Comparative and Competitive Advantage of the Shrimp Industry in Mekong River Delta, Vietnam

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ABSTRACT

Given the growing prominence of Vietnam's fishery products in the world market, this study examines data on shrimp aquaculture in the country, as practiced through intensive and semi-intensive methods, in two provinces in the Mekong River Delta region. The study estimates the comparative and competitive advantage of the shrimp industry using various approaches, namely: 1) the RCA or revealed comparative advantage; 2). the Policy Analysis Method (PAM) method to calculate the resource cost ratio (RCR) and RCR indices; and 3) the Net Social Profitability (NSP) and Net Private Profitability (NPP). To identify the effects of changes in key factors affecting competitive and comparative advantage, a sensitivity analysis is conducted.*

The results show that Vietnam's shrimp products maintain a strong competitive position in the world market, as evidenced by an RCA greater than 1. The RCR and RCR estimates bordering on zero also indicate the strong comparative and competitive advantage of the shrimp industry. These findings are bolstered as well by the resulting NSP and NPP estimates. Furthermore, in terms of farming methods, the lower RCR and RCR* estimates for the intensive farms confirm their higher comparative and competitive advantage, compared to the semi-intensive model. Finally, the sensitivity analysis shows that the comparative and competitive advantage of shrimp is strongly sensitive to the price of feed, exchange rate, shrimp yield, and export price. The wage rate also exhibits a slight effect on the industry's standing in the world market.*

Improving the productivity and quality of shrimp is shown to be vital to the MRD shrimp industry because this would translate into a higher export price and higher yield of shrimp, which will further enhance the industry's comparative and competitive advantage.

INTRODUCTION

Background of the Study

In the late 1980s, when Vietnam's leaders changed the course of the country's history by introducing "Doi Moi", a series of reforms which saw the shift from a centrally planned oriented reforms, Vietnam has recorded some of the highest economic growth rates in the region. It has emerged from economic and political isolation, attracting the international attention of investors, economists, and regional political leaders— all of whom hope to witness, and profit from, the development of the country perceived to be the next Asian "Tiger".

As of 1998, Vietnam had 187 seafood processing factories, with a freezing capacity of about 200,000 tons/year. A total of 27 factories had passed the standards required by European markets. Vietnam's fishery products are exported to most regions of the world. In 1998, these products were consumed in 50 countries and territories. The export turnover had increased dramatically to US$1.777 billion in 2001, equal to 217 percent of the volume in 1998. It is estimated that the fisheries sector contributes as much as 12 percent to the national total export value. The main export products of Vietnam in recent years have been frozen shrimp/prawn, frozen finfish, dried squid, mollusk/crustacean, and tuna. Among the export products, frozen shrimp/prawn has the highest value, contributing 44 percent to the total fisheries export value, while accounting for 23 percent of the total export volume. Vietnam's fishery products have been widely consumed in the major export markets such as the United States, Japan, and Europe. In 2001, the US received the largest share (28 percent) of fishery products exported by Vietnam, closely followed by Asia (excluding Japan) at 27 percent, and Japan with an export share of 26 percent (Ministry of Fishery 2002).

The Mekong River Delta (MRD) region has been playing a key role in the fishery industry of Vietnam. It has provided 50 percent of aquatic fisheries, 60 percent of the exported products, and 80 percent of the shrimp exports.

Over the period 1994-2004, the fishery output of the whole country grew gradually from 1,450,000 tons in 1994 to 3,085,000 tons in 2004. Of this total, the MRD has contributed about 50 percent, with its fishery products increasing from 825,000 tons in 1994 to 1,652,000 tons in 2004.

Statement of the Problem

Joining the ASEAN Free Trade Area (AFTA) has provided Vietnam not only opportunities but also challenges. Mutual relations between members of AFTA are based not merely on cooperation but, more precisely, on interdependence and competition. By accepting the AFTA rules, Vietnam has committed itself to following a tax reduction schedule with a deadline to cut most of its taxes to zero percent by the year 2006. The commitment to reduce trade barriers, including tariff and non-tariff restrictions, was also a good preparation for joining the World Trade Organization (WTO).

Fishery production in Vietnam, particularly shrimp production in MRD, is affected substantially by the trade policies and commitments previously mentioned. Firstly, there are some direct effects on the prices of products traded among the members of AFTA. Secondly, there are also effects on the production costs of fishery products as the prices of their inputs change due to possible import tax reductions. It also means that the domestic production of these products will no longer be protected. Trade liberalization may induce some changes in factor markets, as well. Land and labor costs in rural area have been relatively cheap and could become more expensive in the future. The economic reform and trade liberalization will certainly bring about changes in policies governing the exchange rate and interest rate, among others.

The changing economic, social, and political landscape of Vietnam—as a result of its participation and membership to trade agreements — has numerous implications on the shrimp aquaculture industry. Given this scenario, the study aims to provide a qualitative and quantitative analyses of the industry, particularly its comparative and competitive advantage. Two types of shrimp aquaculture[4] are studied namely: intensive and semi-intensive. The densities of shrimp are >20 ind/m^2 and 5-20 ind/m^2 for intensive and semi-intensive, respectively. Higher technology and capital are needed for the intensive type of shrimp farming, compared to the semi-intensive mode.

It is hoped that the results of this study will serve as an input towards managing policy outcomes and creating future policy directions which will benefit the shrimp aquaculture industry in Vietnam.

Objectives

The major objective of this study is to evaluate the competitive and comparative advantage of shrimp aquaculture in the MRD, and to recommend initiatives for its growth.

The specific objectives of the study are:

1. Provide an overview of the fishery and shrimp aquaculture in Vietnam and MRD;
2. Determine the current comparative and competitive advantage of shrimp production in MRD;
3. Compare the net social and private profitability of the intensive and semi-intensive types of shrimp farming in MRD;
4. Determine the responsiveness of the comparative advantage and competitive advantage to key parameters in shrimp production in MRD; and
5. Recommend initiatives to improve the comparative advantage of the shrimp industry in MRD, Vietnam.

Hypotheses of the Study

A number of hypotheses will be tested in this study, namely:

1) Vietnam has both comparative and competitive advantage in the shrimp industry in MRD
2) The export price of shrimp, the exchange rate, and the shrimp yield significantly affect the comparative and competitive advantage of shrimp production in Vietnam.
3) The intensive type of shrimp aquaculture has more comparative advantage than the semi-intensive type.

Significance of the Study

Under trade liberalization, knowledge about the competitive and comparative advantage of shrimp production becomes very important for the policymakers. This information would be an important input to policymakers in designing policies that would help shrimp growers improve their income and avoid the risks from the trade liberalization. It will also provide basis for the planners in formulating long-term programs for the effective use of resources.

