The Domestic Resource Cost of Prawn Production in Negros Occidental: A Case of Comparative Advantage

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Many economists believe that industrialization toward economic development should commence in the agricultural sector. As Balassa (1981, pp. 3-5) comments,

> "industrialization is meant to convey the idea that the development of manufacturing industries is part and parcel of overall economic development. At its earlier stages, industrial development is contingent on demand and savings generated in the primary sector... Industrial development begins in response to domestic demand generated in the primary sector that also provides investible funds for manufacturing industries."

Presently, Negros Occidental is experiencing economic recovery which can be attributed to an improvement in the world price of sugar, and her income from the rapid-growing prawn industry. Since there has been no empirical study conducted whether it has comparative advantage in prawn production or not, the authors want to confirm its (comparative advantage) existence. Apparently, the Philippines has a comparative advantage since prawn growers are reaping big profits. But the authors still doubt this because the industry is reputed to be capital intensive, especially with the technology that is being utilized in Negros Occidental (Esleyer, 1988). The status of the prawn industry is important for Philippine policy makers so that they can rightfully direct the optimal use of the country's economic resources towards economic prosperity.

STATEMENT OF THE PROBLEM

One of the dictum in economics is the efficient use of resources. Negros Occidental is in the process of gearing up her production of prawns as one of the pillars of the province's economic recovery scheme. The authors want to find out whether or not the prawn industry in Negros Occidental has a comparative advantage and, to that effect, if the said industry uses the country's economic resources efficiently.

OBJECTIVES OF THE STUDY

In the light of this study about the role of the expanding prawn industry in the revitalization of the agricultural economy of the Philippines, the authors have set the following objectives:

1. to determine the cost component of the prawn industry in Negros Occidental;

2. to derive the domestic resource cost of the prawn industry in Negros Occidental;

3. to compare the domestic resource cost of the industry with the shadow exchange rate; and

4. to assess the future of the industry and cite the problems that have and may beset it.

THEORETICAL FRAMEWORK

Since the authors are interested in whether or not the prawn industry has a compara-

tive advantage, the Heckscher-Ohlin Theory, otherwise known as the Factor-Endowment Theory, is utilized in the analysis.

The Heckscher-Ohlin Theorem is one of the most modern theories of international trade. It explains the differences in comparative costs among trading partners. The said theory is the handiwork of two Swedish economists, Eli Heckscher and Bertil Ohlin.

The Hechscher-Ohlin Theorem can be abbreviated as follows: Different goods require different factor proportions, and different countries have different relative factor endowments; therefore countries will tend to have comparative advantages in producing goods that use their more abundant factor more intensively; for this reason each country will end up exporting its abundant-factor goods in exchange for imported goods that use its scarce factors more intensively (Kindleberger and Lindert, 1978, p. 30). In other words, a capital-rich country will have a comparative advantage in goods that use more capital relative to other factors (Atkinson, 1982, p. 685).

Factor abundance, as mentioned in the preceding paragraph, can be defined in two ways: in terms of factor price and in physical terms. The factor price definition of factor abundance states that a country is capital-rich compared with another country if capital is relatively cheaper in the former than in the latter (Sodersten, 1980, p. 42). The second definition of factor abundance in terms of physical quantity compares overall physical amounts of labor and capital. It says that Country A is rich in capital if the ratio of capital to labor is larger in Country A than in Country B (Sodersten, 1980, p.43).

OPERATIONAL FRAMEWORK

Today, the Domestic Resource Cost (DRC) criterion used to determine social profitability is the most widely used method in measuring the comparative advantage of an industry. It can be considered as a way of applying the Heckscher-Ohlin Theorem on empirical studies.

If the prawn industry is to be considered a vehicle to revitalize Negros Occidental's economy, it must be an industry where the country enjoys a comparative advantage. Therefore, the Domestic Resource Cost is the primary concept we shall be using in our analysis.

Domestic Resource Cost, as defined by Bautista, represents a social valuation of domestic resources used per unit of foreign exchange earned (through exports) or saved (through import substitution).

There are various methods and formulae in computing the DRC. Here, the authors opted to use Medalla's formula due to its simplicity.

The Domestic Resource Cost (DRC), folowing Medalla's formula, is formally expressed as follows:

$$DRC = \frac{\text{domestic costs in shadow prices per unit of output}}{\text{border price of output - foreign cost per unit in border price}}$$

The numerator is in local currency, while the denominator is in foreign currency, so that the result, is in effect, the "own exchange rate" for the activity (Medalla and Power, staff paper series no. 85-04).

