prices of human labor in the study area. It was because social values of human labors (Ks/day) were calculated from their weighted average marginal values and these were lower than the average private values. Economic values of animal labors were calculated as human labors.

Therefore, the positive divergences occurred in domestic factor costs due to higher prices paid to labor especially at the peak season. The percentage of relative divergences in domestic factor costs of Shwebo Pawsan was 6% and Ayeyarmin was 5%. Therefore, the percentage of relative divergences in domestic factor costs was slightly higher in Shwebo Pawsan than Ayeyarmin rice production. It pointed out that labor wage was 6% more than social prices for Shwebo Pawsan rice production and Ayeyarmin was 5% more than that of social price in the study area.

Divergences in private and social profits or net transfer (L) measured the total of net distortions in both input and output markets. In this study, the net transfer (L) was negative value for Shwebo Pawsan rice variety. Then, Ayeyarmin rice variety was positive value in the net transfer.

The negative value in divergences pointed out that the domestic price of Shwebo Pawsan was lower than export parity price or the production was more profitable socially than privately. The negative divergence between private and social profit implied that the net effect of interventions was to reduce the private profitability of rice production. Low level of private profit was resulted due to high private costs of inputs and low private revenues in rice production.

The positive value in divergences pointed out that the domestic price of Ayeyarmin was greater than export parity price or the production was more profitable privately than socially. The positive divergence values occurred between private and social profits indicated that the domestic consumer prices would be greater than world market prices and domestic production was subsidized.

The divergence of profit for Shwebo Pawsan cultivation was -519,634 Ks/ha and Ayeyarmin cultivation was 207,511 Ks/ha. The negative values of relative divergence for Shwebo Pawsan rice production were -67%. It is implied that the private profits received by sample farmers were much lower than their respective social profits. It means that farmers who grew Shwebo Pawsan variety would obtain the additional profits of 67% of social values without any taxes and subsidies. The positive value of relative divergence percentage for Ayeyarmin rice production was 256%. The private profits received by sample farmers were greater than their respective social profits.

Taxes and subsidies were commodity-specific policies. They directly affected the prices of products or inputs. Government might use indirect policies such as the manipulation of the exchange rate of the country's currency to affect commodity prices. The exchange rate was required to convert international prices in their domestic currency equivalents for PAM calculation. The effects of exchange rate manipulation depended upon whether the policy results in over or under valuation.

Table 4. 12 Calculation of Policy Analysis Matrix for Shwebo Pawsan and Ayeyarmin Rice Production

N = 120

Items	Shwebo Pawsan	Ayeyarmin
Private revenues (A)	1,041,571	792,169
Social revenues (E)	1,489,447	522,832
Output policy (I)	-447,875	269,338
Relative divergences (A-E)/E in %	-30	52
Private tradable cost (B)	246,693	158,237
Social tradable cost (F)	205,531	112,959
Input policy (J)	41,162	45,278
Relative divergences (B-F)/F in %	20	40
Private domestic factor cost (C)	533,647	345,385
Social domestic factor cost (G)	503,051	328,836
Factor cost (K)	30,596	16,548
Relative divergences (C-G)/G in %	6	5
Private profit (D)	261,231	288,549
Social profit (H)	780,865	81,037
Net policy (L)	-519,634	207,511
Relative divergences (D-H)/H in %	-67	256

Source: Own Estimation

4.5 Calculations of Efficiency Coefficients of Shwebo Pawsan and Ayeyarmin Rice Production and Policy Effects

The Policy Analysis Matrix (PAM) is a simple and effective conceptual framework for organizing information at the micro economic level to show the effects of policy on financial profitability and comparative advantage of agricultural systems. According to Monke and Pearson (1989), PAM was suitable for agricultural price policy analysis and for evaluating public investment policy and efficiency, and this analysis provided an insight into the adverse impacts of policies pursued.

Table 4.13 illustrated the summary results of Policy Analysis Matrix (PAM) indicators namely Domestic Resource Cost (DRC) ratios, Nominal Protection Coefficients for Revenues (NPC), Nominal Protection Coefficients for Tradable Inputs (NPCI) and Effective Protection Coefficients (EPC) for Shwebo Pawsan and Ayeyarmin rice production under the study area. All of these indicators were calculated, being based on the results of Table 4.10.

DRC ratios for Shwebo Pawsan and Ayeyarmin rice varieties were less than 1 in the study area. The DRC value of Shwebo Pawsan was 0.39 and that of Ayeyarmin was 0.80. Therefore, it could be seen that the study area had comparative advantages in these two kinds of rice production. The private and social benefit-cost ratios of Shwebo Pawsan rice production was greater than 1 therefore it was desirable to produce and expand the production of these varieties from the social point of view. The private benefit-cost ratio of Ayeyarmin rice production was greater than 1 but its social benefit- cost ratio was lower than 1. Therefore it was undesirable to produce and expand the production of these varieties from the social point of view.

According to the results, the comparative advantage of Shwebo Pawsan rice production was higher with respect to the world markets, current technologies and input prices because its lower DRC ratio was 0.39. This DRC value showed that 0.39 unit of domestic resources was utilized in order to earn 1 unit of foreign exchange by exporting Shwebo Pawsan variety. A lower value of DRC indicated a lower relative cost of domestic resources which again exhibited a higher comparative advantage for a country and vice versa.

Nominal Protection Coefficients for Revenues (NPC) were also calculated in this study. These coefficients from PAM were defined as the ratios between the revenues of the products in private prices to their counterpart in social prices. The NPC values on Shwebo Pawsan rice production were less than 1. Therefore, the

domestic prices were lower than the world market prices and negative protections occurred for farmers. The low NPC values implied that the producers implicitly paid taxes on the crop. The NPC values on Ayeyarmin rice production were greater than 1. Therefore, the domestic prices were greater than the world market prices.

NPC value for Shwebo Pawsan variety was 0.70 and Ayeyarmin variety was 1.52 in study area. The value of Nominal Protection Coefficient for Revenue of Shwebo Pawsan (0.70) indicated that the policies caused private price of output to be 30% lower than socially. The value of Nominal Protection Coefficient for Revenue of Ayeyarmin (1.52) implied that policies caused output private price to be 52% higher than socially.

These NPC values could be explained that the trade margin could contribute a large difference between farm gate prices received by farmers and export prices received by traders. The market information dissemination service in Myanmar was an inadequate condition and there was an information gap between primary producers and terminal markets. Hence, these divergences could be caused by market imperfection.

Nominal Protection Coefficients for Tradable Inputs (NPCI) were greater than 1 for both Shwebo Pawsan and Ayeyarmin varieties. The values for two rice varieties were 1.20 and 1.40 in Shwebo Township. NPCI was defined as the ratio between the private values of all tradable input components to their social values. Therefore, these large NPCI values indicated that the private values of tradable inputs were greater than the social values. In the study area, the extents and cost of chemical inputs used by farmers were high for rice production. The large values of NPCI demonstrated that the farmers were implicitly taxed on the prices of tradable inputs by purchasing. Therefore, inputs costs in both Shwebo Pawsan and Ayeyarmin are raised by the existing trade policy.

The last indicator from PAM, Effective Protection Coefficients (EPC), was calculated to measure the combined effects of policy transfers affecting both tradable product and tradable inputs markets. The values of EPC for Shwebo Pawsan and Ayeyarmin varieties were 0.62 and 1.55. The value of EPC was less than 1 for Shwebo Pawsan rice production. This can be interpreted that the farmers had taxes from both output and input policies and these policies were disincentive to farmers. The farmers were not protected through government interventions. The value of EPC for Ayeyarmin variety was greater than 1. This can be interpreted that the farmers had

subsidized by both output and input policies and these policies were incentive to farmers. The farmers were protected through government interventions.