RESEARCH METHODOLOGY

Data Selection and Data Types

Both primary and secondary data are used in this study. Primary data are extracted from a survey on shrimp aquaculture production and cost conducted by the School of Economics and Business Administration, and the College of Fishery of Cantho University in Vietnam. Secondary data are sourced from various government agencies, a number of publications, and industry associations such as shrimp exporters, as shown in Table 1.

Table 1. Sources of secondary data used for the study.

DATA	SOURCES
World's shrimp export, world's total export and world shrimp production	FAOSTAT, Globefish, International Trade Statistics, TradeMap
Vietnam's shrimp export, Vietnam's total export and Vietnam shrimp production	Ministry of Fishery, Ministry of Trade
World price of frozen shrimp	Globefish
Import price of tradable inputs	Ministry of Trade, General Statistical Office (GSO)
Interest rate, inflation rate	Vietnam Commercial Bank
Exchange rate	Vietnam Commercial Bank
Export and import tariffs	Ministry of Fishery, Ministry of Trade, Customs Department
Water charges and aquaculture policies	Ministry of Fishery, Ministry of Agriculture and Rural Development of Vietnam (MARD)
Transportation fee, export prices, conversion rate, loading and unloading	Customs Department, Related commodity trading companies
Conversion wage rate	World Bank

Sampling Procedure

Selection of the study areas. The Mekong River Delta is the southernmost part of Vietnam, and has about 39.747 km^2 of area, 65 percent of which is used for agriculture and aquaculture. Its economy in 2002 grew by 10.4 percent, posting a per capita income of US$356.6 (Cantho Statistics Department 2002).

The population of MRD is over 16.755 million, of which 51 percent is female. About 18 percent of the population lives in the urban areas. The working age population that has regular work is 8.65 million people, of whom 64 percent work in in sector I (Agricultural sector), 12 percent are in sector II (Industry sector) , and 25 percent are in sector III (Service and Construction sector) (Ministry of Labor, Invalid and Social Affairs 2005).

Up to 2003, the Mekong Delta comprised 13 administrative units, including one city (Cantho City), which were directly under the Central Government, and 12 provinces (Longan, Dongthap, Angiang, Tiengiang, Bentre, Vinhlong, Travinh, Haugiang, Kiengiang, Soctrang, Baclieu, and Camau).

The study areas cover two major shrimp-producing regions in MRD, Vietnam, namely: Soctrang and Baclieu. As shown in Table 2, the two provinces contributed almost 40 percent of the total shrimp production in MRD in 2003.

Selection of sample. The primary data are extracted from the results of the complete production cost survey carried out by the School of Economics and Business Administration, and the College of Fishery of Cantho University in Soctrang and Baclieu provinces in 2005. In this survey, 180 shrimp farmers are selected using the random sampling method. This sample represents approximately 5 percent of the total number of shrimp farmers in the two provinces (Departments of Fishery of Soctrang and Baclieu Province,

Table 2. Production (MT) of the farmed shrimp in selected locations, Vietnam.

YEAR / LOCATION	2000	2001	2002	2003	2004	2005 (Prelim)
Whole country	**93,503**	**154,991**	**186,215**	**237,880**	**281,816**	**330,146**
Mekong River Delta	**68,995**	**118,432**	**142,907**	**182,221**	**222,643**	**270,652**
Soctrang	11,143	13,700	15,980	21,211		
Baclieu	10,403	28,347	37,392	55,268	27,424	42,837
					68,342	63,616

Source: GSO, *Statistical Year Book 2005*

2005). The sampled population consists of 100 (50 intensive and 50 semi-intensive) shrimp growers from the Hongdan and Giarai districts of Baclieu province; and 80 (40 intensive and 40 semi-intensive) shrimp growers who were interviewed in the Vinhchau and Myxuyen districts of Soctrang province.

ANALYTICAL PROCEDURE

Comparative and Competitive Advantage Analysis

Following the framework of this study, it is intended that the perspective of global competitiveness of the Vietnamese shrimp industry be linked to the production efficiency at the farm sector. Hence, there is a need to have a more systematic analysis of how a prospective change in micro/macroeconomic policies (e.g., exchange rate, wage rate, and output prices) would simultaneously affect industry competitiveness and profitability.

To address these interrelated issues, the use of a Policy Analysis Matrix (PAM) is employed. This approach, which was developed by Monke and Pearson (1989), aims to obtain a complete and consistent analysis on the impact of policy on competitiveness and farm-level profits, the influence of investment policy on economic efficiency and comparative advantage, and the effects of agricultural research policy on changing technologies. More specifically, it provides a potentially useful tool for investigating whether or which commodity systems within the economy's agricultural sector hold a comparative or competitive advantage (Morrison 2000).

PAM is constructed through a double-entry bookkeeping method. From the production and cost data of the sampled shrimp farmers, a matrix is drawn up consisting of their revenues, costs, and profits at private and social (often called "shadow") prices (Table 3). The top of the matrix is a budget showing the costs of production and marketing at market (private) prices. These are the observed revenues and costs that reflect the actual prices received or paid by a typical shrimp producer and thus incorporate any effects of direct and indirect policy and market failures. The cost components are divided into two categories: (i) the tradable inputs such as fuel, feed, chemical, etc., and (ii) the non-tradable inputs which usually refer to the immovable domestic factors of production such as land, labor, and capital.

The second row in the matrix shows the same cost elements expressed at social (economic) prices. For tradable products, adjusted world cost elements are normally taken as social prices, applying import and export parity measures. In valuing the domestic factors of production, their

opportunity costs are used, or the return at the margin in the best available alternative.

The third row of the matrix is derived by subtracting the economic values from the private values. It shows the net impact of market failure, distorting policies, and efficient policies (those that correct market failures).

The advantage of the PAM (Table 3) as an analytical tool is that it simplifies the calculation of the essential indicators in analyzing the competitive and comparative advantage of the industry. Once the revenue-cost-profit matrix has been properly set up, the indicators of competitive and comparative advantage, including other measures of global competitiveness, are directly computable.

Figure 1 shows the PAM building model for the shrimp industry in MRD. To construct the PAM table as shown in Table 3, we need physical input and output tables as well as private and social price tables, from which the social and private budgets are derived.

As a measure of the comparative advantage of Vietnam's shrimp products, the revealed comparative advantage *(RCA)* approach may be expressed in the form

$$RCA_{ij} = \frac{c_{ij}}{c_j} \qquad (1)$$

$$c_{ij} = x_{ij} / \sum_j x_{ij}$$

where is the ratio between the export value of Vietnam's shrimp products (X_{ij}) and the total value of its exports; and $C_i = A_i/B$ is the ratio between the world export value of shrimp product (A_i) and the total world export value. According to this definition, $RCA_{ij} > 1$ indicates that Vietnam's export specialization in shrimp products (measured by c_{ij}) is higher than the world average (measured by c_j), which implies that (compared to other countries) Vietnam has allocated relatively more of its resources to shrimp product and, hence, reveals its comparative advantage in it. Conversely, $RCA_{ij} < 1$ indicates that Vietnam has below-average specialization and, hence, comparative disadvantage in shrimp products.