To find out whether the prawn industry has a comparative advantage, the Domestic Resource Cost derived shall be compared with the shadow exchange rate, using the formula:

$$\frac{\text{Domestic Resource Cost (DRC)}}{\text{Shadow Exchange Rate (SER)}}$$

where $\dfrac{DRC}{SER} <$ 1, would mean that the industry has comparative

advantage while $\dfrac{DRC}{SER} >$ 1, would mean otherwise

SCOPE AND LIMITATIONS OF THE STUDY

The prawn industry that the authors are contemplating here includes fishpond operators engaged in the culture of black tiger prawns with a pond area of not less than half

a hectare. Since the focus is Negros Occidental, primary data will be taken from fishpond operators based in Bacolod City, the provincial capital. Secondary data will also be taken from different government agencies related with the prawn industry.

Due to time constraints, the authors cannot investigate into the industry's forward, backward and horizontal linkages, which could make this study more comprehensive.

Another limitation in this study is the set of assumptions which the authors have made in the methodology, to rid the study of minute details that may complicate matters and make the analysis unmanageable.

SAMPLING METHODOLOGY

The sampling method the authors used was the simple random sampling. As of September 1988, it was estimated that there were about 247 prawn growers in Negros Occidental, most of whom are based in Bacolod City. The authors needed at least 30 respondents so that the sample can be a good representation of the population (Central Limit Theorem). The authors sent out 100 questionaires to prawn growers, some of whom are members of the Negros Prawn Producer's Association. The pieces of information the authors needed were considered highly confidential; only 38 returned accomplished forms.

PROFILE OF RESPONDENTS

The authors have found that their respondents are mostly based in Bacolod City and that the prawn farms are obviously located within the boundaries of Negros Occidental. Almost all of the respondents are involved in semi-intensive and/or intensive culture of prawns and are raising the said commodity with an aggregate pond area of not less than five hectares. Based on the pond area, in hectares, utilized by respondents using the median, it can be said that the median size of prawn ponds of the samples is 15 hectares. Pond sizes larger than the median are already

considered to be of large scale production while those lower than the median are considered to be of small scale production. With regard to our samples, there are 17 growers with pond sizes between 5 to 12 hectares, 18 growers with pond sizes between 17 to 60 hectares, and 3 growers with an area of 15 hectares. It can also be said that most, if not all, of these respondent-prawn growers were formerly sugar planters.

STATISTICAL METHODOLOGY

In accomplishing the first objective to determine whether or not the prawn industry has a comparative advantage, the authors will employ the concept of DRC. The resultant

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DRC will be compared with the shadow exchange rate, from which comparative advantage can be determined. It is implied that in solving for the industry's DRC, the authors must first determine the cost component of the industry under study.

With regard to the other objective, to determine the problems besetting the industry and to assess the future of the industry, the authors shall rely mainly on secondary sources. This portion (as regards the future of the industry) will require subjectivity from the authors, and therefore can be subjected to criticisms.

The authors used primary data, surveying costs of production of prawn growers picked at random. The different costs of production were then classified as either domestic or foreign inputs. Since the DRC formula of Medalla requires that both the domestic and foreign inputs be expressed in their shadow prices or their true costs, the authors had to determine not only their accounting costs but also estimate their opportunity costs in terms of the costs of the input's

next alternative use [e.g. leasing rate for land, interest foregone (especially for capital costs)].

For unskilled labor, Medalla estimated that the shadow price is equal to 80 percent of the current wage rate due to distortions brought about by government regulations, while for skilled labor, its shadow price is equivalent to its nominal price. This assumption was made on the basis that in a perfectly competitive market, any deviation from the shadow price tends to induce the factor to migrate toward the activity offering the shadow price (eventually, the equality of the nominal and the shadow price will be achieved by the stabilizers present in the perfectly competitive market). Another possible basis of Medalla's assumption as regards the equality of the shadow and nominal price of skilled labor is the fact that there is flexibility in the supply of skills in the case of the prawn industry. The authors believe however that the market for skilled labor is not perfectly competitive (e.g. presence of dual labor markets) but merely approximates one due to the inaccessibility of certain information.

The authors also computed the shadow exchange rate by adding a 20 percent premium to the official exchange rate. The authors expressed all costs of production in a confidence interval so that the estimation would be able to reflect efficient as well as inefficient producers.

After determining the respective shadow prices of inputs, the authors converted all figures as per unit of output and then substituted all upper limits into the DRC formula to obtain the industry's upper domestic resource cost. Another DRC using all lower limits, and a third DRC using the class marks (means) were derived to give the readers a concrete idea as to the point estimate of the DRC of prawn production. After deriving the upper and lower limit DRC of the prawn industry, the authors compared it with the shadow exchange rate (dividing the DRC by the shadow exchange rate) so that we can

know whether there is a comparative advantage.