Table 4. 13 Summary of Policy Analysis Matrix (PAM) Indicators in Study Area

Policy Analysis Matrix (PAM) Indicator	Shwebo Pawsan	Ayeyarmin
Domestic Resource Cost Ratio (DRC)	0.39	0.80
Nominal Protection Coefficient for Revenue (NPC)	0.70	1.52
Nominal Protection Coefficient for Tradable Inputs (NPCI)	1.20	1.40
Effective Protection Coefficient (EPC)	0.62	1.55

Source: Own Estimation

4.6 Sensitivity Analysis on DRC Ratios

Comparative advantage rankings tend to be highly sensitive to world reference prices of outputs, to the level of yields and to the shadow exchange rates. Sensitivity analyses on DRC ratios were done by different yield levels, world reference prices, and exchange rates of Shwebo Pawsan and Ayeyarmin rice varieties.

To conduct the sensitivity analyses, the required data were obtained from own survey data and other related records. The domestic resource costs, tradable input costs, labor and cattle costs and the prices of the products were assumed as a constant.

The current average yield level of Shwebo Pawsan variety was 3.16 MT/ha, 61 baskets per acre (bsk/ac) the current average border price was 924 USD/MT and the current average exchange rate was 935 Ks/USD. The DRC ratio of Shwebo Pawsan variety was 0.39.

For Shwebo Pawsan rice production in study area, the calculation was based on different average yield levels (3.10, 3.62, 4.13, 4.65, 5.16 MT/ha). The border prices (570, 680, 924, 1,000 and 1,100 USD/MT) which were based on export prices of Thai Fragrant 100% from 2007, 2008, 2010 and 2012 (FAO Rice Market Monitor 2008 and 2013) and the exchange rates (800, 900, 935, 1,000, 1,200 Ks/USD). Calculations of DRC ratios in Shwebo Pawsan rice cultivation based on the scenarios were described in Appendix 17 and Appendix 18.

If 5.16 MT/ha (100 bsk/ac), the highest yield level of Shwebo Pawsan variety, was obtained by sample farmers at the highest world price (1,100 USD/MT) and maximum exchange rate (1,200 Ks/USD), it is the highest comparative advantage was obtained because the DRC ratio of 0.13 was resulted.

If 3.62 MT/ha (70 bsk/ac) of the yield level in Shwebo Pawsan vatiety, at the lowest border price (570 USD/MT) and minimum exchange rate (800 Ks/USD), farmers could not obtain comparative advantage due to its DRC value 1. The result of DRC value (1) indicated that 1 unit of domestic resources was used in order to save 1 unit of foreign exchange by exporting Shwebo Pawsan variety. Based on the results of the scenarios, farmers could get various comparative advantage levels at the current border price and present exchange rate under the analyzed different yield levels of Shwebo Pawsan variety.

For Ayeyarmin rice production, the calculation was based on different average yield levels (3.10, 3.62, 4.13, 4.65, 5.16 MT/ha), border prices (364, 400, 450, 500 and 600 USD/MT) which were based on export price of Thai 25% broken rice from

2007 to 2011 (FAO Rice Market Monitor 2008 and 2013) and the exchange rates (800, 900, 935, 1,000, 1,200 Ks/USD). Calculations of DRC ratios for Ayeyarmin based on the scenarios were described in Appendix 19 and Appendix 20.

At the current average yield level of Ayeyarmin variety 3.66 MT/ha, the border price 364 USD/MT and exchange rate 935 Ks/USD, the DRC ratio of Ayeyarmin variety was 0.80.

If the farmers obtained the average yield of Ayeyarmin variety 5.16 MT/ha and sold at the highest border price (600 USD/MT) and maximum exchange rate (1,200 Ks/USD), the highest comparative advantage (DRC = 0.18) would be achieved. Therefore, it could be concluded that the appropriate strategy for the increased productivity would be the most efficient for comparative advantage of Ayeyarmin cultivation. If the farmers obtained the average yield level (3.62 MT/ha) irrational comparative advantage could be obtained at the lowest border price (364 USD/MT) and minimum exchange rate (800 Ks/USD). The DRC value at this point was 1.

According to the overall results of sensitivity analyses on DRC ratios, DRC ratios became smaller and smaller if yield and exchange rate increased. Therefore, it could be concluded that Shwebo Pawsan and Ayeyarmin rice production would obtain more favorable comparative advantages if border prices are higher than current prices at the increased exchange rate and different levels of yield. At the lower world price and lower exchange rate, costs of tradable inputs would play a vital role in rice production.

CHAPTER V
CONCLUSION AND POLICY IMPLICATION

5.1 Conclusion of the Study

The contribution of rice production to economic development in Myanmar depends to a considerable extent on their economic efficiency in terms of comparative advantage of domestic production and export marketing. This study analyzed the comparative advantages of the currently exported rice varieties (Shwebo Pawsan and Ayeyarmin). The overall objective was to ascertain whether Myanmar is an efficient producer of Shwebo Pawsan and Ayeyarmin rice varieties.

Domestic Resource Cost (DRC) analysis was used to measure comparative advantages and Policy Analysis Matrix (PAM) was also applied to determine the effects of existing interventions on production of Shwebo Pawsan and Ayeyarmin rice varieties. Moreover, the effects of changes in different yield levels, world prices of that commodity and different levels of exchange rates on DRC ratios were examined by conducting sensitivity analyses.

According to the Cost and Benefit analysis, the private benefit-cost ratio was 1.18 and social benefit cost ratio was 1.83 in Shwebo Pawsan production. In Ayeyarmin rice production, the private benefit-cost ratio was 1.35 and social benefit-cost ratio was 0.99 in the study area. Profit from Ayeyarmin rice cultivation in term of private value (1.35) was higher than that of profit from Shwebo Pawsan production (1.18). It can be assumed that Ayeyarmin rice production was more suitable for domestic market. Then, the profit from Shwebo Pawsan rice cultivation in term of social value (1.83) was higher than that of profit from Ayeyarmin (0.99). Therefore, Shwebo Pawsan rice production was more suitable for export. Otherwise, the enterprise budget results can be concluded that the activity of Shwebo Pawsan rice production was financially and economically feasible but Ayeyarmin rice production was financially feasible in the study area.

According to the Policy Impact analysis, for determining the effects of existing interventions on production for Shwebo Pawsan and Ayeyarmin rice production the comparative advantage of Shwebo Pawsan rice production was higher than that of Ayeyarmin rice production because of low DRC value of Shwebo Pawsan (DRC=0.39). High comparative advantage of Shwebo Pawsan was due to the higher output value resulted mainly from higher price of Shwebo Pawsan comparing with Ayeyarmin. High DRC value of Ayeyarmin rice production (DRC=0.80) indicated the

low potential of comparative advantage compared to Shwebo Pawsan rice production in the study area. High DRC value of Ayeyarmin rice production will be sensitive to decline world market price, exchange rate appreciation and decrease yield level. If DRC value of Ayeyarmin rice production reaches 1, it is not worth variety for the domestic production in order to save foreign exchange. To expand the Ayeyarmin rice production, output policy, input policy and net policy should be taken into consideration to maintain its comparative advantage.

Negative output policy divergences between private and social revenues in Shwebo Pawsan rice production indicated that farmers were implicitly taxed by the government. And then, they sold their outputs at lower prices than export parity price by the trade distortion. Positive output policy divergences between private and social revenues in Ayeyarmin rice production explained that farmers sold their outputs at higher prices than export parity price. If the government chooses to permit an unrestricted supply of rice imports, the private (market) price of Ayeyarmin may fall to the social price.

Positive input policy divergences indicated that the private costs of tradable inputs were higher than the social costs. Those private costs were affected by the port charges and custom duty. The effect of input policies was that the farmers had purchased tradable inputs at high prices and government did not subsidize any tradable inputs in the study area. Therefore, the government intervention and market distortion also affected in tradable inputs which were used by farmers.