Comparative advantage is measured by the ratio of the domestic resource/factor cost in social or economic price (DRC) to the Shadow Exchange Rate (SER). In other words, this is the ratio of the cost of domestic resources used in shrimp production to the value created by the production activity, both expressed in social prices. The discounted domestic resource cost, in social prices (DRC) is directly obtainable from the computed values in row two, column four of Table 3.

To recapitulate, computing the ratio of the DRC to the shadow exchange rate results in the value of *RCR* (Resource cost ratio in social prices), which is the efficiency measure of comparative advantage, as shown below:

$$RCR = \frac{\text{Domestic factor cost at social price } (DFs)}{\text{Difference between the revenue } (R_s) \text{ and tradable inputs } (Ti_s), \text{ both in social prices}}$$

$$RCR = \frac{DF_s}{R_s - T_{is}} \qquad (2)$$

The values derived from DRC and RCR will only be relevant if the border price of the output is higher than the foreign cost of producing it, because the country will obviously have no comparative advantage to speak of, if it cannot even cover the foreign component of producing the commodity.

To assess the comparative advantage of the Vietnamese shrimp industry, it is important to express DRCs in social/economic values. This represents the best terms at which the country

Table 3. Illustrative PAM for analyzing the competitiveness of the shrimp industry.

ITEM	REVENUES	COST OF INPUTS		PROFIT
		Tradable	Non-tradable	
Private prices (market prices)	R_p	Ti_p	DF_p	$\prod_p$
Social prices (shadow price or opportunity costs)	R_s	Ti_s	DF_s	$\prod_s$
Transfers	R_t	Ti_t	DF_t	$\prod_t$

(Adapted from Monke and Pearson, 1989)

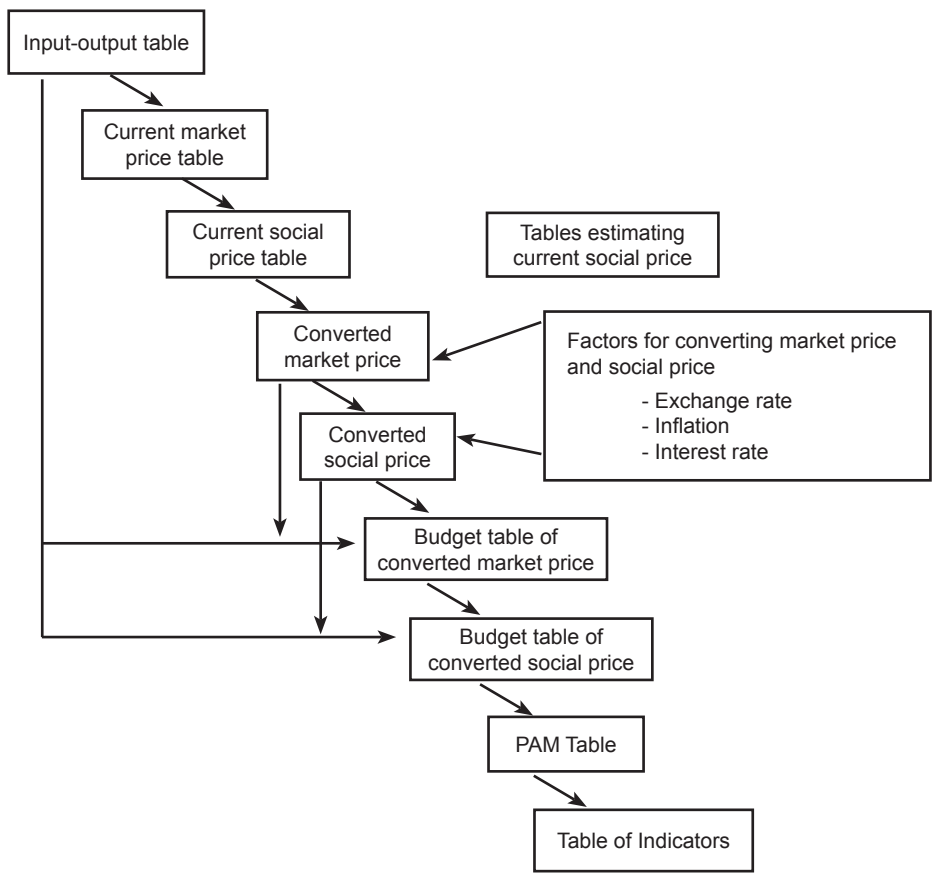

Figure 1. PAM building model for the shrimp industry in Mekong Delta, Vietnam

can trade with the world. It is essential to assume that all tradable inputs would be valued at border prices and would appear in the denominator of the DRC ratio. Only the domestic primary factor cost would appear in the numerator. Thus, any additional tradable goods produced or used must affect the trade balance to that extent, and the appropriate opportunity costs are the border prices (ADB 1993).

Thus if:

RCR < 1: the shrimp industry has a comparative advantage;

RCR = 1: the shrimp industry is comparative neutral

RCR > 1: the shrimp industry has a comparative disadvantage.

Competitive Advantage

Competitive advantage, on the other hand, is measured by comparing the domestic resource cost valued at market price (*DRC**) with the official exchange rate (OER). Converting the market price *DRC*s into foreign currency value can indicate whether the production activity of shrimp is competitive. The essential step in the process is to come up with a calculation of *DRC**. In terms of the information in Table 3, the value of the discounted domestic resource costs at private prices (*DRC**) is directly obtainable from the first row of the fourth column. The computation of the estimated value is facilitated by an automated link from a spreadsheet-generated enterprise budget of a typical shrimp farm considered in the analysis.

Moreover, the denominator in equation (3) is expressed based on the official exchange rate. This, therefore, allows the *DRC** to measure the market opportunity cost of domestic resources employed in earning a marginal unit of foreign exchange (MADECOR 2001). Comparing the exchange rate of the Vietnamese dong with *DRC** determines the cost- competitiveness of the shrimp production. Thus, a shrimp production activity is cost- competitive if the opportunity cost of earning an incremental unit of foreign exchange is less than the official exchange rate.