ANALYSIS OF DATA AND INTERPRETATION

Following our methodology, we have been able to derive the DRC of the prawn industry. The tables presented below show the components of domestic and foreign costs of the prawn industry, the former in shadow prices and the latter in border prices:

DOMESTIC COST OF INPUTS (per hectare per cropping) OF THE PRAWN INDUSTRY (in shadow prices)

ITEM	LOWER LIMIT	CLASS MARK	UPPER LIMIT
1. Land	P 9279.08	P 10909.09	P 12539.10
2. Land Development			
Acctg. Cost (Depn)	16187.71	18835.96	21484.21
Int. Foregone	10462.83	11569.14	12675.46
3. Skilled Labor	2071.30	2457.42	2843.54
4. Unskilled Labor	3080.59	3578.37	4076.15
5. Land Reconditioning			
Acctg. Cost	15171.54	19744.74	24317.20
Int. Foregone	1024.08	1332.77	1641.41
TOTAL	P 57277.13	P 68427.49	P 79577.07

The average production of the sample is 4.9 tons, equivalent to 4,900 kilos, and the world price was obtained by dividing the total value exports by the volume (FOB)-- $ 154,596,007/14,935,176 kgs. or roughly US$10.35 (1987 Foreign Trade Statistics of the Philippines).

Since the DRC formula requires that the inputs be in terms per unit of output, there was a need to divide all the cost components by the average production in kilograms. Also, because Medalla's formula expressed the denominator in foreign exchange rate, there was also a need to convert the foreign cost into its US dollar equivalent (they are also expressed in terms of per unit of output).

By performing the above, three DRCs can be obtained: one using all the lower limits;

FOREIGN COST COMPONENTS (per hectare per cropping)
OF THE PRAWN INDUSTRY
IN THEIR BORDER PRICES

ITEM	LOWER LIMIT	CLASS MARK	UPPER LIMIT
1. Generator			
Acctg. Cost (Depn)	₱ 2651.70	₱ 3339.17	₱ 4026.64
Int. Foregone	239.48	307.71	375.94
2. Water Supply System			
Acctg. Cost (Depn)	3633.94	4064.34	4494.74
Int. Foregone	272.55	304.83	333.11
3. Feed Requirements			
Acctg. Cost (Depn)	212253.95	230088.11	247922.27
Int. Foregone	20467.35	22187.07	23906.79
4. Fry			
Acctg. Cost	54276.72	58071.32	61865.92
Int. Foregone	4070.75	4335.35	4639.94
5. Aerators			
Acctg. Cost (depn)	6954.32	7361.51	7768.70
Int. Foregone	670.59	709.86	803.80
6. Fuel			
Acctg. Cost	4987.63	8336.74	11685.85
Int. Foregone	420.77	703.41	985.99
TOTAL	₱ 310899.75	₱ 340829.42	₱ 368813.69

another using all the upper limits (for interval estimate); and a last set using all the class marks (for point estimate). The confidence level of the said interval estimate is set at 95 percent.

LOWER LIMIT DRC

Domestic cost in Shadow Prices per unit of output:
₱ 57277.13 /4900 kgs. = ₱ 11.69
World Price = $10.35
Foreign Cost in Border Prices per unit of output:
₱ 310899.75 / 4900 kgs. = ₱ 64.45/
*₱ 20.50/$ = $3.095

*Official Exchange Rate as of Dec. 31, 1988 (Far Eastern Economic Review, 1989)

$$DRC = \frac{₱\,11.69}{\$10.35 - \$3.095} = 1.61$$

UPPER LIMIT DRC

Domestic Cost in Shadow Prices per unit of output:

₱ 79577.07 / 4900 kgs. = 16.24

Foreign Cost in Border Prices per unit of output:

₱ 368813.69 / 4900 kgs. = 75.27/ *₱ 20.50/ $ = $3.67

$$DRC = \frac{₱\,16.24}{\$10.35 - \$3.67} = 2.43$$

POINT ESTIMATE OF DRC

Domestic Cost in Shadow Prices per unit of output:

₱ 68427.49 / 4900 kgs. = ₱ 13.96

Foreign Cost in Border Prices per unit of output:

₱340829.42 / 4900 kgs. = ₱69.56/ * ₱20.50/$ = $3.39

$$DRC = \frac{₱13.69}{\$10.35 - \$3.39} = 2.01$$

It can be said that the DRC of the prawn industry in Negros Occidental lies between 1.61 and 2.43, 95 percent of the time. But these figures will be more significant if they are compared with the shadow exchange rate (the official exchange rate with a 20 percent premium ---> OER = ₱20.50 + 0.20*20.50 = ₱24.60).