Positive divergences in domestic factor costs were found in this study area of rice production because of distortions in prices of non tradable inputs due to 65-67% of high labor requirement in transplanting and harvesting time. It can be said that policy effects on domestic factors were relatively high because of high labor wage rate especially at peak labor time.

The negative divergence between private and social profits in Shwebo Pawsan rice production implied that the net effect of policy interventions was to reduce the private profitability of farmers in rice production. Low private profit level of Shwebo Pawsan rice production in study area was due to the intensive uses of tradable inputs, high uses of domestic factors, and low levels of rice yield.

The positive divergence between private and social profits in Ayeyarmin rice production implied that the net effect of policy interventions increased the private profitability of farmers in rice production. High private profit level of rice production

in study area was due to the high domestic price received by farmer and comparatively low uses of tradable inputs and domestic factors.

Nominal Protection Coefficients (NPC) for revenue (0.70) of Shwebo Pawsan rice production indicated that several constraints were being imposed on the production of rice such as implicitly taxed on the product of the producers. It also indicated that policies have caused the domestic rice price to be lower than the export parity price by approximately 30%. Therefore, farmer was explicitly and implicitly taxed by the government and affected by the market distortion.

Nominal Protection Coefficients (NPC) for revenue (>1) in Ayeyarmin rice production revealed that private price was greater than its parity price and hence producers are positively protected for their tradable product. The producers obtained 52% increase in revenue of private price. On the other hand, the country's trade-restrictive policy has permitted the private price of Ayeyarmin variety to be 52% higher than without the policy in the study area.

Nominal Protection Coefficients for Tradable Inputs (NPCI) were greater than 1 in both Shwebo Pawsan and Ayeyarmin rice production. The large values of NPCI indicated that the producers were probably taxed via the prices of tradable chemical inputs by input policy. In terms of interpretation on NPCI indicator, Shwebo Pawsan farmers are paying a premium for agricultural inputs 20% higher than the import parity price whereas Ayeyarmin farmers pay 40% higher than that of its import parity price.

The resulted Effective Protection Coefficient (EPC) values can be interpreted that the producers had taxes from the policies in both tradable output and tradable input markets as a whole. The value of EPC in Shwebo Pawsan (0.62) indicated that the government policies on input and output gave value added in private price 38% lesser than the value added without policy, hence the government policies was disfavoring for Shwebo Pawsan grown farmers. The value of EPC in Ayeyarmin (1.55) explained that the government policies on input and output gave value added in private price 55% greater than the value added without policy. The government policy environment was favoring for Ayeyarmin rice production.

To overcome the limitation of a static model, PAM, sensitivity analyses on DRC were done by using different world reference prices, different yield levels, and different exchange rates. At the current average yield of Shwebo Pawsan (3.16 MT/ha) and the current border price (924 USD/MT), and the current exchange rate

(935 Ks/USD), domestic resources cost in Shwebo Pawsan rice productions was 0.39. Therefore, it can be concluded that there was comparative advantage for production in study area under existing production system. According to the sensitivity analyses on DRC ratios of Shwebo Pawsan rice, DRC value was 0.13 at highest world price (1100 USD/MT), the highest yield level 5.16 MT/ha and the highest exchange rate 1200 Ks/USD.

At the current average yield of Ayeyarmin (3.66 MT/ha), the current border price (364 USD/MT) and the current exchange rate (935 Ks/USD), domestic resources cost in Ayeyarmin rice productions was 0.80. Therefore, it can be expressed that there was less comparative advantage for production under existing production system. Calculation of sensitivity analyses revealed that DRC ratio was 0.18 by using the highest yield level of Ayeyarmin, 5.16 MT/ha with the highest world price (600 USD/MT) and highest exchange rate (1200 Ks/USD). The most comparative advantage was found at the highest world price, the highest yield level and the highest exchange rate. Therefore, at the lower world price and lower exchange rate, cost of tradable inputs played a vital role in rice production.

The overall results of the study showed that there were comparative advantages for Shwebo Pawsan and Ayeyarmin rice production at present production practices and world prices in Shwebo Township. Moreover, Shwebo Pawsan was still financially and economically viable and Ayeyarmin was only financial viable under existing technologies and government interventions on export of rice. Financial returns to domestic producers were also attractive even though there were distortions in market prices and other constraints. Therefore, it has a potential in Myanmar to increase the income of producers as well as to contribute to foreign exchange earnings for the country.

5.2 Policy Implications

The main objective of this study was conducted to find out comparative advantages and the effects of interventions on Shwebo Pawsan and Ayeyarmin rice productions by using DRC ratio derived from PAM approach. By summation up the findings and their interpretations of all calculated efficiency coefficients, private and social profitability of economic activities and the impact of government policy intervention in the selected rice productions are worthy discussions for policy implications in this study.

By comparing economic profitability of different rice production activities with Benefit and Cost ratio and DRC indicator it is concluded that Shwebo Pawsan is more suitable for export and Ayeyarmin is desirable to produce for domestic market. According to Policy Analysis Matrix analyses, however, the positive divergences of domestic factor costs in both rice productions indicated higher labor requirement and high cost of labor at the peak seasons. To overcome this production problem, therefore farm mechanization technologies should be introduced by providing farm machines such as transplanter, combined harvester and power thresher to reduce labor intensive activities.

To obtain higher comparative advantages in productions of Shwebo Pawsan and Ayeyarmin rice varieties in the long-term, productivities of these two rice varieties should be enhanced by applying improved production technologies through technical changes and increased technical efficiency. As the DRC ratios will become smaller and the more comparative advantage can be obtained if yield increased. If an area expansion of land is available for rice production, high yielding varieties such as Ayeyarmin variety should be cultivated for food sufficiency of increasing population.

Government should be created to develop the export demand by the advertising of Myanmar's rice in international market. Then, it is necessary to develop the infrastructure by the state which plays a significant role in the conducts of market participants which led to the lower marketing costs and margins to be more efficient in rice marketing system. Although domestic factors of Shwebo Pawsan and Ayeyarmin rice productions was positive indicated that high labor requirement in transplanting and harvesting time. Therefore, government should provide farm machines such as transplanter and combined harvester to the farmer. Then other infrastructure such as farm to market road, milling plants and storage facilities should be developed to reduce the transportation costs and to increase the profitability.

Financial infrastructure is also essential for supporting urgent requirement of investment especially during the peak crop season with high labor cost. Not only state credit system but also other private organizations should be allowed to participate for supporting finance. By procuring credit loan, farmers can decide their products when favorable high price is reached. Farmers do not sell their products at unfavorable lower price for urgent repayment of debts from purchasing inputs. In this way, farmers will avoid the effects of trade distortion manipulated by market participants such as inputs and outputs dealers.

Positive divergence of tradable inputs and the large values of Nominal Protection Coefficient of Tradable Inputs demonstrated that the extents and cost of chemical inputs were high for both existing trade policy. Therefore, the government should support the smooth flow of imported agricultural inputs and it can cause the reduction of inputs costs for the Shwebo Pawsan and Ayeyarmin rice grown farmers.

Analyses on divergences of net policy (transfer) and Effective Protection Coefficient also indicated low level of private profit in Shwebo Pawsan resulted from unfavorable input policies and these policies are disincentive to farmers. Therefore, for the economic with farmers' livelihoods government policy intervention is essential to solve the constraints and problems found in the current rice production. The policy should be to focus on facilitating the open market trading through the creation of certainty regarding the governmental role (e.g. policy consistency) in the rice marketing. In order to reduce the trade distortion, the government should pay attention to build up the more transparent rice price information system in marketing channel. The State authorities would not hamper the marketing functions of private rice traders to avoid the unnecessary marketing costs along the marketing channel.