To sum up, the efficiency measure of competitive advantage, otherwise known as the resource cost ratio (*RCR**) is obtained by comparing the discounted *DRC** with the official exchange rate (*OER*). In terms of the disaggregated values in Table 3, the domestic resource cost ratio (*RCR**) is given as:

$$RCR^* = \frac{\text{Domestic Factor Cost at private price } (DFp)}{\text{Difference between the revenue } (R_p) \text{ and tradable inputs } (Ti_p), \text{ both in private prices}}$$

$$RCR^* = \frac{DF_p}{R_p - T_{ip}} \qquad (3)$$

Thus if:

*RCR** < 1: the shrimp industry has a competitive advantage;

*RCR** = 1: the shrimp industry is competitively neutral;

*RCR** > 1: the shrimp industry has a competitive disadvantage.

Equation (3) is estimated for the two study areas. The result converts *RCR** into foreign currency value so the competitive advantage could be compared internationally.

Other Measures of Comparative and Competitive Advantage

Net social profitability (NSP). This is another measure of comparative advantage derived by getting the difference between the social value of output and the social value of input expressed in domestic currency. It is defined as the net gain or loss associated with an economic activity when

all inputs and outputs of production are valued at social or economic prices. In terms of the accounts in Table 3, this is given as:

$$\prod_s = R_s - Ti_s - DF_s \quad (4)$$

where:
$\prod_s$ = Discounted Net Social Profitability (DNSP), VND;
R_s = Discounted revenue valued at social or economic price, VND;
TI_s = Discounted cost of tradable inputs e.g., material inputs used in shrimp production activity, valued at social prices, VND; and
DF_s = Discounted cost of domestic factors (primary inputs, e.g., land, labor, capital management) used in shrimp production activity, valued in social prices, VND

The point of interest is not simply obtaining the value for NSP, but also the ratio of NSP per unit of output, capital, foreign exchange or any constraining factor in the production process. This shows the extent of the value added to the economy per unit use of inputs or production of output.
Thus if:
$\prod_s > 0$, the shrimp industry has comparative advantage;
$\prod_s = 0$, the shrimp industry is comparatively neutral;
$\prod_s < 0$, the shrimp industry has no comparative advantage.

Net private profitability (NPP). This is another measure of the competitive advantage of a product or a commodity given the current technology, output values, and input cost. It is defined as the net gain or loss connected with an economic activity when the prices of inputs and outputs are valued at private or market prices. In terms of the items in Table 3, this is the difference between the revenues at private prices (market prices) and the total cost of both tradable and domestic inputs at private prices.

This is given as:

$$\prod_p = R_p - Ti_p - DF_p \quad (5)$$

where:
$\prod_p$ = Discounted Net Private Profitability (DNSP), VND;
R_p = Discounted revenue valued in private prices, VND;
Ti_p = Discounted cost of tradable inputs e.g., material inputs used in shrimp aquaculture activity, valued in private prices, VND; and
DF_p = Discounted cost of domestic factors (primary inputs) used in shrimp aquaculture activity, valued in private prices, VND.

A product or commodity is said to have competitive advantage when the calculated NPP value is greater than zero. NPP = 0 would mean neutrality in terms of advantage while the absence of competitive advantage would be denoted by an NPP less than zero (<0).

Social Valuation Methodology

Valuation of output. In measuring the values of tradable inputs and outputs, the determination of the border prices is important. Since shrimp is a tradable output, the border price (export parity price at the point of export) is adjusted to allow for domestic transport and marketing costs between the point of export and the production area (Table 4). The border price for shrimp we use in this study is the export parity price of the pond gate. This adjustment is made due to the sheer difficulty in getting a single value for marketing and transport costs from the point of export to the production area because of differences in distance and physical infrastructure across study areas.

Valuation of tradable inputs (*TI*). These are inputs which are directly traded in the world market (e.g., fuel and shrimp feed) and are priced according to their domestic border price as represented by CIF. The CIF price is the landed

Table 4. Derivation of export parity price of shrimp at the pond gate.

ITEM	VALUE
FOB price (USD/ton)	
Exchange rate (USD/VND)	
FOB price (VND/ton)	
Less	
Unloading	
Inspection fees and Insurance	
Transport to point of export	
Export price at X-province/location	
Less:	
Transport/load & unload	
Processing cost	
Bags	
Processing Conversion (%)	
Transport from pond to factory	
Mark-up	
Export Parity Price at the pond gate (VND/ton)	
Export Parity Price at the pond gate (VND/kg)	

cost of the import on the dock or other point of entry in the receiving country. It is inclusive of the cost of international freight and the insurance cost of unloading onto the dock. Simply, this is the import parity price at the farm gate (Table 5).

In this study, the costs of tradable inputs such as shrimp feed and fuel, which are actually imported, are considered as foreign cost, and import parity price is used to estimate their values at pond gate. For chemicals and electricity, which are domestically produced, their social prices are equal to their private prices. For post-larvae (shrimp seed), the shadow price is assumed to be equal to the market price and treated as domestic cost.

Valuation of nontradable inputs (*DF*). These are domestic or primary factors of the production (land, labor, water, capital) whose economic values are essentially important for comparative advantage efficiency measure.

Land. The economic value of rented land is determined by averaging the rental price of the land in the study area as an approximation of the marginal value product. If owned, its economic value is the imputed rent obtained by applying the shadow interest rate to the estimated market value of the land.

Labor. Labor valuation is also based on the principle of opportunity cost. Labor is classified as skilled or unskilled. Two sources of labor are employed in the production of shrimp: hired labor and family labor. Family labor can work as hired labor on other farms. Thus, family labor is deemed to have an opportunity cost equal to the average rate for hired labor. In this study, a conversion ratio of 0.8 is used to compute the shadow wages for unskilled laborers, as suggested by the World Bank (2002).

Water. Water is clearly a natural resource in Vietnam as well as other countries. However, it has not been charged properly in aquaculture use in Vietnam until recently. Shrimp farmers either did not pay the water charges, or paid a minimal fee which was not even enough to cover the

Table 5. Derivation of import parity price of imported inputs at the pond gate.

ITEM	VALUE
CIF price (USD/ton)	
Exchange Rate (USD/VND)	
Import price at the point of import (VND/ton)	
Add:	
Port charge	
Unloading	
Transport to Province's company	
Tax on imported inputs (%)	
Import price at X-province (location)	
Add:	
Processing cost	
Transport to Wholesaler's location	
Import price at the Wholesaler's Location	
Add:	
Transport/loading	
Handling/storage	
Import price at Retailer's Location	
Add:	
Mark-up	
Import Parity Price of input at the pond gate (VND/ton)	
Import Parity Price of input at the pond gate (VND/kg)	

maintenance costs of irrigation systems. It is a difficult task to estimate the social value of water use in shrimp production because its value depends on the characteristics of the particular irrigation systems and the quality of irrigation services. The proposed water charge of 420,000 VND/ha per year applicable with pumping irrigation systems in Mekong Delta is used as the shadow price of water in this analysis (MARD 1998).