If we compare these DRCs with the shadow exchange rate which is ₱24.60, it is obvious that there is comparative advantage in the prawn industry. The authors attributed the comparative advantage to the following factors: 1) the very high price of prawns in the world market such that the net foreign exchange earned is positive; 2) the Philippines is abundant in land, the primary input of the prawn industry; therefore, it is relatively cheaper as compared to land-scarce area like Taiwan (congruent to the price definition of the Heckscher-Ohlin Theorem); and 3) although investment in capital is substantial in the prawn industry, it cannot be said that the industry is capital intensive because the prawn growers are operating on a large scale basis (cultivating more hectarage), which decreases the cost of capital per hectare.

PROBLEMS AND PROSPECTS OF THE INDUSTRY

There are basically three categories of problems that the prawn industry is facing: those which hinder the industry's growth; those which result as the industry expands; and those that the industry will encounter in the future, whether it remains static or not.

There are a number of constraints on the industry's development; topping the list is the difficulty of obtaining loans from financing institutions to fund a prawn-growing venture. The slow transfer of technology from research institutions to fishfarmers is also an area of concern. Other constraints put forth by some researchers are the following: the fluctuating price of shrimps/prawns in the export market; uncertainty of the availability and adequacy of shrimp seeds; the lack of trained manpower for the shift in species from milkfish to prawn, particularly for the intensive method of prawn rearing; the presence of climatic hazards; the security and insurgency problems in some areas which tend to discourage investors; the lack of adequate infrastructures; and the dumping of waste from sugarmills into rivers, which are the main water source of the industry.

There are three problems brought about by the expansion of the prawn industry. The first is the use of underground water that dilutes the salinity of the water, and also leads to the depression of land elevation, disease infestation of ponds, lowering of the water table in some areas and, in some cases, the

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intrusion of salt water into the water table. The second problem is the pollution of rivers by foul water discharged from prawn farms. The third problem is the displacement of sugar workers, brought about by the conversion of sugarlands to prawn ponds because the prawn industry has a low capacity to absorb displaced laborers.

Regarding the problems that the industry might encounter in the future, one primary concern is that the country's export destination for the said commodity is too concentrated in one country -- Japan. The industry is also concentrating its production on medium size prawns.

The prawn industry, despite all the odds that it must hurdle, faces a bright future. The Philippines has vast potentials. The country

has over 200,000 hectares of fishponds, only a little more than 20 percent of which is devoted to prawn production. The geographical location of the country also provides for a more suitable climate and water quality, and is endowed with trainable manpower. It is not far behind Japan and the United States, the two major prawn importers.

CONCLUSIONS

Subject to the scope, limitations and weaknesses of this study, the Domestic Resource Cost of the prawn industry in the country, specifically that in Negros Occidental, is far below the shadow exchange rate. We therefore conclude that the study affirms the thesis statement that the prawn industry has a comparative advantage. Hence, the Philippines is using her resources efficiently in producing such a commodity.

However, among prawn producers, there is a variation on how efficient they produce the said commodity. Some are quite efficient with a DRC of 1.61 while others are less efficient; thus, they have a DRC of 2.43. But even with such a variation, the country still has a comparative advantage as mentioned above. In this respect the authors can also conclude that with the expansion of the industry, and with the foreign exchange earnings that it generates, the prawn industry helps in the revitalization of the economy of Negros Occidental and of the country as a whole.

The authors, however, would like to reiterate the fact that the conclusions of this study have also taken into consideration the governing assumptions like the non-consideration of non-tariff barriers, energy cost reduce to diesel cost, the absence of rejects and uniformity of machine life. It is further made known that the authors wholly utilized the model and assumptions of Erlinda Medalla. These assumptions include a 20 percent premium on the official exchange rate to obtain the shadow exchange rate, the approximation of the shadow price of skilled labor using the nominal wage rate, and the shadow wage of unskilled labor being 80 percent of the nominal wage rate.

It is therefore logical that this study has adopted the weaknesses of the DRC formula of Medalla which are: 1) the approach is of partial equilibrium and therefore; 2) static; 3) the classification of all tradable inputs as foreign cost is a simplification of reality.

RECOMMENDATIONS TO GOVERNMENT

The government should do everything to support the prawn industry as part and parcel of its economic thrust to develop the agricultural sector and rural areas. Financial assistance should be made available to prospective prawn growers. Technology transfer should be accelerated. The industry's backward, forward and horizontal linkages should be developed. The pollution of rivers by sugarmills should be checked to minimize the harmful ecological effects of the industry.

RECOMMENDATION FOR PRAWN GROWERS

Prawn growers should strive to be more efficient in their production of the commodity, especially those in the higher domestic resource cost bracket. They should also diversify their production in terms of size, and not concentrate on the production of medium-size prawns. Prawn growers could also benefit by taking advantage of economies of scale if they cultivate a wider area.

RECOMMENDATIONS TO EXPORTERS

Exporters should also diversify their export markets. Today, more than 75 percent of the Philippine prawn exports goes to Japan. Other markets, especially the European market should be penetrated.

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