The concept of comparative advantage should be introduced in decision making process of crop cultivation. The government should persuade and educate farmers to grow the more comparative advantage crops if they cannot make their own decision to grow profitability. Further studies should be done beyond DRC analysis to achieve the long-term comparative advantages in other rice varieties of productions for Myanmar.

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APPENDICES

Appendix 1 Production and Export of Rice in Myanmar after Market Liberalization (2003)

Year	Production ('000 MT)	Export ('000 MT)	Export (% of production)
2003-2004	22,770	168	0.74
2004-2005	24,330	182	0.75
2005-2006	28,370	180	0.63
2006-2007	30,980	14.5	0.05
2007-2008	31,450	359	1.14
2008-2009	32,573	666	2.04
2009-2010	32,681	818	2.50
2010-2011	32,576	536	1.65
2011-2012	29,010	707	2.44

Source: MOAI 2012

Appendix 2 Rice Production and Export of Myanmar and Neighboring Countries (2010-2011)

Country	Sown area (million ha)	Yield (MT/ha)	Total production (million MT)	Export ('000MT)
World	159	4.31	687	33,081
Asia	142	4.32	614	24,943
Thailand	11	2.97	31	9,196
India	44	3.37	147	6,450
Vietnam	7	5.23	38	4,558
China	30	6.56	194	1,325
Myanmar	8	4.07	33	536
Bangladesh	12	4.00	47	19
Cambodia	2	2.75	7	2.6
Indonesia	12	4.90	60	1.2
Philippine	4	3.76	17	0.4
Malaysia	1	3.59	3	0.2
Laos	1	3.55	3	0.0

Source: MOAI 2011

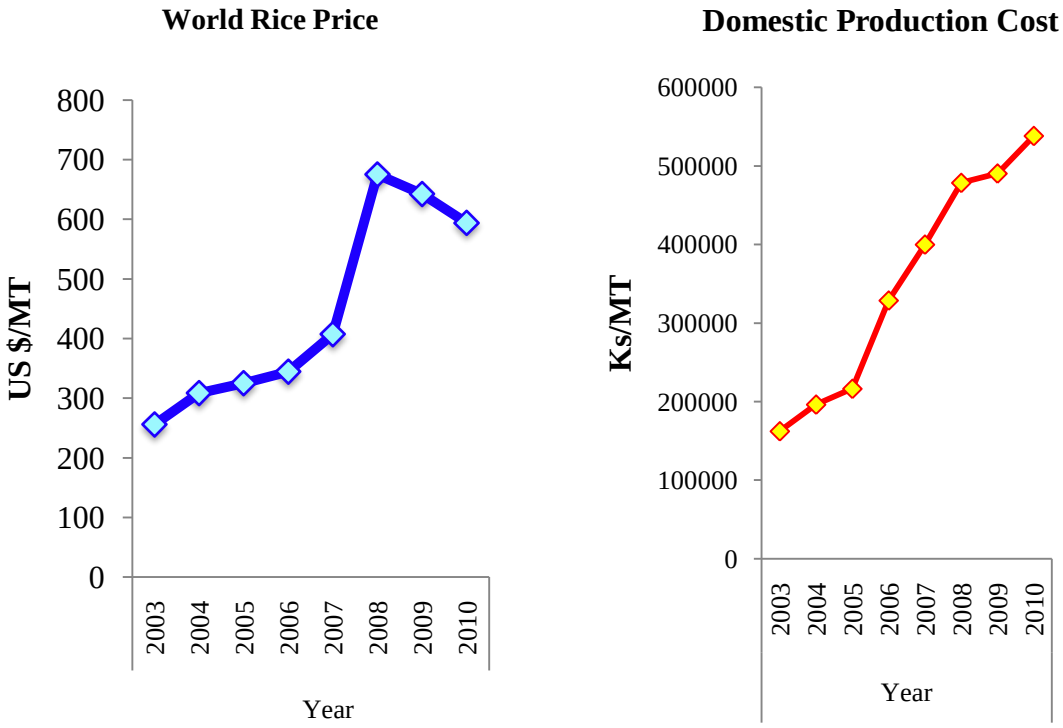
Appendix 3 Myanmar's Total Rice Export and Border Rice Export

Year	Total rice export ('000 MT)	Border rice export [a] ('000 MT)	Proportion of border rice export (%)
2007-2008	359	1.98	0.55
2008-2009	666	35.14	5.27
2009-2010	818	61.81	7.56
2010-2011	536	0.00	0.00
2011-2012	707	125.33	17.73
2012-2013	1400	400.52[b]	28.61

Note: [a] Border rice export through Muse

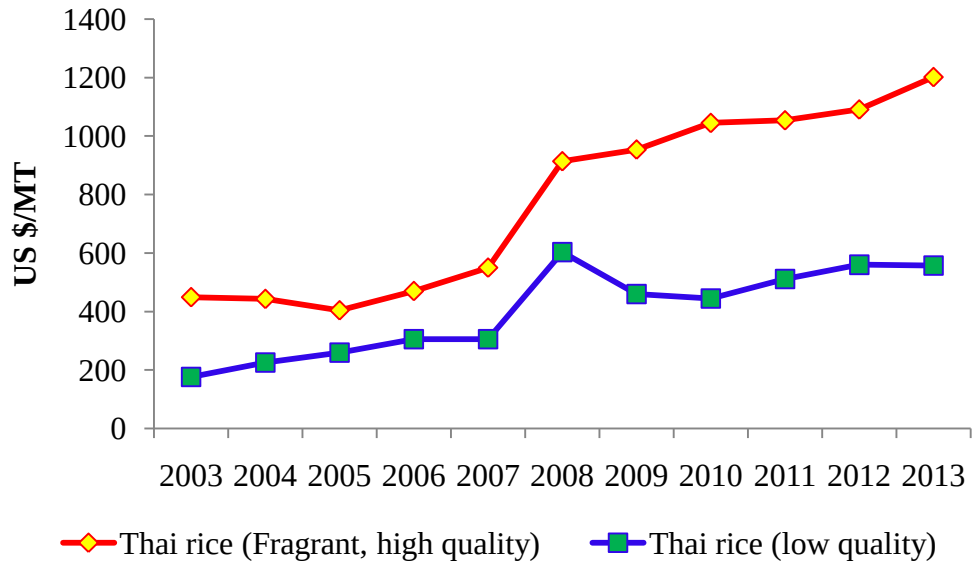
[b] Border rice export from April 2012 to November 2013

Source: MOAI 2012 and MOC 2012



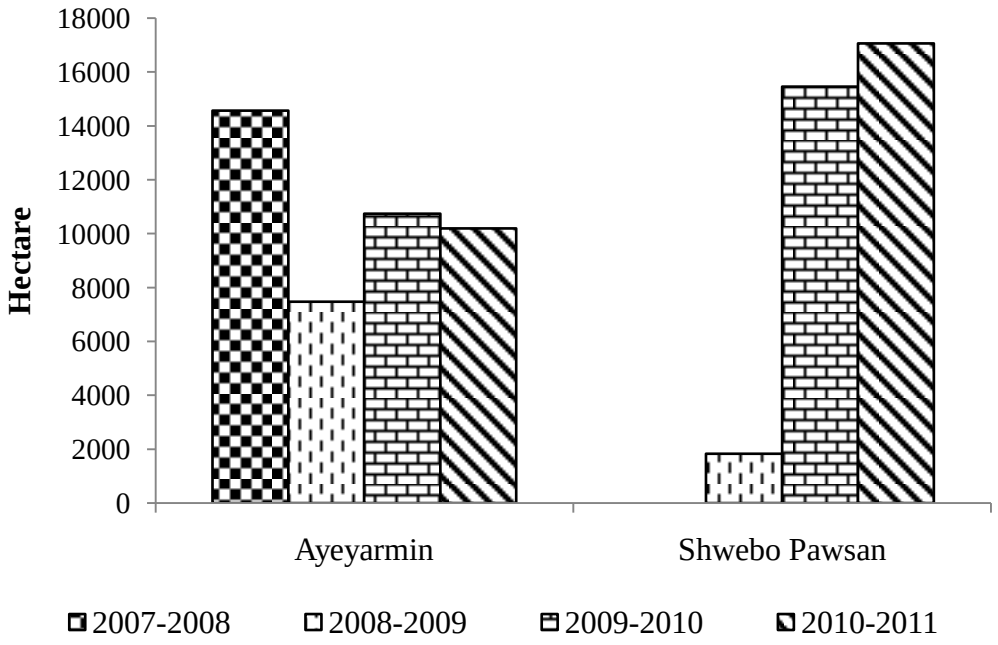
Appendix 4 Trend of World Rice Price and Domestic Rice Production Cost