Capital. Capital covers those fixed inputs which could be used for several production periods. These are the pond building, machineries, tools, and other pieces of equipment. In addition, capital may include the total farm investment or farm inventory. Since capital stock is used for at least more than one production period, it is crucial to determine the value service used during the production periods. The cost of capital service of fixed assets consists of the depreciation cost, interest cost, and cost of repair and maintenance. For this study, it is assumed that the interest rate from formal sources represents the shadow interest rate when adjusted for the inflation rate of the year 2005 .

The shadow interest rate is estimated by finding the observed interest rate in the capital market, and adjusting it for inflation using the formula:

$$1 + i^R = \frac{1 + i^N}{1 + inf} \qquad (6)$$

where:

i^R = real rate of return

i^N = observed (nominal) interest rate in the capital market

inf = inflation.

Exchange rate. In an economy where there is price distortion, as found in most developing countries, an appropriate foreign exchange rate is needed to estimate the comparative advantage of a productive activity as measured by DRC.

The official exchange rate (OER) may not reflect the shadow price of foreign exchange due to market distortion. Thus, the shadow exchange rate (SER) has to be estimated for use in the conversion of domestic price of traded goods into border prices. The major factors causing distortions in the OER are export taxes, discriminatory indirect taxes, import tariff, and subsidies.

Following Tsakokyr (1990), the shadow exchange rate (SER) is estimated in this study through the standard conversion factor (SCF) and official exchange rate, as shown below:

$$SCF = \frac{OER}{SER}$$

or

$$SER = \frac{OER}{SCF} \qquad (7)$$

Following the ADB's guide to estimate the shadow exchange rates for project economic analysis, the average SCF from 1996 to 2003 is 0.95. The official exchange rate in 2006 is 15,900 VND/US$. So, SER = 15,900/0.95 = 16,737 VND/US$.

Sensitivity Analysis

For sensitivity analysis, the study measures the elasticity of *DCR*, that is, the responsiveness of *DCR* to a change in various constraining parameters such as shrimp feed, exchange rate, wage rate, export price, and shrimp yield. The same elasticity would apply to comparative and competitive advantage measures. Theoretically, *DRC* elasticity is computed as follows (ADB 1993):

$$e_d = \frac{\text{\% change in DRC}}{\text{\% change in component parameter}}$$

$$e_d = \frac{\delta DRC}{\delta D} \frac{D}{DRC} \qquad (7)$$

δDRC = change in DRC
δD = change in component parameter

The equation refers to the elasticity of the *DRC* response to domestic factor cost. The same mathematical argument applies in getting the elasticity of *DRC* with respect to other constraining parameters.

Limitations of the Study

The limitations related to the design and analyses of this study have a bearing on the reliability and applicability of the results as follows:

- The study aims to evaluate the comparative and competitive advantage of the shrimp industry in the Mekong River Delta, Vietnam, but, owing to financial and time constraints, the study focuses only on four villages in two provinces of the region.
- The primary data on aquatic and transportation costs in this study cover only the year 2005.
- There is a limited database and access to secondary data in Vietnam.

PRESENTATION AND ANALYSIS OF RESULTS

This chapter starts with an overview of the shrimp aquaculture in the Mekong River Delta in Vietnam. Then the subsequent sections present the estimation results on the competitive and comparative advantage of the shrimp industry using the following analytical tools:(1) the revealed comparative advantage; (2) PAM, (3) the RCR and RCR* to measure comparative and

competitive advantage, and (4) the sensitivity analysis to estimate the changes in factors affecting the competitive and comparative advantage of the shrimp industry.

Overview of Shrimp Aquaculture in the MRD

The MRD lies on very flat lands. The average temperature is around 27°C, and annual rainfall ranges from 1,500–2,000 mm. The monsoon rains combine with the high flow of the Mekong River from September to October, causing annual flooding over the entire delta. Around two to four months every year, floodwaters reaching 1–4 meters high inundate an area covering 1.4–1.9 million hectares. In contrast, during the dry season, the water table moves deep into the soil profile, causing localized drought. The MRD soils are young alluvium, about 40 percent of which are characterized as acid sulfate soils and seasonal saline soils (Khiem et al. 2002). Salinity is high in the dry season, making shrimp culture suitable for 2–3 months per year. Depending on the weather each year, salinity is generally lowest in the wet season. MRD is a major source of shrimp for the whole country, accounting for more than 50 percent of fishery fields in the fishery industry (Table 6).

The country's total fishery production grew steadily from 2,435 thousand tons in 2001 to 2,795 thousand tons in 2003, equivalent to a 15 percent increase. Similarly, MRD's total fishery output increased from 1,274 thousand tons in 2001 to 1,436 thousand tons in 2003, or a 13 percent increase. For farmed shrimp production, the national volume reached 238 thousand tons in 2003, which represented a 54 percent increase compared to that of 2001 (155 thousand tons). Farmed shrimp production in MRD reached 182 thousand tons in 2003, also equivalent to 54 percent increase compared to that in 2001 (118 thousand tons), and contributing 77 percent to national farmed shrimp quantity. The data show that farmed shrimp production in MRD plays a key role in the shrimp industry of Vietnam (Table 6).

General Characteristics of Shrimp Growers

Most shrimp growers practice only one cycle of aquaculture per year because certain environmental factors like pollution prevent them from doing two cycles per year. On average, one farming period takes 4.67 months (140.03 days) and 5.25 months (157.59 days) per

Table 6. Contribution of MRD's fishery to national fishery industry ('000 tons).

ITEM	2001		2002		2003	
	MRD	National	MRD	National	MRD	National
Production of Fishery	1,274	2,435	1,355	2,647	1,436	2,795
In which:						
Caught products	829	1,725	835	1,803	816	1,829
Farmed products	444	710	519	845	620	966
In which:						
Fish	249	421	284	486	355	573
Shrimp	118	155	143	186	182	238

Source: GSO, *Statistical Yearbook 2004*

hectare for intensive and semi-intensive farming, respectively.

Shrimp farming in the surveyed area consists of six steps. There is not much difference between the two provinces in terms of the time length of pond dredging and of harvesting, icing and selling. Soil treatment and water treatment of the intensive and semi-intensive farms in Baclieu province both take longer time than the same tasks of intensive and semi-intensive farming in Soctrang province (Table 7).

Releasing post-larvae into the pond takes only one day for both provinces, as well as in MRD, on average. Step 5 involves 95.7 days per hectare for intensive farming and 112.8 days for semi-intensive farming in Soctrang; these figures are higher than the counterpart duration in Baclieu (88.5 days and 107.6 days per hectare, respectively).