Source: FAOSTAT 2013 and MOAI 2012



Appendix 5 World Rice Price Difference According to the Quality of Rice Varieties

Source: FAO Rice Market Monitor 2008 and 2013



Appendix 6 Change of Shwebo Pawsan and Ayeyarmin Varieties Sown Areas in Shwebo Township

Source: DoA 2012

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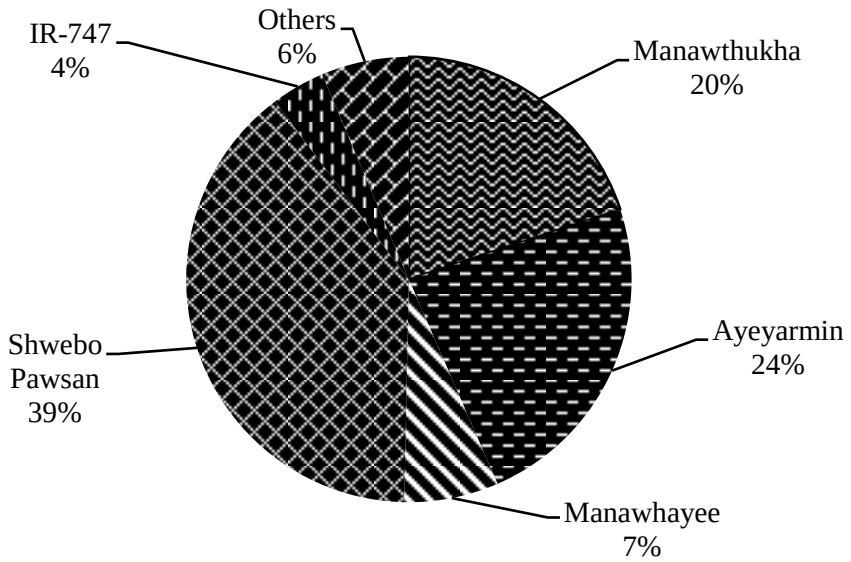
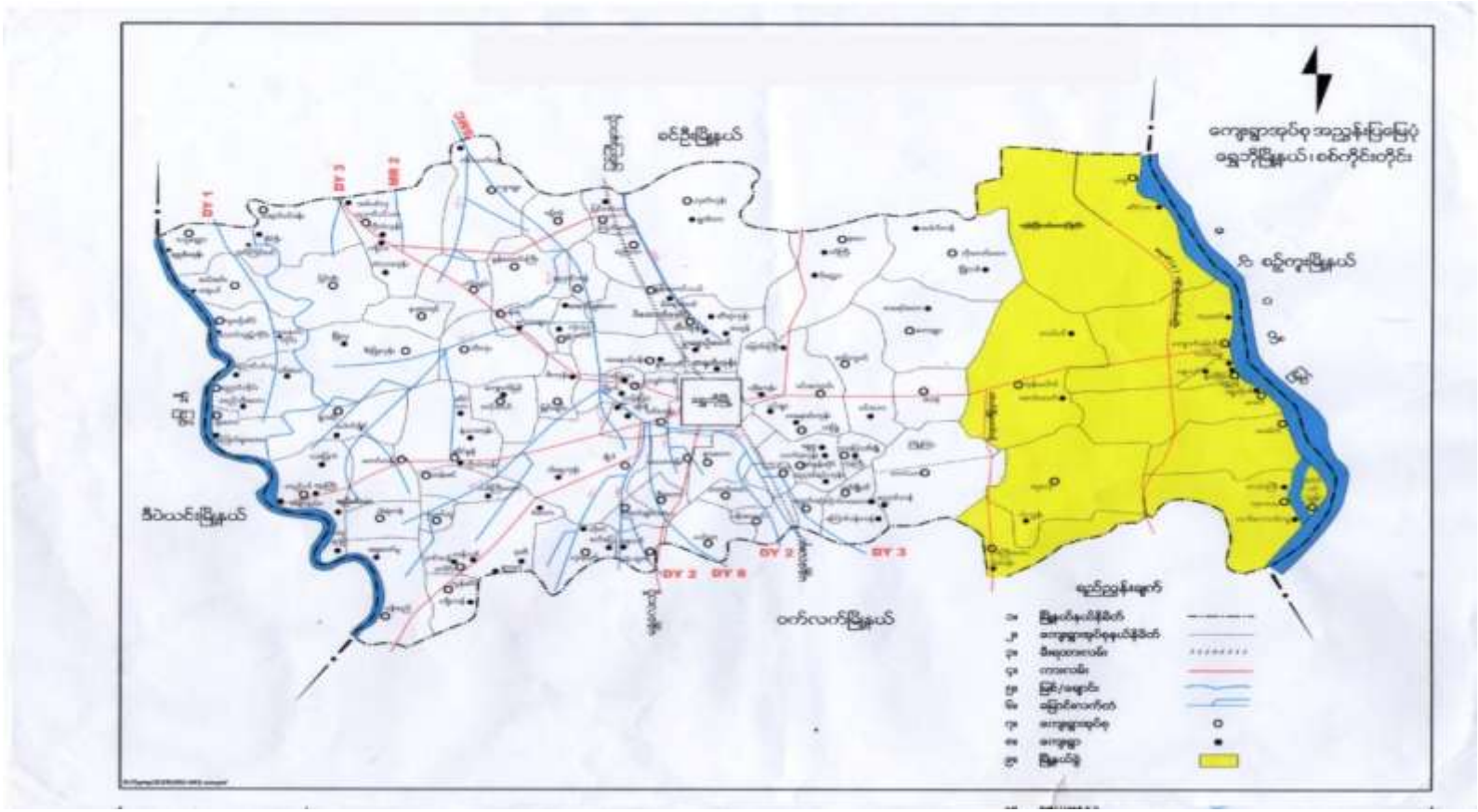


Appendix 7 Proportion of Monsoon Rice Varieties Sown Areas in Shwebo Township (2010-2011)

Source: DoA 2012



Appendix 8 Map of Shwebo Township

Source: DoA 2012

Appendix 9 Calculation of Export Parity Prices of Shwebo Pawsan and Ayeyarmin Rice Varieties in Shwebo Township