Intensive shrimp farming requires more capital and more technology. The growers in this setup pay more attention to attending training (5.53 times) than farmers in semi-intensive farms (2.6 times).

The average age of the household head is 45.37 and 46.51 for intensive and semi-intensive farming, respectively; this can be explained by the fact that intensive farming had been introduced later compared to the semi-intensive type (Table 8). Moreover, on average, the number of persons per household in the semi-intensive model is higher than that of the intensive model. Table 8 also shows that total land, as well as pond area, per household is higher in semi-intensive farming than in intensive farming.

Comparative and Competitive Advantage of the Shrimp Industry in the Two Provinces, Mekong River Delta

The first part of this section presents the revealed comparative advantage index. This is followed by the comparative and competitive advantage computation for the shrimp industry in MRD, and the sensitivity analysis results.

Revealed comparative advantage of Vietnam's shrimp exports. Under the Harmonized System, shrimps and prawns ─ whether "frozen, in shell or not, including boiled in shell"─ are classified as belonging to the 6-digit group 030613. Table 9 shows the values of the exports in this category for Vietnam and

Table 7. Time length (days/ha) of shrimp faming practices, by province, MRD, 2005.

STEP	ITEM	SOCTRANG		BACLIEU		AVERAGE OF BOTH PROVINCES	
		Inten (n=40)	Semi (40)	Inten (50)	Semi (50)	Inten (90)	Semi (90)
1	Pond dredging	7.5	7.6	7.8	7.2	7.67	7.38
2	Soil treatment	7	7.3	8	7.9	7.56	7.63
3	Water treatment	30.5	29.5	31.3	30.5	30.94	30.06
4	Releasing post-larvae into the pond	1	1	1	1	1	1
5	Feeding, caring, and water and disease management	95.7	112.8	88.5	107.6	91.7	109.91
6	Harvesting, icing and selling	1	1.5	1.3	1.7	1.17	1.61
Total		142.7	159.7	137.9	155.9	140.4	157.59

Source: Computed from survey data

Table 8. Characteristics of shrimp growers in the two provinces, MRD, Vietnam, 2005.

ITEM	SOCTRANG		BACLIEU		AVERAGE OF BOTH PROVINCES	
	Intensive (n=40)	Semi-int (n=40)	Intensive (n=50)	Semi-int (n=50)	Intensive (n=90)	Semi-int (n=90)
Family size	4.9	5.45	5.24	5.11	5.09	5.26
Age of HH head	45.7	46.4	45.1	46.6	45.37	46.51
Experience (yrs)	6	6.6	6.2	6.7	6.11	6.66
Attend training in shrimp farming (number of times)	5.2	2.1	5.8	3.0	5.53	2.60
Total land (ha/HH)	2.1	3.4	1.9	3.5	1.99	3..46
Pond area (ha)	1.7	2.5	1.5	3.1	1.59	2.83

Source: Computed from survey data

Table 9. Shrimp export and total export value of Vietnam and the world.

AREA	2001	2002	2003	2004	2005
Shrimp Export Value (Million USD)					
Vietnam	722.29	793.63	1,008.69	995.70	1,091.06
World	8,188.61	7,523.90	8,479.25	8,475.06	9,002.58
Total Export Value (Million USD)					
Vietnam	15,029	16,706	20,149	26,503	32,223
World	9,173,801	9,689,002	11,236,403	13,576,604	15,261,605

Source: COMTRADE Statistics, TradeMap and Vietnam Ministry of Trade

the world from 2001 to 2005. It also shows the corresponding total export values for the same period.

The RCA indices of Vietnam shrimp from 2001 to 2005 are presented in Table 10. The indices are much greater than 1, indicating that Vietnam shrimp held very strong comparative advantage in the world market from 2001 to 2005. The RCA is highest (66.34) in 2003 since the total export value of Vietnam's shrimp is higher in this year than in 2001, 2002 and 2004; only in 2005 does the total export value of Vietnam slightly exceed its 2003 figure. However, its export value in 2003 is remarkably higher than the world's total export value in 2003, meaning that Vietnam shrimp in 2003 had greater revealed comparative advantage than the other years cited.

The Policy Analysis Matrix of the shrimp industry in the two provinces of MRD. The information extracted from the private price budget and social price budget is used in formulating the PAM. The domestic resource cost ratio ─ in terms of both private price and social price, net private profit and net social profit ─ is calculated from the PAM.

Private and social profits for the intensive farming model are both positive in both provinces. Comparing the two, Baclieu has higher private and

Table 10. RCA indices of Vietnam frozen shrimp (6-digits).

INDICATOR	2001	2002	2003	2004	2005
RCA	53.84	61.18	66.34	60.19	57.40

Source: computed based on data from Table 9

Table 11. PAM for intensive shrimp farming in the two provinces, MRD, Vietnam, 2005 (VND/ha).

ITEM	LOCATION	REVENUES	COST OF INPUTS		PROFIT
			Tradable	Non-tradable	
Private prices (market)	**Average of both provinces**	**299,591,425**	**213,157,407**	**6,397,831**	**80,036,188**
	Soctrang	292,758,400	218,717,956	6,337,023	67,703,421
	Baclieu	*306,424,450*	*207,596,858*	*6,458,638*	*92,368,955*
Social prices (shadow)	**Average of both provinces**	**318,018,101**	**214,841,562**	**12,475,144**	**90,701,394**
	Soctrang	309,729,019	220,428,924	12,204,178	77,095,916
	Baclieu	*326,307,183*	*209,254,198*	*12,746,110*	*104,306,874*
Transfers	**Average of both provinces**	**-18,426,676**	**-1,684,155**	**-6,077,314**	**-10,665,206**
	Soctrang	-16,970,619	-1,710,968	-5,867,155	-9,392,495
	Baclieu	*-19,882,733*	*-1,657,341*	*-6,287,472*	*-11,937,919*

Source: Computed from survey data. 1USD = 15,900 VN

social profits than Soctrang. However, the profit transfer of Baclieu is smaller than Soctrang's profit transfer (Table 11).

Under semi-intensive farming, the same patterns emerge in terms of the comparisons between the two provinces' private and social profits. That is, Baclieu has higher private and social profits than those of Soctrang because Baclieu has a lower cost of tradable inputs and higher revenues than those of Soctrang for both private and social prices. Moreover, Soctrang's profit transfer is higher than Baclieu's profit transfer (Table 12) since the latter has higher private profit and higher social profit than these of Soctrang. but the difference between their social profit is higher than that of private prices.

For the two provinces as a whole, as presented in Tables 11 and 12, both private profit and social profit in both models are significantly positive, thereby showing that shrimp aquaculture in the two models is profitable for the producer. However, the extent of private profit is greater than that of social profit in the semi-intensive model, implying that from the society's point of view, shrimp-growing does not appear to be as profitable as might be suggested by the private value. It is the reverse in the case of the intensive model: from the society's point of view, shrimp aquaculture should be considered as socially profitable as suggested by the private value.