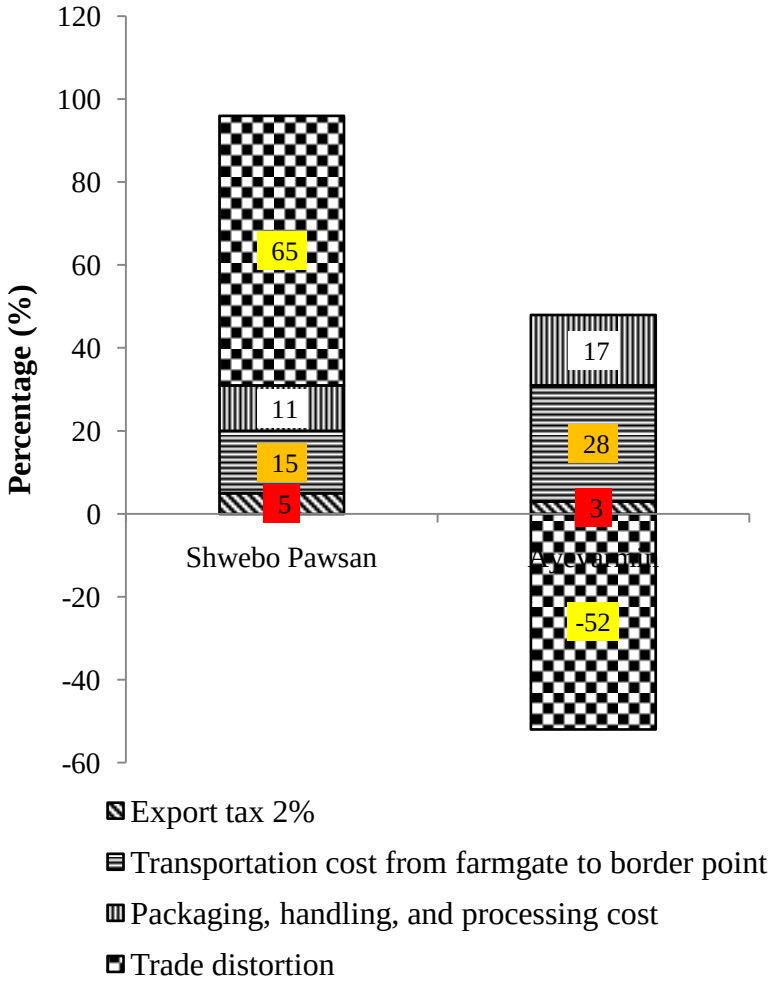
No.	Steps in Calculation	Unit	Shwebo Pawsan	Ayeyarmin
1	Border price at Muse [a]	USD/MT	924	364
2	Exchange rate Kyats per USD [b] (average daily value in January, 2011)	Ks/USD	935	935
3	Border price in domestic currency {(1)*(2)}	Ks/MT	863,940	340,340
4	(-) Export tax 2% [c]	Ks/MT	17,280	6,807
5	(-) Transport from Mandalay (Wholesale) to Border point [d]	Ks/MT	50,000	50,000
6	(-) Transport from Shwebo to Mandalay [e]	Ks/MT	10,000	10,000
7	(-) Packaging, handling and processing Cost in Shwebo [f]	Ks/MT	38,205	38,205
8	(-) Transport from farm gate to Shwebo [g]	Ks/MT	5,003	5,003
9	Economic farm gate value of Rice {(3)-(4)-(5)-(6)-(7)-(8)}	Ks/MT	743,452	230,325
10	Economic farm gate value of Rice {(9)/(2)}	USD/MT	795	246
11	Financial farm gate value of Rice [h]	Ks/MT	520,000	350,000
12	Conversion Factor {(9)/(11)}		1.43	0.66

[a] = Border prices in January 2011 derived from Ministry of Commerce, Nay Pyi Taw

[b] = MIS (MOAI), 2012

[c, d, e, f, g] = Derived from exporters in Shwebo Township

[h] = Derived from field survey, 2012



Appendix 10 Comparison of Trade Distortion and Cost Based on Financial Farm gate Value of Rice

Appendix 11 Calculation of Import Parity Price of Urea Fertilizer (China Urea)

No.	Steps in Calculation	Unit	Value of Urea fertilizer
1	Border price at Muse [a]	USD/MT	220
2	Exchange rate Kyats per USD [b] (average value in June to September, 2010)	Ks/USD	926
3	Import price of fertilizer in domestic currency {(1)*(2)}	Ks/MT	203,720
4	(+) Handling and custom duty [c]	Ks/MT	40,729
5	Landed cost of fertilizer at Mandalay {(3)+(4)}	Ks/MT	50,000
6	(+) Transport to ex-warehouse [d]	Ks/MT	4,000
7	Price of fertilizer at ex-warehouse (wholesale price) {(5)+(6)}	Ks/MT	298,449
8	(+) Transport from Mandalay to Shwebo [e]	Ks/MT	14,000
9	(+) Transport from Shwebo to farm gate [f]	Ks/MT	4,000
10	Economic farm gate value of fertilizer in domestic currency {(7)+(8)+(9)}	Ks/MT	316,449
11	Economic farm gate value of fertilizer	USD/MT	342
12	Financial farm gate value of fertilizer [g]	Ks/MT	434,300
13	Conversion Factor {(10)/(12)}		0.73

[a] = Border price in January 2010 derived from Ministry of Agriculture and Irrigation, Department of Agriculture, Nay Pyi Taw

[b] = MIS (MOAI), 2012

[c, d, e, f] = Derived from private fertilizer importing company (Agro Asia Star Co. Ltd.), Yangon

[g] = Derived from field survey, 2012

Appendix 12 Calculation of Import Parity Price of Compound Fertilizer

No.	Steps in Calculation	Unit	Value of Compound Fertilizer
1	Based import price (CIF) at Yangon [a]	USD/MT	260
2	Exchange rate Kyats per USD [b] (average value in June to September, 2010)	Ks/USD	926
3	Import price of fertilizer in domestic currency {(1)*(2)}	Ks/MT	240,760
4	(+) Handling, port charges and custom duty [c]	Ks/MT	85,000
5	Landed cost of fertilizer at Yangon {(3)+(4)}	Ks/MT	325,760
6	(+) Transport from port to ex-warehouse [d]	Ks/MT	8,500
7	Price of fertilizer at ex-warehouse (wholesale price) {(5)+(6)}	Ks/MT	334,260
8	(+) Transport from Yangon to Shwebo [e]	Ks/MT	24,000
9	(+) Transport from Shwebo to farm gate [f]	Ks/MT	4,000
10	Economic farm gate value of fertilizer in domestic currency {(7)+(8)+(9)}	Ks/MT	362,260
11	Economic farm gate value of fertilizer	USD/MT	391
12	Financial farm gate value of fertilizer [g]	Ks/MT	497,091
13	Conversion Factor {(10)/(12)}		0.73

[a] = Border price in January 2010 derived from Ministry of Agriculture and Irrigation, Department of Agriculture, Nay Pyi Taw

[b] = MIS (MOAI), 2012

[c, d, e, f] = Derived from private fertilizer importing company (Agro Asia Star Co. Ltd.), Yangon

[g] = Derived from field survey 2012

Appendix 13 Calculation of Import Parity Price of Insecticide (Dimethorate)

No.	Steps in Calculation	Unit	Value of Dimethorate
1	Based import price (CIF) at Yangon [a]	USD/Liter	1.8
2	Exchange rate Ks per USD [b] (average value in June to September, 2010)	Ks/USD	926
3	Import price of Insecticide in domestic currency {(1)*(2)}	Ks/Liter	1,666
4	(+) Handling, Port charges and custom duty [c]	Ks/Liter	125
5	Landed cost of Insecticide at Yangon {(3)+(4)}	Ks/Liter	1,791
6	(+) Transport from port to ex-warehouse [d]	Ks/Liter	25
7	Price of Insecticide at ex-warehouse (wholesale price) {(5)+(6)}	Ks/Liter	1,816
8	(+) Transport from Yangon to Shwebo [e]	Ks/Liter	24
9	(+) Transport from Shwebo to farm gate [f]	Ks/Liter	4
10	Economic farm gate value of Insecticide {(7)+(8)+(9)}	Ks/Liter	1,788
11	Economic farm gate value of Insecticide	USD/Liter	1.93
12	Financial farm gate value of Insecticide [g]	Ks/Liter	5,374
13	Conversion Factor {(10)/(12)}		0.33

[a] = Border price in January 2010 derived from Ministry of Agriculture and Irrigation, Department of Agriculture, Nay Pyi Taw

[b] = MIS (MOAI), 2012

[c, d, e, f] = Derived from private fertilizer importing company (Agro Asia Star Co. Ltd.), Yangon

[g] = Derived from field survey, 2012

Appendix 14 Calculation of Import Parity Price of Weedicide (Glyphosate)

No.	Steps in Calculation	Unit	Value of Glyphosate
1	Based import price (CIF) at Yangon [a]	USD/Liter	1.5
2	Exchange rate Ks per USD [b] (average value in June to September, 2010)	Ks/USD	926
3	Import price of Weedicide in domestic currency {(1)*(2)}	Ks/Liter	1,389
4	(+) Handling, Port charges and custom duty [c]	Ks/Liter	125
5	Landed cost of Weedicide at Yangon {(3)+(4)}	Ks/Liter	1,514
6	(+) Transport from port to ex-warehouse [d]	Ks/Liter	25
7	Price of Weedicide at ex-warehouse (wholesale price) {(5)+(6)}	Ks/Liter	1,539
8	(+) Transport from Yangon to Shwebo [e]	Ks/Liter	24
9	(+) Transport from Shwebo to farm gate [f]	Ks/Liter	4
10	Economic farm gate value of Weedicide {(7)+(8)+(9)}	Ks/Liter	1,511
11	Economic farm gate value of Weedicide	USD/Liter	1.63
12	Financial farm gate value of Weedicide [g]	Ks/Liter	7,089
13	Conversion Factor {(10)/(12)}		0.21

[a] = Border price in January 2010 derived from Ministry of Agriculture and Irrigation, Department of Agriculture, Nay Pyi Taw

[b] = MIS (MOAI), 2012

[c, d, e, f] = Derived from private fertilizer importing company (Agro Asia Star Co. Ltd.), Yangon

[g] = Derived from field survey, 2012

Appendix 15 Calculation of Import Parity Prices of Furadum 3G

No.	Steps in Calculation	Unit	Value of Furadum 3G
1	Based import price (CIF) at Yangon [a]	USD/MT	670
2	Exchange rate Ks per USD [b] (average value in June to September, 2010)	Ks/USD	926
3	Import price of Furadum 3G in domestic currency {(1)*(2)}	Ks/MT	620,197
4	(+) Handling, Port charges and custom duty [c]	Ks/MT	40,729
5	Landed cost of Furadum 3G at Yangon {(3)+(4)}	Ks/MT	660,926
6	(+) Transport from port to ex-warehouse [d]	Ks/MT	81,459
7	Price of Furadum 3G at ex-warehouse (wholesale price) {(5)+(6)}	Ks/MT	742,385
8	(+) Transport from Yangon to Shwebo [e]	Ks/MT	24,000
9	(+) Transport from Shwebo to farm gate [f]	Ks/MT	4,000
10	Economic farm gate value of Furdum 3G {(7)+(8)+(9)}	Ks/MT	714,385
11	Economic farm gate value of Furdum 3G	USD/MT	772
12	Financial farm gate value of Furdum 3G [g]	Ks/MT	1,938,095
13	Conversion Factor {(10)/(12)}		0.37

[a] = Border price in January 2010 derived from Ministry of Agriculture and Irrigation, Department of Agriculture, Nay Pyi Taw

[b] = MIS (MOAI), 2012

[c, d, e, f] = Derived from private fertilizer importing company (Agro Asia Star Co. Ltd.), Yangon

[g] = Derived from field survey, 2012

Appendix 16 Calculation of Import Parity Prices of Rodenticide (Turbufos)

No.	Steps in Calculation	Unit	Value of Turbufos
1	Based import price (CIF) at Yangon [a]	USD/MT	800
2	Exchange rate Ks per USD [b] (average value in June to September, 2010)	Ks/USD	926
3	Import price of Rodenticide in domestic currency {(1)*(2)}	Ks/MT	740,533
4	(+) Handling, Port charges and custom duty [c]	Ks/MT	40,729
5	Landed cost of Rodenticide at Yangon {(3)+(4)}	Ks/MT	781,263
6	(+) Transport from port to ex-warehouse [d]	Ks/MT	81,459
7	Price of Rodenticide at ex-warehouse (wholesale price) {(5)+(6)}	Ks/MT	862,721
8	(+) Transport from Yangon to Shwebo [e]	Ks/MT	24,000
9	(+) Transport from Shwebo to farm gate [f]	Ks/MT	4,000
10	Economic farm gate value of Rodenticide {(7)+(8)+(9)}	Ks/MT	834,721
11	Economic farm gate value of Rodenticide	USD/MT	902
12	Financial farm gate value of Rodenticide [g]	Ks/MT	1,654,286
13	Conversion Factor {(10)/(12)}		0.50

[a] = Border price in January 2010 derived from Ministry of Agriculture and Irrigation, Department of Agriculture, Nay Pyi Taw

[b] = MIS (MOAI), 2012

[c, d, e, f] = Derived from private fertilizer importing company (Agro Asia Star Co. Ltd.), Yangon