The profit transfer of 1,237,044.27 VND per hectare in the semi-intensive model shows that

Table 12. PAM for semi-intensive shrimp farming in the two provinces, MRD, Vietnam, 2005 (VND/ha).

ITEM	LOCATION	REVENUES	COST OF INPUTS		PROFIT
			Tradable	Non-tradable	
Private prices (market)	**Average of both provinces**	**156,928,438**	**110,308,329**	**5,228,856**	**41,391,253**
	Soctrang	149,760,700	112,296,240	5,005,042	32,459,418
	Baclieu	*164,096,175*	*108,320,418*	*5,452,670*	*50,323,087*
Social prices (shadow)	**Average of both provinces**	**162,409,374**	**111,545,201**	**10,709,965**	**40,154,208**
	Soctrang	154,577,588	113,476,047	10,234,594	30,866,947
	Baclieu	*170,241,160*	*109,614,357*	*11,185,336*	*49,441,467*
Transfers	**Average of both provinces**	**-5,480,937**	**-1,236,872**	**-5,481,109**	**1,237,044**
	Soctrang	-4,816,888	-1,179,808	-5,229,552	1,592,471
	Baclieu	*-6,144,985*	*-1,293,939*	*-5,732,666*	*881,620*

Source: Computed from survey data. 1USD = 15,900 VND

the profit per hectare from exported shrimp in the MRD should be reduced by that amount to make it socially profitable. On the other hand, the profit transfer of -10,665,206.35 VND per hectare in the intensive model shows that society could actually earn more profit from shrimp aquaculture.

The output transfer of -18,426,675.60 VND per hectare in the intensive model and -5,480,936.70 VND per hectare in the semi-intensive model in MRD implies that society could actually earn more revenues from shrimp export. The output transfer reflects the distortion in the shrimp product market. Its negative value implies that shrimp producers, to some extent, are taxed.

The tradable input transfer seen by a divergence of VND (-1,684,155.35 VND per hectare in the intensive model and -1,236,872.17 VND per hectare in the semi-intensive model in MRD) measures the transfer from the shrimp grower to society for the purchase of these inputs. It is negative in value, in contrast to the case of the shrimp market, showing that producers are subsidized in the tradable input markets. However, as seen in the figures, the extent of this subsidy from the government is not significant as the difference is not a big number. The nontradable input transfer is also negative, meaning that the cost to society of using domestic resources is higher than its private value. The social value of nontradable inputs in this case is significantly higher than their private value. The main reason for the difference is the land rent value.

Analysis of Comparative Advantage

Comparative advantage was measured by comparing the domestic resource cost valued at social price (DRC) with the SER.

Table 13 shows that the RCRs in terms of social price are 0.12 and 0.21 in the intensive and semi-intensive aquaculture, respectively. It means that the shrimp industry in MRD has strong comparative advantage in both types. In this case, the intensive model has more comparative advantage than the semi-intensive model.

The comparative advantage of the shrimp aquaculture in both provinces, as reflected in the average estimates, is high because of the lower

Table 13. Estimated DRC and RCR of the shrimp industry using social price in the two provinces, MRD, Vietnam, 2005.

LOCATION	DOMESTIC RESOURCE COST (VND/ha)		RESOURCE COST RATIO	
	Intensive	Semi-intensive	Intensive	Semi-intensive
Soctrang	12,204,178	10,234,594	0.14	0.25
Baclieu	*12,764,110*	*11,185,336*	*0.11*	*0.19*
Average of both provinces	**12,475,144**	**10,709,965**	**0.12**	**0.21**

Source: Computed from survey data, 1USD = 15,900 VND

production cost, especially in nontradable input costs. The water charges and land rent form more than 50 percent of the total nontradable cost. This shows that the cost of natural resources in the shrimp aquaculture of both provinces should be considered much higher than the actual private cost incurred.

The RCRs of both the intensive and semi-intensive shrimp industry in Baclieu province are lower than those in Soctrang province. This means that Baclieu has a higher comparative advantage in shrimp aquaculture than Soctrang province.

The NSP was also used to measure the comparative advantage of the shrimp industry in the two provinces. Table 14 shows the NSP value of the shrimp industry in each province and in the average of both provinces.

Baclieu's NSP amounted to 104,306,874VND per hectare for intensive farming and 49,441,467VND per hectare for semi-intensive farming; these figures are higher than the NSP values (77,095,916VND per hectare and 30,866,947VND per hectare, respectively) in Soctrang (Table 14).

Similar to the results shown in the RCR approach, the NSP numbers are all positive, meaning that Vietnam shrimp has comparative advantage; specifically, Baclieu has higher comparative advantage in both models than Soctrang.

Analysis of Competitive Advantage

Competitive advantage was measured by comparing the domestic resource cost valued at market price (DRC*) with the OER. Table 15 shows the DRC* of each province and the whole of MRD.

Table 15 presents the *RCR**, the efficiency measure of competitive advantage, which is calculated by dividing the nontradable cost by the difference between revenues and tradable cost, all in private prices. Table 15 shows that all *RCR**'s are less than 1. This implies that the shrimp industry in the two provinces has competitive advantage. The average *RCR** is 0.08 in the intensive model and 0.11 in the semi-intensive model, showing that shrimp aquaculture using intensive farming is more competitive than the semi-intensive mode of farming. Baclieu still emerges to have more competitive advantage in shrimp aquaculture than Soctrang.

Shrimp aquaculture in the two provinces is competitive since it has low production cost. The shrimp growers do not pay for land and water, and the wage rate is low (around 0.32 US$/hr).

We also measured competitive advantage in terms of net private profit (NPP). It is taken from the fifth column and second row of the PAM tables. The results presented in Table 16 also indicate that the shrimp industry in the two provinces

Table 14. Net social profit of the shrimp industry in the two provinces, MRD, Vietnam, 2005 (VND/ha).

LOCATION	NET SOCIAL PROFIT	
	Intensive	Semi-intensive
Soctrang	77,095,916	30,866,947
Baclieu	*104,306,874*	*49,441,467*
Average of both provinces	**90,701,394**	**40,154,208**

Source: Computed from survey data. 1USD = 15,900 VND.

Table 15. Estimated DRC* and RCR* of the shrimp industry using private price in the two provinces, MRD, Vietnam, 2005.