[g] = Derived from field survey, 2012

Appendix 17 Calculation of Import Parity Price of Diesel

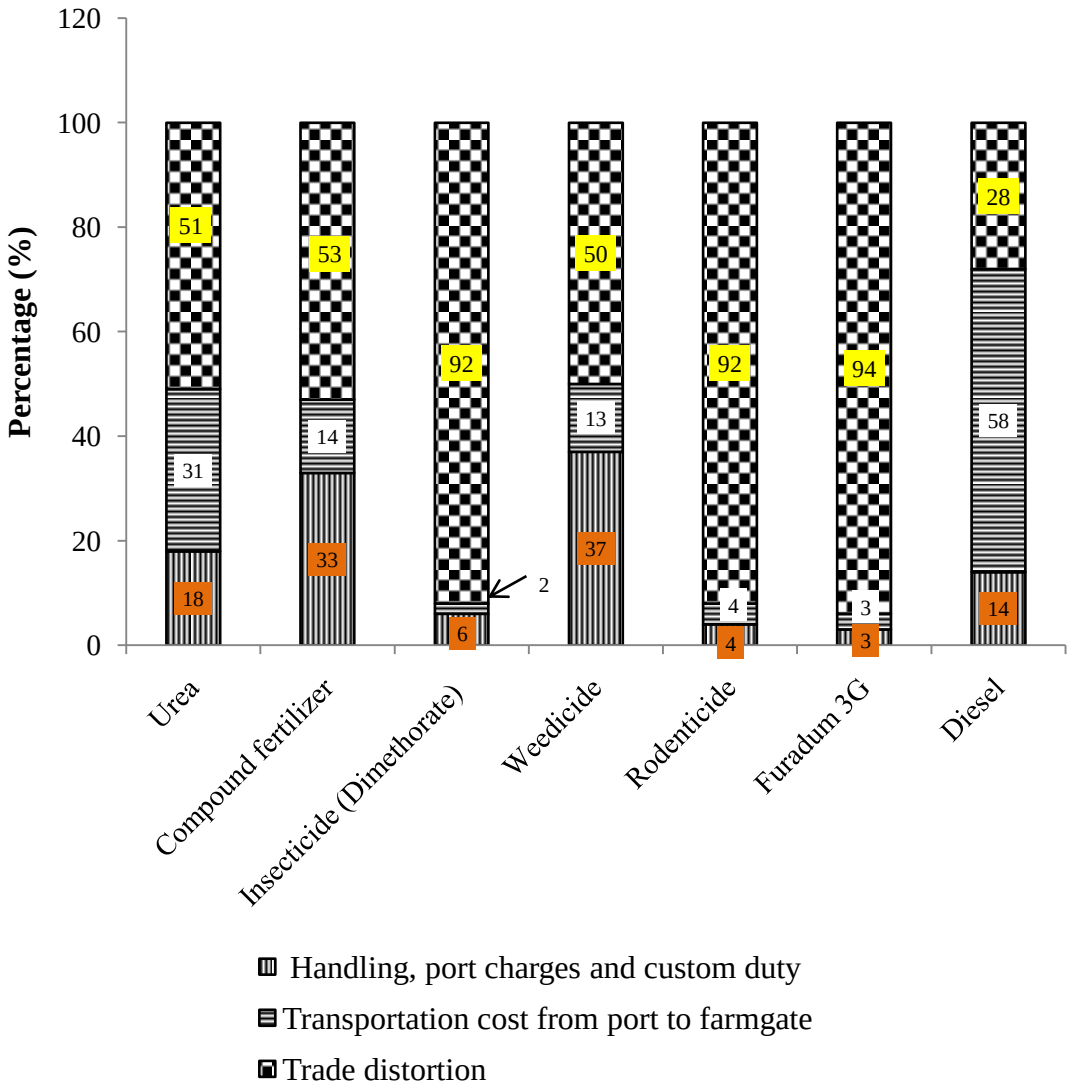
No.	Steps in Calculation	Unit	Diesel
1	Based import price (CIF) at Yangon [a]	USD/MT	696
2	Exchange rate Ks per USD [b] (average value from June to Sep, 2010)	Ks/USD	926
3	Import price of Diesel in domestic currency {(1)*(2)}	Ks/MT	644,681
4	(+) Handling, Port charges and custom duty [c]	Ks/MT	37,394
5	Landed cost of Diesel at Yangon {(3)+(4)}	Ks/MT	682,075
6	(+) Transport from port to ex-warehouse [d]	Ks/MT	31,500
7	Price of Diesel at ex-warehouse (wholesale price) {(5)+(6)}	Ks/MT	713,575
8	(+) Transport from Yangon to Shwebo [e]	Ks/MT	105,000
9	(+) Transport from Shwebo to farm gate [f]	Ks/MT	13,125
10	Economic farm gate value of Diesel {(7)+(8)+(9)}	Ks/MT	831,700
11	Economic farm gate value of Diesel	USD/MT	898
12	Financial farm gate value of Diesel [g]	Ks/MT	903,788
13	Conversion Factor {(10)/(12)}		0.92

[a] = Border price in January 2010 derived from Ministry of Agriculture and Irrigation, Department of Agriculture, Nay Pyi Taw

[b] = MIS (MOAI), 2012

[c, d, e, f] = Derived from private fertilizer importing company (Agro Asia Star Co. Ltd.), Yangon

[g] = Derived from field survey, 2012



Appendix 18 Comparison of Trade Distortion and Cost Based on Financial Farm gate Value of Inputs

Appendix 19 Sensitivity Analysis of Different Yield Levels, World Prices, and Exchange Rates on DRC ratios for Shwebo Pawsan Rice Production

Yield		DRC at Different World Prices (USD/MT) and Exchange Rates (Ks/USD)														
		USD 570					USD 680					USD 924				
MT/ha	**bsk/ac**	**800**	**900**	**935**	**1000**	**1200**	**800**	**900**	**935**	**1000**	**1200**	**800**	**900**	**935**	**1000**	**1200**
3.1	60	1.44	0.89	0.83	0.74	0.56	0.8	0.65	0.65	0.56	0.43	0.5	0.42	0.4	0.36	0.29
3.62	70	1.00	0.73	0.68	0.61	0.46	0.66	0.54	0.54	0.46	0.36	0.41	0.35	0.33	0.31	0.24
4.13	80	0.94	0.61	0.58	0.52	0.4	0.56	0.46	0.46	0.4	0.31	0.35	0.30	0.29	0.26	0.31
4.65	90	0.80	0.53	0.50	0.45	0.35	0.48	0.40	0.40	0.35	0.27	0.31	0.26	0.25	0.23	0.19
5.16	100	0.70	0.47	0.44	0.40	0.31	0.43	0.35	0.35	0.31	0.24	0.28	0.24	0.22	0.21	0.17

Source: Own Estimation

Appendix 20 Sensitivity Analysis of Different Yield Levels, World Prices, and Exchange Rates on DRC ratios for Shwebo Pawsan Rice Production (Contd.)

Yield		DRC at Different World Prices (USD/MT) and Exchange Rates (Ks/USD)									
		USD 1000					USD 1100				
MT/ha	**bsk/ac**	**800**	**900**	**935**	**1000**	**1200**	**800**	**900**	**935**	**1000**	**1200**
3.1	60	0.44	0.38	0.36	0.33	0.26	0.39	0.33	0.32	0.29	0.23
3.62	70	0.37	0.32	0.30	0.28	0.22	0.33	0.28	0.27	0.25	0.20
4.13	80	0.32	0.27	0.26	0.24	0.19	0.28	0.24	0.23	0.21	0.17
4.65	90	0.28	0.24	0.23	0.21	0.17	0.25	0.21	0.2	0.19	0.15
5.16	100	0.25	0.21	0.20	0.19	0.15	0.22	0.19	0.18	0.17	0.13

Source: Own Estimation

Appendix 21 Sensitivity Analysis of Different Yield Levels, World Prices, and Exchange Rates on DRC ratios for Ayeyarmin Rice Production

Yield		DRC at Different World Prices (USD/MT) and Exchange Rates (Ks/USD)														
		USD 364					USD 400					USD 450				
MT/ha	**bsk/ac**	**800**	**900**	**935**	**1000**	**1200**	**800**	**900**	**935**	**1000**	**1200**	**800**	**900**	**935**	**1000**	**1200**
3.1	60	1.37	1.07	0.99	0.86	0.64	1.12	0.89	0.83	0.73	0.54	0.89	0.72	0.67	0.61	0.46
3.62	70	1.00	0.87	0.81	0.71	0.53	0.91	0.74	0.69	0.61	0.45	0.74	0.60	0.56	0.50	0.38
4.13	80	0.92	0.74	0.68	0.60	0.45	0.77	0.62	0.58	0.52	0.39	0.62	0.51	0.48	0.43	0.33
4.65	90	0.79	0.64	0.59	0.52	0.40	0.66	0.54	0.51	0.45	0.34	0.54	0.44	0.42	0.38	0.29
5.16	100	0.70	0.56	0.52	0.46	0.35	0.58	0.48	0.45	0.40	0.30	0.48	0.39	0.37	0.33	0.26

Source: Own Estimation

Appendix 22 Sensitivity Analysis of Different Yield Levels, World Prices, and Exchange Rates on DRC ratios for Ayeyarmin Rice Production (Contd.)

Yield		DRC at Different World Prices (USD/MT) and Exchange Rates (Ks/USD)									
		USD 500					USD 600				
MT/ha	bsk/ac	800	900	935	1000	1200	800	900	935	1000	1200
3.1	60	0.73	0.60	0.57	0.51	0.39	0.54	0.46	0.43	0.39	0.31
3.62	70	0.61	0.50	0.48	0.43	0.33	0.45	0.38	0.36	0.33	0.26
4.13	80	0.52	0.43	0.41	0.37	0.29	0.39	0.33	0.31	0.29	0.23
4.65	90	0.45	0.38	0.36	0.32	0.25	0.34	0.29	0.27	0.25	0.20
5.16	100	0.40	0.33	0.32	0.29	0.22	0.30	0.26	0.24	0.22	0.18

Source: Own Estimation