LOCATION	DOMESTIC RESOURCE COST (VND/ha)		RESOURCE COST RATIO	
	Intensive	Semi-intensive	Intensive	Semi-intensive
Soctrang	6,337,023	5,005,042	0.09	0.13
Baclieu	*6,458,638*	*5,452,670*	*0.07*	*0.10*
Average of both provinces	**6,397,831**	**5,228,856**	**0.08**	**0.11**

Source: Computed from survey data. 1USD = 15,900 VND

Table 16. Net private profit of the shrimp industry in the two provinces MRD Vietnam, 2005 (VND/ha).

LOCATION	NET PRIVATE PROFIT	
	Intensive	Semi-intensive
Soctrang	67,703,421	32,459,418
Baclieu	*92,368,955*	*50,323,087*
Average of both provinces	**80,036,188**	**41,391,253**

Source: Computed from survey data. 1USD = 15,900 VND

maintain a high competitive advantage since all the numbers are strongly positive. Specifically, Soctrang appears to have lower comparative advantage in both intensive and semi-intensive shrimp farming than Baclieu.

Sensitivity Analysis

In this part, the RCR elasticity was calculated to measure the responsiveness of the comparative advantage to a change in level of each affecting factor. More specifically, they are measures of the percentage change in RCR with respect to a percentage change in the corresponding affecting factor. In this study, each affecting factor was simulated to vary by 1 percent and the corresponding PAM was then re-estimated. The elasticity results are presented in Table 17.

As seen in this table, the elasticity of RCR with respect to a change in the export price is

Table 17. The RCR elasticity of the shrimp industry in the two provinces, MRD, Vietnam, 2005.

VARIABLES	MODELS	RCR ELASTICITY	RELATIONSHIP WITH THE SHRIMP INDUSTRY COMPARATIVE ADVANTAGE
Feed price	Intensive	1.28	-
	Semi-intensive	1.44	-
Exchange rate	Intensive	-3.14	+
	Semi-intensive	-3.11	+
Shrimp yield	Intensive	-2.99	+
	Semi-intensive	-2.67	+
Export price	Intensive	-3.52	+
	Semi-intensive	-3.65	+
Wage rate	Intensive	0.16	-
	Semi-intensive	0.23	-

Source: Computed from survey data

– 3.52 for the intensive model and -3.65 for the semi-intensive model, implying that a 1 percent increase in world shrimp price (defined as the Ho Chi Minh City's FOB price) would result in a 3.52 percent and 3.65 percent reduction in the RCR for intensive and semi-intensive models, respectively. In other words, the shrimp comparative advantage is improved by 3.52 percent for intensive farming and 3.65 percent for the semi-intensive type. The positive relationship between export price and comparative advantage is presented by the positive sign in the third column of the table. Similarly, the elasticity of RCR with respect to the change in OER is about -3.14 for intensive aquaculture and -3.11 for semi-intensive, implying that a 1percent increase in the SER would cause a reduction of 3.14 percent and 3.11 percent in the RCR of the two models. So, the comparative advantage of Vietnam shrimp in this case increases by 3.14 percent and 3.11 percent for intensive and semi-intensive modes, respectively. As for shrimp yield, the results show that it is positively related to shrimp's comparative advantage. The results tell us that a 1percent increase in shrimp yield would result in an increase in shrimp's comparative advantage by 2.99 percent for intensive, and 2.67 percent for semi-intensive farming.

On the other hand, the imported feed price and the wage rate have a positive relationship with RCR, meaning they all have negative relationships with shrimp industry's comparative advantage. In the case of the wage rate, for example, an increase of 1 percent in the wage rate would result in a reduction of 0.16 percent and 0.23 percent in comparative advantage for the two models.

The value of the elasticity of RCR* is higher than its RCR. It means that these variables have a stronger effect on RCR*. But the trend of RCR* elasticity is still similar to that of RCR. The elasticity of RCR* feed price is 1.51 percent for intensive model and 1.55 percent for semi-intensive one. This implies that if the feed price increases by 1 percent, the competitive advantage of the shrimp industry would be reduced by 1.51 percent and 1.55 percent, respectively, for the two models (Table 18).

The absolute values of RCR elasticities and RCR* show the extent of impact or the relative importance of the corresponding affecting factors. The exchange rate, export price, shrimp yield, and feed price appear to be crucial factors determining the competitive and comparative advantage of the shrimp industry in the two provinces. The wage rate has an impact on the shrimp industry's

Table 18. The RCR* elasticity of the shrimp industry in the two provinces, MRD, Vietnam, 2005.

VARIABLES	MODELS	RCR ELASTICITY	RELATIONSHIP WITH THE SHRIMP INDUSTRY COMPARATIVE ADVANTAGE
Feed price	Intensive	1.51	-
	Semi-intensive	1.55	-
Exchange rate	Intensive	-3.49	+
	Semi-intensive	-3.26	+
Shrimp yield	Intensive	-3.35	+
	Semi-intensive	-3.26	+
Export price	Intensive	-3.93	+
	Semi-intensive	-3.82	+
Wage rate	Intensive	0.40	-
	Semi-intensive	0.59	-

Source: Computed from survey data

competitive and comparative advantage, but to a smaller degree.

RECOMMENDATIONS

Based on our findings and their policy implications we recommend the following measures to further enhance the comparative and competitive advantage of the shrimp-growing industry in the MRD:

- *Find ways to decrease the prices of shrimp feeds.* As shrimp feed prices are positively related to *RCR* and *RCR**, a decrease in the price of shrimp feed would increase the comparative and competitive advantage of the shrimp industry.
- *Manage the exchange rate at suitable levels that would minimize its negative effects on RCR and RCR*.* A devaluation of the Vietnam dong would improve the comparative and competitive advantage of the shrimp industry.
- *Improve the productivity of the shrimp producers by offering more training on shrimp farming because a higher shrimp yield leads to lower RCR and RCR*, which means greater comparative and competitive advantage for the shrimp industry in MRD.* Higher post-larvae density does not automatically result in higher shrimp yield. For this reason, a research on technical practices should be conducted to find out solutions and hence improve the productivity of shrimp aquaculture.
- *The government should stabilize the price by facilitating a smooth flow from producing to exporting.* Since the export price has a strong positive effect on the comparative and competitive advantage of shrimp (measured by RCR and RCR*), creating a more conducive environment for all parties in the chain linking producers to exporters would enhance the position of Vietnam in the world shrimp market. With the proper support from government, the shrimp producers should focus on upgrading their output since high-quality shrimps command higher prices in the market.
- *Keep the wage rate at a stable level.* Since the wage rate has a negative effect on the industry's comparative and competitive

advantage, this measure is a crucial step to preserving the position of MRD's shrimp aquaculture in the world market.

- *Propagate the technology for intensive shrimp farming since this method promotes greater comparative and competitive advantage than the semi-intensive model.* Government, through the Department of Fishery, should give more financial and technical support to the baking system.

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